MAY 9, 2017
REPLACEMENT OF MNRR BRIDGE OVER ATLANTIC STREET – PHASE 2
FEDERAL AID PROJECT NO. H121(002) & N/A
STATE PROJECT NOS. 0135 – 0301 & 0301 – 0163
CITY OF STAMFORD

ADDENDUM NO. 3

This Addendum addresses the following questions and answers contained on the "CT DOT QUESTIONS AND ANSWERS WEBSITE FOR ADVERTISED CONSTRUCTION PROJECTS":

Question and Answer Nos. 14, 24, 25, 27, 29-31, 33, 50, 54, 55, 58, 62-65, 68, 74, 79-81, 92, 97, 100, 101, 104-108, 110, 112, 114, 118, 121, 123-126, 131, 134-141, 143, 144, 150, 153-155, 158, 161, 164-168, 177, and 179.

SPECIAL PROVISIONS
NEW SPECIAL PROVISIONS

The following Special Provisions are hereby added to the Contract:

- NOTICE TO CONTRACTOR – FEDERAL RAIL SAFETY REGULATIONS (49 C.F.R. PART 219 CONCERNING ALCOHOL AND DRUG TESTING)
- ITEM NO. 0101133A – DISPOSAL OF CONTAMINATED RAILROAD TIES
- ITEM NO. 0216009A – EXPANDED POLYSTYRENE FILL

- ITEM NO. 0813001A – 5" GRANITE STONE CURBING
- ITEM NO. 0813011 A– 5" GRANITE CURVED STONE CURBING

- ITEM NO. 0921001A – CONCRETE SIDEWALK
- ITEM NO. 0922050A – DECORATIVE CROSSWALK

- ITEM NO. 0949038A – CERCIS CANADENSIS "OKLAHOMA" EASTERN REDBUD, 2" – 2.5" CAL. B.B.
- ITEM NO. 0949131A – SYRINGA RETICULATA, "IVORY SILK" JAPANESE TREE LILAC, 2" -2.5" CAL. B.B.
- ITEM NO. 0949737A – PYRUS CALLERYANA "BRADFORD" BRADFORD CALLERY PEAR, 2" – 2-1/2" CALIPER B.B.

- ITEM NO. 0951002A – TREE GRATES
- ITEM NO. 1017052A – REMOVE SERVICE
- ITEM NO. 1108644A – TRAFFIC MANAGEMENT SYSTEM CABINET

The following C.S.I. Special Provisions are hereby added to the Contract:

- SECTION 05 70 00 - DECORATIVE METAL
- SECTION 07 42 93 - SOFFIT PANELS
- SECTION 10 14 26 – POST AND PANEL / PYLON SIGNAGE

REVISED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety and replaced with the attached like-named Special Provisions:

- ITEM NO. 0096065A – REMOVAL OF CATENARY
- ITEM NO. 0096066A – REMOVAL OF SIGNAL AND COMMUNICATION CABLES
- ITEM NO. 0096068A – REMOVAL CATENARY PORTAL STRUCTURE
- ITEM NO. 0096070A – REMOVAL OF CATENARY STRUCTURE FOUNDATION
- ITEM NO. 0096081A – REMOVAL OF FEEDER OR AERIAL GROUND WIRE
- ITEM NO. 0099010A – REMOVAL OF ABONDONED RAILROAD EQUIPMENT

- ITEM NO. 0100600A – CONSTRUCTION ACCESS
- ITEM NO. 0601276A – PRECAST SUBSTRUCTURE ELEMENTS
- ITEM NO. 0921018A – BRICK PAVING
- ITEM NO. 0971001A – MAINTENANCE AND PROTECTION OF TRAFFIC
- ITEM NO. 0992093A – RESET BRICK PAVING

- ITEM NO. 1008115A – 2” RIGID METAL CONDUIT IN TRENCH
- ITEM NO. 1008117A – 3” RIGID METAL CONDUIT IN TRENCH
- ITEM NO. 1008770A – 4” PVC MULTI-DUCT IN TRENCH
- ITEM NO. 1008780A – 4” PVC MULTI-DUCT UNDER ROADWAY

The following Special Provision entitled “ITEM NO. 0507263A – TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II WITHOUT SUMP” through ITEM NO. 1008780A – 4” PVC MULTI-DUCT UNDER ROADWAY is hereby revised with the addition of “ITEM NO. 0507735A – CONVERT TYPE “C-L” CATCH BASIN TO MANHOLE” AND “ITEM NO. 0507754A – RESET TYPE “C” CATCH BASIN DOUBLE GRATE - TYPE II”.

- ITEM NO. 0507263A – TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II WITHOUT SUMP
- ITEM NO. 0507301A – TYPE "C" DROP INLET

- ITEM NO. 0507501A – TYPE "C-L" DROP INLET
- ITEM NO. 0507601A – MANHOLE
- ITEM NO. 0507687A – MANHOLE - 5' DIAMETER
- ITEM NO. 0507771A – RESET CATCH BASIN
- ITEM NO. 0507781A – RESET MANHOLE
- ITEM NO. 0507809A – CONVERT TYPE "C-L" CATCH BASIN TO TYPE "C" CATCH BASIN
- ITEM NO. 0507735A – CONVERT TYPE "C-L" CATCH BASIN TO MANHOLE
- ITEM NO. 0507754A – RESET TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II

The following C.S.I. Special Provisions are hereby deleted and replaced with the attached like named C.S.I. Special Provisions:

- SECTION 02 41 00 - SELECTIVE BUILDING DEMOLITION
- SECTION 05 10 00 - STRUCTURAL METAL FRAMING
- SECTION 05 30 00 - METAL DECKING
- SECTION 05 50 00 - METAL FABRICATION
- SECTION 05 52 00 - METAL HANDRAIL AND GUARDRAIL SYSTEMS
- SECTION 05 55 13 – METAL STAIR TREADS
- SECTION 07 22 00 - ROOF AND DECK INSULATION
- SECTION 07 50 00 – SINGLE PLY MEMBRANE ROOFING
- SECTION 07 60 00 - FLASHING AND SHEET METAL
- SECTION 07 92 00 - JOINT SEALANTS AND CAULKING
- SECTION 08 45 23 - 2-3/4" TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT CANOPY SYSTEM
- SECTION 09 91 00 – PAINTING
- SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
- SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
- SECTION 26 51 00 – INTERIOR LIGHTING – PLATFORM CANOPY AND STAIRS

DELETED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety:

- ITEM NO. 0504009A – RAILROAD PROTECTION
- ITEM NO. 0952001A – SELECTIVE CLEARING AND THINNING

The following C.S.I. Special Provisions are hereby deleted:

- 03 30 00 CAST-IN-PLACE CONCRETE

- 05 40 00 COLD-FORMED METAL FRAMING
- 07 14 16 COLD FLUID APPLIED WATERPROOFING
- 07 21 00 THERMAL INSULATION
- 07 25 00 WEATHER BARRIER
- 10 81 13 BIRD CONTROL DEVICES
- 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

CONTRACT ITEMS

NEW CONTRACT ITEMS

ITEM NO.	DESCRIPTION	UNIT	QUANTITY
0216009A	EXPANDED POLYSTYRENE FILL	CY	282 CY
0507735A	CONVERT TYPE "C-L" CATCH BASIN TO MANHOLE	EA.	1 EA.
0507754A	RESET TYPE "C" CATCH BASIN DOUBLE GRATE-TYPE II	EA.	1 EA.
0651744	4" POLYVINYL CHLORIDE PIPE	LF	50 LF
0701190	OBSTRUCTIONS	HR.	20 HR.
0755010	GEOTEXTILE (SEPARATION-MEDIUM SURVIVABILITY)	SY	836 SY
0922050A	DECORATIVE CROSSWALK	SF	4,080 SF
0951002A	TREE GRATES	EA.	8 EA.
0949038A	CERCIS CANADENSIS "OKLAHOMA"" EASTERN REDBUD 2"-2.5" CAL. B.B.	EA.	2 EA.
0949131A	SYRINGA RETICULATA, "IVORY SILK" JAPANESE TREE LILAC, 2"-2.5" CAL. B.B.	EA.	2 EA.
0949737A	PYRUS CALLERYANA "BRADFORD" BRADFORD CALLERY PEAR, 2"-21/2" CALIPER B.B.	EA.	4 EA.
1002015	ROCK IN FOUNDATION EXCAVATION	VF	10 VF
1017001	SERVICE ENTRANCE AND CABINET-TYPE 1	EA.	1 EA.
1017052A	REMOVE SERVICE	EA.	1 EA.
1108644A	TRAFFIC MANAGEMENT SYSTEM CABINET	EA.	1 EA.
0099010A	REMOVAL OF ABONDONED RAILROAD EQUIPMENT	EA.	2 EA.
0101133A	DISPOSAL OF CONTAMINATED RAILROAD TIES	TON	135 TONS

REVISED CONTRACT ITEMS

ITEM NO.	DESCRIPTION	ORIGINAL QUANTITY	REVISED QUANTITY
0203000	STRUCTURE EXCAVATION – EARTH (COMPLETE)	5,825 CY	9307 CY
0214100	COMPACTED GRANULAR FILL	139 CY	210 CY
0216000	PERVIOUS STRUCTURE BACKFILL	7,649 CY	7,699 CY
0506070A	GROUND ANCHOR	132 EA.	171 EA.
0506071A	PERFORMANCE TEST FOR GROUND ANCHOR	25 EA.	29 EA.
0506073A	PROOF TEST FOR GROUND ANCHOR	107 EA.	142 EA.
0509001	WELDED STUDS	6,216 EA.	6,904 EA.
0601000	CLASS “A” CONCRETE	1,731 CY	2,395 CY
0601091A	SIMULATED STONE MASONRY	2,561 SY	2,465 SY
0601201	CLASS “F” CONCRETE	2,948 CY	2,988 CY
0601502	½” PREFORMED EXPANSION JOINT FILLER FOR BRIDGES	2,534 SF	2,647 SF
0602000	DEFORMED STEEL BARS	395,310 LB.	471,780 LB.
0602890	DOWEL BAR SPLICER SYSTEM	246 EA.	424 EA.
0603851A	STRUCTURAL STEEL (LOW ALLOY)	955 CWT.	1,163 CWT.
0651011A	12” R.C. PIPE	173 LF	273 LF
0701200	DRILLED SHAFT (2.0’ DIAMETER)	1,960 LF	2,084 LF
0701230	DRILLED SHAFT EARTH EXCAVATION (2.0’ DIAMETER)	1,410 LF	1,489 LF
0701260	DRILLED SHAFT ROCK EXCAVATION (2.0’ DIAMETER)	550 LF	595 LF
0701330	PERMANENT CASING (2.0’ DIAMETER)	1,410 LF	1,489 LF
0702026A	MICROPILES	287 EA.	325 EA.
0702028A	PROOF TEST FOR MICROPILES	29 EA.	34 EA.
0702029A	MICROPILE LENGTH ADJUSTMENT	359 LF	394 LF
0702101A	FURNISHING STEEL PILES	378,715 LB.	407,662 LB.
0714026A	TEMPORARY SHEET PILING (RAILROAD)	6,000 SF	2,500 SF
0714045A	TEMPORARY SOLDIER PILE AND LAGGING (RAILROAD)	3,370 SF	3,280 SF
0714046A	SOLDIER PILE AND LAGGING LEFT IN PLACE (RAILROAD)	3,737 SF	1,700 SF
0716000	TEMPORARY EARTH RETAINING SYSTEM	2,823 SF	3,861 SF
0717000	EARTH RETAINING SYSTEM LEFT IN PLACE	4,006 SF	2,930 SF
0751831	6” OUTLET FOR UNDERDRAIN	135 LF	340 LF

0751996A	GEOCOMPOSITE SHEET DRAIN	7,506 SF	8,961 SF
0813001	5" GRANITE STONE CURBING	306 LF	2,648 LF
0813011	5" GRANITE CURVED STONE CURBING	180 LF	425 LF
0921001	CONCRETE SIDEWALK	9,689 SF	8,405 SF
0921018A	BRICK PAVING	1,791 SF	3,416 SF
0973723A	WORKSITE TRAFFIC SUPERVISOR	20 MO.	28 MO.
0974001	REMOVAL OF EXISTING MASONRY	1,496 CY	1534 CY
0992093A	RESET BRICK PAVING	929 SF	600 SF
1116100A	INTERNALLY ILLUMINATED SIGN (LED)	9 EA.	13 EA.
1131002	REMOTE CONTROL CHANGEABLE MESSAGE SIGN	540 DAY	600 DAY
1210105	EPOXY RESIN PAVEMENT MARKINGS SYMBOLS AND LEGENDS	6,215 SF	4,487 SF
0090037A	DOWN GUYS	9 EA.	8 EA.
0090094A	GUY ANCHORS, TYPE 4	2 EA.	1 EA.
0602006	DEFORMED STEEL BARS – EPOXY COATED	92,165 LB.	97,865 LB.
0603801A	STRUCTURAL STEEL	1,483 CWT.	1,493 CWT.
0702027A	VERIFICATION TEST FOR MICROPILES	3 EA.	5 EA.

DELETED CONTRACT ITEM

ITEM NO.	DESCRIPTION	ORIGINAL QUANTITY	REVISED QUANTITY
0811001	CONCRETE CURBING	2,751 LF	0 LF

PLANS

NEW PLANS

The following Plan Sheets are hereby added to the Contract:

01.03.005-1.A3
01.03.006-1.A3
01.03.007-1.A3
01.03.012-1.A3
01.03.014-1.A3
01.03.014-2.A3
01.03.014-3.A3
01.03.015-1.A3
01.03.016-1.A3

01.03.017-1.A3
01.03.018-1.A3
01.03.020-1.A3
01.03.022-1.A3
01.03.023-1.A3
01.03.031-1.A3
01.03.033-1.A3
01.03.034-1.A3
01.03.035-1.A3
01.03.036-1.A3
01.03.037-1.A3
01.03.038-2.A3
01.03.039-2.A3
01.03.040-2.A3
01.03.041-1.A3
01.03.042-1.A3
01.03.043-1.A3
01.03.049-1.A3
01.03.051-1.A3
01.03.052-1.A3
01.03.053-1.A3
01.03.055-1.A3
01.03.059-1.A3
01.03.060-1.A3
01.03.061-1.A3
01.03.068-1.A3
01.03.069-1.A3
01.03.070-1.A3
01.03.071-1.A3
01.04.004-1.A3
01.04.020-1.A3
01.05.039-1.A3
01.06.002-1.A3
01.06.002-2.A3
01.06.009-1.A3
01.06.009-2.A3
01.06.009-3.A3
01.06.009-4.A3
01.06.009-5.A3
01.07.003-1.A3
01.07.003-2.A3
01.07.010-1.A3
01.07.010-2.A3
01.07.010-3.A3
01.07.010-4.A3
01.07.010-5.A3

02.03.092-1.A3
02.08.009-1.A3
02.08.010-1.A3
02.08.010-2.A3
02.08.011-1.A3
02.08.011-2.A3
02.08.015-1.A3
02.08.015-2.A3
02.08.017-1.A3
02.08.023-1.A3
02.08.023-2.A3
02.08.023-3.A3
02.08.023-4.A3
02.08.023-5.A3
02.08.023-6.A3
02.08.023-7.A3
02.09.002-1.A3
02.09.003-1.A3
02.09.005-1.A3
02.09.006-1.A3
02.09.006-2.A3
02.09.006-3.A3
02.09.006-4.A3
02.09.006-5.A3
02.09.006-6.A3
02.09.006-7.A3
02.09.006-8.A3
02.09.006-9.A3
02.09.020-1.A3
02.09.020-2.A3
02.09.020-3.A3
02.09.020-4.A3
02.09.020-5.A3
02.09.021-1.A3
02.10.002-1.A3
02.10.003-1.A3
02.10.004-1.A3
02.10.005-1.A3
02.10.010-1.A3
02.10.021-1.A3

REVISED PLANS

The following Plan Sheets are hereby deleted and replaced with the like-numbered Plan Sheets:

01.02.001.A3
01.03.008.A3
01.03.010.A3

01.03.019.A3
01.03.021.A3
01.03.026-1.A3
01.03.027-1.A3
01.03.030.A3
01.03.032.A3
01.04.018.A3
01.04.019.A3
01.04.021.A3
01.04.022.A3
01.05.002.A3
01.05.034.A3
01.05.037.A3
01.05.038.A3
01.05.039.A3
01.05.041.A3
01.05.043.A3
01.05.045.A3
01.05.046.A3
01.05.052.A3
01.05.061.A3
01.05.066.A3
01.05.067.A3
01.05.071.A3
01.05.072.A3
01.05.077.A3
01.05.080.A3
01.05.081.A3
01.05.082.A3
01.05.085.A3
01.05.086.A3
01.05.087.A3
01.05.089.A3
01.05.091.A3
01.06.001.A3
01.06.002.A3
01.06.003.A3
01.06.004.A3
01.06.005.A3
01.06.006.A3
01.07.002.A3
01.07.003.A3
01.07.004.A3
01.07.005.A3
01.07.006.A3
01.07.009.A3

01.08.001.A3
01.08.005.A3
02.02.001.A3
02.04.003.A3
02.04.018.A3
02.04.019.A3
02.04.020.A3
02.04.023.A3
02.04.024.A3
02.08.003.A3
02.08.004.A3
02.08.005.A3
02.08.006.A3
02.08.007.A3
02.08.008.A3
02.08.009.A3
02.08.010.A3
02.08.011.A3
02.09.001.A3
02.09.019.A3
02.10.021.A3

DELETED PLANS

The following Plan Sheets are hereby deleted in their entirety:

01.03.005
01.03.007
01.03.012
01.03.014
01.03.015
01.03.016
01.03.017
01.03.018
01.03.020.A1
01.03.022
01.03.023
01.03.031
01.03.033
01.03.034
01.03.035
01.03.036
01.03.037
01.03.038-1.A1
01.03.039-1.A1
01.03.040-1.A1
01.03.041
01.03.042

01.03.043
01.03.049
01.03.051
01.03.052
01.03.053
01.03.055
01.03.059
01.03.060
01.03.061
01.03.068
01.03.069
01.03.070
01.03.071
01.04.004
01.04.020
02.08.015
02.09.002
02.09.003
02.09.005
02.09.006

The Bid Proposal Form has been revised to reflect these changes.

The Detailed Estimate Sheets do not reflect these changes.

There will be no change in the number of calendar days due to this Addendum.

The foregoing is hereby made a part of the contract.

NOTICE TO CONTRACTOR - Federal Rail Safety Regulations (49 C.F.R. Part 219) Concerning Alcohol and Drug Testing

On October 16, 2008, the United States Congress enacted the Rail Safety Improvement Act of 2008 (RSIA). RSIA directs the Federal Railroad Administration (FRA) to promulgate new safety regulations related to railroad safety. The purpose of this NTC is to notify you of certain requirements recently promulgated by the FRA that may be applicable to work you are currently performing, or may in the future perform, for the Connecticut Department of Transportation (Department).

On June 10, 2016, the FRA published a final rule expanding the scope of its drug and alcohol testing regulations (FRA Regulations) to provide that "[e]ach railroad must ensure that a regulated employee is subject to being selected for random testing... whenever the employee performs regulated service on the railroad's behalf." 49 C.F.R. § 219.601. A "regulated employee" includes a contractor to a railroad or any individual who is performing activities for a railroad and includes those contractors, consultants or individuals who are deemed "maintenance-of-way" employees under 49 C.F.R. Part 219 (See 49 C.F.R. §219.5).

The term maintenance-of-way (MOW) employee, as used in 49 C.F.R. Part 219, is defined in 49 C.F.R. § 214.7 as "any employee…of a contractor to a railroad, whose duties include inspection, construction, maintenance or repair of railroad track, bridges, roadway, signal and communications systems, electric traction systems, roadway facilities or roadway maintenance machinery on or near track or with the potential of fouling a track, and flagmen and watchmen/lookouts." (collectively, MOW Activities).

The final rule, which is effective **June 12, 2017,** requires contractors and consultants employing MOW employees to submit a Part 219 Compliance Plan to FRA **prior** to the effective date. Please consult the following link to the model drug and alcohol plan prepared by the FRA for guidance.

https://www.fra.dot.gov/eLib/details/L02814

The final rule mandates, among other things, the establishment of a random testing pool to ensure a testing rate of 50% of MOW employees for drugs and 25% of MOW employees for alcohol on an annual basis. For more information related to the requirements, please refer to:

http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=49:4.1.1.1.14

Every contractor or consultant that is performing MOW Activities must comply with its obligations under 49 C.F.R. Part 219 to ensure that all MOW employees are being randomly tested for drugs and alcohol. Failure of a contractor or consultant to timely comply with the FRA Regulations may subject that firm to civil penalties. In addition, MetroNorth Railroad (MNR) has stated that contractors or consultants who do not comply with the FRA regulations will not be able to work on MNR property.

The Department strongly urges all contractors and consultants to consult with their attorneys and/or to conduct their own independent due diligence regarding the requirements imposed by the new FRA Regulations to determine what steps are necessary to assure compliance. The information provided herein is advisory in nature and is offered without warranty of any kind. The Department does not accept any responsibility or liability for the accuracy, content, completeness, legality, or reliability of the information contained herein.

Any questions regarding the FRA Regulations concerning drug and alcohol testing should be directed to: Mr. Gerald Powers, Drug and Alcohol Program Manager, Office of Safety Enforcement, Federal Railroad Administration, 1200 New Jersey Avenue SE, Mail Stop 25, Washington, DC 20590 or via telephone (202) 493-6313.

GENERAL

ITEM NO. 0101133A – DISPOSAL OF CONTAMINATED RAILROAD TIES

Description:

Work under this Item shall consist of the removal, transportation, and final off-site disposal/recycling/ treatment of contaminated railroad ties and contaminated timber members (excluding concrete), which have been generated from various excavations/demolition and determined to be contaminated with regulated substances at non-hazardous levels. Such railroad ties and timber members, after proper characterization by the Engineer, shall be loaded and transported directly to, and treated/recycled/disposed of, at a permitted treatment/recycle/disposal facility (TDRF) listed herein.

The Contractor must use the following Department-approved TDRFs for the disposal of non-hazardous contaminated railroad ties and timber members.

Allied Waste Niagara Falls Landfill, LLC 5600 Niagara Falls Blvd. Niagara, NY 14304 (716) 285-3344; David Hanson (781) 560-1379; Eugene Lunney	Clean Harbors of Connecticut, Inc. 51 Broderick Road Bristol, CT 06010 (860) 583-8917; Glen Carlson
Waste Management Turnkey Landfill Rochester, NH Bethany Enterline; 413-544-1932; benterli@wm.com	Advanced Disposal Services 635 Toby Road Kersey, PA 15486 (814) 265-1744; Tony LaBenne
Ontario County Landfill (managed by Casella Waste) 555 Post Farm Road Stanley, NY 14561 (603) 235-3597; Scott Sampson	

The above list contains TDRFs that can accept contaminated railroad ties and contaminated timber members generated by the Project in quantities limited by their permits and operational needs. In addition, some of these TDRFs may become unavailable during the duration of the Project. It is the responsibility of the Contractor to verify that a facility will be available and capable of handling the volume, as well as the chemical and physical characteristics of contaminated railroad ties and timber members generated by the Project. As such, the Contractor must factor in such possibilities.

Construction Methods:

A. Submittals

The apparent low bidder shall submit in writing 30 days prior to shipping to any of the TDRFs:

1. The name(s) of the TDRF(s) (from the list above) which the Contractor intends to use to receive contaminated railroad ties and contaminated timber members from the Project;
2. A copy of the attached "Disposal Facility Material Acceptance Certification" form from each facility from the list above, which shall be signed by an authorized representative of each TDRF; and
3. A copy of the facility acceptance criteria and facility sampling frequency requirements from each TDRF.

Disposal of contaminated railroad ties and contaminated timber members shall only be made at a ConnDOT approved TDRF that is permitted to receive this type of waste. No facility may be substituted for the one(s) designated in the Contractor's submittal without the Engineer's prior approval. If the material cannot be accepted by any facilities from the list above, the Department will supply the Contractor with the name(s) of other acceptable facilities.

B. Material Disposal

The Engineer shall sample the in-place contaminated railroad ties and contaminated timber members prior to the start of any work for waste characterization purposes. The Engineer will provide the Contractor with the waste characterization sampling results.

The Contractor shall obtain and complete all paperwork necessary to arrange for material disposal (such as disposal facility waste profile sheets). It is solely the Contractor's responsibility to coordinate the disposal of Controlled Materials with the selected TDRF(s). Upon receipt of the final approval from the facility, the Contractor shall arrange for the removal, loading, transport, and treatment/recycling/disposal of the materials in accordance with all Federal and State regulations.

The Contractor shall not begin removal of contaminated railroad ties and contaminated timber members until the selected disposal facility has indicated final approval of the materials for disposal. No claim will be considered based on the failure of the Contractor's TDRF(s) to meet the Contractor's production rate or for the Contractor's failure to select sufficient facilities to meet its production rate.

Any material processing (including, but not limited to, cutting and removal of steel or other non-wood components) required by the Contractor's selected facility will be completed by the Contractor prior to the material leaving the site. It is solely the Contractor's responsibility to meet any such requirements of its facility.

All manifests or bills of lading utilized to accompany the transportation of the material shall be prepared by the Contractor a minimum of 24 hours in advance and signed by an authorized Department representative, as Generator, for each truckload of material that leaves the site. The Contractor shall forward the appropriate <u>original copies</u> of all manifests or bills of lading to the Engineer the same day the material leaves the Project.

A load-specific certificate of treatment/recycling/disposal, signed by the authorized agent representing the disposal facility, shall be obtained by the Contractor and promptly delivered to the Engineer for each load.

C. Material Transportation

In addition to all pertinent Federal, State and local laws or regulatory agency polices, the Contractor shall adhere to the following precautions during the transport of contaminated railroad ties and contaminated timber members off-site:

1. Transported railroad ties and contaminated timber members are to be covered sufficiently to preclude the loss of material during transport prior to leaving the site and are to remain covered until the arrival at the selected TDRF;

2. All vehicles departing the site are to be properly logged to show the vehicle identification, driver's name, time of departure, destination, and approximate volume, and contents of materials carried;

3. No materials shall leave the site unless a treatment/recycling/disposal facility willing to accept all of the material being transported has agreed to accept the type and quantity of waste; and

4. Documentation must be maintained indicating that all applicable laws have been satisfied and that the materials have been successfully transported and received at the TDRF.

D. Equipment Decontamination

All equipment shall be provided to the work site free of gross contamination. The Engineer may prohibit from the site any equipment that in his opinion has not been thoroughly decontaminated prior to arrival. Any decontamination of the Contractor's equipment prior to arrival at the site shall be at the expense of the Contractor. The Contractor is prohibited from decontaminating equipment on the Project that has not been thoroughly decontaminated prior to arrival.

The Contractor shall furnish labor, materials, tools and equipment for decontamination of all equipment and supplies that are used to handle the contaminated railroad ties and contaminated timber members. Decontamination shall be conducted at an area designated by the Engineer and shall be required prior to equipment and supplies leaving the Project and/or between stages of the work.

The Contractor shall use dry decontamination procedures. Residuals from dry decontamination activities shall be collected and managed as contaminated materials. If the results from dry methods are unsatisfactory to the Engineer, the Contractor shall modify decontamination procedures as required.

The Contractor shall be responsible for the collection and treatment/recycling/disposal of any liquid and solid wastes that may be generated by its decontamination activities in accordance with applicable regulations.

Method of Measurement:

The work of "DISPOSAL OF CONTAMINATED RAILROAD TIES" will be measured for payment as the actual net weight in tons of contaminated railroad ties and contaminated timber members removed and delivered to the TDRF. Such determinations shall be made by measuring each hauling vehicle on the certified permanent scales at the TDRF before and after unloading and subtracting the weight of the empty vehicle from the weight of the loaded vehicle. Total weight will be the summation of weight bills issued by the facility specific to this Project. Excess excavations made by the Contractor beyond the payment limits specified in Specification Sections 2.02, 2.03, 2.05, 2.06, or the Special Provision (as appropriate) will not be measured for payment and the Contractor assumes responsibility for all costs associated with the appropriate handling, management and disposal of this material.

The disposal of railroad ties and timber members, originally anticipated to be contaminated, but determined by characterization sampling to be suitable for disposal as bulky waste, will not be measured for payment under this Item but will be handled in accordance with the applicable provisions of the Contract regarding disposal of surplus excavated material.

Equipment decontamination, the collection of residuals, and the collection and disposal of liquids generated during equipment decontamination activities will not be measured separately for payment.

Any material processing required by the Contractor-selected disposal facility will not be measured for payment.

Basis of Payment:

This work shall be paid for at the Contract unit price, which price shall include the removal, loading and transportation of contaminated railroad ties and contaminated timber members from the Project to the TDRF(s); the treatment/recycling/disposal of such materials; the preparation of manifests, bills of lading, and fees paid; and all equipment, materials, tools, and labor incidental to this work. **This unit price will be applicable to all of the listed TDRFs and will not change for the duration of the Project.**

This price shall also include equipment decontamination; the collection of residuals generated during equipment decontamination; and the collection and disposal of liquids generated during equipment decontamination activities.

Pay Item	Pay Unit
Disposal of Contaminated Railroad Ties	Ton

ITEM #0101133A

ITEM 0216009A - EXPANDED POLYSTYRENE FILL

Description: Work under this item shall consist of furnishing and placement of Expanded Polystyrene fill (EPS), and any dewatering required for placement. Work under this item shall also include the furnishing and placement of low density polyethylene foam. This work shall be performed as hereinafter specified, to the dimensions indicated on the plans, or as directed by the Engineer.

Materials: Furnish EPS blocks of the dimensions shown in the contract documents or as approved by the Engineer. EPS is typically supplied as right rectangular prismoid blocks with nominal dimensions of 2 ft x 4 ft x 8 ft. Blocks shall be smooth and flat on all surfaces and have a dimensional tolerance of ±0.5%. Blocks shall be manufactured using a modified resin that contains a fire retardant additive. Blocks shall be seasoned by storing them at the manufacturer's facility in normal ambient room temperature for a minimum of 72 hours after being released from the mold. Blocks shall meet the following physical requirements after seasoning:

MINIMUM PHYSICAL PROPERTIES
ASTM D6817

Density		1.80 lbs/ft^3
Compressive Strength:	at 1% deformation	10.9 psi
	at 10% deformation	29.0 psi
Flexural Strength		50.0 psi
Flammability (Oxygen Index)		24.0 %

The following reference standards shall apply in whole or in part to material supplied under this specification:

APPLICABLE STANDARDS

ASTM D6817	Standard Specification for Rigid Cellular Polystyrene Geofoam
ASTM C390	Criteria for Sampling and Acceptance of Preformed Thermal Insulation Lots

The EPS blocks shall be produced by a manufacturer with an in-place quality control program which is monitored and certified by an accredited, independent third-party testing organization.

Where called out in the plans, the low density polyethylene foam shall be a closed-cell, foam material and shall comply with the following properties:

Minimum Tensile Strength	100 psi
Minimum Density	3.0 pcf

Submittals A minimum of 20 business days prior to beginning work, submit two copies of certified third-party test reports to the Engineer for approval, showing that at least two separately molded EPS blocks, representative of those which will be supplied, conform to the physical

properties and standards listed above. The date of manufacture of the tested EPS blocks shall be no more than 6 months prior to the date of the submittal. Test specimen selection and preparation shall be done in accordance with ASTM D1621 and D1622.

Submit detailed manufacturing records for the tested blocks which clearly state, in part, the percentage, type (in-plant or post-consumer), and original density of any recycled EPS material (regrind) used in the molding process.

Basis of Acceptance Each EPS block shall be labeled with the manufacturer's name, product type, lot number, date of manufacture and weight (as measured after seasoning and trimming). Unlabeled blocks will be rejected. The Contractor shall supply detailed manufacturing records of individual blocks if requested by the Engineer.

The Engineer will perform on-site density tests by weighing and measuring one block randomly chosen from each truckload or 2500± cubic feet of EPS delivered to the project site. The Contractor shall provide a calibrated scale accurate to within 0.1 lbs and with sufficient capacity for this purpose. Blocks shall be kept clean and dry prior to weighing. If any block does not meet the minimum density requirement, the sampled truckload or 2500± cubic foot batch will be rejected by the Engineer.

EPS blocks that do not meet tolerances, or have side area surface damage of 20% or more or volume damage of 1% or more will be rejected.

The State reserves the right to take random samples from the project site (not to exceed 1 block per 10,000 cubic feet) for additional quality assurance testing. If testing yields unsatisfactory results the Contractor may be directed to remove and replace potentially defective EPS blocks at no additional cost to the State.

Construction Details:

General

A. Exercise care to prevent damage to the EPS during delivery, storage and construction. Protect the EPS blocks from (1) Organic solvents such as acetone, benzene, and paint thinner; (2) Petroleum based solvents such as gasoline and diesel fuel; (3) Open flames and (4) Prolonged exposure to sunlight (more than 30 days).
B. Provide a system of temporary weights or tie downs, approved by the Engineer, to anchor the EPS blocks if there is wind gust or flooding potential.
C. Do not drive or operate heavy machinery or place concentrated loads directly on the EPS blocks. EPS blocks damaged due to the Contractor's operations will be removed and replaced at no additional cost to the State.
D. Trim the EPS blocks in the field where necessary with a portable hot wire device supplied by the manufacturer, or a handsaw, or an alternative cutting method approved by the Engineer.

Block Placement

A. Place the EPS blocks as indicated in the contract documents.
B. There shall be no debris of any kind between adjacent surfaces of EPS blocks at the time adjacent EPS blocks are placed.
C. There shall be no standing water or accumulated snow or ice on the previously placed EPS block layer within the area where subsequent EPS blocks are to be placed at the time of block placement.
D. EPS blocks shall be placed so that all vertical and horizontal joints between blocks are tight. Avoid continuous vertical joints by laying blocks in a running bond pattern and orienting the long axis of the blocks in each successive layer perpendicular to the long axis of the blocks in the previous layer.
E. While placing successive layers of EPS blocks, Contractor should exercise care to guarantee that all placed blocks are supported over their entire bearing area. In the event the top constructed surface of an assembly of blocks becomes uneven or where rocking of the blocks is observed, Contractor shall notify the Engineer and propose a remedial procedure for corrective action. Such procedure shall be submitted for review and approval by the Engineer prior to resuming construction.
F. Blocks shall be placed such that the resulting exterior surfaces on the sides of the EPs-Block Fill structures are vertical and planar within a tolerance of 1/8-inch between blocks. Block faces not satisfying this criterion shall be field trimmed using hot wire cutting apparatus to achieve the desired evenness within the above tolerance.
G. The inter-block connectors shall be placed at the locations shown on the shop drawings and shall be set into the EPS block such that the inter-block connectors do not cause a gap to exist between adjacent layers of EPS blocks.
H. The final surface of the EPS blocks shall be covered as shown on the Contract Drawings. Care shall be exercised during placement of the cover material so as not to cause any damage to the EPS blocks.

Method of Measurement: The quantity of Expanded Polystyrene fill and low density polyethylene foam is the number of cubic yards satisfactorily installed as measured in its final position. Sand layer shall not be measured for payment, but included in the cost of the Expanded Polystyrene fill.

Basis of Payment: The unit price per cubic yard shall include the cost of labor, materials, incidentals and equipment necessary to satisfactorily complete the work.

The cost of furnishing and installing low density polyethylene foam, including labor, material and equipment shall be included in this item.

Pay Item	Pay Unit
Expanded Polystyrene Fill	c.y.

ITEM NO. 0813001 – 5" GRANITE STONE CURBING
ITEM NO. 0813011 – 5" GRANITE CURVED STONE CURBING

The work shall comply with section 8.13 supplemented and amended as follows:

8.13.01 - Description:

Add the following after "prepared base" in the fourth line: "of ¾ inch crushed stone and embedded in concrete as shown on the details and"

8.13.02 - Materials:

Add the following at the end of the first paragraph: Article M.02.06 for ¾ inch Crushed Stone and M.03.01for Class "C" Concrete.

The material for this work shall conform to the following requirements for Concrete:
Concrete shall be 3,000 psi Class "C" Concrete in accordance with the provisions of Article M.03.01 with ¾" Crushed Stone base.

8.13.03 - Construction Methods:

Subarticle 1. Excavation
Revise the first sentence as following:
Excavation shall be made to the bottom of the ¾ inch Crushed Stone base below the curbing and concrete as shown on the details in the plans.

Subarticle 2. Installing Stone Curbing
Revise the first sentence as following:
The curbing shall be set on edge embedded in concrete and set on a bedding of ¾ inch crushed stone settled into place with a heavy wooden hand rammer, to the line and grade required, straight and true for the full depth.

8.13.05 - Basis of Payment:

Delete the last paragraph and replace with the following:

There will be no direct payment for furnishing, placing and compacting ¾ inch crushed stone base and placing concrete bedding, beveling or rounding the ends of the curbing and pointing the joints with mortar; but the cost of this work shall be considered as included in the general cost of the work.

Pay Item	Pay Unit
5" Granite Stone Curbing	Linear Foot
5" Granite Curved Stone Curbing	Linear Foot

ITEM NO. 0921001A – CONCRETE SIDEWALK

The work shall comply with Section 9.21 supplemented as follows:

9.21.01 - Description:

Add the following: The Contractor shall provide a typical 20inch x 20inch square score pattern, adjusted to 18inch to 24inch as necessitated by sidewalk width, in accordance with the details shown on the plans or as directed by the Engineer.

9.21.03 - Construction Methods:

Subarticle 5. Finishing

Add the following: The concrete surface shall be installed with a typical 20inch x 20inch square score pattern, adjusted to 18inch to 24inch as necessitated by sidewalk width in accordance with the details shown on the plans or as directed by the Engineer. Any adjustment to the typical 20inch x 20inch pattern shall be approved in advance of scoring the concrete surface.

9.21.05 - Basis of Payment:

At the end of the first paragraph add the following: The price per square foot for "Concrete Sidewalk" shall include scoring the surface with a square grid pattern.

Pay Item	Pay Unit
Concrete Sidewalk	Square Foot

ITEM #0922050A – DECORATIVE CROSSWALK

Description: This work shall consist of a thermoplastic surfacing system that provides a textured, highly attractive and durable topical treatment to the surface of asphalt pavement. The system will replicate, in relief, the grout lines common to brick or other types of unit pavers or other patterns. The pattern shall match the existing pattern at the intersection of Atlantic Street with Dock Street and Station Place and shall be approved by the Engineer prior to installation.

Materials: The thermoplastic surfacing system shall consist of **ThermoPrintHT™** as manufactured by Flint Trading, Inc.; (www.flinttrading.com), or approved equal.

A. Thermoplastic shall consist of homogeneously mixed non-hazardous polymer resins, pigments, fillers consisting of TiO^2 and $CaCO^3$, glass beads and at least 12% coarse aggregate particles sized 6-14 mesh, with a negligible VOC level and be resistant to deterioration when exposed to sunlight, gasoline, oil, salt, water or adverse weather conditions.

B. Thermoplastic shall be supplied as precut panels at a standard thickness of 180 mils +/- 10 mils. Thermoplastic for transverse lines shall be supplied as pre-formed, white thermoplastic line stripe material 90 mils thick.

C. Thermoplastic shall exhibit the following typical properties:

Characteristic	Test Method	Typical Results of StreetPrintXD™ Thermoplastic
Water Absorption	ASTM D570	<0.5% Binder
Content	AASHTO T250	18.8%-20.0%
Low Temp. Resistance @ 15° F	AASHTO T250	No cracking
Specific Gravity	ASTM D792	2.0 - 2.16
Indentation resistance @ 46.1° C	ASTM D2240	44 - 52
Impact Resistance	ASTM D256, Mtd A	< 20
Flash Point	ASTM D92	> 440° F
Bond Strength	ASTM 04796	316 + psi
Friction	British Pendulum	BPN > 65

Construction Methods:

General

The **ThermoPrintHT™** system shall be supplied and installed only by an accredited **ThermoPrintHT™** applicator or an applicator authorized in writing by Flint Trading, Inc. for a specific project. The **ThermoPrintHT™** system shall be supplied and installed in accordance with the most recent Recommended Application Procedure Guide as provided by Flint Trading, Inc. and the work shall be carried out in accordance with the plans and specifications or as directed by the Engineer. Installation shall not begin without written confirmation of applicator accreditation or authorization.

Surface Preparation

The asphalt pavement surface shall be dry and free from all foreign matter, including but not limited to dirt, dust, de-icing materials, and chemical residue.

Heating the Asphalt Pavement

The optimal pavement temperature for imprinting the template is dependent upon mix design, modifiers used in the mix, and the age of the pavement. Care must be taken to avoid overheating the pavement; excessive blue smoke emanating from the asphalt pavement must be avoided. Typically, the surface temperature of the pavement should not exceed 325°F as determined by reading a calibrated infrared thermometer.

Surface Imprinting

Once the asphalt pavement has reached imprinting temperature, the first (3/8" diameter wire rope) template shall be placed in position then pressed into the surface using vibratory plate compactors. Once the top of the template is level with the surrounding asphalt pavement, the template can be removed. Areas that have an imprint depth less than the depth of the template shall be re-heated and re-stamped prior to installing the thermoplastic.

Installing the Thermoplastic and Sand

A. The area must be thoroughly cleaned and dried before installing the thermoplastic.

B. Do not install during periods of precipitation.

C. Both the ambient air temperature and the pavement temperature must be above 45°F (7°C). Do not install when there is frost still in the ground.

D. Place the thermoplastic sheets over the top of the imprinted asphalt pavement and in-line with the pattern. The sheets are to be butted together without overlap and cover the entire area designated to receive the surfacing system.

E. Using the manufacturer's recommended equipment, heat shall be applied to the thermoplastic to gradually raise the temperature so that the thermoplastic is melted all the way through and begins to flow into the grout lines and fuse with both the surface of the asphalt pavement and the edges of the neighboring thermoplastic sheet.

F. As the thermoplastic starts to flow and adhesion to the pavement surface is attained, the sand is seeded evenly into and on top of the thermoplastic at an approximate rate of 50 pounds per 200 sf of surface.

G. Using a vibratory plate compactor, the thermoplastic shall be post-printed using the second (114" diameter wire rope) template to clearly define the pattern.

Marking Pattern

Thermoplastic Surface Architectural Pavement crosswalks shall consist of alternating 18" white bars and 18" red bars, 96" wide with a 6" wide black border on each side. The white and red bars shall have a 6' x 6" square pattern.

Protection and Opening to Traffic

The melted thermoplastic is to be protected until it cools and hardens. Water may be introduced to the surface as a way to help accelerate the cooling of the thermoplastic. No debris such as dust, excessive water, pollen etc shall be permitted to come in contact with the melted thermoplastic.

The road may be opened to traffic once the thermoplastic has cooled to adjacent pavement temperature.

Method of Measurement

Decorative Crosswalk will be measured for payment by the actual number of square feet of thermoplastic surfacing system installed on the pavement and accepted by the Engineer. ·

No deduction will be made for the area(s) occupied by manholes, inlets, drainage structures, bollards or by any public utility appurtenances within the area.

Basis of Payment

This work will be paid for at the contract unit price per square foot for Decorative Crosswalk" installed on the pavement and accepted. This price shall be for all the work required by this section and all materials, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Decorative Crosswalk	Square Foot

ITEM #0922050A

ITEM NO. 0949038A – CERCIS CANADENSIS "OKLAHOMA" EASTERN REDBUD, 2"-2.5" CAL. B.B.

ITEM NO. 0949131A – SYRINGA RETICULATA, "IVORY SILK" JAPANESE TREE LILAC, 2"-2.5" CAL. B.B.

ITEM NO. 0949737A – PYRUS CALLERYANA "BRADFORD" BRADFORD CALLERY PEAR, 2"-2½" CALIPER B.B.

The work shall comply with Section 9.49 supplemented as follows:

9.49.01 - Description:
Add the following: The Contractor shall install HDPE/ plastic root barrier on all four sides of the tree to extend to the limits of the tree grate.

9.49.02 - Materials:
Add the following:

HDPE / plastic root barrier – Root barrier shall be HDPE and 24 inches wide

9.49.03 - Construction Methods:
Add the following:

HDPE / plastic root barrier – Root barrier shall be placed on all four sides of the tree and extend to the limits of the tree grate. The top of the root barrier shall be set 1 inch above the finished grade of the tree bed.

9.21.04 – Method of Measurement:
At the end of Subarticle 1 add the following:
"including HDPE / plastic root barrier."

9.21.05 - Basis of Payment:
Subarticle 3:
Revise the first line as follows: "The unit prices shall include all materials including HDPE / plastic root barrier, equipment, tools, labor, transportation,"

Pay Item	Pay Unit
Cercis Canadensis "Oklahoma" Eastern Redbud, 2"-2.5" CAL. B.B.	Each
Syringa Reticulata, "Ivory Silk" Japanese Tree LilaC, 2"-2.5" CAL. B.B.	Each
Pyrus Calleryana "Bradford" Bradford Callery Pear, 2"-2½" CALIPER B.B.	Each

ITEM #949038A
ITEM #949131A
ITEM #949737A

ITEM #0951002A – TREE GRATES

Description:
This item shall consist of furnishing and installing tree grates of the type and size specified with frames set in brick pavers, complete in place, at the locations and to the dimensions and details shown on the plans or as directed by the Engineer.

Materials:
The materials for this work shall conform to the following requirements:

Tree Grates

Frames and grates shall be manufactured of cast iron conforming to the requirements of Neenah Foundry Company.

Tree grates shall be the model "Extended Collection Tree Grate, catalog no. R-8815-B, 48"x120" as manufactured by Neenah Foundry Company, 2121 Brooks Avenue, Neenah, WI 54957, or approved equal.

Frame shall be as supplied by the manufacturer.

The Contractor shall provide a sample of the tree grate and frame for approval prior ordering materials.

Construction Methods:
Installation of tree grates and frames shall be in accordance with manufacturer recommendations for paving block installations. A typical installation is described as follows:

1. Excavate tree pit

2. Place assembly within excavation and set to proper grade.

3. Place tree grate halves within the frame.

4. Place setting bed and pavers, plant tree.

Prior to installation the procedure shall be reviewed with the Engineer and City of Stamford for approval.

Method of Measurement:
This work will be measured for payment by number of tree grates and frames, complete and accepted in place.

Basis of Payment:
This work will be paid for at the contract unit price each for "Tree Grates", complete in place, which price shall include all materials, equipment, tools and labor incidental thereto.

Pay Item	Pay Unit
Tree Grates	EA.

ITEM #1017052A - REMOVE SERVICE

DESCRIPTION: Work under this item shall consist of removal of an existing electric service cabinet for highway lighting at the location shown on the plans.

MATERIALS: The Contractor shall be responsible for damage to all equipment and material incurred during removal and hauling to specified area. All repairs or replacements due to damage or loss by the Contractor shall be made at the Contractor's expense.

CONSTRUCTION METHOD: The Contractor shall notify The Utility Co. to disconnect service 30 days prior to removing the service equipment. The service cabinet with all components shall be removed and shall be transported to the contractor's storage yard for the project.

The Contractor shall contact ConnDOT District 4 Electrical (tel: 203-264-9590) and arrange for ConnDOT Electrical personnel to have the opportunity to inspect the cabinet and to salvage the cabinet as a unit or salvage specific components. The Contractor shall assist ConnDOT Electrical personnel in loading the material onto ConnDOT vehicles for transport. Any material not selected for salvage shall remain the property of the Contractor.

The electric meter shall be returned to the appropriate Utility company representative and the Contractor shall note the date on which the meter was returned.

The concrete foundation shall be removed and disposed of by the contractor. The resulting excavation shall be properly backfilled, graded and seeded to match the surrounding area or as indicated on the plans.

The Contractor shall not remove the existing cabinet until the new lighting control cabinet(s) have been installed and are operational.

METHOD OF MEASUREMENT: This work will be measured for payment by the number of services removed and delivered, complete and accepted.

BASIS OF PAYMENT: This work will be paid for at the contract unit price each for "Remove Service" which price shall include removal, delivery and unloading of the cabinet, removal and disposal of the foundation, excavation, backfilling, grading, seeding, and all equipment, labor, work and incidentals thereto.

ITEM 1108644A – TRAFFIC MANAGEMENT SYSTEM CABINET

Description:

This work includes the furnishing and installing of outdoor equipment cabinets as shown on the Drawings and detailed in this specification.

Materials:

1. General:

   1.1. The Traffic Management System Cabinet (TMSC) shall serve as an environmental enclosure for the field equipment. The TMSC shall be installed at camera sites as shown on the plans. The TMSC shall be 24”W x 30”D x 67”H with 19” rack rails mounted inside the cabinet for mounting the following equipment:

   - Ethernet Port Sharing Device supplied as part of item # 1108628A
   - Optical Video/Data Transmitter supplied as part of item #1108704A
   - Single Mode Fiber Optic Media Converter for connecting VMS controller to the input panel in the TMSC, if required, supplied as part of item #1108662A - Single Mode Fiber Optic Media Converter. The Contractor shall refer to the detailed estimate sheet and fiber diagrams for determination for Fiber Optic Media Converter.
   - Local camera control connection, local traffic flow monitor connection, if required, provided as part of item #1112210A (Camera Assembly) and item #1113059A (Traffic Flow Monitor).
   - Input wiring panel with all appropriate surge suppression devices, terminal blocks and power supplies.
   - Power distribution panel rack/panel assembly.

   1.2. Publications listed below form a part of these Specifications to the extent referenced. The publications are referred to in the text by the basic designation only.

   - National Electrical Manufacturers Association (NEMA Standard 250)
   - Underwriters Laboratories UL50 and UL508
   - National Electrical Code – Most recent edition
   - 170 Traffic Signal Control Hardware Specification FHWA-1 P:-78-6

2. Traffic Management System Cabinet (TMSC):

   2.1. The TMSC shall meet the NEMA 3R standard. The TMSC shall be 24”W x 30”D x 67”H with 19” rack rails mounted inside the cabinet. The TMSC shall be fabricated with “S” flanges in the top ventilation to prevent forced snow, ice and road salt from

entering the enclosure.

2.2. The TMSC shall operate from an 115VAC +/- 10%, 60 Hz power source.

2.3. The TMSC shall be an enclosure suitable for outdoor mounting on a concrete foundation.

2.4. The TMSC shall meet the requirements as specified in Chapter 12 of the Type 170 Traffic Signal Control Hardware Specification FHWA-1 P-78-6 as modified by this Specification.

2.5. The TMSC shall be furnished with front and rear doors possessing securing brackets, each door equipped with a Conn-2 lock (tumbler-type). One (1) key shall be furnished for each cabinet installed. When closed, both doors shall fit tightly to a neoprene gasketing material. The door hinge pins shall be made of stainless steel. The hinge pins shall be the length of the door. The door hinges and securing brackets shall be made of stainless steel and bolted so doors may be changed without the need to cut welds.

2.6. The TMSC shall be supplied with internal EIA standard 19" racks as specified in the Drawings. The 19" racks shall be installed on both the front and rear door access points.

2.7. The TMSC shall have one rack mounted shelf that extends the complete width and depth of the cabinet. The shelf shall be adjustable in height and shall have rails to extend outwards. The shelf must be able to support a laptop computer when fully extended outward.

2.8. The TMSC shall be equipped with adequate heating as required for cabinet components and ventilating system to maintain inside temperature between +5 to +60 degrees C at any time. The heating and ventilating system shall include an electric heater, fan and replaceable filter mounted on the intake vent. The ventilation fan assembly shall be of adequate size to circulate air in the cabinet and controlled by an adjustable thermostat. The fan and cabinet are to be located so as to direct the bulk of the airflow throughout the entire cabinet. The fan motor shall have a suppresser across it equal to or better than 0.1 μf/47 ohm protection @ 600v. All points on the thermostat and fan at which 110 VAC are present shall be insulated to prevent electric shock.

2.9. The TMSC shall be equipped with an enclosed, 19" rack mounted electric strip heater and blower with a rating of approximately 800 watts at 120 VAC. The enclosure shall house the strip heater and blower in which air shall be drawn in across the strip heater and exhausted out from the blower. The enclosure shall feature an internal thermal cut-off that will shut off the heater should the exhaust area become obstructed. The ventilation fan and strip heater with blower shall be controlled by a high-low adjustable thermostat which can be set to ensure the cabinet interior temperature remains between +5° C and +60° C under average weather conditions. The strip heater with blower

thermostat shall have an adjustable low temperature range down to at least 0°C. The heater shall be wired directly to the AC circuit breaker reserved for the heaters.

2.10. The TMSC shall be equipped with an outdoor rated LED lamp with a 100 watt incandescent output equivalent rating mounted and wired such that the lamp comes on when either front or rear door is opened. The lamp shall be directly wired to AC.

2.11. The following electrical devices shall be provided on a hinged 19" EIA power distribution rack-mounted assembly in the TMSC. The hinged power distribution assembly shall be rack mounted on the opposite side of the ITS equipment. The hinged rack assembly chassis shall be constructed of aluminum and have a clear anodized finish. The hinged power assembly shall be able to swing out to provide clear access to rack mounted equipment for serviceability. A catalog cut of the power distribution assembly must be submitted for review and approval of the Engineer as part of the shop drawing review process.

2.11.1. One (1) 40 Amp main service input circuit breaker

2.11.2. Eight (8) 15 Amp load circuit breakers

2.11.3. Power bus

2.11.4. Ground bus

2.11.5. Neutral bus

2.11.6. Three (2) 20 Amp duplex 120 VAC power receptacles. In addition, one (1) GFCI duplex receptacle shall be included for tools and test equipment purposes. The electronic equipment to remain in the cabinet shall not be connected to the GFCI receptacles unless directed by the Engineer.

2.11.7. An EDCO ACP-340 surge suppression device shall be provided on the load side of the main circuit breaker. The protector shall be installed on the rack/panel mounted power assembly.

2.12. The TMSC shall have a heavy plastic envelope which will contain cabinet wiring diagrams, schematics, etc. The envelope shall be securely fastened to the inside of the front cabinet door. The envelope shall be 12" (300 mm) x 18" (455 mm) or larger.

2.13. The TMSC shall be fabricated from sheet aluminum providing it is rigid and has a minimum thickness of 3.17 mm. All outside surfaces shall be cleaned and finished. The outside surface appearance shall be brushed aluminum.

2.14. The TMSC shall be suitable for an outdoor installation on a concrete foundation and provide adequate environmental protection for the devices housed in the cabinets for year-round operation.

3.0 Input Wiring Assembly and Surge Suppression:

3.1 A rack mounted input wiring assembly measuring approximately 16"x19" shall be provided for each traffic management system cabinet. The assembly shall serve as the termination point for all communication and low-voltage power wiring to the CCTV cameras, traffic flow monitors (if required), variable message signs (if required) and other field equipment specified in the contract and shown on the plans. In addition, the assembly shall serve as a mounting location for surge suppression devices, low-voltage AC and DC transformers, and equipment cables that connect to devices in the traffic management system cabinet such as OVDT's, Ethernet port-sharing devices, fiber-optic media converters, etc.

3.2 The input wiring assembly shall be rack mounted on the backside of the TMSC above the power distribution panel. The assembly shall be hinged to provide access to rack mounted equipment. All cables shall be securely trained and fastened to allow free swinging of the wiring assembly and prevent fraying or damage. The panel shall swing out to provide access to rack mounted equipment for serviceability.

3.3 All terminal positions and devices on the wiring panel assembly shall be clearly marked and identified

3.4 The following types of voltage transient/surge suppression shall be provided and installed on the wiring panel assembly. Each surge suppression device shall be supplied and installed in an appropriate socket that is fastened to the wiring panel assembly.

- Coaxial CCTV cable input – EDCO CX-06-BNCY-I
- Traffic Flow Monitor power – EDCO PHC060 (one unit for every two (2) TFM's)
- Traffic Flow Monitor data communications – EDCO LCDP-030 (one unit for every TFM). This is only needed for TFM's that are connected to the cabinet using category 6 cable.(Ethernet circuit)
- Variable Message Sign with direct connect communications – EDCO LCDP-030 (one unit for every VMS) This is only needed for VMS's that are connected to the cabinet using category 6 cable (Ethernet circuit)
- CCTV camera data communications – EDCO PC642C-008 LC Two (2) EDCO devices may be required if Manchester data communications is used for local camera control. (RS-422 circuits)
- CCTV camera power – EDCO PHC060.
- Digital CCTV communications (For future use) – EDCO CAT6-POE

3.5 All field terminations, interconnections and wiring cable connections shall be made using terminal block strips except for Ethernet communications. Crimp-on spade lugs shall be installed on all cabling for easy connection and removal. All wiring connections shall be as short as possible to minimize signal loss and reduce transients.

3.6 Cables installed between surge suppression devices and cabinet equipment (such as OVDT's, CICU, etc.) may be made directly from the output terminals of the EDCO surge suppression units.

3.7 Transformers that supply low-voltage power shall be rack mounted on the wiring assembly panel.

4.0 Manufacturer's Qualifications:

4.1 The Manufacturer shall have a minimum of five (5) year's experience in the design, manufacture, and testing of TMSC of the type and size specified here in. The cabinets shall be manufactured according to world class quality standards. The manufacturer shall be ISO 9001 certified.

5.0 Warranty:

5.1. All equipment supplied under these items shall be warranted for parts by the vendor against defects and failures, which may occur through normal use for a period of one (1) year from the date of installation. A copy of the warranty shall be presented to the Engineer before installation of the equipment.

Construction Methods:

1. Submittals:

As part of Section 1.06 (Control of Materials) for this project, the Contractor shall submit the following documentation:

1.1. Detailed shop drawings, wiring diagrams, equipment cabinet front elevation drawings, and equipment installation drawings indicating supports and appurtenances required for proper installation in Visio 2007 format

1.2. Schematic showing wiring panel assembly including panel dimensions, locations of terminal blocks, surge suppression, transformers, cables, including wiring labels, etc. in Visio 2007 format.

1.3. Product data and cut sheets, operating and maintenance manuals. Information regarding materials, finishes and accessories.

2. As-built Documentation:

2.1. As part of the project as-builts, the Contractor shall provide the following information:

2.1.1. Test procedures and test results.

2.1.2. The Contractor shall submit with the documentation for the TMSC item four (4) copies of the "as-built" equipment manuals. The equipment manuals shall include technical information, wiring diagrams and schematics, hookup prints, parts list and a troubleshooting guide.

3. Delivery, Storage, and Handling:

3.1. The Contractor shall deliver, store, handle and install all materials and equipment in such a manner as not to degrade quality, serviceability or appearance.

3.2. The Contractor shall be responsible for storage of the materials and equipment prior to installation in a clean, dry location free from construction dust, precipitation and excess moisture.

3.3. The Contractor shall be required to replace any damaged materials and equipment, as determined by the Engineer, at no additional cost to the Department.

3.4. All materials shall be delivered in the manufacturer's original unopened protective packages. All materials shall be stored in their original protective packaging and protected against soiling, physical damage, or wetting, before installation. All equipment shall be protected during transportation and until installation against damage and stains.

4. Installation:

4.1. The Contractor shall install the TMSC on the foundation per the manufacturer's requirements. Connect all cables for power and fiber. Install all equipment listed in this specification and other equipment as required to power and communications cables/connectors. All communication cables must be terminated by the approved ITS integrator.

4.2. Install the rack mounted optical video/data transmitters, Ethernet port sharing devices and fiber-optic media converters in the field equipment cabinets in accordance with the equipment manufacturer's recommendations.

4.2. Install and connect field fiber optic cable and all other inter-equipment cabling required to fully interconnect the equipment as shown on the Drawings.

4.3. Install and connect the video/data transmitter, Ethernet port sharing device, fiber optic data media converter power supplies to the existing 120 VAC receptacles reserved for the equipment in the cabinet.

4.4. The optical fiber path for each video link shall have been tested and verified in accordance with the plans prior to the equipment installation.

4.5. Power distribution assembly components shall be mounted such that they are readily accessible. All hazardous voltage points shall be covered to prevent inadvertent contact. The circuit breakers shall be labeled.

4.6. Install and connect equipment on wiring panel assembly such as equipment transformers, surge suppression, cabling with spade lugs and/or connectors, surge suppression, etc.

4.7. Install and connect the hinged wiring panel assembly inside traffic management system cabinet. All wiring shall be neat and firm and in conformance with the current National Electrical Code. Any work performed by the Contractor for the utility installation shall be in accordance with P.U.C.A and State of Connecticut Department of Transportation Form 816. The Contractor shall obtain the necessary utility specifications prior to any service work.

4.8. All wiring to the hinged power distribution assembly shall be harnessed so that the panel may be moved to facilitate field repairs on the panel. AC+ signal power shall be brought to an accessible terminal. Logic Ground, AC-, and Chassis Ground must be tied to a common point in the cabinet and grounded. The cabinet shall be wired such that the removal of two jumper wires will completely isolate all said grounds from one another. The AC+ service wire shall be wired direct to the line side of the main circuit breaker.

4.9. All power cables and communication cables connected within the TMSC shall be neatly trained along the rail racks.

4.10. The Contractor shall neatly train all optical patch cords and pigtails together when routing them along the same path and shall neatly train them along the support rails in the camera control equipment cabinet. The contractor will provide rack mounted cable management when needed or as directed by the engineer.

4.11. The fibers shall be carefully managed and connected to a 19" rack mounted patch panel with six SC fiber connectors.. The fiber cable sheath shall be sealed to provide a moisture barrier at the termination point.

4.12. No cables shall be installed with a sweep-bend radius less than the manufacturer's minimum recommended bending radius.

5. Testing:

5.1. The Contractor shall be responsible for all testing and documentation required to establish approval and acceptance of this Item.

5.2. Pre-Installation Testing:

5.2.1. The Contractor shall be required to perform quality control testing on one (1) of the cabinets and all of the thermostats and heating/cooling assemblies prior to delivery.

5.2.2. The Contractor shall submit test procedures and documented test results to the Engineer. The test procedures shall document the nature of test activities to be performed.

5.2.3. The test procedures shall be submitted to the Engineer prior to initiation of the testing. The procedures will be returned to the Contractor within two (2) weeks indicating either "accepted" or "make corrections noted".

5.2.4. In the case that corrections are required, the Contractor shall submit revisions within one (1) week.

5.2.5. Four (4) copies of the final test procedures shall be submitted to the Engineer prior to commencement of testing. The testing and test procedures shall include, but not be limited, to the following:

- Visual Inspection: The Contractor shall perform detailed visual inspection to confirm that the following aspects of the cabinet are in compliance with the

requirements of this specification:

- General appearance: cabinet dimensions, finish, locks and door handles, door frames, latching mechanism, door hinges, bolts, louvered vents and filters, gaskets, and lifting eyes.

- Interior insulation, side panels, equipment rack.

- Electrical components: power distribution assembly, conductors, color coding, terminal blocks, heater operation and mounting, fan ventilation area, trouble lamp.

5.2.6. The Contractor shall perform visual test of the following components: service light, power distribution assembly, fan, heater, main power disconnect and thermostat.

5.2.7. The Contractor shall refer to the testing and documentation of the materials and equipment listed under these items to the testing and documentation for other pertinent items contained in this contract.

5.3. Proof-of-Performance Testing – The contractor shall energize each cabinet and confirm proper operation of heaters, fans, thermostats and service lights.

5.4. Installation Testing - Upon complete installation of all field equipment (including camera assemblies, TMSC, OVDT's, PSD’s, media converter - VMS) an operational test shall be performed by the Contractor and demonstrated to the Engineer to verify proper installation and operation. The test shall verify the proper operation of the field equipment installation.

5.5. 30-day Operational Testing - Upon successful completion of the installation test and approval by the Engineer, a 30-day System Operational Test for each TMSC site shall commence. During the course of this test, the system must function continuously in accordance with the specifications for the duration of the test. If a malfunction occurs within the stated time frame, the Contractor shall make all necessary repairs to the system and re-establish proper operation. Upon approval of the Engineer, the 30-day test will begin anew. The system must operate for a full thirty (30) consecutive days without malfunction before the system will be accepted by the Engineer. The Contractor shall refer to "Notice To Contractor – 30 Day System Operational Test" for additional testing requirements. The Contractor shall coordinate the 30-day System Operational Test with other pertinent items in this contract.

5.6 Ground Test

5.6.1 All cabinet grounding systems when completed in place shall have a resistance to ground of not more than that shown in the table below as determined in the following manner:

1. Temporarily connect a 10 ampere load between the AC+ side of the equipment cabinet fuse and the ground system. It should be assured that the applied power voltage is 120 volts AC at the time of the test.
2. Disconnect the power company AC neutral from the ground system.
3. Connect a voltmeter between the power company AC neutral and the ground system.

Cabinet Insulated	Voltmeter Reading (Volts)	Equivalent Resistance (Ohms)
Model 170 Type	20	2.0

4. If the voltmeter reading is higher than the appropriate voltage shown in the above table under the 10 ampere load, the grounding system has an unacceptable resistance to ground. Additional grounding including electrical bonding of underground metallic conduit, may be necessary in order to meet the requirements of this test.
5. The results of this test shall be recorded and provided to the Engineer for each cabinet installed prior to acceptance and 30-test operational testing.

5.6.2 Insulation Resistance Testing – An insulation resistance test at 500 volts DC shall be made on each circuit between the circuit and ground. The insulation resistance shall not be less than 10 megohms on each circuit.

Method of Measurement:

This item shall be measured for payment by the actual number of equipped Traffic Management System Cabinets supplied.

Basis of Payment:

The work to be done under this item shall be paid for at the Contract unit price each for Traffic Management System Cabinet of the type specified, which price shall include all materials, devices, hardware, termination panels, rack-mounted fiber patch panel, rack-mounted power assembly, rack-mounted wiring panels, surge suppression/transient protection, terminal strips, cable management, cables, connectors, tools, equipment, labor and incidentals necessary to complete this work.

SECTION 05 70 00 - DECORATIVE METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Decorative mechanical grilles and frames.

1.3 COORDINATION

A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including finishing materials.

B. Shop Drawings: Show fabrication and installation details for decorative metal.

1. Include plans, elevations, component details, and attachment details.

2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.

C. Samples for Verification: For each type of exposed finish.

1. Sections of linear shapes.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for the following types of decorative metal:

a. Linear steel fin soffit cover for canopy strip lighting.

2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DECORATIVE METAL FABRICATORS

A. List of manufacturers:

1. Architectural Grille, 42 2nd Ave., Brooklyn, NY 11215
2. Coco Architectural Grilles & Metalcraft, 173 Allen Blvd., Farmingdale, NY 11735
3. Or Approved Equal.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500/A 500M (cold formed).

B. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

2.4 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 316 stainless-steel fasteners where exposed.

2. Dissimilar Metals: Type 316 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099100 "Painting".

B. Universal Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Intermediate Coats and Topcoats for Steel: Provide products that comply with Section 099113 "Exterior Painting".

E. Epoxy Intermediate Coat for Steel: Complying with MPI#77 and compatible with primer and topcoat.

F. Polyurethane Topcoat for Steel: Complying with MPI#72 and compatible with undercoat.

2.6 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

J. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint.

K. Provide castings that are sound and free of warp, cracks, blowholes, or other defects that impair strength or appearance. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.8 STEEL AND IRON FINISHES

A. Preparing Nongalvanized Items for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

B. Primer Application: Apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated ferrous-metal surfaces with universal shop primer.

C. Powder-Coat Finish: Prepare, treat, and coat nongalvanized ferrous metal to comply with resin manufacturer's written instructions and as follows:

1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

3. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

G. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal arc welding and requirements for welding and for finishing welded connections in "Fabrication, General" Article. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

3.3 INSTALLING DECORATIVE GRILLES

A. Mount decorative grilles in positions indicated.

1. Secure to framing with specified fasteners.

3.4 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

C. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 70 00

SECTION 07 42 93 - SOFFIT PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes metal soffit panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical soffit as shown on Drawings; approximately four panels wide full eave width, including attachments and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.
2. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels:

1. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 316, fully annealed.

a. Nominal Thickness: 0.031 inch (0.79 mm).
b. Exterior Finish: 2B.

2.3 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

D. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Stainless-Steel Panels and Accessories:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

B. Fasteners:

1. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat enclosure.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.

3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.

4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 93

SECTION 10 14 26 – POST AND PANEL / PYLON SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following types of signs:

1. Porcelain enameled steel panel signs.

1.2 SUBMITTALS

A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide certifications that all work has been designed and installed in accordance with ADA requirements.

B. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details. Key plans showing proposed sign locations for the entire project.

1. Provide message list for each sign required, including large-scale details of wording and lettering layout.

2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed.

3. Additions or modifications to details, which are necessary due to special conditions encountered during the site survey, shall be provided by the Contractor as part of the contract and at no additional cost to the ConnDOT.

C. Materials List: Submit complete list of all materials proposed to be furnished and installed under this Section, making all submittals and re-submittals in accordance with the provisions of the Contract Documents and submit a notarized Certificate of Compliance.

D. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.

1. Samples for verification of color, pattern, and texture selected and compliance with requirements indicated:

a. Porcelain Steel Panel: samples of finish type and color, on 12-inch-long plate sections showing the full range of colors available and actual finish obtained with complete graphics.

b. Typical mounting brackets.

E. As part of Shop Drawing submission provide a detailed schedule of proposed times and dates for the installation of signage. Schedule shall be submitted for review and approval. All work shall be performed in accordance with any modifications affected by train schedule.

1.3 QUALITY ASSURANCE

A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

C. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Most sign units follow or closely adhere to MTA/Metro-North Railroad Sign Manual standards unless otherwise indicated.

D. For actual fabrication of the Station Signage, use only mechanics who are thoroughly trained and experienced in the skills required for the manufacture and fabrication of the units. In acceptance or rejection of the manufactured units, no allowance will be made for lack of skill on the part of the fabricator/manufacturer.

E. Tolerances:

1. Sign Panels

a. The Contractor shall note on the shop drawings all fabrication tolerances including, but not limited to: plumb, thickness, length, width, squareness, camber, and flatness.

b. Signs shall be free of defects including, but not limited to: buckles, dents, warps, wrinkles, and burrs.

2. Messages

a. Message Location: ±1/16 inch from the location as shown.

b. Line-to-Line: ±1/32 inch between each line and ±1/16 inch over entire message

c. Letter-to-Letter or Symbol (horizontally and vertically): ±1/32 inch between each letter or symbol and ±1/16 inch over an entire line.

3. Where multiple panels adjoin, the face and edges shall be milled to a tolerance of a +1/32 inch or -1/32 inch from a straight plane, so that when two adjoining panels are assembled, no gap over 1/16 inch shall be visible between panels.

4. Design components to allow for expansion and contraction for temperatures ranging between -20°F and +100°F, without causing buckling, opening of joints other than control joints, or overstressing of welds and fasteners.

5. Comply with AWS D1.2 for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux and dress on all exposed and contact surfaces.

6. Mill joints to a tight, hairline fit. Cope or miter corner joints.

F. The Contractor shall have all mounting and fabrication details and calculations designed, stamped and approved by a currently licensed Professional Engineer (PE), and reviewed and approved by the Engineer.

G. The unit, or panel to which a unit is to be mounted, must withstand a wind load of 20lbs/sf and horizontal/vertical loads of 250lbs/sf at top center of the sign with a maximum deflection of 1/360 of sign length. Calculations are to be submitted to the Engineer for review.

H. Manufacturer is to provide a five (5) year unconditional guarantee for said units against any defects in workmanship or fabrication from the date of issuance of the Certificate of Compliance.

I. ConnDOT reserves the right to retain an independent testing service to inspect the manufacturing process to ensure conformity to the Contract Documents.

J. The Contractor shall have in effect a Quality Assurance (QA) program clearly defining the procedures and requirements necessary to ensure that all aspects of the Work are accomplished in accordance with the Contract Documents. The Contractor will submit a copy of its QA program to the Engineer within fifteen (15) days after receipt of Notice of Award, for review and approval.

1.4 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

B. The Contractor shall provide adequate staff to take measurements and notes to determine new sign mounting locations and conditions.

1.5 REFERENCES

A. American National Standards Institute (ANSI) A 117.1
B. Copper Development Association (CDA)
C. National Association of Architectural Metal Manufacturers (NAAMM)
D. Americans with Disabilities Act Architectural Guidelines (ADAAG)

E. American Society for Testing and Materials (ASTM)

1. A424 Steel Sheets for Porcelain Enameling Commercial Quality Type 2
2. A286 Porcelain Enameling
3. C282 Porcelain Enamel Coating Acid Resistance Class A
4. C346 Porcelain Enamel Gloss Test Method (60 to 80 units)

F. American Welding Society (AWS) - Structural Welding Code for Steel Plate

G. Federal Specifications (FS)

1. FF-S-92B(1) Screw, Machine, Slotted, Cross Recessed or Hexagon Head

H. Porcelain Enamel Institute (PEI)

1. PEI-1001 Manual for Architectural Porcelain Enamel

1.6 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the signs prior to delivery. The pre-assembled units are to be shipped in water resistant protective covering and crating and palletized. Each sign package is to bear the identification as noted on the sign schedule and grouped according to locations.

B. Packaging: Each sign will come individually shrink wrapped complete with its own bracketry and attachment hardware.

C. Replacements: In the event of damage, repair will be subject to the ConnDOT's discretion as to whether replacement or repair will be the procedure for damaged units, and to be provided by the Contractor at no additional cost to the ConnDOT.

1.7 SCHEDULE OF MANUFACTURE

A. The Contractor shall submit a schedule of completion and sequence of delivery. This schedule shall include but not be limited to the following:

1. Preparation of Shop Drawings and ConnDOT review and approval of Shop Drawings (1 month).

2. Prototype review, final approval, manufacture and sequence of delivery (3 months), unless otherwise indicated on the approved Construction Schedule.

1.8 DELIVERY OF UNITS

A. Contractor shall be responsible for handling and storage. The ConnDOT shall not be responsible until installed and accepted.

1.9 PRODUCTION PROTOTYPE

A. The Contractor shall provide production prototypes for approval. The units will be reviewed by the ConnDOT and comments made. These units will be used as a model for production and will be considered an actual unit for permanent installation and not as a mock-up.

1.10 FUTURE AVAILABILITY

A. The approved manufacturer shall keep on hand the graphic stencils for future requests by the ConnDOT for replacement signage for a period of not less than five (5) years.

1.11 WARRANTY

A. Provide a written warranty issued in the name of the ConnDOT and jointly signed by the supplier stating that the sign panels have a guaranteed life of five years against fading, spalling, pinholes, discoloration, staining, gloss reductions or rusting from date of substantial performance.

1.12 WRITTEN GUARANTEE

A. Supplier shall also certify in writing that the porcelain enameling will be performed in accordance with the current edition of the Manual for Architectural Porcelain Enamel (PEI-1001) as issued by the Porcelain Enamel Institute of WA, DC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Manufacturers of Porcelain Enamel Steel Panel Signs,or Designer approved equal.:

a. American Porcelain Enamel (Dallas, TX)
b. Alliance International Group (Norcross, Georgia)
c. Enameltec/PG Bell (Georgetown, Ontario)
d. Cherokee Porcelain (Knoxville, TN)

2.2 MATERIALS

A. Steel Panels:

1. Panels shall be fabricated from 16 gauge enameling iron of low metalloid and copper content, especially manufactured and processed for the production of porcelain enamel units.

B. Porcelain Enamel Coating:

1. Porcelain enamel shall be impervious, inorganic glasses.

2. All surfaces shall be prepared and porcelain enamel shall be applied by a recognized method and fired at temperatures which will fuse the enamel glass to the surface of the metal and which will expel any volatile matter.

3. Steel plates shall be given one coat of grip enamel on both the front and back surfaces and on all edges and on the front surface one or more applications of cover coats of colors as directed.

4. Each color shall be fired separately and shall be uniform and even.

5. The back surface and all edges shall receive a protective porcelain enamel coating over the ground coating, and such additional coats as may be necessary to counteract stresses that may be placed upon the steel plates because of the thickness of the enamel coating on the front surfaces.

6. The porcelain enamel surfaces shall be uniformly finished and shall be free from bubbles, holes, bumps, or other blemishes, imperfections and surface defects.

7. Surfaces shall be matte or eggshell unless otherwise approved by the Designer. Contractor to certify that Finish & Contrast meets or exceeds ADA A4.30.5.

8. The total thickness of coatings shall be not less than .015 inch nor more than .035 inch on each side of the sheet, except on parts bearing several colors and on corners and returns.

9. Porcelain enamel finish of 8 square feet or less shall not be distorted more than ¼ of an inch from a true plane after installation.

10. All porcelain enamel shall be acid-resisting and shall show no variations in color when submitted to standard tests for staining.

11. All tests shall conform to the Porcelain Enamel Institute Standard Tests for Special Properties and Classifications.

12. The panels shall be finished in colors as indicated.

C. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.

D. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

E. Tactile and Braille Signs:

1. Fabricate signs to comply with ADA requirements and ANSI A 117.1.

2. Provide tactile and braille signs of type and text at locations as shown on the Contract Drawings.

a. Braille/Tactile signs shall be achieved by using a computerized relief process prior to application of the porcelain enamel coating. Letters shall be 5/8 inch upper case, Helvetica Medium typeface with wide letterspacing, raised 1/32 inch and an 18 pt. Grade 2 Braille translation of the message as manufactured by Ceramicoat or Designer approved equal.

b. The sign message layout for restroom signs shall be per Sign Schedule. The Contractor shall certify that the braille message matches the text message.

2.3 SIGN FINISHES

A. The Contractor shall provide signage and graphic materials for the entire project in conformance with the following:

1. Station (General)

a. Tactile/Braille Signs shall have black graphics on a white background. Typeface to be upper case Helvetica Medium with wide letter spacing.

b. Plaque Signs shall have white graphics on a blue background.

c. All signs shall use Helvetica Medium typeface, have a black band on top and black graphics on a white background with the exception of:

* Warning Signs which shall have red text

* Station Identification Signs which shall have tomato red text and band. Logo copy to be provided.

* Exit Signs which shall have white text on a 1'-0" wide red background module.

2.4 COLOR SCHEDULE

A. Signage colors specified herein and shown on the Drawings shall be based on approved manufacturers and/or color system numbers indicated, unless otherwise accepted and approved by the Engineer.

1. Red - Matte PMS-186
2. Tomato Red - Dupont Co. "Imron 326" two part aliphatic polyurethane enamel.
3. Blue - Match PMS-286

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.

1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.

2. Mounting heights for all tactile signs to be in accordance with all ADAAG and ADA requirements (see also references under section 1.6).

B. Bracket-Mounted Units: Provide the manufacturer's standard brackets, fittings, and hardware as appropriate for mounting signs that project at right angles from walls and ceilings.

Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices to comply with manufacturer's directions.

3.2 CLEANING AND PROTECTION

A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the ConnDOT.

END OF SECTION 10 14 26

ITEM #0096065A - REMOVAL OF CATENARY

ITEM #0096066A - REMOVAL OF SIGNAL AND COMMUNICATION CABLES

ITEM #0096068A - REMOVAL CATENARY PORTAL STRUCTURE

ITEM #0096070A - REMOVAL OF CATENARY STRUCTURE FOUNDATION

ITEM #0096081A - REMOVAL OF FEEDER OR AERIAL GROUND WIRE

ITEM #0099010A – REMOVAL OF ABANDONED RAILROAD EQUIPMENT

Description: Work under these items consists of the removal of the existing catenary system, guy wires, guy foundations, aerial ground wire, catenary structures, catenary hardware and supports, abandoned cable messenger wire with or without signal and communication cables.

Work under this section includes the removal and disposal of existing portal Structures 371, 372 and 372B, including columns, pole extensions and all catenary supports and associated hardware.

Work under this section includes removal of the foundations for Structures 371, 372 and 372B to a minimum of 4’ below grade. Where future tracks will be installed, the foundations shall be removed to a minimum of 6’ below grade.

Work under these items includes the removal of lead paint where required. Existing Structures 371 and 372 have been coated with paint containing lead.

Work under this item includes the removal of MOD equipment at Structure 371, which includes the control box, control cable, linkage, insulators, supports and one catenary tap each. This item also includes the removal of the disconnect switch at Structure 372B, which includes the supports and one catenary tap each.

The Contractor shall be responsible for coordinating the necessary outages with the Railroad and the utility (Eversource Energy) company along with following the requirements set forth in the Special Provisions.

Submittals: Contractors proposed method of removing catenaries.

Contractors proposed method of removing existing catenary portal structures, existing foundations, signal and communication cables.

Construction Methods: The removal of existing aerial ground wire and attachment assemblies will occur in the vicinity of electrical energized facilities. De-energizing of the Railroad's and the utility company's electric lines will be required to perform the work. The Contractor shall perform the work in accordance with the following:

1. During the removal of the existing aerial ground wire and along track jumper wire, all equipment and persons will at all times, remain at least 20 feet clear of the utility's existing 115 kV overhead transmission lines, installed on catenary or pole structures along the railroad's mainline right-of-way. When approach closer that the specified distance is required, the Contractor will request in writing, with six months advance notice, the de-energizing of the utility lines or equipment. De-energizing of the utility power line is contingent on power demand and economic dispatch and shall be coordinated with the utility. The Contractor will assume any risk involved in the reasonable denial of a request to de-energize the utility's transmission line and the last minute cancellation of an approved request to de-energize the transmission lines. If so ordered by the Engineer, the Contractor will immediately cease all activity in the areas, where the utility's transmission lines are to be re-energized.

2. The Contractor and the utility must cooperate fully in order to avoid damage to the conductors, and to insure that no delays will occur in the progress of the work. Therefore, the Contractor shall furnish the utility with a schedule for this work, which is to include starting and completion dates and, shall notify the utility six months in advance of the commencement of construction work.

All loose paint debris created by the removal of items covered under this section and by lead paint removal, shall be caught and/or vacuumed and disposed of as specified in DISPOSAL OF LEAD DEBRIS. Specifically the Contractor shall comply with the requirements of the OSHA Standard for Lead in Construction and any other applicable Federal and State laws and adhere to LEAD COMPLIANCE FOR MISCELLANEOUS EXTERIOR TASKS specification.

The existing catenary system is defined as the contact(trolley) wire, auxiliary trolley wire, messenger wire, hangers and insulators, switches, and other items incidental thereto including hanging beams, grounded messengers and bridle wires, structural supports for messengers, pull-off wires and tail wires.

The existing catenary system shall be removed, as shown on the plans, and disposed of by the Contractor.

When any loads are temporarily added to structures, such as dead-ending of messengers, trolley wires, bridles, feeders, aerial ground wire, etc., adequate back guys are to be installed in order to prevent overloading or excessive deflection of the structure. Back guys are to be terminated to

adequately sized, suitable anchors. The Contractor shall calculate all temporary loads to be so terminated and submit for approval, the loads, methods and procedures to be used, materials and anchor locations.

All 2/0 ground wire shall be removed, and shall be replaced as per the contract drawings. Installation of new ground wire shall be covered under AERIAL GROUND WIRE SYSTEMS. Removal shall be coordinated with replacement so that grounding is maintained at all times.

Form 817 Section 1.04.06 applies and Contractor shall dispose of all removed structures, and wires, which shall become property of the Contractor unless the Engineer instructs the Contractor otherwise. Signal and communication cables shall become property of the Contractor.

No signal or communication cables, platform, transformer, switch or control box shall be removed until removal has been authorized by the Railroad's Signal Department and/or Power Department. Prior to the removal of such items, a walkthrough shall be performed by the Contractor, the Engineer and the Railroad to confirm abandoned equipment and removals.

Catenary portal structures (371, 372 and 372B) shall be removed where called for on the plans. Removal shall be coordinated with staging of the work. Catenary portal foundations, guy foundations, and main messenger dead end pole foundations shall be demolished to a minimum depth of 4 feet (or 6' where future tracks will be installed as part of this project) below grade, except as noted elsewhere in this section. All demolished foundation material and concrete shall be disposed of off-site by the contractor.

The MOD at Structure 371 and disconnect switch at Structure 372B being removed under REMOVAL OF ABANDONED RAILROAD EQUIPMENT shall be turned over to the Railroad upon removal. The Contractor shall deliver the materials to 50 Union Avenue, Bridgeport, CT.

Method of Measurement: REMOVAL OF CATENARY will be measured for payment based on the linear feet of the existing catenary system removed, on each track, measured along the baseline. For payment purposes, the linear foot measurement, along the baseline, for the existing catenary system in inclusive of all messenger, auxiliary trolley and trolley wires. The messenger, auxiliary trolley and trolley wires shall not be measured for payment separately. There shall be no separate payment for the removal of tail wires, but the cost thereof shall be included in the item REMOVAL OF CATENARY.

REMOVAL OF FEEDER AND AERIAL GROUND WIRE will be measured for payment based on the linear feet of wire removed measured along the base line.

REMOVAL OF SIGNAL AND COMMUNICATIONS CABLES will be measured for payment based on the linear feet of messenger wire removed, regardless of the number of the signal and communications cables bundled together, and measured along the base line.

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The item REMOVAL OF SIGNAL AND COMMUNICATION CABLES includes the removal of signal and communications cable including messenger support wire. There shall be no separate payment for the removal of messenger support wire at locations where both the messenger support wire and signal and communications cable is to be removed, but the cost thereof shall be included in the item. For locations where removal of messenger support cable, without signal and communication cable is required, the work shall be paid as linear feet for the amount of messenger support cable removed under the item REMOVAL OF SIGNAL AND COMMUNICATION CABLES.

Removal of catenary portal structure shall be measured for payment based on the number of structures removed under the pay item REMOVAL OF CATENARY PORTAL STRUCTURE. A portal structure shall include, but is not limited to, the truss, columns, pole extensions, catenary supports and associated catenary hardware.

Removal of catenary portal foundations shall be measured for payment based on the number of foundations removed under the pay item REMOVAL OF CATENARY STRUCTURE FOUNDATION.

There shall be no separate payment for the disposal of demolished foundation material and concrete, but the cost thereof shall be included in the item for REMOVAL OF CATENARY STRUCTURE FOUNDATION.

Paint recovery and disposal shall be paid for under the item DISPOSAL OF LEAD DEBRIS.

There shall be no separate payment for lead paint removal, but the cost thereof shall be included in the items in this section.

REMOVAL OF ABANDONED RAILROAD EQUIPMENT includes the removal of MODs and Disconnect Switches and shall be measured for payment based on the number of switches removed. There shall be no separate payment for the removal of control boxes, control cables, linkage, insulators, supports and catenary taps and deliver of abandoned equipment but shall be included in the cost of REMOVAL OF ABANDONED RAILROAD EQUIPMENT.

The temporary removal and restoration, if any, of a member of the structure or of signal cables, signal cases, ladders, platforms or other impediment attached to the structure, in order to facilitate the removal of the catenary system, signal and communications cables, signal heads, catenary portal structures and feeder or aerial ground wire, will not be paid for separately, but the cost thereof shall be included in the pay item(s) included in this section.

Basis of Payment: This work will be paid for at the contract unit prices for the following unit prices, which shall include all transportation, materials, equipment, tools and labor incidental thereto:

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Pay Item	Pay Unit
REMOVAL OF CATENARY	LF
REMOVAL OF SIGNAL AND COMMUNICATION CABLES	LF
REMOVAL OF CATENARY PORTAL STRUCTURE	EA
REMOVAL OF CATEANRY STRUCTURE FOUNDATION	EA
REMOVAL OF FEEDER AND AERIAL GROUND WIRE	LF
REMOVAL OF ABANDONED RAILROAD EQUIPMENT	EA

ITEM #0096065A
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ITEM #0096070A
ITEM #0096081A
ITEM #0099010A

ITEM #0100600A - CONSTRUCTION ACCESS

Description: This item consists of all work shown on the plans or as directed by the Engineer to provide the Contractor with access to the railroad tracks at the existing and new locations shown on the access pad location plans.

This work includes, but is not limited to the following:

Furnish and install chain link fence and access gates (6' high or as directed by the Engineer). Access gates shall be 6' high – 12' wide, or as indicated on the plan sheets. Locks to be furnished by MNR and installed by the Contractor, as directed by the Engineer.

Construct temporary access drives, ramps up to on-track access pads and anti-tracking pads at points of vehicular ingress and egress, as shown on the plans or as directed by the Engineer. Includes the removal of topsoil and unsuitable materials from under the areas that access roads are installed.

Remove trees, stumps, brush, dirt and debris, rails, ties, asphalt road curbing and excavated top soil required for the installation of access roads, ramps, fencing and gates, as required and shown on the plans..

Furnish and install construction signs to delineate the area used for access and to notify the public and city or town officials of parking restrictions, as directed by the Engineer.

Restore the access areas to their pre-construction condition.

All work incidental to providing the Contractor access at these locations, maintaining these locations during construction and restoring these areas to their pre-construction condition.

Includes the installation of temporary safety walkways, guardrails, temporary fencing as shown on the plans.

Includes providing ballast or crushed stone between right-of-way and access pads, as well as between access pads on adjacent tracks.

The rubber access pads for the railroad tracks on concrete or wood ties shall be furnished, installed, maintained and removed by the Contractor. Access pads for concrete or wood ties are paid separately under the item RUBBER GRADE CROSSING.

Materials: Materials shall conform with Form 817, as follows:

- 6' Chain Link Fence shall conform to Section 9.13
- Anti-Tracking Pad Stone shall conform to Article M.01, Size No. 3
- Geotextile shall conform to Article M.08.01-19.

- Clearing and Grubbing shall conform to Section 2.01
- Haybales and Temporary Seeding of Disturbed Slopes shall conform to Section 2.10
- Construction Signs shall conform to section 12.20
- Rolled Granular Base – Section M.02.03

Construction Methods: The Contractor shall not disturb the normal flow of traffic at the Stamford Station when he is constructing or using access points. The Contractor shall not use the access point at the stations during the peak commuter hours, if in the opinion of the Engineer a delay will result to commuters due to the Contractor's operations.

The access points are for the Contractor's use to provide access to the tracks with hi-rail equipment, materials or personnel. The access points shall not be used to store equipment or materials, except as approved by the Engineer. The Contractor will not be permitted to remove any parking spaces, except at entrance gates, or as otherwise noted on the construction access plans.

Construction methods shall conform to the appropriate Form 817 items as listed above, under Materials, and also with Section 1.05.06 – Coordination with Utilities (including Railroads) contained elsewhere in these specifications.

Construction methods for anti-tracking pads shall conform to the following and the details contained herein:

1. Construction. The area of the construction entrance shall be cleared of all vegetation, roots and other organic or unsuitable material. The subgrade in the area of the pad shall be graded to drain and the area shall be covered with geotextile fabric.

A 6-inch thick pad of stone shall be placed on the geotextile. The pad shall have a minimum width of 15 feet and a length as directed by the Engineer.

2. Maintenance. The anti-tracking pad shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. Stone shall be added, dressed and cleaned as required. All sediment spilled, dropped washed or tracked onto public rights-of-way shall be removed immediately.

3. Removal. When the construction entrance is no longer needed, or upon project completion, the anti-tracking pad shall be removed in its entirety and the area shall be restored as directed. The pad materials and sediments shall be removed to a location approved by the Engineer.

The Contractor shall not damage existing parking lots. The Contractor, at no expense to the State, shall immediately repair any damage, which results to the parking lot or public streets as a result of the Contractor's operations to the State.

Access roads shall be constructed of processed stone, and rolled. All top soil and unsuitable materials shall be removed from under the areas that access roads are installed.

The contractor shall confirm which tracks have wood or concrete ties. Contractor shall provide access pads for four tracks at each location, unless otherwise noted below. Locations and work required at each of the access pads in addition to crossing pads, as shown on the plans:

1. Between Stamford Station and Atlantic Street –
2. West of Atlantic St -

Method of Measurement: All work for the construction of the access points described herein, shall be included in the lump sum cost of this item.

Procurement, installation, maintenance and removal of access pads for use on concrete or wood ties shall be paid for separately under the item RUBBER GRADE CROSSING.

There shall be no separate payment for materials, labor, and equipment required for the maintenance, re-grading and repair of access roads, access ramps, metal beam guardrail, chain link fencing, and gates, but the cost thereof shall be included in the lump sum price of CONSTRUCTION ACCESS.

There shall be no separate payment for materials, labor, and equipment required for removal or disposal of debris, vegetation, tree trimmings, rails, ties, curbing, and excavated top soil, but the cost thereof shall be included in the lump sum price of CONSTRUCTION ACCESS.

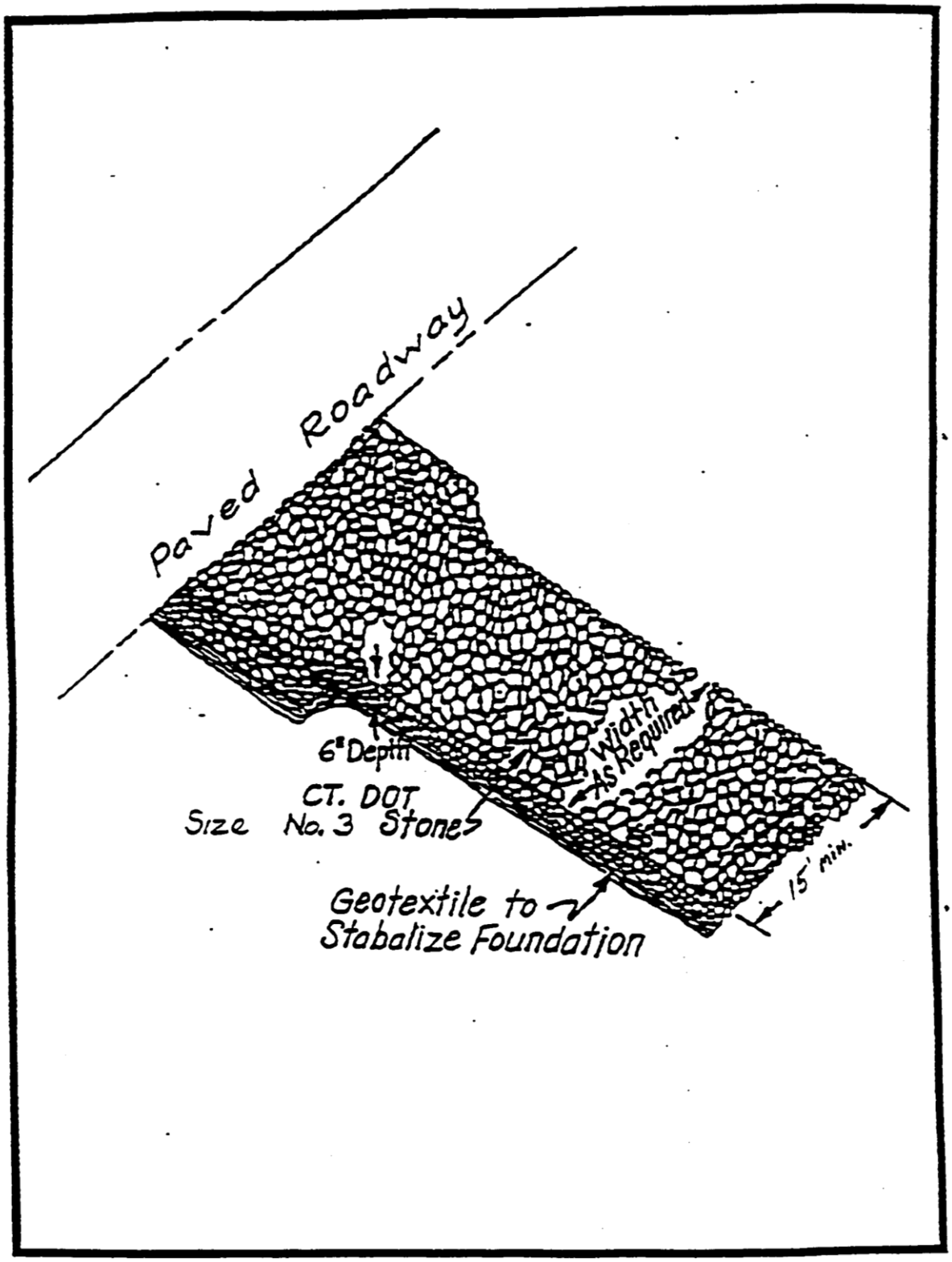
There shall be no separate payment for materials, labor and equipment required for the anchoring of chain link fence and metal beam guardrail into the existing stone retaining walls, but the cost thereof shall be included in the lump sum price of CONSTRUCTION ACCESS.

Any areas in addition to those shown on the plans that the Contractor chooses to obtain for his convenience or access points which the contractor chooses to install for his convenience, other than those shown on the plans, shall be temporary easements, and/or leases from the property owners whose property it is intended to traverse, or occupy, if any. The Contractor shall restore, at his own expense, any landscaping or adjacent property damaged, or other damage caused by his operations, to the satisfaction of the Engineer and the property owner. There will be no separate payment for these additional areas or access points but the cost thereof shall be included in the lump sum for Construction Access.

Basis of Payment: This work will be paid for on a lump sum basis for CONSTRUCTION ACCESS, which shall include all work shown on the plans and/or or as described herein.

Pay Item	**Pay Unit**
CONSTRUCTION ACCESS	LS

ANTI - TRACKING PAD



ITEM #0100600A

ITEM# 0601276A - PRECAST SUBSTRUCTURE ELEMENTS

Description: Work under this item shall consist of furnishing, erecting and fastening precast concrete closure walls to the heels of the proposed abutments as shown on the plans.

Submittals: The submittals requiring written approval from the Engineer are as follows:

Assembly Plan:

a. Refer to Section 1.05 for Shop and Working Drawing requirements.
b. Follow Chapter 5 of the PCI Design Handbook for handling and erection bracing requirements.
c. Comply with the construction timeframes specified in the plans and special provisions.
d. Include a work area plan, depicting items such as utilities overhead and below the work area, drainage inlet structures, and protective measures.
e. Include details of all equipment to be used to lift substructure elements including cranes, excavators, lifting slings, sling hooks, and jacks. Include crane locations, operation radii, and lifting calculations.
f. Include a detailed sequence of construction and a timeline for all operations.
g. Include methods of providing temporary support of the elements. Include methods of adjusting and securing the element after placement.
h. Include procedures for controlling tolerance limits both horizontal and vertical.
i. Prepare the plan under the seal of a Connecticut Professional Engineer.

Element Shop and Working Drawings:

a. Refer to Section 1.05 for Shop and Working Drawing requirements.
b. Prepare drawings and stamp by Professional Engineer licensed in Connecticut.
c. Show all lifting inserts, hardware, or devices and locations on the shop drawings for Engineer's approval.
d. Show locations and details of the lifting devices, including supporting calculations, type, and amount of any additional reinforcing required for lifting. Design all lifting devices based on the no cracking criteria in Chapter 5 of the PCI Design Handbook.
e. Show minimum compressive strength attained prior to handling the precast elements.
f. Show Details of any adjusting hardware.
g. Do not order materials or begin work until receiving final approval of the shop detail drawings.
h. The Department will reject any elements fabricated before receiving written approval, or any elements that deviate from the approved drawings. The Contractor is responsible for costs incurred due to faulty detailing or fabrication.

Concrete Requirements: Submit mix designs for Class "50" Concrete for precast elements.

Defects and breakage of precast elements: Submit proposed written repair procedures for approval.

Materials: Class "50" Concrete: The concrete shall be air-entrained concrete composed of Portland cement, fly ash, fine and coarse aggregate, admixtures and water. The air-entraining feature may be obtained by the use of an approved air-entraining admixture. The entrained air content of the concrete immediately before placement shall be not less than 5 percent or more than 7 percent for Class "50" concrete. The testing of air content shall be performed in accordance with the requirements of ASTM C231. Fly ash shall be used to replace 15% by mass of the required Portland cement.

The consistency shall be determined by the ASSHTO Method T119. A uniform consistency shall be continuously maintained. Slump shall be not more than 3". Slumps greater than 3" may be used only when directed by the Engineer.

The maximum water-cementitious material method by mass shall be 0.40 for Class "50" Concrete.

The minimum mass of cementitious materials per cubic yard of concrete shall be 660 pounds.

The Contractor shall design and submit for the approval of the Engineer, a concrete mix which shall attain a minimum 28-day cylinder strength (f'c) of 5000 pounds per square inch.

Fly Ash: The fly ash shall conform to the requirements of Article M.03.01-13.

Coarse Aggregate: The coarse aggregate shall conform to the requirements of Article M.03.01 and the mix shall be designed utilizing a maximum size of No. 8 aggregate.

Water Reducing Admixture: The Contractor may submit, for the approval of the Engineer, a water reducing admixture for the purpose of increasing workability and reducing the water requirements for the concrete.

Calcium Chloride: The addition of calcium chloride to the mix will not be permitted.

Reinforcing Steel: Conform to Section M.06.01.

Structural Steel: Conform to Section M.06.02 and Contract Plans. The structural steel shall be hot dip galvanized or metallized. Hot dip galvanization shall conform to the requirements of Form 817 Section M.06.03. Metallizing shall conform to the requirements of "0603062A – Structural Steel (Site No. 2)" except the one-year anniversary inspection is not required. The structural steel shall include anchor bolts and hardware.

Precast Concrete Elements: Maintain a minimum compressive strength of 500 psi prior to stripping the form. Continuously wet cure the precast elements for 7-days commencing immediately after final finishing with all exposed surfaces covered. The precast elements will

have a minimum cure of 14 days prior to placement. Supply test data such as slump, air voids, or unit weight for the fresh concrete and compressive strengths for the hardened concrete after 7, 14, and 28 days, if applicable.

Leveling Devices: The plans show fabricated steel leveling devices. Alternate devices may be used provided that they can support the anticipated loads.

Quality Assurance:

Precast Substructure Elements:

Permanently mark each precast element with date of casting and supplier identification. Stamp markings in fresh concrete. Prevent cracking or damage of precast elements during handling and storage.

Replace defects and breakage of precast elements

a. Members that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review or rejection.
b. Obtain approval before performing repairs.
c. Repair work must reestablish the elements' structural integrity, durability, and aesthetics to the satisfaction of the Engineer.
d. Determine the cause when damage occurs and take corrective action.
e. Failure to take corrective action, leading to similar repetitive damage, can be cause for rejection of the damaged element.
f. Cracks that extend to the nearest reinforcement plane and fine surface cracks that do not extend to the nearest reinforcement plane but are numerous or extensive are subject to review and rejection.
g. Full depth cracking and breakage greater than one foot are cause for rejection.

Construct precast elements to tolerances that permit assembly as shown on the plans.

The plant shall document all test results. The quality control file will contain at least the following information:

a. Element identification
b. Date and time of cast
c. Concrete cylinder test results
d. Quantity of used concrete and the batch printout
e. Form-stripping date and repairs if applicable
f. Location/number of blockouts and lifting inserts
g. Temperature and moisture of curing period
h. Document lifting device details, requirements, and inserts

Construction Methods:

Fabrication: Do not place concrete in the forms until the Engineer has inspected and approved all the materials in the elements. Provide the Engineer a tentative casting schedule at least two weeks in advance to make inspection and testing arrangements. A similar notification is required for the shipment of precast elements to the job site. Do not place concrete in the forms until the Engineer has inspected the form and has approved the placement of all materials in the precast elements. Finish the precast elements according to Section 6.01. Trowel-finish the top surface of all precast concrete elements.

Procedure for Installation of Elements:

A. Review the approved assembly plan. If changes are warranted due to varying site conditions, resubmit the plan for review and approval.

B. Establish working points, working lines, and benchmark elevations prior to placement of all elements.

C. Place elements in the sequence and according to the methods outlined in the assembly plan. Adjust the height of each element by means of leveling devices.

Method of Measurement: This work shall be measured for payment by the actual volume in cubic yards of precast substructure elements, including all reinforcing steel and structural steel embedded within.

Basis of Payment: Payment for this work will be made at the contract unit price per cubic yard for "Precast Substructure Elements", complete and in place, which price shall include all materials, equipment, tools, labor and work incidental thereto. Unit price includes all concrete, reinforcement and structural steel, as well as any alternative materials and connecting apparatus as may be proposed to install the precast substructure elements in accordance with the plans or as ordered by the engineer.

Pay Item	Pay Unit
Precast Substructure Elements	c.y.

ITEM NO. 0921018A – BRICK PAVING

Description:

This item shall consist of furnishing and installing Brick Paving on a sand bed and concrete leveling layer placed over granular fill to the dimensions and details as shown on the plans and in accordance with these specifications. The Brick shall match the existing Brick at the northwest corner of Station Place and Atlantic Street in size, color and texture.

Materials:

Material for this work shall conform to the following requirements:

Concrete: 3,000 psi Class "C" Concrete in accordance with the provisions of Article 4.01.03 for Concrete Pavement.

Wire Fabric: 6x6 – W2.9xW2.9 sheets in accordance with Article M.06.01.

Brick Paving: The Contractor shall provide samples of the Brick for approval by the Engineer.

Sand: In accordance with Article M.03.01 – 2 for Fine Aggregate

Granular Fill: In accordance with Article M.02.01 for Granular Fill

Construction Methods:

The Contractor shall receive approval on the Brick paver prior to the installation. The Paving will be free from excessive chips, cracks, voids, discoloration or other defects that might be visible or cause staining in finished work. The Brick Paving will be mixed from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures. The Brick Paving will be cut with motor-driven masonry saw equipment to provide clean, sharp, un-chipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable

1 – Excavation: Excavation shall be made to required depths below finish grade, as shown necessary to achieve the desire surface drainage for the finish surface. The Contractor shall be careful of the adjacent concrete sidewalks, building and bituminous concrete driveway and curbing. Any damage caused to the surrounding features will be replaced at the Contractor's expense.

2 –Granular Fill Base Course: The Granular Fill shall be uniformly spread upon the compacted subgrade to the require depth and thoroughly compacted in accordance with Article 9.21.03-2.

3 – Concrete: Place concrete over the prepared granular fill bedding layer in accordance with Article 9.21.03. Wire Fabric to be discontinued at all expansion joints.

4 – Brick Paving: The Brick Paving shall be placed on a sand leveling layer of approximately 1 inch thick over a concrete layer to provide a flush joint at the interface with the adjoining curbing and or concrete sidewalk. The Brick Paving shall be set to the line and grade to achieve the desired finished surface and grade using a Herringbone pattern set 45 degrees to the curb line with a brick border in accordance with the details shown on the plans. The Brick Paving shall be installed hand tight with a maximum joint not to exceed 1/8". After the Brick Paving have been completely laid, sweep joint sand into the joints until full. Lightly fog with water and continue to fill with sand until no further settlement occurs. Paver edge restraints shall be installed around the entire perimeter that is not restrained by the concrete sidewalk. Place the edge restraint on the base material and spike through pre-drilled holes into the compacted base material using 10" x 3/8" diameter steel spikes as per the manufacturer's recommendations. Upon completion, the surface shall be swept clean.

Method of Measurement

1 – Brick Paving: This work will be measured by the actual numbers of square feet of Brick Paving completed and accepted.

2 – Excavation: All excavation required for the installation of the Brick Paving to the lines and grades directed by the plans or as directed by the Engineer, will not be measured for payment. The disposal of surplus material will not be measured for payment, but the cost shall be included in the price bid for the Brick Paving.

3 – Processed Aggregate Base: This work will not be measured for payment but the cost thereof shall be included in the price bid for the Brick Paving.

4 – Concrete Base: This work will not be measured for payment but the cost thereof shall be included in the price bid for the Brick Paving.

Basis of Payment:

This work will be paid for at the contract unit price per square foot for "Brick Paving" complete in place, which price shall include all excavation as specified above, backfill, disposal of surplus material, processed aggregate base, concrete base, edge restraints, and all equipment, tools, labor and materials incidental thereto.

Pay Item	Pay Unit
Brick Paving	Square Foot

ITEM #0921018A

ITEM #0971001A – MAINTENANCE AND PROTECTION OF TRAFFIC

Article 9.71.01 – Description is supplemented by the following:
The Contractor shall maintain and protect traffic as described by the following and as limited in the Special Provision "Prosecution and Progress":

Atlantic Street, South State Street, North State Street, Manhattan Street and All Other Roadways

The Contractor shall maintain and protect existing traffic operations.

Excepted therefrom will be those periods during the allowable periods when the Contractor is actively working at which time the Contractor will be permitted to reduce the roadway width to 11 foot travel lanes with 1 foot shoulder widths.

Excepted therefrom will be described below in "STAGE CONSTRUCTION REQUIREMENTS" and as shown on the Maintenance and Protection of Traffic Plans shown in the contract drawings.

STAGE CONSTRUCTION REQUIREMENTS

During stage construction, traffic operations will be considered to be shown on the Maintenance and Protection of traffic plans contained in the contract plans supplemented as follows:

Roadway

Stage 1 – This stage maintains the traffic from the completed Phase 1 project, Project 135-326. (Atlantic Street, northbound under the existing MNR Bridge one lane; northbound under the I-95 bridge, two lanes consisting of a left through lane and through lane; southbound under the I-95 bridge, two lanes consisting of an exclusive left lane and through lane; southbound under the existing MNR Bridge, one lane. South State Street, two lanes except at the South State merge with the new I-95 NB Off Ramp, South State Street will be reduced to one lane to provide sufficient room to construct Wall 106, Stage 1A and opened to two lanes after the section Wall 106 Station 513+00 to 516+50 is finished. Traffic signals installed in Project 135-326 to be maintained during this stage. Weekend and other off-peak closures of Atlantic Street will be needed for MNR Bridge work to construct the abutment and pier work the work. Detour patterns to be installed and implemented during road closure periods.

Work this stage includes:

Road and Wall work

- Walls 105 and 106
- Construct south side of South State Street
- Drainage on south side of South State Street to connect to drainage completed in Project 135-326
- Remove temporary drainage structures installed in Project 135-326 and plug pipe

Bridge work

- Construct jump spans for the new MNR Bridge
- Construct the abutments, pier footings and pier for the new MNR Bridge
- Construct the new MNR Bridge superstructure off site in the lay down areas

Stage 2 – Traffic lanes from Stage 1 shall remain during Stage 2 work except Atlantic Street is closed during the construction of the MNR Bridge pier and Atlantic Street and South State Street is closed for the SPMT roll in to be performed over the week of June 28, 2019 to July 5, 2019. Work this stage also includes the construction of the new traffic signal at the I-95 SB Off Ramp and South State Street merge. Detour patterns to be installed and implemented during road closure periods.

After the new MNR Bridge is in place, reopen Atlantic Street and South State Street to traffic with the same lane arrangements in Stage 1 and beginning of Stage 2 work.

Stage 3 - After the new Bridge is in place, Stage 3 work lowers Atlantic Street, South State Street and Manhattan Street. This work will be performed by closing Atlantic Street and South State Street. Prior to closing South State Street the island at Guernsey Avenue between South State Street and the station pickup and drop off area is to be removed to allow left turns from the pickup and drop off area to Guernsey Avenue. South State Street from Washington Boulevard is to be signed No Through Traffic Station Pickup and Drop Off Only and the South State Street detour implemented. During this stage southbound Guernsey Street traffic will be southbound only and the existing traffic signal turned off and signal heads bagged.

Construction of the new traffic signal at Atlantic Street and South State Street and the new traffic signal at Atlantic Street and North State Street will be performed during the closure period. Detour patterns to be installed and implemented during road closures.

Final construction operations will include curb installation, resetting drainage structures and final paving. The removed island at Guernsey Avenue and traffic signal is to be replaced to existing after Stage 3 operations are completed.

Commercial and Residential Driveways

The Contractor shall maintain access to and egress from all commercial and residential driveways throughout the project limits. The Contractor will be allowed to close said driveways to perform the required work during those periods when the businesses are closed, unless permission is granted from the business owner to close the driveway during business hours. If a temporary closure of a residential driveway is necessary, the Contractor shall coordinate with the owner to determine the time period of the closure.

Article 9.71.03 - Construction Method is supplemented as follows:

General

Unpaved travel paths will only be permitted for areas requiring full depth and full width reconstruction, in which case, the Contractor will be allowed to maintain traffic on processed aggregate for a duration not to exceed 10 calendar days. The unpaved section shall be the full width of the road and perpendicular to the travel lanes. Opposing traffic lane dividers shall be used as a centerline.

The Contractor is required to delineate any raised structures within the travel lanes, so that the structures are visible day and night, unless there are specific contract plans and provisions to temporarily lower these structures prior to the completion of work.

The Contractor shall schedule operations so that pavement removal and roadway resurfacing shall be completed full width across a roadway (bridge) section by the end of a workday (work night), or as directed by the Engineer.

When the installation of all intermediate courses of bituminous concrete pavement is completed for the entire roadway, the Contractor shall install the final course of bituminous concrete pavement.

When the Contractor is excavating adjacent to the roadway, the Contractor shall provide a 3-foot shoulder between the work area and travel lanes, with traffic drums spaced every 50 feet. At the end of the workday, if the vertical drop-off exceeds 3 inches, the Contractor shall provide a temporary traversable slope of 4:1 or flatter that is acceptable to the Engineer.

The Contractor, during the course of active construction work on overhead signs and structures, shall close the lanes directly below the work area for the entire length of time overhead work is being undertaken. At no time shall an overhead sign be left partially removed or installed.

If applicable, when an existing sign is removed, it shall be either relocated or replaced by a new sign during the same working day.

The Contractor shall not store any material on-site which would present a safety hazard to motorists or pedestrians (e.g. fixed object or obstruct sight lines).

The field installation of a signing pattern shall constitute interference with existing traffic operations and shall not be allowed, except during the allowable periods.

Construction vehicles entering travel lanes at speeds less than the posted speed are interfering with traffic, and shall not be allowed without a lane closure. The lane closure shall be of sufficient length to allow vehicles to enter or exit the work area at posted speeds, in order to merge with existing traffic.

Existing Signing

The Contractor shall maintain all existing overhead and side-mounted signs throughout the project limits during the duration of the project. The Contractor shall temporarily relocate signs and sign supports as many times as deemed necessary, and install temporary sign supports if necessary and as directed by the Engineer.

Pedestrian Access

The Contractor shall maintain safe pedestrian access at all times throughout the construction by maintaining existing sidewalks or providing temporary sidewalks. At a minimum, pedestrian walkways will be provided on both sides of the street on Atlantic Street excepting that during construction of the abutments for the I-95 Exit 8 NB Off Ramp structure, pedestrian walkways will be provided on one side of the street, opposite of the active work area and during the placement of the bridge superstructure, the pedestrian traffic may be detoured in accordance with the detour plan

included in the plans or as approved by the Engineer. The pedestrian detour shall be used only for the short period required to place the bridge superstructure.

The cost for temporary pedestrian walkways will not be paid for separately but shall be included in the lump sum payment for Maintenance and Protection of Traffic.

When sidewalks need to be closed due to work operations and or unsafe conditions, the Contractor shall erect "Sidewalk Closed" signs and provide clear direction to alternate pedestrian routes.

Requirements for Winter

The Contractor shall schedule a meeting with representatives from the Department including the offices of Maintenance and Traffic, and the Town/City to determine what interim traffic control measures the Contractor shall accomplish for the winter to provide safety to the motorists and permit adequate snow removal procedures. This meeting shall be held prior to October 31 of each year and will include, but not be limited to, discussion of the status and schedule of the following items: lane and shoulder widths, pavement restoration, traffic signal work, pavement markings, and signing.

Signing Patterns

The Contractor shall erect and maintain all signing patterns in accordance with the traffic control plans contained herein. Proper distances between advance warning signs and proper taper lengths are mandatory.

Roadside Protective Systems

The Contractor is alerted that all hazardous areas that are exposed to traffic which have been caused by the removal of specified lengths of roadside protection due to construction operations shall be replaced by the Contractor within the same workday.

In the event that the leading end of a parapet or other obstruction is exposed by the Contractor's operations the contractor shall protect said obstruction from live traffic utilizing a Type A Impact Attenuation System as detailed on the plans or other method of protection as approved by the Engineer.

Where permanent or temporary precast concrete barrier curb is installed for the protection of traffic from a hazardous area, the terminal end facing approaching traffic within 30' of a travel lane shall be protected with a Type A Impact Attenuation System as shown on the plans or as directed by the Engineer. These units will be paid for at the contract unit price for the item involved.

Pavement Markings - Limited Access Highways, Turning Roadways and Ramps

During construction, the Contractor shall maintain all pavement markings throughout the limits of the project.

Interim Pavement Markings

The Contractor shall install painted pavement markings, which shall include lane lines (broken lines), shoulder edge lines, stop bars, lane-use arrows and gore markings, on each intermediate course of bituminous concrete pavement and on any milled surface by the end of the work day/night. All painted pavement markings will be paid under the appropriate items.

If the Contractor does not install permanent Epoxy Resin Pavement Markings by the end of the work day/night on exit ramps where the final course of bituminous concrete pavement has been installed, the Contractor shall install temporary 12 inch wide white stop bars. The temporary stop bars shall consist of Temporary Plastic Pavement Marking Tape and shall be installed by the end of the work day/night. Stop bars may consist of two 6 inch wide white markings or three 4 inch wide white markings placed side by side. The Contractor shall remove and dispose of these markings when the permanent Epoxy Resin Pavement Markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.
If an intermediate course of bituminous concrete pavement will be exposed throughout the winter, then Epoxy Resin Pavement Markings should be installed unless directed otherwise by the Engineer.

Final Pavement Markings

The Contractor should install painted pavement markings on the final course of bituminous concrete pavement by the end of the work day/night. If the painted pavement markings are not installed by the end of the work day/night, then Temporary Plastic Pavement Marking Tape shall be installed as described above and the painted pavement markings shall be installed by the end of the work day/night on Friday of that week.
If Temporary Plastic Pavement Marking Tape is installed, the Contractor shall remove and dispose of these markings when the painted pavement markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

The Contractor shall install permanent Epoxy Resin Pavement Markings in accordance with Section 12.10 entitled "Epoxy Resin Pavement Markings, Symbols, and Legends" after such time as determined by the Engineer.

Pavement Markings -Non-Limited Access Multilane Roadways
Secondary and Local Roadways

During construction, the Contractor shall maintain all pavement markings on paved surfaces on all roadways throughout the limits of the project.

Interim Pavement Markings

The Contractor shall install painted pavement markings, which shall include centerlines, shoulder edge lines, lane lines (broken lines), lane-use arrows, and stop bars, on each intermediate course of bituminous concrete pavement and on any milled surface by the end of the work day/night. If the next course of bituminous concrete pavement will be placed within seven days, shoulder edge lines are not required. The painted pavement markings will be paid under the appropriate items.

If the Contractor will install another course of bituminous concrete pavement within 24 hours, the Contractor may install Temporary Plastic Pavement Marking Tape in place of the painted pavement markings by the end of the work day/night. These temporary pavement markings shall include centerlines, lane lines (broken lines) and stop bars; shoulder edge lines are not required. Centerlines shall consist of two 4 inch wide yellow markings, 2 feet in length, side by side, 4 to 6 inches apart, at

40-foot intervals. No passing zones should be posted with signs in those areas where the final centerlines have not been established on two-way roadways. Stop bars may consist of two 6 inch wide white markings or three 4 inch wide white markings placed side by side. The Contractor shall remove and dispose of the Temporary Plastic Pavement Marking Tape when another course of bituminous concrete pavement is installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

If an intermediate course of bituminous concrete pavement will be exposed throughout the winter, then Epoxy Resin Pavement Markings should be installed unless directed otherwise by the Engineer.

Final Pavement Markings

The Contractor should install painted pavement markings on the final course of bituminous concrete pavement by the end of the work day/night. If the painted pavement markings are not installed by the end of the work day/night, then Temporary Plastic Pavement Marking Tape shall be installed as described above and the painted pavement markings shall be installed by the end of the work day/night on Friday of that week.

If Temporary Plastic Pavement Marking Tape is installed, the Contractor shall remove and dispose of these markings when the painted pavement markings are installed. The cost of furnishing, installing and removing the Temporary Plastic Pavement Marking Tape shall be at the Contractor's expense.

The Contractor shall install permanent Epoxy Resin Pavement Markings in accordance with Section 12.10 entitled "Epoxy Resin Pavement Markings, Symbols, and Legends" after such time as determined by the Engineer.

TRAFFIC CONTROL DURING CONSTRUCTION OPERATIONS

The following guidelines shall assist field personnel in determining when and what type of traffic control patterns to use for various situations. These guidelines shall provide for the safe and efficient movement of traffic through work zones and enhance the safety of work forces in the work area.

TRAFFIC CONTROL PATTERNS

Traffic control patterns shall be used when a work operation requires that all or part of any vehicle or work area protrudes onto any part of a travel lane or shoulder. For each situation, the installation of traffic control devices shall be based on the following:

Speed and volume of traffic
Duration of operation
Exposure to hazards

Traffic control patterns shall be uniform, neat and orderly so as to command respect from the motorist.

In the case of a horizontal or vertical sight restriction in advance of the work area, the traffic control pattern shall be extended to provide adequate sight distance for approaching traffic.
If a lane reduction taper is required to shift traffic, the entire length of the taper should be installed on a tangent section of roadway so that the entire taper area can be seen by the motorist.

Any existing signs that are in conflict with the traffic control patterns shall be removed, covered, or turned so that they are not readable by oncoming traffic.
When installing a traffic control pattern, a Buffer Area should be provided and this area shall be free of equipment, workers, materials and parked vehicles.

Typical traffic control plans 19 through 25 may be used for moving operations such as line striping, pot hole patching, mowing, or sweeping when it is necessary for equipment to occupy a travel lane. Traffic control patterns will not be required when vehicles are on an emergency patrol type activity or when a short duration stop is made and the equipment can be contained within the shoulder. Flashing lights and appropriate trafficperson shall be used when required.

Although each situation must be dealt with individually, conformity with the typical traffic control plans contained herein is required. In a situation not adequately covered by the typical traffic control plans, the Contractor must contact the Engineer for assistance prior to setting up a traffic control pattern.

PLACEMENT OF SIGNS

Signs must be placed in such a position to allow motorists the opportunity to reduce their speed prior to the work area. Signs shall be installed on the same side of the roadway as the work area. On multi-lane divided highways, advance warning signs shall be installed on both sides of the highway. On directional roadways (on-ramps, off-ramps, one-way roads), where the sight distance to signs is restricted, these signs should be installed on both sides of the roadway.

ALLOWABLE ADJUSTMENT OF SIGNS AND DEVICES SHOWN ON THE TRAFFIC CONTROL PLANS

The traffic control plans contained herein show the location and spacing of signs and devices under ideal conditions. Signs and devices should be installed as shown on these plans whenever possible. The proper application of the traffic control plans and installation of traffic control devices depends on actual field conditions.

Adjustments to the traffic control plans shall be made only at the direction of the Engineer to improve the visibility of the signs and devices and to better control traffic operations. Adjustments to the traffic control plans shall be based on safety of work forces and motorists, abutting property requirements, driveways, side roads, and the vertical and horizontal curvature of the roadway.

The Engineer may require that the traffic control pattern be located significantly in advance of the work area to provide better sight line to the signing and safer traffic operations through the work zone.
Table I indicates the minimum taper length required for a lane closure based on the posted speed limit of the roadway. These taper lengths shall only be used when the recommended taper lengths shown on the traffic control plans cannot be achieved.

TABLE I – MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT MILES PER HOUR	MINIMUM TAPER LENGTH IN FEET FOR A SINGLE LANE CLOSURE
30 OR LESS	180
35	250
40	320
45	540
50	600
55	660
65	780

SECTION 1. WORK ZONE SAFETY MEETINGS

1.a) Prior to the commencement of work, a work zone safety meeting will be conducted with representatives of DOT Construction, Connecticut State Police (Local Barracks), Municipal Police, the Contractor (Project Superintendent) and the Traffic Control Subcontractor (if different than the prime Contractor) to review the traffic operations, lines of responsibility, and operating guidelines which will be used on the project. Other work zone safety meetings during the course of the project should be scheduled as needed.

1.b) A Work Zone Safety Meeting Agenda shall be developed and used at the meeting to outline the anticipated traffic control issues during the construction of this project. Any issues that can't be resolved at these meetings will be brought to the attention of the District Engineer and the Office of Construction. The agenda should include:

- Review Project scope of work and time
- Review Section 1.08, Prosecution and Progress
- Review Section 9.70, Trafficpersons
- Review Section 9.71, Maintenance and Protection of Traffic
- Review Contractor's schedule and method of operations.
- Review areas of special concern: ramps, turning roadways, medians, lane drops, etc.
- Open discussion of work zone questions and issues

- Discussion of review and approval process for changes in contract requirements as they relate to work zone areas

SECTION 2. GENERAL

2.a) If the required minimum number of signs and equipment (i.e. one High Mounted Internally Illuminated Flashing Arrow for each lane closed, two TMAs, Changeable Message Sign, etc.) are not available; the traffic control pattern shall not be installed.

2.b) The Contractor shall have back-up equipment (TMAs, High Mounted Internally Illuminated Flashing Arrow, Changeable Message Sign, construction signs, cones/drums, etc.) available at all times in case of mechanical failures, etc. The only exception to this is in the case of sudden equipment breakdowns in which the pattern may be installed but the Contractor must provide replacement equipment within 24 hours.

2.c) Failure of the Contractor to have the required minimum number of signs, personnel and equipment, which results in the pattern not being installed, shall not be a reason for a time extension or claim for loss time.

2.d) In cases of legitimate differences of opinion between the Contractor and the Inspection staff, the Inspection staff shall err on the side of safety. The matter shall be brought to the District Office for resolution immediately or, in the case of work after regular business hours, on the next business day.

SECTION 3. INSTALLING AND REMOVING TRAFFIC CONTROL PATTERNS

3.a) Lane Closures shall be installed beginning with the advance warning signs and proceeding forward toward the work area.

3.b) Lane Closures shall be removed in the reverse order, beginning at the work area, or end of the traffic control pattern, and proceeding back toward the advance warning signs.

3.c) Stopping traffic may be allowed:

- As per the contract for such activities as blasting, steel erection, etc.
- During paving, milling operations, etc. where, in the middle of the operation, it is necessary to flip the pattern to complete the operation on the other half of the roadway and traffic should not travel across the longitudinal joint or difference in roadway elevation.
- To move slow moving equipment across live traffic lanes into the work area.

3.d) Under certain situations when the safety of the traveling public and/or that of the workers may be compromised due to conditions such as traffic volume, speed, roadside obstructions, or sight line deficiencies, as determined by the Engineer and/or State Police, traffic may be briefly impeded while installing and/or removing the advance warning signs and the first ten traffic cones/drums only. Appropriate measures shall be taken to safely slow traffic. If required, traffic slowing techniques may be used and shall include the use of Truck Mounted Impact Attenuators (TMAs) as appropriate, for a minimum of one mile in advance

of the pattern starting point. Once the advance warning signs and the first ten traffic cones/drums are installed/removed, the TMAs and sign crew shall continue to install/remove the pattern as described in Section 5 and traffic shall be allowed to resume their normal travel.

3.e) The Contractor must adhere to using the proper signs, placing the signs correctly, and ensuring the proper spacing of signs.

3.f) Additional devices are required on entrance ramps, exit ramps, and intersecting roads to warn and/or move traffic into the proper travelpath prior to merging/exiting with/from the main line traffic. This shall be completed before installing the mainline pattern past the ramp or intersecting roadway.

3.g) Prior to installing a pattern, any conflicting existing signs shall be covered with an opaque material. Once the pattern is removed, the existing signs shall be uncovered.

3.h) On limited access roadways, workers are prohibited from crossing the travel lanes to install and remove signs or other devices on the opposite side of the roadway. Any signs or devices on the opposite side of the roadway shall be installed and removed separately.

SECTION 4. USE OF HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

4.a) On limited access roadways, one Flashing Arrow shall be used for each lane that is closed. The Flashing Arrow shall be installed concurrently with the installation of the traffic control pattern and its placement shall be as shown on the traffic control plan. For multiple lane closures, one Flashing Arrow is required for each lane closed. If conditions warrant, additional Flashing Arrows should be employed (i.e.: curves, major ramps, etc.).

4.b) On non-limited access roadways, the use of a Flashing Arrow for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the Flashing Arrow.

4.c) The Flashing Arrow shall not be used on two lane, two-way roadways for temporary alternating one-way traffic operations.

4.d) The Flashing Arrow board display shall be in the “arrow” mode for lane closure tapers and in the “caution” mode (four corners) for shoulder work, blocking the shoulder, or roadside work near the shoulder. The Flashing Arrow shall be in the “caution” mode when it is positioned in the closed lane.

4.e) The Flashing Arrow shall not be used on a multi-lane roadway to laterally shift all lanes of traffic, because unnecessary lane changing may result.

SECTION 5. USE OF TRUCK MOUNTED IMPACT ATTENUATOR VEHICLES (TMAs)

5.a) For lane closures on limited access roadways, a minimum of two TMAs shall be used to install and remove traffic control patterns. If two TMAs are not available, the pattern shall not be installed.

5.b) On non-limited access roadways, the use of TMAs to install and remove patterns closing a lane(s) is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to utilize the TMAs.

5.c) Generally, to establish the advance and transition signing, one TMA shall be placed on the shoulder and the second TMA shall be approximately 1,000 feet ahead blocking the lane. The flashing arrow board mounted on the TMA should be in the "flashing arrow" mode when taking the lane. The sign truck and workers should be immediately ahead of the second TMA. In no case shall the TMA be used as the sign truck or a work truck. Once the transition is in place, the TMAs shall travel in the closed lane until all Changeable Message Signs, signs, Flashing Arrows, and cones/drums are installed. The flashing arrow board mounted on the TMA should be in the "caution" mode when traveling in the closed lane.

5.d) A TMA shall be placed prior to the first work area in the pattern. If there are multiple work areas within the same pattern, then additional TMAs shall be positioned at each additional work area as needed. The flashing arrow board mounted on the TMA should be in the "caution" mode when in the closed lane.

5.e) TMAs shall be positioned a sufficient distance prior to the workers or equipment being protected to allow for appropriate vehicle roll-ahead in the event that the TMA is hit, but not so far that an errant vehicle could travel around the TMA and into the work area. For additional placement and use details, refer to the specification entitled "Type 'D' Portable Impact Attenuation System". Some operations, such as paving and concrete repairs, do not allow for placement of the TMA(s) within the specified distances. In these situations, the TMA(s) should be placed at the beginning of the work area and shall be advanced as the paving or concrete operations proceed.

5.f) TMAs should be paid in accordance with how the unit is utilized. When it is used as a TMA and is in the proper location as specified, and then it should be paid at the specified hourly rate for "Type 'D' Portable Impact Attenuation System". When the TMA is used as a Flashing Arrow, it should be paid at the daily rate for "High Mounted Internally Illuminated Flashing Arrow". If a TMA is used to install and remove a pattern and then is used as a Flashing Arrow, the unit should be paid as a "Type 'D' Portable Impact Attenuation System" for the hours used to install and remove the pattern, typically 2 hours (1 hour to install and 1 hour to remove), and is also paid for the day as a "High Mounted Internally Illuminated Flashing Arrow".

SECTION 6. USE OF TRAFFIC DRUMS AND TRAFFIC CONES

6.a) Traffic drums shall be used for taper channelization on limited-access roadways, ramps, and turning roadways and to delineate raised catch basins and other hazards.

6.b) Traffic drums shall be used in place of traffic cones in traffic control patterns that are in effect for more than a 36-hour duration.

6.c) Traffic Cones less than 42 inches in height shall not be used on limited-access roadways or on non-limited access roadways with a posted speed limit of 45 mph and above.

6.d) Typical spacing of traffic drums and/or cones shown on the Traffic Control Plans in the Contract are maximum spacings and may be reduced to meet actual field conditions as required.

SECTION 7. USE OF (REMOTE CONTROLLED) CHANGEABLE MESSAGE SIGNS (CMS)

7.a) For lane closures on limited access roadways, one CMS shall be used in advance of the traffic control pattern. Prior to installing the pattern, the CMS shall be installed and in operation, displaying the appropriate lane closure information (i.e.: Left Lane Closed - Merge Right). The CMS shall be positioned ½ - 1 mile ahead of the lane closure taper. If the nearest Exit ramp is greater than the specified ½ - 1 mile distance, than an additional CMS shall be positioned a sufficient distance ahead of the Exit ramp to alert motorists to the work and therefore offer them an opportunity to take the exit.

7.b) CMS should not be installed within 1000 feet of an existing CMS.

7.c) On non-limited access roadways, the use of CMS for lane closures is optional. The roadway geometry, sight line distance, and traffic volume should be considered in the decision to use the CMS.

7.d) The advance CMS is typically placed off the right shoulder, 5 feet from the edge of pavement. In areas where the CMS cannot be placed beyond the edge of pavement, it may be placed on the paved shoulder with a minimum of five (5) traffic drums placed in a taper in front of it to delineate its position. The advance CMS shall be adequately protected if it is used for a continuous duration of 36 hours or more.

7.e) When the CMS are no longer required, they should be removed from the clear zone and have the display screen cleared and turned 90° away from the roadway.

7.f) The CMS generally should not be used for generic messages (ex: Road Work Ahead, Bump Ahead, Gravel Road, etc.).

7.g) The CMS should be used for specific situations that need to command the motorist's attention which cannot be conveyed with standard construction signs (Examples include: Exit 34 Closed Sat/Sun - Use Exit 35, All Lanes Closed - Use Shoulder, Workers on Road - Slow Down).

7.h) Messages that need to be displayed for long periods of time, such as during stage construction, should be displayed with construction signs. For special signs, please coordinate with the Office of Construction and the Division of Traffic Engineering for the proper layout/dimensions required.

7.i) The messages that are allowed on the CMS are as follows:

Message No.	Frame 1	Frame 2	Message No.	Frame 1	Frame 2
1	LEFT LANE CLOSED	MERGE RIGHT	9	LANES CLOSED AHEAD	REDUCE SPEED
2	2 LEFT LANES CLOSED	MERGE RIGHT	10	LANES CLOSED AHEAD	USE CAUTION
3	LEFT LANE CLOSED	REDUCE SPEED	11	WORKERS ON ROAD	REDUCE SPEED
4	2 LEFT LANES CLOSED	REDUCE SPEED	12	WORKERS ON ROAD	SLOW DOWN
5	RIGHT LANE CLOSED	MERGE LEFT	13	EXIT XX CLOSED	USE EXIT YY
6	2 RIGHT LANES CLOSED	MERGE LEFT	14	EXIT XX CLOSED USE YY	FOLLOW DETOUR

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7	RIGHT LANE CLOSED	REDUCE SPEED	15	2 LANES SHIFT AHEAD	USE CAUTION
8	2 RIGHT LANES CLOSED	REDUCE SPEED	16	3 LANES SHIFT AHEAD	USE CAUTION

For any other message(s), approval must be received from the Office of Construction prior to their use. No more than two (2) displays shall be used within any message cycle.

SECTION 8. USE OF STATE POLICE OFFICERS

8.a) State Police may be utilized only on limited access highways and secondary roadways under their primary jurisdiction. One Officer may be used per critical sign pattern. Shoulder closures and right lane closures can generally be implemented without the presence of a State Police Officer. Likewise in areas with moderate traffic and wide, unobstructed medians, left lane closures can be implemented without State Police presence. Under some situations it may be desirable to have State Police presence, when one is available. Examples of this include: nighttime lane closures; left lane closures with minimal width for setting up advance signs and staging; lane and shoulder closures on turning roadways/ramps or mainline where sight distance is minimal; and closures where extensive turning movements or traffic congestion regularly occur, however they are not required.

8.b) Once the pattern is in place, the State Police Officer should be positioned in a non- hazardous location in advance of the pattern If traffic backs up beyond the beginning of the pattern, then the State Police Officer shall be repositioned prior to the backup to give warning to the oncoming motorists. The State Police Officer and TMA should not be in proximity to each other.

8.c) Other functions of the State Police Officer(s) may include:

- Assisting entering/exiting construction vehicles within the work area.
- Enforcement of speed and other motor vehicle laws within the work area, if specifically requested by the project.

8.d) State Police Officers assigned to a work site are to only take direction from the Engineer.

SECTION 6. WORK ZONE SIGNS AND TRAFFIC CONTROL PLANS

NOTES FOR TRAFFIC CONTROL PLANS

1. IF A TRAFFIC STOPPAGE OCCURS IN ADVANCE OF SIGN (A), THEN AN ADDITIONAL SIGN (A) SHALL BE INSTALLED IN ADVANCE OF THE STOPPAGE.

2. SIGNS (AA), (A), AND (D) SHOULD BE OMITTED WHEN THESE SIGNS HAVE ALREADY BEEN INSTALLED TO DESIGNATE A LARGER WORK ZONE THAN THE WORK ZONE THAT IS ENCOMPASSED ON THIS PLAN.

3. SEE TABLE 1 FOR ADJUSTMENT OF TAPERS IF NECESSARY.

4. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN TRAFFIC DRUMS SHALL BE USED IN PLACE OF TRAFFIC CONES.

5. ANY LEGAL SPEED LIMIT SIGNS WITHIN THE LIMITS OF A ROADWAY / LANE CLOSURE AREA SHALL BE COVERED WITH AN OPAQUE MATERIAL WHILE THE CLOSURE IS IN EFFECT, AND UNCOVERED WHEN THE ROADWAY / LANE CLOSURE IS RE-OPENED TO ALL LANES OF TRAFFIC.

6. IF THIS PLAN REMAINS IN CONTINUOUS OPERATION FOR MORE THAN 36 HOURS, THEN ANY EXISTING CONFLICTING PAVEMENT MARKINGS SHALL BE ERADICATED OR COVERED, AND TEMPORARY PAVEMENT MARKINGS THAT DELINEATE THE PROPER TRAVELPATHS SHALL BE INSTALLED.

7. DISTANCES BETWEEN SIGNS IN THE ADVANCE WARNING AREA MAY BE REDUCED TO 100' ON LOW-SPEED URBAN ROADS (SPEED LIMIT < 40 MPH).

8. IF THIS PLAN IS TO REMAIN IN OPERATION DURING THE HOURS OF DARKNESS, INSTALL BARRICADE WARNING LIGHTS - HIGH INTENSITY ON ALL POST-MOUNTED DIAMOND SIGNS IN THE ADVANCE WARNING AREA.

9. A CHANGEABLE MESSAGE SIGN SHALL BE INSTALLED ONE HALF TO ONE MILE IN ADVANCE OF THE LANE CLOSURE TAPER.

10 SIGN (P) SHALL BE MOUNTED A MINIMUM OF 7 FEET FROM THE PAVEMENT SURFACE TO THE BOTTOM OF THE SIGN.

TABLE 1 - MINIMUM TAPER LENGTHS

POSTED SPEED LIMIT (MILES PER HOUR)	MINIMUM TAPER LENGTH FOR A SINGLE LANE CLOSURE
30 OR LESS	180' (55m)
35	250' (75m)
40	320' (100m)
45	540' (165m)
50	600' (180m)
55	660' (200m)
65	780' (240m)

METRIC CONVERSION CHART (1" = 25mm)

ENGLISH	METRIC	ENGLISH	METRIC	ENGLISH	METRIC
12"	300mm	42"	1050mm	72"	1800mm
18"	450mm	48"	1200mm	78"	1950mm
24"	600mm	54"	1350mm	84"	2100mm
30"	750mm	60"	1500mm	90"	2250mm
36"	900mm	66"	1650mm	96"	2400mm

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

NOTES

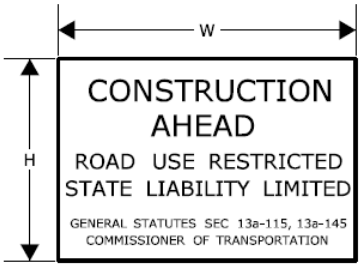
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ PRINCIPAL ENGINEER

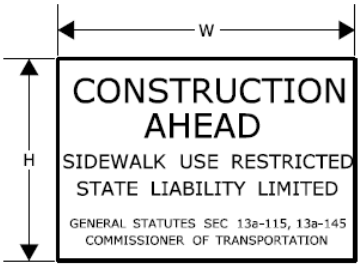
Charles S. Harlow
2012.06.05 15:50:35-04'00'

ITEM #0971001A

SERIES 16 SIGNS



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



		W H
16-S	80-1619	48" x 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 RAMPS PRIOR TO OR WITHIN THE WORK ZONE LIMITS.

THE LOCATION OF SERIES 16 SIGNS CAN BE FOUND ELSEWHERE IN THE PLANS OR INSTALLED AS DIRECTED BY THE ENGINEER.

SIGNS 16-E AND 16-H SHALL BE POST-MOUNTED.

SIGN 16-E SHALL BE USED ON ALL EXPRESSWAYS.

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

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

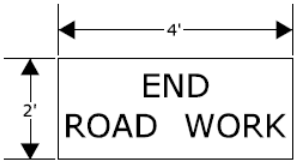
REGULATORY SIGN "ROAD WORK AHEAD, FINES DOUBLED"

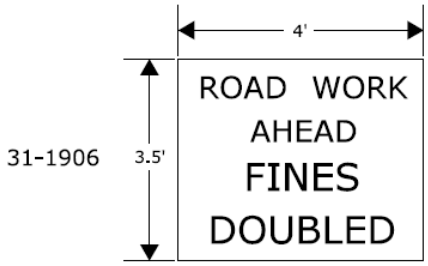
THE REGULATORY SIGN "ROAD WORK AHEAD FINES DOUBLED" SHALL BE INSTALLED FOR ALL WORK ZONES THAT OCCUR ON ANY STATE HIGHWAY IN CONNECTICUT WHERE THERE ARE WORKERS ON THE HIGHWAY OR WHEN THERE IS OTHER THAN EXISTING TRAFFIC OPERATIONS.

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

"END ROAD WORK" SIGN

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





SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

REQUIRED SIGNS

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

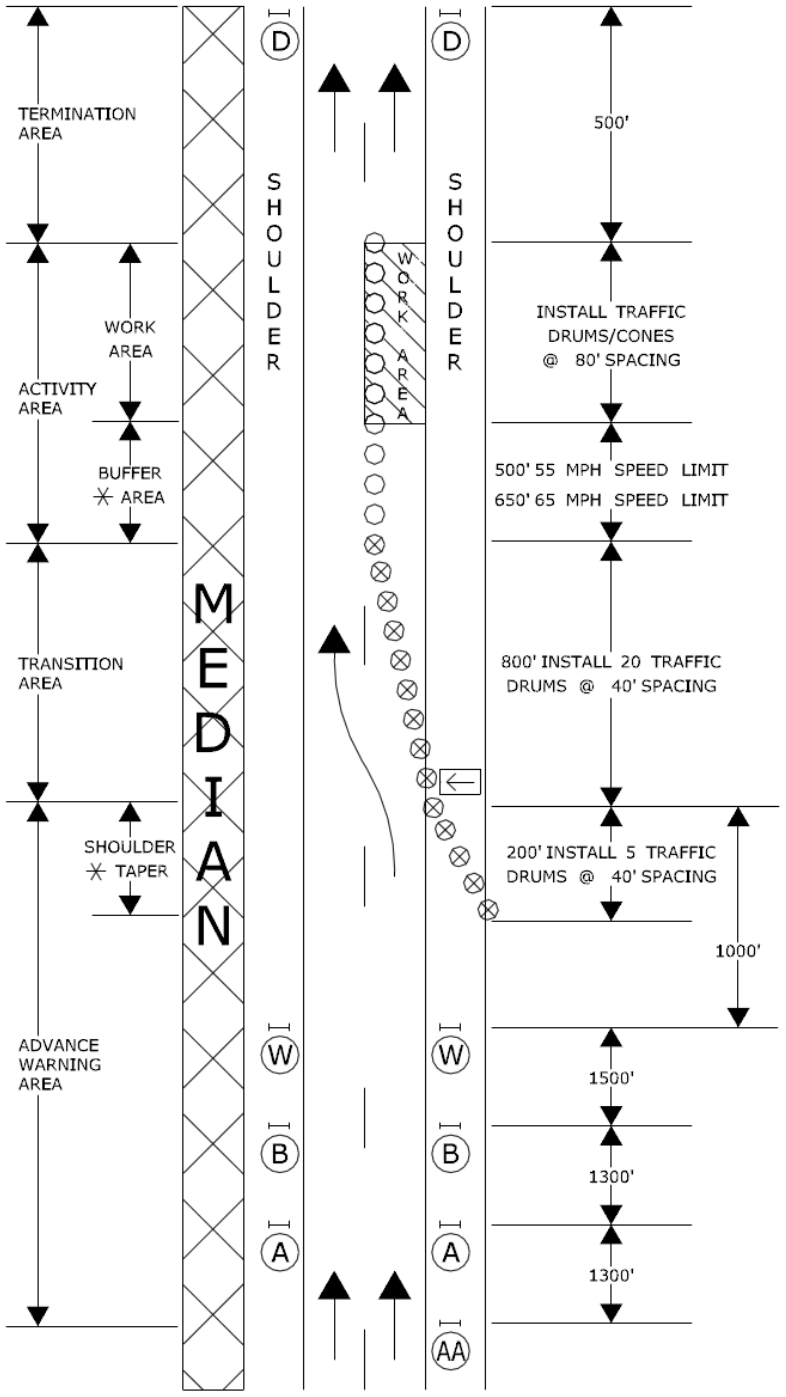
APPROVED _____ PRINCIPAL ENGINEER

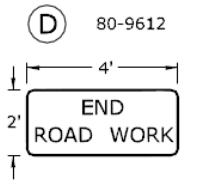
Charles S. Harlow
2012.06.05 11:35:43-04'00'

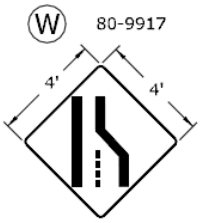
ITEM #0971001A

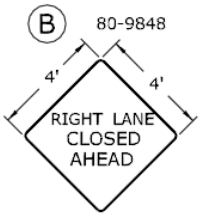
WORK IN RIGHT LANE - MULTILANE HIGHWAY

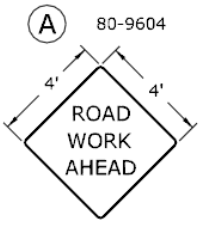
SIGN FACE
126 SQ. FT (MIN.)

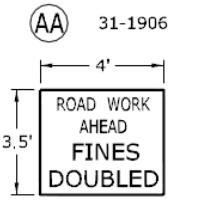












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 1

SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:51:00-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN RIGHT TWO LANES - MULTILANE HIGHWAY

SIGN FACE
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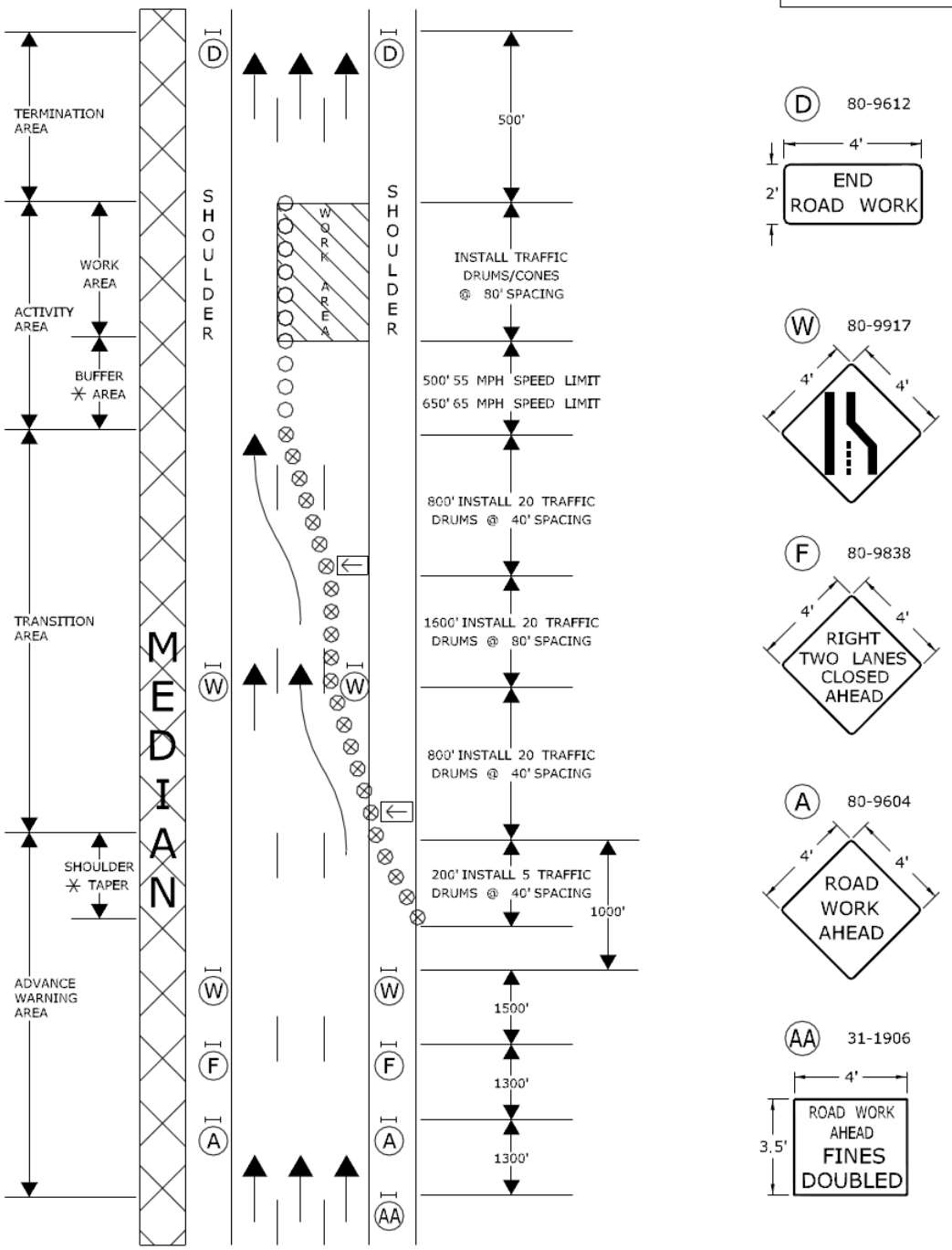


D 80-9612

W 80-9917

F 80-9838

A 80-9604

AA 31-1906

○ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢ PORTABLE SIGN SUPPORT
⇐ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 2

SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

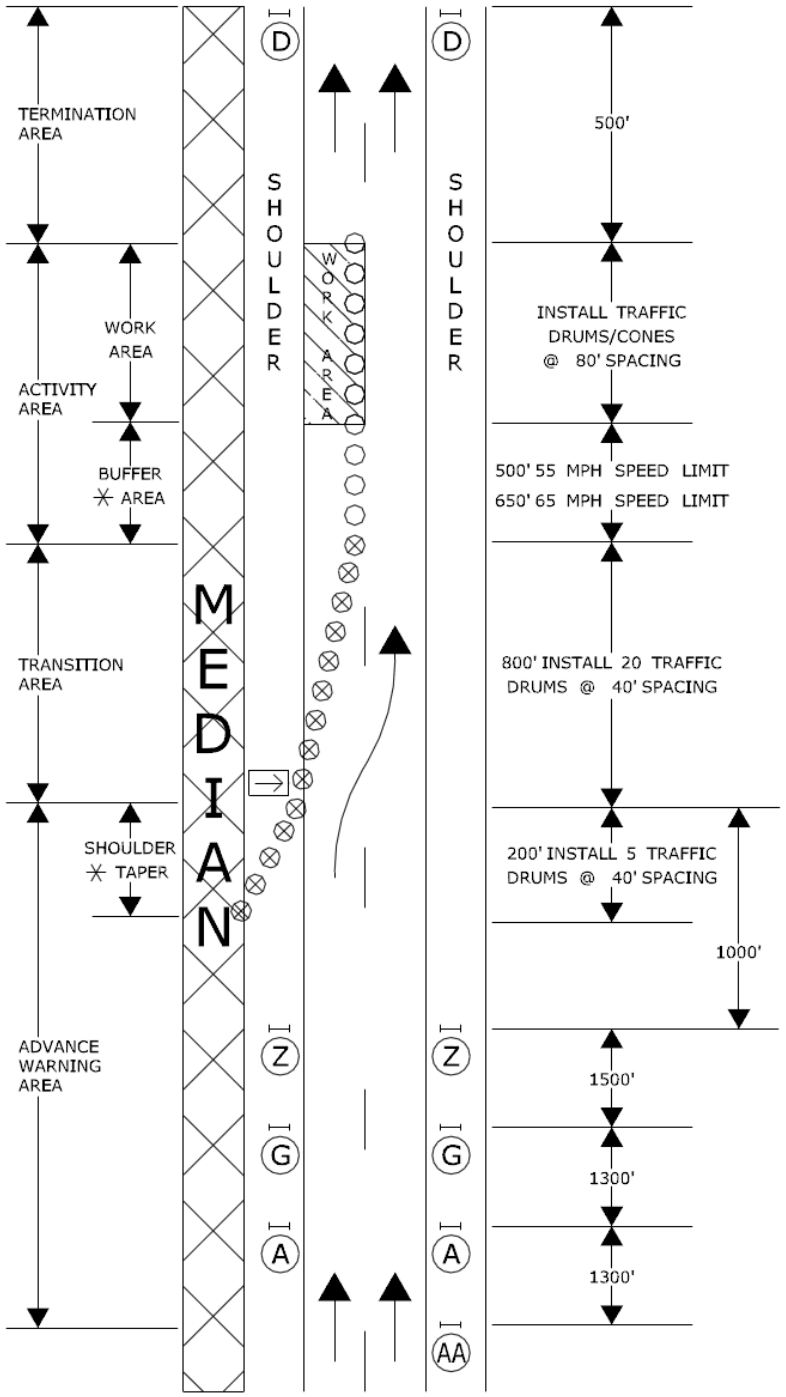
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

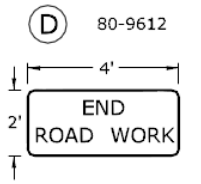
APPROVED Charles S. Harlow 2012.06.05 15:51:23-04'00'
PRINCIPAL ENGINEER

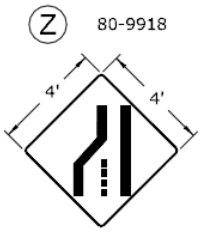
ITEM #0971001A

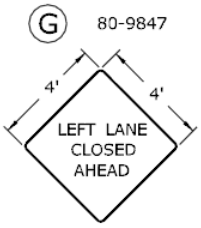
WORK IN LEFT LANE - MULTILANE HIGHWAY

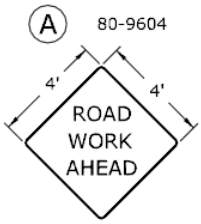
SIGN FACE
126 SQ. FT (MIN.)

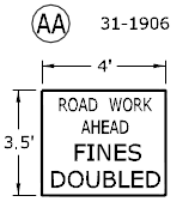












TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 3

SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

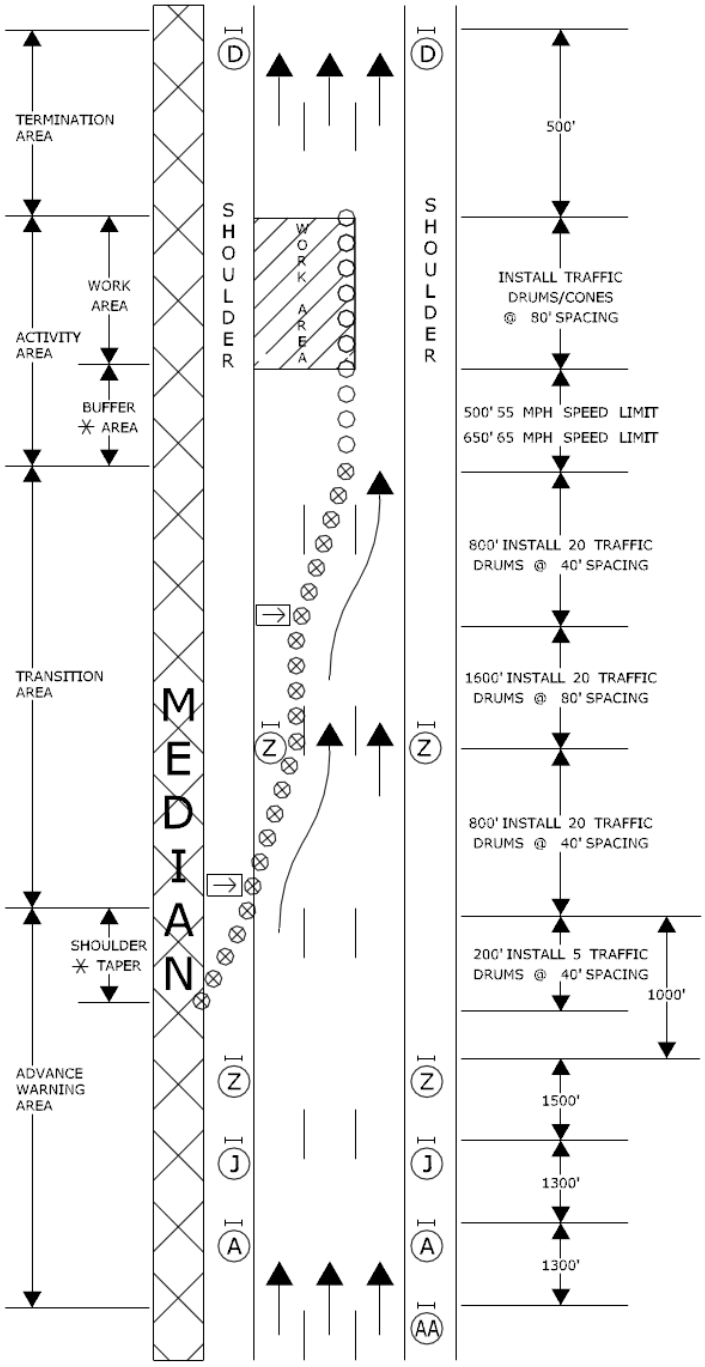
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ Charles S. Harlow 2012.06.05 15:51:46-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN LEFT TWO LANES - MULTILANE HIGHWAY

SIGN FACE
158 SQ. FT (MIN.)



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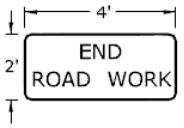

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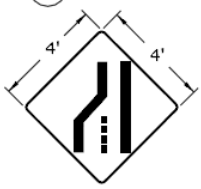

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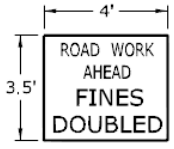
A 80-9604

AA 31-1906



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 4

SEE NOTES 1, 2, 3, 4, 5, 6, 8, 9

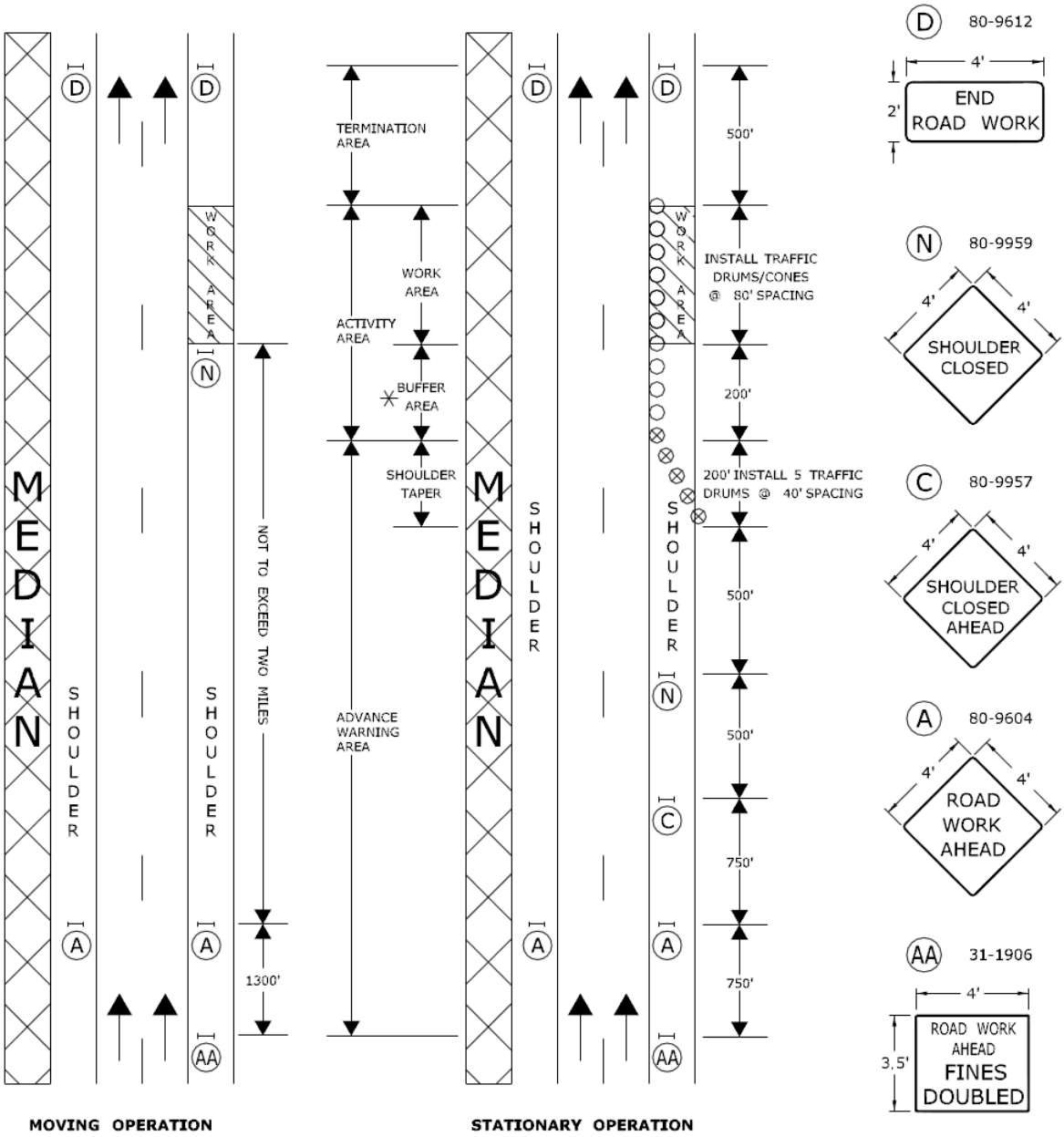
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:52:10-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN SHOULDER AREA - MULTILANE HIGHWAY

SIGN FACE
94 SQ. FT (MIN.)



MOVING OPERATION **STATIONARY OPERATION**

TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 6
SEE NOTES 1, 2, 4, 8

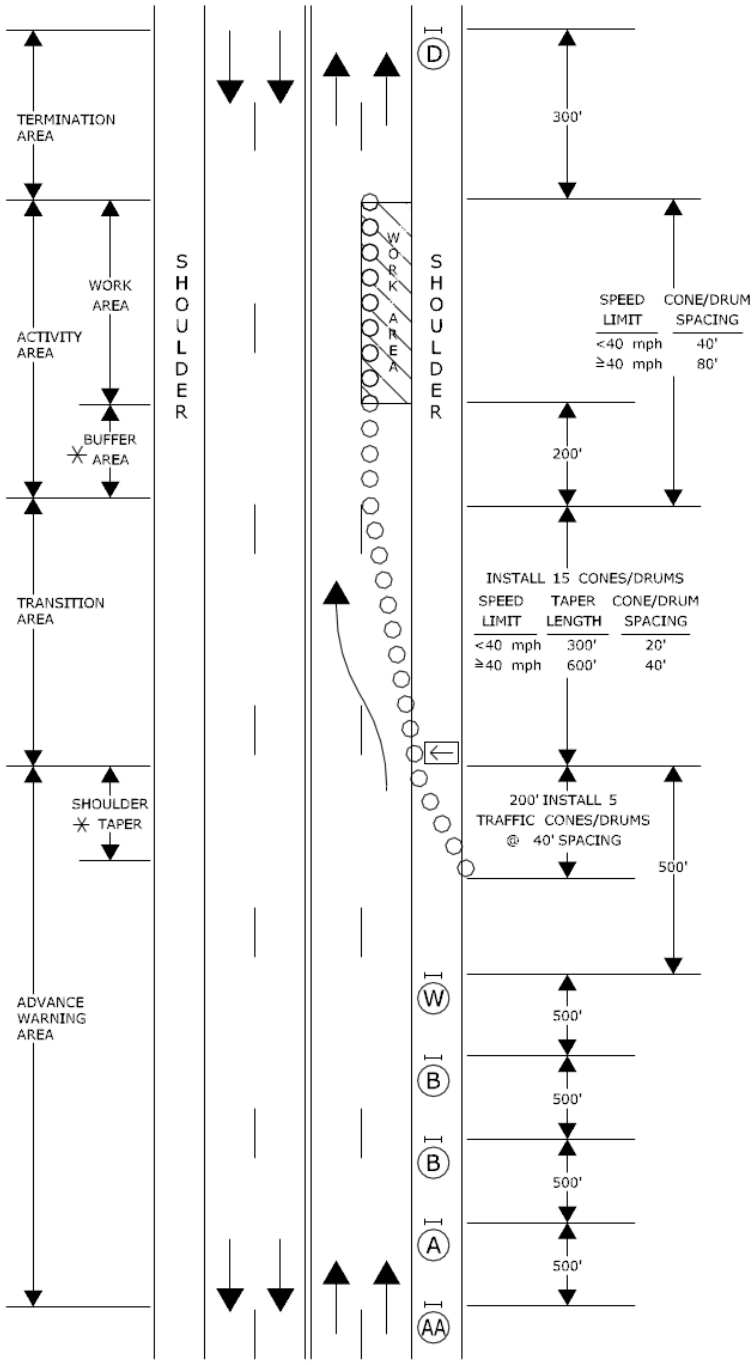
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

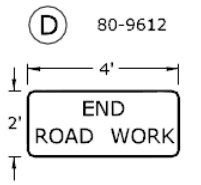
APPROVED Charles S. Harlow 2012.06.05 15:52:38-04'00'
PRINCIPAL ENGINEER

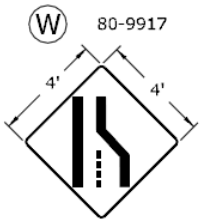
ITEM #0971001A

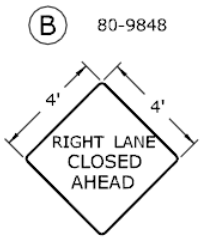
WORK IN RIGHT LANE - 4 LANE UNDIVIDED HIGHWAY

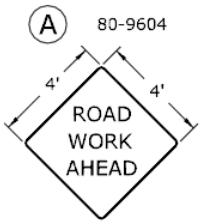
SIGN FACE
86 SQ. FT (MIN.)

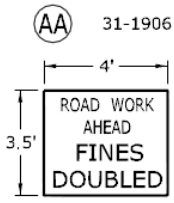












○ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢⊣ PORTABLE SIGN SUPPORT
⟵ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 10

SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

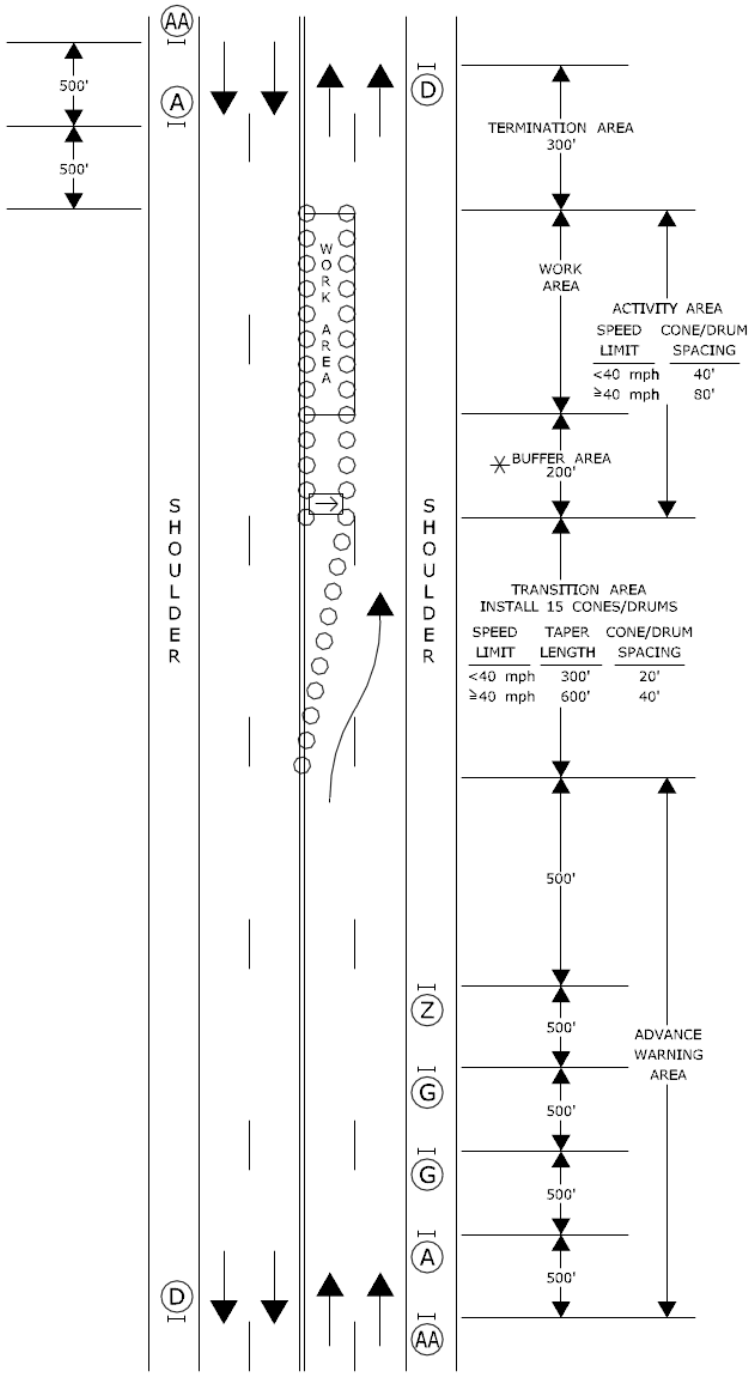
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

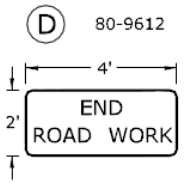
APPROVED Charles S. Harlow 2012.06.05 15:54:15-04'00'
PRINCIPAL ENGINEER

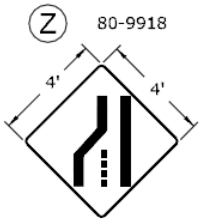
ITEM #0971001A

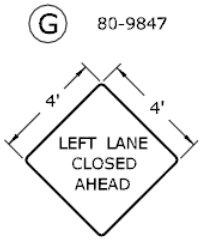
WORK IN LEFT LANE - 4 LANE UNDIVIDED HIGHWAY

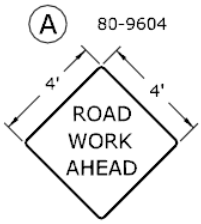
SIGN FACE
124 SQ. FT (MIN.)

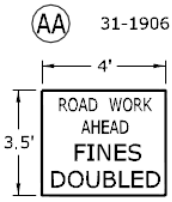












○ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢ PORTABLE SIGN SUPPORT
⟵ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 11

SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

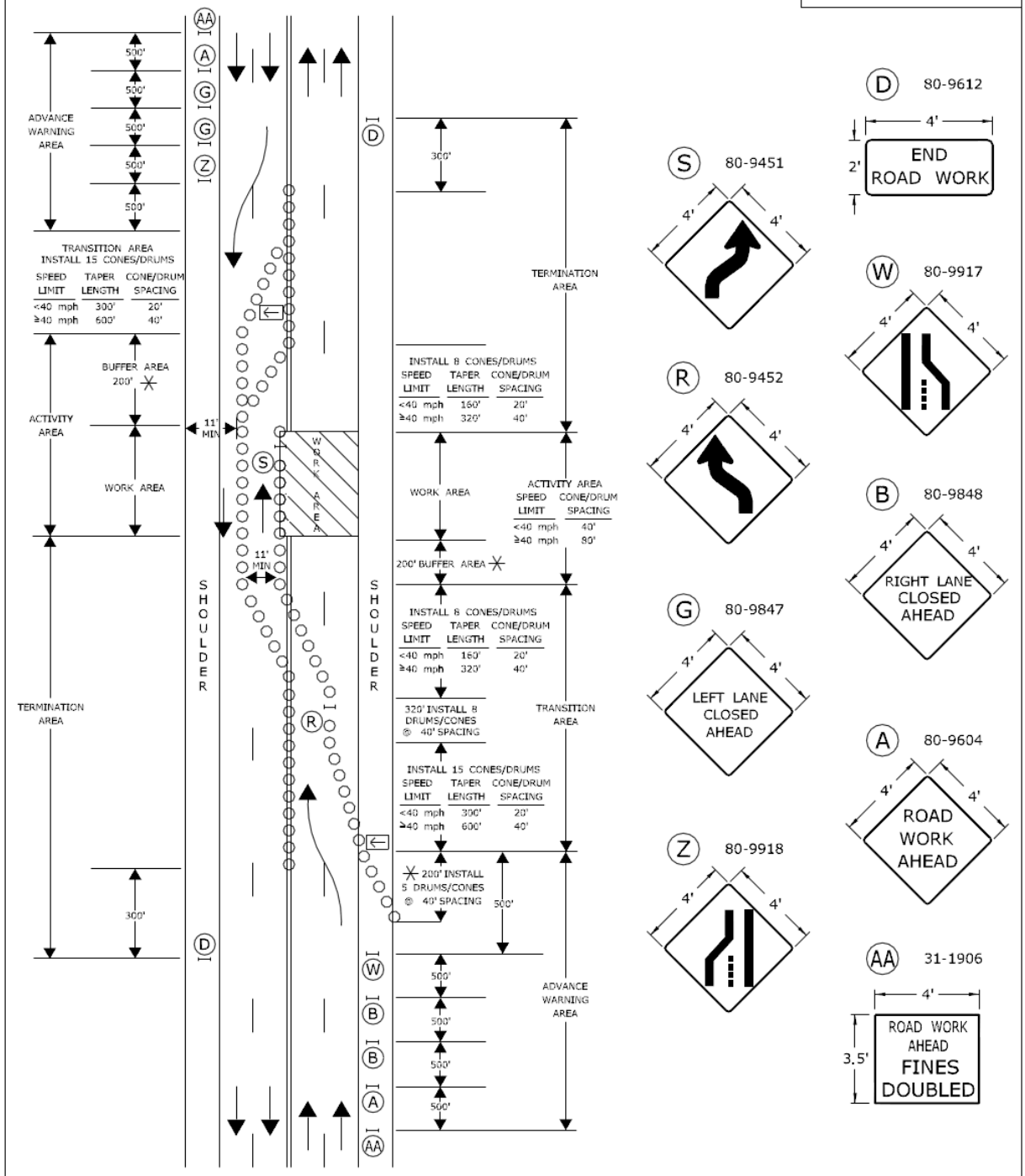
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:54:36-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN BOTH LANES - 4 LANE UNDIVIDED HIGHWAY

SIGN FACE
204 SQ. FT (MIN.)



○ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢ PORTABLE SIGN SUPPORT
← HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 12

SEE NOTES 1, 2, 3, 4, 5, 6, 7, 8

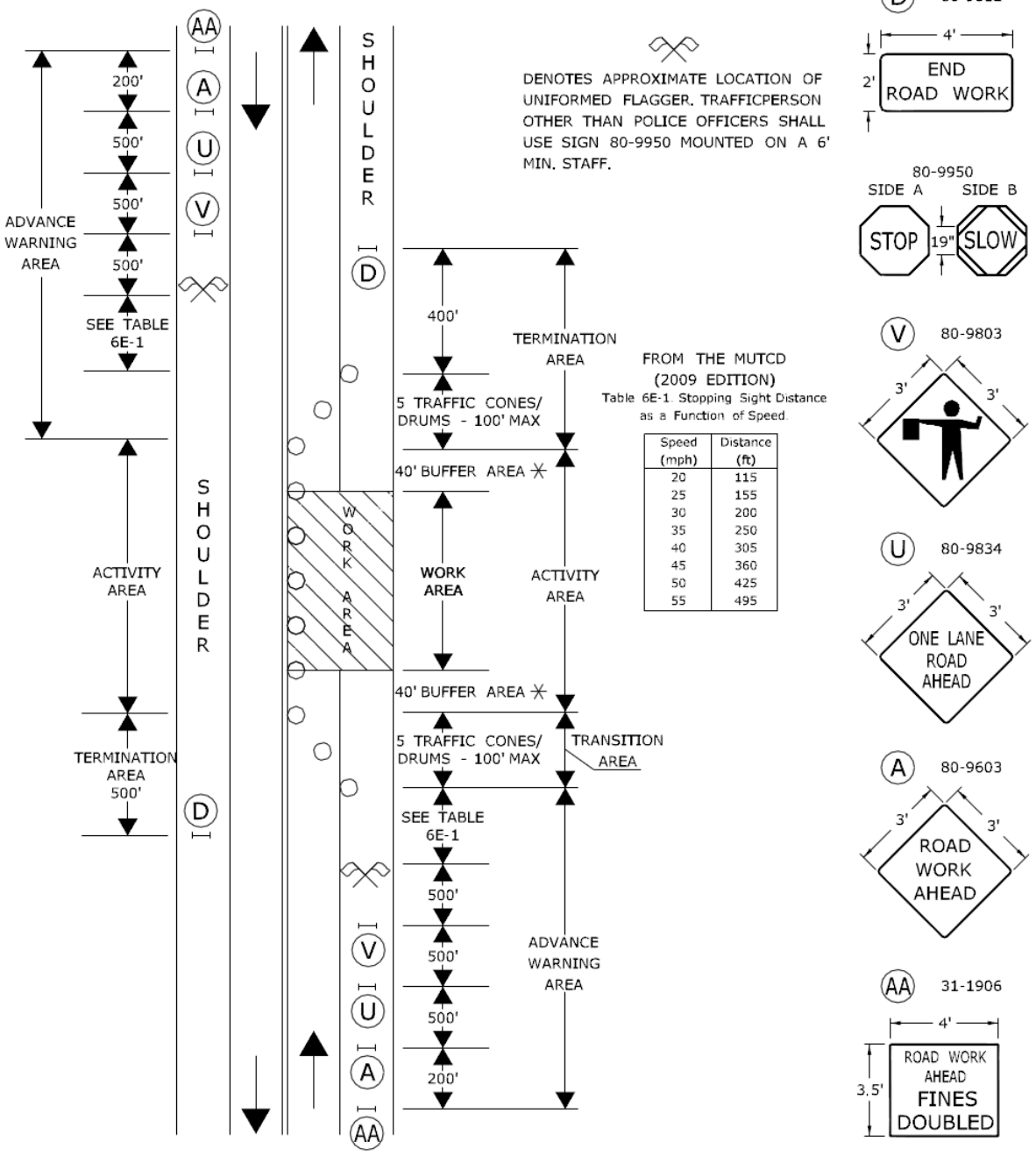
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ Charles S. Harlow 2012.06.05 15:55:01-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

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

SIGN FACE
108 SQ. FT (MIN.)



FROM THE MUTCD
(2009 EDITION)
Table 6E-1. Stopping Sight Distance as a Function of Speed

Speed (mph)	Distance (ft)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495

D 80-9612

80-9950
SIDE A SIDE B

V 80-9803

U 80-9834

A 80-9603

AA 31-1906

TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 13 - SHEET 1 OF 2
SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED
Charles S. Harlow
2012.06.05 15:55:23-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

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

SIGN FACE
108 SQ. FT (MIN.)

HAND SIGNAL METHODS TO BE USED BY UNIFORMED FLAGGERS

THE FOLLOWING METHODS FROM SECTION 6E.07, FLAGGER PROCEDURES, IN THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES," SHALL BE USED BY UNIFORMED FLAGGERS WHEN DIRECTING TRAFFIC THROUGH A WORK AREA. THE STOP/SLOW SIGN PADDLE (SIGN NO. 80-9950) SHOWN ON THE TRAFFIC STANDARD SHEET TR-1220 01 ENTITLED, "SIGNS FOR CONSTRUCTION AND PERMIT OPERATIONS" SHALL BE USED.

A. TO STOP TRAFFIC

TO STOP ROAD USERS, THE FLAGGER SHALL FACE ROAD USERS AND AIM THE STOP PADDLE FACE TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FREE ARM SHALL BE HELD WITH THE PALM OF THE HAND ABOVE SHOULDER LEVEL TOWARD APPROACHING TRAFFIC.

B. TO DIRECT TRAFFIC TO PROCEED

TO DIRECT STOPPED ROAD USERS TO PROCEED, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. THE FLAGGER SHALL MOTION WITH THE FREE HAND FOR ROAD USERS TO PROCEED.

C. TO ALERT OR SLOW TRAFFIC

TO ALERT OR SLOW TRAFFIC, THE FLAGGER SHALL FACE ROAD USERS WITH THE SLOW PADDLE FACE AIMED TOWARD ROAD USERS IN A STATIONARY POSITION WITH THE ARM EXTENDED HORIZONTALLY AWAY FROM THE BODY. TO FURTHER ALERT OR SLOW TRAFFIC, THE FLAGGER HOLDING THE SLOW PADDLE FACE TOWARD ROAD USERS MAY MOTION UP AND DOWN WITH THE FREE HAND, PALM DOWN.

○ TRAFFIC CONE **OR** TRAFFIC DRUM
✳ OPTIONAL ⊗ TRAFFIC DRUM ⊢⊣ PORTABLE SIGN SUPPORT
⟵ HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 13 - SHEET 2 OF 2
SEE NOTES 1, 2, 4, 6, 7, 8

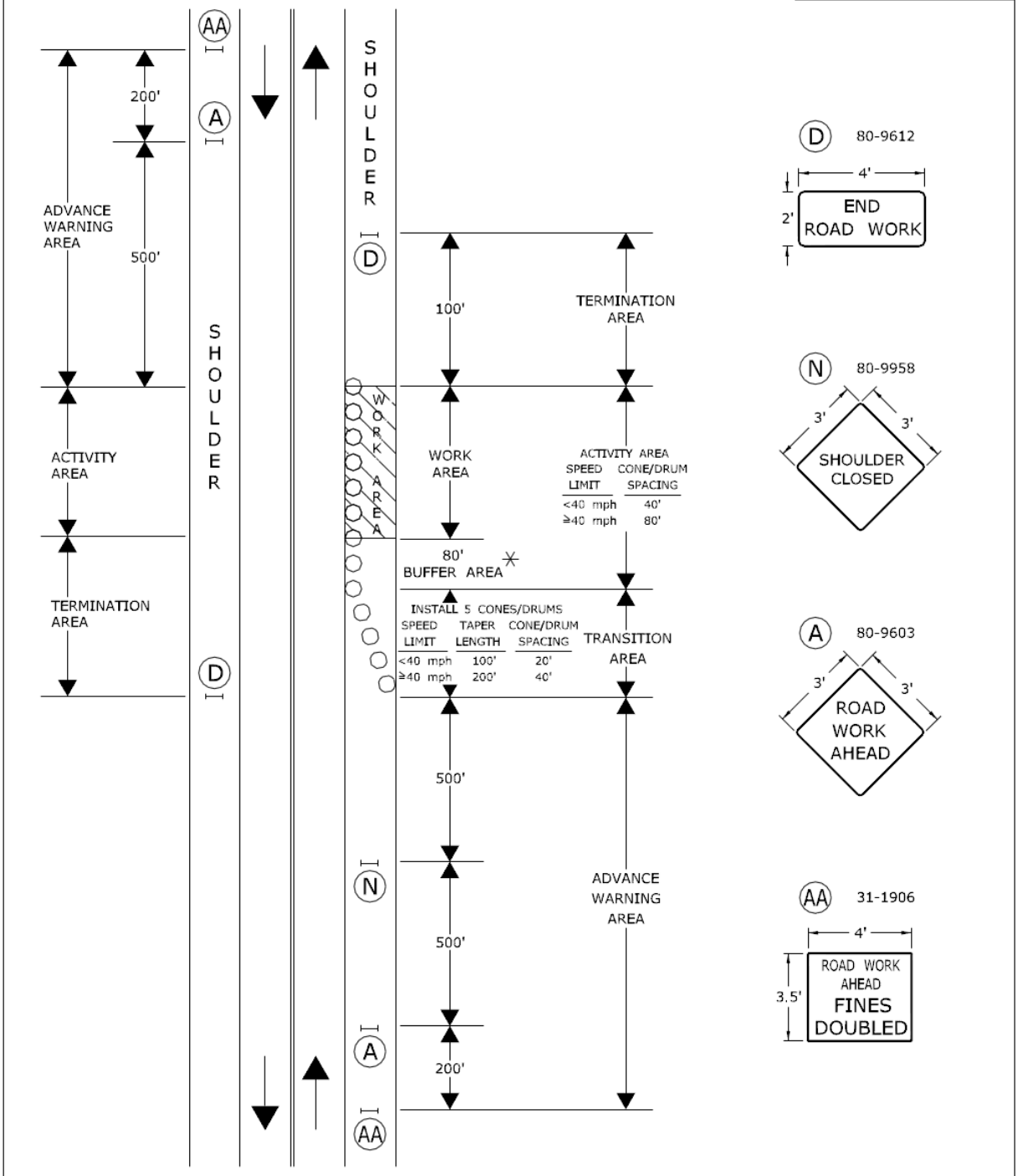
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED _____ Charles S. Harlow 2012.06.05 15:55:45-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN SHOULDER - TWO LANE HIGHWAY

SIGN FACE
71 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN

PLAN 14

SEE NOTES 1, 2, 4, 7, 8

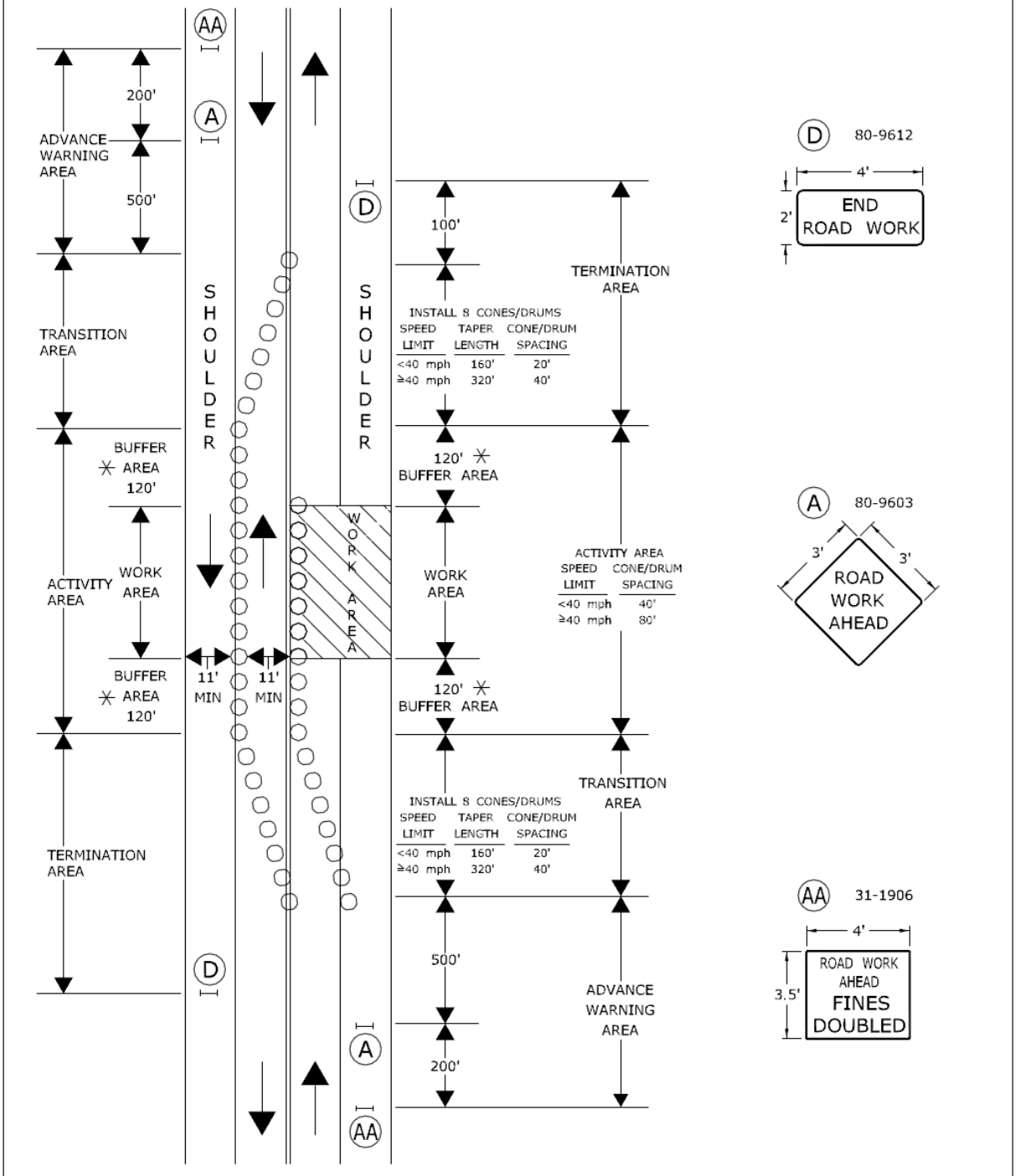
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:56:09-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN TRAVEL LANE AND SHOULDER
TWO LANE HIGHWAY

SIGN FACE
62 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 15
SEE NOTES 1, 2, 4, 6, 7, 8

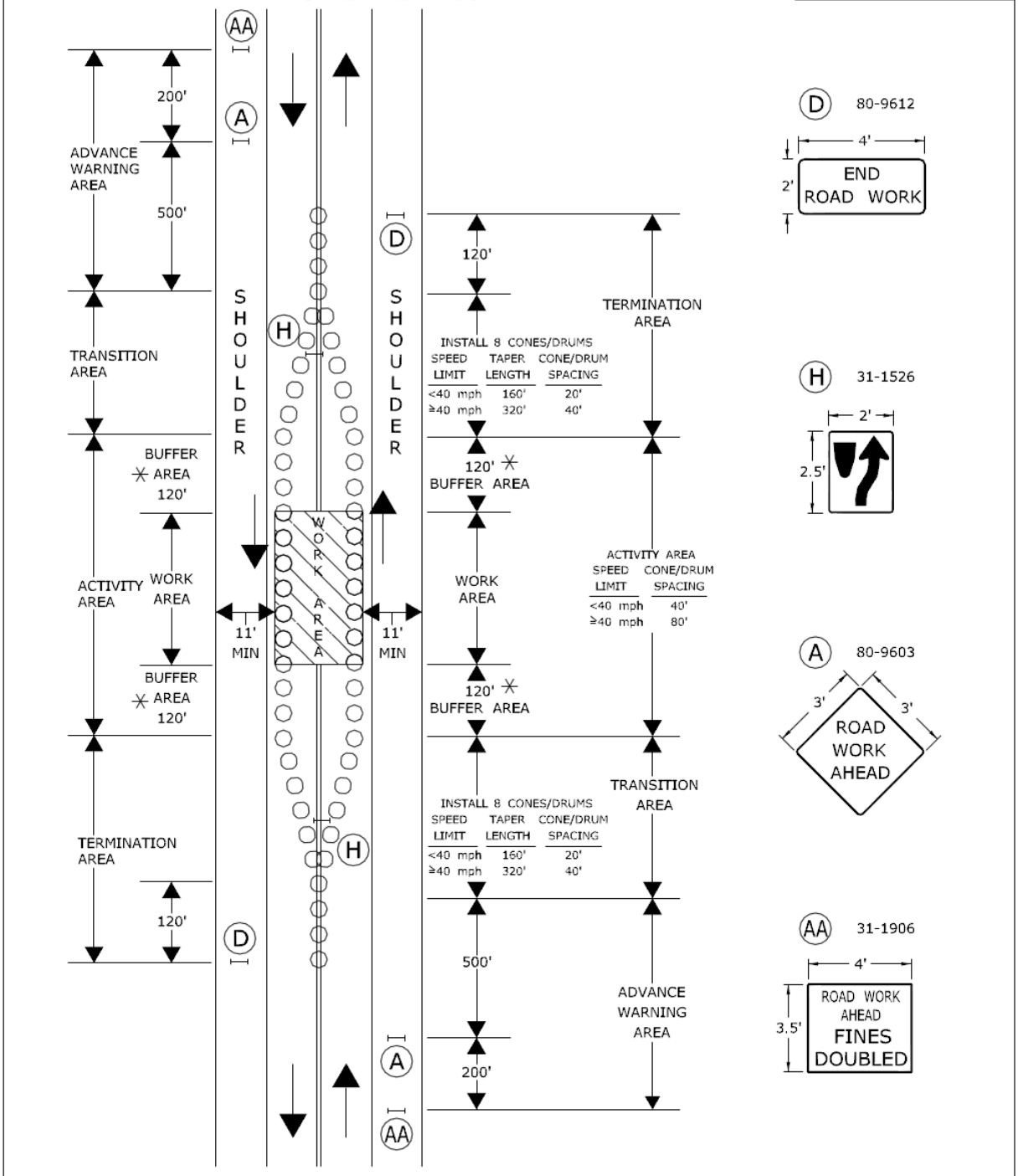
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED
Charles S. Harlow
2012.06.05 15:56:29-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN MIDDLE OF ROADWAY
TWO LANE HIGHWAY

SIGN FACE
72 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 16
SEE NOTES 1, 2, 4, 6, 7, 8

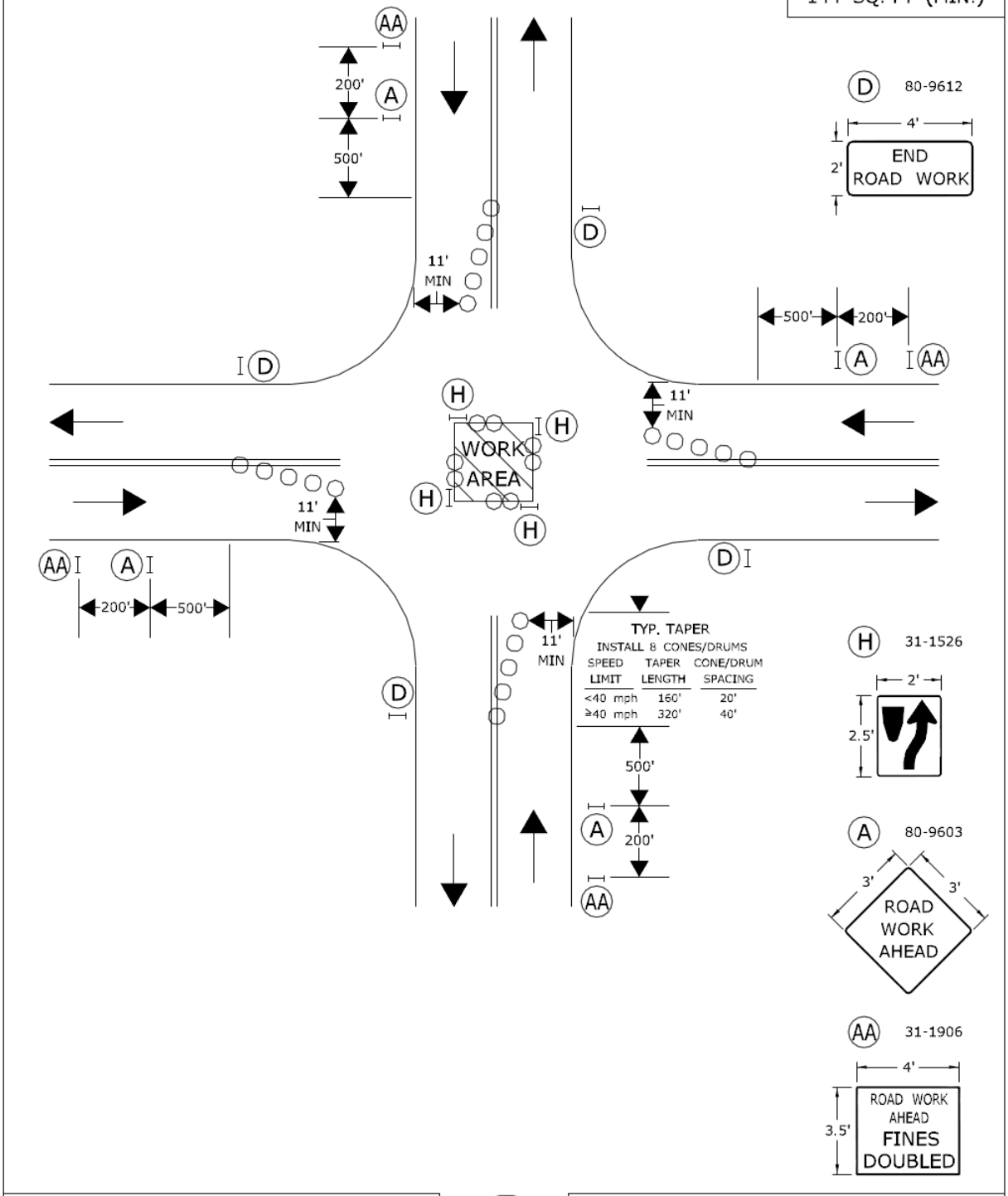
CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

APPROVED Charles S. Harlow 2012.06.05 15:56:51-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

WORK IN MIDDLE OF ROADWAY AT INTERSECTION

SIGN FACE
144 SQ. FT (MIN.)



TRAFFIC CONE **OR** TRAFFIC DRUM
OPTIONAL TRAFFIC DRUM PORTABLE SIGN SUPPORT
HIGH MOUNTED INTERNALLY ILLUMINATED FLASHING ARROW

SCALE: NONE

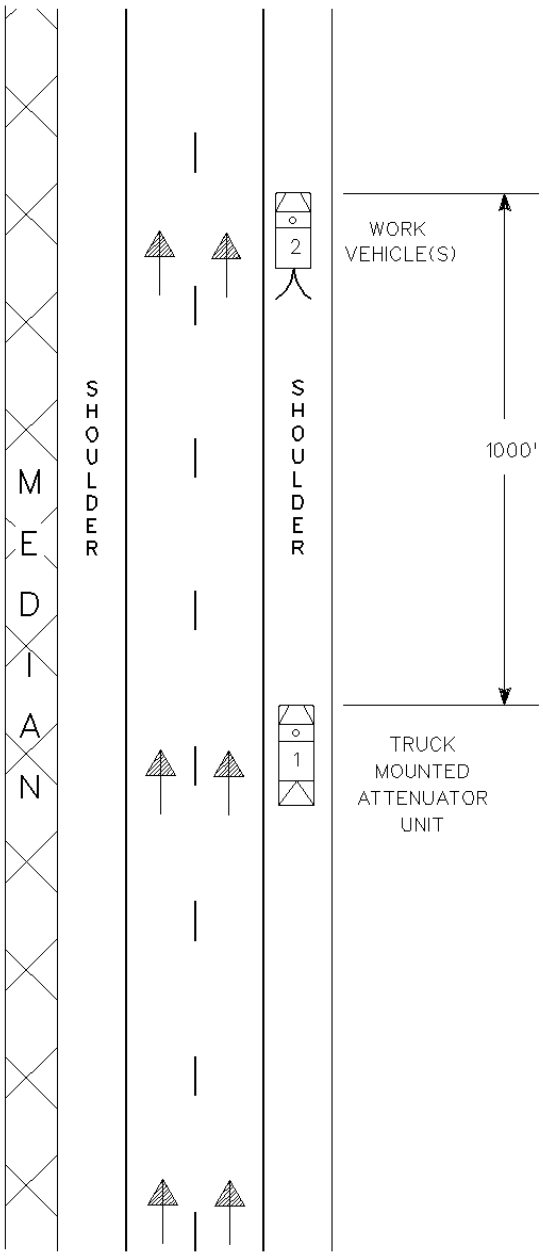
CONSTRUCTION TRAFFIC CONTROL PLAN
PLAN 17
SEE NOTES 1, 2, 4, 6, 7, 8

CONNECTICUT DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & CONSTRUCTION

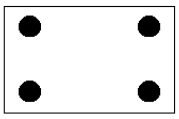
APPROVED
Charles S. Harlow
2012.06.05 15:57:16-04'00'
PRINCIPAL ENGINEER

ITEM #0971001A

MOVING OPERATION ON RIGHT SHOULDER
MULTILANE HIGHWAY & SECONDARY ROADWAYS



SIGN MOUNTED ON TRUCK 1



DEPARTMENT APPROVED
ARROW BOARD
(FLASHING YELLOW MODE)

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING &
HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

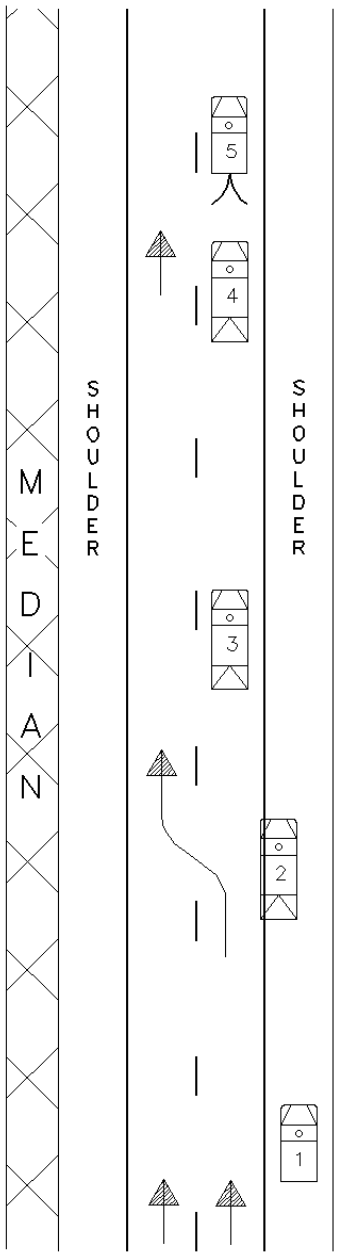
PLAN 19

SCALE NONE

APPROVED J. Mccall PRINCIPAL ENGINEER DATE 1-30-02

ITEM #0971001A

MOVING OPERATION IN RIGHT LANE AND OUTSIDE SHOULDER AT THE SAME TIME MULTILANE HIGHWAY



WORK VEHICLE(S)

150'

TRUCK MOUNTED ATTENUATOR UNIT

DISTANCE VARIES ACCORDING TO OPERATION

800'

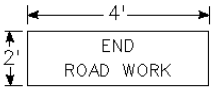
TRUCK MOUNTED ATTENUATOR UNIT

1000'

TRUCK MOUNTED ATTENUATOR UNIT

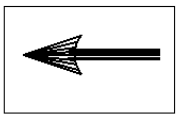
ADVANCE WARNING VEHICLE

SIGN MOUNTED ON VEHICLE 5



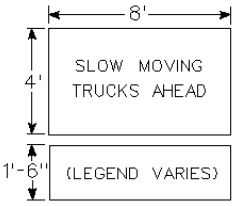
80-9612

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

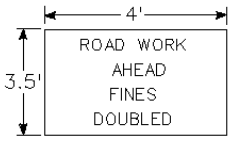
SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

SIGN MOUNTED ON VEHICLE 2



31-1906

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

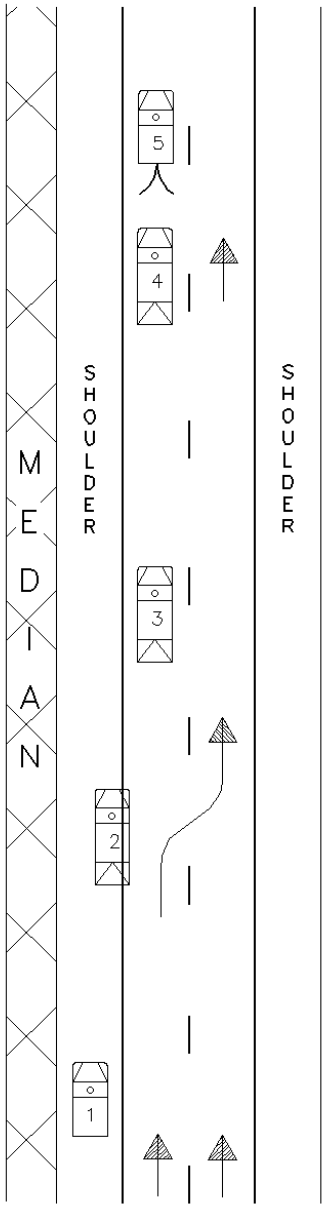
PLAN 20

SCALE NONE

APPROVED John D. Micall PRINCIPAL ENGINEER DATE 1-30-02

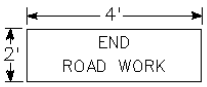
ITEM #0971001A

MOVING OPERATION IN LEFT LANE AND INSIDE SHOULDER AT THE SAME TIME MULTILANE HIGHWAY



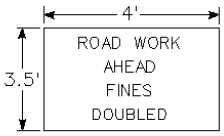
WORK VEHICLE(S)
150'
TRUCK MOUNTED ATTENUATOR UNIT
DISTANCE VARIES ACCORDING TO OPERATION
TRUCK MOUNTED ATTENUATOR UNIT
800'
TRUCK MOUNTED ATTENUATOR UNIT
1000'
ADVANCE WARNING VEHICLE

SIGN MOUNTED ON VEHICLE 5



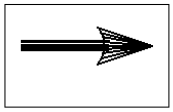
80-9612

SIGN MOUNTED ON VEHICLE 2



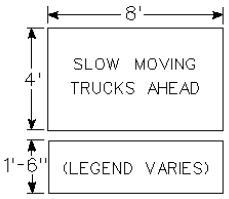
31-1906

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

WHEN THE LEFT SHOULDER WIDTH CANNNOT ACCOMMODATE A VEHICLE, THEN ADVANCE WARNING VEHICLE 1 MAY DRIVE PARTIALLY IN THE LANE.

REV'D 1-02

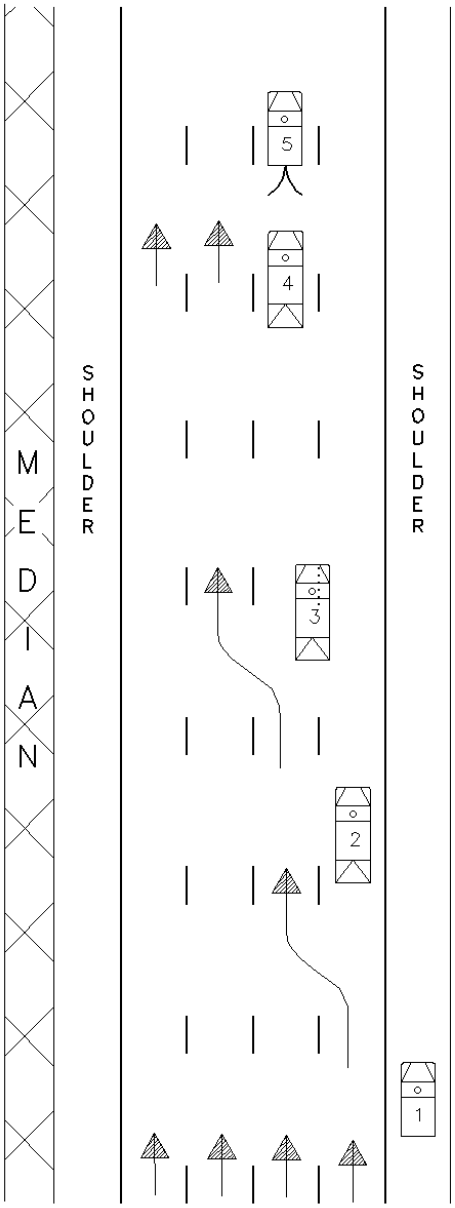
CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN
PLAN 21
SCALE NONE

APPROVED John D. Micali PRINCIPAL ENGINEER DATE 1-30-02

ITEM #0971001A

MOVING OPERATION IN CENTER LANE
MULTILANE HIGHWAY



WORK VEHICLE(S)

150'

TRUCK MOUNTED ATTENUATOR UNIT

DISTANCE VARIES ACCORDING TO OPERATION

TRUCK MOUNTED ATTENUATOR UNIT

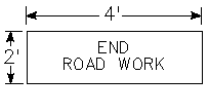
800'

TRUCK MOUNTED ATTENUATOR UNIT

1000'

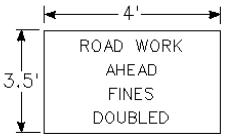
ADVANCE WARNING VEHICLE

SIGN MOUNTED ON VEHICLE 5



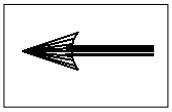
80-9612

SIGN MOUNTED ON VEHICLE 2



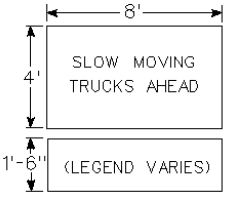
31-1906

SIGN MOUNTED ON TRUCKS 2, 3, & 4



DEPARTMENT APPROVED ARROW BOARD

SIGNS MOUNTED ON VEHICLE 1



80-9815
THIS SIGN SHOULD BE COVERED WHEN NOT IN USE.

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

REV'D 1-02

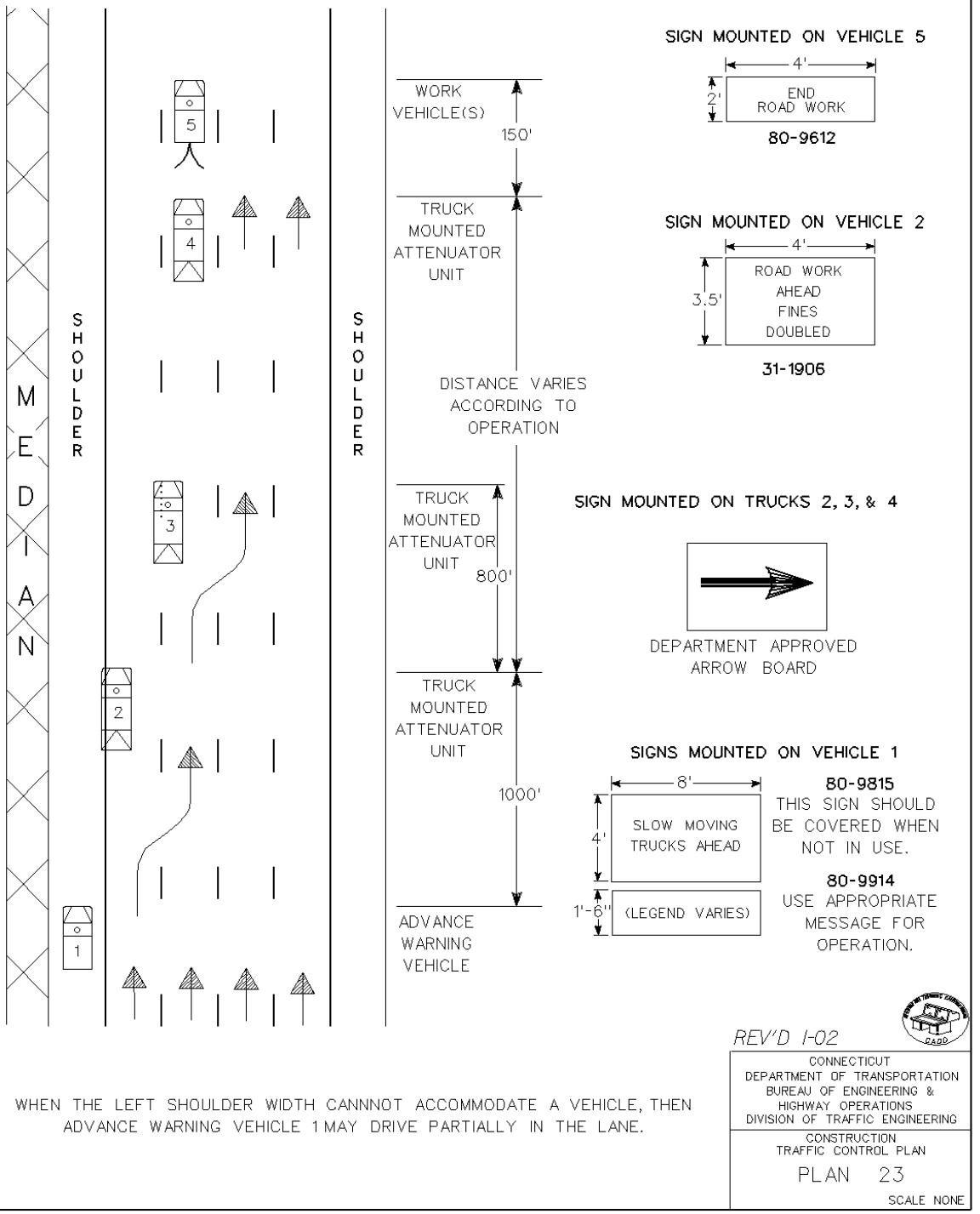
CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN
PLAN 22
SCALE NONE

APPROVED John D. Mcall PRINCIPAL ENGINEER DATE 1-30-02

ITEM #0971001A

MOVING OPERATION IN CENTER LANE
MULTILANE HIGHWAY



WHEN THE LEFT SHOULDER WIDTH CANNNOT ACCOMMODATE A VEHICLE, THEN ADVANCE WARNING VEHICLE 1 MAY DRIVE PARTIALLY IN THE LANE.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

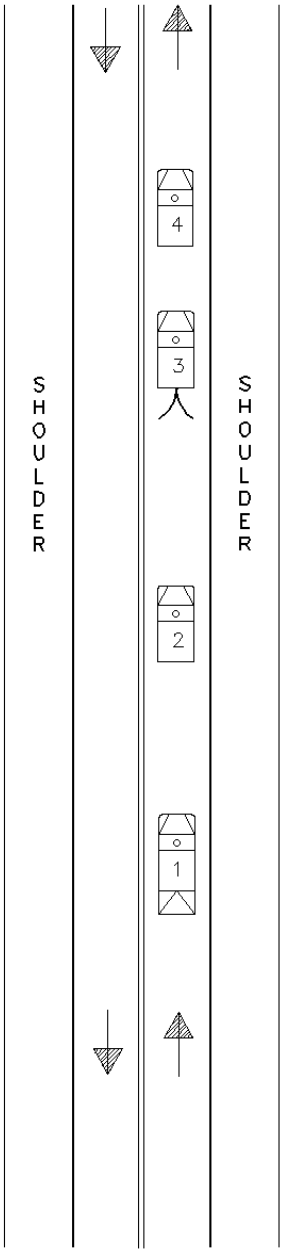
PLAN 23

SCALE NONE

APPROVED John D. Micali
PRINCIPAL ENGINEER
DATE 1-30-02

ITEM #0971001A

MOVING OPERATION
TWO LANE HIGHWAY



LEAD VEHICLE

DISTANCE VARIES

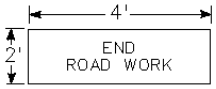
WORK VEHICLE(S)

DISTANCE VARIES ACCORDING TO OPERATION

WORK VEHICLE(S)

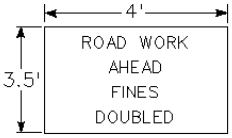
TRUCK MOUNTED ATTENUATOR UNIT

SIGN MOUNTED ON VEHICLE 4



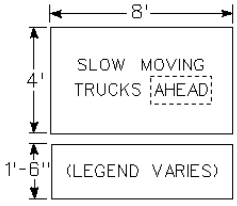
80-9612

SIGN MOUNTED ON VEHICLE 2



31-1906

SIGNS MOUNTED ON VEHICLE 1



80-9815
COVER THE WORD "AHEAD" WITH BLANK PANEL

80-9914
USE APPROPRIATE MESSAGE FOR OPERATION.

REV'D 1-02

CONNECTICUT
DEPARTMENT OF TRANSPORTATION
BUREAU OF ENGINEERING & HIGHWAY OPERATIONS
DIVISION OF TRAFFIC ENGINEERING

CONSTRUCTION
TRAFFIC CONTROL PLAN

PLAN 24

SCALE NONE

APPROVED John D. Mccall
PRINCIPAL ENGINEEER

DATE 1-30-02

ITEM #0971001A

Article 9.71.05 – Basis of Payment is supplemented by the following:

The temporary relocation of signs and supports, and the furnishing, installation and removal of any temporary supports shall be paid for under the item "Maintenance and Protection of Traffic". Temporary overhead sign supports and foundations shall be paid for under the appropriate item(s).

The cost of furnishing, installing, and removing the material for the 4H:1V traversable slope shall be paid for under the item "Maintenance and Protection of Traffic."

ITEM NO. 0992093A - RESET BRICK PAVING

This work shall conform to Section 8.14 of Form 817 supplemented as follows:

Description:

Add the following:
The work shall include the removal and resetting of brick pavers at the northwest corner of Atlantic Street and North State Street on new or existing base material to the limits and grades as shown on the plans.

Base materials shall consist of granular fill, concrete and a sand layer as shown on the details.

Materials:

Delete the section and replace with the following:

Brick Pavers shall be existing. Pavers that are not usable shall be replaced with equal material of the same color and texture.

Material for this work shall conform to the following requirements:

Concrete: 3,000 psi Class "C" Concrete in accordance with the provisions of Article 4.01.03 for Concrete Pavement.

Wire Fabric: 6x6 – W2.9xW2.9 sheets in accordance with Article M.06.01.

Brick Pavers: The Contractor shall provide samples of the brick for approval by the Engineer.

Sand: In accordance with Article M.03.01 – 2 for Fine Aggregate

Granular Fill: In accordance with Article M.02.01 for Granular Fill

Construction Methods:
Add the following:
Resetting of brick pavers will consist of removing existing pavers, granite edging and base material to the limits shown or as directed, storing material, installing the base materials and brick pavers and granite edging to the proposed limits and grade. Damaged or unusable brick paver material shall be replaced with pavers of the same color and texture. Pavers shall be installed to match the existing pattern and details shown on the plans, cut as need to match the proposed curb radius and abut the adjacent pieces. Existing granite edging shall be replaced to match the existing condition.

1 – Excavation: Excavation shall be made to required depths below finish grade, as shown necessary to achieve the desire surface drainage for the finish surface. The Contractor shall be careful of the adjacent concrete sidewalks, building and bituminous concrete driveway and curbing. Any damage caused to the surrounding features will be replaced at the Contractor's expense.

2 –Granular Fill Base Course: The Granular Fill shall be uniformly spread upon the compacted subgrade to the require depth and thoroughly compacted in accordance with Article 9.21.03-2.

3 – Concrete: Place concrete over the prepared granular fill bedding layer in accordance with Article 9.21.03. Wire Fabric to be discontinued at all expansion joints.

4 – Brick Pavers: The brick pavers shall be placed on a sand leveling layer of approximately 1 inch thick to provide a flush joint at the interface with the adjoining curbing and or concrete sidewalk. The brick pavers shall be set to the line and grade to achieve the desired finished surface and grade using a Stack Bond pattern at the northwest corner of Atlantic Street and North State Street. The brick pavers shall be installed hand tight with a maximum joint not to exceed 1/8". After the brick pavers have been completely laid, sweep joint sand into the joints until full. Lightly fog with water and continue to fill with sand until no further settlement occurs. Paver edge restraints shall be installed around the entire perimeter that is not restrained by the concrete sidewalk. Place the edge restraint on the base material and spike through pre-drilled holes into the compacted base material using 10" x 3/8" diameter steel spikes as per the manufacturer's recommendations. Upon completion, the surface shall be swept clean.

Method of Measurement:

Add the following:
Resetting of brick pavers will be measured for payment by actual number of square feet of brick pavers and granite edging reset and accepted, complete in place, which shall include the removal of existing pavers, storage of materials, furnishing and installing the base materials, cutting the pavers if needed and resetting the pavers to the new grade.

Basis of Payment:

Add the following:
The work will be paid for at the contract unit price, Square Foot for "Reset Brick Paving" complete in place, which price shall include the removal of existing pavers and granite edging, storage of materials, adjusting the base materials, furnishing and installing the base materials, cutting the pavers and granite edging if needed and resetting the pavers and granite edging to the new grade.

Pay Item	Pay Unit
Reset Brick Paving	Square Foot

ITEM #0992093A

ITEM 1008115A – 2” RIGID METAL CONDUIT IN TRENCH
ITEM 1008117A – 3” RIGID METAL CONDUIT IN TRENCH
ITEM 1008770A – 4” PVC MULTI-DUCT IN TRENCH
ITEM 1008780A – 4” PVC MULTI-DUCT UNDER ROADWAY

DESCRIPTION:

The mainline conduit shall be a 4” (100 mm) multiduct conduit system designed and engineered for direct burial and protection of optical fiber cable. The multiduct concept shall maximize duct usage by compartmentalization of cables for current requirements and for future expansion.

The Temporary mainline conduit shall be a 2” (50mm) RMC conduit designed and engineered for direct burial and protection of optical fiber cable. The temporary conduit shall not have multiduct’s

For the 4” (100 mm) PVC conduit, the Contractor shall be required to install the conduit **simultaneously** with the pullboxes to insure that the conduit innerduct on each side of the pullbox is at exactly a 90-degree angle to the side of the pullbox. For Rigid Metal Conduit under Roadway, the Contractor shall be required to install the conduit simultaneously with the installation of the pullboxes. For Rigid Metal Conduit under Roadway, the Contractor shall be required to install a minimum of 10 feet (3.0 meters) of Flexible Conduit on each side of the pullbox to insure that the innerduct enters the pullbox at exactly a 90 degree angle to the side of the pullbox. **The cost of the Flexible Metal Conduit shall be included in the cost of the appropriate conduit item; it shall not be paid for separately. The required installation is shown on the IMS details. The required length of Flexible Metal Conduit on each side of a structure shall be as shown on the appropriate detail.**

The mainline conduit shall contain four (4) factory installed 1.25” (30 mm) PVC inner-ducts within a 4” (100 mm) outer-duct. Conduit under road, and as noted on the plans, shall be PVC. Conduit in trench, and as noted on the plans, shall be 4” (100 mm) Polyvinyl Chloride.

The 2” (50 mm) RMC conduit shall be used for mainline optical fiber cable, branches off the mainline conduit, telephone service and electrical service as indicated on the plans. The 2” (50 mm) RMC – Surface used as risers on utility poles shall include an entrance fitting (weatherhead) at the top termination of the conduit run as indicated on the plans. The 3” (75 mm) conduit shall be used for utility service for CCTV cameras and variable message signs as indicated on the plans.

As part of this item, the Contractor will be required to test the integrity of the conduit with a poly-line and to install a pull tape in each and separate innerduct as required in the specification.

Work under the above items shall conform to Public Utility Commission Rules and Regulations, where applicable, and to Section 10.08 of the standard specifications, supplemented and amended as follows:

MATERIALS:

A. General:

The multi-cell conduit system shall be a pre-assembled conduit manufactured from a 4" (100 mm) round outerduct containing four (4) factory installed innerducts. The innerducts shall be held together in a square configuration by a system of spacers, bands, or other mechanism. The coupling system shall be resistant to water infiltration, air loss during cable installation, and shall be capable of locking the system tightly together to not allow free twisting of the innerducts.

The conduit shall be free from defects including non-circularity and foreign inclusions. It shall be nominally uniform (as commercially practical) in color, density, and physical properties. It shall be straight and the ends shall be cut square to the inside diameter. Polyvinyl Chloride (PVC) conduit shall be Type 40 grade conforming to Section M.15.09 of the standard specifications. Rigid Metal Conduit shall be galvanized steel also conforming to Section M.15.09 of the standard specifications. The PVC conduit shall include a grounding wire conforming to Article M.15.13 of the standard specifications. PVC conduit and fittings shall be supplied with an ultraviolet inhibitor.

B. PVC Outerduct:

The complete PVC Type 40 Multi-cell conduit system shall be UL Listed, designed and engineered for direct burial or encased underground applications. Protective outer-duct shall be 4" (100 mm) PVC Type 40 with extended 6" (150 mm) integral bell end and have a lay length of 20 feet (6.1 m). The outer-duct shall have a longitudinal running print line to assure proper innerduct orientation and alignment. This line shall consist of the following wording: "INSTALL THIS SIDE UP – Connecticut D.O.T. Cable – For Assistance Call 860-594-3447". The outer-duct shall be marked with data traceable to plant location, date, shift, and machine of manufacture.

The outer-duct shall have a circumferential ring on the spigot end of the ducts so as to provide a reference point for ensuring the proper insertion depth when connecting conduit ends. Both ends of the conduit shall be capped to protect inner-duct during shipment and job site storage.

The PVC conduit system to be utilized shall be a complete system and the Contractor shall provide the following fittings:

- Coupling Kits
- Terminator Kits
- Lubrication Fittings
- Repair Kits
- Installation Accessories

A complete line of fittings, adapters, and elbows shall be available and shall be manufactured from the same materials and manufacturing process as the conduit. The multi-cell conduit shall be joined by use of a coupling system that effectively seals the outerducts and innerducts but allows for expansion or contraction in the system. A silicone non-petroleum base lubricant may be used for assembly of the multi-cell conduit.

All conduit entering and exiting conduit termination points shall have a terminator installed that is made of PVC with an anti-reversing gasket that prevents ingress of water and debris into the outer conduit and the innerduct.

C. Couplings:

The PVC coupling body shall allow for transitions from PVC conduit to RMC conduit to Flexible Sweeps and any combination thereof. The coupling body shall have a factory assembled, multi-stage gasket that is anti-reversing for sealing both the outer and inner-duct. A secondary, mid-body gasket shall be seated at the shoulder of the bell to assure 100psi (690 kPa) air pressure (in accordance with Bellcore GR-2884 Issue 1) and watertight integrity with minimum joint infiltration of 6 psi (41 kPa). This will allow for the use of Air-Jet technology to be used in the placing of cables. The PVC conduit system shall be designed so that both straight sections and fittings will assemble without the need for cement or glue.

The coupling body shall be designed so that when the conduit is joined, the outer walls of the innerducts and the inner walls of the outerduct shall be sealed, providing an airtight seal from within the innerduct system and a watertight seal from the outside of the outerduct. The coupling body shall be tested for water tightness and air-tightness in accordance with Bellcore GR-2884-CORE Issue 1, July 1995 (R3-41 for water-tightness and R3-43 for air-tightness). The coupling body shall conform to the following requirements:

Watertightness: 6 psi (41 kPa) minimum
Air Tightness: no significant leakage at 100 psi (690 kPa)

The system shall be designed so that expansion and contraction of the inner-duct shall take place in the coupling body, and the fittings shall allow going from steel to PVC without compromising air/water tightness, or pulling capabilities. The coupling body shall be factory assembled in the bell end of the outer duct and shall be manufactured from high impact engineered thermoplastic. The coupling body face shall be supplied with lead-ins to facilitate assembly. The coupling body shall have each conduit entrance identified with a raised number and the white inner duct locator conduit entrance shall have raised ribs that can be felt through a glove.

The PVC system shall be designed so that the assembly of components can be accomplished by inserting the spigot end into the male bell end to the marked insertion depth. (The insertion depth is marked on the spigot end)

D. Sweeps:

The PVC conduit system shall offer a complete line of fixed and flexible sweep-bends with system compatible bell and spigot ends. The PVC conduit system shall offer and the Contractor shall utilize the following standard fixed sweep-bends:

Radius	Bend	System
4 ft & 3 ft. (1200mm & 900mm)	11.25°, 22.5°, 45°, 90°	4-way

Note: Direction changes shall not exceed 90 degrees.

The flexible sweep-bend shall be supplied in two lengths to meet field requirements. They shall have a PVC outer jacket and be acceptable for exposed and direct burial installation. The inner-duct shall extend 6" out of the spigot end of the flexible elbow. Once the elbow is bent to the proper angle, the innerducts shall be trimmed to the proper length for insertion to the bell end. PVC inner ducts shall not be allowed in bend and sweeps.

Length Feet (Meters)	**Radius** Feet (Meters)	**Bend** degrees (°)	**System**
10 (3.2)	4 (1.2) min	0-90	4-way
10 (3.2)	6 (1.8)	0-70	4-way
10 (3.2)	9 (2.7)	0-55	4-way
16 (4.9)	4 (1.2) min	0-90	4-way
16 (4.9)	6 (1.8)	0-70	4-way
16 (4.9)	9 (2.7)	0-55	4-way

All bends, including flexible sweeps, shall have a minimum radius of 3 ft. (900 mm). The inner-duct system shall be solvent welded to the coupling body; supported by a moveable spacer every 4 ft. (1.32 m). The bends shall not violate the minimum bending radius of the fiber optic cable.

All bends shall have nylon inner ducts, or approved equivalent, installed to prevent burn-through in accordance with test procedure outlined in Bellcore GR-2884 Issue 1 Section R3-35 and R3-36.

E. Innerduct:

The inner-duct in straight lengths shall be manufactured from PVC or high density polyethylene (HDPE). Innerducts shall be factory treated with atomized silicone or manufactured in a manner to reduce friction during pulling of fiber optic cable.

Innerduct to be used in bends and sweeps shall have a minimum burn through time of 90 minutes when tested in accordance with Bellcore GR-2884 Issue 1 Section R3-35, and R3-36.
PVC inner ducts shall not be allowed in bends and sweeps.

The innerducts shall have a permanent dry lubricant extruded within the inner wall and shall incorporate longitudinal ribs within the inner wall. The innerducts shall have a nominal size of 1.25" (30 mm) and shall consist of 4 unique colors: white, red, orange, and yellow. Innerduct colors shall be oriented in a clockwise direction as specified above, looking at the spigot end of the multi-cell conduit system. The white innerduct shall be located directly under the print line on the outerduct.

Each inner-duct shall be sealed with an expanding Neoprene Plug that withstands 22 psi (150 kPa) and seals the inner-duct from water and debris infiltration, and a provision for tying off a pull line.

F. Steel Outerduct:

All components of the conduit system shall meet or exceed the following specifications and standards:

1. ASTM A 36. Standard Specification for Structural Steel.
2. ASTM A 53. Standard Specification for Steel Pipe.
3. ASTM A 570 Standard specification for Steel.
4. ASTM A 479 Standard Specification For Stainless Steel.

In addition, the steel outer duct shall conform to the following industry standards:

NEC Article 346
ANSI C80.1
U.L. 6

The conduit system shall be a complete system with all the following fittings:

Manhole Terminator Kits
Deflection Fittings
Offset Fittings
Expansion/Contraction Fittings
Lubrication Fittings
Repair Kits
Installation Accessories
Steel to PVC Sched. 40
Steel PVC-Coated Flexible Elbows
Stand Off Fittings
Entrance Fittings

Galvanized outer-duct shall be hot dipped galvanized inside and out; conduit shall be smooth and free from burrs and coated with rust inhibitor.

Rigid steel shall be supplied in 10 foot (3-meter) lengths with a length tolerance of +/- ½ " (10mm) and shall be Schedule 40 minimum. Conduit shall be supplied with thread protectors.

Each section of steel conduit shall be supplied with one reversing spin coupling that allows straight sections and fittings to be joined without spinning the conduit. The reversing coupling shall be galvanized and have three set screws to lock the coupling in place.
The Steel Outerduct system shall be designed so that the assembly of components can be accomplished in the following steps:

a. Loosen set screws on coupling spin back to allow for insertion
b. Insert male into female and spin coupling forward to bottom
c. Once the spin coupling is installed, there shall be no threads visible on the 4" (100 mm) steel conduits.
d. Tighten set screws

The Steel conduit system shall offer a complete line of fixed and flexible sweep-bends with system compatible bell and spigot ends. The Steel conduit system shall offer and the Contractor shall utilize the following standard fixed sweep-bends:

Radius	Bend	System
4 ft & 3 ft. (1200mm & 900mm)	11.25°, 22.5°, 45°, 90°	4-way

ITEM 1008115A, ITEM 1008117A,
ITEM 1008770A, ITEM 1008780A

Note: Direction changes shall not exceed 90 degrees.

The flexible sweep-bend shall be supplied in two lengths to meet field requirements. They shall have a steel core with a PVC outer jacket and be UL Listed for exposed and direct burial installation. The inner-duct shall always remain flush to the end of the flexible elbow, even when bending. PVC inner ducts shall not be allowed in bend and sweeps.

Length Feet (Meters)	**Radius** Feet (Meters)	**Bend** degrees (°)	**System**
10 (3.2)	4 (1.2) min	0-90	4-way
10 (3.2)	6 (1.8)	0-70	4-way
10 (3.2)	9 (2.7)	0-55	4-way
16 (4.9)	4 (1.2) min	0-90	4-way
16 (4.9)	6 (1.8)	0-70	4-way
16 (4.9)	9 (2.7)	0-55	4-way

All bends, including flexible sweeps, shall have a minimum radius of 3 ft. (900 mm). The inner-duct system shall be solvent welded to the coupling body; supported by a moveable spacer every 4 ft. (1.32 m). The bends shall not violate the minimum bending radius of the fiber optic cable.

All bends shall have nylon inner ducts, or approved equivalent, installed to prevent burn-through in accordance with test procedure outlined in GR-2884 Issue 1 Section R3-35 and R3-36.

.

The following performance requirements shall be met:

Yield	30,000 psi (200 MPa)
Tensile	50,000 psi (345 MPa)
Hardness	Rockwell “B” 55-65

All conduit entering and exiting conduit terminal points shall have a terminator installed that is made of PVC with an anti-reversing gasket that prevents ingress of water and debris into the outer conduit and inner-duct.

The rigid steel conduit system shall offer expansion/contraction fittings with system compatible threads and reversing couplings. The inner-duct of the expansion/contraction fittings shall also be system compatible. The capacity of the fitting shall be 8” (200 mm) total stroke with 4” (100 mm) expansion and 4” (100mm) contraction capacities.

G. Conduit Testing:

The poly-line installed to verify the integrity of the conduit system shall be ¼” (6 mm) polypropylene.

The detectable pull tape shall consist of a single 24 AWG copper wire with polyethylene or PVC jacket woven into the polyester tape. The pull tape shall be NEPTCO Part No. DP1250P, or

approved equal, for cable sizes of less than 97 fibers. NEPTCO Part No. DP1800P, or approved equal, shall be used for cable size of 97-288 fibers.

The detectable pull tape shall have the following properties:

- 1250 lb (567 Kg) tensile strength
- flat, not round, construction
- printed foot markings
- pre-lubricated for reduced pulling tension at start of cable pull
- low susceptibility to absorption of moisture; moisture resistant

Underground utility marking tape shall have a minimum tensile strength of 78 lbf (350 N) and a minimum elongation of 700 percent before breakage. The detectable tape shall not delaminate nor smear when wet and shall be resistant to insects. The tape shall not degrade when exposed to alkalis, acids or other corrosive elements found in soil.

Pressure treated wood for Identification Posts shall conform to Article M.12.13 of the Standard Specifications. Signs on Identification Posts shall conform to Article M.18.13 of the Standard Specifications.

H. Bedding Material:
Bedding material for all conduit shall be No. 100 fine aggregate as defined in Section M.03 of the standard specifications and backfill for the pits shall be pervious structure backfill conforming to Article 2.16.02.

CONSTRUCTION METHODS:

A. General:

Construction methods shall conform to Article 10.08.03 of the Standard Specifications and to the manufacturer's instructions.

PVC Conduit shall be encased in concrete. Marking tape supplied by the City will be used over the PVC conduit.

The Contractor shall layout the trench for the conduit in conjunction with the installation of pullboxes, vaults, or manholes. When installing the conduit, the Contractor shall be aware of the location of the proposed conduit terminal point when they are at a sufficient distance from the terminal point to allow for adjustment of the trench so that the conduit will line up flush with the applicable entry point. Flexible conduit will not be used indiscriminately.

A silicon, non-petroleum based lubricant on the coupling body may be used to facilitate installation.

PVC conduits entering conduit terminal points shall terminate flush with the inside wall. The inner-duct shall extend 6" (150 mm) from the inside face.

Galvanized rigid steel conduit shall extend 2" (50 mm) into the manhole/vault/pull box for installation of grounded end bushings.

Conduits and inner-duct entering conduit terminal points or where terminated in trench, shall be capped or sealed to prevent ingress of water and debris into the conduit. Conduits containing inner-duct shall be plugged using a quadplex expansion plug inside the conduit around the inner-duct. Inner-duct containing one cable shall be plugged using an expandable cable seal off. Conduits terminating in a trench shall be clearly marked and flagged, both in trench and above trench for future locating.

At each conduit terminal point, a PVC coupling body with anti-reversing gasket that seals between the conduit and inner-duct shall be used as follows:

In places where the field installed inner-duct enters and exits existing conduit, the space between the conduit and the inner-duct, as well as the space between the inner-duct and the cable shall be sealed by means of a split internal expansion plug. Bushing sleeves shall be equipped to suit varying cable sizes. Sealing capacity shall withstand 22 psi (150 kPa).

All inner-duct shall be sealed by means of a polypropylene duct plug equipped with a neoprene or polyurethane gasket. Plugs shall be equipped with an attachment to secure the pull rope in the inner-duct.

When PVC cannot be installed at the required depth, such as where ledge or rock is encountered, the Contractor shall install Rigid Metal conduit at the maximum depth possible. If the Contractor is unable to obtain a minimum depth of 18" (0.45 meters), the Contractor shall install the conduit as directed by the Engineer.

Warning Tape shall be placed in trench over conduit as shown on the details. Identification Posts shall be carefully placed adjacent to conduit in trench at intervals not to exceed 1200 ft. (365 meters) in length, except at long span bridges and paved areas.

B. Conduit Under Roadway:

The preferred method of installing steel casing under roadway shall be by veneering or cutting. In areas where the conduit is installed under live traffic, such as a ramp crossing, the conduit will be capped in concrete. In areas where the conduit is installed in the shoulder and the required depth cannot be obtained, the conduit shall be installed at a minimum depth of 18" (0.45 meters) and capped in concrete.

Where veneering or cutting is not possible, and under the direction of the Engineer, steel casing may be furnished and installed by jacking. The casing shall be designed to withstand all the loads that it will be subject to, including the loads during installation and the in-service highway loads. The casing shall be designed by and bear the seal and signature of a Connecticut Licensed Professional Engineer and the computations shall be submitted with the Jacking Plan. The pipe shall be installed to preclude interference with highway traffic or damage to traveled lanes or shoulders. Jacking operations shall be conducted so as to prevent caving ahead or to cause voids outside of the pipe.

The auger head shall not proceed more than 4" (100 mm) ahead of the pipe being jacked. Removal of the material from the jacking pits by washing or sluicing will not be permitted.

A shoring and jacking pit plan shall be prepared by and bear the seal and signature of a Connecticut licensed Professional Engineer.

After the casing pipe is jacked in place, the inside shall be thoroughly cleaned free from grease, dirt, rust, moisture or other deleterious contaminants. All welding on the steel casing pipe shall be done by a certified welder. The galvanized steel conduit shall be inserted with skids securely attached to maintain full support of the conduit and to prevent damage.

The space between the conduit and the casing shall be grout sealed for at least 1 ft. (0.30 meters) from each end of the casing. Grout shall attain a minimum of 400 psi (2.76 MPa) compressive strength after 7 days. Pits shall be back-filled with pervious structure backfill as prescribed in Article 2.16.03 of the Standard Specifications.

For Jacking operations, the Contractor shall provide the following:

A. A jacking pit plan depicting:
   (1) Protection of traffic and pedestrians
   (2) The dimension of pit
   (3) Shoring, bracing struts, walers, or sheet pile
   (4) Size and type of casing
   (5) Conduit skids and means of attachment

B. The proposed method of jacking including:
   (1) The jacking system
   (2) A detail of the separator-cushion at the end of casing against which the jacking force will be applied.
   (3) The support system behind the jack
   (4) The support system under the jack and at the bottom of the pit.

C. Conduit Testing:

The Contractor shall test each cell of the multicell conduit after the conduit is installed. All testing shall be performed using the procedures and mandrel size recommended by the multicell or conduit manufacturer. The Contractor will be required to install a poly-line within each cell of the conduit. The intention of the conduit testing is to verify the integrity of the completed system; therefore, this testing will only be allowed to commence once the conduit system has been completely installed. Testing shall be performed in the presence of the Engineer. The Engineer will document the date, time, and the results of the testing and shall submit this information to Highway Operations for record keeping purposes.

D. Detectable Pull Tape:

The Contractor shall install detectable pull tape, by hand pulling, blowing, or via vacuum method, into each empty conduit and empty cell within a multi-cell conduit during conduit installation. The Contractor shall install the detectable pull tape after conduit testing has been completed. The Contractor shall neatly coil and secure 10 ft (3 meters) of slacked pull tape in each vault location.

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The detectable pull tape shall be field installed within each innerduct for the purpose of attaching to, and pulling of, the fiber optic cable. The Detectable Pulling Tape shall be tied off to an expanding Neoprene Plug.

E. As -Built Plans:

The Contractor shall advise the Engineer of any change of measurement of layout of the Plans submitted to them. Upon completion of construction but prior to acceptance of the contract, the Contractor shall furnish as-built plans on 2 ft. by 3 ft. (55 cm by 91 cm) standard plan sheets. All construction changes, with the final location and depth of the conduits, etc. shall be shown in sepia or other reproducible format. These plans shall include all field installations. One sepia or other reproducible of the Project Plans will be provided to the Contractor for their use. Any other base maps that may be necessary for the Contractor to comply with this requirement shall be the Contractor's responsibility.

METHOD OF MEASUREMENT:

The conduit shall be measured for payment by the actual number of feet (meters) of the type and size installed and accepted**. Expansion fittings, fixed and flexible sweep-bends, conduit fittings, will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.** The measured length shall be from end to end along the centerline through all fittings.

All work necessary to complete the attachment of the rigid metal conduit of the type indicated, including but not limited to mounting brackets, clamps, hangers, anchors, bolts, fittings etc. to the structures, will not be measured for payment but shall be included in the pay item for the conduit. In-Structure conduit installed under the bridge deck and within the girders shall be measured for payment as conduit of the size and type specified – surface.

The warning tape, identification posts with signs, pull tape, and the poly-line conduit testing will not be measured for payment but shall be included in the pay item for the conduit of the type and size specified.

BASIS OF PAYMENT:

Article 10.08.05 – Basis of Payment shall be amended as follows:
In the second paragraph, after the words "bonding bushings", add the words "bonding wire,".

This work shall be paid for at the contract unit price per foot (meter) for conduit of the size and type indicated, within the limits shown on the plans and in the details. This price shall include all materials required including expansion fittings, fixed and flexible sweep-bends, conduit fittings, pervious structure backfill, boxes, caps, entrance fittings, detectable pull tape, poly-line, inserts, warning tape, ground wire, identification posts with signs, structural supports, equipment, tools, labor and work incidental thereto.

Trenching and backfilling shall be paid as specified in Section 10.01 of the Standard Specifications.

PAY ITEM	**PAY UNIT**
2” Rigid Metal Conduit in Trench	LF
3” Rigid Metal Conduit in Trench	LF
4” PVC Multi-Duct in Trench	LF
4” PVC Multi-Duct Under Roadway	LF

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ITEM NO. 0507263A – TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II WITHOUT SUMP
ITEM NO. 0507301A – TYPE "C" DROP INLET
ITEM NO. 0507501A – TYPE "C-L" DROP INLET
ITEM NO. 0507601A – MANHOLE
ITEM NO. 0507687A – MANHOLE - 5' DIAMETER
ITEM NO. 0507771A – RESET CATCH BASIN
ITEM NO. 0507781A – RESET MANHOLE
ITEM NO. 0507809A – CONVERT TYPE "C-L" CATCH BASIN TO TYPE "C" CATCH BASIN
ITEM NO. 0507735A – CONVERT TYPE "C-L" CATCH BASIN TO MANHOLE
ITEM NO. 0507754A – RESET TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II

The work shall conform to Section 5.07 supplemented as follows:

Article 5.07.01 – Description: add the following:

The work will include temporary shoring needed for excavations adjacent to the existing travel way. Temporary shoring will not be paid for separately but will be included in the cost of the work.

In areas of rock, rock will be removed by mechanical means only; no blasting is permitted unless approved by the Engineer.

In areas where incremental lowering is required to lower the roadway during off peak traffic periods and open the roadway full width during off work periods, resetting catch basins and manholes shall be reset to accommodate the incremental lowering as required so that the difference in the structure rim or grate elevation is no more than 3 inches above or below the roadway grade at the time the roadway is opened to traffic at the end of the work day. Reset catch basin and or manhole regardless of how many times they are needed to be reset shall be measured for payment one time.

The work will include resetting catch basins and manholes to the finished grade as shown on the plans which will require resetting to depths of 5 feet or less.

Section 5.07.04 – Method of Measurement: is supplemented with the following:

There will be no measurement for resetting the structure to accommodate the incremental lowering for the roadway construction. Reset Catch basin and or Reset Manhole shall be measured one time. Incremental lowering to accommodate traffic and roadway grades shall be considered incidental to the work.

Section 5.07.05 – Basis of Payment: is supplemented with the following:

There will be no separate payment for resetting catch basins and or manholes to accommodate the incremental lowering for the roadway construction. The work, materials and labor required to reset the structure, no matter how many times a structure requires resetting to accommodate the incremental lowering of the roadway shall be paid one time. Incremental lowering to accommodate traffic and roadway grades shall be considered incidental to the work.

In Subarticle 5.07.05-5, delete "3 feet (1 meter)" in the last sentence and replace with "5 feet (1.52 meters)".

Pay Item	Pay Unit
TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II WITHOUT SUMP	Each
TYPE "C" DROP INLET	Each
TYPE "C-L" DROP INLET	Each
MANHOLE	Each
MANHOLE - 5' DIAMETER	Each
RESET CATCH BASIN	Each
RESET MANHOLE	Each
CONVERT TYPE "C-L" CATCH BASIN TO TYPE "C" CATCH BASIN	Each
ITEM 0507735A – CONVERT TYPE "C-L" CATCH BASIN TO MANHOLE	Each
ITEM 0507754A – RESET TYPE "C" CATCH BASIN DOUBLE GRATE - TYPE II	Each

SECTION 02 41 00 - SELECTIVE BUILDING DEMOLITION

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK:

A. Description: Removal and demolition of selected items from selected areas of the station as indicated on the Drawings, and as required to complete the work and the project objectives.

B. Selective demolition/salvage:

1. Provide selective demolition and removals in accordance with the Contract Documents. The Work of this Section includes, but is not limited to, the following: guardrails, access gate, access ladder and existing platform furnishings such as signage as indicated on the drawings.

a. Document existing conditions with drawings and photographs keyed to drawings and label elements.

b. Provide temporary shoring as required to ensure stability of building elements and fabric to remain.

c. Provide protection as required to protect both elements and materials to be removed and elements and materials to remain from damage or deterioration.

d. Remove all items as indicated on drawings and in technical provisions.

2. Any and all materials that may be found during the current contracted work that is suspected to contain lead is to be brought to the attention of the CTDOT PM, to start the remediation process. A wipe test may be conducted to verify that any & all materials may contain lead. A licensed abatement contractor must perform any & all lead abatement work.

1.2 RESPONSIBILITY, PROTECTION, DAMAGES, RESTRICTIONS

A. Protections: Provide temporary barricades and other forms of protection required to protect railroad personnel and general public from injury due to selective removals and demolition work.

1. Provide protective measures as required to provide free and safe passage of personnel and customers.

2. Protect from damage existing finish work that is to remain in place and which becomes exposed during operations.

B. Damages

1. Promptly repair any and all damages to all property and finishes caused by the removals and demolition work, to the Engineer’s satisfaction.

1.3 SUBMITTALS

A. General: Submit the following:

1. Submit a schedule indicating proposed methods and sequence of operations for selective removal and demolition work prior to commencement of operations.

2. Include details for dust and noise control operation. Provide a detailed sequence of removal and demolition work.

B. Selective Demolition:

1. Qualification Data: Qualification data for firms and personnel specified in "Quality Assurance" Article that demonstrates that both firms and personnel have capabilities and experience complying with requirements specified for firm and foreman, provide a list of at least three completed projects within the Region similar in size and scope to the work required on this project. For each project list project name, address, architect, scope of contractor's work, and other relevant information. This information shall be submitted with the bid.

2. Selective Demolition and Removal Program: Detailed description of methods and procedures, equipment, tools, and materials proposed for use in removal operations including, but not limited to, the following:

a. Documenting and identifying elements and materials to be removed.
b. Procedures for controlling noise and dust.
c. Releasing or freeing materials and elements from existing construction.
d. Protection for elements to be removed and for elements to remain.
e. Handling and transporting materials and elements removed.
f. Packaging elements to be removed.
g. Storage locations.
h. Tools and methods of removing items as indicated.

3. Documentation Photographs: Submit photographs (minimum 5 in. x 7 in.) recording condition of elements to be removed (including overall views and close-up views of any cracks, damage, deterioration, or missing elements) before beginning selective demolition and removals. Record all as built conditions at all demolition locations after final commencement of work has been completed.

4. Shoring and Bracing: The Contractor shall retain the services of a Professional Engineer registered in the State of Connecticut to provide design of all temporary bracing, shoring, etc. that may be required as part of selective demolition and removals work.

a. It shall be the responsibility of the Contractor's Controlled Inspecting Agent to prepare detail drawings and associated calculations representing all shoring, bracing, or other temporary construction that may be required to maintain the structural stability and integrity of the existing construction during the course of the Work represented in these documents.

b. All drawings and calculations prepared by the Contractor's Controlled Inspecting Agent shall bear an original signature and seal indicating the inspector's Connecticut State Registration. Duplicate copies of all drawings and calculations shall be forwarded to the Engineer prior to commencing any of the temporary Work represented in those documents.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to commencement of the selective removals and demolition work, inspect the areas in which the work will be performed. Determine and list the existing conditions of rooms or area surfaces and equipment. After the Work in each respective area is completed, determine if adjacent surfaces or equipment have been damaged as a result of the Work; if so, the damage shall be corrected at the Contractor's expense.

3.2 PROTECTION

A. LAWS AND REGULATIONS: All work shall comply with all safety requirements of the State of Connecticut and City of Stamford; Standard No. 241 "Safeguarding Building Construction and Demolition Operations," latest edition, of the National Fire Protection Association; and OSHA regulations.

B. GENERAL:

1. Protect against damage by water and fire, and injury to the public, workers, occupants, and contents of existing building, damage to adjacent property, and portions of existing building not being selectively demolished. Contractor shall provide adequate protection to building, utilities, and equipment, including temporary supports, dust and other enclosures, barricades, etc., as required to protect elements from damage or deterioration caused by work of this Section.

2. Use every possible precaution to prevent damage to streets, sidewalks, curbs and paving on or adjacent to the site of the work. Repair or replace to Engineer's satisfaction and at no expense to CTDOT any such item destroyed or damaged.

3. Protect all persons from injury and all public and private property and building contents from damage due to the operations under this Section. Adequate protection of persons and property shall be provided at all times, including Saturdays, Sundays, and holidays, during time period in which work is being performed, and after working hours.

3.3 REMOVALS AND DEMOLITION WORK

A. Perform selective demolition work in a systematic manner and use such methods as required to complete the work indicated on the Drawings and as needed for completion of the work and the project objectives in accordance with the requirements of the Project Specification and governing City, State and Federal regulations.

1. Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as specified herein.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Remove all electrical wiring, to include, but not limited to, lighting and all related appurtenances, conduits, devices, fixtures, and other electrical items accessories occurring on or in the construction to be removed, disconnect power and remove wiring and conduit back to source. New electrical work shall be as indicated on Drawings and as needed for the completion of the work and the project objective as specified in the Electrical – Div. 16.

3.4 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove debris, rubbish and other materials resulting from the removals and demolitions from the building immediately; transport and legally dispose of materials off-site. Disposal method shall be in accordance with City, State, and Federal regulations.

B. Burning or burying of removed materials is not permitted on the job site.

C. No materials shall be dropped or thrown from any height. Remove debris from building using suitable containers or conveyances.

D. Keep premises clean by removing accumulation of waste materials, rubbish, and debris from site daily. Dispose of waste, rubbish, and debris in a proper manner in accordance with all federal, state and local laws and regulations, to the satisfaction of all authorities having jurisdiction, and to the satisfaction of the Engineer. Keep site and public rights of way clear. Take all precautions necessary to keep dust resulting from work of this Section at an absolute minimum.

E. Do not store or permit excess debris to accumulate on site. If contractor fails to remove excess debris promptly, Engineer reserves the right to cause same to be removed at Contractor's expense.

3.5 TEMPORARY SHORING

A. Provide temporary shoring as required to maintain existing construction safely in position during removal and salvage.

B. Perform shoring in such a manner as to prevent any settlement or vertical or horizontal deformation of the existing building elements to remain. Before commencing with the work, the Contractor shall thoroughly investigate the existing structure to verify its present condition.

C. Execute shoring in best, substantial, workmanlike manner to avoid danger to workman and public and damage to the building.

3.6 CLEAN-UP AND REPAIR

A. Upon completion of removals and demolition Work, remove tools, equipment and all remaining demolished materials from the site.

B. Repair all damaged areas caused by the removals and demolition Work. Repair adjacent construction or surfaces soiled or damaged by selective demolition work at contractor's expense to the Engineer's approval.

C. All areas in which Work was performed under this Section shall be left "Broom clean."

END OF SECTION 02 41 00

SECTION 05 10 00 - STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and fabricate all items necessary to complete work indicated on the plans and as specified herein. Structural steel shall be as defined in the AISC Code of Standard Practice for Steel Building and Bridges. Work shall include, but not be limited to the following:

1. Structural beams and columns.
2. Structural built-up plate girders, bracing members, and connecting elements

B. Include anchor bolts for column bases, column setting, base and bearing plates, beams, columns, column and beam detail connections, angles, bolts, stiffeners, plates and electrodes (for welded work).

C. The following surfaces shall be milled:

1. Contact surfaces between column and base plates.
2. Abutting ends of columns at column connections.
3. Contact surfaces between beam seat and bearing plate.
4. Bearing stiffener

D. Not Used.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Carefully examine all of the Contract Documents for requirements which affect the work of this section.

B. Other specifications sections which directly relate to the work of this section include, but are not limited to the following:

1. Not Used
2. Section 05 30 00 - Metal Decking
3. Section 05 50 00 - Metal Fabrications
4. Section 09 91 00 - Painting

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following, except as otherwise indicated:

1. AISC 303 "Code of Standard Practice for Steel Buildings and Bridges".

a. Paragraph 4.2.1 of the above code is hereby modified by deletion of the following sentence: "This approval constitutes the Department's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation of these shop drawings".

2. AISC 360 "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including "Commentary" and Supplements thereto as issued.

3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the RCRBSJ “Research Council on Riveted and Bolted Structural Joints” of the Engineering Foundation.

4. ANSI/AWS D1.1 "Structural Welding Code".

5. ASTM A 6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

6. SSPC "Painting Manual Vol. 1, Good Painting Practice".

7. SSPC "Painting Manual Vol. 2, Systems and Specifications".

B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

1. Provide certification that welders to be employed in work meet the requirements of Article 6.03.03, section 1 of the Form 817.

2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests within past 12 months.

3. If recertification of welders is required, retesting will be Contractor's responsibility.

C. Fabricators Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for the project and with a record of successful in-service performance.

1. Fabricator must participate in the AISC quality certification program and be designated in AISC certified plant as follows:

   a. Category STD, conventional steel structures.
   b. Fabricator shall be registered with and approved by authorities having jurisdiction.

D. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.

E. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

1.4 TESTS

A. Inspection and Testing: The Contractor shall employ and pay an independent testing agency to inspect and test steel during fabrication and erection. The Contractor shall cooperate and permit all requested inspection and testing. All reporting by the testing agency shall be provided concurrently to the Department and the Contractor during testing.

B. Field Welds: The Contractor shall employ and pay an independent testing agency to test all welds in strict compliance with AISC and Building Code Requirements.

1.5 SUBMITTALS

A. Submit the following in accordance with Form 817 Article 1.20-1.05.02.

B. Product Data: Submit producers or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).

1. Structural steel (each type), including certified copies of mill reports covering chemical and physical properties.

2. High-strength bolts (each type), anchor bolts, including nuts and washers.

3. Structural steel primer paint and top coat paint.

4. Shrinkage-resistant grout.

5. Expansion Fastening systems

6. Adhesive Anchor Rod systems

C. Shop Drawings: Submit shop drawings, after field survey and adjustments are made, to the Designer for approval. Including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.

1. Include details of cuts, connections, camber, holes, and other pertinent data.

2. Include embedment drawings.

3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.

5. Identify members and connections of the seismic-load-resisting system.

6. Indicate locations and dimensions of protected zones.

7. Identify demand critical welds.

8. For structural-steel connections indicated to comply with design loads, include structural design data and calculations signed and sealed by the qualified professional engineer responsible for their preparation.

9. Submit job standards and typical connection details with calculations for the capacity of the connections for review prior to submittal of shop drawings.

D. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of tests conducted and test results.

E. Welding Certificates: Provide welding certificates for welders who will be used for field welding.

F. Not Used.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Form 817 Article 1.06.03 and Form 817 Article 1.20-1.06.03 for additional information.

B. Deliver structural steel to project site at such intervals to insure uninterrupted progress of work.

C. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time so as not to delay affected work.

D. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

E. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

F. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.7 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metal Surfaces, General: For fabrication of work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding, or by welding and grinding, prior to cleaning, treating and application of surface finishes.

B. Structural Steel Gusset plates: Carbon Steel ASTM A36, except where high-strength is noted, ASTM A 572, Grade50 ksi, and other types indicated on the drawings.

C. Rolled Shapes: ASTM A572 grade 50 ksi

D. All wide flange shapes: ASTM A992, grade 50 ksi

E. Structural Steel HSS Sections: ASTM A500, GR, B (Fy= 46ksi)

F. Structural Steel Pipes: ASTM A53 GR. B (Fy=35ksi)

G. Anchor Bolts: ASTM F1554, Grade 55 with Supplementary Requirement S4

H. Stainless Steel Rods: ASTM A276, T304/304L, Non-polished finish, Tensile Strength = 85ksi

I. Unfinished Threaded Fasteners: ASTM A307, Grade A, regular low-carbon steel bolts and nuts

1. Provide hexagonal heads and nuts for all connections.

J. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:

1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A 325.

2. Nuts shall comply with Heavy Hex Nuts ASTM A536A and Washers shall comply withA436.

K. Electrodes for Welding: Comply with AWS Codes as indicated on Plans. Filler metal for welding shall conform to the requirements of the AWS, E70XX classification.

L. Structural Steel Primer and Topcoat Paint: Primer paint for building steel members shall be aromatic zinc rich urethane primer applied at 2.5 to 3.5 mils DFT. Topcoat Paint shall be an epoxy mastic applied at 4.0 to 6.0 mils DFT. Provide one of the following products for each:

1. Primer

a. Tnemec 394 - Omni-Thane zinc rich urethane primer
b. E.I. du Pont Ganicin 2.8MCZ
c. Hemple 1649 Hemple Zinc HS
d. Or approved equal

1a. Not Used.

2. Topcoat

a. Tnemec 27 WB Typoxy
b. E.I. du Pont Corlar 2.1-PR
c. Hemple Hempadur 45880
d. Or approved equal

M. Galvanizing shall be in accordance with ASTM A123. Touch-up for galvanized surfaces: Galvanizing paint repair shall be ZRC Cold Galvanizing Compound by ZRC World Wide, ZiRP by Duncan Galvanizing, Brite Zinc as manufactured by Brite Products or approved equal and shall conform with the requirements of ASTM A780, with 95 percent zinc by weight.

N. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

1. Non-Metallic Shrinkage-Resistant Grout: Pre-mixed, non-staining, non-corrosive, non-shrink, non-metallic cement based grout complying with ASTM C1107, "Grade C", *Standard Specification for Packaged Dry Hydraulic Grout - Non Shrink.*

a. Products: Subject to compliance with requirements, products which may be incorporated in the work include, but are not limited to, the following or approved equal:

1) Five Star Grout; Five Star Products Inc.
2) Crystex; L&M Construction Chemicals
3) Masterflow 555; Master Builders

O. Stainless Steel Threaded Rods shall meet the requirements of ASTM A193 B7 or AISI 316 for stainless steel rods.

P. Not Used.

2.2 FABRICATION

A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications for building steel, and as indicated on final shop drawings with the modifications and additional requirements specified in this Section.

1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.

2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs, and other defects. Welds shall be finished flush and smooth.

B. Connections: Weld or bolt shop connections, as indicated.

1. Bolt field connections, except where welded connections or other connections are indicated.

a. Provide 7/8" diameter high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.

b. Diameter of holes in bolted parts shall be 1/16" greater than the nominal diameter of the bolt. No unfinished holes will be accepted, and enlargement of holes shall not be accomplished by burning. Burrs resulting from drilling or punching shall be ground to the surface of the material. Shearing and punching shall be done cleanly so as not to deform or mar adjacent surfaces.

2. Eccentric connections shall be avoided if possible. Where necessary, care shall be taken that all shears, tensions and connections provided by eccentricities are amply provided for in connections and that harmful additional stress are not introduced into members.

C. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" (RCRBSJ).

1. Bolts which have been completely tightened shall be marked with an identifying symbol.

2. The tightening of the bolts with other than calibrated wrenches will not be permitted.

   Contractor shall submit to Designer a certification that the calibrating device for setting the calibrated wrenches for high-strength bolts has been checked by the testing laboratory. If at any time during construction the Designer has reason to question the accuracy of the calibrating setting device, he may, at his option, require that the machine be sent back to the Contractor for certification of its accuracy by the testing laboratory. In any case, the calibrating setting device must be checked for accuracy after each six-month period of use on the project, and proof of certification must be submitted to the Designer.

3. In all cases on non-parallel abutment surfaces, the nut shall be torqued against a non-sloping surface.

4. High strength bolts shall have a hardened washer under the element (nut or thread) turned in tightening. Beveled washers shall be provided in all bolt connections to sloping flanges of American Standard beams and channels.

5. High strength bolts once tightened shall not be loosened and re-used.

D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.

1. Provide threaded nuts welded to framing, and other specialty items as indicated to receive other work.

2. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

2.3 SHOP PAINTING

A. General: Shop paint structural steel including those members or portions of members to be embedded in concrete or mortar.

1. Do not paint surfaces which are to be welded. High-strength bolted locations with friction-type connections may be painted using a slip critical primer as specified.

2. Apply 2 coats of paint to surfaces which are inaccessible after assembly or erection.

3. Apply specified coats in paragraph 2.1 I. to all steel embedded into masonry or foundation concrete and steel columns encased in concrete, unless galvanizing is indicated.

B. Surface Preparation: After inspection and before shipping, clean steel work, to be painted.

Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows:

1. For building steel members: SP-6 "Commercial Blast Cleaning".

PART 3 - EXECUTION

3.1 INSPECTION

A. Erector must examine areas and conditions under which structural steel work is to be installed, and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.

3.2 ERECTION

A. Surveys: Employ a registered professional engineer or land surveyor for accurate erection of structural steel. Check elevations of concrete bearing surfaces, and locations of anchor bolts and similar devices, before erection work proceeds, and report discrepancies to the Designer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been agreed upon with the Designer.

B. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

C. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

2. Refer to Division 3 and Division 4 of these specifications for anchor bolt installation requirements in concrete.

D. Setting Bases and Bearing Plates: Clean concrete bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.

E. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.

F. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.

1. For proprietary grout materials, comply with manufacturer's instructions.

G. Field Assembly: Set structural frames accurately to lines and elevations indicated. Align and adjust various members forming part of complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure within specified AISC tolerances.

2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowance for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.

3. Splice members only where indicated and accepted on shop drawings.

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

I. High Strength Bolts: Installation shall be performed by using pneumatic powered impact wrenches with sufficient capacity and on adequate supply of compressed air, or installation shall be performed in accordance with the turn-of-the-nut method outlined in the AISC "Specification for Structural Joints using ASTM A-325 or A 490 Bolts", with the following modification:

1. Use a hardened washer under either the bolt head or nut, whichever is turned in tightening.

J. Welding: Field welding shall be executed in accordance with all requirements of AWS. All field welding shall be done by manual shielded metal-arc welding, only.

1. All groove welds shall be continuous and full penetration welds unless otherwise shown on the design plans. Welds made without the aid of a backing shall have their roots chipped, ground or gouged out to sound metal from the second side, before welding is done from the second side.

K. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

1. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

L. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as acceptable to Designer. Finish gas-cut sections equal to a sheared appearance when permitted.

M. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply primer and topcoat paints to exposed areas on perimeter columns and spandrel beams, using same materials as used for shop painting.

1. Apply by brush or spray to provide minimum dry film thickness as specified for shop painting.

N. Galvanizing: All steel indicated to be “galvanized” shall be cleaned and hot dipped galvanized in strict accordance with ASTM A123.

O. Not Used.

3.3 QUALITY CONTROL

A. The Contractor shall employ and pay an independent testing and inspection agency to perform all specified testing, and to submit full reports of each test conducted. The testing agency shall be responsible for interpreting the results of each test, and shall state in each report whether or not the test specimens comply with the specified requirements, and shall include any deviation therefrom. Test results will be reported in writing to Designer within 24 hours after tests.

1. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

2. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

3. Testing agency may inspect structural steel at plant before shipment; however, Designer reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

B Welded Connection Testing:

1. Visually inspect all welds for size, length, and location in accordance with AWS D1.1. Measure and record the size and length of 25 percent of all welds at random locations.

2. Test 25 percent of all fillet welds at random locations by magnetic particle testing in accordance with ASTM E709.

3. Test 100 percent of all full or partial penetration welds by ultrasonically testing in accordance with AWS D1.1 and ASTM E164.

C. Bolted Connection Testing:

1. Visually inspect all bolted connections for bolt and nut size and grade, and for snug contact of all connected elements in accordance with AISC Manual of Steel Construction.

2. Test 25 percent of bolts (but not less than 2 bolts) in each connection by calibrated torque wrench in accordance with AISC Manual of Steel Construction.

D. Correct deficiencies in structural steel work which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

3.4 CLEAN-UP

A. All work provided under this Section shall be cleaned of all oil, dirt, debris, and other foreign materials, and shall be ready to receive any scheduled finish coating, or attachment or other systems specified elsewhere.

B. The Contractor providing the Work of this Section shall maintain the effected work area neat and clean at all times.

END OF SECTION 05 10 00

SECTION 05 30 00 - METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, and equipment required for the complete installation of all steel deck shown on the Contract Plans and herein specified and as needed for a complete and proper installation. Provide and install the following deck types:

1. Steel roof decking.
2. Not Used.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Carefully examine Contract Documents for requirements that affect work of this section.

B. Other specifications sections that directly relate to work of this section include, but are not limited to, the following:

1. Not Used.
2. Section 05 10 00 - Structural Metal Framing.

1.3 MEASUREMENTS

A. Contractor shall take all necessary measurements at building before executing the work and shall be responsible for proper fitting.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and standards: Comply with the provisions of the following codes and standards as otherwise specified:

1. American Iron and Steel Institute, "Specification for the Design of Cold-Formed SteelStructural Members".
2. American Welding Society, "Structural Welding Code - Sheet Steel, D-1.3".
3. Steel Deck Institute, "Design Manual for Composite Floor Deck, Non-composite Form Deck and Roof Deck".
4. American Society for Testing and Materials, ASTM.
5. Factory Mutual Insurance Company - Norwood, MA

C. Qualification of Welding Work:

1. Qualify welding processes and welding operators in accordance with the AWS "Standard Qualification Procedure".

2. The Contractor shall employ and pay an independent testing agency, acceptable to the Department, to test welding and steel deck work. Decking welded in place shall be subject to inspection and testing. Expense of removing and replacing any portion of decking for testing purposes will be borne by the Department if welds are found to be satisfactory. Remove work found to be defective and provide acceptable work.

3. Provide certification that welders to be employed in work meet the requirements of Article 6.03.03, section 1 of the Form 817.

1.6 SUBMITTALS

A. Submit the following in accordance with Form 817 Article 1.20-1.05.02.

B. Product data for each type of deck, accessory, and product specified.

1. Material list of items to be provided under this Section.

2. Manufacturer's specifications and other data needed to demonstrate compliance with the specified requirements.

C. Shop Drawings showing layout and types of deck panels, anchorage details, reinforcing channels, pans, with details of materials, gages, accessories, openings, finishes, welds, and other pertinent conditions.

1. Manufacturer's recommended installation procedures which, when approved by the Designer, will become the basis for accepting or rejecting actual installation procedures used on the work.

D. Welder certificates signed by Contractor.

E. Product test reports from qualified independent testing agency.

1.7 PERFORMANCE REQUIREMENTS

A. Compute the properties of steel deck sections on the basis of the effective design width as limited by the provisions of the AISI Specifications. Provide not less than the deck section gage shown.

B. Allowable deflection: Design and fabricate roof deck for a maximum deflection of 1/240 of the clear span under the total uniform dead and live load.

C. Uplift loading: Install and anchor roof deck units to resist gross uplift loading of 40 pound per square foot.

1.8 DELIVERY, STORAGE AND PROTECTION

A. Refer to Form 817 Article 1.06.03 and Form 817 Article 1.20-1.06.03 for additional information.

B. Deliver materials to the site at such intervals as to ensure uninterrupted progress of the work.

C. Store material to permit easy access for inspection and identification. Keep steel deck units off the ground using pallets, platforms, or other supports and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

D. Do not store materials on structure in a manner that might cause distortion or damage to supporting structures.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Miscellaneous steel shapes: ASTM A36.

B. Steel Roof Decking: Galvanized Steel Roof Decking: Sheet steel for roof decks and accessories shall conform to ASTM A653, structural steel minimum yield of 33 ksi, roof decks shall be 1-1/2 inch deep, 22 gage as noted on Plans. Type 1.5B (wide rib) configuration for 1-1/2 inch deep as manufactured by Vulcraft or approved equal.

C. Not Used

D. Sheet Metal Accessories: ASTM A653, commercial quality, galvanized, 16 gage minimum.

E. Galvanized Repair Paint: Touch up damaged or abraded galvanized surfaces with ZRC Cold Galvanizing Compound as manufactured by ZRC Products Company, ZiRP Cold Galvanizing Compound as manufactured by Duncan Industries, Brite Zinc Galvanizing Compound as manufactured by Brite Products or approved equal.

F. Welding: AWS D1.1.

G. Reinforcing to be welded shall conform to ASTM A706.

2.2 FABRICATION/ACCESSORIES

A. Deck Types:

1. Roof Deck: Galvanized, 22 gage, depth equal to 1.5 inches; ribs spaced approximately six inches on center; width of rib opening at roof surface not over 2-1/2 inches; width of bottom rib surface not less than 1-3/4 inches.

2. Not Used.

B. Roof Sump Pans: Fabricate from a single piece of not less than 14-gage galvanized sheet steel of the same quality as the deck units; with level bottoms and sloping sides to direct water flow to the drain, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than three inches wide. Recess pans not less than 1-1/2 inches below the roof deck surface, unless otherwise shown or required by the deck configuration. Holes for drains will be cut in the field.

C. Steel Closure Strips: Fabricate steel closure strips of not less than 16-gage, unless otherwise noted, galvanized sheet steel of the same quality as the deck units. Form to the configuration required to provide tight-fitting closures at open ends and sides of decking.

D. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

E. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

F. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

G. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0598-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

H. Not Used.

I. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

J. Repair Paint: Utilize Manufacturer's primer specified above of same color for touch up of deck panels.

PART 3 - EXECUTION

3.1 INSPECTION AND TESTING

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install steel deck units and accessories in accordance with Steel Deck Institute specifications and recommendations, manufacturer's recommendations and final Shop Drawings, and as specified herein.

1. All O.S.H.A. State and Local rules for erection must be followed.

3.3 PLACING STEEL DECK UNITS

A. Place steel deck units on supporting steel framework and adjust to final position with ends bearing on supporting members and accurately aligned end-to-end before being permanently fastened. Lap ends not less than two inches. Do not stretch or contract the side-lap interlocks. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

B. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

C. Do not use deck units for storage or working platforms until permanently secured.

3.4 FASTENING DECK UNITS

A. Permanently fasten steel deck units with metal thickness equal to or greater than 0.0598 inches(16 gage) to steel supporting members by not less than 5/8" diameter fusion welds, or minimum1" elongated welds of equal strength.

B. Permanently fasten steel deck units with metal thickness less than 0.0598 inches (16 gage) through manufacturer's welding washers with weld pattern shown on design plans or where recommended by deck manufacturer.

C. Comply with AWS requirements and procedures for manual shielded metal-arc welding, the appearance and quality of welds, and the methods used in correcting welding work.

D. Mechanical fasteners, either power actuated or pneumatically driven, or screws may be used in lieu of welding to fasten deck to supporting framing, provided they have been specifically approved.

E. Steel roof deck units shall be fastened to the supporting structure (minimum requirements) as follows:

1. Panel ends and end laps: Welded. Maximum spacing of six (6) inches.

2. Intermediate supports: Welded. Maximum spacing of twelve (12) inches.

3. Side laps of adjacent units: Welded or mechanically fastened between supports at intervals not exceeding eighteen (18) inches.

F. Not Used.

3.5 CUTTING AND FITTING

A. Cut and fit steel deck units and accessories around other work projecting through or adjacent to the decking, as shown on the Plans. Provide neat, square and trim cuts.

3.6 REINFORCEMENT AT OPENINGS

A. Provide additional steel reinforcement and closure pieces as required for strength, continuity of decking and support of other work, unless otherwise shown.

B. Reinforce roof decking around openings less than 15" in any dimension by means of a flat steel sheet placed over the opening and fusion welded to the top surface of the deck. Provide steel sheet of the same quality as the deck units, not less than 16 gauge, and at least 12" wider and longer than the opening. Provide welds at each corner and spaced not more than 12" on centers along each side.

3.7 CLOSURE STRIPS

A. Provide steel closure strips at all open uncovered ends and edges of steel decking, and in the voids between decking and other construction. Weld into position to provide a complete decking installation.

3.8 ROOF INSULATION SUPPORT

A. Provide steel closure strips for the support of roof insulation where the rib openings in the top surface of the roof decking occur adjacent to edges and openings. Weld closure strips into position.

3.8 TOUCH-UP PAINTING

A. Upon completion of the steel decking installation, clean and paint scarred areas, welds and rust spots on the top and bottom surfaces of decking units and supporting steel members using a wire brush.

B. Touch-up galvanized surfaces with zinc-rich paint, as recommended by the deck manufacturer.

END OF SECTION 05 30 00

SECTION 05 50 00 - METAL FABRICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. Section Includes but is not limited to:

1. Not Used.

2. Steel framing and supports for applications where framing and supports are not specified in other Sections.

3. Miscellaneous steel trims.

4. Loose bearing and leveling plates for applications where they are not specified in other Sections.

5. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.

6. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

7. Steel ladder.

B. Products furnished, but not installed, under this Section:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.3 RELATED SECTIONS

A. Not Used
B. Section 05 10 00 - Structural Steel Framing
C. Section 05 52 00 - Metal Handrail and Guardrail Systems
D. Section 10 14 00 - Signage

1.4 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material

surfaces.

B. Reference Standards:

1. American Institute of Steel Construction (AISC):

   a. Specifications for the Design of Cold-Formed Steel Structural Members.

2. American Welding Society (AWS):

   a. ANSI/AWS D1.1-Structural Welding Code.

3. American Society for Testing and Materials (ASTM):

   a. A36/A36M, Specification for Carbon Structural Steel
   b. A47, Specification for Ferritic Malleable Iron Castings
   c. A48, Specification for Gray Iron Castings
   d. A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   e. A123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   f. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel hardware
   g. A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
   h. A320/A320M, Specification for Alloy Steel Bolting Materials for Low-Temperature Service
   i. A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi minimum Tensile Strength
   j. A336/A336M, Specification for Steel Forgings, Alloy, for Pressure and High-Temperature Parts
   k. A489, Specification for Carbon Steel Lifting Eyes
   l. A500, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
   m. A563, Specification for Carbon and Alloy Steel Nuts
   n. A570/A570M, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality
   o. A653/A653M, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   p. A786/A786M, Specification for Rolled Steel Floor Plates
   q. F436, Specification for Hardened Steel Washers

4. Federal Specifications (FS)

   a. FF-B-561, Bolts, (Screw), Lag
   b. FF-B-588D, Bolt, Toggle: And Expansion Sleeve, Screw
   c. FF-S-92B(1), Screw, Machine, Slotted, Cross Recessed or Hexagon Head.
   d. FF-S-111D, Screw, Wood
   e. FF-S-325, Shield, Expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry)
   f. FF-T-276B, Thimbles, Rope
   g. FF-T-791B, Turnbuckle
   h. FF-W-84A, Washers, Lock (Spring)
   i. FF-W-92B, Washer, Flat (Plain)
   j. TT-P-641G, Primer Coating; Zinc Dust-Zinc Oxide (For Galvanized Surfaces)

5. American National Standards Institute (ANSI):

    a. ANSI B.18.22.1, Plain Washers.
    b. ANSI/ASME B.18.5, Round Head Bolts (Inch Series).
    c. ANSI/ASME B.18.5.2.2M, Bolts, Metric Round Head Square Neck.

1. National Association of Architectural Metal Manufacturers (NAAMM)

C. Qualifications for Welding Work: Welds shall be made only by welders, tackers and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code, ANSI/AWS D1.1 of the American Welding Society to perform the type of work required.

1.5 SUBMITTALS

A. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

B. Copies of manufacturer's catalog cuts, specifications, load tables, dimension diagrams, anchor details, setting diagrams and templates, and manufacturer's printed installation instructions, including paint products.

C. Certificates of welders' qualifications showing date of qualification, qualification grade and rating, and notarized signature of inspector.

D. Samples of materials and finishes of products as specified and if requested by the Engineer.

E. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Qualification Data: For qualified professional engineer.

G. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

H. Welding certificates.

I. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of metal fabrication is a certified installer with at least a five (5) successfully completed projects of similar size and scope installing manufacturer’s products according to manufacturer’s specifications.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6, "Structural Welding Code - Stainless Steel."

D. Verify dimensions at worksite before preparation of shop drawings and before product fabrication begins. Surfaces to receive metal fabrication shall be sound, square, and true; examine surfaces for defects that would impair installation of metal fabrications before metal fabrications are installed.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacture’s unopened packages and bearing manufacturer’s label

B. Storage and Handling:

1. Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
E. Steel Pipe: ASTM A 53/A 53M, standard weight unless otherwise indicated.

2.3 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semi-red brass).
H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Eyebolts: ASTM A 489.

E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

I. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

K. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

L. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 09 Section 09 91 00 Painting.

C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

G. Concrete: Comply with requirements in Division 03 Section 03 30 00 Cast-in-Place Concrete for normal-weight, air-entrained, concrete.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Galvanize miscellaneous framing and supports where indicated.

E. Prime miscellaneous framing and supports with primer specified in Division 09 Section 09 91 00. Painting where indicated.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Division 09 Section 09 91 00 Painting.

2.9 Not Used

2.10 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 CAST IRON LEADERS

A. Provide round leaders made from cast iron in heights and diameter as noted on drawings.
B. Prime cast iron leaders with zinc-rich primer.

2.13 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.14 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete or unless otherwise indicated.

1. Shop prime with primers specified in Division 09 Section 09 91 00 Painting unless otherwise

indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3. Items Indicated to Receive Primers Specified in Division 09 Section "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.15 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

2.9 STEEL LADDERS

A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.

B. Siderails: Continuous, 1/4-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.

D. Bar Rungs: 3/4-inch-diameter steel bars, spaced 12 inches o.c.

F. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.

G. Support ladder at platform level with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.

H. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which miscellaneous metal items are to be installed. Surfaces that are to receive metal fabrications shall be free from defects. Embedded products shall have been installed where indicated.

B. Furnish setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction. Coordinate delivery of such items to project site.

3.2 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on concrete or steel pipe columns. Secure girders with anchor bolts embedded in concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 Section 09 91 00 Painting.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

SECTION 05 52 00 - METAL HANDRAIL AND GUARDRAIL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. The work specified in this Section consists of furnishing and installing metal handrails, guardrails and railings to match existing as shown and as indicated on the Contract Drawings, including, but not limited to:

1. Painted Steel Guardrails
2. Swing Gates and Hardware.
3. Stainless Steel Handrails

1.3 RELATED SECTIONS

A. Section 05 50 00 - Metal Fabrication
B. Section 09 91 00 - Painting

1.4 PERFORMANCE REQUIREMENTS

A. American Society for Testing and Materials (ASTM):

1. A36, Specification for Carbon Structural Steel.
2. A53, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
3. A153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
4. A307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
5. A312/312M - Seamless and Welded Austenitic Stainless Steel Pipes
6. A320, Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
7. A449, Specification for Quenched and Tempered Steel Bolts and Studs.
8. A480/480M - General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip
9. A484/484M - General Requirements of Stainless Steel Bars
10. A555/555M - General Requirements for Stainless Steel and Heat Resistant Steel Wire and Wire Rods
11. A563, Specification for Carbon and Alloy Steel Nuts.
12. A666 - Austenitic Stainless Steel Sheet, Strip, Plate and Flat Bar for Structural and Architectural Applications
13. E935, Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
14. F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws and Studs

B. American Welding Society (AWS):

1. ANSI/AWS D1.1 - Structural Welding Code.
2. AWS D1.6 Structural Welding code – Stainless Steel

C. NAAMM – National Association of Architectural Metal Manufacturers

1. Metal Finishes Manual; Code of Standard Practice for the Architectural Metal Industry

D. Steel Structures Painting Council (SSPC):

1. Steel Structures Painting Manual, Volume 2, "Systems and Specifications".

1.5 SUBMITTALS

A. In accordance with Chapter 14, Article 1, of the Contract Terms and Conditions, submit the following:

1. Shop Drawings: Show plans and sections; materials of construction; finishes; methods of fastening; locations of cuts, copes, connections, holes, and threaded fasteners; methods of joining components; type, size, and spacing of welds; and proposed marking of fabrications which will require field assembly.

2. Copies of manufacturer's catalog cuts and specifications.

3. Certificates of welders' qualifications showing date of qualification, qualification grade and rating, and notarized signature of inspector.

4. The Contractor shall provide one (1) each of the following for each fabrication shown: 12” square and / or lineal sample which will show adequately the quality of fabrication, welding and finish. These can also represent the required finish samples as noted elsewhere in the specification.

5. Provide certification by the passivator stating that the fabrication was passivated after the stainless steel was bent, cut and/or welded.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of metal handrail and guardrail systems is a certified installer with at least a five (5) successfully completed projects of similar size and scope installing manufacturer’s products according to manufacturer’s specifications.

B. Stainless steel fabrications shall be from a manufacturer who has a dedicated facility for the assembly, welding, and polishing of stainless steel. The manufacturer should have dedicated tooling, fixtures, and machine tools, for the manufacturer of stainless steel products. Dedicated is defined as exclusively used for the use on stainless steel materials. This is to avoid contamination with other metals, especially carbon steel.

C. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Stainless Steel: ASCE 8, "Specification for the Design of Cold-Formed Stainless Steel Structural Members."

2. Structural Steel: AISC S335, "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary."

D. Structural Performance of Handrails and Railings: Provide handrails and railings complying with requirements of ASTM E 985 for structural performance, based on testing performed according to ASTM E 894 and ASTM E 935.

E. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding structural loads required by ASCE 7 without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections.

F. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:

   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.

   b. Uniform load of 50 lbf/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lbf/ft. (1460 N/m) applied vertically downward.

   c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:

   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
   b. Uniform load of 50 lbf/ft. (730 N/m) applied in any direction.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.

3. Infill Area of Guards: Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

   a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

G. Thermal Movements: Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

H. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.7 DELIVERY, STORAGE AND HANDLING

A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions.

B. Deliver units and other components so they will not be subject to damage or deformation. Deliver panel units in crates designated for specific locations on the building as coordinated between GC and installer. Crates shall be able to withstand hoisting loads relevant to the project.

C. Storage: Stack components off the ground/floor on suitable skids in fully enclosed space. Protect against warpage, scratches, damage from moisture, exposure to direct sunlight and other surface contamination.

D. Handling: Exercise care in loading, unloading, storing, and installing units so as to preclude bending, warping, twisting, and surface damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Galvanized Steel square Tube for Guardrails and Supports: Seamless steel tube, conforming to ASTM A53, Type S, Grade A; dimensions as indicated on drawings; standard weight.

B. Stainless Steel shall be Austenitic Grade type 316/316L.

C. Plate: Steel plate for anchor plates shall be standard steel plate, conforming to ASTM A36, weldable quality.

D. Welding Electrodes and Filler Metal: The Contractor shall use the type and alloy of filler metal and electrodes recommended by the producer of the metal to be welded, and as required to match colors, and strength and for compatibility with the individual components of fabricated items.

E. Anchors, Fasteners, and Accessories: Provide all required anchors, fasteners, miscellaneous components, and accessories as required for complete and finished railing installations. Bolts and studs, nuts, and washers shall conform to ASTM A307, A449, and A563.

1. Expansion Bolts: Where anchors are not included in the concrete construction, provide galvanized expansion type anchors with matching galvanized steel bolts or studs with nuts, of sizes as indicated or required. Provide washers under all bolt heads and nuts.

2. Miscellaneous fasteners: Refer to Section 05 50 00 “Metal Fabrication”.

F. Paint: Corrosion-inhibitive protective metal primer as herein specified in Sections 09 99 00

G. Molded Pads: Molded pads shall be manufactured from new unvulcanized elastomer and unused synthetic fibers, with a weight proportion of fiber content equal to approximately one-half of the total weight of the pad. The pads shall be formed into single sheets of 1/8 inch minimum thickness, with a tolerance of plus or minus 10 percent. Pads shall have a Shore 'A' Durometer hardness within the range of 70 to 90, and shall have a minimum compressive breakdown of 7,000 psi.

H. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

1. Provide fasteners fabricated from type 304

I. Fasteners for Interconnecting Railing Components: Use fasteners of same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.

1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where otherwise indicated.

2. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated. Provide Phillips flathead machine screws for exposed fasteners, unless otherwise indicated.

3. Provide non-metallic isolators between aluminum and all ferrous metals.

2.2 FABRICATION

A. Fabricate pipe railings to dimensions and details indicated with smooth bends and to other requirements specified herein. Form fabrications from material of size, thickness and shapes indicated, but not less than that needed to comply with the performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of material indicated or specified for various components of each metal fabrication.

B. Shear, punch, and laser cut metals cleanly and accurately. Remove burrs, sharp and rough areas on exposed surfaces.

C. Welded Connections: Fully weld connections, heat and bend bends without distorting metal. Cope intersections of rails and posts, weld joints and grind smooth. Butt-weld end-to-end joints of railings. In all cases, fabricate top rail continuous over posts, and posts continuous from base to top rail. Welding procedures and welding operations shall conform to, and welders and tackers shall be qualified, in accordance with ANSI/AWS D1.1.

D. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and resist corrosion of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

E. Form exposed work to line and level with angles and surface and with straight sharp edges. Ease exposed edges to radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the work.

F. Form exposed connections with hairline joints to exclude water and which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, Phillips flathead (countersunk) screws or bolts.

G. Assemble railing systems in shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

H. Form changes in direction of railing members as follows:

1. By radius bends of radius indicated.
2. By flush radius bends.
3. By bending.
4. By mitering at elbow bends.
5. By insertion of prefabricated flush elbow fittings.
6. By any method indicated above, applicable to change of direction involved.

I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

J. Fabricator shall take all preventative measures to eliminate cross-contamination of stainless steel with ferrous metals during fabrication, machining, storage and delivery. All grinding, polishing, and buffing shall be performed so that no contamination occurs to affect the material's corrosion resistance or finish. Particular care shall be exercised to protect the material from coming in contact with iron particles. All tools used in the fabrication and finishing process shall be tools dedicated only to use on those materials.

K. Hermetically seal all joints so as to exclude water, or provide weep holes where water may accumulate.

L. All stainless steel shall be passivated prior to packaging and shipping. Any area that has been cut, welded or bent shall be passivated to assure that the area does not show signs of rust discoloration created by the fabrication processes.

M. Finish:

1. Stainless Steel grain shall run in same direction for each fabrication.

2. Finish - Shall match existing brushed handrail finish for all components unless otherwise specified on the drawings.

3. When polishing is completed, passivate and rinse surfaces. Remove any embedded foreign matter and leave surfaces chemically clean.

N. When polishing is completed, passivate and rinse surfaces. Remove any embedded foreign matter and leave surfaces chemically clean

2.3 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: As indicated.

C. Gate Opening Width: As indicated.

D. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.

1. Function: 321 - Gate spring pivot hinge. Fixed tension, self-closing.
2. Material: Malleable iron; galvanized.

E. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.

1. Function: 09 - Entrance by lever only when released by key. Key removable only when locked.

2. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, steel plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.

2.4 CLEANING AND PAINTING

A. General:

1. Exterior steel guardrails, where indicated to be painted on the drawings, non-galvanized and galvanized, shall be painted in accordance with Division 09 Section 09 91 00 Painting

B. Corrosion Control: Apply corrosion inhibitor to railing surface that will abut surfaces constituted of material other than that of the fabricated metal product.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Install metal handrails and guardrails in accordance with the Contract Drawings and the approved shop drawings.

B. Install metal handrails and guardrails with accessories furnished by the railing fabricator as required for complete and finished railing installations.

C. Install handrails and guardrails in accordance with approved shop drawings, true and horizontal, perpendicular, or at the required angle, as the case may be, level and square, with angles and edges parallel with related lines of the building or structure.

D. Adjust railing prior to securing in place to ensure proper matching of butting joints and correct alignment throughout their length. Secure posts not more than 8 feet on center, unless otherwise indicated. Plumb posts in each direction.

E. Secure posts and rail ends as follows:

1. Anchor rail ends into concrete with steel round flanges welded to rail ends and anchored into the wall construction with expansion bolts.

2. Anchor rail ends to steel with steel oval or round flanges welded to rail ends and bolted to the structural steel members, unless otherwise indicated.

3. Provide removable railing sections as indicated. Furnish slip-fit metal socket or sleeve for casting into concrete. Accurately locate sleeve to match post spacing.

4. Secure guardrail base plates to platform with through bolted connections including but not limited to leveling plates, and backing plates.

F. Other than field welded connections:

1. Assemble connections end-to-end and splice joints with internal sleeves.

2. Fitting assembly:

a. Assemble pipe at joints and drive together within 0.02 inch.
b. Assemble fittings into posts before pressing rails into fittings.

G. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.2 PREPARATION

A. Comply with AWS code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

B. All welds shall be subjected to a visual inspection by an independent inspection agency, provided by and paid by the Contractor, for conformance with ANSI/AWS D1.1.

C. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating handrails and railing systems without field measurements. Coordinate other construction to ensure that actual dimensions correspond to guaranteed dimensions

3.3 INSTALLATION, GENERAL

A. After installation, exposed painted surfaces, field welds, and other abraded or damaged primed surfaces shall be prepared as required and touched up with an additional coat of the same primers for ferrous and galvanized surfaces as previously specified for shop painting.

B. Lightly sand and feather out such damaged surfaces so that paint touch-up becomes invisible. Spray-paint all touch-up work.

C. Finish field painting as specified in Division 09 Section 09 91 00 Painting.

D. Clean after installation exposed pre-finished and plated items and items fabricated from stainless steel, as recommended by the metal manufacture and protect from damage until completion of the project.

END OF SECTION 05 52 00

SECTION 05 55 13 – METAL STAIR TREADS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Furnish all labor, materials, tools and equipment, and perform all operations related to abrasive stair treads, set in locations as indicated on the Contract Drawings and herein specified. Work includes:

a. Furnish and install abrasive cast iron nosing.

B. Related Sections:

1. Not Used.
2. Section 05 50 00 - Metal Fabrication
3. Section 09 91 00 - Painting

1.3 SUBMITTALS

A. Submit six (6) sets of shop drawings showing plan and installation details including fastening for review.

B. Submit manufacturer's specifications, product data, and installation instructions for review.

C. Warranty Certificate.

1.4 WARRANTY

A. Manufacturer's standard warranty: Products will be free of manufacturing and material defects. Any defective product will be replaced or repaired free of any charge. Claim have to be brought to manufacturer's attention, in writing, within *One Year* following the date of Final Acceptance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. List of recommended manufactures:

1. Safe-T-Metal Company, Inc., Aluminum, Style B4
2. Wooster Products Inc., ALUMOGRIT; Type 101
3. Westfield Sheet Metal Works, Inc
4. American Safety Tread Co, Inc., ALUMACAST
5. American Abrasive Metals Company; Style A.
6. Or Engineer's Approved Equal

2.2 MATERIALS

A. Provide Cast Iron abrasive stair treads and landings, 5/16” thick for all stairs:

1. Abrasive shall be #20 virgin grain Aluminum Oxide (AL2O3) abrasive, integrally cast into the walking surface to a minimum depth of 1/32 inch (0.79 mm).

2. Safety nosing up to 6" deep with cross-hatched surface being installed into wet concrete shall have a feature strip along the back edge.

3. Concealed type anchors shall be slotted rivet type, integrally cast into the body of the nosing a minimum of 3/8" placed 3” in from each end and approximately 12” centers.

4. Cast metals used shall conform to the following specification:

a. Ferrogrit® (Abrasive cost iron): Class 20 iron; high silicon; machinable; hyper eutectic.

5. Not Used:

6. Not Used.

7. Any holes or countersinks shall be machine-made; cored holes or countersinks are not acceptable. Screw heads shall not protrude above tread surface.

8. Cross hatching and fluting shall be 1/16 inch (1.59 mm) deep minimum and shall be clean and well defined; treads and nosing’s shall be manufactured, packed and shipped so as to arrive at the jobsite in good condition.

PART 3 - EXECUTION

3.1 PREPARATION

A. Transmit Submittals required by this Section

B. Furnish products as indicated

C. Ensure substrates are in suitable condition to receive work.

3.2 INSTALLATION

A. Treads shall be installed in accordance with the manufacturer’s instructions.

B. At the completion of the work, all damaged, improperly installed and marred work shall be replaced or repaired to the satisfaction of the Engineer.

C. Nosings shall terminate not more than 3" from ends of steps for poured concrete stairs; for steel stairs, nosings shall be full length of steps less 1/8" (3.05 mm) clearance.

D. NOTE: Safety nosing’s going into new poured concrete or cement fill shall be installed before "Initial Set" of the concrete or cement occurs.

END OF SECTION 05 55 13

SECTION 07 22 00 - ROOF AND DECK INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Not Used.
B. Installation of tapered insulation to promote positive drainage at the platform canopies.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. Not Used.
B. Sheet metal components: Section 07 60 00, FLASHING AND SHEET METAL.
C. Roofing installation: Section 07 50 00, SINGLE PLY MEMBRANE ROOFING

1.3 QUALITY ASSURANCE:

A. Insulation shall be approved for local use.

B. Source Limitation: Obtain each type of roof insulation through one source.

C. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.
2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

D. Supervision of work by persons that are knowledgeable and experienced in roofing. See submittals for documentation of supervisor's qualification.

C. Unless specified otherwise, comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to insulation for storage, handling, and application.

D. Insulation shall be in accordance with roofing manufacturer's requirements.

E. Roof insulation on combustible or steel decks shall have a flame spread rating not greater than 75 and a smoke developed rating not greater than 150, exclusive of covering, when tested in accordance with ASTM E 84. Insulation bearing the UL label and listed in the UL Building Materials Directory as meeting the flame spread and smoke developed ratings will be accepted in-lieu-of copies of test reports. Compliance with flame spread and smoke developed ratings will not be required when insulation has been tested as part of a roof construction assembly of the type used for this project and the construction is listed as fire-classified in the UL Building Materials Directory or listed as Class I roof deck construction in the FM P7825. Insulation tested as part of a roof construction assembly shall bear UL or FM labels attesting to the ratings specified herein.

1.4 SUBMITTALS:

A. Submit in accordance with Section 01 33 00, SUBMITTAL PROCEDURES.

B. Manufacturer's Literature and Data:

1. Roof insulation, each type
2. Fastening requirements

C. Samples

1. Roof insulation, each type

D. Certificates:

1. Indicating type, thickness and thermal conductance of insulation. (Average thickness for tapered insulation).

E. Laboratory Test Reports: Thermal values of insulation products.

F. Layout of tapered roof system showing units required and slopes.

G. Documentation of supervisors training and experience showing knowledge of roofing procedures.

1.5 DELIVERY, STORAGE AND MARKING:

A. Deliver materials to the site in original sealed packages or containers marked with the name and brand, or trademark of the manufacturer or seller.

B. Keep materials dry, and store in dry, weathertight facilities or under canvas tarps. Use of polyethylene or plastic tarps to cover materials is not permitted. Store above ground or deck level on wood pallets. Cover ground under stored materials with plastic tarp.

1. Store rolled materials (felts, base sheets, paper) on end. Do not store materials on top of rolled material.

2. Store foam insulation away from areas where welding is being performed and where contact with open flames is possible.

C. Protect from damage from handling, weather and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

UU-B-790A .....Building Paper, Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire Resistant)

C. American Society for Testing and Materials (ASTM):

C208-95 (R2001) .....Cellulosic Fiber Insulating Board
C209-98 .....Test Methods for Cellulosic Fiber Insulating Board
C552-03 .....Cellular Glass Thermal Insulation
C726-00 .....Mineral Fiber Roof Insulation Board
C1289-03 .....Faced Rigid Cellular Polyisocynurate Thermal Insulation Board
D41-94 (R2000).....Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
D312-00 .....Asphalt Used in Roofing
D2822-91 (R-1997).....Asphalt Roof Cement

D. Factory Mutual Global (FM):

1-28 .....Winds Loads to Roof Systems and Roof Deck Securement
P7825-04.....Approval Guide

E. National Roofing Contractors Association (NRCA):

The NRCA Roofing and Waterproofing Manual - Fourth Edition.

F. Underwriters Laboratories, Inc. (UL):

Fire Resistance Directory (2003)

G. U.S. Department of Commerce (NBS):

PS 1-83.....Construction and Industrial Plywood

H. National Particleboard Association (NPA):

A208.1-93 .....Mat-Formed Wood Particleboard

PART 2 - PRODUCTS

2.1 GENERAL

A. Manufacturer:

1. GAF
2. Soprema
3. or approved equal

B. Comply with roofing manufacturer's requirements.

2.2 INSULATION

A. Tapered Rigid Insulation: Cellular polyisocyanurate-foam board, rigid, closed-cell, high-density with 25 PSI compressive strength, 6.3 inch maximum vapor transmission; 0.30 percent maximum

water absorption; manufacturer's standard sizes.

1. Cut to provide high and low points with crickets and slopes as shown.

2. Minimum thickness of tapered sections; 13 mm (1/2 inch), unless manufacturers allow taper to zero mm (inch).

3. The roof shall have slope of not less than 1/4:12

B. Miscellaneous: Adhesives as recommended by insulation and roofing manufacturer.

C. Compatibility: Product to be compatible with the roof system and should be coordinated with roofing system manufacturer.

D. Joints: Butt all joints in insulation.

2.3 MISCELLANEOUS

A. Adhesive for Bonding Insulation:

1. Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

2. Adhesive to be provided by roofing manufacturer and applied in accordance with product manufacturer's standards and recommendations.

B. Protection Board: Premolded, semirigid asphalt/fiber composite board, 1/4 inch thick, formed under heat and pressure, of standard size. Board shall be compatible with the roof system and should be coordinated with roofing system manufacturer.

2.4 RECOVERED MATERIALS:

A. Comply with following minimum content standards for recovered materials:

Material Type	Percent by Weight
Plastic rigid foams: Polyisocyanurate/polyurethane	
Rigid foam	9 percent recovered material

B. The minimum-content standards are based on the weight (not the volume) of the material in the insulating core only.

PART 3 - EXECUTION

3.1 GENERAL:

A. Entire roof deck construction of any section of the building shall be completed before insulation system work is begun. Curbs, blocking, edge strips, and other components which insulation, roofing and base flashing is attached to shall be in place ready to receive insulation and roofing. Coordinate roof insulation operations with roofing and sheet metal work so that insulation is installed to permit continuous roofing operations.

B. Insulation system materials shall be dry and damage free when applied. Do not use broken insulation or insulation with damaged facings. Remove damaged insulation from the site immediately.

C. Dry out surfaces that become wet from any cause during progress of the work before roofing work is resumed. Apply materials only to dry substrates.

D. Except for temporary protection specified, do not apply materials during damp or rainy weather, during excessive wind conditions, nor while moisture (dew, fog, snow, ice) or frost is present in any amount in or on the materials when temperature is below 10 C (50 F). Do not apply materials to substrate having temperature of 10 C (50 F) or less.

E. Phased construction is not permitted. The complete installation of all flashing, insulation, and roofing shall be completed in the same day except for the area where temporary protection is required when work is stopped.

3.2 SURFACE PREPARATION:

A. Sweep decks to broom clean condition. Remove all dust, dirt or debris.

B. Remove projections that might damage materials.

C. Not Used.

3.4 SELECTION OF RIGID INSULATION:

A. Insulation Type:

1. Where tapered insulation is used, all insulation shall be factory tapered.

B Insulation Thickness:

1. When thickness of insulation to be used is more or less than that required in specifications and/or shown on the drawings, make adjustments in the alignment and location of roof drains, flashing, gravel stops, fascias and similar items at no additional cost to the Government.

2. Where tapered insulation is used, the thickness of the insulation at high points and roof edges shall be as shown on the drawings; the thickness at the low point (roof edges) shall be not less than 38 mm (1-1/2 inches).

3. Use not less than two layers of insulation when insulation is 25 mm (one inch) or more in thickness unless specified otherwise.

3.5 GENERAL INSTALLATION OF INSULATION:

A. Lay insulating units with close joints, in regular courses and with cross joints broken. When laid in more than one layer, break joints of succeeding layers of roof insulation with those in preceding layer. Bed insulation layers in approved adhesive firmly pressed into the adhesive as per manufacturer's installation instructions.

B. Lay units with long dimension perpendicular to the rolled (longitudinal) direction of the roofing.

C. Do not install wet, damaged or warped insulation boards.

D. Cover all insulation installed on the same day by either:

1. The roofing membrane as specified.

2. Temporary protection as specified.

E. Seal all cut edges at penetrations and at edges against blocking with bitumen or roof cement.

F. Cut to fit tight against blocking or penetrations.

G. Over Vapor Retarder: Lay insulation in adhesive as recommend by roofing manufacturer.

H. Do not apply roof insulation or roofing until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment. A vapor retarder coated lightly with asphalt may be applied to protect the inside of the structure prior to the insulation and final roofing installation. Before the application of the insulation, any damage or deterioration to the vapor retarder must be repaired.

I. Do not install wet, damaged or warped insulation boards.

J. Install insulation boards with staggered board joints in one direction (unless taping joint).

K. Install insulation boards snug. Gaps between board joints must not exceed ¼" (6 mm). All gaps in excess of ¼" (6 mm) must be filled with like insulation material.

L. Wood nailers must be 3-1/2" (8.9 cm) minimum width or 1" (25 mm) wider than metal flange. They shall be of equal thickness as the insulation with a minimum 1" (25 mm) thickness. All nailers must be securely fastened to the deck.

M. Do not kick insulation boards into place.

N. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.

O. Not Used.

P. Cant strips must be installed at the intersection of the roof and all walls, parapets, curbs, or transitions approaching 90°, to be flashed. They shall be approximately 4" (10.2 cm) in horizontal and 4" (10.2 cm) in vertical dimension. The face of the cant shall have an incline of not more than 45 degrees with the roof.

Q. Roof tape, if required over insulation joints, must be laid evenly, smoothly and embedded in a uniform coating of hot steep asphalt with 4" (10.2 cm) end laps. Care must be taken to assure smooth application of tape, and full embedment of the tape in the asphalt.

R. Do not install any more insulation than will be completely waterproofed each day.

3.6 INSULATION – BASE LAYER

A. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

B. Adhesive must be applied as per manufacturer's installation instructions.

C. Install insulation layers applied with bands of adhesive spaced 12" O.C. Allow the foam to rise ¾" to 1". Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (15.2 cm) to eliminate continuous vertical gaps.

3.7 INSULATION – SUBSEQUENT LAYERS

A. The substrate must be free of and debris, dust, dirt, oil, grease, and standing water before applying the adhesive.

B. Adhesive must be applied as per manufacturer's installation instructions.

C. Install insulation layers applied with bands of adhesive spaced 12" O.C. Allow the foam to rise ¾" to 1". Walk each board firmly into place. Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6" (15.2 cm) to eliminate continuous vertical gaps.

END OF SECTION 07 22 00

SECTION 07 50 00 – SINGLE PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. The project consists of installing a Fully Adhered Roofing System as outlined below:

1.02 RELATED SECTIONS:

A. Section 07 22 00 – Roof and Deck Insulation
B. Section 07 60 00 – Flashing and Sheet Metal
C. Section 07 92 00 – Joint Sealants and Caulking

1.03 EXTENT OF WORK

A. Provide all labor, material, tools, equipment, and supervision necessary to complete the installation of a 60-mil thick EPDM membrane Fully Adhered Roofing System including flashings and insulation as specified herein and as indicated on the drawings in accordance with the manufacturer's most current specifications and details.

B. The roofing contractor shall be fully knowledgeable of all requirements of the contract documents and shall make themselves aware of all job site conditions that will affect their work.

C. The roofing contractor shall confirm all given information and advise the building owner, prior to bid, of any conflicts that will affect their cost proposal.

D. Any contractor who intends to submit a bid using a roofing system other than the approved manufacturer must submit for pre-qualification in writing fourteen (14) days prior to the bid date. Any contractor who fails to submit all information as requested will be subject to rejection. Bids stating "as per plans and specs" will be unacceptable.

1.04 SUBMITTALS

A. Prior to starting work, the roofing contractor must submit the following:

1. Shop drawings showing layout, details of construction and identification of materials.

2. Sample of the manufacturer's Membrane System Warranty.

3. Submit a letter of certification from the manufacturer which certifies the roofing contractor is authorized to install the manufacturer's roofing system and lists foremen who have received training from the manufacturer along with the dates training was received.

4. Certification of the manufacturer's warranty reserve.

B. Upon completion of the installed work, submit copies of the manufacturer's final inspection to the Architect prior to the issuance of the manufacturer's warranty.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the job site in the manufacturer's original, unopened containers or wrappings with the manufacturer's name, brand name and installation instructions intact and legible. Deliver in sufficient quantity to permit work to continue without interruption.

B. Comply with the manufacturer's written instructions for proper material storage.

1. Store materials between 60 degrees F and 80 degrees F in dry areas protected from water and direct sunlight. If exposed to lower temperature, restore to 60 degrees F minimum temperature before using.

2. Store materials containing solvents in dry, well ventilated spaces with proper fire and safety precautions. Keep lids on tight. Use before expiration of their shelf life.

C. Insulation must be on pallets, off the ground and tightly covered with waterproof materials. Manufacturer's wrap does not provide sufficient waterproofing.

D. Any materials which are found to be damaged shall be removed and replaced at the applicator's expense

1.06 WORK SEQUENCE

A. Schedule and execute work to prevent leaks and excessive traffic on completed roof sections. Care should be exercised to provide protection to ensure water does not flow beneath any completed sections of the membrane system.

B. Not Used.

1.07 USE OF THE PREMISES

A. Before beginning work, the roofing contractor must secure approval from the building owner's representative for the following:

1. Areas permitted for personnel parking.
2. Access to the site.
3. Areas permitted for storage of materials and debris.
4. Areas permitted for the location of cranes, hoists and chutes for loading and unloading materials to and from the roof.

B. Interior stairs or elevators may not be used for removing debris or delivering materials, except as authorized by the building superintendent.

1.08 EXISTING CONDITIONS

If discrepancies are discovered between the existing conditions and those noted on the drawings, immediately notify the owner's representative by phone and solicit the manufacturer's approval prior to commencing with the work.

1.09 JOB SITE PROTECTION

A. The roofing contractor shall adequately protect building, paved areas, service drives, lawn, shrubs, trees, etc. from damage while performing the required work. Provide canvas, boards and sheet metal (properly secured) as necessary for protection and remove protection material at completion. The contractor shall repair or be responsible for costs to repair all property damaged during the roofing application.

B. During the roofing contractor's performance of the work, the building owner will continue to occupy the facility. The contractor shall take precautions to prevent the spread of dust and debris, particularly where such material may sift into the occupied areas of the facility. The roofing contractor shall provide labor and materials to construct, maintain and remove necessary temporary enclosures to prevent dust or debris in the construction area(s) from entering the remainder of the building.

C. Do not overload any portion of the building, either by use of or placement of equipment, storage of debris, or storage of materials.

D. Protect against fire and flame spread. Maintain proper and adequate fire extinguishers.

E. Take precautions to prevent drains from clogging during the roofing application. Remove debris at the completion of each day's work and clean drains, if required. At completion, test drains to ensure the system is free running and drains are watertight. Remove strainers and plug drains in areas where work is in progress. Install flags or other telltales on plugs. Remove plugs each night and screen drain.

F. Store moisture susceptible materials above ground and protect with waterproof coverings.

G. Remove all traces of piled bulk materials and return the job site to its original condition upon completion of the work.

1.10 SAFETY

A. The roofing contractor shall be responsible for all means and methods as they relate to safety and shall comply with all applicable local, state and federal requirements that are safety related. Safety shall be the responsibility of the roofing contractor. All related personnel shall be instructed daily to be mindful of the full time requirement to maintaina safe environment for the facility's occupants including staff, visitors, customers and the occurrence of the general public on or near the site.

1.11 WORKMANSHIP

A. Applicators installing new roof, flashing and related work shall be factory trained and approved by the manufacturer they are representing.

B. All work shall be of highest quality and in strict accordance with the manufacturer's published specifications and to the building owner's satisfaction.

C. There shall be a supervisor on the job site at all times while work is in progress.

1.12 QUALITY CONTROL

A. The EPDM membrane roofing system must achieve a UL Class A and must have been successfully tested to meet or exceed the calculated uplift pressure required by the International Building Code (ASCE-7) or ANSI/SPRI WD-1.

B. The manufacturer must have extensive documented experience in the manufacturing of vulcanized thermal set sheeting.

C. Unless otherwise noted in this specification, the roofing contractor must strictly comply with the manufacturer's current specifications and details.

D. The roofing system must be installed by an applicator authorized and trained by the manufacturer in compliance with shop drawings as approved by the manufacturer. The roofing applicator shall be thoroughly experienced and upon request be able to provide evidence of having successful experience installing single-ply EPDM roofing systems and having installed at least one (1) roofing application or several similar systems of equal or greater size within one year.

E. Provide adequate number of experienced workmen regularly engaged in this type of work who are skilled in the application techniques of the materials specified. Provide at least one thoroughly trained and experienced superintendent on the job at all times roofing work is in progress.

F. There shall be no deviations made from this specification or the approved shop drawings without the prior written approval of the Architect. Any deviation from the manufacturer's installation procedures must be supported by a written certification on the manufacturer's letterhead and presented for the Architect's consideration.

G. Upon completion of the installation, the applicator shall arrange for an inspection to be made by a non-sales technical representative of the membrane manufacturer in order to determine whether or not corrective work will be required before the warranty will be issued. Notify the building owner seventy-two (72) hours prior to the manufacturer's final inspection.

H. The EPDM membrane meets the CRRC (California Roof Rating Council) requirements for reflectance and emittance. When tested in accordance with ASTM C1549, the material has an initial solar reflectance of .76 and a 3-year aged reflectance of .64. The material has also been tested for emittance in accordance with ASTM C1371; an initial emittance of .90 and a 3-year aged emittance of .87 were achieved.

1.13 JOB CONDITIONS, CAUTIONS AND WARNINGS

A. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.

B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

C. When loading materials onto the roof, the Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

D. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.

E. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.

F. Provide protection, such as 3/4 inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.

G. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.

H. New roofing shall be complete and weathertight at the end of the work day.

I. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.14 WARRANTY

A. Provide manufacturer's 20 year Total System Warranty covering both labor and material with no dollar limitation. The maximum wind speed coverage shall be peak gusts of 110 mph measured at 10 meters above ground level. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.

B. Pro-rated System Warranties shall not be accepted.

C. Evidence of the manufacturer's warranty reserve shall be included as part of the project submittals for the Architect's approval.

PART 2 - PRODUCTS

2.01 GENERAL

A. Manufactures:

1. Carlisle SynTec Incorporated; P.O. box 7000 Carlisle, PA 17013; 800-4-syntec (Basis of design)
2. Firestone building products; 250 West 96th Street, Indianapolis, IN 46260; 800-428-4442
3. Johns Manville; 717 17th street Denver, CO 80202; 303-978-2000
4. Or Approved Equal.

B. Unless otherwise approved by the Architect and accepted by the membrane manufacturer, all products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.

2.02 MEMBRANE

A. Furnish White 60-mil thick EPDM (Ethylene, Propylene, Diene Terpolymer) in the largest sheet possible. The membrane shall conform to the minimum physical properties of ASTM D4637. When a 10 foot wide membrane is to be used, the membrane shall be manufactured in a single panel with no factory splices to reduce splice intersections. EPDM membranes are available with Factory-Applied Tape (FAT).

2.03 INSULATION/UNDERLAYMENT

A. When applicable, insulation shall be installed in multiple layers. The first and second layer of insulation shall be mechanically fastened or adhered to the substrate in accordance with the manufacturer's published specifications.

B. Insulation shall be Tapered Polyiso Insulation. See Specification 07 22 00 Roof and Deck Insulation.

2.04 ADHESIVES, CLEANERS AND SEALANTS

All products shall be furnished by the manufacturer and specifically formulated for the intended purpose.

A. Bonding Adhesive: Low VOC Bonding Adhesive

B. Splicing Cement: White Splicing Cement

C. Splice Tape and Primer: White splice tape or Factory-Applied Tape (FAT) and Carlisle EPDM or Low VOC Primer

D. Cleaning Solvent: Weathered Membrane Cleaner

E. Internal Seam Sealant: Sure-Seal In-Seam Sealant (used with adhesive splices only)

F. External Seam Sealant: White Lap Sealant

G. Pocket Sealant: White Pourable Sealer

H. Insulation Adhesive: Carlisle FAST Adhesive, OlyBond 500 BA, or OlyBond Spot Shot– or approved equal

2.05 FASTENERS AND PLATES

To be used for mechanical attachment of insulation and to provide additional membrane securement:

A. Not Used.

B. Not Used.

C. HP Term Bar Nail-In: a 1-1/4" long expansion anchor with drive pin used for fastening Termination Bar or Seam Fastening Plates to concrete. The fastener is set by hammering the drive pin into place.

D. Insulation Fastening Plate: a nominal 3" diameter FM approved metal plate used for insulation attachment in conjunction with Fasteners.

E. Seam Fastening Plate: a 2" diameter metal fastening plate used in conjunction with Reinforced Universal Securement Strip or EPDM membrane for additional membrane securement.

F. White Pressure-Sensitive Reinforced Universal Securement Strip: a 6" wide, nominal 45-mil thick clean, cured, white reinforced EPDM membrane with 3" wide Factory- Applied Tape laminated along one edge. Used on White Adhered Roofing Systems.

G. Reinforced Universal Securement Strip: a standard 6" or 9" wide, 100' long, strip of reinforced EPDM membrane.

H. The 6" wide standard Reinforced Universal Securement Strip can be utilized horizontally or vertically (in conjunction with Seam Fastening Plates) below the EPDM membrane for additional membrane securement on maximum 10-year warranty projects.

I. The 9" wide standard Reinforced Universal Securement Strip can be utilized in conjunction with gravel stops and metal edgings to allow the continuation of the EPDM deck membrane as flashing.

2.06 METAL EDGING AND MEMBRANE TERMINATIONS

A. Snap-on edge system consisting of a 24 gauge galvanized metal springclip water dam and50-mil thick aluminum Kynar 500, colored anodized finish. The fascia is available in a variety of colors and heights varying from 5" to 10". Metal fascia color shall be as designated by the Owner's Representative.

B. Drip Edge: a metal fascia/edge system with a 24 gauge continuous anchor cleat and.032 inch thick aluminum fascia. Metal fascia color shall be as designated by the Owner's Representative.

C. Termination Bar: a 1" wide and .098 inch thick extruded aluminum bar pre-punched 6" on center; incorporates a sealant ledge to support Lap Sealant or Universal Sealant and provide increased stability for membrane terminations.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with the manufacturer's published instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.

B. Position sheets to accommodate contours of the roof deck and shingle splices to avoid bucking water.

3.02 INSULATION PLACEMENT

A. Install insulation or membrane underlayment over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch. Stagger joints both horizontally and vertically if multiple layers are provided.

B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's specifications.

3.03 MEMBRANE PLACEMENT AND BONDING

A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour before bonding. Fold the sheet back onto itself so half the underside of the membrane is exposed.

B. Apply the Bonding Adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.

1. Roll the coated membrane into the coated substrate while avoiding wrinkles.Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.

2. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.

C. Install adjoining membrane sheets in the same manner, overlapping edges approximately 4 inches. Do not apply bonding adhesive to the splice area.

3.04 MEMBRANE SPLICING WITH TAPE

A. Tape splices must be a minimum of 2-1/2" wide using 3" wide tape extending 1/8" minimum to 1/2" maximum beyond the splice edge. Field splices at roof drains must be located outside the drain sump.

B. Position membrane sheet to allow for required splice overlap. Mark the bottom sheets with an indelible marker approximately 1/4" to 1/2" from the top sheet edge. The pre- marked line on the membrane edge can also be used as a guide for positioning splice tape.

C. Fold the top sheet back and clean the dry splice area (minimum 3" wide) of both membrane sheets by scrubbing with clean natural fiber rags saturated with Primer.

D. When Factory-Applied tape is not used, apply tape in accordance with the manufacturer's specifications and roll the top sheet onto the mating surface.

E. Immediately roll the splice using positive pressure when using a 2" wide steel roller. Roll across the splice edge, not parallel to it. When factory applied tape is used, a Stand- Up Seam Roller can be used to roll parallel to the splice edge.

F. At all field splice intersections, apply Lap Sealant along the edge of the membrane splice to cover the exposed tape 2" in each direction from the splice intersection. Install Pressure-Sensitive Joint Covers or a 6" wide section (with rounded corners) of Pressure- Sensitive Flashing over the field splice intersection.

3.05 MEMBRANE SPLICING WITH SPLICING CEMENT

Adhesive splices must be a minimum of 3" wide. Field splices at roof drains must be located outside drain sump.

A. Fold the top sheet back and clean the dry splice area (minimum 3" wide) of both membrane sheets by scrubbing with clean natural fiber rags saturated with Weathered Membrane Cleaner or Sure-Seal Primer.

B. Apply Splicing Cement and In-Seam Sealant in accordance with the manufacturer's specifications and roll the top sheet onto the mating surface.

C. Roll the splice with a 2 inch wide steel roller and wait at least 2 hours before applyingLap Sealant to the splice edge following the manufacturer's requirements.

D. Field splices without In-Seam Sealant must be overlaid with uncured flashing.

3.06 FLASHING

A. Wall and curb flashing shall be cured EPDM membrane. Continue the deck membrane as wall flashing where practicable.

B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.07 DAILY SEAL

A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.

B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.08 CLEAN UP

A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.

B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

END OF SECTION 07 50 00

SECTION 07 60 00 - FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and SupplementaryConditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. Description: Provide Flashing and Sheet Metal, as shown and specified per Contract Documents; including, but not limited to:

1. Not Used.
2. Not Used.
3. Gutters
4. Exposed metal trim and fascia units.
5. Sheet metal accessories.

1.3 RELATED SECTIONS

A. Not Used.
B. Section 07 53 00 – Single ply membrane roofing
C. Section 07 92 00 - Joint Sealants and Caulking

1.4. SUBMITTALS

A. General: Refer to Division 1 Section 01 33 00 Submittals.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

G. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.

2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.

3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.

4. Details of termination points and assemblies, including fixed points.

5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.

6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counter flashings as applicable.

7. Details of special conditions.

8. Details of connections to adjoining work.

9. Detail formed flashing and trim at a scale of not less than 3 inches per 12 inches.

H. Samples: For each type of sheet metal flashing, trim, and accessory indicated with factory- applied color finishes involving color selection.

I. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

J. Qualification Data: For qualified fabricator.

K. Closeout:

1. Guarantee: Provide, in required form, for a period of two (2) years from date of final acceptance by CTDOT

1.4 QUALITY ASSURANCE

A. General: Refer to Section 01 40 00 Quality Assurance.

B. References:

1. General: Refer to Section 01 42 19 Reference Standards.

2. National Roofing Contractors Association (NRCA): Roofing Manual.

3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

C. Installer Qualifications: Installer of flashing and sheet metal is a certified installer with a documented history installing manufacturer's products according to manufacturer's specifications.

D. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including gutter, fascia**,** and through wall flashing approximately 2 feet long, including supporting construction cleats, seams, attachments**,** underpayments**,** and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect/Engineer specifically approves such deviations in writing.

3. Approved mockups may become part of the completed Work if undisturbed at time of Final Acceptance.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.

1. Finish: 2B (bright, cold rolled).
2. Surface: Smooth, flat.

C. Metallic-Coated Steel Sheet: Restricted flatness steel sheet, metallic coated by the hot-dip process and pre-painted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.

2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C).

2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C).

3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
    b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
    c. Henry Company; Blueskin PE200 HT.
    d. Metal-Fab Manufacturing, LLC; MetShield.
    e. Owens Corning; WeatherLock Metal High Temperature Underlayment.
    f. Or Engineer's approved equal

D. Slip Sheet: Building paper, 3-lb/100 sq. ft. (0.16-kg/sq. m) minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.

    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.

    c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Zinc-Tin Alloy-Coated Copper Sheet: Copper, hardware bronze or Series 300 stainless steel.

3. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

5. Fasteners for Zinc-Tin Alloy-Coated Stainless-Steel Sheet: Series 300 stainless steel.

6. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

7. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Solder:

1. For Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

2. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

3. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

4. For Zinc-Coated (Galvanized) Steel: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead or Grade Sn60, 60 percent tin and 40 percent lead.

5. For Zinc: ASTM B 32, 40 percent tin and 60 percent lead with low antimony, as recommended by manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealanttape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with interlocking counter flashing on exterior face, of same metal as reglet.

1. Stainless Steel: 0.016 inch thick.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) Cheney Flashing Company; Cheney Flashing (Dovetail).
2) Cheney Flashing Company; Cheney Flashing (Sawtooth).
3) Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
4) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
5) Sandell Manufacturing Company, Inc.; Pre-Formed Metal Flashing
6) Or Engineer’s approved equal

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

2. Obtain field measurements for accurate fit before shop fabrication.

3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines as indicated and within1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "ArchitecturalSheet Metal Manual" for application, but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

H. Do not use graphite pencils to mark metal surfaces.

I. Form sections, per referenced standards, true to shape, accurate in size, square, and free from distortion or defects. Form pieces in single length sheets, not to exceed 10'-0" in length. Hem exposed edges on underside 1/2 inch; miter and seam corners.

J. Seams: Flat lock.

K. Corners: One piece with minimum 18 inch long legs; solder for rigidity, seal with sealant.

L. Cleats: Minimum 2 inches wide, interlockable with sheet.

M. Vertical Faces: Bottom edge formed outward 1/4 inch and hemmed to form drip.

N. Flashing Toe: Extend toe 2 inches over roofing; return and brake edges.

O. Soldering: Solder shop formed metal joints. After soldering, remove flux; wipe and wash solder joints clean. Weather seal joints.

P. Back Painting: Paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

2.6 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Interior Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, pitch pan, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.

1. Gutter Style: Box-Style, See drawings.
2. Expansion Joints: Built in.
3. Accessories: pitch pan
4. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following materials:

a. Copper: 16 oz./sq. ft..thick
b. Aluminum: 0.032 inch. thick
c. Stainless Steel: [0.016 inch thick.
d. Zinc-Tin Alloy-Coated Stainless Steel: 0.015 inch thick.
e. Zinc-Tin Alloy-Coated Copper: 16 oz./sq. ft thick.
f. Galvanized Steel: 0.022 inch thick.
g. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.
h. Zinc: 0.039 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof-Edge Flashing and Fascia Cap: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections.

1. Joint Style: flat snap lock seam
2. Finish: Refer to finish schedule..

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Product handling:

1. Delivery: Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer’s unopened packages and bearing manufacturer’s label.

2. Storage: Store materials in a dry and well ventilated place, adequately protected from damage and exposure to the elements.

3.2 PREPARATION

A. Examination: Examine conditions of work in place before beginning work; report defects.

B. Measurements: Take field measurements; report variance between plan and field dimensions.

C. Storage: Stack preformed material to prevent twisting, bending or abrasion; slope to ensure drainage.

3.3 INSTALLATION, GENERAL

A. General: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.

B. Underlayment:

1. Apply one (1) layer of felt underlayment over surfaces as shown; lap all edges 6 inches minimum, in direction of slope.

2. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize useof mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches (50 mm).

3. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails forinstalling underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps with roller. Cover underlayment within 14 days.

C. Application:

1. General: Make corners square, surfaces true and straight in planes, and lines accurate to profiles. Fit sheet metal tight in place; secure using concealed fasteners. Apply plastic cement compound between metal flashing and felt flashing. Seal metal joints watertight.

2. Expansion and Contraction: Allow for expansion and contraction over an ambient temperature range up to 150 degrees F; distortions resulting from fastening or expansion and contraction stresses not acceptable.

3. Dissimilar Metals: Isolate with heavy coat of bituminous paint. Coat all sheet metal in contact with roofing felts.

D. Assemblies:

1. Flashing:

a. General: Install flashing where shown; miter and solder joints at corners. Lap joints in counter flashing at least 6 inches and make watertight with sealing tape. Extend counter flashing down not less than 6 inches.

b. Exterior Metal Frame Flashing: Provide at frame heads, as shown

2. Roof Drainage:

a. Interior Gutter: Install with a minimum pitch of 1/16" per foot, pitch as shown on drawings, with joints and closed ends riveted and soldered; provide expansion joints as required. Secure with sheet metal straps.

b. Rainwater Leaders

1) Downspouts: Connect to gutter as shown. Fasten to column with metal strapslocated at the top, center point and bottom of each downspout; align straps on column face; maximum spacing 6'-0".

E. Sealants: As shown; per manufacturer's directions.

F. Galvanizing Repair Treatment: Repair damaged zinc coating with specified repair compound, as required.

3.4 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

5. Install sealant tape where indicated.

6. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).

2. Prepare joints and apply sealants to comply with requirements in Division 07 Section 07920 "Joint Sealants and Caulking."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.

2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

G. Roof edge flashing / fascias to be installed as per roof panel manufacturer’s recommendations.

3.5 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Interior Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with sealant. Provide for thermal expansion. Attach gutters at steel structure to firmly anchored gutter brackets spaced not more than 36 inches (900 mm) apart. Provide end closures and sealwatertight with sealant. Slope to downspouts.

1. Anchor and loosely lock back edge of gutter to continuous cleat

2. Coordinate installation with roof panel manufacturer.

C. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints.

1. Provide hangers with fasteners designed to hold downspouts securely to walls. Locate hangers at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

2. Provide elbows at base of downspout to direct water away from building.

3. Connect downspouts to underground drainage system indicated.

3.6 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated.

1. Brick Headwall: Sawcut reglet joint at existing mortar joints at minimum recommended height above roof plane. Full continuous seal at reglet joint.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturers written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 60 00

SECTION 07 92 00 - JOINT SEALANTS AND CAULKING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.2 SUMMARY

A. Description: This Section includes but is not limited to sealants for the following applications:

1. Exterior joints in the following vertical surfaces and non-traffic horizontal surfaces:

a. Joints between different materials to prevent infiltration of weather elements.

a. Not Used.

c. Control and expansion joints in sheet metal work, ceilings and overhead surfaces.

d. Other joints as indicated or otherwise required to complete the Work of this Section and the Work of other Sections.

2. Not Used.

3. Primers: Applications of manufacturers' recommended primers or system component Primers to joint surfaces prior to sealant installation.

1.3 RELATED SECTIONS

A. Not Used.
B. Not Used.
C. Not Used.
D. Not Used.

1.4 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and air tight continuous joint seals without staining or deteriorating joint substrates.

1.5 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Warranties: warranties specified in this Section.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of joint sealants and caulking is a certified installer with a documented history installing manufacturer's products according to manufacturer's specifications.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Mockups: Provide a full-scale field mock-up of each type sealant application indicated, consisting of a minimum of 10 linear feet of installed primer and sealant, and indicating the proposed installation methods and proposed finished conditions of each material, component and system required. Install individual components complete, and in the sequence required, in full accordance with Manufacturer's written instructions (where applicable), and in compliance with requirements of Contract Documents.

1. Preparation: Notify Engineer of intention to install mock-ups required and obtain Engineer's acceptance for proposed mock-up locations. Install mock-ups in place within the Work unless other locations are requested by Engineer.

2. Where Engineer requests an opportunity to view the installations in progress, notify Engineer of

exact schedule of mock-up installations, at least 24-48 hours in advance.

1. Reinstall or revise mock-ups where requested by Engineer until satisfactory results and Engineer's acceptance are obtained.

2. Provide precise and consistent match to accepted mock-ups in subsequent work. Where requested by Engineer, remove non-matching work and replace with new work.

3. Protect accepted mock-ups until completion of Project Work. Accepted mock-ups may remain as part of the finished Work only at the discretion of the Engineer.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section 01 31 19 "Project Meetings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.

2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40° F (4.4° C).

3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.9 WARRANTY

A. General Warranty: warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Design-Builder under requirements of the Contract Documents.

B. Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Final Acceptance.

C. Standard Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Final Acceptance.

D. Warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include products of the following manufacturers:

1. Tremco
2. Dow Corning Corporation
3. Pecora
4. GE Silicon
5. Or Engineer’s approved equal

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Fire rated assemblies: Verify with the manufacturer for the appropriate sealant and caulking.

C. Colors of Exposed Joint Sealants: As selected by Engineer/Architect from manufacturer's full range.

2.3 SEALANT MATERIALS

A. For purposes of establishing the standard of quality for sealants and related materials, the following specifications are based on products listed. Equivalent products from the acceptable manufacturers listed will be considered for use in this Project, subject to the approval of the Engineer.

2.4 SINGLE-PART URETHANE SEALANT (Sealant No. 1)

A. Polyurethane Sealant: Single component, chemical during, non-staining, non-bleeding, capable of

continuous water immersion, non-sagging, self-leveling type; complying with Class A ASTM C 920, Type S, Grade NS, Class 25, Use NT, M, A, O.

B. Products: Subject to compliance with requirements, provide the following:

1. Low Modulus Expansion Joint Sealant: Dymonic, product of Tremco or Engineer's approved equal

2.5 SINGLE-PART SILICONE SEALANTS (Sealant No. 2)

A. Silicone Sealant: Single component, neutral-cure, solvent curing, cold-applied, non-sagging, non-staining, fungus resistant, non-bleeding; complying with ASTM C 920, Type S, NS, Class 25.

B. Products: Subject to compliance with requirements, provide one of the following:

1. Silicone Sealant:

a. Dow 795 Silicone Building Sealant, product of Dow Corning Corporation.
b. Silpruf Silicone Sealant, product of GE Silicones.
c. Pecora 864 Silicone Sealant, product of Pecora.
d. Or Engineer's approved equal

2.6 Not Used.

2.7 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

2. Type O: Open-cell material.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26° F (minus 32° C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self- adhesive tape where applicable.

2.8 PRIMERS AND MISCELLANEOUS MATERIALS

A. Primers: Materials recommended by joint sealant manufacturer for advancing or improving adhesion of sealant to joint substrates indicated, as determined from pre-construction joint- sealant-substrate tests and field tests.

B. Primer Use Required: Primer use is required throughout each application, unless unacceptable

staining of adjacent materials results.

1. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

2. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

   a. Concrete.
   b. Not Used.
   c. Not Used.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

   a. Metal.
   b. Not Used.
   c. Porcelain enamel.
   d. Not Used.

B. Joint Priming: Prime joint substrates as recommended in writing by joint sealant manufacturer, based on pre-construction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint- sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

1. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

2. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

3. Install sealant backings of type indicated to support sealants during application and atposition required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

a. Do not leave gaps between ends of sealant backings.

b. Do not stretch, twist, puncture, or tear sealant backings.

c. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

4. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.

5. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

a. Place sealants so they directly contact and fully wet joint substrates.

b. Completely fill recesses provided for each joint configuration.

c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

6. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

a. Remove excess sealants from surfaces adjacent to joint.

b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

c. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

d. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.

e. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Final Acceptance. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 MISCELLANEOUS SEALANT WORK AND REPAIRS

A. Examine existing sealant work to remain and new and existing sealant and other work at platform. Provide such additional sealant applications and installations as may be required to repair existing work, to restore the weather-impermeability of existing and new work, and to complete the work of other Sections.

3.7 SEALANT SCHEDULE

A. Exterior joints requiring sealant work include, but are not limited to, the following:

1. Metal/metal joints: Sealant No. 2.
2. Noted Used.
3. Concrete joints: Sealant No. 1.
4. Not Used.
5. Metal/concrete: Sealant No. 1.
6. Not Used.

END OF SECTION 07 92 00

SECTION 08 45 23 - 2-3/4" TRANSLUCENT FIBERGLASS SANDWICH PANEL SKYLIGHT CANOPY SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the insulated translucent sandwich panel skylight system and accessories as shown and specified. Work includes providing and installing:

1. 2 ¾" curved factory prefabricated structural insulated translucent sandwich panels
2. Aluminum installation system
3. Aluminum flashing attached to skylights

B. Related Sections:

1. Roofing: Section 07 50 00
2. Flashing and Sheet Metal: Section 07 60 00
3. Sealants: Section 07 92 00
4. Not Used.

1.2 SUBMITTALS

A. Submit manufacturer's product data. Include construction details, material descriptions, profiles and finishes of skylight components.

B. Submit shop drawings. Include elevations and details.

C. Submit manufacturer's color charts showing the full range of colors available for factory-finished aluminum.

1. When requested, submit samples for each exposed finish required, in same thickness and material indicated for the work and in size indicated below. If finishes involve normal color variations, include sample sets consisting of two or more units showing the full range of variations expected.

a. Sandwich panels: 14" x 28" units
b. Factory finished aluminum: 5" long sections

D. Submit Installer Certificate, signed by installer, certifying compliance with project qualification requirements.

E. Submit product reports from a qualified independent testing agency indicating each type and class of panel system complies with the project performance requirements, based on comprehensive testing of current products. Previously completed reports will be acceptable if for current manufacturer and indicative of products used on this project.

1. Reports required are:

a. International Building Code Evaluation Report

b. Flame Spread and Smoke Developed (UL 723) – Submit UL Card
c. Burn Extent (ASTM D 635)
d. Color Difference (ASTM D 2244)
e. Impact Strength (UL 972)
f. Bond Tensile Strength (ASTM C 297 after aging by ASTM D 1037)
g. Bond Shear Strength (ASTM D 1002)
h. Beam Bending Strength (ASTM E 72)
i. Fall Through Resistance (ASTM E 661)
j. Insulation U-Factor (NFRC 100)
k. Solar Heat Gain Coefficient (NFRC or Calculations)
l. Air Leakage (ASTM E 283)
m. Structural Performance (ASTM E 330)
n. Water Penetration (ASTM E 331)
o. Class A Roof Covering Burning Brand (ASTM E 108)

1.3 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Material and products shall be manufactured by a company continuously and regularly employed in the manufacture of specified materials for a period of at least ten consecutive years and which can show evidence of those materials being satisfactorily used on at least six projects of similar size, scope and location. At least three of the projects shall have been in successful use for ten years or longer.

2. Panel system must be listed by an ANSI accredited Evaluation Service, which requires quality control inspections and fire, structural and water infiltration testing of sandwich panel systems by an accredited agency.

3. Quality control inspections shall be conducted at least once each year and shall include manufacturing facilities, sandwich panel components and production sandwich panels for conformance with AC177 "Translucent Fiberglass Reinforced Plastic (FRP) Faced Panel Wall, Roof and Skylight Systems" as issued by the ICC-ES.

B. Installer's Qualifications: Installation shall be by an experienced installer, which has been in the business of installing specified skylight systems for at least two consecutive years and can show evidence of satisfactory completion of projects of similar size, scope and type.

1.4 PERFORMANCE REQUIREMENTS

A. The manufacturer shall be responsible for the configuration and fabrication of the complete skylight panel system.

1. When requested, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Standard skylight system shall have less than 0.01 cfm/ft² air leakage by ASTM E 283 at 6.24PSF (50 mph) and no water penetration by ASTM E 331 at 15 PSF; and structural testing byASTM E 330.

3. Structural Loads; Provide skylight system capable of handling the following loads:

a. Live Load: 30 PSF

b. Snow Load: 30 PSF
c. Wind Load: 35 PSF

1.5 DELIVERY STORAGE AND HANDLING

A. Deliver panel system, components and materials in manufacturer's standard protective packaging.

B. Store panels on the long edge; several inches above the ground, blocked and under cover in accordance with manufacturer's storage and handling instructions.

1.6 WARRANTY

A. Submit manufacturer's and installer's written warranty agreeing to repair or replace panel system work, which fails in materials or workmanship within one year of the date of delivery. Failure of materials or workmanship shall include leakage, excessive deflection, deterioration of finish on metal in excess of normal weathering and defects in accessories, insulated translucent sandwich panels and other components of the work.

B. Extended Warranty: 20 years on fiber bloom

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. The basis for this specification is for products manufactured by Kalwall Corporation. Other manufacturers may bid this project provided they comply with all of the performance requirements of this specification and submit evidence thereof. Listing other manufacturers' names in this specification does not constitute approval of their products or relieve them of compliance with all the performance requirements contained herein.

B. Kalwall Corporation, Tel: (800) 258-9777 – Fax: (603) 627-7905 – Email: info@kalwall.com

2.2 PANEL COMPONENTS

A. Face Sheets

1. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.

a. Thermoplastic (e.g. polycarbonate, acrylic) faces are not acceptable.
b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

2. Interior face sheets:

a. Flame spread: Underwriters Laboratories (UL) listed, which requires periodic unannounced retesting, with flame spread rating no greater than 10 and smoke developed no greater than 450 when tested in accordance with UL 723.
b. Burn extent by ASTM D 635 shall be no greater than 1".

3. Exterior face sheets:

a. Color stability: Full thickness of the exterior face sheet shall not change color more than 3 CIE Units DELTA E by ASTM D 2244 after (5) five years outdoor South Florida weathering at 5° facing south, determined by the average of at least three white samples with and without a protective film or coating to ensure long-term color stability. Color stability shall be unaffected by abrasion or scratching.
b. Strength: Exterior face sheet shall be uniform in strength, impenetrable by hand held pencil and repel an impact minimum of 70 ft. lbs. without fracture or tear when impacted by a 3-1/4" diameter, 5 lb. free-falling ball per UL 972.

4. Appearance:

a. Exterior face sheets: Smooth, 0.070" thick and crystal in color to match existing.

b. Interior face sheets: Smooth, 0.070" thick and crystal or white in color to match existing.

c. Face sheets shall not vary more than ± 10% in thickness and be uniform in color.

B. Grid Core

1. Aluminum I-beam grid core shall be of 6063-T6 or 6005-T5 alloy and temper with provisions for mechanical interlocking of muntin-mullion and perimeter. Width of I-beam shall be no less than 7/16".

C. Laminate Adhesive

1. Heat and pressure resin type adhesive engineered for structural sandwich panel use, with minimum 25-years field use. Adhesive shall pass testing requirements specified by the International Code Council "Acceptance Criteria for Sandwich Panel Adhesives".

2. Minimum tensile strength of 750 PSI when the panel assembly is tested by ASTM C 297 after two exposures to six cycles each of the aging conditions prescribed by ASTM D 1037.

3. Minimum shear strength of the panel adhesive by ASTM D 1002 after exposure to four separate conditions:

a. 50% Relative Humidity at 68° F: 540 PSI
b. 182° F: 100 PSI
c. Accelerated Aging by ASTM D 1037 at room temperature: 800 PSI
d. Accelerated Aging by ASTM D 1037 at 182° F: 250 PSI

2.3 PANEL CONSTRUCTION

A. Provide sandwich panels of flat fiberglass reinforced translucent face sheets laminated to a grid core of mechanically interlocking I-beams. The adhesive bonding line shall be straight, cover the entire width of the I-beam and have a neat, sharp edge.

1. Thickness: 2-3/4"
2. Grid pattern: Nominal 12" x 24" Shoji.
3. Light transmission percentage: 35%
4. Solar heat gain coefficient: 0.52

5. Panel U-factor by NFRC certified lab: .53u

B. Standard panels shall deflect no more than 1.9" at 30 PSF in 10' 0" span without a supporting frame by ASTM E 72.

C. Standard panels shall withstand 1200° F fire for minimum one hour without collapse or exterior flaming.

D. Skylight System:

1. Skylight system shall pass Class A Roof Burning Brand Test By ASTM E 108.

2. Skylight system shall be UL listed as a Class A Roof by UL 790, which requires periodic unannounced inspections and retesting by Underwriters Laboratories.

E. Skylight System shall meet the fall through requirements of OSHA 1910.23 as demonstrated by testing in accordance with ASTM E661, thereby not requiring supplemental screens or railings.

2.4 BATTENS AND PERIMETER CLOSURE SYSTEM

A. Closure system:

1. Extruded aluminum 6063-T6 and 6063-T5 alloy and temper clamp-tite screw type closure system.

3. Curved closure system may be roll formed.

4. Skylight perimeter closures at curbs shall be factory sealed to panels.

B. Sealing tape: Manufacturer's standard, pre-applied to closure system at the factory under controlled conditions.

C. Fasteners: 300 series stainless steel screws for aluminum closures, excluding final fasteners to the building.

D. Finish:

1. Manufactures factory applied finish which meets the performance requirements of AAMA 2604. Color to be selected from manufactures full range of standards

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine substrates, supporting structure and installation conditions.

B. Do not proceed with panel installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer

for this purpose.

1. Where aluminum will contact concrete, masonry or pressure treated wood, protect against corrosion by painting contact surfaces with bituminous paint or method recommended by manufacturer.

3.3 INSTALLATION

A. Install the skylight system in accordance with the manufacturer's installation recommendations and approved shop drawings.

1. Anchor component parts securely in place by permanent mechanical attachment system.

2. Accommodate thermal and mechanical movements.

3. Set perimeter framing in a full bed of sealant compound, or with joint fillers or gaskets to provide weather-tight construction.

B. Install joint sealants at perimeter joints and within the panel system in accordance with manufacturer's installation instructions.

3.4 FIELD QUALITY CONTROL

A. Water Test: Installer to test skylights according to procedures in AAMA 501.2.

B. Repair or replace work that does not pass testing or that is damaged by testing and retest work.

3.5 CLEANING

A. Clean the skylight system inside and outside, immediately after installation.

B. Refer to manufacturer's written recommendations

END OF SECTION 08 45 23

SECTION 09 91 00 – PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. The work of this Section includes, but is not limited to, painting and finishing of all exposed surfaces, both interior and exterior, except the following:

1. Factory finished items, except as noted.

2. Finished metal surfaces of stainless steel, copper, brass, bronze, and aluminum, unless noted to be painted.

3. Finished metal surfaces that are plated such as finished hardware, no UL labels shall be painted.

4. Surfaces in concealed areas such as above ceilings, and the like.

5. Moving parts, code required labels, and equipment data plates.

6. Mechanical and electrical items not in public spaces.

7. Not Used.

8. Finished masonry surfaces such as face brick, ground or split face concrete masonry and the like.

B. Where an item or surface is not specifically mentioned, paint the same color as adjacent materials or surfaces, including exposed surface-mounted conduit, piping and exposed ductwork.

C. Structural steel and metal decking that will require a field applied top coat shall include, but not be limited to, the following locations:

1. Steel beams, steel tubes and steel deck at canopy structures.
2. Not Used.

1.2 WORK NOT INCLUDED

A. Not Used.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Upon requestfrom other trades, furnish information or characteristics of finish materials provided for use, to ensure that compatible coats are used.

1.4 TESTS

A. Testing Agency: The Department may employ an independent testing agency to perform tests, evaluations and certifications. Cooperate and permit samples of materials to be taken as they are used. The Contractor shall pay all costs of tests which show failure to comply with Contract Documents.

1.5 SUBMITTALS

A. Submit the following in accordance with Form 817 Article 1.20-1.05.02.

B. Submit list of all materials proposed for use, indicating:

1. Manufacturer.
2. Product name.
3. Surface for which proposed.

C. Initial Selection Samples: Submit color swatches showing complete range of colors and finishes available for each paint and finish system.

D. Verification Samples: Submit representative samples of each material that is to be exposed in the finished work, showing the full range of color and finish variations expected. Prepare paint samples on gypsum drywall or poster board and make samples not less than 12 inches square.

1.6 DELIVERY, STORAGE AND HANDLING

A. Refer to Form 817 Article 1.06.03 and Form 817 Article 1.20-1.06.03 for additional information.

B. Deliver materials and products in unopened factory labeled packages. Store and handle in strict compliance with manufacturers' instructions and recommendations. Protect from freezing and damage.

C. Avoid the possibility of fire by removing flammable materials, solvents and spirits from the project site or by storing materials in UL approved fire-resistive cabinets. Keep work area free from flammable waste and soiled rags.

1.7 PROJECT CONDITIONS

A. Weather, Temperature, and Humidity: Perform work only when existing and forecasted conditions are within the limits established by manufacturers of the materials and products used.

1. Water-Base Paints: Apply only when temperature of surfaces to be painted and surrounding air temperatures are between 50°F and 90°F, unless otherwise permitted by manufacturer's printed instructions.

2. Solvent-Thinned Paints: Apply only when temperature of surfaces to be painted and surrounding air temperatures are between 45°F and 95°F, unless otherwise permitted by paint manufacturer's printed instructions.

3. Conditions: Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds85%, or to damp or wet surfaces, unless otherwise permitted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

B. Substrates: Proceed with work only when substrate construction and penetrating work is complete. Do not apply finish in area where dust is being generated.

C. Ventilation: Comply with manufacturer's requirements and recommendations.

D. Lighting: Since lighting conditions can change the appearance of the work, work only when permanent lighting system is operational and in use. If not in use provide temporary lighting that simulates as closely as possible permanent lighting system.

E. Protection: Cover or otherwise protect finished work of other trades.

1.8 COORDINATION

A. Meeting: Convene a pre-installation meeting to establish procedures to maintain optimum working conditions and to coordinate this work with related and adjacent work.

B. Coordinate this work with work specified in other sections. Furnish information on finish materials to be used in the field to ensure that correct prime coats are used in the shop.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Except as otherwise specified, materials shall be first line products of the following manufacturers or approved equal:

1. Conventional Paint Finishes:

a. Benjamin Moore
b. ICI Devoe
c. PPG, Pittsburgh Paints
d. Sherwin-Williams

2. Special Coatings:

a. Tnemec Company
b. Dupont
c. Hempel International Coatings
d. PPG Protective & Marine Coatings, Inc. (PPG PMC)

2.2 MATERIALS

A. Products specified are as manufactured by Benjamin Moore and Company and those of Tnemec Company unless otherwise indicated; approved equal products of acceptable manufacturers listed in Paragraph 2.1 may be furnished in lieu of those listed.

1. Quality: Select primary products of the system from the products of a single manufacturer.

2. Secondary products: Products not specified by name and required for the job, such as shellac, thinners, putty, shall be "best grade" or "first Line" products of a reputable manufacturer and acceptable to the manufacturer of the paint coatings.

3. Colors: Provide colors as directed by Designer; match Designer's color chips and numbers. Custom mix colors as directed. Deep tone, bright, and accent colors will be used. Public areas of the building shall be considered decorative and will require the use of several colors and accents.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Inspection: The Applicator shall examine substrates and conditions under which this work is to be performed and notify Contractor, in writing, of conditions detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected. Beginning work means Applicator accepts substrates and conditions.

B. Responsibility: The Applicator shall be solely responsible for the finishing work and shall prepare substrates as needed to obtain the highest quality finished surfaces.

C. Manufacturer's Recommendations: Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this section.

D. Cleaning: Do not finish over dirt, rust, grease, moisture and other conditions detrimental to formation of a durable finish film. Clean surfaces to remove dirt, oil, grease, mildew, asphalt, concrete splatters, and all other foreign substances.

E. Removal and Protection: Remove finished hardware, fixtures, accessories, and similar items or provide adequate protection to ensure that these surfaces are not finished or splattered. Replace these items when finishing work is completed.

F. Shop Primers: Remove incompatible primers and reprime or provide barrier coats in compliance with finish manufacturer's instructions.

G. Not Used.

H. Ferrous Metal: Prepare shop primed metal surfaces by solvent wiping, sanding and touching-up shop prime coats. Prepare bare metal surfaces by power tool cleaning [Steel Structures Painting Council SP-3]. Remove rust, welding flux and splatter, burrs, and all other surface defects and foreign substances. Clean surfaces by washing with water followed by phosphate rinsing. Apply prime coats immediately after completion of cleaning.

I. Galvanized Metal: Aggressively clean new unprimed galvanized surfaces with grease cutting solvent, such as mineral spirits, to remove fabricating oils. After cleaning provide a SSPC SP7 brush off blast of galvanized steel surfaces to create a 2mil profile for paint adherence. Touch-up abraded surfaces immediately with zinc-rich paint or rust-inhibiting paint acceptable to the Designer.

J. Galvanized, Shop Primed Metal: Solvent clean surfaces equal to SSPC SP-1.

K. Aluminum: Solvent clean surfaces equal to SSPC SP-1.

L. Not Used.

M. Not Used.

N. Not Used.

3.2 APPLICATION

A. Manufacturer's Recommendations: Strictly comply with manufacturers' instructions and recommendations, except where more restrictive requirements are specified in this section.

B. Material Preparation: Mix and prepare materials in strict compliance with manufacturer's recommendations. Do not thin materials without Designer's approval. Keep foreign substances out of finishing materials.

C. Primers: Provide primers as recommended by finish system manufacturer for substrates encountered. Tint all primers and undercoats to the approximate shade of the finish coat, making each coat slightly darker and closer to the finished shade. Use deep base primers for deeptone, bright, and accent colors. Prime surfaces immediately after surface preparation to prevent contamination of substrate.

D. Application: Apply finish materials at the lowest coverage rates and the highest dry film thicknesses recommended by their manufacturers. Provide additional coats as needed to eliminate all show through and bleed through areas. Apply paint and finish systems as scheduled using brushes or rollers. Stain shall be applied with a brush and then wiped off at the proper time to produce the desired effect.

1. Spray Painting: Spray application of paint and finish systems is acceptable for metal doors and frames and interior steel joists, metal deck and mechanical ducts where Contractor can demonstrate adequate control of overspray, control of coats, and has first obtained Designer’s written permission.

E. Extent: Finish all surfaces behind removable items. Finish inside of ducts and grilles with flat black paint when these surfaces are visible.

F. Sanding: All painted woodwork and painted metal shall be finely sanded between coats as recommended by finish system manufacturer.

G. Recoat Time: Allow manufacturer's recommended waiting period between successive coats.

H. Finish Appearance: Provide uniform final finishes, free of runs, sags, wrinkles, streaks, shiners, brush/roller marks, color variations and other imperfections.

I. Mock-Up Matching: Provide final finishes which exactly match approved mock-ups.

J. Pipe Identification: Where exposed utility piping is required to be completely painted in code color under requirements of ANSI A13.l and ANSI Z535.l, paint such piping in proper color in accordance with aforementioned standards and as specified herein.

3.3 FIELD QUALITY CONTROL

A. Testing: The Department reserves the right to employ an independent testing agency to conduct material evaluation and application tests. The Contractor shall cooperate fully and, when requested, permit samples of materials to be taken from containers as the materials are applied to building surfaces.

B. Cost of Testing: If tests indicate that materials or work does not comply with requirements, the Contractor shall pay for tests performed, all retesting, and shall remove and replace non-complying work.

3.4 TOUCH UP, CLEANING, AND PROTECTION

A. Touch up damaged coatings and finishes to eliminate evidence of repair.

B. Clean finished surfaces and remove all finish splatters from adjacent work. Remove and replace work that cannot be successfully cleaned.

C. Provide signs and temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.

3.5 FINISH PAINTING SCHEDULE

A. The following finish systems refer to products of Benjamin Moore and the Tnemec Company, unless indicated otherwise. Provide these systems or approved equal systems from manufacturers listed in Paragraph 2.1.

1. Not Used.

2. EXTERIOR FERROUS METAL

(Surface Preparation: SSPC-SP#6)
Coat 1: Tnemec Series 394 Onmithane Zinc (shop applied) at 3.0 mils DFT touch up.
Coat 2: Tnemec Series #27 WB Typoxy at 2.5 to 3.0 mils DFT.
Coat 3: Tnemec Series 1075U Endura-Shield at 3.0 mils DFT.

6. Not Used.

7. Not Used.

8. EXTERIOR FERROUS METAL AND GALVANIZED METAL EXPOSED TO UV LIGHT

Surface Preparation for Galvanized Surfaces: SSPC-SP#1 Solvent Wipe followed by SP#7
Surface Prep for Shop Primed Ferrous Metal: SSPC-SP#1
Coat 1: Tnemec Series #27 WB Typoxy at 2.5 to 3.0 mils DFT
Coat 2: Tnemec Series 1081 Endura-Shield at 3.0 mils DFT.

9. Not Used.

10. ANTI- GRAFFITI - COATING OVER NEW CONCRETE (Exterior Locations)

Coat 1: Chemprobe 626 Dur A Pell GS at 100-125 sq. ft. per gallon
Coat 2: Chemprobe 626 Dur A Pell GS at 100-125 sq. ft. per gallon

11. OVERHEAD DECK, PIPING, DUCTWORK ETC.

Surface prep for galvanized composite acoustical deck: Clean steel deck in accordance with manufacturer's specific directions for preparation of galvanized steel deck prior to coating. Surface Prep for Shop Primed and Intermediate Coated Ferrous Metal: SSPC-SP#1

Coat 1: Tnemec Series N69 at 3.0 to 4.0 mils DFT
Coat 2: Same as coat 1.

13. Not Used.

END OF SECTION 09 91 00

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Sleeves and sleeve seals for cables.

1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-dieneterpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A. Submit the following in accordance with Form 817 Article 1.20-1.05.02.

B. Product Data: For each type of product indicated.

C. Qualification Data: For testing agency.

D. Field quality-control test reports.

E. Quality Assurance Submittals:

1. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.
2. Source quality-control test reports.
3. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

1.5 COORDINATION

A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

1.6 WARRANTY

A. Refer to Form 817 Article 1.20-1.06.08 and for additional information.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Refer to Form 817 Article 1.06.03 and Form 817 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 NON-EMERGENCY CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Southwire Company.
4. Or approved equal.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 and UL 44 for Types XHHW-2.

D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC; Type MC cable shall be allowed on and above the third floor only.

2.2 EMERGENCY CONDUCTORS AND CABLES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Raychem.
2. BICC General.
3. Or approved equal.

B. Copper Conductors: Annealed copper designed to ensure tensile strength under fire conditions.

C. Conductor Insulation: Thermoset, low smoke, zero halogen silicone rubber, with cross-linked polyolefin jacket Type RHW, listed per UL 44 or compacted refractory magnesium oxide with seamless, phosphorous deoxidized copper sheath Type MI (mineral insulated). Individual ground conductor(s) shall be provided for each circuit.

D. The conductor shall be at a minimum listed 600V, 90 degree C dry or 75 degree C wet with ampacities derived from NFPA 70 Tables 310.16, 75 degree C Column. Termination temperatures shall be rated 90 degree C.

E. Two (2) hour fire-rated per UL 2196 and UL Fire Resistance Directory either installed in conduit or in free air and meeting the requirements of an "Electrical Circuit Protective System" as referred in NFPA 70 Articles 695 and 700. Either type material shall be capable of being installed in conduit sleeves.

F. The Contractor shall install the conductor or cable in accordance to all manufacturer recommendations which include but not limited to providing all terminations, junction boxes, and fittings. Support spacing shall be at maximum five (5) foot intervals.

G. Required emergency conductors are defined in the IBC, NFPA 70, NFPA 72, and NFPA 101. Additional emergency conductors are indicated on the Contract Plans.

2.3 CONNECTORS AND SPLICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. O-Z/Gedney; EGS Electrical Group LLC.
2. 3M; Electrical Products Division.
3. Tyco Electronics Corp.
4. Or approved equal.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. All conductors shall be Stranded. S

B. Branch Circuits: Copper. All conductors shall be Stranded.S

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW, or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

B. Feeders Exposed: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW, listed UL 44 or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

C. Feeders Concealed in Ceilings, Walls, Partitions: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW for emergency circuits, listed as 2-hour fire rated when installed in conduit.

E. Branch Circuits Exposed: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

F. Branch Circuits Concealed above Acoustic Ceilings: Type XHHW or Type XHHW-2, single conductors in raceway or Type MC metal-clad listed UL 1596; Type RHW or Type MI for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW or Type XHHW-2, single conductors in raceway; Type RHW for emergency circuits, listed as 2-hour fire rated when installed in conduit or free air for Type MI.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section 26 05 29 "Hangers and Supports for Electrical Systems."

F. Identify and color-code conductors and cables according to Division 26 Section 26 05 53 "Identification for Electrical Systems."

G. Install through walls and floors according to Division 26 Section 26 05 00 “Common Work Results for Electrical”.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

A. Inspect and test conductors and cables in accordance with Form 817 Article 1.20-1.05.10 and as follows:

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors to all equipment indicated on the one-line diagram including the critical equipment.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

D. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.2 DEFINITIONS

A. RMC: Rigid Metal Conduit (also known as RGS; Rigid Galvanized Steel Conduit).

B. EMT: Electrical Metallic Tubing.

C. RNC: Rigid Nonmetallic Conduit.

D. PVC: Polyvinyl Chloride.

E. FRE: Fiberglass Reinforced Epoxy.

F. LFMC: Liquidtight Flexible Metal Conduit.

G. LFNC: Liquidtight Flexible Nonmetallic Conduit.

1.3 SUBMITTALS

A. Submit the following in accordance with Form 817 Article 1.20-1.05.02.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

C. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.

1. Custom enclosures and cabinets.

D. Coordination Plans: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

E. Quality Assurance Submittals:

1. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR - POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

2. Source quality-control test reports.
3. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.5 WARRANTY

A. Refer to Form 817 Article 1.20-1.06.08 for additional information.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Refer to Form 817 Article 1.06.03 and Form 817 Article 1.20-1.06.03 for additional information.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Anamet Electrical, Inc.; Anaconda Metal Hose.
3. Electri-Flex Co.
4. Manhattan/CDT/Cole-Flex.
5. O-Z Gedney; a unit of General Signal.
6. Wheatland Tube Company.
7. Or approved equal.

B. RMC: Galvanized Steel, ANSI C80.1, UL 6.

C. EMT: Steel, ANSI C80.3, UL 797.

D. PVC-Coated Rigid Metal Conduit:

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch, minimum.

E. LFMC: Flexible steel conduit with PVC jacket, UL 360.

F. Fittings for Conduit (Including all Types and Liquidtight), EMT and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations as indicated on the Contract Plans: Comply with UL 886.
2. Fittings for EMT: Steel, set-screw or compression type.
3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

G. Joint Compound for RMC or PVC-Coated Rigid Metal Conduit: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Electri-Flex Co.
2. Lamson & Sessions; Carlon Electrical Products.
3. RACO; a Hubbell Company.
4. Champion.
5. Or approved equal.

B. RNC: NEMA TC 2, Type EPC-80-PVC, UL 651, unless otherwise indicated.

C. FRE: Extra Heavy Wall type, all joints shall be inside tapered bell end and of even socket depth through out the raceway.

D. LFNC: UL 1660.

E. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

F. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.
4. Or approved equal.

B. Description: Sheet metal sized and shaped as indicated, UL 870, NEMA 250, Type 12 in dry locations and 3R for wet or damp locations and as defined per NFPA 70, unless otherwise indicated.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Screw-cover type or Flanged-and-gasketed type, as defined per NFPA 70, unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Hoffman.
3. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
4. Or approved equal.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, with gasketed cover.

G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

H. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

2.5 HANDHOLES AND BOXES FOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.

2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC", "COMMUNICATION, or as identified on the Contract Plans.
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. CDR Systems Corporation.
    d. Or approved equal.

C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide product by one of the following:

    a. Armorcast Products Company.
    b. Carson Industries LLC.
    c. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
    d. Or approved equal.

2.6 SLEEVES FOR RACEWAYS

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section 07 84 00 "Firestopping."

2.7 SLEEVE SEALS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. Metraflex Co.
3. Pipeline Seal and Insulator, Inc.
4. Or approved equal.

B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Exterior: Apply raceway products as specified below, unless otherwise indicated:

1. Exposed Conduit: RMC.
2. Concealed Conduit, Aboveground: RMC.
3. Concealed Conduit, Belowground: RMC or PVC. However, identified emergency and stand-by circuits shall always be in RMC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R unless otherwise indicated.

B. Interior: Comply with the following applications, unless otherwise indicated:

1. Exposed: RMC from finished grade to at least ten (10) feet above finished floor. EMT may be substituted when mounted greater than ten (10) feet above finished floor.
2. Concealed in Ceilings and Interior Walls or partitions: RMC or EMT and as identified per Codes.
3. Risers between Floors: RMC.
4. Third floor and above, EMT unless otherwise indicated.
5. Connection to Vibrating Equipment (Including but not limited to Transformers, damp or wet locations, Hydraulic, Electric Solenoid, or Motor-Driven Equipment): LFMC, below ten (10) feet from finished floor and LFNC may be substituted when above ten (10) feet from finished floor and as identified per Codes.

6. Damp or Wet Locations: RMC.

C. Minimum Raceway Size: 3/4-inch trade size.

D. Minimum Flexible Conduit Size: 1/2-inch trade size.

E. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. RMC: Use threaded rigid galvanized steel conduit fittings, unless otherwise indicated.
2. PVC Externally Coated, rigid galvanized steel conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Plans or in this Article are stricter.

B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Support raceways as specified in Division 26 Section 26 05 29 "Hangers and Supports for Electrical Systems."

E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

F. Conceal conduit within finished walls, ceilings, and floors, unless otherwise indicated. Conduits in the shop area that travel perpendicular to the roof joists shall be mounted at least ten (10) feet above finished floor.

G. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings; see architectural and structural plans for maximum anticipated expansion.
3. Change from Type EPC-80-PVC to RMC before rising above the floor.

H. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Exterior Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating grounding bushings to protect conductors, including conductors smaller than No. 4 AWG.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits travel from interior to exterior locations.
2. Where otherwise required by NFPA 70.

L. Expansion/Deflection-Joint Fittings for RNC or EMT: Install in each run of conduit that has straight-run length that exceeds 100 feet. Install additional fittings as required per NEC.

1. Install expansion-joint fittings for each of the following locations:

   a. At building expansion locations indicated on the Electrical Plans, see architectural and structural plans for maximum anticipated expansion.

2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
4. Install fitting(s) that provide deflection of at least one (1) inch for each 100 foot run.

M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Issuance of Certificate of Compliance.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

SECTION 26 51 00 – INTERIOR LIGHTING – PLATFORM CANOPY AND STAIRS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Luminaires, lamps,
2. Luminaire supports.

1.2 DEFINITIONS

A. BF: Ballast factor.

B. CRI: Color-rendering index. C.

CU: Coefficient of utilization.

D. HID: High-intensity discharge.

E. LER: luminaire efficacy rating.

F. Luminaire: Complete Luminaire, including ballast housing if provided.

G. RCR: Room cavity ratio.

H. FC: Footcandles.

I. IES: Illuminating Engineering Society

1.3 SUBMITTALS

A. Submit the following :

B. Product Data: For each type of luminaire, arranged in order of luminaire designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire including dimensions.
2. Energy-efficiency data.

3. Life, lumen output, and energy-efficiency data for lamps.
4. Photometric data, in IES format, based on laboratory tests of each luminaire type, outfitted with lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.

    a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by the manufacturer.
    b. Photometric data shall have been performed within the last three (3) years from Contractor notice to proceed.
    c. Provide an IES formatted file for each type of luminaire submitted; this IES file shall have been prepared by an independent testing agency within the last three (3) years from Contractor's Notice to Proceed. Data to be provided in hard copy and in electronic format on a CD-ROM.

C. Shop Drawings:
1. Show details of nonstandard or custom luminaires. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

2. Wiring Diagrams: Power and control wiring.

D. Samples for Verification: Luminaires designated for sample submission in Luminaire Schedule are to be provided in 120-volt and 277-volt for sample review only. Each sample shall include the following:

1. Lamps: Specified units installed.
2. Accessories: Cords and plugs.

E. Product Certificates: For each type of ballast for non-dimmer and dimmer-controlled luminaires, signed by product manufacturer.

F. Qualification Data: For agencies providing photometric data for luminaires.

G. Field quality-control test reports.

H. Operation and Maintenance Data: For lighting equipment and luminaires to include in emergency, operation, and maintenance manuals.

I. Warranties: Special warranties specified in this Section.

1.4 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

E. FMG Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

F. Mockups: Provide luminaires for room or module mockups, complete with power and control connections.

1. Obtain Lighting Designer's approval of luminaires for mockups before starting installations.
2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
3. Approved luminaires in mockups may become part of the completed Work if undisturbed at time of issuance of Certificate of Compliance.

1.5 COORDINATION

A. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.6 WARRANTY

A:. Warranty Period for Luminaires: Manufacturer's standard form, made out to the Department and signed by the luminaire manufacturer agreeing to replace luminaire components, , that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, with the warranty period indicated below.

1. Warranty Period: 5 years from date of issuance of the Certificate of Compliance

1.7 SPARE PARTS

A. Furnish to the Department spare parts described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: The design and installation for each luminaire is based on the product named. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the manufacturers specified. Any manufacturers making a submission are responsible for making the necessary revisions to insure the luminaires can be mounted as shown in the drawings, otherwise all changes will be the responsibility of the Contractor.

2.2 LUMINAIRES AND COMPONENTS, GENERAL REQUIREMENTS

A. A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. Bulb shape complying with ANSI C79.1.
Lamp base complying with ANSI C81.61 or IEC 60061-1.
CRI of 80. CCT of 3000 K.
Rated lamp life of 50,000 hours.

D. Remote driver.

E. Nominal Operating Voltage: 120 V ac.
Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

F. Housings: (Wet location and gasketed)

1. Die-cast -aluminum housing and heat sink.
2. Powder-coat finish.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. The electrical contractor is responsible for providing all mounting hardware required for properly mounting and wiring the luminaires in their respective location or locations.

2.6 The Contractor shall provide complete photometric data with a point-by-point illuminance calculation and IES file in accordance with the recommendations of IES and the criteria listed with each type luminaire; the more stringent of IESNA or criteria listed with each type luminaire shall be provide.

2.7 REQUIREMENTS FOR INDIVIDUAL LUMINAIRES

The Contractor shall select Type "H" and Type "EM" LED fixtures as identified on the plan sheets.

Type H Fixture, Equal to : Spectrum Lighting : SJ2LEDGV 27L 35K DS10 1 FJ2 WH2 WL CP106 GW

Type EM Fixture, Equal to Hubbell Dual-Lite Geopak RDI1 3K U WH EH

2.8 EXAMINATION

A. Examine elements and surfaces to luminaires, hanging systems, trims, etc. for compliance with installation tolerances, required clearances and other conditions affecting performance.

2.9 INSTALLATION

A. Luminaires: Set level, plumb, and square with ceilings and walls. Install LED lamps in each luminaire.

2.10 FIELD QUALITY CONTROL

Perform tests and inspections and prepare test reports.

B. Test for Emergency Lighting: The Contractor shall notify the Designer, at least fourteen (14) days in advance, of the proposed testing date. The emergency lights shall be tested after dusk in the presence of the Designer and remain operational for at least one-hundred twenty (120) minutes. The test shall be acceptable to the Designer; if not, the Contractor shall provide additional testing at no additional cost to the Contract. Interrupt normal power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00