



**STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION**



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NEWINGTON, CONNECTICUT 06131-7546**

Phone: 860-594-3129

Subject: Project Nos. 310-0056 & 310-0057
Branford & Guilford: Construction of Branford & Guilford Railroad Stations,

October 2, 2012

NOTICE TO CONTRACTORS:

This is to notify all concerned and especially the prospective bidders that the bid opening for the subject project was previously postponed to October 17, 2012 at 2:00 P.M. in the Conference Room of the Department of Transportation Administration Building, 2800 Berlin Turnpike, Newington, Connecticut.

Addendum No. 1 is attached and can also be obtained on the Statewide Contracting Portal at http://www.biznet.ct.gov/scp_search/BidResults.aspx?groupid=64

This addendum is necessary to add, revise and delete Special Provisions, Contract Items, Plan Sheets, and to respond to questions asked on the subject project.

Bid Proposal Forms (0310-0056.EBS file and amendment file 0310-0056.00# if applicable) are available for those bidders that have received approval from the Department to bid on the subject project.

The Department has established a general mailbox to receive contractor questions. Please send all future questions to DOTContracts@ct.gov

Philip J. Melchionne

For: Gregory D. Straka
Contracts Manager
Division of Contracts Administration

OCTOBER 2, 2012
BRANFORD RAILROAD STATION AND GUILFORD RAILROAD STATION
FEDERAL AID PROJECT NOS.N/A
STATE PROJECT NOS. 310-56 & 310-57
TOWNS OF BRANFORD AND GUILFORD

ADDENDUM NO. 1

SPECIAL PROVISIONS
NEW SPECIAL PROVISIONS

The following Special Provisions are hereby added to the Contract:

- NOTICE TO CONTRACTOR – AMTRAK LEASE AGREEMENT
- ITEM NO. 0204213A – HANDLING CONTAMINATED GROUNDWATER

REVISED SPECIAL PROVISIONS

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

- NOTICE TO CONTRACTOR – FORM 816 REFERENCES ON STANDARD DRAWINGS.
- NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT
- ITEM NO. 0601651A – RETAINING WALL (SITE NO. 1)
- ITEM NO. 0601652A – RETAINING WALL (SITE NO. 2)
- ITEM NO. 0601653A – RETAINING WALL (SITE NO. 3)
- ITEM NO. 0728032A – NO. 6 CRUSHED STONE

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

- SECTION 050310 – THERMAL SPRAY METALLIZING AND SEALER COATS
- SECTION 088000 – GLAZING

DELETED SPECIAL PROVISIONS

The following Special Provisions are hereby deleted in their entirety:

- NOTICE TO CONTRACTOR – DEMOLITION AND HAZARDOUS MATERIALS ABATEMENT
- ITEM NO. 0101111A – SECURING, CONSTRUCTION AND DISMANTLING OF WASTE STOCKPILE AREA (SITE NO. 1)
- ITEM NO. 0913950A – PROTECTIVE FENCE (CHAIN LINK)

CONTRACT ITEMS

NEW CONTRACT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>UNIT</u>	<u>QUANTITY</u>
<u>0204213A</u>	<u>HANDLING CONTAMINATED</u> <u>GROUNDWATER</u>	<u>LS</u>	<u>LS</u>
<u>0653001</u>	<u>CLEAN EXISTING CATCH BASIN</u>	<u>EA.</u>	<u>2 EA</u>
<u>0653100</u>	<u>CLEAN EXISTING CULVERT-12" –</u> <u>42" DIAMETER</u>	<u>LF</u>	<u>75 LF</u>
<u>0714026A</u>	<u>TEMPORARY SHEET PILING</u> <u>(RAILROAD)</u>	<u>SF</u>	<u>930 SF</u>
<u>0715021A</u>	<u>SHEET PILING MATERIAL LEFT IN</u> <u>PLACE (RAILROAD)</u>	<u>SF</u>	<u>645 SF</u>

DELETED CONTRACT ITEMS

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>ORIGINAL</u> <u>QUANTITY</u>	<u>REVISED</u> <u>QUANTITY</u>
<u>0101111A</u>	<u>SECURING CONSTRUCTION AND</u> <u>DISMANTLING OF WASTE</u> <u>STOCKPILE AREA (SITE NO. 1)</u>	<u>LS</u>	<u>0</u>
<u>0913000</u>	<u>REMOVE CHAIN LINK FENCE</u>	<u>300 LF</u>	<u>0</u>
<u>0913950A</u>	<u>PROTECTIVE FENCE (CHAIN LINK)</u>	<u>650 LF</u>	<u>0</u>

PLANS

NEW PLAN

The following Plan Sheet is hereby added to the Contract:

02.03.047-1.A1

REVISED PLANS

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

- 01.02.A1
- 02.02.A1
- 01.03.078.A1
- 01.03.079.A1
- 01.03.092.A1
- 01.03.099.A1
- 01.03.104.A1
- 01.03.110.A1
- 01.03.114.A1
- 01.03.115.A1
- 02.03.006.A1
- 02.03.022.A1
- 02.03.035.A1
- 02.03.037.A1
- 02.03.038.A1

QUESTIONS & ANSWERS

1. Q: For the project of “Construction of Branford & Guilford Railroad Stations” in the final specs on page 269, ITEM#0913857A, Vehicle Barrier Gate, does this gate need to be crash rated?

A: ITEM#0913857A, VEHICLE BARRIER GATE, does not need to be crash rated.

2. Q: The second Notice To Contractor - Environmental Investigations section states that contaminated groundwater is to be collected and disposed off-site per Item #0204210A. This Item is not in the specification.

A: ITEM NO. 0204213A – HANDLING CONTAMINATED WATER is hereby added as a New Contract Item in this Addendum. The Bid Proposal Form has been revised to reflect this change.

3. Q: Branford Drawing S-101 (sic), Note F-4, In the event groundwater is encountered during the execution of foundation work the cost of pumping and dewatering operations shall be included in contractors bid price. Please provide a Bid item and specification.

A: The cost for all pumping and dewatering operations shall be paid for under ITEM NO. 0204213A – HANDLING CONTAMINATED WATER, hereby added as a New Contract Item in this Addendum. The Bid Proposal Form has been revised to reflect this change. The note appears on S-001.

4. Q: Branford Drawing S-201, Detail Section at Column has note for sheeting left-in-place and sheeting/shoring with-in railroad embankment line. Please provide a Bid item and specification.

A: ITEM #0714026A – TEMPORARY SHEET PILING (RAILROAD) and ITEM #0715021A – SHEET PILING MATERIAL LEFT IN PLACE (RAILROAD) are listed in the Special Provisions. Section 02261A – REQUIREMENTS FOR TEMPORARY SHEETING AND SHORING TO SUPPORT AMTRAK TRACKS is listed in the CSI Specifications. Detail call-out for Sheeting / Shoring on Sheet No. 01.03.104 (Dwg. S-201) has been removed. Plan Sheet No. 01.03.104 (Dwg. S-201) is hereby revised in this addendum.

5. Q: Guilford Drawing S-201, Detail Section at Column has note for sheeting left-in-place and sheeting/shoring with-in railroad embankment line. Also note for Temporary sheet piling (Railroad) and sheet piling material left in place (Railroad). Please provide a Bid item and specifications.

A: ITEM #0714026A – TEMPORARY SHEET PILING (RAILROAD) and ITEM #0715021A – SHEET PILING MATERIAL LEFT IN PLACE (RAILROAD) are listed in the Special Provisions. Section 02261A – REQUIREMENTS FOR TEMPORARY SHEETING AND SHORING TO SUPPORT AMTRAK TRACKS is listed in the CSI Specifications. The Bid Proposal Form has been revised to reflect this change.

6. Q: Will the Department be providing a copy of the Task 210 environmental reports prior to the Bid Date?

A: Copies of the Task 210 reports can be obtained directly from the CTDOT website under Contractor Resources – Construction Bidding & Contracts Page – Environmental Reports at: <http://www.ct.gov/dot/cwp/view.asp?a=2288&Q=462836&PM=1>

7. Q: Is there a detail of the logo referenced on Detail A-A-100?

A: The detail will be provided during construction. Referenced detail (A-A-100) is on Sheet A-300.

8. Q: Glass Specification 088000 makes reference to both ultra-clear glass (2.2B) and self-cleaning glass (2.2D). Laminated glass type 2.10 makes reference to ultra-clear only. Please confirm self-cleaning glass is not required.

A: Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass as identified in Specification Section 08800, 2.2D is not required. Specification Section 08800 – GLAZING is hereby revised and re-issued as part of this Addendum.

9. Q: 088000 2.4 A thru D specifies fire rated glazing. The only fire rated glazing we see is for doors 100 N and S at the Branford Station.

a. Please advise the location of any other fire rated glazing required.

A: a: There are no other locations for fire rated glazing.

b. Please confirm 2.4 B would be the glass used for the doors.

A: b: 2.4B Monolithic Ceramic Glazing shall be used for the Fire Rated doors 100N and 100S.

10. Q: Regarding the Guilford Station plans, the site plan on sheet 02.03.006 shows a Protective Fence to be installed between the tracks. The limits of the fence are not shown. Also I cannot find a detail for the fence. The Schedule of Items has Protective Fence 650 I.f. Item 0913950.

A: Reference on Sheet 02.03.006 for Protective Fence installed between the tracks has been removed. Sheet No. 02.03.006 (Dwg. No. C-105) is hereby revised and re-issued as part of this Addendum. Special Provision ITEM NO. 0913950A - PROTECTIVE FENCE (CHAIN LINK) has been deleted in its entirety as part of this Addendum. This Item No. was removed from the estimate prior to bidding. Any other reference to ITEM NO. 0913950A - PROTECTIVE FENCE (CHAIN LINK), whether that is graphical or noted, shall not be deemed part of this contract.

11. Q: Contract drawing 01.03.092, Note F-1 refers to a geotechnical report dated April 12, 2011 which is considered to be part of the construction documents. Where is this report available?

A: A copy of the Geotechnical Report can be obtained directly from the “State Contracting Portal Solicitation Details” for Project #s 310-0056/0057, under the documents section. Please

note the Final Geotechnical Report is dated April 14, 2011. Plan Sheet No. 01.03.092 (Dwg No. S-001) is hereby revised in this Addendum.

12. Q: Contract drawing 02.03.035 gives the elevation for the bottom of the new and existing footings as elevation 6'-6". Is this elevation referenced to the top of the rail as 0'-0" or to NGVD 1929? If it is referenced to the top of the rail should it be preceded by a minus sign? If it is referenced to NGVD 1929 what is the relationship between the two datums?

A: On Contract Drawing 02.03.035 (Dwg. No. S-100), Platform Foundation Plan Note #6 indicates the Bottom of Existing Foundation is based on NGVD 1929. The 6'-6" elevation is based upon the existing conditions determined at the west side of Column Grid 1N, +/-4'-0" (to be verified in field). Sheet No. 02.03.035 (Dwg. No. S-100) and Sheet No. 02.03.038 (Dwg. No. S-201) are hereby revised in this Addendum.

13. Q: Contract drawing 02.03.038, Note 3 refers to the special provision "Temporary Sheet Piling (RR)" and "Sheet Piling Material Left in Place (RR)". The contract documents do not contain these special provisions nor does the proposal include the corresponding items. Please advise.

A: ITEM #0714026A – TEMPORARY SHEET PILING (RAILROAD) and ITEM #0715021A – SHEET PILING MATERIAL LEFT IN PLACE (RAILROAD) are listed in the Special Provisions. Section 02261A – Requirements for Temporary Sheeting and Shoring to Support Amtrak Tracks is listed in the CSI Specifications.

14. Q: Contract drawing 02.03.038, Note 6 states "Refer to civil drawings for horizontal limits of sheet piling". On which civil drawing is these limits indicated?

A: Note 6 has been deleted and Sheet No. 02.03.038 (Dwg. No. S-201) is hereby revised in this Addendum.

15. Q: Contract drawing 02.03.038, section 1/S-100 and 1/S-101 has a note depicting the vertical limits for "Temporary Sheet Piling (RR)" and "Sheet Piling Material Left in Place (RR)" as (varies- refer to profiles). Where in the contract documents are the profiles shown?

A: Profiles are not provided. Sheet No. 02.03.038 (Dwg. No. S-201) is hereby revised in this Addendum.

16. Q: Are the existing contours that are shown on sheet C 107 at the passenger drop-off driveway representative of the actual conditions or are they representative of the condition prior to the parking lot expansion project recently completed?

A: The survey is a compilation of the original station survey and data that was updated following the recent construction of the North tower and partial platform and the parking area. To the best of our knowledge, these contours are accurate and up to date.

17. Q: Bid item # 0101111 calls for a waste stockpile for site no. 1 as shown on the plans. I cannot find a TWSA for the Branford site. Please review.

A: There is no TWSA for the Branford site. Bid Item #0101111 for Project No. 310-0056 is hereby removed in its entirety from the Contract as part of this Addendum.

18. Q: Are the reset of the gate valve & water meter at Guilford to be included in bid item # 1700001?

A: All utility work outside the Vertical Construction Limits of the platform, stairs, and towers shall be paid for as an estimated cost under ITEM #170001A – SERVICE CONNECTIONS (ESTIMATED COST). The Vertical Construction Limits is now defined in NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT, is hereby revised in this Addendum.

19. Q: In the notice to contractor about demolition & hazardous material abatement there is a mention of abatement in the Westbrook Maintenance garage. Can we assume this is left over from the Westbrook project?

A: NOTICE TO CONTRACTOR – DEMOLITION & HAZARDOUS MATERIALS ABATEMENT is hereby removed in its entirety from the Contract as part of this Addendum.

20. Q: The notice to contractor about the use of state property may include environmental testing at the contractor's expense. Can I assume we are only responsible for this if we contaminate the site?

A: The State will evaluate the contractor's intended use of the property. Should the State determine that the intended use could pose a risk of contamination; the State will direct the contractor to perform environmental baseline testing before allowing use. At the completion of the contractor's use of the property, supplemental testing performed by the contractor will determine if the contractor contaminated the property. The contractor would then be responsible for remediation of any contamination that it caused as a result of its operations on the site.

21. Q: Will there be a unit price for sedimentation control?

A: Sediment Control shall be paid for under ITEM #0219001 – SEDIMENTATION CONTROL SYSTEM on a linear feet basis.

22. Q: Will there be a unit price for sheet piling and sheet piling material left in place?

A: ITEM #0714026A – TEMPORARY SHEET PILING (RAILROAD) and ITEM #0715021A – SHEET PILING MATERIAL LEFT IN PLACE (RAILROAD) are listed in the Special Provisions. Section 02261A – Requirements for Temporary Sheeting and Shoring to Support Amtrak Tracks is listed in the CSI Specifications.

23. Q: Can you clarify the difference between items 0913000 Removal of existing fence & 0201013 Removal of existing fence?

A: All quantities should be listed under ITEM NO. 0201013 REMOVAL OF EXISTING FENCE. ITEM NO. 0913000 REMOVE CHAIN LINK FENCE is hereby deleted in its entirety from the Contract as part of this Addendum. This includes the chain link fence at Guilford and the VA Rail Fence at Branford.

24. Q: Can you clarify the limits of the foul line? There is some discrepancy on the drawings. Will we be able to work outside of 15 feet during regular hours on both projects?

A: Note #6 on Sheet No. 01.03.026 provides the limits of the foul line that contractor is required to establish prior to the start of work. Refer to NOTICE TO CONTRACTOR – WORK ON RAILROAD PROPERTY, for established hours of construction operations when working directly over or adjacent to the operating right-of-way. Work outside the foul line limits is allowed during regular hours at both sites.

25. Q: Under which pay item should we account for the fill required under the access road and turnaround at the Branford North Platform?

A: Fill material shall be paid for under ITEM # 0207003 BORROW.

26. Q: Are there any foundation details for the bike shelter in Guilford?

A: Sheet No. 02.03.047-1.A1 (Dwg. No. S-404) is hereby added to the Contract as part of this Addendum.

27. Q: Please clarify or elaborate further on what work is allowed during normal daytime hours. Under The Notice To Contractor- Work on Railroad Property, the Contractor is advised that all operations directly over or adjacent to the operating right-of-way shall be performed at night. What is considered adjacent to the right-of-way? Can any work pertaining to the loading platforms or stair towers be performed during daytime hours?

A: Unless otherwise authorized by the Railroad, work that is allowed during normal daytime operations would include work not directly over and adjacent to the operating right-of-way. Adjacent to the operating right-of-way means any work performed within Amtrak property lines. Any work pertaining to the loading platforms or stair towers is considered operations adjacent to the operating right-of-way.

28. Q: Please advise where the WSA is located for the Branford site only. Provide construction details as well.

A: There is no TWSA for the Branford site. Bid Item #0101111A – Securing, Construction and Dismantling of Waste Stockpile (Site No. 1) for Project No. 310-0056 is hereby removed in its entirety from the Contract as part of this Addendum.

29. Q: On Drawings S-100 and S-101 the bottom of mat elevations shown for the North Tower and the North Platform are such that they will not be 4'-0" (min) below finished grade as specified on drawings S-201. Please advise.

A: Details 1 and 2 on Sheet No. 02.03.038 (Dwg. No. S-201) have been revised to match Note #7 on the same page. The note indicates the bottom of footing must be a minimum of 3'-6" below finished grade. A bottom of mat elevation of +8.5' will allow for the 3'-6" minimum depth. Sheet No. 02.03.038 (Dwg. No. S-201) is hereby revised in this Addendum.

30. Q: Item # 0601651-653A lists Doublewal Corporation at 7 West Main Street, Plainville, CT as an acceptable alternate for the Modular Retaining Walls on the project. The patent rights to produce this product now resides with United Concrete Products of Wallingford, CT. Does the Doublewal product remain and acceptable alternate.

A: Acceptable alternates list has been revised and Special Provision ITEM #s. 0601651A – RETAINING WALL (SITE NO. 1), 0601652A – RETAINING WALL (SITE NO. 2), and 0601653A – RETAINING WALL (SITE NO. 3) are hereby revised in this Addendum.

31. Q: Item # 0728032A- No. 6 crushed stone, under method of measurement says the work will be measured for the payment by the actual number of cubic feet of No. 6 crushed stone. The item basis of payment is in cubic yards. Should the method of measurement be changed?

A: Special Provision ITEM # 0728032A – NO. 6 CRUSHED STONE is hereby revised in this Addendum.

32. Q: On Drawing S-206, Section (1/S-102) states to refer to drawing S-100 for sizes and location of Micropiles. On Drawing S-206, section (2/S-102) states to refer to drawing S100 for sizes and locations of APG piles. Drawing S-100 shows locations and depths of all piles yet fails to designate which are Micropiles and which are APG. Furthermore the only detail for Micropiles is actually that of APG piles as shown on S-207. Please show details for Micropiles, as well as the locations of both the APG piles and the Micropiles.

A: APG piles are not being used on this project and references to them have been revised to indicate Micropiles. Sheet No. 01.03.110 (Dwg. No. S-207) has been revised to show details for Micropiles and is hereby in this Addendum. Per section 9.2 of the geotechnical report, the contractor's engineer is responsible for the design and detailing of micropiles.

33. Q: Ref. dwg C-503 CIP Parapet is not fully designed. It is only upper half is detailed.

A: The gutter line fabricator of the proprietary wall system chosen is responsible for the design of the wall and parapet. Special Provision Description has been revised to include parapet and Special Provision ITEM #s. 0601651A – RETAINING WALL (SITE NO. 1), 0601652A – RETAINING WALL (SITE NO. 2), and 0601653A – RETAINING WALL (SITE NO. 3) are hereby revised in this Addendum.

34. Q: I do not find detailed CIP retaining wall design anywhere. The dwg C-503 shown options for modular and segmented designs. Is there any option for CIP concrete retaining wall mentioned for ret. Walls 1, 2, and 3?

A: No option for CIP concrete retaining walls was provided on this project.

35. Q: Ref. dwg 3/S-102. The extent of 2” cone topping to be clarified. Is it between cols 14N to 16N or up to 18N?

A: Per Detail 2/S-102 on Sheet No. 01.03.108 (Dwg. No. S-205) and Detail 3/S-102 on Sheet No. 01.03.109 (Dwg. No. S-206), the 2” concrete topping is 7” beyond column 15N (flush to inside of elevator pit) to 1’-0” beyond column 16N.

36. Q: Guilford ref. dwg S-100. What is elevation of top of rail (0’-0”) in NGVD 1929 terms:

A: Top of Rail elevation changes along rail. Top of Rail reference at 0’-0” is an Architectural Datum line for constructing the platforms at 4’-0” above Top of Rail for the full platform length and shall not be construed as a given spot elevation.

37. Q: Please direct us to the location for the detail prints for items below;

- | | | | |
|----------------|---|--------|------|
| • 0670 0913043 | 8’ Polyvinyl Chloride Chain Link Fence | 825.00 | l.f. |
| • 0680 0913857 | Vehicle Barrier Gate (see special prov.) | 1.000 | each |
| • 0690 0913950 | Protective Fence - Chain Link (see special prov.) | | l.f. |

A: The CTDOT Highway Standard Drawing HW-913_01 detailing the 8’ high PVC Chain Link Fence was included in the bid set for both Branford and Guilford. A detail of the Vehicle Barrier Gate is not provided. The Contractor shall submit shop drawings based on the special provision ITEM #0913857A – VEHICLE BARRIER GATE for approval by the Engineer during construction. ITEM #0913950A – PROTECTIVE FENCE – CHAIN LINK has been removed from the contract as part of this Addendum.

38. Q: NTC-Environmental Investigations states that there is a contaminated groundwater AOEC at the Branford site. How is the contractor compensated for treating this water? I see no pay item to cover this work.

A: ITEM NO. 0204213A – HANDLING CONTAMINATED WATER (L.S.) is hereby added as a New Contract Item in this Addendum. The Bid Proposal Form has been revised to reflect this change.

39. Q: My bid quantity does match the proposal quantity. I count 115 micropiles on Sheet S-100 and the proposal schedule of items (Item 470) says there are 129 micropiles. What is the correct quantity?

A: The correct quantity is 129 micropiles. The Table provided on Sheet No. 01.03.110 (Dwg. No. S-207) is hereby revised and re-issued as a part of this Addendum.

40. Q: Are the micropiles in the north tower mat footing supposed to be Type I or Type III? It is difficult to tell.

A: The types of piles for each location are listed in the Pile Foundation Type Schedule located at the bottom, middle of Plan Sheet No. 01.03.094 (Dwg. No. S-100). Refer to revised Table on Plan Sheet No. 01.03.110 (Dwg. No. S-207) for Quantities, hereby revised in this Addendum.

41. Q: The foundation plan and specification talk about micropiles but drawing 1/S-207 shows an auger pressure grouted pile. Is it the intent to use a 12-inch auger grouted pile or 8-inch micropile?

A: APG piles are not being used on this project. The details on Sheet No. 01.03.110 (Dwg. No. S-207) have been revised to show Micropiles and this sheet is hereby in this Addendum. While the intent is to use 12” micropiles, Section 9.2 of the geotechnical report, the contractor’s engineer is responsible for the design and detailing of micropiles.

42. Q: Detail 1/S-207 does not show any permanent casing for the micropiles. Is permanent casing required? If so, how long.

A: Permanent casing is required for the Micropiles. The Details on Sheet No. 01.03.110 (Dwg. S-207) have been revised to show the casing and this sheet is hereby reissued as part of this Addendum. Contractor’s engineer shall determine the permanent casing length per Section 9.2 of the Geotechnical Report. However, the Geotechnical Report recommends that the drill casing be left in place through the Fill and Swamp deposits (estimated bottom of these deposits is approximately EL. -14ft) to maintain the borehole integrity during construction; thus eliminating potential collapsing, squeezing of weak soils, and/or loss of ground. The down drag analysis and the forces noted in the table on Sheet No. 01.03. 110 (Dwg. No. S-207) have been determined using the recommended permanent drill casing length.

43. Q: Please confirm the following on the insurance specifications:

- Builders Risk 100% Replacement Cost
- Flood Insurance - \$10,000,000 minimum limits
- Equipment Breakdown - 50% of Contract Cost - Not Equipment Values

A: The Department will not be revising Section 1.03 – Award and Execution of Contract.

44. Q: What is the glass thickness for the Hope's Steel windows specified, and the color or tint for this glass?

The specs indicate mark ups for insulated and laminated glass, but no thickness or indication of clear or tinted, low e, etc.

A: Glazing thickness is based on performance requirements called out in the specifications and depends on the manufacturer meeting those requirements. The thickness may vary depending on the manufacturer selected by the contractor, but must meet any indicated thicknesses as a minimum as well as meeting the performance requirements. All laminated glazing must provide safety glazing labeling markings as specified in ANSI Z97.1, shall be present on each separate piece of glass and shall remain visible after installation. Window Type W1, W2 and W10A shall be laminated, frosted glazing. CSI Specification 088000 and Sheet No. 01.03.078 (Dwg. No. A-601) and Sheet No. 01.03.079 (Dwg. A-602) are hereby revised in this Addendum.

45. Q: According to S-105 it calls out 5/8" T&G Plywood for the roof sheathing at the canopy. A-300 notes 1x6 T&G roof sheathing. Please clarify what materials to price?

A: The material to be installed is 1x6 T&G, V-Groove roof sheathing. The call-outs on Sheet No. 01.03.099 (Dwg. No. S-105) and Sheet No. 02.03.037 (Dwg. No. S-102) are revised in this Addendum.

46. Q: 061063 - Specs for the rafters and sheathing materials call for Fire-Retardant. Is this correct?

A: Yes the sheathing materials should be Fire-Retardant as indicated in CSI Specification Section 061063 Exterior Rough Carpentry.

47. Q: Glass specification 088000 makes reference to ultra clear glass [2.2B] and self cleaning glass [2.2D]. Please confirm that both of these are required.

A: Ultra-clear Float Glass [2.2B] is required per specification. Pyrolytic-Coated, Self-Cleaning, Low-Maintenance Glass [2.2D] is not required. Specification Section 08800 is hereby revised in this Addendum.

48. Q: You have a pay items for "ITEM #0063521A – RAIL FACILITY UPGRADE SITE NO. 1" and "ITEM #0063522A – RAIL FACILITY UPGRADE SITE NO. 2", which one is the Guilford Station and which is the Branford?

A: SITE NO. 1 refers to Branford Station and SITE NO. 2 refers to Guilford Station.

49. Q: There are Emergency Phones shown on the Branford site with power only. Will there need to be a voice connection to these units?

A: Contractor shall refer to Key Notes #6 and #7 on Sheet 01.03.134 (Dwg. No. ES-101).

The Bid Proposal Form has been revised to 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 – AMTRAK LEASE AGREEMENT

This project requires a Lease Agreement between the State of Connecticut and the National Passenger Rail Corporation.

The Contractor will not be able to apply for an Amtrak “Temporary Permit to Enter Upon Property” nor perform work on Amtrak Property until the Lease Agreement is in place.

Bidders are hereby notified of this condition of the contract.

ITEM #0204213A - HANDLING CONTAMINATED GROUNDWATER

Description:

Under this Item, the Contractor shall manage, treat, and dispose of contaminated groundwater that may be generated during dewatering operations associated with Project work.

The Contractor shall furnish, install, and operate a coordinated system that provides for the temporary containment of contaminated groundwater encountered during construction operations. After temporary containment, the Contractor shall transport contaminated groundwater to the Contractor-selected and Department-approved disposal facility and off-load transported liquids at said facility.

The contamination is documented in the report listed in the “Notice to Contractor – Environmental Investigations”. The Contractor shall be responsible for designing, procuring, installing, operating, cleaning, decontaminating, and dismantling the temporary groundwater containment system.

This Item does not apply to the possible diversion of existing storm water flow around the construction site during Project activities. Diversion of existing storm water or surface flows shall be completed in accordance with the Contract and all applicable permits.

Construction Methods:

1. Contractor Submittals

(A) Temporary Containment Tanks and Transport

The Contractor shall submit for the Engineer’s review and approval, the proposed system of Handling Contaminated Groundwater. Such system shall not release contaminated groundwater into the environment. This submittal shall include schematics of proposed pump set-ups in excavations, sedimentation controls, probable location(s) of temporary containment tank(s), schematics of proposed method to transfer groundwater from temporary containment tank(s) to transport vehicles, schematic of proposed method to off-load groundwater at the disposal facility, and documentation that transport vehicles are permitted to haul the contaminated liquids.

This work shall require the services of a subcontractor who shall hold a “Waste Transportation Permit” per CGS 22a-454. This subcontractor shall provide leak-free containment tanks, for temporary containment of groundwater from dewatering activities and shall also provide and operate pumps, hoses, transport vehicles (e.g. vac trucks or bulk tanker trucks) and safety equipment to transfer groundwater from the temporary containment tanks to the disposal facility. The contractor shall use one of the following disposal facilities for

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the disposal of contaminated groundwater:

United Oil Recovery, Inc.
136 Gracey Avenue
Meriden, CT 06451
(888) 276-0887

Bridgeport United Recycling, Inc.
50 Cross Street
Bridgeport, CT 06610
(888) 276-0887

Clean Harbors of Connecticut, Inc.
51 Broderick Road
Bristol, CT 06010
(860) 583-8917

The Engineer will sample the contaminated water in the holding tanks as required by the disposal facility. The Engineer shall furnish the Contractor with copies of the analytical results for submittal to the disposal facility. The Contractor is hereby notified that laboratory turnaround time is expected to be fifteen (15) working days. Turnaround time is the period of time beginning when the Contractor notifies the Engineer that the containment tank is ready for sampling and ending with the Contractor's receipt of the laboratory analytical results. Any change of intended disposal facility may prompt the need to resample and will therefore restart the time required for laboratory turnaround. The laboratory will furnish such results to the Engineer. Upon receipt, the Engineer will make available to the Contractor the analytical results. **No delay claim will be considered based upon the Contractor's failure to accommodate the laboratory turnaround time as identified above.**

The Contractor shall obtain and complete all paperwork necessary to arrange for contaminated water disposal, including disposal facility waste profile sheets or similar forms. It is solely the Contractor's responsibility to coordinate the disposal of contaminated water with its selected disposal facility(s). Upon receipt of the final approval from the facility, the Contractor shall arrange for the loading, transport, and disposal of the water in accordance with all Federal and State regulations. **No delay claim will be considered based on the failure of the Contractor's disposal facility(s) to meet the Contractor's production rate.**

All manifests that accompany the transportation of the contaminated water shall be prepared by the Contractor and signed by an authorized Department representative, as Generator, for each load that leaves the site. The Contractor shall forward the appropriate original copies of all manifests to the Engineer the same day the water leaves the Project site.

The temporary containment shall be leak-free containment tanks (e.g. Baker Tanks, Highland Tanks, or Manufacturing brand tanks). The temporary containment tanks shall be sized to contain the total discharge from the groundwater collection and removal sump for a sufficient amount of time to prevent settleable solids from exiting. Such tanks shall be emptied when the tank is two-thirds full.

No claim for delay, request for additional time, or request for additional design costs

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for the system will be considered based upon the Contractor's failure to design a system to meet this performance specification.

2. System Operation

The Contractor shall operate the dewatering equipment at a rate that removes the groundwater that naturally infiltrates the excavation. The Contractor shall not cause a hydraulic gradient that draws groundwater into the excavation at an excessive rate.

It is anticipated that this work may involve specialty services and/or proprietary products.

All equipment associated with this Item shall arrive at the Project site decontaminated, at no cost to the State. The equipment shall be decontaminated, as directed by the Engineer, before it leaves the Project site.

If the sediment level in any tank or other containment vessel used to contain contaminated groundwater from dewatering activities exceeds 20 inches, the tank or containment vessel shall be cleaned. The Contractor shall bring such sediments to a temporary stockpile area for characterization by the Engineer.

Method of Measurement:

Measurement for work and materials involved with contaminated groundwater handling will include: all equipment, materials, tools and labor incidental to removal of the contaminated groundwater from the excavation, conveying groundwater from the dewatering point to the temporary containment tank(s), disposal of dewatering fluids (including transportation as necessary), and final equipment decontamination. This shall also include the initial design of the system, but not any additional design that may become necessary due to the Contractor's failure to meet this performance specification. There will be no direct payment for implementing methods to limit the volume of groundwater.

The measurement for payment under this Item will be in accordance with the terms and conditions in Article 1.09.04 - Extra and Cost Plus Work.

The sum of money shown on the estimate and in the itemized proposal as "Estimated Cost" for work under this Item will be considered the price bid even though payment will be made only for actual work performed. The estimated cost figure is not to be altered in any manner by the bidder. Should the bidder alter the amount shown, the altered figures will be disregarded and the original price will be used to determine the total amount for the Contract.

Increased costs directly related to the Contractor's operation (i.e. treatment or increased charges due to changes in pH related to grouting, treatment, and disposal of excess water related to process or waste water, etc.) will not be paid under this Item but will be considered a part of the Contractor's cost for the Item under which the work is being performed.

The Engineer will sample any silt or sediments generated as a part of this Item for waste characterization determination. Disposal of the material, if necessary, shall be in accordance with Item 0202315A – Disposal of Controlled Materials or Article 1.04.05 in the item’s absence.

Sedimentation control associated with work under this Item will be paid under the appropriate items of the Contract.

Basis of Payment:

The handling and disposal of contaminated groundwater from dewatering activities will be paid for in accordance with Article 1.09.04 - Extra and Cost Plus Work, which shall include: all equipment, materials, tools, and labor incidental to conveyance of groundwater from the dewatering point to the temporary containment tank(s), as well as the initial equipment design, mobilization of containment tanks, transportation to the disposal facility, disposal fees, and final equipment decontamination and removal.

Pay Item	Pay Unit
Handling Contaminated Groundwater	Est.

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NOTICE TO CONTRACTOR – FORM 816 REFERENCES ON STANDARD DRAWINGS

The Contract includes standard Connecticut Department of Transportation drawings with material and pay limit references to Form 816. For work shown on these drawings that is included under the Major Lump Sum Item (MLSI) for the Project, the Contractor shall disregard these references within the Vertical Construction Limits which are defined in Notice to Contractor – Measurement and Payment. Concrete shall comply with the requirements of CSI Specification Section 033000 under the MLSI.

Pay limits for unit price and lump sum items other than the MLSI shall be in accordance with Method of Measurement (Part 4), and Basis of Payment (Part 5) of the appropriate special provision section. Concrete for unit price items other than the MLSI shall be in accordance with Form 816, unless specifically noted otherwise.

NOTICE TO CONTRACTOR – MEASUREMENT AND PAYMENT

This Project is being bid with both lump sum and unit price items. The bid items include unit price and lump sum items which are IN ADDITION TO the Major Lump Sum Items, hereby referred to as “MLSI”. The MLSI of the Project includes both item number 0063521A, titled "Rail Facility Upgrade Site No. 1.", and item number 0063522A, titled "Rail Facility Upgrade Site No. 2."

The unit price and lump sum bid items will be measured for payment on a unit price or lump sum basis (whichever is applicable) for which a separate bid price is required, at the quantities as indicated in the Bid Proposal Form. Standard Form 816 Items are referenced by their standard item numbers. Refer to the applicable article of Form 816 for the requirements for these items. Special Provisions included in this Contract are referenced by their item number followed by an "A" suffix. Refer to the Special Provisions contained within this Contract for requirements for these items. All work depicted on the Contract Plans and described in the Contract Specifications, including mobilization, is included in the MLSI of the Project, with the exception of the unit price or other lump sum items listed on the Bid Proposal Form. Any work that is outside the limits stated under “Method of Measurement” and “Basis of Payment” for a specific item, other than the MLSI, but is shown on the Contract Plans or described in the Contract Specifications, is included in the MLSI. Any work that is incidental to an item which is not specifically described or included in the item, but which is required for performance and completion of the work required under the Contract, is included in the MLSI.

Vertical Construction Limits

The vertical construction limits are defined as 5-feet outside of the vertical projection of the edges of the platform and stair assemblies and 5-feet (horizontally) outside the face of footing of stair tower building walls. The following unit price items will only be measured for payment up to the vertical construction limits:

Item No. 0213012, “Granular Fill”

Item No. 0205001A, “Trench Excavation 0’-4’ Deep”

Item No. 0205003A, “Trench Excavation 0’-10’ Deep”

Item No. 1208906A, “Sign Face - Sheet Aluminum - Bright Wide Angle Retroreflective Sheeting”

Work associated with these items located within the vertical construction limits (as defined above) is included in the MLSI.

The following unit price items will be measured for payment, whether or not they are enclosed within the vertical construction limits:

Item No. 0000985A, "Track Monitoring"
Item No. 0062680A, "Tactile Warning Strip"
Item No. 0101117A, "Controlled Material Handling"
Item No. 0101126A, "Disposal of Hazardous Waste"
Item No. 0202315A, "Formation of Subgrade"
Item No. 0212003, "Subbase"
Item No. 0714026A, "Temporary Sheet Piling (railroad)"
Item No. 0715021A, "Sheet Piling Material Left In Place (Railroad)"
Item No. 0728020, "Stone Ballast"
Item No. 0751711 "6" Underdrain"
Item No. 0755009 "Geotextile"
Item No. 0811001 "Concrete Curbing"
Item No. 09113043 "8' Polyvinyl Chloride Chain Link Fence"
Item No. 0921001A, "Concrete Sidewalk"
Item No. 0999001A, "Disposal of Buildings"
Item No. 1700003A, "Contractor Supplied Materials to Others"

Platform/Site Amenities

There will be no separate payment for platform/site amenities, including, but not limited to benches, trash receptacles, bicycle racks, etc. The cost of these site amenities, including any hardware and any required excavation and backfill, is included in the MLSI.

Signs

There will be no separate payment for signage, including but not limited to station identification signs, kiosks, accessible route signage, tactile signage, schedule holders and other pedestrian wayfinding signs. The cost of these signs, including any hardware and any required excavation and backfill, and installation is included in the MLSI. Vehicular signage, including directional signage, stop signs and parking signs, including any posts, hardware, footings, installation, and any required excavation and backfill, will be paid for these separate items will be measured for payment on a unit price for which a separate bid price is required at the quantities as indicated in the Bid Proposal Form.

Electrical Pads and Bases

There will be no separate payment for concrete associated with the fabrication and installation of light pole bases, equipment pads, or for protection of electrical conduit and service entrances. The cost of concrete, including reinforcing, spacers, formwork, excavation and backfill, is included in the MLSI.

Electrical

There will be no separate payment for excavation and backfill associated with the installation of site electrical items including, but not limited to; exterior lighting; video monitoring equipment; internally lit signs; illuminated egress signs; fire alarm components; train approach message boards; emergency kiosks; communication cable and conduit; or any other electrical cable,

conduit, or service connection components. The cost of excavation for all site electrical items is included in the MLSI.

Water Connections

There will be no separate payment for the excavation, backfill and materials required for; and the installation of, the hose bib(s). All associated material and installation costs for the water service are included in the MLSI.

Railroad Grounding Connections

There will be no separate payment for necessary components to complete the station grounding connections, including connection to the railroad counterpoise wire and associated excavation and backfill. The costs for all grounding items are included in the MLSI.

Station Downspouts, Leaders, and Splash Blocks

There will be no separate payment for necessary components to complete the drainage systems from the vertical construction to the discharge of the associated runoff. Downspouts, leaders, splash blocks, and all necessary excavation and backfill are included in the MLSI.

ITEM #0601651A - RETAINING WALL (SITE NO. 1)

ITEM #0601652A - RETAINING WALL (SITE NO. 2)

ITEM #0601653A - RETAINING WALL (SITE NO. 3)

Description: This item will consist of designing, furnishing and constructing a retaining wall in the location, grades, and to the dimensions and details shown on the contract drawings, and in accordance with these specifications.

Retaining Wall Selection: The wall chosen shall be selected from the list shown on the contract drawings. The contract drawings may detail a cast-in-place reinforced concrete retaining wall. This type of retaining wall may also be used as an option. The Engineer will reject any proposed retaining wall that is not listed on the contract drawings.

The list on the contract drawings is for all proprietary retaining walls that are appropriate for each site. This list does not warrant that the walls can be designed to meet either the dimensional, structural, or geotechnical constraints at each site.

The following is a list of the Department's current approved proprietary retaining walls, no other proprietary retaining walls will be allowed:

NOTE: SEE THE CONTRACT DRAWINGS FOR THE SPECIFIC WALLS THAT ARE ACCEPTABLE FOR EACH SITE.

Prefabricated Modular Walls

1. Doublewal-Standard Module
United Concrete Products
173 Church Street
Yalesville, CT 06492
(203) 269-3119

2. T-Wall Retaining Wall System
The Neel Company
8328-D Traford Lane
Springfield, VA 22152
(703) 913-7858

Mechanically Stabilized Earth (MSE) Walls

1. Reinforced Earth Walls
The Reinforced Earth Company
133 Park Street
North Reading, MA 01864
(978) 664-2830

2. Retained Earth
The Reinforced Earth Company
1372 Oldbridge Road, Suite 101
Woodbridge, VA 22192
(703) 499-9818

Design: Design computations are not required for the cast-in-place wall detailed on the contract drawings except for any temporary earth retaining systems included in the lump sum item. The

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Contractor shall submit working drawings and design computations for temporary earth retaining systems in accordance with Article 7.14.03.

1 - Design Computations: If the Contractor chooses one of the proprietary wall options, he is fully responsible for the design, detailing and additional specifications required. The actual designer of the retaining wall shall be a qualified Professional Engineer licensed in the State of Connecticut. The designer must have designed at least three proprietary walls within the last three years.

2 - Designer's Liability Insurance: The Designer of the proprietary retaining wall shall secure and maintain at no direct cost to the Department, a Professional Liability Insurance Policy for errors and omissions in the minimum amount of One Million Dollars (\$1,000,000). The Designer may, at his election, obtain a policy containing a maximum Two Hundred Fifty Thousand Dollars (\$250,000) deductible clause, but if he should obtain a policy containing such a clause, the Designer shall be liable to the extent of the deductible amount. The Designer shall obtain the appropriate and proper endorsement to its Professional Liability Policy to cover the indemnification clause in this contract as the same relates to negligent acts, errors or omissions in the work performed by the Designer. The Designer shall continue this liability insurance coverage for a period of three years from the date of the acceptance of the work by the agency head as evidenced by a certificate of acceptance issued to the contractor or for three years after the termination of the contract, whichever is earlier, subject to the continued commercial availability of such insurance.

The Designer shall supply the certificate of this insurance to the Engineer prior to the start of construction of the wall. The designer's insurance company shall be licensed in the State of Connecticut.

3 - Preliminary Submissions for Proprietary Retaining Walls: Prior to the start of fabrication or construction, the Contractor shall submit to the Engineer a design package, which shall include, but not be limited to the following:

a. Detailed Plans:

- Plan sheets shall be approximately 24" x 36".
- Stamped by a licensed Professional Engineer (Connecticut).
- Full plan view of the wall drawn to scale. The plan view must reflect the horizontal alignment and offset from the horizontal control line to the face of the wall. Beginning and ending stations, all utilities, signs, lights, etc. that affect the construction along with all property lines and easement lines adjacent to the wall shall be shown.

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- Full elevation view of the wall drawn to scale. Elevation views should indicate the elevation at the top and bottom of walls, horizontal and vertical break points, and the location of finished grade.
- Typical cross sections drawn to scale including all appurtenances. Detailed cross section should be provided at significant reinforcement transitions such as wall ends.
- Details of all wall components and their connections such as the length, size and type of reinforcement and where any changes occur; modular component and facing details including reinforcing steel and reinforcement connections; joint material including geotextile filter location and horizontal joint compression material, etc.
- Drainage details for embankment backfill including attachment to outlets shown on contract drawings.
- Details of any roadway drainage pipe projecting through the wall, or any attachments to the wall. Details of the treatment of drainage swales or ditches shown on the contract drawings.
- Design parameters used along with AASHTO references.
- Material designations for all materials to be used.
- Detailed construction methods including a quality control plan. Construction quality control plans should include monitoring and testing frequencies (e.g, for setting batter and maintaining horizontal and vertical control). Construction restraints should also be listed in the details. Specific requirements for construction around obstructions should be included.
- Details of parapet attachments where required along with any lighting and/or signing requirements.
- Details of Architectural Treatment where required.
- Details of Temporary Earth Retaining Systems where required.
- Details of wall treatment where the wall abuts other structures.
- Treatment at underground utilities where required.

b. Design Computations:

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- Stamped by a licensed Professional Engineer (Connecticut).
- Computations shall clearly refer to the applicable AASHTO provisions as stated in the Notes on the Contract Drawings.
- Documentation of computer programs including all design parameters.
- The design shall conform to the criteria listed below.

c. Construction Specifications:

- Construction methods specific to the proprietary retaining wall chosen. These specifications should include construction limitations including vertical clearance, right-of-way limits, etc. Submittal requirements for materials such as certification, quality, and acceptance/rejection criteria should be included. Details on connection of modular units and connection of reinforcements such that assurance of uniform stress transfer should be included.
- Any requirements not stated herein.

The submissions for proprietary retaining walls shall be treated as working drawings in accordance with Section 1.05 amended as follows:

- a. 6 sets of each submission shall be supplied to the Department
- b. The Contractor shall allow 21 days for the review of each submission. If subsequent submissions are required as a result of the review process, 21 days shall be allowed for review of each submission. No extensions in contract time will be allowed for the review of these submissions.

4 - Final Submissions for Proprietary Retaining Walls:

Once a proprietary retaining wall design has been reviewed and accepted by the Department, the Contractor shall submit the final plans. The final submission shall include one set of full size (approximately 24" x 36") mylar sheets and five sets of full size blue line copies.

The final submission shall be made within 14 days of acceptance by the Department. No work shall be performed on the retaining wall until the final submission has been received.

Acceptance of the final design shall not relieve the Contractor of his responsibility under the contract for the successful completion of the work.

The actual designer of the proprietary retaining wall is responsible for the review of any shop drawings prepared for the fabrication of the wall. One set of full size blue line copies of all approved shop drawings shall be submitted to the Department's permanent records.

5 – General Design Requirements

a. All designs for proprietary walls and temporary earth retaining systems (if required) shall conform to the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges including the latest Interims published except as noted otherwise herein.

b. The wall design shall follow the dimensions of the wall envelope shown in the contract drawings.

For all proprietary walls, the top of the leveling pad or reinforced concrete toe footing shall be located at or below the bottom of the footing elevation shown on the contract drawings. If no footing elevation is shown, the minimum wall embedment shall be four feet as measured to the top of the leveling pad or toe footing.

If steps at the bottom of the wall are required, they shall be kept at or below the footing elevation shown on the contract drawings. Steps in addition to those shown on the contract drawings will be permitted at no additional cost to the Department.

c. The wall shall be designed to be within all property lines and easement lines shown on the contract drawings. If additional work areas are necessary for the construction of the proprietary retaining wall, the Contractor shall be responsible for obtaining the rights from the affected property owners. Copies of these rights shall be forwarded to the Department.

d. The top of the wall shall be at the top of the wall elevations shown on the contract drawings. Where coping or barrier is utilized, the wall face panel shall extend up into the coping or barrier a minimum of two inches. The top of the face panels may be level or sloped to meet the top of the wall line noted.

e. Cast-in-place concrete will not be an acceptable replacement for areas noted by the wall envelope, except for minor grouting of pipe penetrations and leveling required for coping or traffic barrier.

f. The wall shall be designed for a minimum live load surcharge equal to two feet of soil at a unit weight of 125 pounds per cubic foot. If there are specific live load surcharges acting on the wall, they shall also be accounted for. The minimum equivalent fluid pressure used to design the wall shall be 33 pounds per cubic foot per linear foot of wall.

g. If stated on the contract drawings, the wall shall be designed for seismic forces according to the AASHTO Specifications.

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h. If the wall is detailed with a concrete parapet, the top two courses of prefabricated modular walls units shall be designed to support a transverse railing load of 10 kips. The 10 kip load may be distributed over the length of the parapet section between joints, but not exceeding 20 feet. Computations that verify the stability of the top two courses of the modular units shall be submitted to the Engineer.

The detailing and reinforcement in the parapet section above the gutterline or finished grade, including any light standard attachments, shall be as shown on the contract drawings.

i. The wall shall be designed to accommodate all roadway drainage and drainage structures as shown on the contract drawings.

j. The maximum allowable bearing pressure of the soil shall be as shown on the contract drawings. The bearing pressure stated assumes a uniform pressure distribution. If additional soils information is required by the Contractor’s designer, it must be obtained by the Contractor and will not be reimbursed by the Department.

k. Parapet and Moment slab Design:

- General requirement for parapet and moment slab design:

The parapet and moment slab shall be designed in accordance the AASHTO Standard LRFD Bridge Design Specifications – 2007, including the latest interim specifications and errata, amended as follows:

The parapet shall be designed and constructed of precast or cast-in-place concrete. The moment slab shall be designed and constructed of cast-in-place reinforced concrete.

Above the finished grade, the parapet dimensions, concrete and reinforcement shall conform to the Department’s retaining wall parapet details. Below the finished grade, the parapet shall be designed to resist the forces specified in Table A13.2-1 of the AASHTO LRFD Bridge Design Specifications for the parapet types indicated below:

Parapet Type	AASHTO LRFD Test Level
42” High Standard Parapet	TL-4
32” High Standard Parapet	TL-3
Sidewalk Parapet	TL-3

The moment slab and its connection to the parapet shall be designed to resist, at a minimum, a transverse load equal to 133% of F_t . The length of the structural connection between parapet and moment slab assumed to resist transverse force F_t shall be the distance between parapet joints but not greater than 30 feet in any case. The length of the moment slab assumed to resist sliding and overturning may exceed

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parapet joint spacing but shall be no greater than 30 feet in any case. The moments shall be summed about the front face of the wall facing. All resistance factors shall be taken as 1.0. The internal angle of friction for the soil shall be assumed to be 34 degrees unless otherwise shown on the contract plans.

The top of the moment slab shall be designed to match the elevation and grade of the top of subbase as shown on the plans. The top of the moment slab shall be protected with membrane waterproofing woven-glass fabric as shown on the plans. Minimum concrete cover for reinforcing steel shall be 2 inches for top bars and 3 inches for bottom bars

- Precast Concrete Parapet Alternative:

Precast parapet sections shall be no less than 8 feet in length.

Parapets shall include details for shear transfer between adjacent units by either concrete shear keys or steel dowels as follows:

- Shear keys when used shall be monolithically cast in each parapet section or joint location. Shear keys shall be located vertically within the top 32 inches of the parapet and shall be a minimum of 24 inches in length with a tapered width between 3 and 4 inches, and a minimum interlock depth of 2 inches.
- Steel dowels when used shall be a minimum of 3 in number, smooth, 14 inches long minimum, and 1 inch diameter at each parapet interface. Steel dowels shall be located in each parapet joint and spaced approximately 1 foot apart vertically. Steel dowels shall be positioned to project equally into each adjoining parapet sections and shall be detailed to avoid impeding shrinkage and thermal movements. Bond breakers may be used with steel dowels for that purpose. Alternatively, pockets may be cast to receive steel dowels in adjacent parapet units. Pocket widths shall not exceed steel dowel diameters by more than ½ inch.

Moment slabs for precast concrete parapets shall be structurally continuous throughout the overall wall length. Construction joints are permitted in moment slabs.

- Cast-in-Place Parapet Alternative:

The minimum distance between parapet joints shall be 20 feet. Expansion and contraction joints shall be placed in accordance with Section 11.6 of the AASHTO LRFD Bridge Design specifications. Expansion and contraction joints shall be located a minimum of 10 feet from the nearest edge of a catch

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basin. Expansion and contraction joints shall be located a minimum of 6 feet from the centerline of light standard anchorages and junction boxes. Preformed expansion joint filler, ½ inch thick, shall be installed at the expansion joints in the parapet.

Parapets shall include details for shear transfer between sections by way of concrete shear keys or steel dowels as follows:

- Shear keys when used shall be monolithically cast in each parapet section or joint location. Shear keys shall be located vertically within the top 32 inches of the parapet and shall be a minimum of 24 inches in length with a tapered width between 3 and 4 inches, and a minimum interlock depth of 2 inches.
- Steel dowels when used shall be a minimum of 3 in number, smooth, 14 inches long minimum, and 1 inch diameter at each parapet interface. Steel dowels shall be located in each parapet joint and spaced approximately 1 foot apart vertically. Steel dowels shall be positioned to project equally into each adjoining parapet sections and shall be detailed to avoid impeding shrinkage and thermal movements. A bond breaker shall be used with steel dowels for that purpose.

Moment slabs for cast-in-place parapets shall extend to the outside face of the retaining wall as shown on the plans. Moment slabs for cast-in-place parapets shall be structurally continuous throughout the overall wall length except at parapet contraction and expansion joint locations where longitudinal reinforcing within 2 feet of the wall face shall be discontinuous for the purpose of crack control. All remaining longitudinal reinforcing in moment slabs at parapet expansion and contraction joint locations shall be continuous. A vertical 1” deep chamfer on the exposed face of the moment should be provided in locations directly under parapet expansion and contraction joints. Construction joints are permitted in moment slabs for cast-in-place concrete.

6 - Design Requirements for Mechanically Stabilized Earth Walls: The design shall consider the internal stability of the wall mass as outlined below. The global stability of the structure, including slope stability, bearing capacity safety, and total and differential settlement is the responsibility of the Department.

a. Hydrostatic Forces: Unless specified otherwise, when a design high water surface is shown on the contract drawings at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a three foot minimum differential head of saturated

backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.

b. Backfill: The friction angle of the pervious structure backfill used in the reinforced fill zone for the internal stability design of the wall shall be assumed to be 34 degrees unless shown otherwise on the contract drawings. The friction angle of the in-situ soils shall be assumed to be a maximum of 30 degrees unless otherwise shown on the Contract drawings.

c. Soil Reinforcement: The soil reinforcement shall be the same length from the bottom to the top of each wall section. The reinforcement length defining the width of the entire reinforced soil mass may vary with wall height along the length of wall. The minimum length of the soil reinforcement shall be seventy percent of the wall height, H, or eight feet, whichever is greater.

The soil reinforcement length shall be sufficient to satisfy the sliding, overturning and pullout factors of safety designated in AASHTO Specifications and the minimum lengths required for external stability as recommended by the Department. Calculation of stresses and pullout factors of safety shall be in accordance with the AASHTO Specifications for Highway Bridges.

Calculations for stresses and factors of safety shall be based on assumed conditions at the end of the design life. The design life shall be 75 years unless otherwise indicated on the contract drawings. The design of soil reinforcements shall account for section loss as outlined in the AASHTO Specifications. All soil reinforcement shall be hot dipped galvanized.

7 - Design Requirements for Prefabricated Modular Walls: The general design of the wall shall be according to the AASHTO Specifications. The design shall consider the stability at each level of modules. The global stability of the structure, including slope stability, bearing capacity safety, and total and differential settlement is the responsibility of the Department.

a. Hydrostatic Forces: Unless specified otherwise, when a design high water surface is shown on the contract drawings at the face of the wall, the design stresses calculated from that elevation to the bottom of wall must include a three foot minimum differential head of saturated backfill. In addition, the buoyant weight of saturated soil shall be used in the calculation of pullout resistance.

b. Backfill: The friction angle of the pervious structure backfill shall be assumed to be 34 degrees if sufficient amounts of pervious backfill are used. The friction angle of the in-situ soils shall be assumed to be a maximum of 30 degrees unless otherwise shown on the Contract drawings.

c. Infill: The maximum assumed unit weight of infill material used for determining the factor of safety for overturning shall be 100 pounds per cubic foot. If Doublewal modules are to be filled with crushed stone, the maximum assumed unit weight of the infill shall be 80 pounds per cubic foot.

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d. Safety Factors: The minimum factors of safety shall be as specified in the AASHTO Specifications amended as follows. The factor of safety for T-Wall shall be 1.5 for pullout of the concrete stem. Shear keys are not to be included in these computations. Only resisting forces developed beyond the theoretical failure plane may be used in these computations.

Materials:

1 - Cast-in Place Concrete Walls: The materials furnished and used in the work shall be those prescribed within the Standard Specifications for Roads, Bridges and Incidental Construction, including supplemental specifications and applicable special provisions.

2 - Prefabricated Modular and Mechanically Stabilized Earth Walls: Materials shall conform to the following requirements and those not listed below shall be as prescribed within the Standard Specifications for Roads, Bridges and Incidental Construction, including supplemental specifications and applicable special provisions.

a. Concrete: The concrete shall conform to the requirements of Section M.03 and as follows:

Concrete for all precast components shall be air-entrained composed of portland cement, fine and coarse aggregates, admixtures and water. The air-entraining feature may be obtained by the use of either air-entraining portland cement or an approved air-entraining admixture. The entrained-air content shall be not less than four percent or more than seven percent. The concrete utilized shall be a mix which will attain a minimum 28-day strength (f'_c) of 4,500 pounds per square inch. The mix design shall be furnished to the Engineer.

Concrete for footings or unreinforced leveling pads shall be conform to the requirements of Class "A" Concrete. Class "F" Concrete shall be used for cast-in-place concrete copings.

Concrete Finish: Unless otherwise indicated on the contract drawings or elsewhere in the specifications, the concrete surface for the exposed face shall have an ordinary steel form finish. All non-exposed surfaces shall have a unformed finish which shall be free of open pockets of aggregate and surface distortions in excess of 1/4 inch.

Acceptance Criteria for Precast Components: Precast components shall be accepted for use in wall construction provided the concrete strength meets or exceeds the minimum compressive strength requirement, the soil reinforcement connection devices and the panel or module dimensions are within the manufacture's allowable tolerances and any chipping, cracks, honeycomb or other defects are within acceptable standards for precast concrete or repaired as determined by the Engineer.

It is recognized that certain cracks and surface defects are not detrimental to the structural integrity of the precast components if properly repaired. The Engineer shall determine the need

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for and proper method of such repair. All repairs shall be approved by the Engineer prior to acceptance of the precast component for use in wall construction.

Marking: The date of manufacture, the production lot number, and the piece-mark shall be clearly marked on the side of each panel or module.

b. Reinforcing Steel: Reinforcing steel shall conform to the requirements of ASTM A615, Grade 60.

c. Attachment Devices for Prefabricated Modular Walls: All structural connectors shall be hot dipped galvanized according to the requirements of ASTM A123 (AASHTO M-111). The minimum thickness of the galvanizing shall be based on the service life requirements in the AASHTO Specifications.

d. Soil Reinforcing and Attachment Devices for MSE Walls:

Soil Reinforcement: All soil reinforcement and structural connectors shall be hot dipped galvanized according to the requirements of ASTM A123 (AASHTO M-111). The minimum thickness of the galvanizing shall be based on the service life requirements as previously stated.

Steel strip reinforcement shall be hot rolled to the required shape and dimensions. The steel shall conform to AASHTO M223 (ASTM A572) Grade 65 unless otherwise specified.

Welded wire fabric reinforcement shall be shop fabricated from cold-drawn wire of the sizes and spacings shown on the plans. The wire shall conform to the requirements of ASTM A82, fabricated fabric shall conform to the requirements of ASTM A185.

Connection Hardware: Connection hardware shall conform to the details on the plans and the requirements in the special provisions or the plans. All fasteners shall be galvanized according to the requirements of ASTM A-153 (AASHTO M-232). The minimum thickness of the galvanizing shall be based on the service life requirements as previously stated.

e. Joint Materials: All horizontal and vertical joints between panels shall be covered by a geotextile (separation-high survivability) conforming to the requirements of Article M.08.02-26. The minimum width and lap shall be twelve inches. Details of installation including connection of the geotextile to coping shall be provided.

f. Backfill: Backfill shall be pervious structure backfill conforming to the requirements of Articles M.02.05 and M.02.06.

In addition, the backfill for Mechanically Stabilized Earth Walls shall conform to all of the following requirements:

Electrochemical Requirements: The backfill material shall conform to the following electrochemical requirements:

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PROPERTY	REQUIREMENT	TEST METHODS
Resistivity at 100% saturation	Minimum 3000 ohm-cm	ASTM G-57-78 AASHTO T-288-91I
pH	Acceptable Range 5-10	ASTM G-51-77 AASHTO T-289-91I
Chlorides	Maximum 100 ppm	ASTM D-512-88 AASHTO T-291-91I
Sulfates	Maximum 200 ppm	ASTM D-516-88 AASHTO T-290-91I

g. Membrane waterproofing: Membrane waterproofing materials shall conform to the requirements of Article M.12.04 for primer, woven glass fabric saturated with asphalt, seal coat, and for asphalt flashing cement.

h. Smooth Steel dowels: Steel dowels used in parapets joints shall conform to the requirements of ASTM A36 and shall be galvanized in conformance with the requirements of ASTM A153.

Construction Methods:

1 - Cast-in-Place Concrete Walls: All construction methods for cast-in-place retaining walls shall be in accordance with the detailed requirements prescribed for the construction the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

2 - Prefabricated Modular Walls: All construction methods for items not listed below shall be in accordance with the detailed requirements prescribed for the construction of the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

a. Special Surface Treatment: If a special surface finish is proposed for the wall, before proceeding with production, a model modular unit shall be provided by the fabricator for the Engineer's approval to establish a guide and standard for the type of finish to be furnished on the exposed face. This model shall be kept at the fabricator's plant to be used for comparison purposes during production. Formed surfaces other than the exposed face shall not require a special finish.

b. Inspection and Rejection: The quality of materials, the process of manufacture, and the finished units shall be subject to inspection by the Engineer prior to shipment.

Modular units which have imperfect molding, honeycomb, open texture concrete, or broken corners shall be repaired to the satisfaction of the Engineer or shall be rejected. Insufficient compressive strength shall also be cause for rejection.

Modular units with special surface treatments shall be rejected if there are variations in the exposed face that deviate from the approved model as to color or texture in accordance with precast concrete industry standards.

c. Marking: The date of manufacture shall be clearly scribed on an inside surface of each modular unit.

d. On Site Representative: A qualified and experienced representative from the wall supplier shall be at the site at the initiation of the wall construction to assist the Contractor and the Engineer. If there is no more than one wall on a project then this criteria will apply to construction of the initial wall only. The representative shall also be available on as needed basis, as requested by the Engineer.

e. Installation: The modular units shall be installed in accordance with manufacturer's recommendations. Special care shall be taken in setting the bottom course of units to true line and grade.

The vertical joint opening on the front face of the wall shall not exceed 3/4 inch. Vertical tolerances and horizontal alignment tolerances measured from the face line shown on the contract drawings shall not exceed 3/4 inch when measured along an eight straightedge. The overall tolerance of the wall from top to bottom shall not exceed 1/2 inch per eight feet of wall height or one inch total, whichever is the lesser, measured from the face line shown on the contract drawings. A strip of geotextile shall be installed at all vertical joints.

Assembly of the various components shall be performed in such a manner that no undue strain or stress is placed on any of the members that constitute the completed structure.

f. Backfilling:

Doublewal:

Infill for modular units shall be placed, one course at a time, in lifts not exceeding two feet in thickness. The dry density of each lift of pervious structure backfill placed inside the modular units, after compaction, shall not be less than 90 percent of the dry density for that material when tested in accordance with AASHTO T-180, Method D. Each lift shall be thoroughly compacted with a vibratory tamping device.

Placement of the pervious structure backfill behind the wall shall closely follow erection of successive courses of modular units. At no time shall the difference in backfill elevation between the interior and exterior of the wall exceed six feet.

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The units may be backfilled with crushed stone, provided that the design of the wall was based on a density of 80 pounds per cubic foot.

All pervious structure backfill placed outside of the modular units shall be placed in accordance with the requirements of Article 2.16.03.

T-Wall:

Backfill placement shall closely follow erection of each course of modules. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the modules. Any wall materials which become damaged or disturbed during backfill placement shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any backfill material placed within the wall envelope which does not meet the requirements of this specification shall be corrected or removed and replaced at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

If 30 percent or more of the backfill material is greater than 3/4 inch in size, AASHTO T-99 is not applicable. For such a material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material as determined by a method specification provided by the wall supplier, based on a test compaction section, which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed ten inches. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density.

Compaction within three feet of the face of the modules shall be achieved by at least three passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used. Care shall be exercised in the compaction process to avoid misalignment or damage to the module. Heavy compaction equipment shall not be used to compact backfill within three feet of the wall face.

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At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. The Contractor shall control and divert runoff at the ends of the wall such that erosion or washout of the wall section does not occur. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

3 - Mechanically Stabilized Earth Walls: All construction methods for items not listed below shall be in accordance with the detailed requirements prescribed for the construction of the appropriate items as specified in the Standard Specifications for Roads, Bridges, and Incidental Construction.

a. Special Surface Treatment: If a special surface finish is proposed for the wall, before proceeding with production, a model face panel shall be provided by the fabricator for the Engineer's approval to establish a guide and standard for the type of finish to be furnished on the exposed face. This model shall be kept at the fabricator's plant to be used for comparison purposes during production. Formed surfaces other than the exposed face shall not require a special finish.

b. Foundation Preparation: The foundation for the structure shall be graded level for a width equal to or exceeding the length of the soil reinforcements, or as shown on the plans. Prior to wall construction, the foundation, if not in rock, shall be compacted. Any foundation soils found to be unsuitable shall be removed and replaced with granular fill.

At each panel foundation level, an un-reinforced concrete leveling pad shall be provided as shown on the plans. The leveling pad shall be cast to the design elevations as shown on the plans.

c. On Site Representative: A qualified and experienced representative from the wall supplier shall be at the site at the initiation of the wall construction to assist the Contractor and the Engineer. If there is no more than one wall on a project then this criteria will apply to construction of the initial wall only. The representative shall also be available on as needed basis, as requested by the Engineer.

d. Wall Erection: Panels shall be placed in successive horizontal lifts in the sequence shown on the plans as backfill placement proceeds. As backfill material is placed behind the panels, the panels shall be maintained in a vertical position. Vertical tolerances (plumbness) and horizontal alignment tolerances shall not exceed 3/4 inch in eight feet. The allowable offset in any panel joint shall be 3/4 inch. The overall vertical tolerance of the wall (plumbness from top to bottom) shall not exceed 1/2 inch per eight feet, or one inch total, which ever is the lesser, measured from the face line shown on the plans.

e. Placement of Reinforcements: Bending of reinforcements in the horizontal plane that results in a permanent deformation in their alignment shall not be allowed. Gradual bending in the vertical direction that does not result in permanent deformations is allowable.

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Connection of reinforcements to piles or bending of reinforcements around piles shall not be allowed. A structural connection (yoke) from the wall panel to the reinforcement shall be used whenever it is necessary to avoid cutting or excessive skewing of reinforcements due to pile or utility conflicts.

Soil reinforcements shall be placed normal to the face of the wall, unless otherwise shown on the plans.

f. Backfill Placement: Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the wall materials or misalignment of the facing panels. Any wall materials which become damaged or disturbed during backfill placement shall be either removed and replaced at the Contractor's expense or corrected, as directed by the Engineer. Any backfill material placed within the reinforced soil mass which does not meet the requirements of this specification shall be corrected or removed and replaced at the Contractor's expense.

Backfill shall be compacted to 95 percent of the maximum density as determined by AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T-99, Method C or D (with oversize correction, as outlined in Note 7).

If 30 percent or more of the backfill material is greater than 3/4 inch in size, AASHTO T-99 is not applicable. For such a material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material as determined by a method specification provided by the wall supplier, based on a test compaction section, which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed ten inches, regardless of the vertical spacing between layers of soil reinforcements. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. Prior to placement of the soil reinforcements, the backfill elevation at the face shall be level with the connection after compaction. From a point approximately three feet behind the back face of the panels to the free end of the soil reinforcements the backfill shall be two inches above the attachment device elevation unless otherwise shown on the plans.

Compaction within three feet of the back face of the panels shall be achieved by at least three passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used.

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Care shall be exercised in the compaction process to avoid misalignment of the panels or damage to the attachment devices. Heavy compaction equipment shall not be used to compact backfill within three feet of the wall face.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. The Contractor shall control and divert runoff at the ends of the wall such that erosion or washout of the wall section does not occur. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

Membrane Waterproofing shall be installed on the moment slab in accordance with the requirements of Section 7.03.03.

Method of Measurement: This work will be paid for on a lump sum basis and will not be measured for payment.

Basis of Payment: This work will be paid for at the contract lump sum for "RETAINING WALL (SITE NO. X)", complete in place, which price shall include all work shown within the pay limits shown on the contract drawings for the retaining wall including but not limited to the following:

1. Design and construction of the proprietary retaining wall.
2. Excavation required for the construction of the retaining wall.
3. Design and construction of temporary earth retaining systems to retain the existing facilities during construction.
4. The furnishing, placing and compacting of pervious structure backfill within the payment lines.
5. The furnishing and placing of backfill drainage systems for the wall.
6. The furnishing and placing of rigid metal conduit, junction boxes, light standard anchorages, and other electrical appurtenances located within the wall proper.
7. Services of the On-Site Representative.
8. Any other work and materials shown on the plans for the retaining wall.

The price shall also include all materials, equipment, tools and labor incidental thereto.

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ITEM #0728032A – NO. 6 CRUSHED STONE

Description: This item shall consist of crushed stone placed to a uniform depth to the limits and for the depth shown on the plans, or as directed by the Engineer.

Materials: The material for this work shall conform to the requirements of Article M.01.01 for No. 6 Crushed Stone.

Construction Methods: The Contractor shall place crushed stone to the limits and depths, and to the grade, shown on the Plans, or as directed by the Engineer.

Method of Measurement: This work will be measured for payment by the actual number of cubic yards of No. 6 Crushed Stone completed, accepted and measured in place after compaction.

Basis of Payment: This work will be paid for at the contract unit price per cubic yard for “No. 6 Crushed Stone,” complete in place, which price shall include all materials, tools, equipment and work incidental thereto.

Pay Item

Pay Unit

No. 6 Crushed Stone

c.y.

SECTION 050310 – THERMAL SPRAY METALLIZING AND SEALER COATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions of Division 1, State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816 - 2004 and supplemental specifications thereto, shall be a part of this specification.
- B. Work included in this section may require coordination with Amtrak regarding track outages, flagmen, or other issues related to work around railroad facilities. The Contractor shall pay special attention to the specification entitled “SAFETY AND PROTECTION OF RAILROAD TRAFFIC AND PROPERTY” and other Amtrak Specifications contained in the Contract.

1.2 PURPOSE:

- A. This section provides the workmanship requirements for surface preparation, the shop application of a thermal spray (metallizing) coating and a seal coat of urethane. All work shall be done in the shop unless otherwise noted.
- B. Unless otherwise directed by CTDOT, the coatings to be applied are as follows:
 - 1. Application: Metalize and seal all exterior exposed bridge overpass structural steel systems – vertical window wall members and floor framing including deck.
 - 2. The feedstock material used for metallizing must be one of the following: aluminum, zinc, 85/15 (Zn/Al) or 90/10 MMC.
 - 3. The sealer coat to be applied over the metallizing is an acrylic urethane coating.
- C. The General Contractor is responsible for coordinating the work to assure that the products of only one metallizing supplier and one sealer/paint manufacturer are utilized on the entire structure, including the necessary field touch-up work.
- D. The Contractor(s) are required to implement and maintain programs and procedures which comply with the requirements of the specifications and all applicable Federal, state, and local OSHA and EPA standards and regulations. The Contractor is cautioned that it must comply with all applicable regulations even if the regulation is not specifically referenced herein. If a state or local regulation is more restrictive than the requirements of this specification, the more restrictive requirements prevail.

1.3 PRE-METALLIZING MEETING

- A. A mandatory pre-metallizing meeting will be held prior to the beginning of any metallizing work. This meeting will be held separately from other general construction meetings for the overall project.

- B. The following parties are required to attend this meeting: General Contractor, Metallizing Contractor, Coating Contractor, Thermal Spray Feedstock and Paint Manufacturer, Metallizing Equipment Manufacturer, Project Engineer, Paint Inspector, Test Laboratory, CTDOT Personnel and other parties as deemed appropriate by the Engineer.

1.4 REFERENCE STANDARDS

- A. The latest edition of the following standards and regulations form a part of this specification.

1. American Society for Testing and Materials (ASTM)
 - a. ASTM D1400, Standard Test Method for Non-Destructive Measurement of Dry Film Thickness of Non-Conductive Coatings Applied to a Non-ferrous Metal Base
 - b. ASTM D3359, Standard Test Methods for Measuring Adhesion by Tape Test
 - c. ASTM D4138, Standard Test Method for Measurement of Dry Paint Thickness of Protective Coating Systems by Destructive Means
 - d. ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air
 - e. ASTM D4414, Standard Practice for Measurement of Wet Film Thickness by Notch Gages
 - f. ASTM D4417, Standard Test Methods for field Measurement of Surface Profile of Blast Cleaned Steel
 - g. ASTM D 4940, Standard Test Method for Conductometric Analysis of Water-Soluble Ionic Contamination of Blasting Abrasive
2. American Welding Society
 - a. ANSI/AWS C2.18-93 Guide for the Protection of Steel with Thermal Sprayed Coatings of Aluminum and Zinc and Their Alloys and Composites.
 - b. ANSI/AWS A5.33, "Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying."
3. Code of Federal Regulations (CFR)
 - a. 29 CFR 1926, Occupational Safety and Health Regulations for the Construction Industry
 - b. 29 CFR 1926.104, Safety Belts, Lifelines, and Lanyards
 - c. 29 CFR 1926.105, Safety Nets
 - d. 29 CFR 1926.451, Scaffolding
 - e. Society for Protective Coatings (SSPC)
 - f. SSPC-SP 1, Solvent Cleaning
 - g. SSPC-SP 2, Hand Tool Cleaning
 - h. SSPC-SP 3, Power Tool Cleaning
 - i. SSPC-SP 10, Near White Metal Blast Cleaning
 - j. SSPC-PA 2, Measurement of Dry Film Thickness with Magnetic Gages
 - k. SSPC-VIS 1, Visual Standard for Abrasive Blast Cleaned Steel
 - l. SSPC-VIS 3, Visual Standard for Hand and Power Tool Cleaned Steel
 - m. SSPC-AB1, Abrasive Specification No. 1
 - n. SSPC-AB2, Specification for Cleanliness of Recycled Ferrous Metal Abrasives

- o. SSPC-AB4, Newly Manufactured or Re-Manufactured Steel Abrasives
 - p. SSPC-QP1, Standard Procedure for Evaluating Qualifications of Painting Contractors: Shop Applicators
 - q. SSPC-CS 23.00, Guide for Thermal Spray Metallic Coating Systems
4. Equipment and Metallizing Material and Coating Manufacturers' Published Instructions

1.5 SUBMITTALS

- A. Submit the following plans and programs to CTDOT for review and acceptance a minimum of fifteen (15) days prior to metallizing.
- B. Surface Preparation/Metallizing and Sealing/Painting Plan
 - 1. Provide written procedures for the preparation of surfaces and the application of the metallizing and the urethane sealer. Also include a procedure for the repair and touch up of any damage that occurs to the newly applied metallizing or coatings.
 - 2. Provide a written QA/QC plan. Include quality control checkpoints for surface preparation, metalize application, adhesion testing of metallizing application and coating thickness measurements.
 - 3. Identify the metallizing and coating materials to be applied. Include manufacturer's name, product names, and product numbers. Provide Product Data Sheets, VOC levels for liquid coatings, MSD sheets, and written application instructions including mixing requirements, specified thinners, and thinner amounts for liquid coatings.
 - 4. Identify the type and brand name of the abrasive proposed for use.
 - 5. In the event of a conflict between the manufacturer's technical data and this section, this section will govern unless the manufacturer's requirements are more restrictive.
 - 6. Identify the thermal spray equipment to be used to apply the feedstock.
- C. Work Schedule - Provide a schedule for surface preparation, metallizing and sealing/painting. CTDOT shall be notified a minimum of one week prior to starting work.
- D. CTDOT Review
 - 1. Do not construe CTDOT acceptance of Contractor submittals to imply approval of any particular method or sequence for conducting the work, or for addressing health and safety. Acceptance of the programs does not relieve the Contractor from the responsibility to conduct the work in strict accordance with the requirements of this section, or to adequately protect the health and safety of all workers involved in the project including any members of the public who may be affected by the project.
 - 2. The Contractor remains solely responsible for the adequacy and completeness of the programs and work practices and adherence to them.

1.6 SUPERINTENDENCE BY THE METALLIZING AND PAINTING CONTRACTORS

- A. The Metallizing and Painting Contractors are responsible for supervising and directing the coating work efficiently using the best skills and attention, and are solely responsible for the means, methods, techniques, sequences, and procedures of construction.

- B. Keep an experienced, competent, resident superintendent acceptable to CTDOT on the project at all times. Do not replace the superintendent except under extraordinary circumstances, and only upon approval of the CTDOT.
- C. The superintendent is the Metallizing and Painting Contractors' representative and must have the authority to act on behalf of the Contractor. All communications given to the superintendents are binding upon the Contractor.

1.7 CONTRACTOR/WORKER QUALIFICATIONS

- A. The Metallizing Contractor shall be certified by the SSPC Painting Contractor Certification Program QP-3, entitled "*Standard Procedure for Evaluating Qualifications of Shop Painting Contractors*" in the *enclosed shop* category or be certified in the American Institute of Steel Construction (AISC) Sophisticated Paint Endorsement (SPE) category – *enclosed shop* P1 or *covered shop* P2. A list of approved contractors can be found on the AISC website at www.AISC.org. The Metallizing Contractor shall be fully certified, including endorsements, for the duration of the time they are doing surface preparation and coating application.
- B. The complete coating system shall be applied in an enclosed shop except for field touch-up painting which shall be applied after all bolts are fully tensioned and deck form work removed. The enclosed shop shall be a permanent facility with outside walls to grade and a roof where surface preparation and coating activities are normally conducted in an environment not subject to outdoor weather conditions and/or blowing dust.
- C. All metallizing and coating work shall be performed by a Contractor with at least two years of experience performing metallizing of structural steel. Prior to the pre-metallizing meeting as per 1.02 A., the Contractor shall submit written documentation of at least three successful metallizing projects in the last three years. Information shall include the name of owner of each metallizing project, number and location of each job and year each job was completed. The Contractor shall possess knowledge and experience in all areas of the surface preparation and metallizing work. This documentation will be reviewed and verified by CTDOT prior to beginning work on this project.
- D. Each spray operator shall be qualified to metalize according to ANSI/AWS C2.18-93. Any operator who does not show evidence of qualification shall not be allowed to spray.
- E. Technical Advisors: It is mandatory that the Contractor obtains the services of qualified technical advisors that represent the coating manufacturer, the thermal spray feedstock manufacturer, and the metallizing application equipment manufacturer. The Contractor shall make all necessary arrangements for technical advisor site visits. The technical advisors shall assist the Engineer and the Contractor in establishing the correct application methods for the metallizing and painting.

1.8 WARRANTY:

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – WARRANTIES for additional information.
 - 1. Warranty Period: Manufacturer's standard, but not less than 5-years from the issuance of the Certificate of Compliance.

PART 2 - PRODUCTS

2.1 ABRASIVES

- A. Provide abrasives that are clean, dry, and sized properly to provide the surface profile required by this section.
- B. Use abrasives that are acceptable to CTDOT. Abrasives shall be hard and sharp in order to produce an angular surface profile. Acceptable abrasives include, but are not limited to, angular aluminum oxide, angular steel grit and angular crushed slag. Silica sand shall not be used. Steel shot and other abrasives that produce a rounded surface profile shall not be used.
- C. Abrasives shall conform to the following:
 - 1. SSPC AB 1 for mineral slag abrasives
 - 2. SSPC AB 2 for recycled ferrous metal abrasives
 - 3. SSPC AB 3 for new steel abrasives

2.2 COATING MATERIALS

- A. Thermal Spray Feedstock - Provide the type and quantity of thermal spray feedstock needed to metalize all carbon steel surfaces in the field and then seal those surfaces.
 - 1. The zinc, aluminum, alloy or metal matrix composite (MMC) shall be manufactured for thermal arc spraying and shall have a chemical composition that meets the requirements that meets ANSI/AWS A5.33, "Specification for Solid and Ceramic Wires and Ceramic Rods for Thermal Spraying."
 - 2. The Contractor shall provide a certificate of the chemical composition of the feedstock from the feedstock supplier.
- B. Urethane Sealer (mist coat and full seal coat) – Provide the type and quantity of urethane sealer needed to seal all surfaces of the metallizing.
 - 1. The mist coat and full seal coat shall be a urethane applied over all metallizing in accordance with the manufacturer's requirements. The products of Carboline Company and Sherwin Williams Company listed below are examples of the standard of quality to be achieved. Equivalent products of other manufacturers may be submitted to CTDOT for consideration:
 - a. Carboline: *Carbothane 134 Series, HS*
 - b. Sherwin Williams: *High Solid Polyurethane B65*
 - c. Devoe: *Devthane 379UVA*
 - 2. Use a single manufacturer to supply all thermal spray feedstock, and a single manufacturer to supply the coating materials and including thinners, additives, and touch-up coatings. Do not co-mix coating products or components produced by different manufacturers under any circumstances.
 - 3. Only use materials that are packaged and sealed, original, labeled containers bearing manufacturer's name, type of material, brand name, shelf life, batch number, and instruc-

tion for mixing and thinning.

4. Colors: As specified in the Contract Drawings.

2.3 CAULKING MATERIALS - When caulking is required, provide 100% solids material that is recommended by the coating manufacturer.

2.4 SURFACE PREPARATION, THERMAL SPRAYING, AND PAINTING EQUIPMENT

- A. Provide thermal spray metallizing, and surface preparation and painting equipment in accordance with the requirements of this section.
- B. Use equipment and materials that are clean and sized properly to accomplish the work, including the required surface profile and finish as required by this section.
- C. The thermal spray equipment shall be gas or electric arc equipment set up, calibrated, and operated in accordance with the manufacturer's written instructions. Proper set up and functioning of equipment shall be verified by performing tests in accordance with Part 3.02 F.3. of this section.

2.5 PERSONAL PROTECTIVE EQUIPMENT

- A. Provide all of the necessary personal protective equipment (PPE) for the project to assure that workers are protected from hazards during surface preparation, metallizing, coating application, and clean-up activities.
- B. Furnish and have available to the Engineer, two new NIOSH/MESA approved thermal spray air respirators and other safety equipment needed to permit the inspection of ongoing metallizing/coating work.
- C. Repair or replace PPE as required to assure that it continues to provide its' intended purpose.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. Weld Spatter, Sharp Edges, and Holes
 1. Remove slag, flux deposits, and weld spatter and steel irregularities such as fins, tears and slivers. Grind any resulting burrs smooth, including burrs around holes.
 2. All corners and edges shall be rounded to a 1/16-inch radius or chamfered to a 1/16-inch chamfer.
 3. Flame cut edges shall be ground over their entire surface such that any hardened surface layer is removed, and subsequent abrasive blast cleaning produces the specified surface profile depth.

B. Pre-Surface Preparation Cleaning of Steel

1. Prior to surface preparation, remove visible grease and oil, etc. from bridge surfaces in accordance with SSPC-SP 1 using only solvents or detergents acceptable to the coating manufacturer and CTDOT. The use of pressurized water for this cleaning is also acceptable.
2. Use clean cloths for the final wiping.

C. Compressed Air Cleanliness

1. Provide compressed air that is free from moisture and oil contamination.
2. Verify the cleanliness of the compressed air by the white blotter test in accordance with ASTM D4285 at least once per shift for each compressor system. Sufficient freedom from oil and moisture is confirmed if soiling or discoloration are not visible on the paper.
3. If air contamination is evident, change filters, clean traps, add moisture separators or filters, or make adjustments as necessary to achieve clean, dry air.

D. Ambient Conditions: Do not conduct final surface preparation which exposes bare steel under damp environmental conditions or when the surface temperature is less than 5° F greater than the dew point temperature of the surrounding air.

E. Abrasives/Profile

1. Use clean, dry, uniformly graded recyclable steel or disposable abrasives for blast cleaning that are free of oil, soluble salts and other similar substances that could contaminate the blast cleaned surface.
2. Provide abrasive that is sized to produce a sharp, angular, uniform surface profile to a minimum height of 3.0 mils, unless the requirements of the metallizing products are otherwise. Measure the profile using the Keane-Tator Surface Profile Comparator or Testex Replica Tape in accordance with ASTM D4417.

F. Pre-Production Test Sections

1. Prior to proceeding with production surface preparation operations, blast clean and metallize at least 9 square feet of steel surface.
2. Use the same metallizing equipment, set up, materials, and calibration and operating procedures in the test section(s) that will be used for the production operations.
3. Spray parameters should be set for spraying the submitted feedstock and at a minimum, be validated by passing a bend test as follows:
 - a. Spray five carbon steel coupons with approximate dimensions of 2 x 4 to 8 x 0.050 inches. The surface of the coupons should be prepared to the same degree as specified for the project. Bolt, bracket or otherwise fasten the coupons to larger pieces of stock during the blast cleaning and metallizing operations.
 - b. Spray metallizing 8 to 10 mils thick in a right angle cross hatch spray passes laying down approximately 3 to 4 mils per pass.
4. Metallographic analysis of additional coupons may be required by CTDOT to establish the suitability of the surface preparation and the thermal spray coating. Supply, prepare, and thermal spray coat these panels using the same materials, equipment and process parameters for the contract work at no additional cost to CTDOT.

5. Provide safe access for close visual inspection and testing.
6. Do not proceed with production surface preparation activities until CTDOT agrees that the surfaces of the test section has been prepared to conform with the requirements.

3.2 SEALER/PAINT AND METALLIZING MATERIAL STORAGE, MIXING, AND HANDLING

A. Sealer/Paint and Metallizing Material Storage

1. Keep all containers unopened until required for use.
2. Store all sealer/paint, metallizing materials (i.e. feedstock wire), thinners, and solvents in accordance with OSHA regulations and the requirements of the manufacturer. Store the materials under cover, out of direct sunlight. Maintain the temperature between 40°F and 90°F, unless the requirements of the manufacturer are more restrictive.
3. Provide the size and number of fire extinguishers in proper proportion to the quantity of sealer/paint stored.
4. Do not permit smoking in sealer/paint storage, mixing, and application areas.
5. Do not open or mix sealer/paint in the storage area.
6. Do not return mixed sealer/paint to the storage area.
7. Bulk containers for solvents and thinners must be equipped with spring-loaded, self-closing, dispensing nozzles. Use Underwriter's Laboratories approved containers for transporting paint to mixing areas.
8. Use explosion-proof lighting fixtures.
9. Do not permit the accumulation of empty sealer/paint cans, combustibles, and other debris.
10. Maintain MSDS for all materials.

B. Mixing and Thinning of Sealer/Paint Materials

1. Verify that the sealer/paint to be mixed has not exceeded its' shelf life. When required by the manufacturer, warm paints stored at less than 40°F to above 50°F prior to mixing.
2. Utilize proper ventilation in the mixing area to prevent injury to workmen or the accumulation of volatile gases.
3. Mix all sealer/paint coatings in accordance with the requirements of the coating manufacturer.
4. Mix only complete kits of material. Mixing of partial kits is not allowed.
5. Do not use two component materials beyond the pot life established by the manufacturer's written instructions.
6. Thin sealer/paint in strict accordance with the coating manufacturer's written instructions. Use only those types, brands, and amounts of thinner recommended by the coating manufacturer. Limit the thinning to the minimum amount necessary to facilitate application except for the mist coat of urethane sealer applied over metallizing. Unless directed otherwise by the coating manufacturer, thin the sealer coating approximately 25% and first apply as a mist coat to seal the surface. When the mist coat has penetrated the metallizing, follow with the full coat with proper thinning.

3.3 COATING APPLICATION

A. Quality of Surface Preparation

1. Verify that the surface exhibits the specified SSPC-SP10 degree of cleaning immediately prior to metallizing.
- B. Surface Cleanliness - Thoroughly clean the surface of each coat prior to the application of the next to remove overspray, spent abrasive, dirt, dust, and other interference material.
- C. Grease/Oil - If grease or oil have become deposited on the bare steel or on the surface of any of the applied coats, remove by solvent cleaning in accordance with SSPC-SP1 prior to the application of the next coat.
- D. Ambient Conditions -Apply metallizing and sealer/paint under the following conditions unless the requirements of the coating manufacturer are more restrictive.
1. Relative Humidity - Less than 85%.
 2. Frost/Rain - Do not apply coatings to surfaces containing frost or during rain, fog, or similar conditions.
 3. Remove and replace any coating that is damaged or marred from exposure to unacceptable conditions (e.g. rain or dew) prior to adequate curing.
- E. Metallizing Application
1. The coating shall be applied in a neat and workmanlike manner and shall be applied uniformly and shall be free of ridges or other defects. The coating shall be applied by thermal spray employing multiple passes to achieve a thickness of 0.008 to 0.010 inches (8-10 mils). No single pass shall deposit more than 0.004 inches.
 2. A cut test shall be performed at the end of each shift to confirm that metallizing is being properly applied. The cut test consists of a single cut 1.5 inches long through the thermal spray coating to the substrate without severely cutting the substrate. A cut shall be made with a hammer and sharp chisel. The chisel cut should be made at a shallow angle. The bond of the metallizing is considered unsatisfactory if any part of the metallizing lifts from the substrate along the cut.
 3. Spraying shall be performed in a block pattern, typically 2 square feet or as per the equipment manufacturer's written recommendation. Overlapping spray passes to ensure uniform coverage, and produce the required thickness and uniformity. A minimum of two passes are required, overlapping and at right angles to each other. The gun shall be held at such a distance from the work surfaces so that the metal is still plastic on impact, typically 5 to 8 inches from the surface. The coating shall be firmly adherent and free from uncoated spots, lumps or blisters, and have a fine sprayed texture.
 4. Special care shall be exercised to avoid contamination of surrounding areas or property by over spraying. Containment tarps should be used when spray application is performed.
 5. The work area shall be properly ventilated to assure proper worker protection.
- F. Metallizing Adhesion: Adhesion strength of the metallizing shall be 700 psi minimum as measured with approved equipment as per ASTM D4541 using apparatus under Annex A4. All adhesion test locations shall be re-metallized in accordance with this specification at no additional cost. Measurements shall be taken every 500 square feet. If adhesion is less than 700 psi but greater than 560 psi, four additional adhesion tests shall be made. If any of the additional adhesion tests are less than 700 psi, the coating shall be removed and re-applied at the Contractor's expense. Any adhesion test result less than 560 psi, will be grounds for the Contractor to re-

move the entire coating at their expense.

G. Sealer/Paint Application

1. Apply all sealer/paint by the methods shown below unless the methods recommended by the sealer/paint manufacturer are more restrictive. Apply the sealer/paint to all previously metallized surfaces. In no cases shall the seal coat be applied over visible oxidation of the metallizing.
2. Apply the sealer/paint in a two-coat operation, a mist coat and a full coat. Thin the mist coat up to the manufacturer's written maximum amount using the recommended thinner in order to penetrate the metallizing layer. Apply the full finish sealer/paint coat without thinning.
3. Airless or conventional spray application - If conventional spray is used, verify that the compressed air supply is clean and dry as determined by the blotter test. When spraying, use extreme care to avoid contamination of surrounding areas or property by overspray.
4. Brush or roller application - Brushes or rollers may be used to control overspray, or for localized application such as touch-up, in areas of limited accessibility for spraying, or for stripe coating.

H. Recoat Times For Liquid Coatings

1. Apply each coat only after the previous coat has been allowed to dry as required by the manufacturer's written instructions, but as soon as possible to minimize the length of time that the coating is exposed to dust and contamination.
2. Do not allow any coat to remain exposed for longer than fourteen (14) calendar days prior to overcoating.

I. Coverage and Continuity

1. Apply each coat to assure thorough wetting of the substrate or underlying coat, and to achieve a smooth, streamline surface relatively free of dryspray, overspray, and orange peel. Shadow-through, pinholes, bubbles, skips, misses, lap marks between applications, or other visible discontinuities in any coat are unacceptable. Runs or sags in liquid coatings may be brushed out while the material remains wet. If the discontinuities remain in the film after drying, remove and replace the defective coating as described later in the "Repair" section of this specification.
2. Thoroughly coat all surfaces with special attention to hard-to-reach areas, and irregular surfaces. Some configurations may require spraying from multiple directions to assure complete coverage.

J. Tint - Tint successive coats (if approved by the manufacturer), or use materials of sufficiently different color to facilitate proper coverage and to provide a visual distinction between coats.

K. Sealer/Paint Adhesion

1. Apply sealer/paint in such a manner to assure that they are well-adherent to each other and to the underlying surface. If the application of any coat causes lifting of an underlying coat, or there is poor adhesion between coats or to the substrate, remove the coating in the affected area to adjacent sound, adherent, coating, and reapply the material.
2. If sealer/paint adhesion is suspect, conduct adhesion tests in accordance with ASTM D3359 or ASTM D4541 as directed by CTDOT and repair all test areas. The acceptance

criteria for the testing will be established by CTDOT and the coating manufacturer. Replace all defective coating that is revealed by the testing.

L. Wet Film Thickness - Use wet film thickness gages in accordance with ASTM D4414 to verify the thickness of each liquid coat at the time of application.

M. Dry Film Thickness

1. Apply each coat to the thicknesses specified below:

Metallizing	8.0 to 10.0 mils
Urethane Sealer (mist coat)	1.0 to 2.0 mils
Urethane Sealer (full coat)	<u>2.0 to 4.0 mils</u>

TOTAL SYSTEM 11 to 16 mils

2. Measure the thickness of each coat using nondestructive magnetic dry film thickness gages. Comply with SSPC-PA2 for the calibration and use of the gages, and the frequency of thickness measurements. Spot readings both 20% above and 20% below the thicknesses shown above are permitted, provided the average thicknesses are within the specified tolerances.
3. If there are questions regarding the non-destructive measurements of coating thickness, a Tooke Gage (destructive scratch gage) may be used when authorized by CTDOT. Conduct measurements in accordance with ASTM D4138, but limit its' use to a minimum of locations. Mark and repair all damage caused by the destructive testing, whether created by CTDOT or the Contractor.
4. Apply additional coating to areas of insufficient thickness with care to assure that all repairs blend in with the surrounding material.
5. Unless directed otherwise by CTDOT, remove excessive coating thickness and reapply the affected coat(s).

3.4 REPAIR OF FILM DISCONTINUITIES AND DAMAGE TO COATING SYSTEM AFTER ERECTION

A. Surface Preparation of Film Discontinuities or Damage

1. Remove localized film discontinuities (e.g., runs, sags, shadow-through, etc.) or damage and corrosion by solvent cleaning in accordance with SSPC-SP 1 followed by sanding or power tool cleaning.
2. In damaged metalized areas, if the repair operation exposes the substrate, remove all loose material and prepare the steel in accordance with SSPC-SP 5 and achieve a uniform and dense surface profile of 2 to 4 mils.
3. If the substrate is not exposed, remove all loose material and prepare the surface in accordance with SSPC-SP 3.

B. Feathering of Repair Areas

1. Feather the existing material surrounding each repair location. Feather for a distance of 1 to 2 inches to provide a smooth, tapered transition into the existing intact coating.
2. Verify that the edges of coating around the periphery of the prepared areas is tight and in-

tact by probing with a putty knife in accordance with the requirements of SSPC-SP3. Roughen the existing coating in the feathered area to assure proper adhesion of the repair coats.

C. Coating Application

1. When the bare substrate is exposed in the repaired area, apply the metallizing and urethane sealer/paint.
2. When the repair does not extend to the bare substrate, apply only the seal coats.
3. Maintain the thickness of the system in overlap areas within the specified total thickness tolerances.

3.5 INSPECTION

- A. CTDOT may inspect any or all phases of the Work to verify that it is in accordance with the requirements of this section. Facilitate this inspection as required, including allowing ample time for the inspections and access to the work. Inspections may include, but are not limited to, surface preparation, pre-painting cleanliness, paint application, dry film thickness, film appearance and continuity, and adhesion.
- B. The presence or activity of CTDOT inspections in no way relieves the Contractor of the responsibility to comply with all requirements of this Section and to provide adequate inspections of its' own.
- C. Furnish, until final acceptance of the coating system, all equipment and instrumentation needed to inspect all phases of the work.

3.6 ONE-YEAR ANNIVERSARY INSPECTION

- A. A one-year anniversary inspection will be conducted approximately twelve months after the structure has been erected. Provide for all aspects of this inspection (i.e. access, rigging, safety traffic control, etc.) and participate in this inspection with CTDOT. All at no additional cost to CTDOT.
- B. Repair, at no cost to CTDOT, all locations where the coating exhibits disbonding, cracking, rusting, or other such defects. Perform all repairs in accordance with this Section and the coating manufacturer's written instructions.

END OF SECTION 050310

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions of Division 1, State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges, and Incidental Construction, Form 816 - 2004 and supplemental specifications thereto, shall be a part of this specification.
- B. Work included in this section may require coordination with Amtrak regarding track outages, flagmen, or other issues related to work around railroad facilities. The Contractor shall pay special attention to the specification entitled "SAFETY AND PROTECTION OF RAILROAD TRAFFIC AND PROPERTY" and other Amtrak Specifications contained in the Contract.

1.2 SUMMARY

- A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
 - 1. Windscreens
 - 2. Opaque spandrel panels in window systems
 - 3. Glass mounting accessories
 - 4. Glazing in elevator towers, stair towers, and pedestrian overpass.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. Interspace: Space between lites of an insulating-glass unit.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2003 International Building Code (except as amended, altered or deleted by the 2005

Connecticut State Building Code with 2009 Amendments) by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on Drawings.
 - b. Basic Wind Speed: 120 mph.
 - c. Importance Factor: 1.0
 - d. Exposure Category: C.
 3. Design Snow Loads: As indicated on Drawings.
 4. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
 5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 6. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.5 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.6 ACTION SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Product Data: For each glass product and glazing material indicated.

- C. Glass Samples: For each type of the following products; 12 inches square.
 - 1. Tinted glass.
 - 2. Fire-resistive glazing products.
 - 3. Laminated glass.
 - 4. Frosted (White) Laminated Glass
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Submit the following in accordance with Form 816 Article 1.20-1.05.02 and NOTICE TO CONTRACTOR – SUBMITTALS.
- B. Qualification Data: For installers.
- C. Product Certificates: For glass and glazing products, from manufacturer.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for glazing sealants and glazing gaskets.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- E. Preconstruction adhesion and compatibility test report.
- F. Warranties: Sample of special warranties.
- G. Manufacturer Certification Letter in accordance with NOTICE TO CONTRACTOR – POTENTIAL FOR ASBESTOS CONTAINING MATERIALS.

1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain products from a single manufacturer in accordance with Form 816 Article 1.20-1.06.01.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

- E. Source Limitations for Glass: Obtain laminated glass and insulating glass from single source from single manufacturer for each glass type.
- F. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
 - 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR-A7, "Sloped Glazing Guidelines."
 - 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 - 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark each glass with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies. Label shall not be obscured by frame assembly.
- H. Fire-Protection-Rated Glazing Labeling: Permanently mark each fire-protection-rated glass panel with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes. Label shall not be obscured by frame assembly.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Form 816 Article 1.06.03 and Form 816 Article 1.20-1.06.03 for additional information.
- B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- C. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F.

1.11 WARRANTY

- A. Refer to Form 816 Article 1.20-1.06.08 and NOTICE TO CONTRACTOR – CLOSEOUT DOCUMENTS for additional information.
- B. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- C. Manufacturer's Special Warranty on Laminated Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.
- D. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

- A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.
 - 1. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
 - 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance

Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

- C. Windborne-Debris-Impact Resistance: Provide exterior glazing that passes enhanced-protection testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
 - 1. Large-Missile Test: For glazing located within 30 feet of grade.
 - 2. Small-Missile Test: For glazing located more than 30 feet above grade.
 - 3. Large-Missile Test: For all glazing, regardless of height above grade.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 - 5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 - 6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Ultraclear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, complying with other requirements specified and with visible light transmission not less than 91 percent and solar heat gain coefficient not less than 0.87.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AFG Industries, Inc.; Krystal Klear.
 - b. Guardian Industries Corp.; Ultrawhite.
 - c. Pilkington North America; Optiwhite.
 - d. PPG Industries, Inc.; Starphire.
- C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
 - 2. For uncoated glass, comply with requirements for Condition A.
 - 3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide safety glazing labeling. Markings as specified in ANSI Z97.1, shall be present on each separate piece of glass and shall remain visible after installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- B. Frosted (White) Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide safety glazing labeling. Markings as specified in ANSI Z97.1, shall be present on each separate piece of glass and shall remain visible after installation.
1. Construction: White Laminate glass with polyvinyl butyral interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written recommendations.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.
- C. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Provide safety glazing labeling. Markings as specified in ANSI Z97.1, shall be present on each separate piece of glass and shall remain visible after installation.
1. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:
 - a. Polyvinyl butyral interlayer.
 - b. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.
 - c. Ionoplast interlayer.
 - d. Cast-in-place and cured-transparent-resin interlayer.
 - e. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.
 2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
 3. Interlayer Color: Clear unless otherwise indicated.

- D. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.4 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing, General: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252 for door assemblies and NFPA 257 for window assemblies.
- B. Monolithic Ceramic Glazing: Clear, ceramic flat glass; 3/16-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Nippon Electric Glass Co., Ltd. (distributed by Technical Glass Products); Premium FireLite.
 - b. Safti First; SuperLite C/P.
 - c. Schott North America, Inc.; Pyran Star.
 - d. Vetrotech Saint-Gobain; SGG Keralite FR-R.
 - e. .
- C. Fire-Protection-Rated Tempered Glass: 1/2-inch- thick, fire-protection-rated tempered glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. InterEdge, Inc., a subsidiary of AFG Industries, Inc.; PyroEdge-20.
 - b. Safti First; SuperLite20.
 - c. Vetrotech Saint-Gobain; SSG Pyroswiss.
 - d. .
- D. Fire-Protection-Rated Laminated Glass: 5/16-inch- thick, fire-protection-rated laminated glass, complying with testing requirements in 16 CFR 1201 for Category II materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Oldcastle Glass, Inc.; Pyroguard.

2.5 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
 - 1. Neoprene complying with ASTM C 864.
 - 2. EPDM complying with ASTM C 864.
 - 3. Silicone complying with ASTM C 1115.
 - 4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene EPDM silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
 - 1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.
- C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.6 GLAZING SEALANTS

- A. General:
 - 1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 790.
 - b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
 - c. May National Associates, Inc.; Bondaflex Sil 290.
 - d. Pecora Corporation; 890.
 - e. Sika Corporation, Construction Products Division; SikaSil-C990.
 - f. Tremco Incorporated; Spectrem 1.
 - g. .
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Omniseal 50.
 - b. Dow Corning Corporation; 995.
 - c. GE Advanced Materials - Silicones; UltraPruf II SCS2900.
 - d. May National Associates, Inc.; Bondaflex Sil 295.
 - e. Pecora Corporation; 898.

- f. Polymeric Systems, Inc.; PSI-641.
- g. Sika Corporation, Construction Products Division; SikaSil-C995.
- h. Tremco Incorporated; Spectrem 3.

- D. Glazing Sealants for Fire-Rated Glazing Products: Products that are approved by testing agencies that listed and labeled fire-resistant glazing products with which they are used for applications and fire-protection ratings indicated.

2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
 - 1. AAMA 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

2.10 LAMINATED-GLASS TYPES

- A. Glass Type : Clear laminated glass with two plies of ultraclear fully tempered float glass.
 - 1. Thickness of Each Glass Ply: As indicated.
 - 2. Interlayer Thickness: 0.030 inch.
 - 3. Provide safety glazing labeling. Markings as specified in ANSI Z97.1, shall be present on each separate piece of glass and shall remain visible after installation.

2.11 FIRE-PROTECTION-RATED GLAZING TYPES

- A. Glass Type : 60-minute fire-rated glazing with 450 deg F temperature rise limitation; laminated glass with intumescent interlayers or gel-filled, double glazing units.
 - 1. Provide safety glazing labeling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 LOCK-STRIP GASKET GLAZING

- A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000