DISCLAIMER: ***THIS DRAFT PLAN SET AND DRAFT SPECIFICATIONS ARE PROVIDED FOR INFORMATIONAL PUPOSES ONLY AND AS A CONVENIENCE TO ALL INTERESTED PARTIES. THE CD, DRAFT PLANS AND DRAFT SPECIFICATIONS ARE NOT INTENDED TO BE USED FOR PREPARATION OF BIDS. BIDS MAY ONLY BE PREPARED ON THE BASIS OF BID DOCUMENTS FROM NJDOT WHEN THIS PROJECT HAS BEEN OFFICALLY ADVERTISED FOR RECEIPT OF BIDS. ANY DISCREPANCIES BETWEEN THE INFORMATION PROVIDED AT THE INFORMATIONAL MEETING AND THE OFFICIAL WRITTEN CONTRACT DOCUMENTS WHEN THE PROJECT HAS BEEN OFFICIALLY AVERTISED FOR BIDS SHALL NOT PROVIDE A BASIS FOR ANY ACTION AGAINST THE NEW DEPARTMENT OF TRANSPORTATION OR ITS DESIGN CONSULTANTS.***

SPECIAL PROVISIONS

ROUTE 139
CONTRACT NO. 001970190 (CONTRACT 2)
REHABILITATION OF:
12TH STREET VIADUCT STRUCTURE NO. 0904-153
14TH STREET VIADUCT STRUCTURE NO. 0904-154
JERSEY CITY
HUDSON COUNTY
FEDERAL PROJECT NO. BHF-0047(112)

AUTHORIZATION OF CONTRACT

The Contract for this Project is authorized by the provisions of Title 27 of the Revised Statutes of New Jersey and supplements thereto, and Title 23 of the United States Code - Highways.

SPECIFICATIONS TO BE USED

The 2001 Metric Standard Specifications for Road and Bridge Construction, of the New Jersey Department of Transportation as amended herein will govern the construction of this Project and the execution of the Contract.

These Special Provisions consist of the following:

Pages 1 to 305 inclusive for General, Road, and Bridge Provisions.

Required Contract Provisions, Federal-Aid Construction Contracts (Form FHWA-1273) pages 1 to 10 inclusive, revised March 1994.

Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246), pages 1 to 5 inclusive, dated December 1980, revised April 1984.

Notice of Requirement for Affirmative Action to Ensure Equal Employment Opportunity (Executive Order 11246), pages 1 and 2, dated December 1980, revised April 1984.

State of New Jersey Equal Employment Opportunity for Contracts Funded by FHWA, page 1, dated November 1978, revised April 1984.

Emerging Small Business Enterprise Utilization Attachment, FHWA Funded Contracts, pages 1 to 7 inclusive, dated March 2001.

Equal Employment Opportunity Special Provisions, pages 1 to 11 inclusive, dated February 1976, revised April 1984, November 22, 1988, and March 1998.

Special Contract Provisions for Investigating, Reporting, and Resolving Employment Discrimination and Sexual Harassment Complaints, pages 1 and 2 inclusive, dated January 1989.

General wage determinations issued under Davis-Bacon and related acts, published by US Department of Labor, may be obtained from the Davis-Bacon web site at http://www.access.gpo.gov/davisbacon/nj.html under the appropriate county, select the construction type heading: HIGHWAY.

The Contractor shall pay the minimum wage rates determined by the United States Secretary of Labor and the New Jersey Department of Labor. If the minimum wage rate prescribed for any craft by the United States Secretary of Labor is not the same as the minimum wage rate prescribed for that craft by the New Jersey Department of Labor, the higher rate shall be the rate paid.

State wage rates may be obtained from the New Jersey Department of Labor (Telephone: 609-292-2259) or by accessing the Department of Labor's web site at http://www.nj.gov/labor/lsse/lspubcon.html The State wage rates in effect at the time of award will be made a part of this Contract, pursuant to Chapter 150, Laws of 1963 (NJSA 34:11-56.25, *et seq.*).

In the event it is found that any employee of the Contractor or any subcontractor covered by the Contract, has been paid a rate of wages less than the minimum wage required to be paid by the Contract, the State may terminate the Contractor's or subcontractor's right to proceed with the Work, or such part of the Work, as to which there has been a failure to pay required wages and to prosecute the Work to completion or otherwise. The Contractor and its sureties shall be liable to the State for any excess costs occasioned thereby.

State of New Jersey Equal Employment Opportunity for Contracts Funded by Wholly State Funds, pages 1 to 4 inclusive, dated April 2003.

The Contractor shall pay the minimum wage rates determined by the New Jersey Department of Labor.

State wage rates may be obtained from the New Jersey Department of Labor (Telephone: 609-292-2259) or by accessing the Department of Labor's web site at http://www.nj.gov/labor/lsse/lspubcon.html The State wage rates in effect at the time of award will be made a part of this Contract, pursuant to Chapter 150, Laws of 1963 (NJSA 34:11-56.25, *et seq.*).

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DIVISION 100 - GENERAL PROVISIONS

SECTION 101 - GENERAL INFORMATION

101.01 General.

THE FOLLOWING IS ADDED:

Pursuant to NJSA 27:1B-21.6, the Commissioner intends to enter into a multi-year contract for the advancement of the Project. Although the multi-year contract will pledge funds anticipated to be appropriated for the Project by the Legislature, payment of the moneys pledged is subject to the availability of funds in the fiscal year (FY) in which the funds are to be appropriated. Only amounts appropriated by law may be expended.

The Commissioner intends to proceed expeditiously with the Project. However, there is no assurance that the Annual Appropriations Act will contain an appropriation or that the Federal Government will approve or provide federal funding for the Project. The Legislature has no legal obligation to make such an appropriation. Failure by the Legislature to appropriate funds or failure by the Federal Government to approve or provide federal funding sufficient to advance the Project will not constitute a default under, or breach of, any contract entered into by the State for the construction of the Project. However, if the State terminates the Contract or suspends work under the Contract because the Legislature has failed to appropriate or the Federal Government has failed to provide or approve sufficient funding to advance the Project, the parties to the Contract will retain their rights pursuant to the suspension of work and termination of Contract Provisions of the Project specifications; except as indicated below.

The Contractor shall not expend or cause to be expended any sum in excess of the amount allocated in the current fiscal year's Capital Program (as specified below). The Department will notify the Contractor when each level of additional funding has been appropriated by the Legislature or approved or provided by the Federal Government. Any expenditure by the contractor which exceeds the amount actually appropriated or exceeds the amount of approved federal funding is at the Contractor's risk and the Contractor waives any right to recover any sum in excess of that appropriated amount or the amount approved or provided by the Federal Government even if the State terminates or suspends work under the Contract because the Legislature has failed to appropriate or the Federal Government has not provided or approved sufficient funds to advance the Project.

The approved 2005 Capital Program has an item with $27.7 million for the construction of the Project.

It is anticipated that 32.1 million dollars in additional funds will be provided during Federal FY 2006.

It is further anticipated that the balance of the funds necessary to complete the Project will be provided during Federal FY 2007.

It should be noted that the Federal FY begins October 1 of the previous calendar year and that the State FY begins July 1 of the previous calendar each year.

101.03 Terms.

THE THIRD ITEM LISTED UNDER THE TERM “COMPLETION” IS CHANGED TO:

3. the Contractor has satisfactorily executed and delivered to the Engineer all documents, which is to include the federal form FHWA-47 “Contractor’s Statement of Materials and Labor” according to 23CFR 635, for Federal Funded Projects, certifications, and proofs of compliance required by the Contract Documents, it being understood that the satisfactory execution and delivery of said documents, certificates, and proofs of compliance is a requirement of the Contract.

THE TERM “EXTREME WEATHER CONDITIONS” IS CHANGED TO:

EXTREME WEATHER CONDITIONS. When, solely as a result of adverse weather, the Contractor is not able to work, the Contractor is entitled to claim that progress of the Work has been affected by extreme weather conditions and may seek an extension of Contract Time consistent with the provisions of Subsection 108.11.

THE FOLLOWING IS ADDED:

PARCEL. Property to be acquired for transportation purposes, described by metes and bounds.

THE FOLLOWING TERMS ARE ADDED:

ADDITIONAL COMPENSATION. A monetary payment(s), sought by the Contractor, premised upon (1.) an adjustment or modification to the Contract pay item(s) for particular work or (2.) any or all forms of compensation over and above that which is specifically provided under the various individual Contract Pay Items or Contract payment provisions.

COMPLETION OF THE CONTRACT. The event termed "Completion of the Contract", under the Specifications and the Contractual Liability Act NJSA 59:13-1 *et seq.,* shall be deemed to have occurred as of the date the Contractor accepts or accepts with reservation of specific claims, in writing in accord with forms supplied by the Department, the Final Certificate issued by the Department or the 31st day after issuance of said Final Certificate by the Department, whichever event may be the first to occur.

CLAIM. The Contractor has reason to believe it is entitled to additional compensation and/or an extension of contract time, in accordance with and subject to the Contract Documents and the provisions of the Contractual Liability Act, N.J.S.A. 59:13-1 *et seq*., arising out of or relating to the happening of an event, thing or occurrence or an act or failure to act by the Engineer. A claim accrues when it arises, meaning when a situation or occurrence takes place or comes about which has or possesses the potential to support or become the basis for additional compensation and/or an extension of time.

DISPUTE (AS TO A CLAIM). A disagreement between the Department and the Contractor with regard to the Work or Contract Documents arising out of a claim by the Contractor for additional compensation or an extension of time.

FINAL CERTIFICATE. It is the final payment document that sets forth the total amount payable to the Contractor, including therein an itemization of said amount segregated as to Pay Item quantities, Extra Work, and any other basis for payment; it also includes therein any retainage to be released and all deductions made or to be made from prior payments as required pursuant to the provisions of the Contract Documents, which may result in either a Final Payment to the Contractor or a Credit (payment) due the Department.

NON-BINDING MEDIATION. The fourth and final step in the Department's Contractual Claim Resolution Process for claims arising under the Contract utilizing a non-binding mediation forum wherein an independent mediator is engaged in an attempt to resolve a claim presented by a Contractor.

SECRETARY, DEPARTMENT CLAIMS COMMITTEE. The individual employed by the Department who gathers information and provides administrative assistance to the members of the Department Claims Committee. This individual is the conduit between the Department Claims Committee members and the Contractor. Contact by the Contractor regarding any issue involving the Claims Committee or Mediation shall be through the Secretary.

THE FOLLOWING TERMS ARE REVISED:

DEPARTMENT CLAIMS COMMITTEE. A contractual body available to review and resolve claims that arise under the Contract. The Committee consists of three voting members with the Director of Design Services as the chairperson, one member is the Department's Chief Financial Office, and one member is selected from the other directors within Capital Program Management. Additional non-voting members are a Deputy Attorney General, the Secretary of the Department Claims Committee, and a member of the Federal Highway Administration (for federally funded projects).

REGIONAL DISPUTE BOARD. A three-member Board, comprised of one member from the Division of Project Management, one member from the Bureau of Construction Engineering, and the Regional Construction Engineer (Chairperson), that is available under the terms of the Contract to review Disputes which have not been resolved by the Resident Engineer.

THE FOLLOWING TERMS ARE DELETED:

CLAIMS REVIEW BOARD

DISPUTE

101.04 Inquiries Regarding the Project.

Inquiries regarding the various types of work of this Contract shall be directed to the following representatives of the Department having offices at P.O. Box 600, Trenton, New Jersey 08625, or such other individuals as may hereafter be designated:

1. **Before Award of the Contract.** All inquiries shall be directed to the Bureau of Quality Assurance at P.O. Box 600, Trenton, New Jersey 08625.

   Telephone: 609-530-2499 (Warren Howard)

   Fax: 609-530-3853

   All inquiries shall include the following:
   a. Name of the company;
   b. Telephone number, fax number, and contact person; and
   c. Specifics of the inquiry, including anticipated impacts.

   The Department will investigate the information provided in the inquiry and then respond through an addendum only if determined to be necessary.

2. **After Award of the Contract.** All inquiries shall be directed to the Resident Engineer through the following Regional Construction Office:

   North
   Mr. Carl F. Kneidinger, Regional Construction Engineer
   200 Stierli Court
   Mt. Arlington, NJ 07856-1322
   Telephone: 973-770-5025

SECTION 102 - BIDDING REQUIREMENTS AND CONDITIONS

102.01 Prequalification of Prospective Bidders.
THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

Additionally, for wholly State-funded contracts, bidders must be registered with the New Jersey Department of Labor, Division of Wage and Hour Compliance, at the time of bid pursuant to the "Public Works Contractor Registration Act," N.J.S.A. 34:11-56.48 et seq. (P.L. 2003, c. 91). This requirement for registration at the time of bid does not apply to FHWA funded projects.

102.02 Disqualification of Prequalified Prospective Bidders.
THE FOLLOWING IS ADDED TO THE END OF LIST:

10. For wholly State-funded contracts, failure to have valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance according to N.J.S.A. 34:11-56.48 et seq., at the time of bid.

102.06 Examination of Contract Documents and Site of Project.
THE ENTIRE TEXT IS CHANGED TO:

The Bidder shall examine carefully the site of the proposed Project, the Contract Documents, and other information before submitting a Proposal. The Contract Documents are not to be construed as an averred representation or warranty of the existing conditions. In the event the Bidder's examination reveals that the site conditions are inconsistent with the Contract Documents or there are discrepancies, errors, omissions or patent ambiguities within the Contract Documents, the Bidder shall immediately notify the Department as provided in Subsection 101.04. Bidders shall make such independent investigation and examination as necessary to satisfy the Bidder as to the conditions to be encountered in the performance of the Work and the type of equipment and operations required to perform the Work. The Bidder shall investigate, with respect to possible local material sources, the quality and quantity of material available and the type and extent of processing that may be required to produce material conforming to the requirements of the Contract Documents. The submission of a Proposal shall be considered prima facie evidence that the Bidder has made such independent investigation and examination, including the information provided below, and is fully aware of the requirements of the Contract Documents, including all restrictions. Further, the Bidder warrants that the proposed contract prices in the Proposal include all costs to complete the Work.

The Bidders must provide written notice to the Regional Construction Engineer as listed in the Special Provisions Subsection 101.04, at least 24 hours in advance of any investigation at the site, and insure any staff at the site have two forms of identification and the site authorization form received with the purchase of the Contract Documents.

What is specified below is not a part of the Contract and is made available for information only. The Department makes no representation, warranty or guarantee, expressed or implied, by making available such information. It is also the Bidder's responsibility to access such information.

1. Investigation of Subsurface and Surface Conditions.

The records of the Department's subsurface investigation, including, but not limited to, boring logs and Geotechnical Engineering Design Reports, may be inspected at or ordered through the Department's plan file room, 1035 Parkway Avenue, P.O. Box 600, Trenton, New Jersey 08625. This investigation, while considered by the Department to be sufficient for design purposes, may not be a sufficient substitute for the Bidder's own investigation, interpretation, or judgement in preparing a Proposal for construction purposes. The Bidder shall not rely on any estimates and quantities included in these investigations. The conditions indicated by such investigations or records thereof, and as shown by the cross-sections in the Plans, may not be representative of those existing throughout such areas, or that materials other than, or in proportions different from those indicated, may be encountered.

The soil and rock descriptions shown on the boring logs are determined by a visual inspection of samples from the various explorations unless otherwise noted. These samples may be available for nondestructive examination. The observed water levels and other water conditions indicated on the boring logs are as recorded at the time of the exploration. These levels and other conditions may vary considerably, with time, according to the prevailing climate, rainfall, and other factors. If a generalized soil profile is described in the text it is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples.

The Bidder is charged with knowledge of the State's physical geography, and in performing its site investigation shall be fully aware of the following publications and such others as may be listed in the Special Provisions:

a. Bulletin 50, Geologic Series, "The Geology of New Jersey" by H. Kummel, out of print, available generally as library reference material.
b. Geologic Maps of New Jersey, available through NJDEP.
c. Engineering Soils Survey of New Jersey, available through the Bureau of Research, College of Engineering, Rutgers University, New Brunswick, New Jersey 08903.
d. Soil Surveys of Individual Counties prepared by the US Department of Agriculture, Soil Conservation Service, in cooperation with the New Jersey Agricultural Experiment Station and Cook College, Rutgers University, available through local Soil Conservation District Offices.

2. **Utility Agreements.** In addition to what is provided under Subsection 105.09, the Utility agreements, modifications, and orders relating to the Project may be inspected at or ordered through the Department's plan file room, 1035 Parkway Avenue, P.O. Box 600, Trenton, New Jersey 08625. Existing information and proposed construction documents shall be obtained through the utility owners for their respective work.
3. **Existing Plans & As-builts**. As-built plans of Department owned facilities may be inspected at the Department's plan file room or copies ordered upon written request through the Engineering Documents Unit, New Jersey Department of Transportation, 1035 Parkway Avenue, P.O. Box 600, Trenton, New Jersey 08625. Contour maps may be available for some Projects and the Bidders may inspect such maps or obtain copies for their use upon written request to the Engineering Documents Unit. Plans of Municipal owned or County owned facilities shall be obtained through the Municipality or County. Any information obtained from the existing documents shall be verified by the Bidder in regards to its application for bidding and completing the Project. A list of existing structures within the Project will be provided on the Plans.

Existing Plans & As-builts used are as follows:

Existing Plans

Plans of Route 139 (1) Contract No. 000970189 (Contract 1), 1999, Rehabilitation of:
12th Street Viaduct Structure No. 0904-153
14th Street Viaduct Structure No. 0904-154
Conrail Viaduct Structure No. 0904-151

14th Street Viaduct Structure No. 0904-154

Steelwork – Contract HT-12, 1948
Foundations – Contract HT-11, 1948
Concrete Deck and Approaches – Contract HT-13, 1949

12th Street Viaduct Structure No. 0904-153

Route No. 1 Extension, Section No. 1, 1925
Route 1 Business, Section 1C, 12th Street Viaduct Redecking, Resurfacing and Rehabilitation, 1968

New Jersey Turnpike Newark Bay-Hudson County Extension

Steel Superstructure – Contract N-27B, 1955
Concrete Deck – Contracts N-25A, N-25B, N-25C and N-25D, 1955
Substructure – Contracts N-26B and N-26C, 1955
Bridge Deck Repair and Resurfacing – Contract R-1277, 1996

As-builts

12th Street Viaduct Structure No. 0904-153 Shop Drawings

Original Shop Drawings dated 6/12/26 by American Bridge Co. for Route 1 Extension Viaduct Approach to Vehicular Tunnel, Section No. 1

Fredrick Snare Corporation Contract 1332, 1926

McClintic-Marshall Construction Co., dated 1927

Repairs, Route 1 Business, Section 1C, 1968

4. **Permits**. In addition to the permit information provided in the Contract Documents, the full permits relating to the Project may be inspected at or ordered through the Department's plan file room, 1035 Parkway Avenue, P.O. Box 600, Trenton, New Jersey 08625.

SECTION 103 - AWARD AND EXECUTION OF CONTRACT

103.06 Execution and Approval of Contract.

THE HEADING AND THE ENTIRE TEXT IS CHANGED TO:

103.06 Execution and Escrow of the Contract.

1. **Execution.** The successful Bidder shall properly and duly execute a Contract in accord with Contract Documents and return same, together with the Performance Bond and Payment Bond, within ten State Business Days of the date of Award or Conditional Award. The successful bidder shall also provide the Department, within the same ten State Business Day period, proof of a valid business registration with the Division of Revenue in the New Jersey Department of Treasury. The Contract will not be entered into by the Department unless the Bidder first provides proof of a valid business registration in compliance with N.J.S.A. 52:32-44 (P.L. 2001, c134). For FHWA funded projects, the successful bidder shall also provide proof of valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by "Public Works Contractor Registration Act," N.J.S.A. 34:11-56.48 et seq. (P.L. 2003, c. 91). If said Contract is not executed by the Commissioner within 45 State Business Days following receipt from the Bidder of the executed Contract and Performance Bond and Payment Bond, the Bidder may within its discretion withdraw its bid without penalty; where the Bidder chooses not to withdraw prior to the Commisioner executing said Contract, the Bidder shall be deemed to have waived any claim for Additional Compensation or for an extension of time. The Contract shall not become effective until it has been fully executed by all parties.

2. **Escrow.** The successful Bidder who would like to participate in the Non-Binding Mediation of any and all claims arising under the Contract, as provided in Subsection 107.02, shall, within the same ten State Business Day period, escrow all of its bid preparation documents, which are dated prior to or as of submission of the bid proposal to the Department, in sealed boxes with a Custody Agent, and return to the Department a Custody Agreement fully executed by the Bidder and the Custody Agent. The Bidder shall also certify under oath that the escrowed documents have not been modified changed or corrected in any manner since the date appearing on said documents and that the documents escrowed constitute all related documents relied upon in preparing the proposal. The Custody Agreement Form will be provided by the Department at the time of Award and shall be completed in its entirety and include a detailed list of all documents contained in the boxes of bid documents placed in escrow.

   A failure by the Bidder to escrow its bid preparation documents and to return to the Department the fully executed Custody Agreement within ten State Business Days shall constitute a waiver by the Bidder of any ability or opportunity to participate in the Non-Binding Mediation of claims arising under the Contract. The use and preservation of escrowed bid documents shall be governed by the terms of the escrow agreement that is to be executed by the Contractor and the escrow agent, which agreement shall be in accord with the form provided by the Department. Upon Completion of the Contract, the Contractor may apply to the Department to release any escrowed documents so long as there are no pending claims.

SECTION 104 - SCOPE OF WORK

104.05 Increased or Decreased Quantities.

THE FOLLOWING IS ADDED:

Those Pay Items listed below shall be considered as major Pay Items even though their Contract value may not be more than ten percent of the Total Contract Price:

104.07 Changes in Character of Work.

THE FIRST PARAGRAPH UP TO AND INCLUDING THE FIRST SENTENCE OF ITEM 1 IS CHANGED TO:

If an ordered alteration in the Work pursuant to Subsection 104.02 materially changes the character of the work of a Pay Item, and if the change substantially increases or decreases the actual unit cost of such changed item as compared to the actual or estimated actual cost of performing the work of said item according to the Contract Documents originally applicable thereto, in the absence of a supplementary agreement or unprotested Change Order specifying the compensation payable, an adjustment in compensation therefore will be made according to the following:

1. The basis of such adjustment in compensation will be the difference between the actual unit cost to perform the work of said item or portion thereof involved in the alteration as originally planned and the actual unit cost of performing the work of said item or portion thereof involved in the alteration, as changed.

SECTION 105 - CONTROL OF WORK

105.04 Working Drawings.

THE ELEVENTH PARAGRAPH IS CHANGED TO:

Working Drawings shall be 22" x 36" sheets or 8½" x 11" sheets. Seven copies shall be submitted to the designated design unit for review and a copy of the transmittal letter shall be sent to the Resident Engineer, except that for railroad carrying structures, four additional copies shall be submitted to the designated design unit. One additional copy each shall be submitted when an outside testing agency or an outside authority is involved in the Project. Working Drawings and any work related to the New Jersey Turnpike Authority Northbound and Southbound Ramps will also be reviewed by the New Jersey Turnpike Authority. An additional three copies of the working drawings shall be required by the New Jersey Turnpike Authority for review. The above submittal procedure will simultaneously facilitate both certification and distribution.

THE FOLLOWING IS ADDED TO THE SEVENTEENTH PARAGRAPH:

22. Bracket retrofits
23. Floorbeam retrofits
24. Girder retrofits
25. Column retrofits
26. Base plate retrofits
27. Restrainer/Anchor bracket assembly
28. Restrainer cable connection assembly
29. Bracket repairs
30. Floorbeam repairs
31. Girder repairs
32. Truss repairs
33. Hole repairs
34. Column repairs
35. Bent bracing repairs
36. Steel grid flooring
37. Demolition plans and calculations

THE FOLLOWING IS ADDED TO THE EIGHTEENTH PARAGRAPH:

9. Drilled Shaft Work Plan
10. Test Boring Logs
11. Welding Qualifications

The contractor shall submit copies of Welding qualifications as described herein to the design unit for recommendation of approval. The design unit shall return the copies to the engineer for approval.

105.09 Cooperation with Utilities.

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The corporations, companies, agencies, or municipalities owning or controlling the utilities, and the name, title, address, and telephone number of their local representative are as listed below:

Railroads

Consolidated Rail Corporation (Conrail)
1000 Howard Blvd.
Mt. Laurel, NJ 08054
Mr. Leo McGlynn
Tel. (856) 231-2450

Electric

Public Service Electric & Gas Company (Electric)
325 County Ave.
Secaucus, NJ 07094
Mr. James Lizer
Tel.(201)330-6543

Gas

Public Service Electric & Gas Company (Gas)
80 Park Plaza, M-12C.
Newark, NJ 07101
Mr. Willard Carey
Tel.(973)430-7000

Telephone

Verizon Communication
1500 Teaneck Rd.
Teaneck, NJ 07666
Mr. Ronald Kempe
Tel. (201) 541-9934
Fax (201) 541-7343

American Telephone & Telegraph
50 Patricia Drive
Flanders, NJ 07836
Mr. Lou Morrello
Tel. (973) 927-1114

Water

Jersey City Municipal Utilities Authorities
Bureau of Water Engineering
555 Route 440 South
Jersey City, NJ 07305
Keh-Jong Liu, P.E.
Chief Water Engineer
Tel. (201)209-0319

Sewer
Jersey City Municipal Utilities Authorities
555 Route 440
Jersey City, NJ 07305
Mr. Joseph Beckmeyer, P.E.
Chief Engineer
Tel. (201) 432-1150
Fax (201) 432-1576

ITS

Port Authority of New York and New Jersey
Tunnels, Bridges and Terminals Department

1 Madison Avenue, 7th Floor
New York, NY 10010
Mr. Hardy Pearl
Project Manager – Holland Tunnel Projects
Tel. (212) 435-4901
Fax (212) 435-4917

Cable Television

Jersey City Comcast
2121 Kennedy Blvd.
Jersey City, NJ 07305
Mr. Kevin Rooney
Tel. (201) 915-0508 Extension 7165

Bidders are advised to verify the above information as its accuracy and completeness is not guaranteed by the Department.

The Contractor is advised that the design for this Contract did not identify any anticipated utility conflicts. However, this Contract does require the Contractor to perform underground excavation and/or the driving of guide rail posts and is reminded to call the State's One Call System as specified in the Standard Specification's, as noted in the first paragraph of Subsection 105.09, to verify that a conflict does not exist.

UTILITY WORK AND TIME FRAME

Utility General Notes:

1. Contractor will provide the utility with notices called for in the schedules.
2. Contractor will provide the utility with survey control. The Contractor and the utility shall jointly verify the location of the facilities prior to installation.
3. Utility schedules are estimated time frames for this utility owner only and do not include work performed by other utility owners sharing joint facilities.
4. Utility schedules are based on the project traffic control and staging plan for each utility mobilization. Utility service demands, field and weather conditions may alter these schedules.
5. Contractor changes to the traffic control and staging plan require reestablishing utility schedules.
6. Where joint facilities are proposed, the utility shall coordinate its work with the joint owners.
7. Existing facilities can only be removed after the relocated facilities have been installed and are in operation.
8. Distances, stations, offsets, lengths or units on the utility plan are approximate (plus or minus).

Utility Work to be Performed

Public Service Electric & Gas Company – Electric Facilities

Existing Facilities

Underground Mains 9-125 mm (5") duck bank 15kv – XLPE Copper Cable with neutral (5 circuits), 2-125 mm (5") duck bank 15kv – 500 MCMEPM Primary Service, 9-125 mm (5") duck bank 15kv – XLPE Copper Cable with neutral (4 Circuits)

Work to be Performed by Public Service Electric & Gas Company (Electric):

1. Install 174m (571') of 12-125mm (5") duct bank (2088m (6852') total) from proposed manhole at 12th Street STA 3+192+/-LT to existing manhole No. 2456 at 14th Street STA 0+146+/-RT. Rebuild existing manhole No. 2456 to facilitate new conduit and cable.
2. Install 900m (2952') of cable (5 circuits) from existing manhole No. 2456 at 14th Street STA 0+146+/-RT to proposed manhole at 12th Street STA 3+192+/-LT. Install 180m (590') of bonding cable.
3. Install 15m (50') of 9-125mm (5") duct bank from proposed manhole at 12th Street STA 3+192+/-LTthrough existing manhole No. 2459 at 12th Street STA 3+180.5+/-LT and pick up existing conduit to manhole No. 2461 at 12th Street STA 3+068+/-LT.
4. Install 620m (2035') of cable (5 circuits) from proposed manhole at 12th Street STA 3+192+/-LT to existing manhole No. 2461 at 12th Street STA 3+068+/-LT. Install 124m (407') bonding cable.
5. Abandon existing underground utility and remove cable where conflict with proposed construction from existing manhole No. 2456 at 14th Street STA 0+146+/-RT to existing manhole No. 2459 at 12th Street STA 3+180.5+/-LT.
6. Install two 6m (20') – 300mm (12") split steel casing within foundation areas centered at 12th Street STA 3+293+/-LTand STA 3+309+/-LT. Install one 9m (30') – 300mm (12") split steel casing within foundation area centered at 12th Street STA 3+325+/-LT to facilitate 3-125mm (5") conduit. Casing to include spare 125mm (5") duct.
7. Install 68m (223') of 12 – 125mm (5") duct bank from existing manhole No. 2462 at 14th Street STA 0+289+/-RT to existing manhole No. 2463 at 14th Street STA 0+307.5+/-LT. Rebuild manhole No. 2462 and No. 2463 to facilitate 12 – 125mm (5") duct bank.
8. Install 299m (980') of cable from existing manhole No. 2462 at 14th Street STA 0+289+/-RT to existing manhole No. 2463 at 14th Street STA 0+307.5+/-LT. Install 75m (245') of bonding cable.
9. Abandon existing underground utility and remove cable where conflict occurs with proposed construction from existing utility manhole No. 2463 at 14th Street STA 0+307.5+/- LT to existing utility manhole No. 2462 at 14th Street STA 0+289+/- RT.
10. Install new utility poles at the following locations: 14th Street STA 0+317+/- RT and 14th Street STA 0+359.5+/- RT.
11. Install 77m (253') of 3W secondary cable from proposed utility pole at 14th Street STA 0+317+/- RT to proposed utility pole at 14th Street STA 0+359.5+/- RT.
12. Abandon existing overhead utility from existing utility pole No. 71126JC at14th Street STA 0+313+/- RT to existing utility pole No. 20727JC at 14th Street STA 0+362+/- RT.

Notes:

1. Utility Company requires 3 months advance notice and 16 weeks to complete relocation work.
2. All electric duct banks shall be concrete encased as per utility requirements.

Public Service Electric & Gas Company – Gas Facilities

Existing Facilities

100mm (4") CI (Cast Iron) Gas Main, 100mm (4") Gas Main

Work to be Performed by Public Service Electric & Gas Company (Gas):

1. Install 29m (95') of 100mm (4") plastic gas main from 12th Street STA 3+194.5+/- LT to 12th Street STA 3+194.5+/- RT.
2. Abandon and remove 10m (33') of 100mm (4") gas main as necessary to facilitate proposed construction from 14th Street STA 0+155.5+/- Left to 14th Street STA 0+158+/- Left.
3. Abandon and remove 100mm (4") gas main where conflict with proposed construction occurs from 12th Street STA 3+194.5+/- LT to 12th Street STA 3+194.5+/- RT.

Notes:

1. Utility Company requires 2 months advance notice and 4 weeks to complete relocation work.
2. State's contractor to coordinate with utility company for service connection protection.

Verizon Communication – Communication Facility

Existing Facilities

400 Pair Copper, 3 Inter-ducts – 72 Fiber, 24 Fiber, 432 Fiber, Utility pole No. A68749, Utility pole No. 68748, Utility pole No. 66463, Utility pole No. PS13177JC

Work to be Performed by Verizon Communication

1. Install 49m (161') of 5-100mm (4") duct bank (245m (805') total) and transfer overhead utility to underground from existing utility pole No. A68749 at 14th Street STA 0+161.5+/-LT to existing utility pole No. 68748 at 14th Street STA 0+149+/- RT. Utility to transition from underground to overhead at utility pole (riser) locations. Install 61m (200') of 400 pair copper cable.
2. Abandon and remove overhead utility from existing utility pole No. A68749 at 14th Street STA 0+161.5+/-LT to existing utility pole No. 68748 at 14th Street STA 0+149+/- RT.
3. Install 48m (158') of 400 pair copper cable (overhead) from 12th Street STA3+203+/- LT to existing utility pole No. 66463 at 12th Street STA 3+199.5+/- RT. Install utility pole at 12th Street STA 3+199.5+/- RT (Cable to connect at building corners at south to north sides of 12th Street).
4. Abandon and remove existing overhead utility from 12th Street STA 3+203+/- LT to existing utility pole No. 66463 at 12th Street STA 3+199.5+/- RT. Abandon and remove utility pole No. PS13177JC at 12th Street STA 3+199.5+/- RT.

Notes:

1. Utility Company requires 2 months advance notice and 6 weeks to complete relocation work.

CHANGE FIRST SENTENCE OF PARAGRAPH 5 TO READ:

Electrical and communication installations constructed either before or as part of the Contract, shall be considered a utility and all provisions of this Subsection shall be applicable.

ADD TO END OF PARAGRAPH 5:

In addition to the requirements for various notifications to utility owners and the State's One Call System as noted in Paragraphs 1, 4, & 6 of this subsection, the contractor shall make separate such notifications to the Department's Electrical Maintenance and Traffic Operations Bureaus where construction may impact or be adjacent to their respective existing facilities. For above and underground electrical facilities involving traffic signals, highway lighting, and movable bridges notification shall be made to the Regional Bureau of Electrical Maintenance at the locations and telephone numbers indicated below.

Bureau of Electrical Maintenance, North Region
200 Stierli Court
Mount Arlington, N. J.
973-770-5065

For all fiber optic underground conduit/cable and Intelligent Transportation Systems equipment (CCTV, Variable Message Signs, Radar Detectors, Highway Advisory Radio, etc.) Installations, as well as electrical equipment serving those facilities, the contractor shall notify the ITS Maintenance Bureau at the Regional Traffic Operations office at the telephone number noted below.

ITS Maintenance Bureau
Traffic Operations North
670 River Drive
Elmwood Park, N. J. 07407
201-797-3575

3. Railroad Traffic and Property.
THE FOLLOWING IS ADDED:

Location	Speed	Number Per Day	Time

105.11 Construction Stakes, Lines, and Grades.

A. For Projects with Construction Layout as a Pay Item.

THE FIFTH PARAGRAPH IS CHANGED TO:

The Contractor shall complete all utility work layout required after acceptance of the insurance certificates required under Subsection 107.23.

105.15 Field Office.

1. Construction Field Offices.

a. Type A.

THE FOLLOWING IS ADDED:

(1) Six___ multi-line touch-tone telephones and Three___ telephone lines for use with the telephones installed as directed and operational in the Field Office and other facilities specified.

(a) Five___ dedicated, operational telephone line(s) for One Fax machine and four microcomputer system modem use installed as directed in the Field Offices specified.

(b) Two___ portable hand held cellular phone(s). The cellular telephone plan shall provide for the anticipated usage of approximately 300 minutes per telephone per month. Each of the cellular phones shall have as a minimum the following features:

1) Home rate with no roaming charges within the entire state
2) 832 Channel Compatible
3) Mute Function
4) Back Light Display with Battery Saver
5) Signal Strength Indicator
6) Individual Call Length Timer
7) Full Lock Function
8) 30 Memory Number Feature
9) Low Battery Warning
10) 70 Minute Continuous Use
11) 12 hour Standby Mode
12) Alphanumeric Display
13) Transmission Power 0.6 Watt
14) Passive Repeating Antenna for Vehicle
15) Spare high capacity Battery Pack
16) Home Charging Station
17) Cigarette lighter power adapter /charger
18) AC charging station

THE FOLLOWING IS ADDED:

19) Hands-Free headset
20) Walkie-talkie capability

(c) Two___ pager units, if walkie-talkie capability is not available for the cell phones. The number should be an exchange local to the Project. The units shall have the following features:

1) Lighted Alphanumeric Display
2) Tone and Vibrator Alert
3) High Sensitivity
4) Message Storage
5) Statewide Coverage
6) Exchange Local to Project
7) LCD Readout

(d) One___ telephone answering machine

(17) The microcomputer system shall include the following:

(a) Four___ base computer system(s) having at minimum:

1) Pentium IV Processor at 1.5 GHz or faster, Intel processor with MMX technology, with a 512 MB RAM, 32 MB Video RAM, mouse, mouse pad, 60 GB hard drive, one 52X DVD-ROM Drive, one CD-R Recordable Drive, and one 90-millimeter (3½-inch), 1.44 MB floppy diskette drive installed as the "A" drive.
2) 56K baud data/fax modem. (e.g., 3Com U.S. Robotics 56K Faxmodem, 3Com U.S. Robotics Courier V.Everything/V.34 - 56K ITU / x2 Technology, or Hayes Accura 56K).
3) One network card for each base computer system specified, when more than one base computer is specified
4) One Fast Ethernet Hub Switch with appropriate number of ports and cables (e.g., 3COM 100 Hub)
5) One dedicated telephone line to be used in conjunction with the microcomputer modem.
6) 483-millimeter (19-inch) or larger Super VGA color monitor having a dot pitch of 0.28, with anti-glare screen, and tilt/swivel capabilities.
7) 250-Megabyte Zip Drive internal or external with backup software for MS Windows and thirty 250-Megabyte formatted data cartridges corresponding to the tape drive size (e.g., Iomega Zip Drive or equivalent).
8) Uninterruptible power supply (UPS) - OMNI 1000 or approved equal (e.g., APC-1000 - American Power Corporation).
9) Surge protector for the entire computer workstation to be used in conjunction with the UPS (e.g., Zero Surge Power, Inc. - Point of Use - 2R-15 amp/120 volts).
10) Static mat, floor type, 1.2 by 1.5 meters or larger with grounding capabilities.
11) Computer workstation, printer stand, and/or table having both appropriate surface and chair height.
12) Five boxes of 90-millimeter (3½-inch) floppy diskettes that match the drive density of the 1.44-MB floppy diskette drive (ten per box).
13) 150 CD-R 700-MB (or larger) recordable CD's compatible to CD drive.
14) One floppy diskette holder (holds 50 floppy diskettes), and dust covers for the microcomputer, monitor, keyboard, and printer.
15) Two head cleaner kits for 90-millimeter (3½-inch) floppy diskette drive.

(b) Three base printers having at minimum:

1) Laser printer having HP PCL 5 emulation, with a 64 Megabyte expanded memory, appropriate printer cable, and legal size tray (e.g., HP-2200 or equivalent).
2) One printer toner cartridge every other month for the duration of the construction project.
3) One 10-ream carton of 8½ X 11 inches size paper (500 sheets per ream, weight: 75 grams per square meter, color: white, grain: long, for laser printers and copiers) every two months for the duration of the construction project.
4) One 10-ream carton of legal size paper (500 sheets per ream, weight: 75 grams per square meter, color: white, grain: long, for laser printers and copiers) every three months for the duration of the construction project.

(c) Four software packages, on CD-ROM with documentation, including:

1) Microsoft Windows, latest version with future upgrades.
2) Microsoft Office Professional, latest version. Software package should contain the following: word processor, spreadsheet, and database.
3) Helix Nuts and Bolts Advanced Utilities for Windows, latest version, or compatible software package.
4) Anti-Virus software, latest version with monthly updates (e.g., Norton's Anti-Virus, McAffe Anti Virus, or Dr. Solomon's).
5) Visio Professional Graphics Software for Windows, latest version.

(d) One___ base printer(s) for Primavera having at minimum:

1) Color Inkjet printer of current technology, with appropriate printer cable.
2) Ink cartridge replacements, one of each color, every other month for the duration of the construction project.
3) One 10-ream carton of 8½ X 11 inches size paper (500 sheets per ream, weight: 75 grams per square meter, color: white, grain: long, for laser printers and copiers) every three months for the duration of the construction project.

(e) One___ Primavera Project Planner (P3) or equivalent software, latest version.

To be approved as a Substitute or "Or Equal", the software must be completely compatible with the Department database that contains the Capital Program Management's design process schedule and budget, as well as the construction scheduling from design through construction. The software shall be compatible with the hierarchy of the coding and able to import and export data within the Department's Capital Program Management's database without distortion of any coding or relationships contained in the database.

The Contractor shall only utilize equivalent or compatible software for a project, which has received written approval from the Department in accordance with the most current NJDOT Capital Program Management Construction Scheduling Standard Coding and Procedures for Designers and Contractors Manual. The approved equivalent/compatible software utilized shall not vary throughout the construction phase.

The following additional equipment shall be furnished by the Contractor for the exclusive use of the Resident Engineer. This equipment shall conform to the applicable ASTM designation, when appropriate, and be in good working condition. The Contractor shall repair or replace damaged equipment throughout the duration of the Contract. The equipment shall become the property of the Contractor after Acceptance:

(18) One___ TV/VCR (Video Cassette Recorder) Combo with: 4-head VCR, crystal-clear-slow-motion, still frame, and frame advance, and index search.
(19) One___ video camcorder with video tripod, extra battery, battery charger, capability to play video tape on standard VCR Player, and one blank video cassette tape per month.
(20) Eight (8) each: hard hats (Orange in color, reflectorized) and safety vests (Orange in color, reflectorized, 360 degree high-visibility that meet ANSI/ISEA standards for Class 3 garments). Safety vests are to be replaced yearly for the duration of the project.
(21) Eight (8) sets: ear protection and eye protection.
(22) Concrete testing equipment to include: Concrete receptacle (wheel barrow), square tipped shovel, concrete scoop, slump cone & base set (rod, slump cone, base and funnel), tamping rod (305 mm long, 10 mm diameter with hemispherical ends), tamping rod (610 mm long, 16 mm diameter with hemispherical ends), 305 mm (12 inch) ruler, Forney air meter (complete set) or equivalent, two concrete thermometers, sponge, long-handled round scrub brush, rubber or rawhide mallet (1.02 +/- 0.23 kg), pointed trowel, 18.9 liter (5 gallon) plastic bucket, concrete cylinder curing box with high-low thermometer, and concrete curing items in accordance with this project's applicable governing specifications.
(23) One (1) electronic Smart level
(24) Eight (8) two-meter folding wood rules
(25) Two (2) thirty-meter cloth tape measures
(26) One (1) thirty-meter steel tape measure
(27) Two (2) fifteen-meter cloth tape measures
(28) Two (2) plumb bobs and cords
(29) Two (2) line levels and cords
(30) Two (2) digital infrared thermometers
(31) One (1) surface thermometer
(32) Two (2) asphalt thermometers
(33) One (1) sledge hammer
(34) One (1) metric measuring wheel
(35) One (1) wet film thickness gauge
(36) Four (4) lanterns for night work with replacement batteries as required

SECTION 106 – CONTROL OF MATERIAL

106.03 Materials, Inspections, Tests, and Samples.

THE FOLLOWING SUBPART IS ADDED:

D. Sharing of Pay-Adjustments for Portland Cement Concrete. Positive and negative pay-adjustments, as defined in Subsection 914.02, Subpart E, are awarded to encourage high quality construction and, when necessary, to recoup the anticipated extra costs to the Department resulting from poor quality construction. The manner in which positive and negative pay-adjustments are to be shared by the prime Contractor and Subcontractors or Producers is to be negotiated by the affected parties. A letter signed by both parties, stating that an agreement has been reached between the parties shall be provided to the Engineer before commencement of Work. Nothing contained herein shall create right of action either in law or equity against the Department.

106.06 Materials Field Laboratory

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The Contractor shall annually pay all fees necessary to procure and maintain a Uniform Code Type Four Fire Permit according to regulations of the New Jersey Department of Community Affairs. Additional information concerning the permit fees and processing of the application may be obtained by contacting the Bureau of Materials.

1. Laboratory.

b.

THE FOLLOWING IS ADDED:

(19) Hands-Free headset

z.

THE FIRST SENTENCE IS CHANGED TO:

Equipment and test apparatus conforming to that listed in AASHTO T 310 when the Pay Item "Nuclear Density Gauge" appears in the Proposal.

(1)

TEXT IS CHANGED TO:

(1) Conformance to AASHTO T 310,

THE LAST SEVEN PARAGRAPHS ARE CHANGED TO:

Setting up the materials field laboratory shall consist of furnishing the laboratory and enclosure complete with furniture, equipment, electricity, water, heating, air-conditioning, installation and activation of telephone lines, telephone sets (touch tone and cellular), pager units, sanitary facilities, and lavatory supplies.

Maintenance of the materials field laboratory, for the time required, shall consist of maintaining the furniture, equipment, and utilities which includes the cost of telephone fixed monthly service charges, cellular phone fixed monthly service charges for the plan specified and pager services, providing lavatory supplies, janitorial and waste disposal services weekly, restocking of the first aid box, and snow removal services. Maintenance of the materials field laboratory shall also include monthly rent.

Payment for nuclear density gauge will be made by the number of units supplied.

Payment for setting up the materials field laboratory will be made by the number of units.

Payment for the maintenance of the materials field laboratory will be made for each month or fraction thereof that the materials field laboratory is required, except that payment will not be made for any month or fraction thereof in which the Contractor is assessed liquidated damages according to Subsection 108.16.

Payment will be made under:

Pay Item	*Pay Unit*
NUCLEAR DENSITY GAUGE	UNIT
MATERIALS FIELD LABORATORY SET-UP	UNIT
MATERIALS FIELD LABORATORY MAINTENANCE	MONTH

Payment for telephone service will be made according to Subsection 108.15.

SECTION 107 - LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

107.01 Legal Jurisdiction.

THE ENTIRE TEXT IS CHANGED TO:

1. **Applicable Law.** This Contract shall be construed and shall be governed according to the Constitution and laws of this State.
2. **Sovereign Immunity.** The State by entering into this Contract does not waive its Sovereign Immunity, except as provided by the New Jersey Contractual Liability Act, NJSA 59:13-1 *et seq.* The rights or benefits provided the Contractor in this Contract which exceed those provided under the Act are contractual in nature and shall not be deemed to expand the waiver of Sovereign Immunity as set forth in that Act.
3. **Litigation of Claims by Contractor.** The Contractual Claims Resolution Process is not an administrative procedure but is contractual in nature, intended to review properly filed and documented claims. Pursuant to N.J.C.A. 16:45-1.3, exhaustion of the Claims Resolution Process as set forth under the Specifications is not a prerequisite to the filing of a legal action against the Department or State. The Contractor, however, must fully comply with all of the terms and conditions of the Contractual Liability Act, N.J.S.A. 59:13-1 *et seq.* prior to commencing a legal action. Therefore, where a Contractor brings a legal action, arising out of a Contract, against the Department or State or any officials or employees, thereof, arising out of or related, directly or indirectly, to a claim pending against the Department; the Contractual Claims Resolution Process, at any step, shall terminate as to that claim(s) or related claims being litigated, no matter which level of review the claim may be at when the legal action is filed. Furthermore, once the Contractor files a legal action any claim(s), related to that legal action will no longer qualify to be reviewed by the Claims Committee or to have the same claim(s) resolved under the Non-Binding Mediation Procedure or at any other Level of review. Such claim(s) will, thereafter, be resolved under the legal action subject to the provisions of the Contractual Liability Act, N.J.S.A. 59:13-1 *et seq.* unless and until the legal action is dismissed with or without prejudice. The Contractor may submit to the Department for processing through the various steps of the Contractual Claims Resolution Process any claims that are unrelated to the pending litigation subject to the terms of the Specifications and the Contractual Liability Act N.J.S.A. 59:13-1 *et seq*.
4. **Completion of the Contract.** The Completion of the Contract shall control as to any issue that may arise regarding the particular point in time when a Contractor may be barred from recovering against the State as provided under N.J.S.A. 59:13-5 *et seq.* The Contractual Claims Resolution Process and the various steps thereof may continue beyond the Completion of the Contract; however, the Contractual Claims Resolution Process will not in any manner, expressed or implied, extend any statute of limitation that may apply as to a claim. The Contractor by entering into the Contract with the Department agrees no further notice to the Contractor regarding the provisions stated in this Section are required. The Contractor also agrees to be responsible for compliance with all statutes of limitation and compliance with the various provisions of the Contractual Liability Act, N.J.S.A. 59:13-1 *et seq*.
5. **Subcontractor(s).** Pursuant to Subsection 108.02, the Department will not process or review any claims submitted by a subcontractor(s) or supplier(s) at any tier. All claims submitted by the Contractor must be an obligation or liability of the Contractor and cannot be merely a pass through of a claim by a subcontractor or by a supplier.

107.02 Notice of Potential Claim and the Administrative Process for the Resolution Contract Disputes.

THE HEADING AND THE TEXT IS CHANGED TO:

107.02 Notice of Claim and the Contractual Claim Resolution Process.

1. Notice.

a. Obligations. The various notice provisions set forth in this Contract are contractual obligations assumed by the Contractor by the act of executing the Contract. The Contractor shall be responsible to notify the Department in writing within the time frame as may be mandated in an applicable Subsection of the Specifications as well as within 90 days of any situation or occurrence which may potentially result in or be the basis of a belief that additional compensation or an extension of time is due from the State, except where permission to file a "late notice of claim" has been obtained by the Contractor from

the Superior Court in accordance with N.J.S.A. 59:13-6. The Department is not authorized to expand, reduce or waive either the contractual or statutory time limitations within which a notice of claim is to be filed with the Department. Any required notice shall be given only on the Contractual Notice Form provided by the Department. Submission of a Contractual Notice Form is required in order to comply with the notice requirements of the New Jersey Contractual Liability Act, N.J.S.A. 59:13-5 *et seq.*, provided such notices are given within the time limits established by that Act. The Contractor, by executing the Contract, agrees that the only evidence of compliance with the notice provisions of the Contractual Liability Act, N.J.S.A. 59:13-5 *et seq.*, and the Specifications shall be the filing of a fully completed (except that the amount of the claim need not be stated when unknown) Contractual Notice Form with the Department, and that no other documents sent or delivered to the Department or any of its officers or employees shall satisfy the statutory and/or contractual notice requirements.

b. Time. The Contractor, by the act of executing the Contract, acknowledges that it will be forever barred from recovering against the State if it fails to give timely notice in accordance with N.J.S.A. 59:13-5 *et seq.*, on the Contractual Notice Form required under this Subsection of any happening of an event, thing, or occurrence or of an act or failure to act, by the Department and that the Contractor is solely responsible for complying with the various notice requirements and the timeliness of a claim as set forth under the Contractual Liability Act, N.J.S.A. 59:13-5 *et seq.* and the Specifications.

c. Notice Form. The Contractual Notice Form shall be completed in its entirety for each and every claim and shall be signed by an authorized representative of the Contractor. Any Contractual Notice Form filed which does not provide all of the minimum information listed in this Subsection will be considered incomplete for the purpose of processing the claim under the Contractual Claim Resolution Process and no formal discussions or meetings concerning a claim filed on an incomplete Form will take place. A Contractual Notice Form which identifies the amount of the claim as being unknown may be considered by the Department as only satisfying the notice requirements as set forth under the Contractual Liability Act, N.J.S.A. 59:13-5 et seq., as long as the notice of claim is timely filed and provides all of the other minimum information on or attached to a properly executed Contractual Notice Form. However, for any claim requesting Additional Compensation, it shall not be sufficient to begin the Claim Resolution Process until the exact amount is provided according to 3.j. below. The Contractor's act of executing the Contract shall be construed to be an acknowledgment by the Contractor that it understands that the processing of a claim by the Department at any step of the Contractual Claims Resolution Process shall not constitute a waiver by the State of any defense that a claim was filed out of time and is thereby barred under the terms of the Contractual Liability Act or of any defense that there is no merit to the "claim being asserted by the Contractor".

2. Steps of Review. The Contractual Claim Resolution Process is sequential in nature and is composed of the following steps:

Step I: Review by the Resident Engineer;
Step II: Review by the Regional Dispute Board;
Step III: Review by the Department Claims Committee;
Step IV: Non-Binding Mediation.

Processing through the steps is subject to the following conditions:

a. No claim will be accorded a particular level of review unless and until the claim has been reviewed at the preceding step. Additionally, there will be no further review of the claim, unless and until the Contractor provides, in writing, that the decision of a review step within the specified timeframe is unacceptable and further requests that the claim be forwarded to the next step. Absent the written submittal of this information the claim will be considered withdrawn from the Contractual Claim Resolution Process. If at any step in the process, a claim is resolved, the Contractor must sign an unconditional release, furnished by the Department, as to any and all matters arising from the claim.

b. In order to begin the Contractual Claim Resolution Process the Contractor must state in writing that all documentation in support of the claim, as required under this Subsection, has been provided to the Department as part of or attached to the contractually required Contractual Notice Form and that the Contractor has requested that the review process, as outlined above, begin. The Resident Engineer will take no formal action until this notification is received and the Resident Engineer independently determines that the Contractor has in fact satisfied the requirements of this Subsection. If the documentation submitted by the Contractor is determined to be incomplete, the Resident Engineer will notify the Contractor that the review process cannot begin and include a list

of missing components required to start the process. When the additional material is submitted, the Contractor is required to again notify the Resident Engineer in writing that all documentation in support of the claim has been provided and the Contractual Claim Resolution Process should begin. The Contractor shall be limited to the documentation provided to the Resident Engineer at the beginning of Step I, in support of a claim, throughout all steps of the Claim Resolution Process. The submission of additional information by the Contractor at any step beyond Step I, shall be cause for the claim to revert back to Step I for review at each and every Step. The Resident Engineer will provide written notice to the Contractor when Step I was begun.

c. When the value of the claim submitted by the Contractor is $20,000 or less, the Step II review will be the final step in the Contractual Claim Resolution Process. In such a case, the decision of the Regional Dispute Board will be final and there will be no further contractual review.

d. Where there has been a determination, at both Step I and Step II, that the specifications do not provide a contractual basis for the resolution of the claim submitted by the Contractor or that the Notice of Claim was filed late without obtaining permission of the Superior Court, the Department reserves the right to conclude the Contractual Claim Resolution Process at the end of the Step II review. In such instance, the Secretary of the Department Claims Committee will provide the Contractor with the reason(s) for the no further review determination and rejection of the claim. However, where the Claims Committee does review a claim, there shall not be deemed a waiver by the Department of any defense that the Notice was filed late or that there does not exists a contractual basis for resolution.

3. Information Required. As a minimum, all of the following information must accompany each claim and be incorporated into or attached to the contractually required Contractual Notice Form:

a. A detailed factual statement of the claim providing all necessary dates, locations, and items of work affected by the claim.

b. The date on which facts arose that gave rise to the claim.

c. A copy of any notice given to the Department pursuant to any other Subsection of the Contract which relates to the matter giving rise to the claim.

d. The name, function, and activity of each State individual, official, or employee involved in or knowledgeable about the claim.

e. The specific provisions of the Contract which support or mitigate against the claim and a statement of the reasons why such provisions support or mitigate against the claim.

f. If the claim relates to a decision of the Department which the Contract leaves to the Department's discretion or as to which the Contract provides that the Department's decision is final, the Contractor shall set out in detail all facts supporting its contention that the decision of the Department was fraudulent, arbitrary or capricious.

g. The identification of any documents and the substance of any oral communications relating to such claim attaching same to the Form.

h. A statement as to whether the additional compensation or extension of contract time sought is based on the operation of the provisions of the Contract or an alleged breach of contract.

i. If an extension of contract time is sought, the specific days sought and the basis for such claim, supported by the Contractor’s approved baseline progress schedule and updates, as well as a fragment, which will include a time impact evaluation, depicting the delay according to Subsection 108.04.

j. If additional compensation is sought, the exact amount sought and a breakdown of that amount into the following categories:

(1) Direct Labor
(2) Direct Materials
(3) Direct Overhead as specified in Subsections 109.03 and 109.04.
(4) Subcontractor's Work
(5) Other categories as specified by the Contractor.
(6) The basis and manner of the Contractor’s calculations of the additional compensation claimed.

The Department will not determine liability separate and apart from damages. The Contractual Claims Resolution Process shall not be bifurcated. The Department shall review liability and damage valuation issues at the same time.

4. The Procedures for the Process.

a. **Step I, Resident Engineer Review.** The Resident Engineer will render a written decision regarding the claim presented within 30 State Business Days of the Resident Engineer's determination that the information provided by the Contractor on the Contractual Notice Form in support of the claim satisfied the requirements to begin Step I. This time limit may be extended by mutual agreement of the parties. Within 15 State Business Days of the receipt of the decision by the Resident Engineer, the Contractor shall either accept or reject the decision in writing; or upon failure to complete this, the claim will be considered withdrawn from the Contractual Claim Resolution Process and there will be no further review of the claim. If the Contractor accepts the decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment.

b. **Step II, Regional Dispute Board Review.** If the Contractor provides a written rejection of the Resident Engineer's decision and a request to forward the claim to Step II, the Resident Engineer will forward the claim and supporting information previously submitted by the Contractor to the Regional Dispute Board within five State Business Days. The Regional Dispute Board will schedule and hold a meeting to review the claim with the Contractor within 30 State Business Days of receipt of the said claim information from the Resident Engineer. This time limit may be extended by mutual agreement of the parties. The Regional Dispute Board will issue a written decision regarding the claim within 20 State Business Days of the meeting.

Within 15 State Business Days of receipt of the Regional Dispute Board decision, the Contractor shall either accept or reject it in writing; or upon failure to complete this, the claim will be considered withdrawn and the Contractual Claim Resolution Process shall be considered to be concluded for that particular claim. If the Contractor accepts the decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment.

The Director, Construction Services and Materials, may request an informal meeting with the Contractor to discuss the then pending claim(s) after the Step II decision has been issued and sent to the Contractor, but prior to the matter being reviewed at the next step, subject to the mutual consent of the Contractor and the Department.

c. **Step III, Claims Committee Review**. A written request for a Step III review of the claim is to be made to the Secretary of the Department Claims Committee, P.O. Box 600, Trenton, New Jersey 08625-0600 with a copy to the Director, Construction Services & Materials. The Contractor may request that the Department Claims Committee immediately review claims, which are unresolved after review by the Regional Dispute Board,, when the following conditions are met:

1. A claim or the combination of claims exceed $250,000; or
2. It is mutually agreed to by the Contractor and the Department.

However, when a project becomes 75 percent complete by contract time or dollar amount, which ever first occurs, claims that are unresolved at Step II will be reviewed at a single session of the Department Claims Committee after the Completion of the Work.

Additionally, the Contractor may request at the time of issuance of the Final Certificate that all unresolved claims, with the exception of the exclusionary cases as provided for in this Subsection, that have gone through the Steps I and II of the Contractual Claim Resolution Process, and which have not been presented at Step III of the Contractual Claim Resolution Process, be reviewed by the Department Claims Committee as provided for in this Subsection. The Contractor's written request must accompany its exceptions to the Final Certificate, with a copy sent to the Secretary of the Department Claims Committee and shall be made no later than 30 State Business Days after the issuance of the Final Certificate.

The Secretary of the Department Claims Committee will schedule a Claims Committee meeting with representatives of the Contractor and the Region, to be held within 45 State Business Days of the receipt of the claim information. This time limit may be extended by mutual agreement of the parties. The Department Claims Committee will notify the Contractor in writing of its decision on the claim(s) within 45 State Business Days of the meeting, stipulating the terms of any resolution of the claims. If the Department Claims Committee determines after review of the claims that no resolution and no further payment is warranted, it shall notify the Contractor in writing of its decision. Within 15 State Business Days of the receipt of the Department Claims Committee decision, the Contractor shall either accept or reject it in writing, or upon failure to complete this, the claim will be considered withdrawn and the Contractual Claim Resolution Process shall be considered to be concluded for that particular claim. If the Contractor accepts the

decision, such acceptance shall include execution of an unconditional release furnished by the Department effective upon payment. If the Contractor rejects the decision, there will be no further review of the claim unless the Contractor submits a written request for the utilization of Non-Binding Mediation.

d. Step IV, Non-Binding Mediation.

(1) Conditions. The Contractor may request at any time during the Project, but no later than 30 State Business Days after issuance of the Final Certificate, that any claim unresolved by the Department Claims Committee be elevated to Step IV. The request must be in writing to the Secretary, Department Claims Committee, P.O. Box 600, Trenton, New Jersey 08625-0600. No claim will be elevated to Step IV unless all of the following conditions are satisfied:

(a) The claim has been reviewed by the Department Claims Committee.

(b) The Contractor has escrowed its bid preparation documents as required under Subsection 103.06 and the documents are still being held in escrow.

(c) The Contractor has entered into a Non-Evidential agreement to the effect that any statement or information provided during the Non-Binding Mediation proceedings shall not be evidential in any legal proceeding unless obtained by other discoverable means.

(d) The Contractor has entered into a cost sharing agreement to equally share the cost of using Non-Binding Mediation in accord with Department issued forms.

(e) The utilization of Non-Binding Mediation has been mutually agreed to by the Department and the Contractor; and

(f) Prior to the commencement of the Non-Binding Mediation the parties shall confer with one another for the purpose of resolving the format of presenting the claim summary, supporting information, opening statements, and responses.

Failure by the Contractor to request Non-Binding Mediation within the required time period shall constitute a waiver by the Contractor of any utilization of the Non-Binding Mediation Step.

(2) Forms. Where the Contractor requests that Non-Binding Mediation be conducted, the Department will forward to the Contractor the required Non–Evidential and cost sharing agreement forms which shall be executed by the Contractor and returned to the Department within ten State Business Days. The failure by the Contractor to return the fully executed Non-Evidential and cost sharing agreements to the Department within the ten-day period shall constitute a waiver by the Contractor of the availability of Step IV.

(3) Mediator. The Department will select the Mediator to be utilized for the Non-Binding Mediation from a list of candidates submitted by the Contractor. The Contractor shall submit the names of six proposed Mediators, along with a biographical background listing the experience and qualifications of each candidate. Candidates may be from the same employment category or disciplines, such as construction, mediation, partnering facilitation, consulting engineer, attorney, judiciary (retired), accountant, architect, etc.

A candidate may have been used for mediation purposes for this Project or another project but shall not have any other relationships with either the Department or the Contractor for a period of two years preceding the request for Step IV. If the Department determines that none of the candidates submitted are acceptable, the Department will request and the Contractor shall submit four additional Mediator candidates. The Contractor shall submit this additional list within five State Business Days of the receipt of the written request. Upon mutual agreement, the Mediator can be an individual proposed by the Department.

(4) Escrow Documents. Once the Contractor has fully executed the required Non-Evidential and cost sharing agreements, its escrowed bid documents will be released upon request of the Department Claims Committee Chairperson solely for the exclusive use of the Mediator, the Department's selected Negotiator(s), the Department Regional Representative(s) and the Contractor Representative(s) participating in the Mediation session. These documents will be used by the Department as part of the Contractual Claims Resolution Process only to resolve the pending claims except it may seek such documents through the discovery process in the event mediation is not successful and litigation ensues.

(5) Meeting. The Secretary of the Department Claims Committee will schedule a meeting for the Non-Binding Mediation of the submitted claims to be held within 30 State Business Days

of the return of the executed Non-Evidential and cost sharing agreements. The meeting time limit may be extended by mutual agreement of the parties. The Secretary of the Department Claims Committee will issue the recommendations of the Department's Negotiator to the Commissioner for action within 15 State Business Days of the Non Binding Mediation session. The Commissioner, or their designee, will accept, reject, or modify the recommendation of the Department Negotiator and notify the Contractor of the decision within 15 State Business Days.

(6) Decision. The Contractor shall accept or reject the decision within 15 State Business Days of notification of the Commissioner's decision. If the Contractor accepts the decision of the Commissioner, or their designee, such acceptance shall be in writing and include execution of an unconditional release furnished by the Department effective upon payment. If the Contractor fails to accept or reject the Commissioner's decision within 15 State Business Days, the decision of the Commissioner will be withdrawn and the Contractual Claims Resolution Process shall be deemed concluded as to that particular claim under review.

After submission of the recommendation to the Commissioner, the bid documents released from escrow will be returned to the escrow agent for continued escrow in the designated repository.

107.05 Permits, Licenses, and Taxes

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The Contractor may be required to obtain an NJDEP, Division of Water Quality, New Jersey Pollutant Elimination System permit for dewatering excavations. The Contractor shall perform all work necessary to obtain this permit. Charges incurred by the Contractor for all work and investigations necessary to obtain the permit shall be paid by the Contractor and shall be included in the prices bid for the various Pay Items scheduled in the Proposal.

107.22 Risks Assumed by the Contractor

SUBPART 1 IS CHANGED TO:

1. **Risks of Loss or Damage to the Permanent Construction**. Until Acceptance, and within the limits of the Project's work, the Contractor shall bear the risk of all loss or damage to all permanent construction and temporary construction performed under this Contract and to materials, whether or not it has received payment for such construction or materials under Subsection 109.05, 109.06, or 109.07, except payment will be made to the Contractor for the repair or replacement of any permanent element of the construction which has not been accepted by the Department, if the element of the work damaged is completed to the stage of serving its intended function and is subsequently damaged by accident by public traffic. In order to receive payment, the Contractor must supply satisfactory evidence that such damage was caused by a public traffic accident which was not caused by vandalism or by the equipment of the Contractor or any of its subcontractors or suppliers. Satisfactory evidence shall generally be limited to: accident reports filed with the Division of Motor Vehicles, police agencies or insurance companies; statements by reliable, unbiased eye witnesses; identification of the vehicle involved in the accident. Physical evidence that the damage was caused by a motor vehicle (such as tire marks or broken headlight glass) will not be sufficient unless it can be clearly shown that the damage was not caused by the Contractor's vehicles or by vandalism. The Contractor shall take every precaution, as allowed by the Contract against injury or damage to any part of the construction or to materials by the action of the elements, the traveling public, vandalism, or from any other cause, whether arising from the execution or the non-execution of the work. The Contractor shall promptly repair, replace, and make good any such damage or loss without cost to the Department. The Contractor shall not bear such risk of loss or damage, which arises from acts of war or floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon unless such loss or damage is covered by insurance.

107.23 Insurance.

6. Railroad Insurance.

Insurance coverage shall be procured and maintained for the following railroad(s):

Consolidated Rail Corporation (CONRAIL) and its successors

It is estimated that 2___ percent of the Project cost is located within or adjacent to the railroad right-of-way.

SECTION 108 - PROSECUTION AND PROGRESS

108.02 Subcontracting.

Specialty Items are as listed below:

Drilling and blasting.
Above ground highway lighting items.
Above ground sign lighting items.
Above and below bridge deck lighting items.
Electrical wire items.

THE FOLLOWING IS ADDED TO THE END OF THE FIFTH PARAGRAPH:

The Contractor shall also attach to that form (application for subcontracting form) proof of the Subcontractor's valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by "Public Works Contractor Registration Act," N.J.S.A. 34:11-56.48 et seq. (P.L. 2003, c. 91). Pursuant to P.L. 2003, c. 91, the Department will not consent to the proposed subcontracting, and the Subcontractor shall not perform any work under the Contract, unless the Contractor first provides the required proof of the Subcontractor's valid, current registration with the New Jersey Department of Labor, Division of Wage and Hour Compliance as required by "Public Works Contractor Registration Act." The Contractor shall ensure full compliance with the Public Works Contractor Registration requirements by their Subcontractors.

108.03 Commencement of Work.

THE THIRD SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

Construction operations shall not begin until the Contractor has supplied, and the Engineer has accepted, the preliminary schedule and other certifications, forms, schedules, and any other information required by the Contract Documents, and until the Contractor has established a field office as required by Subsection 105.15.

108.04 Progress Schedule and Prosecution of the Work.

THIS SUBSECTION IS CHANGED TO:

In scheduling and executing the Work, the following shall be complied with:

1. Progress Schedules. The progress schedule shall conform to and incorporate the following requirements:

a. General.

(1) The work shall be monitored by a detailed CPM schedule. The CPM schedule shall be developed utilizing the most current NJDOT Capital Program Management Construction Scheduling Standard Coding and Procedures for Designers and Contractors Manual and the NJDOT Primavera template project containing the latest standard coding. The manual and template are available from the Bureau of Quality Management Services.

The CPM schedule shall consist of diagrams and accompanying mathematical analyses. The scheduling of submittals, procurement, construction, and all else necessary to complete the Work as described in the Contract Documents, is the responsibility of the Contractor. The requirement for the CPM schedule is included to ensure adequate planning and execution of the Work and to assist the Department in appraising the reasonableness of the proposed schedule, as well as its compliance with Contract requirements.

The CPM schedule is the Contractor's committed plan to complete all work within the allotted time. The Contractor assumes full responsibility for the prosecution of the Work as shown. The CPM schedule shall be based on and derived from detailed schedules used to complete all Contract activities.

(2) No claim for extension of time due to extra work or any other type of delay will be considered unless the baseline schedule has been approved and monthly updates are current and submitted within the time limits stated.

(3) No claim for additional compensation as specified in Subsection 109.04 will be considered unless the baseline schedule has been approved and monthly updates are current and submitted within the time limits stated.

(4) The CPM preliminary, baseline, and updated schedules shall be submitted in electronic format on a floppy diskette or compact disk, in addition to the required number of copies specified in b. (1) and b. (2) below.

(5) Once the CPM baseline schedule has been approved, the Contractor shall not deviate therefrom without first notifying the Engineer in writing and schedule is updated in accordance with 1.h. and 1.i. below.

b. Submittals. The CPM schedule shall consist of the following two distinct initial submittals:

(1) **Preliminary Schedule.** No later than 10 State Business Days after execution of the Contract, the Contractor shall submit to the Engineer for review and approval or rejection and return a preliminary schedule. The contractor shall submit six copies of:

(a) A CPM time-scaled diagram defining the Contractor's planned activities during the first 90 Calendar Days. For projects with a construction cost over $ 40 million, a CPM time-scaled diagram defining the Contractor's planned activities during the first 120 Calendar Days.

(b) A summary network for the remainder of the Contract time. The preliminary schedule shall indicate all milestone activities expected to be completed or partially completed before submission and approval of the CPM baseline schedule as specified in b. (2) below.

(c) All multiple shifts per day and anticipated production rates shall be detailed in the Contractor's narrative accompanying the preliminary schedule.

(d) The Work shall not begin until the preliminary schedule has been approved. Five State Business Days will be required for review and approval or rejection and return of the preliminary schedule.

(2) **Baseline CPM Schedule.** In accordance with the time frames listed below, the Contractor shall submit six copies of the Baseline CPM Schedule documents depicting the Contractor's work plan for the entire Contract.

Project Construction Cost ($ million)	Time Frame After Approval of Preliminary Schedule for Submission of the Baseline CPM Schedule (State Business Days)
< 5	10
5 - 15	15
15 - 40	20
> 40	30

The Contractor shall submit to the Engineer for review and approval or rejection and return:

(a) Computer generated tabular schedule and logic reports in accordance with 1.e. below.

(b) Time-scaled computer generated Layout Output in conformance with 1.f. below.

(c) A written narrative explaining the schedule and the Contractor's general approach for achieving Substantial Completion and the date of Completion as specified in Subsection 108.10 of these Special Provisions. Multiple shifts per day and anticipated production rates shall be detailed in the Contractor's narrative accompanying the Baseline CPM Schedule.

(d) Electronic version as specified in 1.a. (4) above.

c. CPM Schedule Requirements for the Baseline and Updates.

(1) The CPM schedule and updates shall contain the following:

(a) The order in which the Contractor proposes to prosecute the Work; the starting dates of the various work stages, operations, and principal items of work including procurement of materials and plant, and the contemplated dates for completing the same.

(b) List dates for all required submissions.

(c) A clear outline of the intended maintenance of traffic.

(d) The locations and timeframes for the installation of temporary and permanent soil erosion and sediment control measures to be installed.

(e) All unusual requirements specific to the project included in the Contract Documents or as deemed appropriate for the project.

(f) Special consideration to sensitive areas such as wetlands, floodplains, waterways, and parklands to ensure that appropriate staging and seasonal constraints are considered in order to maximize the effectiveness of the soil erosion and sediment controls.
(g) The time frames when work is restricted in sensitive areas as reflected in present and future permits as anticipated or known.
(h) Updates to reflect permit conditions if changed.
(i) Include a detailed, step-by-step outline of any clean-up operations regarding contaminated material.
(j) The work of the Contractor, subcontractors, suppliers, the Department, permitting agencies, utility companies, and all others that affect progress shall be shown and identified on the schedule by responsibility codes.
(k) Procurement activities shall be shown, including plans, permits, materials, individual working drawings, fabrication, and delivery of the material. Twenty_____ State Business Days will be required for review and certification or rejection and return of fabrication working drawings. Thirty_____ State Business Days will be required for review and approval or rejection and return of working drawings for items that were included as conceptual and the Contractor is required to complete final design plans. The time frames set forth in this paragraph are provided for scheduling purposes only. The Department reserves the right to enlarge such time periods for review by a reasonable amount of time where circumstances necessitate, within the sole discretion of the Engineer.
(l) Traffic staging, delivery of Department - furnished labor/equipment, project phasing, right-of-way availability dates, and any other requirements specified in Divisions 200 through 900 shall be shown.
(m) The CPM schedule shall contain sufficient activities to adequately depict the Work, and will be subject to the review and approval of the Engineer.
(n) The logic and activity time durations established by the Contractor shall be consistent with the Contract Documents and be reflective of proper coordination between trades.
(2) The CPM schedule shall operate as follows:
(a) The CPM schedule shall be of the precedence type.
(b) One activity for each discrete component part of each Pay Item scheduled in the Proposal. The Engineer may allow grouping of similar Pay Items into one activity. No work activity shall have a duration greater than 30 Calendar Days, except as approved by the Engineer. The activities shall be consistent with the Work Breakdown Structure (WBS), and shall also include discrete component parts of the Contractor's submittal preparation, Department approval, procurement, and construction work activities with sufficient detail such that all the relationships with all direct and non-direct parties to the Work are shown.
(c) The system shall be based upon network diagrams and accompanying mathematical tabulations as described hereinafter. Diagrams shall show the order and interdependence of activities and the sequence and quantities in which work is to be accomplished. The basic concept of network scheduling shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion may affect the start of subsequent activities. The critical path shall be distinguished from other paths on the network.
(d) The completion date of the CPM schedule shall be the date of Completion specified in Subsection 108.10 of these Special Provisions, except as specified in Subsection 108.04 subpart 5, which shall be input as a Finish Milestone with a Late Finish Constraint. All Intermediate Milestones required in the Contract shall be shown in proper logical sequence and input as a "Start-no-Earlier-Than" constraint for entrance into an area or start activity or a "Finish-no-Later-Than" constraint date for completions.
(e) Activities shall be described such that the Work is readily identifiable for assessment of start and completion, as well as intermediate status. Descriptions shall utilize activity codes for physical locations at each stage such as distance-markers, structures, and elevations where possible to define the Work. Activity descriptions of "Start," "Continue," "Completion," "X percent," "Y percent," "Z percent" or similar nonspecific descriptions will not be allowed.
(f) The CPM schedule shall be calculated in Working Days. The Working Day to calendar date correlation shall be based upon the Contractors proposed work week with adequate allowance for weekends, legal holidays and any special requirements of the Contract. Activities shall indicate the

calendar being used. Durations for activities shall not be less than one workday. Multiple shifts per day and anticipated production rates shall be detailed in the Contractor's narrative accompanying the baseline schedule and subsequent updates.

(g) Constraint dates are permitted only on milestone activities, unless otherwise approved by the Engineer.

(h) All activities with the exception of the Project Start Milestone and Project Completion Milestone shall have predecessors and successors. The start of an activity shall have a Start-to-Start or Finish-to-Start relationship with preceding activities. The completion of an activity shall have a Finish-to-Start or Finish-to-Finish relationship with a succeeding activity. Start-to-Finish relationships are not acceptable.

(i) CPM schedules, which have been resource leveled, are permissible, provided the effects of leveling are incorporated in the schedule using "Start-no-Earlier-Than" date constraints.

d. Computer Program Requirements. The computer program requirements shall be the same as that specified in Subsection 105.15 subpart 1.e. of these Special Provisions.

e. Tabular Reports.

(1) CPM schedule reports shall be provided for the following sort orders:

(a) Total float, then early start for activities with float less than 20 days.

(b) Grouped by responsibility, then by early start.

(c) Grouped by WBS, area, then sorted by early start.

(2) The minimum activity information required for each of the above reports in (1), shall include the following:

(a) A unique activity ID for each activity.

(b) A description of the Work represented by the activity.

(c) Location code identification.

(d) Work responsibility code identification.

(e) Original activity duration and remaining activity duration in Working Days.

(f) Early and late, start and finish dates calculated according to CPM principles.

(g) Total float.

(h) Historical (actual) dates for activities completed or underway shall replace the appropriate calculated dates.

(i) Stages.

(j) Calendar used for each activity.

f. CPM Time-Scaled Layout Output.

(1) The network displayed on the schedule diagram shall depict the exact detail of the CPM schedule reports.

(2) The network diagram shall be of the precedence type and drawn by using early dates.

(3) The layout output shall be time-scaled. The length of the activity representation shall be proportional to the activity duration.

(4) The activity display shall include the:

(a) Activity description.

(b) Activity identification.

(c) Activity original duration and remaining duration.

(d) Activities coded by area, responsibility, and WBS.

(e) Activity total float.

(f) Activities early start dates.

(g) Activities finish dates.

(5) The activities, which are displayed on the network diagram, shall be grouped by WBS and sorted by area. The title of these components shall appear on the left-hand side of the plot.

(6) The critical path shall be identified on the plot.

(7) Vertical lines indicating the start and the end of each month shall be shown.

(8) The data date shall be indicated on the plot in the activity display and in the title at the top or bottom of the plot.

(9) Completed activities shall be indicated on the plot.

(10) The Contract title shall be displayed on the plot.

(11) A legend shall be provided which indicates the various symbols used and their meanings.

(12) Milestone Activity shall be indicated by a prominent symbol.

(13) Different line types shall indicate the critical path and completed Milestone and activities.

g. Review and Approval. The Engineer will review a submitted preliminary schedule for approval or rejection within five State Business Days of receipt and will thereafter return same to the party having submitted it. There will, in turn, be allotted ten State Business Days for review and approval or rejection by the Engineer of the submitted baseline schedule, which will thereafter be returned to the party having submitted it. The Engineer will review revised preliminary or revised baseline submittals within five State Business Days of receipt. The time periods set forth in this paragraph are provided for scheduling purposes only. The Department reserves the right to enlarge such time periods for review by a reasonable amount of time where circumstances necessitate, within the sole discretion of the Engineer.

h. Updating and Revisions.

(1) Within ten State Business Days after review by the Engineer, all preliminary and baseline schedules that are not approved shall be revised and resubmitted by the Contractor until the Engineer's approval is received.

(2) The Contractor shall update the CPM schedule monthly whether or not the Engineer has accepted the schedule, to reflect actual activity progress. The update shall include the historical record of actual start and actual finish dates for activities in progress, or completed, and the remaining duration based on the amount of workdays required to complete the activity.

(3) Monthly progress meetings shall be held. The updated CPM schedule shall be the basis for the monthly progress review meetings. Activity progress shall be prepared in advance of the meeting. At this meeting, attended by the Engineer, all progress during the calendar month shall be presented and reviewed for incorporation into the schedule by the Contractor. Within a period of ten State Business Days from the date of this progress meeting, the Contractor shall submit the schedule update to the Engineer with the agreed upon changes.

(4) The monthly schedule update submission shall consist of three copies of electronic format on floppy diskettes or compact disks and three copies of the following:

(a) Updated CPM schedule reports (see Item e. above).

(b) Layout output. (See item f. above)

(c) CPM progress narrative.

The CPM progress narrative report submitted as part of the update analysis shall include, but not be limited to, the:

1. Description of schedule status.
2. Discussion of current and anticipated delaying problem areas and their estimated impact.
3. Schedule slippage, pay revisions, and/or progress along the critical path in terms of days ahead or behind the allowable dates, and if the Work is behind schedule, progress along other paths with negative float. This shall be in addition to and not a substitute for requirements in Subsection 108.11.
4. Logic changes and an explanation of the revisions. Revisions to activities not worked on during the period, including changes in duration, or revisions to activity relationships are to be considered logic revisions. Out-of-sequence activities are not acceptable and shall be corrected in logic revisions prior to submission to the Department.

(5) When, in the Engineer's opinion, the CPM schedule fails to reflect the Contractor's actual plan and method of operation, or the Contractor's completion date as indicated by the CPM is more than one month behind the Contract completion date, the Engineer may require the Contractor to submit for review within ten State Business Days, a recovery plan for completion of the remaining work within the Contract completion date. A recovery plan shall include, but not be limited to, a revised CPM schedule and additional manpower and equipment that shall be utilized to complete the project by the date of Completion.

(6) When the Contractor adds activities that are not Extra Work Items to the CPM schedule, they shall be added in a method that completion dates of any succeeding baseline activities are not affected. All revisions shall be submitted to the Engineer for approval before incorporation into the CPM schedule.

(7) The Engineer shall have the right, within its sole discretion, to prepare its own update(s) or revision(s) to the baseline schedule in the event of a dispute between the parties regarding the appropriateness of the submitted revision(s) or updates to the baseline schedule or by reason of a failure on the part of the contractor to prepare same, which update(s) or revision(s) may reflect what the Engineer has determined to be the actual status of the project progress, actual sequencing

of the Work and appropriate scheduling logic required under this Subsection. The Engineer may thereupon rely on its own revision(s) or update(s) of the baseline schedule in the administration of the project, review of claims and/or the imposition of liquidated damages.

i. Changes and Delays. To ensure that the CPM schedule continues to accurately reflect the Contractor's plan for the Work and that it incorporates the impact of all changes and delays as soon as the Work scope can be defined, the Contractor shall use the following procedure to incorporate changes and delays.

When Extra Work or a change is proposed or claimed, the Contractor shall submit a Time Impact Evaluation form. Each Time Impact Evaluation must identify in a CPM fragnet sketch, additional work required as a result of the proposal and its interrelationship to the CPM schedule. Each change or delay shall be represented by adding a new activity or activities. These activities shall be clearly identified. This sketch shall show all activities, logic revisions, duration changes, and new activities with all the predecessors and successors. The Time Impact Evaluation form shall also include any associated cost changes for performing the Work in question. Upon the Engineer's approval of the Time Impact Evaluation, the Contractor shall incorporate the fragnet's illustrating the influence of changes and delays into the baseline schedule and the working schedule in the next schedule update. An extension of time may only be considered when the Time Impacted scheduled completion date exceeds the date of Completion. For cases where the Contractor is behind schedule, an extension will be granted for only the amount of time that the Department is responsible as supported by a Time Impact Evaluation. In the event of a dispute, the Engineer may prepare an update, which is believed to be the true impact on the project. No additional compensation will be paid to the Contractor for preparing these revisions. Any request for extension of time shall be verified by CPM analysis and shall be in accordance with Subsection 108.11. Compensation for additional expense to the Contractor and allowance of additional time for completion of the Work shall be as set forth in a Construction Order in accordance with Subsections 108.11 and 109.03.

2. Staging. The Contractor shall schedule the Work using such procedures and staging as may be specified in the Contract Documents. Work designated as part of separate stages may be performed simultaneously where provided by the Contract Documents or where approved.

When the Contract Documents provide for staging or specific procedures, the Contractor may present, for written approval of the Engineer, a detailed, written alternate staging plan or procedure which incorporates the requirements of the Department. If the Contractor proposes an alternate-staging plan, two CPM schedules shall be submitted. One based on the original staging and one based on the Contractor's alternate staging. As a condition of the Engineer's reviewing of the alternate staging plan or procedure, the Contractor agrees that it is not entitled to additional Contract Time or compensation arising from possible delays to construction due to the time spent in reviewing the Contractor's staging plan or procedure, regardless of whether the Department accepts or rejects it. The Engineer will review and approve or reject and or return, with comments, the staging plan within ten State Business Days. If such staging plan or alternate procedure is approved in writing, the Contractor shall then finalize the progress schedule consistent with the alternate approved staging.

3. Prosecution of the Work.

a. At or prior to the preconstruction conference, the Contractor shall furnish the name and location of the solid waste facilities to be utilized as well as the fee structure of each of the facilities. Failure to provide such information shall make the Contractor ineligible for adjusted compensation as provided for in Subsection 104.07.

b. The Contractor shall provide sufficient materials, equipment, and labor to guarantee the Completion of the Project in accordance with the Contract Documents and within the time set forth under Subsection 108.10.

c. The Contractor shall supply the Engineer with a weekly work schedule indicating the Contractor's planned work, the subcontractor's planned work, the dates when materials and submissions are to be delivered, and a forecast of lane closings.

d. The Contractor shall notify the Engineer, in writing, prior to discontinuing work for any reason and at least 24 hours in advance of resuming operations.

e. The Contractor shall arrange and prosecute the Work so that each successive construction operation at each location shall follow the preceding operation as closely as the requirements of the various types of construction permit.

f. Underground structures for traffic signals, except for pressure detector installations shall be constructed prior to completion of the intersecting road.

g. Work, which closes or alters the use of existing roadways shall not be undertaken until adequate provisions, conforming to the requirements of Section 617, have been made by the Contractor and approved.

h. The Engineer may revise stage construction and maintenance of traffic, if deemed necessary, by the Engineer due to unforeseen circumstances that may arise during construction.

i. When possible, the construction of subsurface structures adjacent to traffic shall be performed while traffic is being diverted from such areas. If traffic must be maintained in such areas, the Work shall be done expeditiously in stages, as approved, and with minimum interference with traffic.

j. Subsurface structure excavation adjacent to traffic shall not remain open overnight unless adequately protected by approved safety devices.

k. The Contractor shall proceed with the Work of demolition of the various buildings that are identified with a demolition number as and when they become available for demolition. If any of the buildings to be demolished is not available for demolition at the time the Contractor begins work on the Project, the Contractor shall temporarily defer its work in the vicinity of the building and complete the Work when the building is made available for demolition.

l. Operations adjacent to traffic shall be confined to only one side of the traffic at any one time unless otherwise specified in the Contract Documents.

m. Concrete curbs constructed adjacent to flexible base and surface courses shall be completed, cured, and backfilled before the flexible base and surface courses are constructed.

n. Bituminous paving operations shall be staged to progress up to the bottom of the surface course. The top layer of the bituminous concrete surface course for the full width of the traveled way, shoulder, and auxiliary lanes shall be paved as a single stage of construction and as the final paving operation.

4. Acceleration and Default. If, in the opinion of the Engineer, the Contractor falls behind its baseline schedule, and cannot complete the Work within the time prescribed under Subsection 108.10, as modified pursuant to Subsection 108.11, the Contractor shall take such steps as may be necessary to improve its progress. The Engineer may require the Contractor to increase the number of shifts, begin overtime operations, work extra days including weekends and holidays, or supplement its construction plant and to submit for approval such supplementary schedule or schedules, as may be deemed necessary to demonstrate the manner in which the agreed rate of progress shall be regained, all at no cost to the State.

Failure of the Contractor to comply with the requirements of the Engineer under this Subheading is grounds for the determination that the Contractor is not prosecuting the Work with such diligence as to ensure Completion within the time specified. Upon such determination, the Engineer may terminate the Contractor's right to proceed with the Work or any separate part thereof in accordance with Subsection 108.17.

5. Intent, Responsibility, and Time. Scheduling of construction shall be the responsibility of the Contractor. The Contractor's shall determine the most feasible order of work commensurate with the Contractor's abilities and the Contract Documents. The CPM schedule will be used for determining extensions or reductions of Contract Time pursuant to Subsection 108.11.

It is not intended that the Engineer, by approving the CPM schedule, agrees that it is reasonable in any or all respects or that following the CPM schedule can result in timely completion of the Project. The progress schedule is not a part of the Contract.

If, in the preparation of the CPM schedule, the Contractor reflects a completion date different than that specified under Subsection 108.10, this in no way voids the date set therein. The date as specified in that Subsection governs. Where the CPM schedule reflects a completion date earlier than that specified as the Contract Time, the Engineer may approve such schedule with the Contractor specifically understanding that no claim for additional Contract Time or compensation shall be brought against the State as the result of failure to complete the Work by the earlier date shown on the CPM schedule.

6. Payment. Payment for the accepted progress schedule will be made on a lump sum basis for the costs for schedule preparation, maintenance, updating, facilities, personnel, computer hardware and software requirements, schedule submittals and reproduction as specified. Twenty-five percent of the lump sum bid will be paid upon approval of the baseline submission, and the balance paid on approval of updates at a prorated sum based upon the number of anticipated updates to be submitted during the Contract Time.

Payment will be made under:

Pay Item	*Pay Unit*
PROGRESS SCHEDULE	LUMP SUM

108.05 Mobilization.

THIS SUBSECTION IS CHANGED TO:

Mobilization shall consist of the preparatory work and operations necessary for the movement of personnel, equipment, supplies, and incidentals to the Project site, and other work performed or costs incurred prior to beginning Work.

Payment for mobilization will be made on a lump sum basis regardless of the fact that the Contractor may have, for any reason, shut down its work on the Project or moved equipment away from the Project and back again.

Payment will be made in accordance with the following schedule:

1. When five percent of the Work is completed and the Baseline Progress Schedule is approved by the Engineer, 25 percent of the lump sum bid for mobilization or 2.5 percent of the Total Contract Price, whichever is less, will be paid.
2. When ten percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 50 percent of the lump sum bid for mobilization or five percent of the Total Contract Price, whichever is less, will be paid.
3. When 15 percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 75 percent of the lump sum bid for mobilization or 7.5 percent of the Total Contract Price, whichever is less, will be paid.
4. When 20 percent of the Work is completed and all required CPM Progress Schedule Updates are approved by the Engineer, 100 percent of the lump sum bid for mobilization or ten percent of the Total Contract Price, whichever is less, will be paid.
5. When all Work on the Project is complete, payment for the lump sum bid for mobilization in excess of ten percent of the Total Contract Price will be made.
6. The percentage of Work completed shall be the total of payments earned compared to the Total Contract Price. The total of payments earned excludes the amount paid for this item and the amount paid for materials furnished but not incorporated into the Work in accordance with Subsection 109.06, as shown on the monthly estimates of the approximate quantities of Work performed, prepared in accordance with Subsection 109.05.
7. No payment will be made for mobilization until a Baseline Schedule is approved, except when all Work on the Project is complete, then 50 percent of the lump sum bid for mobilization will be paid and no further payment(s) will be made for the lump sum bid for mobilization.

Payment will be made under:

Pay Item	*Pay Unit*
MOBILIZATION	LUMP SUM

When mobilization is not a Pay Item, all costs for the Work shall be included in the prices bid for various Pay Items scheduled in the Proposal.

108.06 Limitation of Operations.

THE FOLLOWINGS IS ADDED TO THIS SECTION:

In order to work on any ITS component, The Traffic Management System (MIST) shall be permitted to be out of operations only during the following hours.

Friday before Memorial Day through Labor Day

Monday through Thursday	9:00 PM to 4:00 AM (Next day)
Friday	9:00 PM to 9:00 AM (Saturday)
Saturday	9:00 PM to 9:00 AM (Sunday)
Sunday	9:00 PM to 4:00 AM (Monday)

Day after Labor Day through Thursday before Memorial Day

Monday through Thursday	9:00 PM to 4:00 AM (Next day)
Friday	9:00 PM to 4:00 AM (Monday)

108.10 Time of Completion.

A. All work required for completion of the two right lanes of the 14th Street Viaduct (Stage 2B) shall be completed in 73 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the number of traffic lanes on the 14th Street Viaduct are reduced from its

existing condition. The work shall be considered complete when the two right lanes of the 14th Street Viaduct are open to traffic permanently and the temporary concrete barriers removed.

B. All work required for completion of the North Ramp Retaining Wall (Stage 3B as shown on the Traffic Control and Staging Plans) shall be completed in 76 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the right lane of the westbound lower roadway is closed and the number of traffic lanes through the 12th Street/14th Street merge area (approximately Station 3+500 to Station 3+720) are reduced from its existing condition. The work shall be considered complete when the right lane of the westbound roadway is open to traffic permanently and the number of traffic lanes in this area are returned to its existing condition and the temporary concrete barriers removed.

C. All work required for Completion of the South Ramp Retaining Wall (Stage 4A) shall be completed in 77 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the right lane of the eastbound lower roadway is closed and the number of traffic lanes through the 12th Street/14th Street merge area (approximately Station 3+500 to Station 3+720) are reduced from its existing condition. The work shall be considered complete when the right lane of the eastbound roadway is open to traffic permanently and the number of traffic lanes in this area are returned to its existing condition and the temporary concrete barriers removed.

D. All work required for Completion of the Merge Area Bridge Deck (Stage 4B) shall be completed in 107 Calendar Days. This work shall be considered started when the first section of movable concrete barrier is set in place and the left lane of both the eastbound and westbound lower roadway are closed and the number of traffic lanes through the 12th Street/14th Street merge area (approximately Station 3+500 to Station 3+720) are reduced from its existing condition. The work shall be considered complete when the left lane of both the eastbound and westbound lower roadway are open to traffic permanently and the number of traffic lanes in this area are returned to its existing condition and the movable concrete barriers removed.

E. All work required for completion of the two left lanes of the 12th Street Viaduct (Stage 5) shall be completed in 164 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the number of traffic lanes on the 12th Street Viaduct are reduced from its existing condition. The work shall be considered complete when the two left lanes of the 12th Street Viaduct are open to traffic permanently and the temporary concrete barriers removed.

F. All work required for completion of the two right lanes of the 12th Street Viaduct (Stage 6A) shall be completed in 175 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the number of traffic lanes on the 12th Street Viaduct are reduced from its existing condition. The work shall be considered complete when the two right lanes of the 12th Street Viaduct are open to traffic permanently and the temporary concrete barriers removed.

G. All work required for completion of the left lane of the northbound New Jersey Turnpike (Stage 6B) shall be completed in 92 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the number of traffic lanes on the New Jersey Turnpike are reduced from its existing condition. The work shall be considered complete when the left lane of the New Jersey Turnpike is open to traffic permanently and the temporary concrete barriers removed.

H. All work required for completion of the Concrete Deck on the 12th Street Viaduct (Stage 6C) between Bent 30 and Bent 27 shall be completed in 57 Calendar Days. This work shall be considered started when the first section of the temporary concrete barrier is set in place and the number of traffic lanes on the eastbound lower roadway are reduced from its existing condition. The work shall be considered complete when all lanes on the eastbound lower roadway are open to traffic permanently and the temporary concrete barriers removed.

I. All work required for Substantial Completion of Route 139 – Contract 2 shall be completed by August 4, 2009.

J. The entire Work of the Project shall be completed by October 5, 2009.

108.11 Extensions and Reductions of Contract Time.

THIS SUBSECTION IS CHANGED TO:

A. Basis for Extension. Where appropriate under the provisions of this Subsection, extensions or reductions to the Contract Time may be provided by Construction Order, however, such extensions or reductions will be allowed only to the extent that the increase or decrease in the Work or delays of the types indicated below affect current controlling operations and the overall Completion. Increases or decreases in Work or such delays, which do not affect the overall Completion, are not to be the basis for reduction or extension of Contract Time. Extensions of Contract Time will not be granted under this Subsection where it is determined that the Contractor could have avoided the circumstances which caused the request for extension.

If the Contractor is delayed in completion of the Work by reason of changes made under Subsection 104.02, or by failure of the Department to acquire right-of-way, or by any act of other contractors consistent with Subsection 105.10, or due to the discovery of archeological finds consistent with Subsection 108.13, or the discovery of hazardous substances, or by any act of the Engineer or of the Department not contemplated by the Contract, an extension of Contract Time commensurate with the delay in overall completion of the Contract thus caused will be granted, and the Contractor is relieved from any claim for liquidated damages or engineering and inspection charges.

Additionally, the Contractor may be granted an extension of Contract Time and not be assessed liquidated damages or the costs of engineering and inspection for any portion of the delay in overall completion of the Work beyond the time provided in Subsection 108.10 caused by the following reasons:

1. acts of civil or military authorities, war, or riot;
2. fire;
3. floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon (except on working day contracts);
4. extreme weather conditions (see Item 1 of the fourth paragraph) (except on working day contracts);
5. epidemics or quarantine restrictions;
6. strikes or labor disputes beyond the control of the Contractor which prevent work on the construction operations which are critical to the completion of the Project;
7. shortages of materials (see Item 2 of the fourth paragraph) or freight embargoes;
8. acts of the State in its sovereign capacity;
9. failure of the Engineer to furnish interpretations of the Contract Documents (see Item 3 of the fourth paragraph).

B. Criteria for Evaluation. Extension of Contract Time for the reasons set forth in this Subsection will not be granted unless the Contractor has notified the Engineer in writing of the causes of delay within 15 State Business Days from the beginning of any such delay on forms provided by the Department. The Engineer will evaluate the facts and the extent of the delay, and the Engineer's findings will be final and conclusive and will be based on the following:

1. Extensions of Contract Time for extreme weather conditions will be granted in accordance with the following:

Number of Days the Contractor's Work is Limited to in One Month as the Result of Extreme Weather Conditions (April through November inclusive)	Extension of Contract Time Allowable
16 – 31	0
15	1
14	2
13	3
12	4
11	5
10	6
9	7
8	8
7	9
6	10
5	11
4	12
3	13
2	14
1	15
0	16

Extensions of Contract Time for extreme weather conditions will be granted in accordance with the following for the months of December through March inclusive:

It is anticipated that the average number of total Working Days during this four month winter period is Twenty for road work (Exclusive of temperature sensitive work, for example but not limited to, paving operations, earthwork, aggregates, curb and sidewalk, etc.) and Forty for bridge work (Exclusive of temperature sensitive work, for example but not limited to, concrete decks, parapets, bridge repairs, bridge painting, etc.)

In using the above, the Engineer will:

a. Consider days for which an extension is granted under the above category "floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon" as days on which the Contractor's work is limited as the result of these extreme weather conditions;

b. Consider days for which an extension is granted under the above categories for causes other than "floods, tidal waves, earthquakes, cyclones, tornadoes, hurricanes, or other cataclysmic natural phenomenon" as days on which the Contractor worked and was unaffected by extreme weather conditions; and

c. Make the above calculation based on the full number of days in the calendar month as being days on which the Contractor could have worked without regard to Saturdays, Sundays, and holidays.

d. Extension of time for extreme weather conditions will only be granted when the Critical Path of the Progress Schedule is affected and documented by the contractor in accordance with Subsection108.04. No extension of time will be granted unless the Contractor submits daily documentation of such extreme weather.

2. Extensions of Contract Time will not be granted for a delay caused by a shortage of materials unless the Contractor furnishes:

a. Documentary proof that it has diligently made every effort to obtain such materials from all known sources within reasonable distance from the Work, and

b. Further proof in the form of a progress schedule, as required in Subsection 108.04, showing that the inability to obtain such materials when originally planned, did, in fact, delayed the date of Completion which could not be compensated for by revising the sequence of the Contractor's operations. The term "shortage of materials" applies only to raw and fabricated materials, articles, parts, or equipment which are standard items and does not apply to materials, parts, articles, or equipment which are processed, made, constructed, fabricated, or

manufactured to meet the specific requirements of the Contract. Only the physical shortage of materials and not the cost of materials will be considered.

3. Extensions of Contract Time will not be granted for failure of the Engineer to furnish interpretations of the Contract Documents until 20 State Business Days after receipt of such demand in writing as required by Subsections 105.01 and 105.07, and not then unless such request for an interpretation of the Contract Documents is reasonable and made in good faith, and the failure to respond was unwarranted.
4. It is understood and agreed that the Contractor has considered in its bid all of the permanent and temporary utility facilities in their present or relocated positions as may be shown on Plans, as described in Specifications and as revealed by its site investigation; is aware that utility company service demands, adverse field conditions and emergencies may affect the owner's ability to comply with the proposed schedules for utility work; and is cognizant of the limited ability of the State to control the actions of the utility companies, including the actions of railroads, and has made allowances in its bid. Extensions of Contract Time will be granted for extreme weather and exigent circumstances only, as specifically set forth above and which are outside the control of the respective utility company(ies) or the Contractor as determined by the Engineer utilizing the Extreme Weather provisions specified in 1. above. Extension of time for utility work will only be granted when the Critical Path of the Progress Schedule is affected and documented by the Contractor in accordance with Subsection108.04.

Except where specifically provided in the Contract Documents, the Contractor shall not make any claim for damages or additional compensation for any delay in or hindrance to the performance of the Contract occasioned by any act or omission to act by the State or any of its representatives, or for any of the reasons enumerated in this Subsection and agrees that any such claim shall be fully compensated for by an extension of Contract Time to complete performance of the Work.

Extensions of Contract Time will not be granted due to delays caused by, or in any way related to, the financial condition of the Contractor, subcontractors, sub-subcontractors, material, men, fabricators, or suppliers. The Contractor and its surety assume full responsibility for ensuring that the financial condition of any of the above does not delay completion of the Contract.

If, as a result of modifications made under Subsection 104.02, 104.05, 104.06, or 108.09, the Work required is reduced or altered so that the time required for Completion is reduced, the Engineer may reduce the Contract Time provided under Subsection 108.10. The Engineer will evaluate the facts and the extent of the reduction. The Engineer's findings thereon will be final and conclusive.

It is the intention of the above provisions that the Contractor or surety is not relieved of liability for liquidated damages or engineering and inspection charges for any period of delay in Completion in excess of that expressly provided for in this Subsection.

108.12 Right-Of-Way Delays.

THE TITLE OF THIS SUBSECTION IS CHANGED TO:

108.12 Right-Of-Way Information and Delays.

108.12 Right-Of-Way Information and Delays.

THE FOLLOWING IS ADDED:

The Contractor shall obtain from the Engineer all information regarding ROW Parcels and Easements acquired for the Project as well as the nature and type of title acquired. The Contractor shall make periodic requests for updates to this information during the course of the Contract.

The Contractor shall not enter an Easement until the Resident Engineer provides written notice to the property owner. The Contractor shall provide written notice to the Resident Engineer, 30 calendar days prior to entering a particular Easement or right, which is lesser than a fee interest. The Contractor shall make no claim for delays by reason that entry upon an Easement or right which is lesser than a fee interest is conditioned upon notice or is limited in duration; the Contractor is required to schedule accordingly and take such limitations into account when planning performance of the Work.

Temporary Easements and/or temporary construction rights will in most cases contain a limitation as to the length of time that they are extant. The Contractor shall schedule the Work pursuant to Subsection 108.04 so as to accommodate the particular time limitations of an Easement or right which is lesser than a fee interest as reflected on the R.O.W. plans. The Contractor shall provide a written request to the Engineer that the Department procure an extension from the owner of a particular temporary easement or right, which is lesser than a fee simple interest, so as to enable the

Contractor to continue occupancy of or re-enter same in the future, beyond the initial time period set forth in the respective property description prior to the expiration thereof.

Where the Contractor fails to complete the work within an area of a temporary easement or right lesser than a fee interest during the time allowed under the property description, by reason of the Contractor's own fault; the Contractor shall reimburse the State for the sum payable to the owner of the underlying fee interest for the extended period of occupancy use. The Resident Engineer may deduct an amount equal to such payments from the monthly estimate of the Work performed after providing 30 day written notice to the Contractor of such action, including a breakdown of the costs sought or to be sought by reason of the delay in timely vacating a temporary easement or right lesser than a fee interest.

108.16 Failure to Complete on Time.

THE TITLE AND ENTIRE TEXT OF THIS SUBSECTION IS CHANGED TO:

108.16 Liquidated Damages/ Incentive Payments For Early Completion.

LIQUIDATED DAMAGES

A. The Contractor and the Department recognize that delay in Completion results in damages to the State in terms of the effect of the delay on the use of the Project, upon the public convenience and economic development of the State, and also results in additional costs to the State for engineering, inspection, and administration of the Contract. Because it is difficult or impossible to accurately estimate the damages incurred; therefore, the parties agree that if the Contractor fails to complete the Contract within the time stated in these Special Provisions, or within such further time as may have been granted in accordance with the provisions of the Contract, the Contractor shall pay the State liquidated damages in accordance with the following paragraph. Such liquidated damages shall be paid for each and every day, as hereafter, defined that the Contractor is in default to complete the Contract.

LIQUIDATED DAMAGES SHALL BE AS FOLLOWS:

1. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item A of Subsection 108.10 of these Special Provisions, for Stage 2B, the Contractor shall pay liquidated damages to the State in the amount of $10,000.00.

2. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item B of Subsection 108.10 of these Special Provisions, for Stage 3B, the Contractor shall pay liquidated damages to the State in the amount of $10,000.00.

3. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item C of Subsection 108.10 of these Special Provisions, for Stage 4A, the Contractor shall pay liquidated damages to the State in the amount of $10,000.00.

4. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item D of Subsection 108.10 of these Special Provisions, for Stage 4B, the Contractor shall pay liquidated damages to the State in the amount of $5,000.00.

5. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item E of Subsection 108.10 of these Special Provisions, for Stage 5, the Contractor shall pay liquidated damages to the State in the amount of $5,000.00.

6. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item F of Subsection 108.10 of these Special Provisions, for Stage 6A, the Contractor shall pay liquidated damages to the State in the amount of $5,000.00.

7. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item G of Subsection 108.10 of these Special Provisions, for Stage 5, the Contractor shall pay liquidated damages to the State in the amount of $5,000.00.

8. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item H of Subsection 108.10 of these Special Provisions, for Stage 5, the Contractor shall pay liquidated damages to the State in the amount of $5,000.00.

9. For each Calendar Day that the Contractor fails to complete Construction Operations, as specified in Item I of Subsection 108.10 of these Special Provisions, for Substantial Completion, the Contractor shall pay liquidated damages consisting of Road User Costs and Construction Engineering Costs, as defined in Subsection 101.03, to the State in the amount of $8,400.00.

10. For each Calendar Day that the Contractor fails to complete the entire Work of the Project as specified in Item J of Subsection 108.10 of these Special Provisions, for Completion, the Contractor shall pay liquidated damages consisting of Construction Engineering Costs, as defined in Subsection 101.03, to the State in the amount of $1,700.00 provided that Construction Operations as specified for Substantial Completion are actually completed.

B. The days in default set forth above are the number of Calendar Days in default when the time for Completion is specified on the basis of Calendar Days or a specified completion date, and are the number of Working Days in default when the time for Completion is specified on the basis of Working Days.

C. Anytime after the Engineer notifies the Contractor in writing, that Substantial Completion of the Project has been actually achieved, the Commissioner may elect, to waive the imposition of liquidated damages under Subpart 3 above and, in lieu thereof, require the Contractor to pay the actual costs incurred by the State for engineering, inspection, and administration (including overhead) between the actual date of Substantial Completion or such subsequent date as the Commissioner may determine and the actual date of Completion of all Work, as established by the Certificate of Completion. The Contractor hereby waives the right to challenge this election by the Commissioner on the grounds that such costs exceed the amount of liquidated damages specified under Subpart 9 above.

D. The Commissioner will recover all liquidated damages specified above by deducting the amount thereof from any monies due or that may become due the Contractor, or from the Contractor or from its surety.

INCENTIVE PAYMENT FOR EARLY COMPLETION

E. For this particular contract, the Department agrees to pay the Contractor an "incentive payment for early completion", but only where the Contractor actually and fully completes the Construction Operations as specifically specified in Subsection 108.10 and fully and completely complies with the provisions set forth in the paragraphs below and subject to the conditions and limitations set forth below. There are two separate forms of "incentive payment for early completion" (incentive payment) set forth in Subparts 1 through 8 below, which are mutually exclusive. If, for example, the Contractor does not meet the conditions applicable to receive the incentive payment set forth in Subpart 1, the Contractor may however, receive incentive payments under Subpart 2, provided the Contractor actually and fully completes the Construction Operations as specifically specified in Subsection 108.10, subject to the provisions of this Subsection.

1. For each calendar day prior to the 73 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph A, the Contractor will receive a per day incentive payment of $10,000.00, not to exceed a total maximum amount of $400,000.00.

2. For each calendar day prior to the 76 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph B, the Contractor will receive a per day incentive payment of $10,000.00, not to exceed a total maximum amount of $300,000.00.

3. For each calendar day prior to the 77 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph C, the Contractor will receive a per day incentive payment of $10,000.00, not to exceed a total maximum amount of $300,000.00.

4. For each calendar day prior to the 107 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph D, the Contractor will receive a per day incentive payment of $5,000.00, not to exceed a total maximum amount of $300,000.00.

5. For each calendar day prior to the 164 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph E, the Contractor will receive a per day incentive payment of $5,000.00, not to exceed a total maximum amount of $400,000.00.
6. For each calendar day prior to the 175 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph F, the Contractor will receive a per day incentive payment of $5,000.00, not to exceed a total maximum amount of $450,000.00.

7. For each calendar day prior to the 92 Calendar Days allotted, that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph G, the Contractor will receive a per day incentive payment of $5,000.00, not to exceed a total maximum amount of $250,000.00.

8. For each calendar day prior to the substantial completion of work that the Contractor actually and fully completes Construction Operations as specifically specified in Subsection 108.10 Paragraph H, the Contractor will receive a per day incentive payment of $5,000.00, not to exceed a total maximum amount of $150,000.00.

F. In order for the Contractor to receive an incentive payment, the Construction Operations stated in Subsection 108.10 Paragraphs A, B, C, D, E, F, G, or H must be actually and fully completed and the Project must be safe and convenient for use by the public to the extent that there will be no interference with utilizing all proposed lanes, shoulders and driveways as of the respective times set forth in Paragraph E above, except by reason of corrective action as defined and as carried out in accord with the Specifications. The State reserves the right to add extra work to the contract or increase the quantity of an item(s) in accord with the Specifications. All added work must also be completed in order to receive an incentive payment; unless, however, such work is added or increased within four months of the respective times set forth in Paragraph E above or the total thereof is equivalent to more than 20% of the original contract price. In such event the new, extra, added or increased work included in the contract within 4 months of the aforesaid date or in excess of 20% will not be required to be completed in order to receive the incentive payment, although all original work and item quantities and work added or increased before the four month period or having a total value of 20% or less will have to be fully completed in accord with Paragraph E above. Also, all added, increased or extra work that is not required to be completed in order receive an incentive payment as determined by the Engineer must still be completed in accord with completion date set forth in the respective Change Order or Supplemental Agreement.

G. The Contractor shall have no right to, nor shall it make any claim for additional compensation because an extension or reduction of time to perform the contract work is granted by the Engineer which in turn results in the incentive payments under Subparts E1, E2, E3, E4, E5, E6, E7, or E8 being reduced or eliminated. The Contractor may, however, seek to have the time frames of the incentive payment as provided under Paragraph E above increased one day for each scheduled working day (as defined under Subsection 108.04) the Contractor is unable to work, as determined by the Engineer, with respect to construction operations specified in Subsection 108.10 Paragraphs A, B, C, D, E, F, G, or H solely by reason of exigent circumstances so long as the Contractor acts in good faith to mitigate the effects of such exigent circumstances. Exigent circumstances shall only include the following events which are determined by the Engineer to impact specific items of work which are on the critical path of an approved schedule pursuant to Subsection 108.04 or significantly impact an approved schedule so as to cause such effected items of work to become critical as determined by the Engineer: 1) fire; 2) acts of civil or military authorities, war or riot; 3) severe floods, hurricanes, cyclones, severe straight winds exceeding 75 mph, tornadoes, tidal waves or other cataclysmic natural phenomenon exclusive of extreme weather, and snow, sleet, hail and/or ice; 4) strikes or labor disputes beyond the control or fault of the contractor; and 5) court orders or injunctions not resulting from the fault of the contractor. The total maximum amount of an incentive payment under Subparts E1, E2, E3, E4, E5, E6, E7, or E8 will not be adjusted for any extension of time granted for any reason other than those set forth above. Extensions of time, where granted, will, result in an adjustment to the amount of liquidated damages recovered as set forth in Paragraphs A through J above.

H. The Contractor, by entering into this contract, hereby acknowledges that it shall not have the right nor the right to make any claims for additional compensation by reason of any delays which result in the loss of or diminution of the incentive payment, whether or not the fault of the Contractor, arising from, by way of example and not limitation, acts, errors, or failure to act of the State, other Government bodies, the Department's Design Forces, Consultants, Suppliers, Subcontractors, Fabricators, Manufactures, or any third party; or as a result of weather conditions, natural events, strikes, riots, court action, fire, flood, changed conditions, ordered or construction changes in the work, extreme traffic, accidents, civil disobedience, criminal acts, vandalism, fuel shortages, equipment failures or shortages, or for any other reason whatsoever except that it may seek to have the time frames of the incentive payment modified as specifically provided in Paragraph G above.

I. The Contractor further acknowledges that it shall not have any right to an increase in the amount of the incentive payment over and above the maximum limit of $2,600,000.00, no matter when the Contractor completes the work and that the Contractor shall not be entitled to an incentive payment in the event of a termination of contract by the Commissioner whether it be for fault or convenience or a default under Subsection 108.17 or 108.18. In the event of a termination by convenience, compensation for premium time expended will be paid subject to and in accord with Paragraph L below.

J. The Contractor, by entering into this agreement, agrees that it shall not rely upon or anticipate receipt of an incentive payment, either under Subparts E1, E2, E3, E4, E5, E6, E7, or E8 as compensation for the work performed and shall not include in any manner, anticipation of the receipt of the incentive payment while calculating its bid proposal for the various items of work. By entering into this contract, the Contractor further agrees that the Contractor neither possesses nor is entitled to the receipt of an incentive payment unless the work set forth in Subsection 108.10 Paragraphs A, B, C, D, E, F, G, or H is actually and fully achieved, in accord with and subject to the 2001 Standard Specifications as supplemented and the special provisions and the Contractor fully and completely complies with the provisions of this subsection.

K. Time shall be of the essence as to all time frames set forth in this subsection. The doctrine or principal of substantial completion shall not apply to the determination of whether the Contractor is due an incentive payment.

L. In the event of a termination for convenience pursuant to Subsection 108.18, and not a termination for fault or a default and termination, and the Contractor has not been determined by the Engineer to be entitled to be qualified for any incentive payment under this subsection, the Contractor shall only be entitled to payment of documented premium time for contract labor and documented premiums paid to subcontractors and suppliers not under control or ownership of the Contractor reasonably expended by the Contractor to accelerate the Work so as to qualify for the incentive payment and not because it was behind in its progress schedule as controlled under Subsection 108.04. Any such payment shall be in lieu of an incentive payment. The Contractor agrees that it shall not be entitled to any additional compensation in the event the contract is terminated prior to the Contractor qualifying for an incentive payment and that its remedy shall be limited to payment of premium time and subcontractor and supplier premiums only. The State retains the right to eliminate any item of work or part of any item of work at any time; the contractor shall not make any claim to increase the incentive payment in such an event. However, where the State eliminates work the total value of which is equivalent to more than 20% of the original contract price, the State may eliminate the incentive payment. In such event the contractor’s remedy will be limited to that provided under a termination for convenience.

M. The Contractor shall notify the Engineer in writing when it contends that the Construction operations under Subsection 108.10 Paragraphs A, B, C, D, E, F, G, or H have been completed or are to be completed in the near future. Upon receipt of such notice, the Engineer shall respond within 5 working days of the date the notice was received from the Contractor or from the date that the Contractor contends the Construction Operations will be done which ever is later. The Engineer’s response will also be in writing and in the event completion is not found to have occurred, the Engineer shall enumerate the reasons for its determination. Should the Contractor comply with Paragraph E through L and it is determined by the Engineer that an incentive payment is due pursuant to this subsection (either by Subpart E1, E2, E3, E4, E5, E6, E7, or E8), such payment will be made by a single payment (possibly multiple checks) after a change order has been prepared and approved by the Engineer and has been fully processed by the Department, but in no event prior to Substantial Completion. Breach by the State, its official or employees, of this provision, or any other provision of this subsection shall not nullify the terms or the conditions for an incentive payment under this Contract.

N. Nothing herein shall affect the payment and amount of the Liquidated Damages as specified in this Subsection 108.16, which will remain in full force and effect regardless of the reduction or elimination of payments or early completion. Furthermore, nothing herein shall affect the actual completion date of the work as set forth in Subsection 108.10 Paragraph I or extensions of time thereof, independent of the completion date set, for the purposes of the incentive payment.

THE FOLLOWINGS IS ADDED TO THIS SECTION:

For each hour the contractor interrupts or fails to restore the operation of any part of the ATMS as specified in the subsection 108.06 of these special provisions, the contractor shall be liable for and pay liquidated damages to the state in the amount of $6000. This shall include any interruptions caused by accidental fiber optic cable damage or those resulting from the Contractor's failure to follow the procedures detailed in the general notes on the plan sheet.

108.19 Lane Occupancy Charges.

THE FOLLOWING IS ADDED:

The rate or rates to be applied in the calculation of a Lane Occupancy Charge shall be in accordance with the following:

Description	Rate per Minute per Lane
Overrun of "One Lane Maintained" time limits	$100/minute/lane
Overrun of time limit for installation of Steel Grid Flooring	$100/minute/lane

SECTION 109 – MEASUREMENT AND PAYMENT

109.03 Force Account Payment.

5. Profit. Profit shall be computed at ten percent of the following:

SUBPART C. IS ADDED AS FOLLOWS:

c. Total fringe benefits on total direct labor cost as computed above.

6. Overhead.

THE FIRST SENTENCE IS CHANGED TO:

Any and all overhead for the Contractor is defined to include the following:

THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

Any and all overhead costs of the Contractor for Force Account work shall be computed at 15 percent of the following:

109.07 Payment Following Substantial Completion.

SUBPART 1 OF THE FIRST PARAGRAPH IS CHANGED TO:

1. Each subcontractor or supplier has been promptly paid any amount due from any previous progress payment and shall be paid any amount due from the current progress payment, including all retainage withheld from the subcontractor or supplier, within 14 days of the receipt by the Contractor of payment from the Department; or

109.07 Payments Following Substantial Completion

THE LAST PARAGRAPH IS CHANGED TO:

All monies retained subsequent to the first estimate following Substantial Completion may be released as specified in Subsection 109.11.

109.09 Payment Following Acceptance

THE ENTIRE TEXT IS CHANGED TO:

All Partial payments by monthly estimate will be processed prior to acceptance. Final payment will be made as specified in Subsection 109.11.

109.10 As-Built Quantities.

THE FIRST AND SECOND SENTENCE OF THE SECOND PARAGRAPH ARE CHANGED TO:

The Resident Engineer may from time to time, before Substantial Completion, prepare as-built quantities and incorporate these quantities into monthly estimate certificates through an appropriate Field Order or Change Order. Such interim as-built quantities are subject to recalculation in completion of the Final Certificate.

THE THIRD PARAGRAPH IS DELETED.

109.11 Final Payment and Claims.

THE ENTIRE TEXT IS CHANGED TO:

1. Final Certificate. All prior estimates and payments made by the Department are subject to correction in the Final Certificate, which will be completed as follows:

a. After Acceptance is completed as specified in Subsection 105.23 and the As-Built quantities finalized, the Department will make an estimate of the total amount of Work done under the Contract, and prepare and issue the Final Certificate to the Contractor.

b. Within 30 State Business Days after said Final Certificate has been issued to the Contractor, the Contractor shall submit to the Department either a written acceptance of the Final Certificate without exception together with an executed release in the form provided with the Final Certificate or a written acceptance of the Final Certificate with a reservation of specific claims, but otherwise releasing all claims not specifically reserved, by executing a conditional release in the form provided with the Final Certificate. The Contractor's failure to submit any written acceptance or acceptance with reservation within said 30 days will be construed by the Department as an acceptance by the Contractor of the Final Certificate without exception or reservation of Claims.

c. Upon receipt of the Contractor's written acceptance of the Final Certificate with unconditional or conditional release, or when the Contractor fails to provide any written acceptance of the Final Certificate within 30 State Business Days of issuance, the Department will pay the entire sum due thereunder as provided by the New Jersey Prompt Payment Act NJSA 52:32-32 *et seq.*, provided the Final Certificate indicates a payment is due the Contractor. However, where the Final Certificate indicates a Credit (payment) is due the Department, the Contractor shall remit said Credit (payment) to the Department in the amount set forth in the Final Certificate.

d. If the Contractor fails to remit the Credit (payment) due the Department, as indicated on the Final Certificate, within 30 State Business Days of issuance of the Final Certificate, the Department may pursue all legal means available to recover the amount due the State, including but not limited to, deducting the amount from payment due the Contractor on this or other Department Contracts or from retainage and/or the sale of bonds held in lieu of retainage for the Contract or for other Contracts, even where the credit is being contested by the Contractor.

Neither the failure of the Contractor to accept the tendered Final Payment nor the failure of the Contractor to remit the credit (payment) due the Department shall affect when the "Completion of the Contract" shall be deemed to have occurred for any reason. Where there is a remaining monetary balance due to the Contractor by the Department, Final Payment will be made after the "Completion of the Contract". Retainage shall be released to the Contractor upon completion of the contract unless a credit (payment) is due to the Department, which shall be deducted or adjusted in accord with the Specifications.

2. Conditions for Claims. Conditional acceptance of the Final Certificate will be permitted only where all of the following are met:

a. When the Contractor submits a Release conditioned with exception or reservation, the release shall state the specific monetary amounts and category of the claims being reserved. The Contractor acknowledges, by the act of executing the contract, that the failure to state specific monetary amounts and specific categories shall result in a waiver of such claims lacking as to amounts or specific categories thereof. The Contractor may reserve only those claims properly filed with the Department pursuant to Subsection 107.02 and not previously resolved. The Contractor waives all claims for which the required notice has not been filed with the Department.

b. The Contractor further understands and agrees, by the act of executing the Contract that neither the procedures established under this Subsection nor the review of claims by the Department pursuant hereto shall in any way modify the requirements applicable to the filing of a Contractual Notice Form or the filing of a suit pursuant to the provisions of N.J.S.A. 59:13-1 *et seq.* .

c. If the Contractor conditions its acceptance of the Final Certificate by reserving particular claims, the Contractor shall at the same time state in writing whether it would like to submit its reserved claims for review by the Department Claims Committee. Only those claims properly reserved, as provided for in Subsection 107.02, and which are unresolved after completing Steps I and II of the Contractual Claim Resolution Process for the resolution of contract claims, are eligible for review by the Department Claims Committee to the extent provided in that Subsection. If the Contractor states that it does not want Department Claims Committee review of the reserved claims or if it fails to request Department Claims Committee review of reserved claims when it conditions its acceptance of the Final Certificate or if it files suit in a court of law regarding those claims, the Contractor shall be deemed to have waived any ability to have its reserved claims reviewed by the Department Claims Committee.

d. If the Contractor requests review of its reserved claims when it conditions its acceptance of the Final Certificate, it shall send at the same time a copy of its request for review to the Secretary of

the Department Claims Committee, PO Box 600, Trenton, NJ 08625-0600. Department Claims Committee review will then take place according to Subsection 107.02.

e. At the election of the Contractor upon completion of the Contract, claims that are unresolved after review by the Department Claims Committee may be submitted to Non-Binding Mediation according to Subsection 107.02.

f. Interest shall neither be paid nor shall it accrue upon the amount of any additional compensation paid in resolution or settlement of a claim resolved through the various steps of the Contractual Claims Resolution Process.

DIVISION 200 - EARTHWORK

SECTION 201 - CLEARING SITE

201.01 Description.

THE FOLLOWING IS ADDED:

Clearing Site shall also include removal of the concrete sidewalk and curb over the covered concrete gutter, along the northerly side of the Route 139 Lower Westbound Roadway, under the pay item Removal of Concrete Sidewalk, Type X.

201.03 Clearing Site.

THE FOLLOWING IS ADDED:

The Contractor shall conduct all clearing and removal activities in areas identified on the environmental plan sheets as containing Regulated Waste in accordance with the Site Specific Health and Safety Plan (HASP) in Subsection 202.04 and 202.13. The Contractor shall institute controls to minimize contact with materials containing regulated waste as defined elsewhere in the Special Provisions and Specifications during clearing and removal activities. Site clearing shall not be initiated until the Contractor's Site Specific HASP has been reviewed and accepted by the Engineer.

201.04 Removal of Bridges, Culverts, and Other Structures.

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

The completion of this project requires the removal and disposal of the existing deck slabs, parapets, sidewalks and other miscellaneous items included for the 12th and 14th Street Viaducts in construction stages and to the limits shown on the plans. The completion of this project also requires the removal and disposal of miscellaneous items for the 14th Street Shoulder Structure in construction stages and to the limits shown on the plans.

THE FOLLOWING IS ADDED:

The Contractor shall submit demolition plans and calculations to the engineer for approval prior to commencement of any removal work. The plans shall include field verification of staging lines and deck cut lines to be performed at each stage of construction. The plans shall include location of all temporary shielding as necessary in each stage of construction. The plan shall also show the location of, if any, of field equipment, trucks and entrance/exit lanes along with maintenance and protection of traffic for each stage of construction. The plans shall include all provisions for maintaining safe working conditions for the crew as well as viaduct traffic.

THE FOLLOWING IS ADDED:

The bridge work to be performed under this Contract includes removal and disposal of reinforced concrete bridge decks, sidewalks, curbs, parapets, median barrier, existing structural steel, deck joints, railings, and conduit as shown on the Plans and as directed by the Engineer.

The equipment listed below is permitted subject to the following applicable restrictions:

1. **Pneumatic or Electric Equivalent Hand Operated Hammers.**
    a. Up to 41-kilogram (90-pound) hammers exclusive of the bit may be used for deck removal not closer than 150 millimeters to structural members. This hammer may also be used for removal of barriers, sidewalks, curbs, and parapets not closer than 150 millimeters from structural members. Only chisel point bits will be permitted. Structural members are defined as girders, floorbeams, stringers, diaphragms, or cross frames.
    b. Up to 14-kilogram (30-pound) hammers exclusive of bit may be used for removal of concrete within 150 millimeters of structural members.
2. **Saw Cutters.**

a. Vermeer concrete cutters or cutting saws may be used to cut within 150 millimeters adjacent to structural members.
b. If water is used in conjunction with cutting operations, shielding beneath the operation shall prevent water leakage. Water shall be disposed by an approved method. The disposal method shall be submitted by the Contractor for approval by the Engineer.

3. Hydraulic Breakers. Hydraulic breakers, such as, but not limited to, Tramac or other ram-hoe type breakers, are permitted for removal of substructure concrete. For deck concrete removal, such equipment is permitted subject to the following restrictions:
a. The girders shall be analyzed to determine if induced stresses may be harmful.
b. The centerline and limits of the top flange of girders shall be delineated before starting the equipment operation.
c. The equipment shall not be used directly over the top of girders nor in overhang areas. Concrete removal in these areas shall be performed by jackhammers.
d. Pulling and twisting of the reinforcement steel is prohibited.
e. Any damage to existing reinforcement, shear studs, structural steel, or any other structural components that are to remain shall be repaired at no cost to the State.

4. Hydraulic Splitters. Hydraulic splitters such as Darda hydraulic splitters are permitted subject to approval.

5. Other Equipment. Equipment not specifically approved in this Section may be used only with written approval.

The sequence of removal shall be coordinated with the operations of the utility company to protect and maintain its facilities.

During removal operations, the Contractor shall take all necessary precautions so as not to damage the structural members scheduled to remain. All damage done to the existing structural members scheduled to remain shall be repaired. The repair procedure shall be as follows:

1. Steel Stringers, Floorbeams, Cross Frames, and Diaphragms.
a. Repair procedures to tensile components shall conform to ASTM A 6/A 6M and the following:
(1) Gouges up to 3 millimeters shall be removed by grinding flush in the direction of principal stress.
(2) Gouges deeper than 3 millimeters shall be removed first by grinding; then, weld metal shall be deposited and ground flush with the surface of the metal in the direction of principal stress. Welding shall be done using low hydrogen electrodes conforming to current AWS Specifications A5.1 and A5.5. The electrodes shall be protected from moisture during storage.
(3) Kinks and deformations shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.
b. Repair procedures to compression components shall conform to the following:
(1) Where more than five percent of the cross-sectional area of the member is damaged due to removal operations, the Contractor shall submit a repair procedure for approval.
(2) Kinks and deformations shall be repaired as outlined in 2.a (3) above.

Existing top flanges of beams exposed by removal operations shall be cleaned and painted with a prime coat of paint according to Subsection 514.07, Subpart B.

THE FOLLOWING IS ADDED:

Special protective systems for the removal of bridges, culverts, and other structures shall be as follows:

1. Temporary Shielding. Temporary shielding for demolition and new construction shall include furnishing, installing, and removing a structural framing and barrier system. The system shall be supported from girders to provide an adequate and substantial temporary shielding system to protect vehicular, pedestrian, and railroad traffic from falling construction materials or other objects. The barrier system shall remain in place during the time that construction work is performed and until the work is completed and accepted.

For deck replacement or new deck work, the temporary shielding shall seal the underside of deck and extend outside of the fascia stringers to enclose the soffits and parapets.

For parapet removal and replacement or new parapet construction, an outrigging type of temporary shielding, which encloses the soffit and parapet, shall be used.

The Contractor shall submit for approval detailed working drawings showing all elements of the temporary shielding system, including bonding and grounding over electrified rail lines, design calculations, and the sequence of operations thereof, signed and sealed by a Professional Engineer licensed in the State.

Should the Contractor's operation or construction staging require it to install and remove the shielding more than once, no additional payment will be made.

The traffic lanes and pedestrian areas below the areas where temporary shielding is being installed shall be closed, in accordance with the requirements of Section 617.

The temporary shielding shall be designed to withstand a load of at least 5.75 kilopascals or greater if heavier loads are anticipated and shall prevent small particles and dust from falling through.

Bolted connections or welding between temporary shielding and bottom flanges of the beams shall not be permitted. Any materials dropped on the temporary shielding shall not be allowed to accumulate and shall be removed promptly.

The selection of sizes, materials, their arrangements, and details shall be the Contractor's option and responsibility, but subject to approval by the Engineer.

In no case shall the temporary shielding reduce the existing underclearances of the bridges to less than 4.5 meters over roadways and 6.75 meters over railroads. If any existing underclearance is less than these values, it shall be maintained without any further reduction.

The Contractor shall obtain the Engineer's approval of the method, design, and details of the temporary shielding system that the Contractor intends to use for the protection of traffic. No construction work shall be performed above traffic before such approval.

201.06 Removal of Sidewalks, Driveways, Curbs, and Gutters.

THE FOLLOWING IS ADDED TO THE END OF THIS SUBSECTION:

Removal of Concrete Sidewalk, Type "X": Removal of Concrete Sidewalk, Type "X" shall consist of the removal of the existing sidewalk and curb over the covered concrete gutter along the northerly side of the Route 139 Lower Westbound Roadway to the limits shown on the plans, without causing damage to the existing concrete gutter and concrete cover. Before beginning removal of sidewalk and curb, the Contractor shall visually inspect the covered concrete gutter. If the Contractor observes any damage to, or blockage in, the covered concrete gutter, the Contractor shall notify the Engineer.

Sidewalk and curb shall be removed using pneumatic or electric equivalent hand operated hammers complying with Subsection 201.04 of the Special Provisions. Hand operated concrete cutting saws may also be used. Machine mounted concrete cutting saws may only be used if they do not damage the covered concrete gutter. If the Contractor wishes to use machine mounted concrete cutting saws the Contractor shall demonstrate to the Engineer's satisfaction that the saws will not damage the covered concrete gutter on a test section of the sidewalk and curb no more than 5 meters long. Hydraulic breakers such as ram-hoe type breakers and hydraulic splitters will not be allowed. Milling will not be allowed.

The surfaces that remain after the sidewalk and curb are removed shall be finished so that they are suitable for construction of the Superpave Hot Mix Asphalt Base Course and 375 by 875 mm Concrete Barrier Curb, Dowelled. Tolerance of the surfaces that remain after the sidewalk and curb are removed shall be plus 0 mm and minus 50 mm.

Damage to the concrete gutter and concrete cover that is a result of the demolition process shall be repaired by the contractor at no expense to the State. Damage shall be defined as any change to the shape of the concrete gutter, any obstruction to the flow of water in the concrete gutter, and any holes in or loss of support for the concrete cover over the gutter. Repairs to the concrete gutter and concrete cover must have same cross sectional shape as the existing concrete gutter waterway.

The concrete gutter shall be cleaned by flushing with water after curb and sidewalk are removed, and after inlets along the covered concrete gutter are repaired or modified.

THE FIRST ITEM OF THE FIRST PARAGRAPH IS DELETED.

201.11 Method of Measurement.

THE FOLLOWING IS ADDED:

Removal of Concrete Sidewalk, Type "X", will be measured by the linear meter, measured along the existing curbline.

201.12 Basis of Payment.

THE FOLLOWING IS ADDED:

Pay Item	*Pay Unit*
REMOVAL OF CONCRETE SIDEWALK, TYPE "X"	LINEAR METER

THE SECOND PARAGRAPH IS CHANGED TO:

Payment for the Pay Item "Clearing Site" in excess of $ 500,000.00 will not be made until Completion.

THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

Payment for the Pay Item "Clearing Site, Bridge (___)" in excess of $_____ will not be made until Substantial Completion.

Payment for the Pay Item "Clearing Site, Structure (___)" in excess of $_____ will not be made until Substantial Completion.

THE FOLLOWING IS ADDED:

Payment for the preparation and submission of demolition plans and calculations for the 12th and 14th Street Viaducts shall be included under the pay item "Clearing Site, Bridge".

SECTION 202 - ROADWAY EXCAVATION

202.01 Description.

THE FOLLOWING IS ADDED:

This work shall also include the excavation, handling, stockpiling, disposal and/or recycling of Regulated Waste generated in excavation for roadway, foundations, utilities and subsurface structures.

202.02 Classification.

Roadway Excavation, Regulated Waste. Roadway Excavation, Regulated Waste consists of the excavation and management of all contaminated soil, sediment, and debris as noted on the Environmental Plans. This soil may exhibit non-hazardous and hazardous characteristics.

202.04 Excavation.

THE LAST PARAGRAPH IS CHANGED TO:

All unstable material shall be used in embankments, as directed, or disposed of in accordance with Subsection 202.12 and 202.13, as appropriate.

THE FOLLOWING IS ADDED:

MANAGEMENT OF REGULATED WASTE

Preliminary analysis has identified areas of contaminated soil within and adjacent to planned excavations. Excavation in areas containing one or more contaminants exceeding NJDEP soil cleanup criteria, as identified in the construction documents including the Remedial Action Work Plan developed by Metcalf & Eddy INC dated_____, as directed by the Engineer, or as determined by the Contractor and approved by the Engineer, shall be performed in accordance with applicable Federal and State law, rules and regulations; The Contractor's Site Specific Health and Safety Plan; the specifications and the direction of the Engineer.

A. REQUIREMENTS AND METHODS FOR EXCAVATION AND MANAGEMENT OF REGULATED WASTE

Description. The work shall include the excavation, handling, stockpiling, sampling and analysis for disposal, recycling or treatment of regulated waste except as provided for in Subsection 202.13.. The disposal of Regulated Waste shall comply with the plan, specifications, Federal, State and local law, rules, and regulations, the waste management plan of the district of origin, and Subsection 202.13. The term “Regulated Waste” as used shall mean Regulated Waste and Regulated Waste, Hazardous, as appropriate.

Construction Requirements. The Contractor shall provide all personnel, materials and equipment needed to undertake excavation as required to complete the work in a safe manner that is protective of human health and the environment. Excavation of Regulated Waste shall be performed with equipment of suitable size and compatible with site conditions. All equipment shall comply with and shall be operated in accordance with all applicable regulations. Excavation of Regulated Waste shall be to the limits shown on the plans or as directed by the Engineer. No soil shall be excavated beyond the limits shown, unless directed by the Engineer.

The Contractor shall handle all excavated material in a manner that protects site personnel, the public, and the, environment in accordance with all applicable federal, state, and local laws and regulations. Prior to any excavation of regulated waste the Contractor shall develop a Site-Specific Health and Safety Plan (HASP) in accordance with 29 CFR 1910, 29 CFR 1926 and the Site Specific Health and Safety Requirements specified herein.

Environmental Sampling and Testing. The Contractor shall provide all personnel, materials, and equipment, needed to properly characterize excavated Regulated Waste material as required for disposal and/or recycling facility

approval. The Contractor shall submit as part of the Material Handling Plan described herein, a sampling analysis section for characterizing the Regulated Waste for off-site disposal in accordance with applicable Federal, State and Local laws, rules and regulations: or according to the disposal facility accepting the waste.

The Contractor shall submit as part of the sampling and analysis section, the name, address-and telephone number of the contact for the Contractor proposed environmental laboratory and the name and experience of the proposed environmental sampling technician. The use of a proposed environmental laboratory and proposed environmental sampling technician are subject to review and acceptance by the Engineer.

The Contractor shall provide all personnel, equipment and ancillary services required to collect, transport and analyze environmental samples required for proper characterization of the material. All sampling, testing and inspections, conducted in areas containing potential regulated waste shall be performed in accordance with the site-specific HASP in Subsection 202.04.

All sampling, testing and data management procedures shall comply with current versions of the NJDEP Field Sampling Procedures Manual, NJDEP Technical Requirements for Site Remediation, NJDEP Management of Excavated Soils Guidelines, and Appendix 1 and the NJDEP Waste Classification Form and EPA requirements.

Where required by the Contractor's disposal facility, the Contractor shall collect and analyze those additional parameters not previously tested for off-site treatment or disposal.

Stockpiling Regulated Waste. The Contractor shall provide all personnel, materials and equipment needed to properly store (and dewater, if necessary) Regulated Waste in temporary stockpiles. If needed, any temporary stockpile(s) shall be located at area(s) within the project limits selected by the Contractor and approved by the Resident Engineer. Regulated Waste, shall not be stockpiled for more than 180 days. Regulated waste subsequently classified as hazardous shall be properly staged and removed within 90 days of excavation.

Stockpiles shall only be placed on dry areas on a layer of minimum 10mils thick PVC sheeting or similar, as approved by the Engineer and contained with hay bales or silt fence placed continuously at the perimeter of the stockpile(s). All joints in the underlying PVC sheeting shall overlap with a minimum of 300 millimeters at the ends. Temporary stockpile shall be constructed so that heights shall not exceed 4.5 meters, nor with sideslopes steeper than one vertical and two horizontal. The Contractor shall segregate material of differing types and degrees of contamination so as to prevent cross-contamination of uncontaminated material. Stockpiles shall be a minimum of 50 feet from the area shown on the Environmental Plans to contain hazardous waste. This distance must be maintained to eliminate the possibility for mixing of non-hazardous and hazardous soil.

The Contractor shall provide protection for the regulated waste stockpile to prevent the run-on of stormwater, migration of contaminants, dusting, erosion and unauthorized contact. Temporary stockpiles shall be covered with PVC sheeting of the same thickness. The sheeting shall be secured in place with tie downs and/or heavy objects such as concrete blocks at the end of each workday and during adverse weather conditions. All joints in the coyer shall have a minimum 300 millimeters overlap and securing materials shall be placed along the joints such that the cover will not be opened by wind action. The Contractor shall maintain the sheeting as needed to repair damage and replace displaced cover sheeting.

Drainage shall be controlled with hay bales, placed continuously at the perimeter of the stockpile(s), PVC cover and silt fence such that run-on and run-off from the regulated waste stockpile(s) is mitigated. Decant from the dewatering of sediments shall be in accordance with the Pollution Prevention and Control Plan (described herein Subsection 212.06). The Contractor shall be responsible for the proper protection and maintenance for the regulated waste stockpile and embankment until completion of the work and acceptance by the Engineer. The Contractor shall maintain the sheeting as needed to repair damage and replace displaced cover sheeting. At the direction of the Engineer, the Contractor shall remedy any observed deficiencies in the cover and sediment barrier surrounding the temporary stockpile or embankment as soon as practicable, including but not limited to the removal and disposal of accumulated sediments behind the sediment barrier, to maintain satisfactory protection, and as otherwise needed to prevent contamination migration or exposure.

Soil Usage Tracking Log. The Contractor shall monitor and record on Daily Soil/Sediment Tracking Logs the source location, type, quantity, and characteristics of Regulated Waste excavated, stockpiled, recycled and taken off-site for disposal. The Contractor shall submit a Daily Soil/Sediment Tracking Log to the Engineer for each workday involving excavation, stockpiling, transport and disposal of regulated waste. The Daily Soil Tracking Log shall contain, at a minimum, the following information:

A) Date,

B) Location(s) of excavation and placement of material,

C) Volume of regulated waste removed, and

D) Name(s) and signature(s) of the Contractor representative(s) responsible for preparing and executing the Soil Usage Log.

Two copies of Daily Soil/Sediment Tracking Logs shall be submitted to the Engineer on a weekly base.

The Engineer will not approve any progress payment invoice if the required Daily Soil/Sediment Tracking logs have not been submitted.

B. SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

Background Environmental Information. The documentation and environmental information provided by the New Jersey Department of Transportation (NJDOT) is for informational purposes only. The Contractor is responsible for appropriate interpretation of the information. The Contractor shall perform a hazard assessment of each proposed work task and make an independent evaluation regarding the appropriate level of health and safety requirements.

Description. This work shall consist of the Contractor preparing, submitting and implementing a Site-Specific Health and Safety Plan (HASP) in accordance with all applicable health and safety requirements for work in and with contaminated soil, sediment. and water. The Engineer shall review all submittals for compliance with the health and safety requirements. Excavation shall not be commenced until the Engineer's review has been completed as evidenced by written comment and acceptance as to completeness and compliance with these specifications. The Engineer will not approve the plan. However, acceptance of the plan by the Engineer implies only that at the time of review, the Engineer was not aware of any reasons to object to the plan. The acceptance of the plan, by the Engineer, does not relieve the Contractor of any responsibilities under the contract.

Construction Requirements. The Contractor shall employ a Certified Industrial Hygienist (CIH) or Certified Safety Professional (CSP) to develop and oversee implementation of the Contractor's HASP. The CIH/CSP shall prepare the HASP to protect the Contractor's employees, the subcontractor's employees, NJDOT employees and consultants, and the public from contamination present in the areas requiring excavation as designated on the construction plans. The HASP shall be prepared in accordance with all applicable local, state, and federal .rules and regulations, including the health and safety requirements of OSHA 29 CFR parts 1910 and 1926.

The CIH/CSP shall review the site specific data and address the proposed activities to the level of detail as needed to ensure that site specific data, appropriate regulations, and a description of the site conditions are incorporated into the HASP. The Contractor shall comply with all the requirements of the accepted HASP during the excavation, handling, stockpiling, disposal, or recycling of regulated wastes.

The HASP as needed shall describe workplace and emergency procedures to be followed so that this project may be constructed in a safe manner. The HASP shall govern all facets of the project constructed and encompass the activities of all persons who enter and/or work on the site. The HASP shall incorporate procedures that conform to all federal, state, and local regulations pertaining to employee working conditions where appropriate, National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), US Coast Guard, US Environmental Protection Agency (USEPA), and New Jersey Department of Environmental Protection (NJDEP).

The HASP shall require that a health and safety designate monitor working conditions during all excavation procedures and during the handling of regulated wastes to ensure conformance with the accepted HASP. The CIH/CSP shall evaluate the need for air monitoring during excavation and loading operations in Regulated Waste. The air monitoring program shall, if deemed necessary by the CIH/CSP, be implemented by the CIH/CSP or an assigned designate suitably trained and approved by the CIH/CSP for the work required. The CIH/CSP shall include in the HASP applicable training and qualifications documentation for him/her self and each health and safety designate

The Contractor shall provide initial and annual training and medical monitoring for all contractor employees scheduled to work in/with contaminated soil/water and per the Engineers request up to ten (10) state employees and/or their authorized representatives as per OSHA 29 CFR 1910. The initial training for state employees and/or their authorized representatives shall be provided one (1) month prior to any excavation.

The Contractor shall deliver 4 copies of the HASP and a listing of the health and safety personnel prior to clearing Site to the Engineer for review and acceptance at least one month prior to beginning excavation. No work on the site shall be permitted until the HASP has been submitted, reviewed and accepted by the Engineer. The Contractor shall be responsible for implementing the HASP submitted to and accepted by the Engineer. The Contractor shall deliver original logs and reports related to the HASP to the Engineer on a weekly basis.

C. MATERIAL HANDLING PLAN

This work shall consist of developing and implementing a Materials Handling Plan (MHP) for Regulated Waste encountered, moved, and disposed and/or recycled during construction. The MHP shall explain the Contractor's planned techniques to be used in managing Regulated Waste so as to protect workers, the Resident Engineer and his representatives, visitors, the public and adjoining property owners against uncontrolled exposure toRegulated Waste, plus to prevent uncontrolled release of Regulated Waste to the environment.

The Contractor shall prepare and submit for Engineer's approval a MHP prior to any excavation. The MHP shall detail standard operating procedures for excavation, stockpiling, transporting, sampling and analysis, measurement, transportation, and disposal of hazardous and regulated waste. The Contractor shall make all necessary modifications to the MHP that result from comments given by the Engineer and the Department. The Contractor shall perform planning, administrative and control functions required in implementing the MHP. The MHP shall be in full compliance with the Specification. The Contractor shall implement the MHP in accordance with the contract documents.

The Contractor shall not commence work activities governed by the MHP until written acceptance of the MHP has been given by the Engineer. The Contractor shall submit the MHP to the Engineer for review and acceptance at least one month prior to commencing excavation.

The Contractor MHP shall include at a minimum: details of current certification, permits, insurance types and levels of coverage; qualifications of the transportation and receiving facilities; the types of equipment to be used in transporting regulated waste; proposed route(s) to disposal facilities and weighing facilities; waste characterization forms, sampling logs and analyses reports; transport manifests; and waste disposal documentation forms from the receiving facility.

The Contractor shall provide periodic reports documenting the excavation, stockpiling, sampling, off-site management and on-site placement of Regulated Waste. The periodic reports shall be mailed to the Engineer by the tenth calendar day of each month. The periodic reports shall provide the location and date(s) of excavation, stockpiling, sampling, off-site management, and placement of regulated Waste. The periodic reports shall explain any changes to or differences with construction plans. The periodic reports shall also include dates of planned excavation, sampling and off-site management of Regulated Waste for the coming months.

The contractor shall provide a final report documenting the Management of Regulated Waste, including the location and date(s) of excavation, stockpiling, sampling, off-site management, and on-site placement of Regulated Waste. The final report also shall include plans depicting placement of Regulated Waste. The Contractor shall deliver four paper copies and one digital copy of the final report to the Engineer within one month of completing all Roadway Excavation, Regulated Waste, Off-Site Management of Regulated Waste and Embankment.

202.09 Milling of HMA.

2. Construction Requirements.

THE FOLLOWING IS ADDED AFTER THE NINTH PARAGRAPH:

Milled areas shall not be left unpaved for longer than 72___ hours, unless approved by the Engineer.

202.13 Disposal of Regulated Waste.

THE TITLE AND CONTENT OF THIS SUBSECTION IS CHANGED TO:

202.13. Off-Site Management of Regulated Waste
Off-Site Management of Regulated Waste, Hazardous

Description. This work shall include the, loading and off-site transport, and disposal of Regulated Waste and Regulated Waste, Hazardous designated by the Engineer as excess, unusable or unsuitable material to the project. The disposal, recycling or treatment of Regulated Waste and Regulated Waste, Hazardous shall be in accordance with these specifications, the Material Handling Plan, Federal and State laws, rules, and regulations and local laws, and the waste

management plan of the district of origin. The references to Regulated Waste hereinafter shall mean Regulated Waste and Regulated Waste, Hazardous as appropriate.

Construction Requirements. The Contractor shall provide all labor, equipment and materials needed to load, transport and dispose/recycle of Regulated Waste in a manner protective of human health and the environment. All work in and with Regulated Waste shall be performed in accordance with 202.04 Management of Regulated Waste and applicable Federal, State and Local regulations.

Transport and Disposal. The Contractor shall provide all personnel, material and equipment needed to transport and dispose/recycle all Regulated Waste generated on the project in accordance with Federal and State laws, rules, and regulations and local laws, the waste management plan of the district of origin and Subsection 201.10.

The Contractor shall be solely responsible for locating and contracting with appropriate hauler(s) and disposal facility(ies) for the Regulated Waste directed to be removed in accordance with Federal and State laws, rules and regulations and local laws. The Contractor shall prepare and submit all documentation to obtain all Federal, State or local approvals and fees necessary for disposing of Regulated Waste. The Contractor shall ensure that the waste disposal facility(ies) proposed for receipt of the material is (are) properly permitted to accept theclassification of Regulated Waste.

The Contractor shall submit to the Engineer, results of waste sampling and analysis, waste facility applications and acceptance documentation, and fee payment requirements at least two weeks prior to planned removal of Regulated Waste. The Contractor shall submit to the Engineer a bill of lading (for ID-27 waste) or a hazardous waste manifest (for hazardous waste) for each truckload of Regulated Wasteremoved from the site. The bill of lading and/or waste manifest form shall present the following information:

A. Transport subcontractor name. address, permit number and phone number.
B. Type and quantity of waste removed.
C. Weight of vehicle with weigh slip.
D. Recycling or disposal facility name, address, permit number and telephone number.
E. Date removed from site.
F. Signature of transport vehicle operator.
G. Waste manifest number.

The Resident Engineer will sign all waste manifests and/or bill of lading as the generator of the waste. The Contractor shall submit to the Engineer a copy of all waste manifests of Regulated Waste by the end of the day that the truck leaves the site.

All vehicles leaving the site with regulated material shall be inspected by the Contractor to ensure that no excess soil adheres to the wheels or under carriage of the vehicles, and that the vehicles are properly lined, securely covered and equipped to prevent leakage of water. In the event of leakage of soil or water to the public roads, the Contractor shall immediately clean the road to restore it to the original condition and immediately notify the Engineer.

The licensed hauler shall transport the Regulated Waste to the disposal/recycling facility with no unauthorized stops in between, except as required by regulatory authority The hauler shall use appropriate vehicles and operating practices to prevent spillage from occurring during transport. Regulated Waste shall not be transported over public roads if they contain free liquid or are sufficiently wet to be potentially flowable during transport.

The Contractor shall obtain appropriate documentation of disposal facility acceptance of the Regulated Waste and provide a copy of the documentation, including the weight ticket slips. to the Engineer and the County of origin within ten working days of waste acceptance at the disposal facility.

Should any problems arise regarding the facility chosen to accept the Regulated Waste for off-site management that would require the return of waste, or should such facility have violated any environmental regulation which may result in any regulatory enforcement action, the Contractor shall immediately notify the Engineer in writing of such a situation. The Contractor shall propose an alternate disposal facility, and obtain the written approval of the Engineer for off-site management at such facility.

The disposal of all Regulated Waste shall be in accordance with the Material Handling Plan. Federal and State laws, rules and regulations and locals laws and the waste management plan of the district of origin.

The New Jersey Department of Transportation will provide the Contractor with a USEPA Hazardous Waste Identification Number for the project containing Hazardous Waste.

202.14 Method of Measurement.

THE FOLLOWING IS ADDED:

Off-site management of Regulated Waste, which includes the off-site transport and the disposal/recycling of Regulated Waste classified as non-hazardous waste shall be measured by the megagram. This will be verified by using certified weigh tickets.

Off-site management of Regulated Waste, Hazardous, which includes the off-site transport and the disposal/recycling of Regulated Waste, classified as hazardous waste shall be measured by the megagram. This will be verified by using certified weigh tickets.

Sampling and Analysis for disposal and/or recycling will be measured by the Unit. Each unit will include all costs associated with planning, collecting, analyzing, and processing individual waste characterization samples as needed by regulatory authority and/or disposal/recycling facility to classify regulated wastes and obtain regulatory and/or facility approval for acceptance.

202.15 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE ADDED:

Pay Item	*Pay Unit*
OFF-SITE MANAGEMENT OF REGULATED WASTE	MEGAGRAM
OFF-SITE MANAGEMENT OF REGULATED WASTE, HAZARDOUS	MEGAGRAM
SAMPLING AND ANALYSIS FOR DISPOSAL AND/OR RECYCLING	UNIT

Separate payment will not be made for mobilizing, preparing periodic reports, or planning special handling and placement of regulated waste in a manner protective of human health and the environment. All costs associated with labor, equipment, and materials needed for special handling and placement of regulated waste shall be included in the applicable excavation pay items.

Separate payment will not be made for the development and implementation of the Site Specific HASP, including supply and operation of air quality monitoring equipment performed during execution of excavation, handling, stockpiling and transport of regulated waste, but, all costs thereof shall be included in applicable excavation and disposal pay items.

Separate payment will not be made for the developing and implementing the Material Handling Plan (MHP). Payment for preparation, implementation, monitoring and administration of the MHP, including supervision, documentation and monitoring performed during execution of excavation, handling, stockpiling and transport of Regulated Waste, shall be included in the applicable excavation and disposal pay items.

Separate payment will not be made for Management of Regulated Waste, but all costs thereof shall be included in applicable excavation pay items.

THE FOLLOWING IS ADDED AFTER THE FOURTH PARAGRAPH.

Separate payment will not be made for Sawcutting when used with the Pay Items "Joint Removal" or "Removal of Concrete Base Course and Concrete Surface Courses".

SECTION 203 – EMBANKMENT

203.08 Control Fill Method.

A. Control Strips.

4. Procedure

THE LAST SENTENCE OF THE FOURTH PARAGRAPH IS CHANGED TO:

Density of the control strip will be determined according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

A. Embankment Compaction.

THE THIRD PARAGRAPH IS CHANGED TO:

The density of such inaccessible areas will be determined from the average of five randomly located measurements according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

203.10 Density Control Method.

THE LAST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

The compacted density of embankments will be determined by taking the average of a minimum of five randomly located measurements for each 765 cubic meters placed according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

SECTION 204 – BORROW EXCAVATION

204.03 Construction Requirements.

THE THIRD SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

A minimum of two field density tests will be taken according to AASHTO T 191 or AASHTO T 310 (Direct Transmission Method) on each compacted layer at each substructure unit, except that only one of the referenced methods will be used on the Project.

SECTION 206 – FOUNDATION AND BRIDGE EXCAVATION

206.01 Description.

THE FOLLOWING IS ADDED AFTER THE FIRST SENTENCE:

This work shall include excavation dewatering for the construction, retrofit and repair of piers, walls, abutments, box culverts, and other structures.

206.02 Classification of Excavation.

THE FOLLOWING IS ADDED:

Foundation Excavation, Regulated Waste shall include the excavation of Regulated Waste as noted in the Rules of the Solid Waste Administration, NJDEP, in accordance with the rules and regulations of NJAC 7:26 and as noted on the environmental plan sheet.

206.07 Excavation.

THE FOLLOWING IS ADDED:

Excavation in areas of Regulated Waste, as depicted on Environmental Plans or as directed by the Engineer, shall be performed in accordance with Subsections 202.04 Management of Regulated Waste, 202.13 Off-site Management of Regulated Waste and Off-site Management of Regulated Waste, Hazardous and 212.06.

206.09 Preparation of Footings.

THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

Foundation excavation associated with the 14th Street Shoulder Structure, 14th Street Viaduct, 12th Street Viaduct, Retaining Wall No. 1 and other locations shall include excavation dewatering as required. Dewatering the foundation excavation shall be in accordance with contract documents. Dewatering discharge is a function of the support of excavation system selected by the Contractor. The groundwater elevation as shown on the contract documents shall be considered as approximate. Groundwater is identified as contaminated as indicated in the Site Investigation and Remedial Investigation Report prepared by Metcalf & Eddy, Incorporated.

206.11 Excess or Unusable Material.

REPLACE THE FIRST PARAGRAPH WITH THE FOLLOWING:

Excess excavated material from areas identified and reported as containing Regulated Waste shall be managed in accordance with Subsection 202.04, Management of Regulated Waste and 202.13, Off-Site Management of Regulated Waste.

Excavated material from area identified as Hazardous Waste shall be managed in accordance with Subsection 202.04, Management of Regulated Waste and 202.13, Off-Site Management of Regulated Waste, Hazardous.

206.12 Method of Measurement.

Foundation Excavation, Regulated Waste and Foundation Excavation, Regulated Waste, Hazardous which include the handling, stockpiling, on-site transport of regulated waste shall be measured by the cubic meter. Off-site Management of Regulated Waste and Off-site Management of Regulated Waste, Hazardous shall be in accordance with 202.13. Sampling and Analysis for Disposal and/or Recycling will be measured in accordance with 202.14.

206.13 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE ADDED:

Pay Item	*Pay Unit*
FOUNDATION EXCAVATION, REGULATED WASTE	CUBIC METER
FOUNDATION EXCAVATION, REGULATED WASTE HAZARDOUS	CUBIC METER

Separate payment will not be made for work conducted in Regulated Waste in accordance with subsection 202.04 but all cost thereof shall be included under the Pay Item "Foundation Excavation, Regulated Waste" or "Foundation Excavation, Regulated Waste Hazardous".

Payment for sampling and analysis for disposal and/or recycling of Regulated Waste and Regulated Waste Hazardous will be made in accordance with Subsection 202.15.

Payment for off-site management of Regulated Waste and Regulated Waste Hazardous will be made in accordance with Subsection 202.15.

Separate payment will not be made for implementing Site Specific Health and Safety Plan requirements, and reporting requirements for working with regulated materials, and all associated costs shall be included in the applicable excavation pay item.

THE FOLLOWING IS ADDED AT THE END OF THE SUBSECTION:

Payment for furnishing all labor, materials, tools, equipment, and incidentals and all work involving dewatering shall be included in the Pay Item "Foundation Excavation, Regulated Waste". No separate payment shall be made for dewatering.

Payment for furnishing all labor, materials, tools, equipment, and incidentals shall be included in the Pay Item "Foundation Excavation, Regulated Waste Hazardous".

SECTION 207 – SUBSURFACE STRUCTURE EXCAVATION

207.02 Classification of Excavation
THE FOLLOWING IS ADDED:

Subsurface Structures excavation shall also include the excavation of Regulated Waste as noted in the Rules of the Solid Waste Administration, NJDEP, in accordance with the rules and regulations of NJAC 7:26 and as noted on the environmental plan sheet.

207.03 Bedding Materials.
SUBSECTION HEADING IS CHANGED TO:

207.03 Bedding and Backfill Materials.

207.03 Bedding and Backfill Materials.
THE FOLLOWING IS ADDED:

Controlled Low Strength Material (CLSM) shall conform to Subsection 919.22

207.04 Construction Requirements
THE FOLLOWING IS ADDED:

Work conducted in Regulated Waste identified on the Environmental Plans as containing contaminants above NJDEP restricted use criteria shall be in accordance with Subsection 202.04 and 202.13 Off-Site Management of Regulated Waste and 212.06.

207.06 Backfilling.
A. Pipes and Culverts.
THE FOLLOWING IS ADDED AFTER THE FOURTH PARAGRAPH:

CLSM may be used as alternate backfill material when backfilling trenches for drainage pipe and utility conduit. Combining other backfill materials in the same trench as CLSM shall not be permitted. Mixing and placement of CLSM shall begin only when the ambient temperature is at least –1 °C. During placement, the CLSM mixture shall have a temperature of at least 5 °C and shall not be placed on frozen ground. The CLSM mixture shall be discharged directly from the truck into the trench to be filled with care taken to prevent the pipe from becoming displaced. After placement, the CLSM mixture shall be cured and protected to prevent damage from cold weather according to Subsection 405.14. CLSM shall not be used to replace pavement, base courses or drainage layers that form the structure of the roadway.

207.07 Excess or Unusable Material
REPLACE THE FIRST PARAGRAPH WITH THE FOLLOWING:

Regulated Waste shall be disposed of in accordance with Subsection 202.13 Off-Site Management of Regulated Waste and 202.13 Off-Site Management of Regulated Waste, Hazardous

207.08 Method of Measurement
THE FOLLOWING IS ADDED:

Off-site Management of Regulated Waste shall be in accordance with 202.13. Sampling and Analysis for Disposal and/or Recycling will be measured in accordance with 202.14.

207.09 Basis of Payment.
THE FOLLOWING IS ADDED:

Separate payment will not be made for implementing Site Specific Health and Safety Plan requirements, and reporting requirements in accordance with Subsection 202.04 Management of Regulated Waste and Subsection 202.13, and all costs shall be included in the applicable pay item.

THE THIRD AND FOURTH PAY ITEMS ARE CHANGED TO:

ROCK EXCAVATION, SUBSURFACE STRUCTURES	CUBIC METER
PIPE BEDDING, CLASS ___	CUBIC METER

SECTION 208 - SUBBASE

208.01 Description.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

This work shall also consist of supplying and placing a waterproofing membrane on top of the prepared subgrade prior to placement of the subbase.

MATERIALS

208.02 Materials.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Waterproofing Membrane. The material supplied under these specifications shall be first quality goods specifically formulated and tested for the containment of water. The material used for the lining shall be a high density polyolefin reinforced low density polyethylene membrane and shall have been satisfactorily demonstrated by prior use and testing to be suitable appropriate and durable for the purpose of this work.

The waterproofing membrane shall be manufactured by the application of Low Density coating over High Density scrim and shall be uniform in color, thickness, size and surface texture. The finished lining shall be a sunlight (UV) and weather resistant (Cold temperature) membrane that is a flexible, durable, liquid tight product free from pin holes, blisters, contaminates or other defects. Only domestic resins and additives shall be used. Reprocessed materials will not be acceptable other than clean rework materials of the same virgin ingredients generated from the manufacturer's own production. The finished membrane liner shall consist of 0.0508 millimeter (2 mils) of LD polyethylene coating over fin scrim followed by 0.0508 mm (2 mils) of LD polyethylene coating over HD scrim followed by 0.0508 millimeter (2 mils) of LD coating creating as layer impermeable membrane with tremendous strength and resistance to hydrocarbons. The finished weight shall be 0.088 kg/ square meter (2.6 oz. per square yard) minimum and the thickness shall be a minimum of 0.6069 mm (24 mils).

The waterproofing membrane shall conform to the following:

Weight Per Square Yard	0.34 kg (12 Oz.)	ASTM D 1910
Nominal Thickness	0.6096 mm (24 Mils)	
Tensile Strength (Grab Method)	Warp 1997 N (449 Lbs.) Weft 1802 N (405 Lbs.)	ASTM D 751
Tear Strength (Tongue Method)	Warp 12,959 N/m (74 Lbs/In.) Weft 16,462 N/m (94 Lbs/In.)	ASTM D 751
Bursting Strength (Diaphragm Method)	5599 kPa (812 Psi)	ASTM D 751
Hydrostatic Resistance	2137 kPa (310 Psi)	ASTM D 751A
Puncture Resistance (1" Steel Ball Tipped Probe)	4426 kPa (642 Psi)	ASTM D 751
Moisture Vapor Transmission	0.4647 Grams/square meter/24hrs	ASTM E96 B
Low Temperature Clod Crack	-54 degrees C (-65 degrees F)	ASTM D 2136
Flex/Abrasion	No Damage To Scrim After 2800 Cycles, Black Coating Worn Away	ASTM D 3885
Dimensional Stability@100 C (212F)/1hr	@Edge: Warp -9.3 Weft -7.7 @Center: Warp -7.6 Weft -6.4	ASTM D 1204
Accelerated Weathering, UV	More Than 80% Of Strength Retained After 2000 Hours	ASTM G 53
Hydrocarbon Resistance		

Crude Oil 30 Days @ 73f	Warp 2113 N (475 Lbs.) Weft 1757 N (395 Lbs.)	ASTM D 751
Sae 40 Wt Motor Oil 30days @ 73f	Warp 2269 N (510 Lbs.) Weft 1784 N (401 Lbs.)	ASTM D 751
Diesel 30 Days @ 73f	Warp 2113 N (475 Lbs.) Weft 1664 N (374 Lbs.)	ASTM D 751
Gasoline 30 Days @ 73f	Warp 1957 N (440 Lbs.) Weft 1659 N (373 Lbs.)	ASTM D 751
Salt Water 30 Days @ 73f	Warp 2140 N (481 Lbs.) Weft 1766 N (397 Lbs.)	ASTM D 751
Soil Burial 30 Days @ 30c 95% Rel. Humidity	Warp 2402 N (540 Lbs.) Weft 2091 N (470 Lbs.)	ASTM D 751

The individual widths of the 0.0508 mm (24 mil fabric) shall be assembled into large sheets designed for the project so as to minimize field seaming. The factory seaming shall be performed on thermal welding equipment with pressure wheels and shall consist of seams of 40 mm (1.5") minimum thickness which will provide a film tearing bond of 80% of the fabric tensile strength.

CONSTRUCTION

208.03 Preparation of Subgrade.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Before the placing waterproofing membrane construction of all subsurface utilities, underdrains, storm sewers, and electrical items shall be completed. The subgrade shall be prepared immediately prior to the placing of the liner. The subgrade shall be shaped and compacted to within a tolerance of plus or minus 13 millimeters of grade and contour, with no areas consistently high, according to Section 203 and shall be free from water pockets. The subgrade shall be free of all sharp objects, roots, grass and vegetation. Foreign materials, protrusions, voids, cracks and other penetrating or raised objects shall by removed from the subgrade. Loose rocks, rubble and other foreign matter will be collected and removed from the area to be lined. Waterproofing membrane shall not be placed on soft, muddy, or frozen areas, or until all irregularities in the prepared areas, including soft areas in the foundation, have been corrected.

208.04 Spreading and Compacting.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

A continuous sheet of waterproofing membrane shall be installed to the limits shown on the plans. The waterproofing membrane shall be placed over the prepared surfaces to be lined in such a manner as to assure a minimum of handling. The sheets shall be of proscribed lengths and widths and shall be placed in such a manner as to minimize field seams. Only those pieces of waterproofing membrane that can be installed and anchored in place during the workday shall be unpacked and placed in position.

Sandbags and or other suitable weights may be used as required to hold the waterproofing membrane in position during the installation. The weights shall not have any sharp edges which may snag or otherwise penetrate the waterproofing membrane fabric. Care should be taken to keep the seam areas as clean as possible. It may be necessary to wipe down the edges prior to heat sealing the panels together.

No materials or equipment shall be dragged across the face of the waterproofing membrane nor shall the waterproofing membrane be subjected to abuse by the workmen while installing the liner. All installation party members shall wear soft-soled shoes or boots while working on the surface of the waterproofing membrane.

Waterproofing membrane shall be attached to the existing concrete retaining walls by use of adhesives and wood cleats. Waterproofing membrane shall be folded double thickness, attached to the wall with an adhesive that does not degrade the membrane, and held against the existing concrete wall with wood cleats fastened to the concrete with mechanical anchors or explosive driven anchors. Sufficient anchors shall be used to ensure that the waterproofing membrane remains in contact with the wall. The top of the wood cleat shall be set 300 mm above subgrade, but below

the top of the dense graded aggregate base course. The waterproofing membrane shall have about 100 mm of slack between the wood cleat and subgrade, to ensure that it is not taut and will not cause voids to form under the membrane when subbase is placed.

All seaming shall be done with thermal heat sealing equipment or with the adhesives of the lining fabric manufacturer's brand. Heat sealing is the preferred method of field seaming wherever possible. Lap joints must be a minimum of 65 mm (2.5") overlap of the factory-fabricated panels. The contact surfaces of the panels must be cleaned and all moisture and other foreign materials must be removed prior to heat sealing. The correct usage of the heat sealing equipment requires the establishment of the proper operating temperature by the workmen and the placement of the gun between the overlapped sheets of material so as to effect the proper seal in width and strength. It may be necessary to place a backer board under the liner to give a firm rolling surface. Immediately after heating the fabric it is necessary to use the roller to press the melted fabrics together. Extreme caution should be taken throughout the installation to avoid wrinkling the edge of the liner. These "fish mouths" must be slit back sufficiently to remove them and the liner sealed to assure total integrity.

Any repairs resulting from damage during installation shall be repaired with like fabric and heat sealing to ensure a secure lining. It is recommended that at least 50 mm (2") of overlap be used on any penetrations. It is suggested that any major scuffing be replaced with undamaged liner. The ends of the panels can be used for a patching source.

Subbase shall be end dumped and spread in a manner that does not tear or distort the waterproofing membrane. Vehicles shall not drive on the waterproofing membrane.

COMPENSATION

208.08 Method of Measurement.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Waterproofing membrane will be measured by the square meter.

208.09 Basis of Payment.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Payment will be made under:

Pay Item	*Pay Unit*
WATERPROOFING MEMBRANE	SQUARE METER

SECTION 212 - SOIL EROSION AND SEDIMENT CONTROL

CONSTRUCTION

212.06 Soil Erosion and Sediment Control Measures.

THE FOLLOWING IS ADDED

J. Dewatering Basin.

The Contractor shall control all storm and ground waters removed from excavations in areas of Regulated Waste and groundwater so as to capture all free product and meet discharge requirements for permitted discharge to dewatering basin, surface water body or storm sewer system as selected by the Contractor. Following use, the discharge basin shall be backfilled using soils excavated during construction of the basin.

Excavations throughout the project will encounter groundwater. Due to the shallow depth to groundwater, the volume of groundwater to be pumped into the Dewatering Basin or Basins is expected to be substantial. Excavation dewatering discharge is a function of the support of excavation system selected by the contractor.

According to the project Site Investigation and Remedial Investigation Report, prepared by Metcalf and Eddy, groundwater samples taken throughout the work area contain metals at concentrations that exceed NJDEP Groundwater Quality Standards. Therefore, groundwater pumped from excavations shall remain within the project Right of Way, and shall be reinjected into the ground via percolation of water retained in the Dewatering Basins.

The dewatering basin shall be a minimum of 50 feet from the area shown on the Environmental Plans to contain hazardous waste. The hazardous waste area contains leachable lead. Precautions must be taken to prevent dewatering effluent from coming into contact with the soil in the hazardous waste area.

Note: In lieu of a dewatering basin, the State is pursuing a contractual indirect agreement with the Passaic Valley Sewerage Commissioners for the discharge of groundwater pumped from the excavations into the storm sewer.

K. Pollution Prevention and Control Plan

Description. This work consists of developing and implementing a Pollution Prevention and Control Plan (hereinafter referred to as PPC Plan) to prevent unpermitted discharge of contaminated storm water, ground water, sediments and/or free product during stormwater control, excavation and dewatering operations.

Construction Requirement. The Contractor shall prepare a PPC Plan detailing methods, personnel, equipment, and reporting requirements in preventing unpermitted discharge of contaminated sediment and water generated during stormwater control, excavation and dewatering operations. The PPC Plan shall comply with all Federal, state, and local laws, rules, and regulations relative to contaminated discharges. The Contractor shall submit the PPC plan to the Engineer for review and approval at least one month prior to beginning excavation.

The PPC Plan shall provide methods and equipment for collecting, pumping, treating, monitoring, and disposing liquids generated during storm water control, measures to prevent storm water run-on and runoff, dewatering of excavations, dewatering of sediments, decontaminating personnel and equipment, and storing fuels and chemicals. The PPC Plan shall detail water collection, treatment, monitoring, discharge activities, and reporting requirements. The PPC plan shall require that water collection, treatment, monitoring, and discharge activities, personnel and equipment, and relevant quantities shall be included in daily construction reports.

Water removed from excavations and decant water derived from contaminated soil/sediment shall be handled and treated such that when the water is discharged to the dewatering basin, it is done in accordance with all Federal, State and local regulations governing such discharges.

The Contractor shall maintain a PPC log of incidents and water collection, monitoring, and handling activities, and shall make the log available to the Engineer upon request. The PPC log shall note daily water removal, treatment and discharge volumes, effluent sampling activities and results, discharge or spill incidents, and sampling and reporting activities.

L. Oil-Water separator.

The Contractor shall provide all personnel, materials and equipment to mobilize, operate and maintain an oil-water separator for removal of free product and contaminated sediments generated in dewatering excavations in areas of petroleum contaminated groundwater. If the Contractor chooses to conduct multiple dewatering operations in such areas, then multiple oil-water separators shall be required to properly treat all flows.

The oil-water separator shall be a self-contained factory assembled unit capable of removing free petroleum product and contaminated sediments to achieve a discharge quality of less than 30 parts per million as total petroleum hydrocarbon or as required by discharge permits obtained by the Contractor. The separator shall be designed in accordance with Chapters 3 and 5 of the American Petroleum Institute (API) manual on disposal of refiner wastes (volume on liquid wastes, latest edition) and with API bulletin #1630, First Edition, May, 1989. Each separator shall be designed for intermittent, varied or continuous flows of water, oil and/or combinations on non-emulsified oil-water mixtures, and in a manner to minimize solids buildup in the separators oil-water collection chamber that would reduce the efficiency of the unit.

Construction and thickness of each separator shall be in strict accordance with Underwriters Laboratories UL-58 standard for steel tanks for flammable and combustible liquids. Each separator shall bear Underwriters label. Each separator shall be mounted so that the unit may be moved about the project as needed.

The Contractor shall dispose all oils and sediments collected in the oil-water separator(s) in accordance with subsection 201.10 and the Solid Waste Management Act (NJSA B:13 E-1). No separate payment will be made for the disposal of oils and sediment collected in the oil-water separator.

212.09 Method of Measurement.

THE FOLLOWING IS ADDED:

Development, preparation, and acceptance of the Contractor's PPC Plan will not be measured.

Implementation of the Contractor's PPC Plan will not be measured.

Oil-Water separator will be measured by the unit.

212.10 Basis of Payment.

THE FOLLOWING IS ADDED:

Pay item	*Pay unit*
OIL-WATER SEPARATOR	UNIT

The Oil-water separator shall include all costs associated with purchase, permitting, operation, maintenance, demobilization of equipment; monitoring and reporting; and disposal of wastes. No separate payment will be made for the disposal of oils and sediment collected in the oil-water separator.

Payment for dewatering will be made under the pay item "Dewatering Basin".

Separate payment will not be made for any work involved in adhering to the PPC plan and implementing the various provisions thereof.

Payment for development of the PPC plan will be made under the applicable excavation pay items.

SECTION 213- CONCRETE ENCASEMENT REMOVAL

213.01 Description.

This work shall consist of the removal of concrete encasement from the various structural steel members of the 12th Street and 14th Street Viaducts to the limits shown on the plans or as directed by the Engineer.

213.02 Construction Requirements.

A. Concrete encasement removal shall be performed on the various members to the limits shown on the plans or as directed by the Engineer. In the performance of this work, the equipment listed below is permitted subject to the following restrictions:

1. Pneumatic or Electric Equivalent Hand Operated Hammers.
   Up to 14-kilogram hammers exclusive of bit may be used for removal of concrete within 150 millimeters of structural members.

2. Saw Cutters.

   a. Vermeer concrete cutters or cutting saws may be used to cut within 150 millimeters adjacent to structural members.
   b. If water is used in conjunction with cutting operations, shielding beneath the operation shall prevent water leakage. Water shall be disposed by an approved method. Disposal method shall be submitted by the Contractor for approval by the Engineer.

3. Hydraulic Breakers.
   Hydraulic breakers such as, but not limited to, Tramac or other ram-hoe type breakers are not permitted.

4. Hydraulic Splitters.
   Hydraulic splitters such as the Darda hydraulic splitters are permitted subject to approval.

5. Hydrodemolition.
   Hydrodemolition is permitted subject to approval by the Engineer and provided that the Contractor can demonstrate experience with the technique in similar conditions. All equipment operated by internal combustion engines shall have additional sound muffling equipment installed to reduce sound levels to acceptable decibels as prescribed by the local township ordinances and Subsection 107.28, Part 2 of the Standard Specifications.

6. Other Equipment. Equipment not specifically approved in this Specification may be used only with written approval.

   During removal operations, the Contractor shall take all necessary precautions so as not to damage the structural members scheduled to remain. All damage done to the existing structural members scheduled to remain shall be repaired at no additional cost to the State. The repair procedure shall be as follows:

   Steel Stringers, Floorbeams, Girders Cross Frames, and Diaphragms.

   a. Repair procedures to tensile components shall conform to ASTM A 6/A 6M and the following:

      (1) Gouges up to 3 millimeters shall be removed by grinding flush in the direction of principal stress.

(2) Gouges deeper than 3 millimeters shall be removed first by grinding; then, weld metal shall be deposited and ground flush with the surface of the metal in the direction of principal stress. Welding shall be done using low hydrogen electrodes conforming to current AWS Specifications A5.1 and A5.5. The electrodes shall be protected from moisture during storage.

(3) Kinks and deformations shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

b. Repair procedures to columns, truss compression members and other compression components shall conform to the following:

(1) Where more than five percent of the cross-sectional area of the member is damaged due to removal operations, the Contractor shall submit a repair procedure for approval.

(2) Kinks and deformations shall be repaired as outlined in Subpart 6a-3.

c. Repair procedures to truss tensile components.

(1) Where more than five percent of the cross-sectional area of the member is damaged due to removal operations, the Contractor shall submit a repair procedure for approval.

B. Concrete encasement shall be completely removed so as to fully expose the underlying steel members. Wire mesh or reinforcing steel used to anchor the encasement to the steel members shall also be removed including any clips or other devices to secure the mesh or reinforcing steel to the steel members. Holes in the steel members through which the wire mesh, reinforcing steel or clips pass shall be completely cleaned of all concrete.

Removed encasement and wire mesh, reinforcement steel, clips and other materials generated by the removal process shall be disposed of in a manner that is consistent with any applicable laws and regulations.

C. Except in those areas where temporary shielding is scheduled to be installed, the Contractor may allow the removed encasement to drop to the ground except as stipulated below. Where encasement is dropped to the ground, the Contractor will be required to restore the areas to the pre-construction condition. If the Contractor proposes to drop removed encasement to the ground, extreme caution shall be exercised when working adjacent to the steel bents or other substructure units so as to not cause damage to these units from falling encasement. Any damage to these units shall be repaired by the Contractor to the satisfaction of the engineer at no cost to the State.

At the following locations, the Contractor shall furnish and install temporary shielding and capture the removed encasement:

1. 12th Street Viaduct.

a. Spans 10 through Span 19 (over 12th Street).
b. Span 20 (over Monmouth Street).
c. Span 10 (over Coles Street).
d. Span 31 over N.J. Turnpike Southbound Ramp.
e. Other locations as indicated by the Engineer.

2. 14th Street Viaduct.

a. Span 1 to Span 3 (over Port Authority Storage Area).
b. Span 5 to Span 15 (over Port Authority Vehicle Parking Area).
c. Span 15 (over Monmouth Street).
d. Span 4 (over Coles Street).
e. Other locations as indicated by the Engineer.

D. Upon removal of the concrete encasement, the underlying structural steel members will be inspected by the Consultant to determine the presence and extent of structural steel deterioration. In this matter, the Contractor is provided to the Engineer, at the Pre-Construction meeting, a schedule indicating the location, time and duration of each removal operation to assist the Consultant in scheduling of manpower. This schedule shall be updated as necessary.

The Contractor shall provide access to the work area for the Consultant's inspection. The Contractor shall contact the consultant through the Engineer when the encasement in a given location has been removed and before the means of access has been removed for the Consultant's inspection. Three (3) days minimum notice is required.

213.03 Method of Measurement.

Concrete Encasement Removal will not be measured and payment will be made for the quantity in the Proposal adjusted for Change Orders except as provided for in Subsection 109.01. Concrete Encasement Removal is considered to be a Type 2 Pay Item with a Charge per Unit of Measure of $8.00 per cubic meter. If measurement of the quantity is requested, when calculating the quantities of concrete encasement removal, deteriorated concrete is to be deducted. The quantity of deteriorated concrete will be taken as the difference between the As Built Quantity and Contract Quantity as indicated in the plans.

213.04 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
CONCRETE ENCASEMENT REMOVAL	CUBIC METER

DIVISION 300 - BASE COURSES

SECTION 301 - SOIL AGGREGATE BASE COURSE AND DENSE-GRADED AGGREGATE BASE COURSE

301.05 Compaction.

THE LAST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

The in-place dry density of each compacted layer will be determined according to AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

2. Compaction Acceptance Testing.

THE THIRD SENTENCE OF THE LAST PARAGRAPH IS CHANGED TO:

One density determination will be made at each of the selected locations using AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

3. Waiving Standard Compaction Requirements.

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The compaction requirements in Subsection 301.05, Subparts 1 and 2, are waived.

301.08 Maintenance Under Traffic.

THIS SUBSECTION IS CHANGED TO:

When it is provided on the Plans that traffic is permitted to ride on the completed base course, the base course shall be maintained smooth and uniform until covered by the following stage of construction.

302.09 Compaction, Shaping, and Finishing.

A. Compaction.

THE LAST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

The in-place dry density of each compacted course will be determined according to AASHTO T 191 or T 310 (Direct Transmission Method) except that only one method will be used throughout the Project.

DIVISION 400 - SURFACE COURSES

SECTION 404 – HOT MIX ASPHALT (HMA)

404.05 Plant Laboratory.

ITEM 23. OF THE FIFTH PARAGRAPH IS CHANGED TO:

23. Microcomputer and workstation requirements shall be according to Subsection 106.06.

404.06 Vehicles for Transporting HMA Mixtures.

THE ENTIRE SUBSECTION IS CHANGED TO:

The mixture shall be transported from the mixing plant to the Project in trucks equipped with tight, clean bodies, which may be lightly coated with a soap or lime solution, or other such non-petroleum-based release agent. Under no circumstance shall a petroleum-based product be used as a release agent.

The trucks shall be permanently equipped with an airfoil that is capable at any speed or under any weather conditions to deflect air over the tarp and to prevent air from going under the tarp. The airfoil will be affixed no more than 600 millimeters in front of the tarp roll and be at least as high as the top of the tarp roll.

Each truckload shall be covered immediately after loading at the plant with a waterproof tarpaulin of such size to protect the mixture from the weather. The tarpaulin shall be able to withstand normal handling and placement temperatures of up to 205 ºC without endangering the structural integrity and serviceability of the fabric. The tarpaulin shall also comply with one of the following:

1. A heavyweight tarpaulin to completely drape the load. The heavyweight tarpaulin shall have a minimum weight of 0.61 kg/m^2 and shall be a minimum of 600 millimeters wider and 1.2 meters longer than the truck body. The heavyweight tarpaulin shall securely meet or overlap the top of the tailgate and be securely held in place so as to prevent air from lifting the tarp during transport.
2. A tarpaulin equipped with side and back flaps sufficient to lap down outside along the sides and rear of the truck bed a minimum of 300 millimeters. The tarpaulin shall be secured by tie downs at a maximum of 1.5 meter spacing along the sides and rear of the truck.

The truck bodies shall be insulated or heated as necessary, to ensure delivery of the mixture at the specified temperature. Any truck that: causes excessive segregation of the mixture by its suspension or other contributing factors; leaks; causes delays; does not have an airfoil; or does not have an approved tarpaulin shall be removed from the work until such conditions are corrected and the truck is presented for inspection to the Engineer. The Engineer may require that all vehicles for transporting HMA mixture to be used by the contractor be made available for inspection at the plant laboratory prior to any shipments of materials.

404.07 Materials Transfer Vehicle (MTV)

THE ENTIRE SUBSECTION IS CHANGED TO:

The MTV shall independently deliver mixtures from the hauling equipment to the paving equipment. A paver hopper insert with a minimum capacity of 12.7 megagrams shall be installed in the hopper of conventional paving equipment when an MTV is used.

As a minimum, the MTV shall have a high capacity truck unloading system which will receive mixtures from the hauling equipment; a storage system in the MTV with a minimum capacity of 13.6 megagrams of mixture; and a discharge conveyor, with the ability to swivel to either side, to deliver the mixture to the paving spreader while allowing the MTV to operate from an adjacent lane. In addition, the paving operation must contain a remixing system to continuously blend the mixture prior to placement. The remixing may be done by the MTV or in the paver hopper.

A materials transfer vehicle (MTV) is optional for the construction of the pavement. No structures on the project may be traversed by a loaded MTV.

404.08 HMA Paver.

THE seventh paragraph is deleted.

404.17 Spreading and Finishing.

SUBPART 1. “LONGITUDINAL JOINTS” IS CHANGED TO:

1. Longitudinal Joints. All longitudinal joints shall be cleaned free from dust and coated with a uniform application of tack coat in a separate application before coating the surface upon which the HMA is to be placed. For echelon paving the longitudinal joints need not be tacked.

The paving shall be done with the spring loaded end plates of the paver in the "down" position. When constructing the first lane, care shall be exercised in rolling so as not to displace the line and grade of the edges of the HMA. The longitudinal joint in one layer shall offset that in the layer immediately below by approximately 150 millimeters. The joint in the surface course shall be offset from the lane lines by 150 millimeters except for the centerline of a roadway in which the joint shall fall between the double yellow traffic stripe.

Paving, compaction and the supply of material shall proceed at a uniform rate with minimal or no stopping.

If a single paver does not spread the HMA material the entire width of the roadway, two pavers shall be used provided that the rate of production of HMA material can be maintained. The second unit shall follow within 90 meters of the first unit in echelon, so as not to permit cooling of the longitudinal joint between the two lanes. If echelon paving is to be utilized, the distance that the screed and end gate of the trailing paver shall extend over the uncompacted HMA layer behind the first paver shall be 25 millimeters or less. The inside end gate of the second paver must be set at the same level as the bottom of the screed plate of the first paver. Raking of the joint is not needed**.**

A wedge joint shall be constructed when traffic is to be maintained and lift thickness is greater than 57 millimeters. A vertical edge joint will be permitted for lift thickness 57 millimeters or less when traffic has to be maintained. For lift thickness greater than 57 millimeters and traffic is not required to be maintained, a vertical edge shall be utilized.

Longitudinal joints shall be constructed utilizing one of the following methods:

A. Vertical Edge Joint. The HMA material being placed in the abutting lane shall be tightly crowded against the vertical face of the previously placed HMA layer. The paver shall be positioned so that in spreading, the material overlaps the edge of the lane previously placed by 25 to 50 millimeters and shall be left sufficiently high to allow for compaction. In general, the height of the uncompacted HMA above the compacted HMA shall be 6 millimeters for every 25 millimeters of compacted mix. When compacted, the new mat at the joint shall be even or slightly higher (Maximum 3 millimeters) than the previously placed adjoining mat. If the newly compacted mat results in a depression at the joint of 3 millimeters or more lower than the previously placed adjacent HMA layer, all paving operations shall cease until corrective action is taken by the Contractor to prevent reoccurance. For all longitudinal joints that do not meet this requirement, the Contractor shall saw joints according to dimension guidelines of Subsection 404.19 and seal with an approved sealer.

B. Wedge Joint. The sloped plate of the paver shall produce a wedge edge having a face slope of 1V:3H. The bottom of the sloped plate shall be mounted 25 millimeters above the existing surface. The plate shall be interchangeable on either side of the screed. The Contractor shall maintain the wedge configuration under traffic conditions.

All loose material shall be removed from the Traveled Way before opening to traffic. The rolling operation of the adjoining lane shall proceed as indicated in subpart A above.

To assure a true line, the paver shall closely follow lines or markings placed along the joint for alignment purposes. All longitudinal joints shall be constructed parallel to the centerlines within a tolerance of plus or minus 75 millimeters for every 30 linear meters. If this tolerance is not met, the mat shall be cut back to conform. The width and depth of overlapped material shall be kept uniform at all times. Overlapped material shall be luted back, pushing the material off of the cold HMA and onto the hot HMA mat directly over the joint. In no case shall excess material be broadcast across the new layer. All excess material shall be removed.

404.18 Compaction.

THE FOLLOWING IS ADDED AFTER THE FOURTH PARAGRAPH:

Care shall be taken to prevent lateral displacement of the unconfined edge during the compaction operation. The edge of the drums of vibratory or static wheel rollers shall extend over the free edge of the mat by at least 150 millimeters. When compacting the joint, while paving the adjacent lane, the roller shall be placed on the newly placed HMA and overlap the joint by a distance of approximately 150 millimeters, however this does not prohibit compaction from the previously placed HMA.

THE FIFTH PARAGRAPH IS CHANGED TO:

Alternate trips of the roller shall be terminated in stops approximately 600 millimeters from the preceding stop. During the compaction process rollers compacting the mat behind the lead paver shall maintain approximately 150 millimeters of uncompacted material adjacent to the second paver. After mix from the second paver is placed against the uncompacted edge of the mat from the first paver, the rollers shall compact the HMA on both sides of the joint.

The Contractor shall submit a plan, to ensure proper compaction of the wedge edge, for the Resident Engineer's approval prior to the commencement of paving operations.

THE FOLLOWING IS ADDED AFTER THE ELEVENTH PARAGRAPH:

After compaction has been completed, the pavement shall be free of all visible defects such as segregation, bleeding, ruts, ridges, roller marks, cracking, tearing, raveling, open or segregated transverse or longitudinal joints, depressed or raised areas around manholes or raised areas around inlets in the Traveled Way or any other defects, as determined by the Resident Engineer. All visible defects shall be repaired to the satisfaction of the Resident Engineer at no additional cost to the State.

At the discretion of the Resident Engineer where it is deemed to be impractical to repair such visible defects, a payment reduction due to nonconformance will be applied according to Subsection 404.26.

404.25 Method of Measurement.

THE SIXTH FULL PARAGRAPH FROM THE LAST IS CHANGED TO:

The basic asphalt price index will be the monthly asphalt price index published during the month of Advertisement.

THE EIGHTH AND NINTH PARAGRAPHS ARE CHANGED TO:

Sealing of Cracks in HMA surface course will be measured by the linear meter.

Sawing and sealing joints in HMA overlays will be measured by the linear meter. Sawing joints in base or intermediate course will be measured by the linear meter.

404.26 Basis of Payment.

THE NINTH AND THIRTEENTH PAY ITEMS IN THE FIRST PARAGRAPH ARE CHANGED TO:

SAWING JOINTS IN INTERMEDIATE OR BASE COURSE	
CORE SAMPLES, HOT MIX ASPHALT	UNIT

THE FOLLOWING PAY ITEM IS DELETED:

SEALING OF CRACKS AND JOINTS IN HOT MIX ASPHALT SURFACE COURSE	LINEAR METER

THE NINTH PAY ITEM IS CHANGED TO:

SAWING JOINTS IN INTERMEDIATE OR BASE COURSE	LINEAR METER

THE FOLLOWING IS ADDED AFTER THE FIFTH PARAGRAPH:

Payment reduction calculations for irrepairable visible defects as determined by the Resident Engineer shall be as follows:

1. **Longitudinal and Transverse Joints.** A total length in meters of defective joints multiplied by $65.00.
2. **Other Defects.** A total area in square meters of defective area multiplied by $108.00.

SECTION 405 – CONCRETE SURFACE COURSE

405.08 Mixing Concrete.

1. Mixing on the Project in Truck Mixers.

THIS FIRST SENTENCE IN THE FIFTEENTH PARAGRAPH IS CHANGED TO:

Each batch shall be mixed not less than 50 revolutions at the rate of rotation designated as mixing speed.

3. Transit Mixing.

THE NINTH PARAGRAPH IS CHANGED TO:

Mixing shall begin immediately following the complete charging of the drum and continue for not less than 50 revolutions of the drum at the mixing speed recommended by the manufacturer of the truck mixer. Upon completion of at least the minimum number of mixing revolutions at the plant, the speed of the drum shall be reduced to the agitation speed recommended by the manufacturer.

THE LAST PARAGRAPH IS CHANGED TO:

Transit mix concrete will be rejected for any of the following reasons:

a. If the concrete is not discharged within the specified time limit after loading all ingredients into the drum;
b. If the indicator on the counter shows that the instrument has been turned off or tampered with;
c. If the non-resettable total revolution counter shows more than 300 revolutions;
d. If water has been added while the truck mixer is en route to the Project. Two-way telephone or radio communication between the site of the placement of concrete and the batching plant shall be provided.

SECTION 406 – SUPERPAVE HOT MIX ASPHALT COURSES

406.13 Surface Course Rideability Requirements.

For this Project, the no payment reduction provisions shall govern.

406.19 Basis of Payment.

THE LAST PARAGRAPH IS CHANGED TO:

Separate payment will not be made for MTV, test strips, and quality control for compaction, including comparison cores, and nuclear density testing. All costs thereof shall be included in the prices bid for Superpave Hot Mix Asphalt 12.5H76__ __ __ Surface Course, Superpave Hot Mix Asphalt 19H64__ __ __ Intermediate Course, and Superpave Hot Mix Asphalt 25M64__ __ __ Base Course.

DIVISION 500 - BRIDGES AND STRUCTURES

SECTION 501 - CONCRETE STRUCTURES

501.02 Materials.

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

The epoxy resin system that is to be used for the filling of concrete cracks by pressure injection shall be a two component 100 percent solid moisture insensitive high-modulus high-strength epoxy resin adhesive. The following products, or approved equal, may be used:

1. Sikadur Hi-Mod LV, manufactured by Sika Corporation.
2. Duralcrete, as manufactured by Dural International Corporation.
3. Metaband HMLV, as manufactured by American Metaseal Company.
4. Thermal-Chem Injection Resin Product No. 2, as manufactured by Thermal-Chem, Inc.
5. Concressive 1380, as manufactured by Adhesive Engineering Co. of San Carlos, California.

THE FOLLOWING IS ADDED AT THE END OF THE SUBSECTION:

Concrete for cast-in place and precast parapets shall be portland cement concrete. The portland cement concrete shall be High Performance Concrete (HPC) in accordance with Subsection 539 of the Special Provisions.

501.07 Forms.

7. Permanent Steel Bridge Deck Forms.

THE FIRST SENTENCE OF THE SECOND PARAGRAPH IS CHANGED TO:

The use of permanent steel bridge deck forms shall conform to the following:

501.16 Concrete Deck Surface Requirements.

THE FIRST PARAGRAPH IN SUBPART C IS CHANGED TO:

C. Acceptance Testing. Conformance to the surface tolerance for concrete deck slabs will be determined in lots, each being equal to the length of deck in one span or continuous span. The longitudinal limits of the lot will be bounded by the expansion joints or fixed structural deck joints. The full length of the lot will be tested through any construction joints within the deck, whether these joints are required for the placement sequence or caused by the Contractor's operations. Such lot quantity will be calculated using the specified nominal deck thickness and excludes the quantity of concrete placed in haunches, end dams, and diaphragms. For the second course of the two-course deck slab construction, such lot quantity will be calculated using the specified nominal thickness of the concrete overlay protective system.

501.26 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE ADDED:

Pay Item	*Pay Unit*
CONCRETE IN SUPERSTRUCTURE, PARAPETS, 610 MM WIDE WITH ARCHITECTURAL TREATMENT – HPC	LINEAR METER
DECK JOINT RECONSTRUCTION	LUMP SUM
PIER RECONSTRUCTION	LUMP SUM

THE FOLLOWING IS ADDED AFTER THE FIRST PARAGRAPH:

Concrete for "Concrete in Superstructure, Parapets" shall be High Performance Concrete (HPC) and shall conform to Subsection 539 of the Special Provisions.

Concrete for "Concrete in Superstructure, Parapets, 610 mm Wide with Architectural Treatment – HPC" shall be High Performance Concrete (HPC) and shall conform to Subsection 539 of the Special Provisions. Separate payment for

architectural treatment will not be made and shall be included in the Pay Item "Concrete in Superstructure, Parapets, 610 mm Wide with Architectural Treatment".

Deck Joint Reconstruction shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing concrete and reinforcement and all work involving the replacement of reinforcement and partial replacement of deck slab with quick setting patch material and class A concrete, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer.

Concrete for "Pier Reconstruction" shall be Class A and shall conform to all the requirements applicable for the Pay Item "Concrete in Substructure, Pier Columns and Caps". Separate payment for concrete and sign structure removal, drilling and grouting reinforcement, reinforcement, epoxy coating for existing exposed reinforcement to remain, epoxy bonding coat, epoxy waterproofing and seal coat will not be made and shall be included in the Pay Item "Pier Reconstruction".

SECTION 503 - STEEL STRUCTURES

503.01 Description.

THE FOLLOWING IS ADDED:

Structural Steel, Grade HPS 485 W shall be used for the top and bottom girder flanges for the 14th Street Viaduct - Shoulder Widening. Structural Steel, Grade HPS 345 W shall be used in all other structural steel members for the 14th Street Viaduct - Shoulder Widening including but not limited to girder webs, cross frames, splices, and stiffeners as indicated on the drawings. Structural Steel, If and Where Directed, shall consist of the replacement of stringers for the 12th Street Viaduct and the floorbeams for the 14th Street Viaduct. When the deck slab is removed, the stringers and floorbeams shall be replaced if the engineer determines that the floorbeam and/or stringer top flange is beyond repair as specified in Subsection 531.05.

503.03 Inspection and Testing.

PART 4, SUBPART B SHALL BE CHANGED TO:

b. Nondestructive Testing. Field welding will be inspected by nondestructive tests at the site of erection.

The Department shall be notified, in writing, not less than 15 calendar days in advance, when any shop or field welding is to be undertaken so that arrangements for inspection may be made.

503.04 Working Drawings.

THE FOLLOWING IS ADDED:

D. Bearing Replacement – Submittals.

In the jacking of the structural steel for bearing replacement at Spans 19, 20, 21 and 22 for the 14th Street Viaduct, the following shall be provided:

1. The Contractor shall submit his method of jacking for approval before the jacking operation begins to replace the bearings. The submission shall be in accordance with Standard Specification Subsection 105.04.
2. The schedule of anticipated jacking operation shall be submitted to the Engineer for approval before commencing jacking.
3. Design computations, working drawings, and details of the proposed jacking system, sealed by a Professional Engineer registered in New Jersey, shall be submitted to the Engineer for approval prior to jacking. The following information shall be included in the submission:
    a. Detailed sequence of work coordinated with other related work items.
    b. Size, capacity and positioning of jacking equipment.
    c. Temporary support framing details.
    d. Existing superstructure framing modifications as required.
    e. Jacking plate sizes and thicknesses.
    f. Substructure analysis where applicable.
4. The method and details of jacking assembly prototype testing shall be submitted to the Engineer for approval prior to jacking.

E. Bearing Replacement - Testing and Inspection.

1. As part of this work item the Contractor shall fabricate and test on-site his prototype jacking assembly to verify the coefficient of friction assumed and to establish the safe working capacity of the system.
2. The jacking assemblies shall not be fabricated until a successful test has been performed.
3. The jacking assembly shall be loaded by jacking against temporary supports.
4. No slippage shall occur after the system has been loaded with 75 percent of the testing load.
5. If slippage occurs, the Contractor shall modify his lifting system and retest until the system can support the load without slippage.
6. The test load shall be held for a period of 24 hours.
7. The Contractor may submit an alternate testing method to the Engineer for approval.

F. Bearing Replacement – Construction Requirements.

1. Jacking operations shall be limited and performed only as required to remove and replace existing bearing

assemblies where indicated on contract plans.
2. Coordinate girder jacking with structural steel repairs and retrofits.
3. The temporary jacking system shall be properly braced in order to safely transmit all stresses imposed by the jacking operation.
4. Repair any damage to the bridge due to the jacking operation as directed by the Engineer and at no additional cost to the State.
5. Once the bridge has been lifted to the required height to remove existing bearings, lockoff the jacks and hold the load for 4 hours. If the load cannot be maintained, lower the bridge, restress temporary supports and repeat lifting operation.
6. Temporary lateral support shall be provided to the bridge superstructure during the lifting operation.
7. At no time during the bearing removal process shall the superstructure be left unsupported. The Contractor shall provide a system to temporarily support the bridge, other than the primary jacking system, to provide redundancy against a potential jacking system failure.

503.05 Fabrication and Welding.

THE FOLLOWING IS ADDED TO PART B:

The contractor shall submit certification and qualification records as described in Section 5 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code and Subsection 105.04 of these Special Provisions 15 calendar days prior to commencing any field or shop welding operations. The contractor shall also provide specialized welders where field welding positions require additional certification and a plan shall be included detailing locations of specialized welds and the respective certified welder to perform the work.

503.16 Steel Grid Flooring.

THE FIRST PARAGRAPH IS DELETED AND THE FOLLOWING IS ADDED TO THIS SUBSECTION:

A. <u>Description.</u>

1. The work of this item applies to the concrete filled steel grid deck for the 12th Street Viaduct and 14th Street Viaduct at locations as indicated on the drawings. The steel grid flooring shall be galvanized and shall conform to Section 12 of the AASHTO LRFD Bridge Construction Specifications. Concrete for the filled type grid flooring shall be High Performance Concrete (HPC) and shall conform to Section 539 of the Special Provisions. Concrete placement for filled type grid flooring shall conform to Section 501.

2. This work includes the field measurement, working drawings, installation of steel threaded studs, the fabrication and transportation of new concrete filled steel grid decking, the installation of the filled grid on the prepared stringers and floorbeams and the placing of rapid setting concrete as indicated on the drawings.

3. Included in this work is the attachment of trim angles and steel extrusions at deck expansion joints. The trim angles and steel extrusions will be furnished under this item. The neoprene strip seal will be included under a separate item. Also included is the placement of rapid setting concrete at the closer pour.

4. Also included in this item is temporary feathering of the Bituminous Binder Course as required at the deck construction joints. Temporary feathering shall be removed before placing new wearing course.

5. The panels placed during construction stages shall include reinforcing bars with mechanical connectors as shown in the plans, as part of this item.

6. This work shall proceed within the available times and days indicated on the plans and in the Special Provisions. This work shall be completed by the indicated time or a Lane Occupancy Charge will be collected from the Contractor, as indicated in Subsection 108.19.

7. This item also includes an emergency panel support system to be used to keep the roadway open in case delays in construction do not allow for placing and curing of cast-in-place concrete. The Contractor shall submit an emergency panel support system to the Engineer for approval prior to starting fieldwork under this item.

8. This item also includes all material and labor required for shop installation of bridge scuppers at locations of concrete filled steel grid deck.

B. <u>Materials.</u>

Materials shall conform to the following:

1.	Threaded Bolt	ASTM A307M
2.	Haunch Forms	Sheet Steel, Uncoated
3.	High-Strength Bolts	ASTM A325M
4.	Nuts	ASTM A563M, Grade A
5.	Structural Steel	ASTM A709M, Grade 345
6.	Concrete Bonding Adhesive	ASTM C881M
7.	Washers	ASTM F436M
8.	Concrete Fill	Section 539 Special Provisions
9.	Reinforcement Bars, Epoxy Coated	Section 501 Standard Specifications
10.	Steel-Grid – All Components except reinforcing bars	ASTM A709M, Grade 345

Floorbeam supported steel grid shall consist of 132mm main bars at 152mm spacing. Stringer supported steel grid shall consist of 132mm main bars at 203mm spacing. A minimum of one supplemental bar shall be parallel and equally spaced between main bearing bars. Crossbars for floorbeam and stringer supported steel grid shall be equally spaced at 102 mm. The tops of the crossbars and supplemental bars shall be placed so that a plane flush with the top of the main bars is formed.

Epoxy coated No. 16 reinforcing bars shall be placed between crossbars in the bottom half of the main bars at 204 mm spacing. Crossbars and reinforcing bars shall be field-welded at each transverse roadway splice. Damaged galvanizing and epoxy coating shall be touched-up prior to concrete pour and after welded shear stud attachment.

The steel grid shall be fabricated in an AISC Class I fabrication shop. The steel grid deck panels shall be galvanized after fabrication.

11. Rapid Setting Concrete Closer Pour

a. <u>Physical Requirements</u>:

The rapid setting concrete closer pour material shall attain the following minimum values in accordance with the noted testing procedures:

Test	Procedure	Strength
Compressive Strength (Tested @ 21°C)	ASTM C109	1 Hour……..…… 13.8MPa 3 Hour……..….. 17.3Mpa 1 Day …….…... 29.0MPa 28 Days……..… 43.5MPa
Flexural Strength	ASTM C78	4 Hours …….….. 3.5MPa 5 Hours……...4.5MPa 28 Days……. 8.7MPa
Modulus of Elasticity	ASTM C469	29 096MPa@ …28 Days
Bond Strength	ASTM C882	24 Hours……..13.8MPa
Expansion - Shrinkage	ASTM C157	-0.028%…… Air Cured +0.017%……Water Cured
Freeze-Thaw	ASTM C666	Relative Modulus of 97.9 After 72 Cycles
Compressive Strength After Freeze	ASTM C109	Minimum 90% of 28-Day Compressive Strength
Surface Scaling	ASTM C672	0.2% after 14 Days of Moist and Air Cure
Set Time	ASTM C403	Initial Set – 15 Minutes

The material shall consist of a mixture of cement, silica-free sand, and aggregate (maximum size 9mm) and be ready for mixing just prior to use in accordance with the manufacturer's instructions. It shall be similar in color to Portland cement concrete and contain no gypsum or calcium chlorides. It shall be quick-setting for use as a rapid setting concrete compound where fast setting, rapid strength gain, non-shrink and high-bond strength characteristics are needed. The material shall meet ASTM C928.

b. Certification:

Material purchased and used on the basis of the Affidavit of Compliance may be sampled and tested at any time, and if found not to be in conformity with these specifications, will be subject to rejection whether in use or not.

c. Packaging:

The material shall be packaged in strong, moisture-resistant polyethylene-lined bags, capable of withstanding shipping, normal handling and storage without breaking. The package shall protect the material from moisture and deterioration when stored in doors in unheated buildings for a period of one-year. The packaging shall be clearly marked with the name of the product and instructions for mixing and placing. Use or type of material shall be printed on the bag. Instructions for use shall include, but not be limited to, the recommended amount of water or additive to be mixed with the patch material if necessary, the recommended mixing procedure, and sequence instructions for use of adhesive or bonding agent, if any, to bond fresh material to the existing concrete. Other information to be marked on the package includes the date the material was packaged, the net yield after final set in cubic meters or in

square meters per millimeter thickness, and the net weight in each package. Any broken packages will be rejected.

d. Technical Representative:

The rapid setting concrete material manufacturer shall have a Technical Representative at the site for the first three days of rapid setting concrete placement. The Technical Representative shall be certified by the material's manufacturer as being competent in the placement of this product. The Technical Representative shall return for one visit after ten days of placement and one visit after 30 days of placement and as required by the Engineer or Contractor. The cost of the Technical Representative shall be incidental to this item.

12. Emergency Panel Support System Material

a. Temporary wearing surface shall be timber decking with steel attachment hardware. Sand or other abrasive material approved by the Engineer shall be applied to the roadway surface to improve skid resistance.

b. Temporary support blocking shall be placed on the stringers or floorbeams to support the main bars.

c. All materials used for the emergency panel support system and blocking shall remain the property of the Contractor and shall be removed from the site following the completion of bridge deck replacement operations.

d. Material that is not new shall be inspected by the Engineer for structural soundness and integrity.

C. Quality Assurance.

1. ASTM Standards:

ASTM A108M	Steel Bars, Carbon, Cold-Finished, Standard Quality
ASTM A325M	High-Strength Bolts
ASTM A563M	Carbon and Alloy Steel Nuts
ASTM A709M	Structural Steel for Bridge
ASTM C78M	Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading)
ASTM C109M	Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens)
ASTM C157M	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C403M	Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C469M	Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete Compression

ASTM C666M	Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C672M	Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals
ASTM C881M	Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C882M	Test Method for Bond Strength of Expoxy-Resin Systems Used with Concrete
ASTM C928M	Specification for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs
ASTM F436M	Hardened Steel Washers

2. American Institute of Steel Construction

Quality Certification Program	Class I

3. American Welding Society Standards

D1.5	Bridge Welding Code

4. Other Technical Provisions

Special Provisions Section 539	High Performance Concrete Fill
Standard Specifications Section 501	Reinforcement Bars
Standard Specifications Section 503	Deck Joint Installation

D. Submittals.

1. The Contractor shall submit to the Engineer catalog cuts for the steel grid. The Contractor shall not use these materials without written approval of the Engineer.

2. The Contractor shall submit to the Engineer catalog cuts for the cast-in-place raid setting concrete closer pour. The Contractor shall not use these materials without written approval of the Engineer.

3. The Contractor shall submit to the Engineer a narrative procedure for the proposed time schedule and narrative procedure for the deck removal and steel grid installation to occur during the stages as indicated on the drawings. The field work shall not begin without written approval of the Engineer.

4. The Contractor shall submit to the Engineer working drawings for the structural steelwork to be done under this item. The field work shall not begin without the written approval of the Engineer.

5. The Contractor shall submit to the Engineer an Erection Diagram indicating the location of each grid unit and sequence of construction. The field work shall not begin without written approval of the Engineer.

E. Construction Requirements.

1. Steel grid flooring shall be constructed as indicated on the contract drawings. Grid shall be set to the correct elevation and prevented from any movement before and during welded shear stud attachment and cast-in-place rapid setting concrete closer pour placement. Touch-up all damaged galvanizing and epoxy coating prior to concrete pour and after welded shear stud attachment. Insure that all expansion joints are set to proper opening prior to shear stud installation and concrete placement.

2. The top of the floorbeam and stringer elevations shall be surveyed by the Contractor to verify correct slope prior to grid installation. Steel grid shall be shimmed and concrete haunch shall be provided as required to maintain level grid deck thickness as indicated.

3. The precast concrete fill, to be placed in the grid prior to the placement of the grid on the bridge deck, shall be finished with an overfill over the top of the steel grid members.

4. Steel grid units shall be carefully lifted from transport vehicles so that the grid is not marked or damaged.

5. The units shall not be placed directly on the ground, but shall be laid with ample blocking under the lower units of the stack of units.

6. Before placing the units on the bridge floorbeams or stringers, the location of each unit shall be carefully marked on the floorbeams or stringers to correspond with the location shown on the Erection Diagram. In this way, any gain or loss in length or width is readily discovered as soon as the units show any tendency to overrun or underrun.

7. The units shall then be properly aligned and bolted into position on the threaded studs. The fabricating shop is allowed a small tolerance of 3mm $\pm$ with regard to all dimensions of each unit. These tolerances apply to flatness of units, sweep or bow in a horizontal direction and out-of-squareness at ends and top and crossbar alignment. Any sweep or horizontal bow shall be removed from units before bolting to the threaded studs to ensure proper alignment of crossbars and preserve overall dimensions of completed deck.

8. The grid units shall be installed in accordance with the manufacturer's instructions and as detailed. Splices between grid units shall be provided by means of welds and bolts, as shown on the drawings.

9. At the floorbeams or stringers the vertical projections from the grid downward on each side of the floorbeam or stringer flanges shall be tied together across the flange, using form ties or an acceptable alternative.

10. The steel extrusion for expansion joints and trim bars shall be attached to the steel grid in the shop. The steel extrusions and trim bars are provided and installed under this item.

11. Rapid Setting Concrete Closer Pour

    a. The rapid setting concrete shall have a minimum cure time of three hours from the placement of last portion of rapid setting concrete to the opening of this portion of the bridge.

b. The manufacturer of the rapid setting concrete shall provide a Technical Representative at the site for a pre-grid placement meeting, the first two days or nights of rapid setting concrete closer pour placement and at two subsequent days or nights of rapid setting concrete closer pour placement, as required by the Engineer.

c. The rapid setting concrete shall be finished to match the plane of the precast concrete overfill. The texture of the rapid setting concrete shall nearly match the texture of precast concrete overfill. There shall be no high points or valleys at the intersection of the planes of the two types of concrete surfaces.

d. A minimum of three hours shall be required to cure the rapid setting concrete at a 16-Degree C minimum temperature.

12. Cold Weather Placement of Rapid Setting Concrete Closer Pour

The rapid setting concrete will cure to sufficient strength when the ambient air temperature is above 16 Degrees C at the time of placement.

If early ambient temperature at the time of placement of grid fill is expected to be below 16 Degrees C, the Contractor shall take the following precautions:

a. Store the grid panels in an interior space that is heated to a minimum of 21 Degrees C for 24 hours prior to placement of the grid panel.

b. Store the rapid setting concrete dry materials in a storage area at a minimum of 21 Degrees C for 24 hours prior to placement.

c. Provide mixing water for the rapid setting concrete at a minimum temperature of 21 Degrees C.

d. Use admixtures as recommended by the rapid setting concrete manufacturer and as approved by the Engineer.

e. Preheat the floorbeams and stringers and provide heat to the area below the grid deck and between the floorbeams and stringers and provide insulation blankets on the top of the finished rapid setting concrete until the bridge lanes will be reopened to traffic. Monitor the temperature at the upper and lower surfaces of the concrete to maintain a temperature between 16 and 32 Degrees C.

13. Construction Schedule

Prior to the start of deck removal and grid installation, the Contractor shall prepare a narrative of the procedure proposed for this staged construction. In the narrative, the Contractor shall include a sequential time schedule and bar chart of the proposed construction method for the stages which include steel grid deck as indicated on the drawings. The time schedule shall include “milestone” items that will affect the possible lack of completion of the staged grid installation. Do not start field work on this item until the proposed time schedule has been approved by the Engineer.

14. Existing structural steel that has had its existing paint coating damaged and remains exposed after the placement of the grid shall be painted in accordance with Section 514 of the Standard Specifications.

15. Emergency Panel Support System Installation

a. When the Contractor determines that he will be unable to place the rapid setting concrete closer pour within the required time frame, the Engineer shall be notified immediately for his approval of the use of an emergency panel support system. The Engineer will then direct the Contractor to place the temporary wearing surface and temporary blocking under the grid unit. The decision to use the emergency panel support system shall be made with sufficient time to allow for installation and opening of the bridge to the number of required lanes and by the time indicated on the plans. The temporary material shall be replaced with rapid setting concrete the next construction day.

b. The Contractor shall establish a "critical time" at which a predetermined amount of work will have to be completed to allow adequate time for the placement of the rapid setting concrete. If the work has not been completed by this time, the Contractor shall install the emergency panel support system. The Engineer shall be informed at the "critical time" of the situation and whether the Contractor will proceed with the placement of the rapid setting concrete or with the installation of the emergency panel support system.

c. This emergency panel support system work shall include temporary blocking or an approved alternative. The temporary blocking shall be used to temporarily support the grid panel when it is opened to traffic. The temporary blocking material shall be placed under the grid main bars to transfer load directly to the floorbeam or stringer top flanges.

d. The temporary wearing surface shall provide a skid-resistant surface at the roadway level.

e. Prior to the start of deck removal and grid panel installation, the Contractor shall prepare a narrative of the procedure proposed for installing the emergency panel support system at times when the complete grid installation cannot be thoroughly completed by the end of the staged construction allocated time. The Contractor shall not start field work until this procedure is approved by the Engineer.

f. Prior to installing the first grid panel in a test at the site, the Contractor shall demonstrate to the Engineer the capability to assemble the emergency panel support system efficiently with appropriate tools and equipment, thereby establishing an installation time period for this operation.

g. Under deck work platforms may be provided on an as needed basis for use in installing the grid and formwork at the floorbeams and stringers, in installing and maintaining temporary heating for use in curring the rapid setting concrete, and as an access platform for use in installing the wood blocking for the emergency panel support system.

503.17 Method of Measurement.

THE FOLLOWING IS ADDED:

"Structural Steel, If and Where Directed" will be measured by the Kilogram.

503.18 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE ADDED:

Pay Item	*Pay Unit*
STRUCTURAL STEEL, GRADE HPS 345 W	LUMP SUM
STRUCTURAL STEEL, GRADE HPS 485 W	LUMP SUM
STRUCTURAL STEEL, IF AND WHERE DIRECTED	KILOGRAM

THE SECOND PARAGRAPH IS CHANGED TO:

Structural bearing assemblies shall include payment for furnishing all labor, materials, tools, equipment and incidentals, and all work involving furnishing, testing, and installing said bearing assemblies, complete and in place, as shown on the Working Drawings.

THE FOLLOWING IS ADDED AT THE END OF THE LAST PARAGRAGH:

Structural bearing assemblies shall include payment for furnishing all labor, materials, tools, equipment, and incidentals and all work involved with installing temporary supports and the jacking operation required to raise the existing structural steel to remove existing bearing assemblies at locations as indicated on the drawings. Structural bearing assemblies shall also include payment for furnishing design calculations and working drawings for temporary supports. The design calculations and working drawings shall be submitted by the Contractor to the Engineer for approval. These design calculations and working drawings shall be prepared and sealed by a Professional Engineer registered in New Jersey. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. The fieldwork shall not begin until written approval of these calculations and working drawings has been given by the Engineer.

"Structural Steel, If and Where Directed" shall include payment for furnishing all labor, materials, tools, equipment, and incidentals and all work involving furnishing, testing and installing said Structural Steel, If and Where Directed, complete and in place as shown on the Shop Drawings, as required by the Standard Specifications, Special Provisions and as directed by the Engineer.

SECTION 504 - TIMBER STRUCTURES

504.03 Construction Requirements.

THE FOURTH PARAGRAPH IS DELETED.

SECTION 509 – SIGN SUPPORT STRUCTURES

509.01 Description.

THE FOLLOWING IS ADDED:

For sign lighting, the "Lumi-Trak Lighting Maintenance System" shall be used in place of the maintenance walkway and handrail on Overhead Sign Support Structure No.2. No substitutions will be permitted. The contractor may contact Lumi-Trak directly at the following address:

Lumi-Trak
P.O. Box 158
Shrewsbury, PA 17362
Telephone: (717) 235-2863

Maintenance walkway and handrail shall be provided for Overhead Sign Support Structure No. 1.

509.02 Materials.

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

Materials shall conform to the following subsections:

Inorganic Zinc Coating System……..912.13

THE THIRD PARAGRAPH IS CHANGED TO:

Steel box beam and columns shall conform to ASTM A709M, Grade 345. All other steel shall conform to ASTM Specification A36/A36M. All main load carrying members subject to tensile stresses shall meet supplementary requirements for notch toughness.

THE EIGHTH PARAGRAPH IS CHANGED TO:

After complete fabrication, each section shall be painted according to subsection 503.15 of the Standard Specifications.

509.04 Steel Structures:

THE THIRD PARAGRAPH IS CHANGED TO:

After fabrication, the steel assemblies shall be painted according to Subsection 503.15.

509.11 Basis of Payment:

THE ENTIRE SUBSECTION IS CHANGED TO:

Payment will be made under:

Pay Item	*Pay Unit*
OVERHEAD SIGN SUPPORT, STRUCTURE NO. 1	UNIT
OVERHEAD SIGN SUPPORT, STRUCTURE NO. 2	UNIT

Payment for foundation excavation will be made according to Section 206.
Payment for concrete and reinforcement steel will be made according to Section 501.
Payment for drilled shafts will be made according to Section 543.
Payment for sheeting will be made according to Section 513.
No separate payment will be made for sign lighting on Overhead Sign Support, Structure No. 2. Overhead Sign Support, Structure No. 2 shall include payment for furnishing all labor, materials, tools, equipment and incidentals for the installation of the "Lumi-Trak Lighting Maintenance System".
No separate payment will be made for maintenance walkway and handrail on Overhead Sign Support, Structure No. 1

SECTION 513 - SHEETING, TEMPORARY AND LEFT IN PLACE

513.04 Construction Requirements

ADD THE FOLLOWING AFTER THE FIRST PARAGRAPH:

Existing site conditions include foundations supported on battered timber piles, low height clearances, access limitations and utility restrictions that may require braced excavation support systems. Low clearance equipment may be required to drive sheeting. Temporary sheeting for 14th Street Viaduct Bents 20 to 24 shall be interlocking steel sheet piling. Typical interlocking steel sheeting may not be feasible at other locations. Braced Soldier pile and lagging using wale and struts may be required.

SECTION 514 - PAINTING EXISTING BRIDGES

514.01 Description.

THE FIRST PARAGRAPH IS CHANGED TO:

This work shall consist of the cleaning and painting of structural steel and metal surfaces on existing and proposed structural steel including but not limited to the following: bracket retrofits, floorbeam retrofits, girder retrofits, column retrofits, base plate retrofits, restrainer/anchor bracket assembly, restrainer cable connection assembly, bracket repairs, floorbeam repairs, girder repairs, truss repairs, hole repairs, column repairs, bent bracing repairs, and rivet replacements. This work shall consist of the cleaning and painting of existing and proposed structural steel and metal surfaces associated with the aforementioned retrofits and repairs with the following coating system:

Inorganic Zinc Coating System for shop structural steel painting

Organic Zinc Coating System for field structural steel painting

Payment for the cleaning and painting of existing and proposed structural steel associated with retrofits and repairs shall be included in the individual retrofit and repair pay items as indicated in Sections 523 through 536 and Section 538 of the Special Provisions.

514.04 Limits of Cleaning and Painting.

A. General.

THE FIRST SENTENCE IS CHANGED TO:

Surfaces to be cleaned and painted shall include all surfaces of existing structural steel that have previously been painted, surfaces of other metal and proposed structural steel including but not limited to the following: bracket retrofits, floorbeam retrofits, girder retrofits, column retrofits, base plate retrofits, restrainer/anchor bracket assembly, restrainer cable connection assembly, bracket repairs, floorbeam repairs, girder repairs, truss repairs, hole repairs, column repairs, bent bracing repairs, and rivet replacements.

514.05 Cleaning Methods.

SUBPART B. IS CHANGED TO:

B. Epoxy Mastic Coating System. All existing surfaces shall be hand/power tool cleaned according to Subpart A.1 above, except where commercial blast cleaning is indicated on the Plans. All commercial blast cleaned surfaces shall leave an anchor profile from 38 to 76 micrometers deep.

514.13 Protection of Environment, Structure, Persons, and Property.

1. Blast Cleaning Requirements.

a. Pollution Control System.

(2) Waste Disposal Plan.

THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

The hazardous waste generator identification number(s) for use on the manifest is (are) as follows:

Structure No.	**EPA ID No.**
0904-153	NJR 000432409
0904-154	NJR 000432409

1. Blast Cleaning Requirements.

b. Lead Health and Safety.

THE FIRST PARAGRAPH OF SUBPART (2) IS CHANGED TO:

(2) Lead Health and Safety Plan (LHASP). When over 450 megagrams of structural steel are to be blast cleaned, the following additional requirements and provisions shall be complied with by the Contractor.

2. Epoxy Mastic Surface Preparation.

a. Pollution Control System.

(2) Hazardous Waste Collection and Disposal.
THE FOLLOWING IS ADDED AFTER THE THIRD PARAGRAPH:

The hazardous waste generator identification number(s) for use on the manifest is (are) as follows:

Structure No.	**EPA ID No.**
0904-153	NJR 000432409
0904-154	NJR 000432409

SECTION 518 - BRIDGE DECK REHABILITATION

518.02 Materials.

A. Repair of Concrete Deck. Quick-setting patching materials classified as Type IA shall be those Type I quick-setting patching materials that contain manufacturer specified mix proportions and have more than 6.8 kilograms of No. 8 coarse aggregate and/or sand added. The mix proportions for the use of products classified as Type IA will be approved by the Bureau of Materials.

Type I
Five Star Highway Patch manufactured by
Five Star Products, Inc.
425 Stillson Road
Fairfield, CT 06430
Telephone: 800-243-2206

Horn 240 manufactured by
A.C. Horn Company
12116 Conway Road
Beltsville, MD 20705-1302
Telephone: 800-654-0402

Set 45 manufactured by
Master Builders, Inc.
23700 Chagrin Boulevard
Cleveland, OH 44122
Telephone: 800-722-8899

Bostik 276 manufactured by
Emhart Chemical Group
UPCO Division
4805 Lexington Avenue
Cleveland, OH 44103

Duracal manufactured by
The United States Gypsum Company
Industrial Gypsum Division
1100 Ashwood Parkway
Suite 300
Atlanta, GA 30338-4769
Telephone: 800-365-5857

D.O.T. Repair Mortar
Rapid Set Products Co.
1023 Dogwood Lane
West Chester, PA 19382

Day Chem Perma Patch manufactured by
Dayton Superior Corporation
P.O. Box 355
First Street and Adams
Oregon, IL 61061

Industrial Fast Setting Cement Mix (IFSCEM 110)
American Stone Mix, Inc.
8320 Bellona Avenue

Towson, MD 21204-2086
Telephone: 410-296-6770

"FX-930" manufactured by
Fox Industries
3100 Falls Cliff Road
Baltimore, MD 21211

Emaco T415 manufactured by
Master Builders, Inc.
23700 Chargin Boulevard
Cleveland, OH 44122

Five Star Cement manufactured by
Five Star Products, Inc.
425 Stillson Road
Fairfield, CT 06430
Telephone: 800-243-2206

Pave Patch 3000 manufactured by
Conspec Marketing Man.
636 South Terance
Kansas City, KS 66111

Type 1A
Five Star Cement manufactured by
Five Star Products, Inc.
425 Stillson Road
Fairfield, CT 06430
Telephone: 800-243-2206

Duracel manufactured by
The United States Gypsum Company
Industrial Gypsum Division
1100 Ashwood Parkway
Suite 300
Atlanta, GA 30338-4769
Telephone: 800-365-5857

Type II
Speedcrete manufactured by
Tamms Industries
1222 Ardmore Avenue
Itasco, IL 61143
Telephone: 312-773-2350

Type III
Horn 240 manufactured by
A.C. Horn Company
12116 Conway Road
Beltsville, MD 20705-1302
Telephone: 800-654-0402

Set 45 manufactured by
Master Builders, Inc.
23700 Chagrin Boulevard

Cleveland, OH 44122
Telephone: 800-722-8899

Type IV
Set 45 “Hot Weather Formula” manufactured by
Master Builders, Inc.
23700 Chagrin Boulevard
Cleveland, OH 44122
Telephone: 800-722-8899

Type V
Emaco R-350 manufactured by
Master Builders, Inc.
23700 Chargin Boulevard
Cleveland, OH 44122

Emaco S88-CA manufactured by
Master Builders, Inc.
23700 Chargin Boulevard
Cleveland, OH 44122

Sika Repair 223 manufactured by
Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071

HD-25 manufactured by
Dayton Superior Corporation
P.O. Box 355
First Street and Adams
Oregon, IL 61061

Polyfast FS manufactured by
Dayton Superior Corp.
First Street and Adams
Chicago, IL 61067

Speedcrete Redline manufactured by
TAMMS Ind.
3835 Route 72
Kirkland, IL 06164

Verticoat Supreme manufactured by
Euclid Chemical Co.
5 Joanna Court
East Brunswick, NJ 08816
Telephone: 732-390-9770

Verticoat–2 Part manufactured by
Euclid Chemical Co.
5 Joanna Court
East Brunswick, NJ 08816
Telephone: 732-390-9770

SECTION 519 - PREFABRICATED MODULAR WALLS

519.01 Description.

Prefabricated Modular Wall Systems acceptable for use in the project are as follows:

DOUBLEWAL as manufactured by
The Doublewal Corporation
7 West Main Street
Plainsville, CT 06062
Telephone Number: 860-747-1627

T-WALL as manufactured by
The Neel Company
8328-D Tratford Lane
Springfield, VA 22152
Telephone Number: 703-913-7859

519.03 Construction.

D Installation.

3. Compaction of Backfill Material.

f

THE SECOND SENTENCE IS CHANGED TO:

AASHTO T 310 (Direct Transmission Method) shall be used to determine the achieved density.

SECTION 520 - MECHANICALLY STABILIZED EARTH (MSE) WALLS

520.01 Description.

The acceptable MSE walls are as follows:

Reinforced Earth as manufactured by
Reinforced Earth Company
8614 Westwood Center Drive, Suite 1100
Vienna, VA 22182-2233
Telephone Number: 703-749-4325

Inter-Loc as manufactured by
Atlantic Concrete Products
8900 Old Route 13
P. O. Box 129
Tullytown, PA 19007
Telephone Number: 215-945-5600

Retained Earth as manufactured by
Foster Geotechnical
1372 Old Bridge Road, Suite 101
Woodbridge, VA 22192
Telephone Number: 703-499-9818

SSL MSE Plus Retaining Wall System as manufactured by
SSL
4740-E Scotts Valley Drive
Scotts Valley, CA 95066
Telephone Number: 831-430-9300

Isogrid Retaining Wall System as manufactured by
The Neel Company
8328-D Traford Lane
Springfield, VA 22152
Telephone Number: 703-913-7859

520.03 Methods of Construction.

O. Compaction of Backfill Material.

6.

THE SECOND SENTENCE IS CHANGED TO:

AASHTO T 310 (Direct Transmission Method) shall be used to determine the achieved density.

THE FOLLOWING 24 SECTIONS ARE ADDED:

SECTION 523 - BRACKET RETROFIT

523.01 Description.

This work shall consist of the construction of bracket retrofits at the top of column locations for both the 12th and 14th Street Viaducts where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of removing existing brackets and replacing with new brackets and/or strengthening existing brackets. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements, which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the bracket retrofit.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

523.02 Materials.

Structural Steel shall conform to Subsection 917.10.

Bolts and Bolting Materials shall conform to Subsection 917.01.

Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.

Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

523.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

523.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

523.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the bracket shall be removed prior to beginning the retrofit.
3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.

6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
8. Cut and remove existing structural steel as shown on the drawings.
9. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
10. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
11. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
12. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
13. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
14. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
15. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

523.06 Method of Measurement.

Bracket retrofits will be measured on a unit basis for each type of bracket retrofit that is furnished and installed, complete and to the satisfaction of the Engineer.

523.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
BRACKET RETROFIT TYPE BR1	UNIT
BRACKET RETROFIT TYPE BR2	UNIT
BRACKET RETROFIT TYPE BR3	UNIT
BRACKET RETROFIT TYPE BR4	UNIT
BRACKET RETROFIT TYPE BR5	UNIT
BRACKET RETROFIT TYPE BR11	UNIT
BRACKET RETROFIT TYPE BR12	UNIT

Bracket retrofit shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving removing and disposing of the existing brackets, furnishing, testing, and installing said bracket retrofit, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Bracket retrofit shall include payment for removing existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Bracket retrofit shall also include payment for the cleaning

and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 524 – FLOORBEAM AND CAP BEAM RETROFIT

524.01 Description.

This work shall consist of the construction of floorbeam and cap beam retrofits for the14th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the strengthening of existing floorbeams and cap beams. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall also include the grinding and removal of existing welds. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the floorbeam and cap beam retrofits.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

524.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

524.03 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

524.04 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the floorbeam or cap beam shall be removed prior to beginning the retrofit.
3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.

8. Grind and remove existing welds at the locations shown on the drawings. The base metal to remain shall not be damaged during this operation. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
9. Cut and remove existing structural steel as shown on the drawings.
10. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
11. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
12. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
13. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
14. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
15. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
16. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

524.05 Method of Measurement.

Floorbeam and cap beam retrofits will be measured on a unit basis for each type that is furnished and installed, complete and to the satisfaction of the Engineer.

524.06 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
FLOORBEAM RETROFIT TYPE FB1	UNIT
FLOORBEAM RETROFIT TYPE FB2	UNIT
FLOORBEAM RETROFIT TYPE FB3	UNIT
CAP BEAM RETROFIT TYPE CB1	UNIT
CAP BEAM RETROFIT TYPE CB2	UNIT

Floorbeam and cap beam retrofits shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said floorbeam and cap beam retrofits, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Floorbeam and cap beam retrofits shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Floorbeam and cap beam retrofits shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 525 - GIRDER RETROFIT

525.01 Description.

This work shall consist of the construction of girder retrofits for the14th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the strengthening of existing girders. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the girder retrofit.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

525.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

525.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

525.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

525.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.

7. Cut and remove existing structural steel as shown on the drawings.
8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

525.06 Method of Measurement.

Girder retrofits will be measured on a unit basis for each type of girder retrofit that is furnished and installed, complete and to the satisfaction of the Engineer.

525.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
GIRDER RETROFIT TYPE GR1	UNIT

Girder retrofits shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said girder retrofits, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Standard Specifications, and as directed by the Engineer. Girder retrofit shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Girder retrofit shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 526 - COLUMN RETROFIT

526.01 Description.

This work shall consist of the construction of column retrofits for the12th and 14th Street Viaducts where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the strengthening of existing columns. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the fabrication and installation of temporary supports prior to commencing the column retrofits. This work shall include the removal and disposal of existing structural steel and rivets. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the column retrofit.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

526.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

526.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

526.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

Design calculations and working drawings for temporary supports shall be submitted by the Contractor to the Engineer for approval. These design calculations and working drawings shall be prepared and sealed by a Professional Engineer registered in New Jersey. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. The fieldwork shall not begin until written approval of these calculations and working drawings has been given by the Engineer.

526.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the column shall be removed prior to beginning the retrofit.
3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.

4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
8. Cut and remove existing structural steel as shown on the drawings.
9. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
10. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
11. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
12. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
13. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
14. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
15. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

526.06 Method of Measurement.

Column retrofits will be measured on a unit basis for each type of column retrofit that is furnished and installed, complete and to the satisfaction of the Engineer.

526.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
COLUMN RETROFIT TYPE C1	UNIT
COLUMN RETROFIT TYPE C2	UNIT
COLUMN RETROFIT TYPE C3	UNIT
COLUMN RETROFIT TYPE C4	UNIT
COLUMN RETROFIT TYPE C5	UNIT
COLUMN RETROFIT TYPE C6	UNIT
COLUMN RETROFIT TYPE C7	UNIT
COLUMN RETROFIT TYPE C8	UNIT
COLUMN RETROFIT TYPE C11	UNIT
COLUMN RETROFIT TYPE C12	UNIT

Column retrofits shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said column retrofits, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Standard Specifications, and as directed by the Engineer. Column retrofit shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Column retrofits shall include payment for the design, fabrication and installation of temporary support systems. Column retrofit shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 527 – BASE PLATE RETROFIT

527.01 Description.

This work shall consist of the construction of base plate retrofits at the bottom of column locations for both the 12th and 14th Street Viaducts where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the widening the existing reinforced concrete pedestals and/or strengthening the structural steel components of the existing bases. This work shall consist of the construction of reinforced concrete doweled to the existing reinforced concrete pedestals at locations where indicated on the drawings. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as anchor bolts, high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the base plate retrofit.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

527.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.
Curing Materials shall conform to Subsection 905.03.
Epoxy Bonding Coat shall conform to Subsection 912.06.
Reinforcement Steel for Structures shall conform to Subsection 915.01.
Portland cement concrete, mortar, and grout shall conform to Section 914.

527.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

Concrete testing shall conform to Section 501.

527.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

527.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and

shall be based on field measurements.

4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions.
7. Cut and remove existing structural steel as shown on the drawings.
8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
15. Automatic end-welded studs shall be in accordance with Subsection 503.10 of the Standard Specifications.

527.06 Method of Measurement.

Base plate retrofits will be measured on a unit basis for each type of base plate retrofit that is furnished and installed, complete and to the satisfaction of the Engineer.

527.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
BASE PLATE RETROFIT TYPE BP1	UNIT
BASE PLATE RETROFIT TYPE BP2	UNIT
BASE PLATE RETROFIT TYPE BP3	UNIT
BASE PLATE RETROFIT TYPE BP4	UNIT
BASE PLATE RETROFIT TYPE BP5	UNIT
BASE PLATE RETROFIT TYPE BP6	UNIT
BASE PLATE RETROFIT TYPE BP7	UNIT
BASE PLATE RETROFIT TYPE BP8	UNIT
BASE PLATE RETROFIT TYPE BP11	UNIT
BASE PLATE RETROFIT TYPE BP12	UNIT
BASE PLATE RETROFIT TYPE BP13	UNIT
BASE PLATE RETROFIT TYPE BP14	UNIT

BASE PLATE RETROFIT TYPE BP15	UNIT
BASE PLATE RETROFIT TYPE BP16	UNIT
BASE PLATE RETROFIT TYPE BP17	UNIT
BASE PLATE RETROFIT TYPE BP18	UNIT

Base plate retrofits shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said base plate retrofits, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Base plate retrofit shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Base plate retrofit shall include payment for drilling and grouting reinforcing steel and drilling, setting and prestressing anchor bolts in the existing concrete foundations as shown on the Contract Drawings. Base plate retrofit shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 528 – RESTRAINER / ANCHOR BRACKET ASSEMBLY

528.01 Description.

This work shall consist of the construction of a restrainer assembly and anchor bracket assembly at the South Ramp, North Ramp and 12th Street Viaduct adjacent to the West Abutment.

The restrainer assembly shall be attached to the girders of the South Ramp adjacent to the West Abutment as shown on the drawings. The contractor has the option to install threaded steel anchor rods or steel cables for the restrainer assembly at the South Ramp.

The anchor bracket assembly shall be attached to the stringers of the 12th Street Viaduct and North Ramp adjacent to the West Abutment as shown on the drawings. Threaded steel anchor rods shall be used for the anchor bracket assembly.

The restrainer assembly and anchor bracket assembly shall be in accordance with the drawings, with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of attaching threaded steel anchor rods or steel cables to the girders and stringers as indicated in these Special Provisions and in accordance with the plans. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets as required and in accordance with the plans. The work shall consist of drilling of holes in the existing structural steel for high strength bolts. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the restrainer assembly and anchor bracket assembly.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

528.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

528.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

528.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

The Contractor shall submit to the Engineer catalog cuts for the jacking equipment that is proposed for tensioning. Such equipment shall not be used until written approval has been given by the Engineer.

528.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the girders and stringers

adjacent to the 12th Street Viaduct West Abutment shall be removed prior to beginning the work.

3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each retrofit location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
8. Cut and remove existing structural steel as shown on the drawings.
9. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
10. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
11. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
12. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
13. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
14. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
15. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

528.06 Method of Measurement.

Restrainer assembly and anchor bracket assembly will be measured on a unit basis.

528.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
RESTRAINER ASSEMBLY	UNIT
ANCHOR BRACKET ASSEMBLY	UNIT

Restrainer assembly and anchor bracket assembly shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets as required and shown on the plans and all work involving furnishing, testing, and installing said restrainer assembly and anchor bracket assembly, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these

Special Provisions and the Specifications, and as directed by the Engineer. Restrainer assembly and anchor bracket assembly shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Restrainer assembly and anchor bracket assembly shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 529 – RESTRAINER CABLE CONNECTION ASSEMBLY

529.01 Description.

This work shall consist of the construction of the restrainer cable connection assembly for the14th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall also include the removal and disposal of existing structural steel and rivets. The work shall also consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall also include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the restrainer cable connection assembly.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

529.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.
Zinc-Coating on Steel shall conform to Subsection 917.12.
Steel Wire Structural Strand shall conform to ASTM A 586.

529.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

529.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. The working drawings shall show the plan, elevation and sections of the assembly. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

529.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.

6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
7. Cut and remove existing structural steel as shown on the drawings.
8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.

529.06 Method of Measurement.

Restrainer cable connection assemblies will be measured on a unit basis.

529.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
RESTRAINER CABLE CONNECTION ASSEMBLY	UNIT

Restrainer cable connection assembly shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said restrainer cable connection assemblies, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Restrainer cable connection assembly shall include payment for the removal of existing rivets as required and drilling new holes in the existing structural steel as required for high strength bolts. Restrainer cable connection assembly shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 530 - BRACKET REPAIR

530.01 Description.

This work shall consist of the construction of bracket repairs for the12th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the bracket repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

530.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

530.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

530.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

530.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the bracket shall be removed prior to beginning the repair.
3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.

7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
8. Cut and remove existing structural steel as shown on the drawings.
9. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
10. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
11. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
12. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
13. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
14. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
15. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
16. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
17. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
18. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

530.06 Method of Measurement.

Bracket Repair Type BR12 will be measured by the kilogram. Bracket Repair Types BR11 and BR13 will not be measured and payment will be made on a unit basis. Bracket repair measured by the kilogram includes the weight the new material including the structural steel, bolts, and welds and does not include the weight of the existing material removed.

530.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
BRACKET REPAIR TYPE BR11	UNIT
BRACKET REPAIR TYPE BR12	KILOGRAM
BRACKET REPAIR TYPE BR13	UNIT

Bracket repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said bracket repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by

these Special Provisions and the Standard Specifications, and as directed by the Engineer. Bracket repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Bracket repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 531 - FLOORBEAM REPAIR

531.01 Description.

This work shall consist of the construction of floorbeam and stringer repairs for the 12th Street Viaduct and floorbeam repairs for the 14th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the floorbeam repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

This work shall not consist of concrete encasement removal. Concrete encasement removal shall conform to Section 213 of the Special Provisions.

531.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

531.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

531.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

531.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the floorbeam and/or stringer shall be removed prior to beginning the repair.
3. After the deck slab concrete has been removed, the Contractor shall submit to the Engineer the limits of deterioration of the floorbeam and/or stringer top flange prior to working drawing preparation. The Engineer will determine if the repair details as indicated on the drawings are to be used by the Contractor or if the floorbeam and/or stringer top flange is corroded to the extent beyond repair. The Engineer will submit to the Contractor in writing whether to repair the floorbeam and/or stringer as indicated on the drawings or to replace the floorbeam and/or stringer. The decision to modify the repair details as indicated on the drawings or to replace the floorbeam and/or stringer shall be on a case by case basis and at the sole discretion of the Engineer.

4. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
5. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
6. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
7. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
8. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
9. Cut and remove existing structural steel as shown on the drawings.
10. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
11. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
12. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
13. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
14. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
15. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
16. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
17. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
18. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
19. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

531.06 Method of Measurement.

Floorbeam Repair Type FB12 will be measured by the kilogram. Floorbeam Repair Types FB1, FB2, FB3, FB11 and FB 13 will not be measured and payment will be made on a unit basis. Floorbeam repair measured by the kilogram includes the weight the new material including the structural steel, bolts, and welds and does not include the weight of the existing material removed.

531.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
FLOORBEAM REPAIR TYPE FB1	UNIT
FLOORBEAM REPAIR TYPE FB2	UNIT
FLOORBEAM REPAIR TYPE FB3, IF AND WHERE DIRECTED	UNIT
FLOORBEAM REPAIR TYPE FB11	UNIT
FLOORBEAM REPAIR TYPE FB12	KILOGRAM
FLOORBEAM REPAIR TYPE FB13, IF AND WHERE DIRECTED	UNIT

Floorbeam repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said floorbeam repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Floorbeam repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Floorbeam repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

If the Engineer determines that the floorbeam and/or stringer top flange is beyond repair and requires replacement as specified in Subsection 531.05, payment for the proposed structural steel shall be in accordance with the pay item "Structural Steel, If and Where Directed" in Section 503 of the Standard Specifications and Special Provisions. The pay item "Structural Steel, If and Where Directed" shall be in accordance with Subsection 102.05 of the Standard Specifications. The method of floorbeam and/or stringer removal and replacement shall be submitted to the engineer for approval prior to construction.

SECTION 532 - GIRDER REPAIR

532.01 Description.

This work shall consist of the construction of girder repairs for the14th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts and removal of existing rivets and replacement with high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the girder repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

532.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

532.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

532.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

532.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection

538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.

7. Cut and remove existing structural steel as shown on the drawings.
8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
15. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
16. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
17. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

532.06 Method of Measurement.

Girder repairs will be measured on a unit basis.

532.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
GIRDER REPAIR TYPE GR1	UNIT

Girder repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said girder repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Girder repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Girder repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 533 - TRUSS REPAIR

533.01 Description.

This work shall consist of the construction of truss repairs for the12th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the truss repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

533.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

533.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

533.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

533.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
7. Cut and remove existing structural steel as shown on the drawings.

8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
15. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
16. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
17. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

533.06 Method of Measurement.

Truss repairs of the various kinds will be measured by the kilogram. Truss repairs measured by the kilogram includes the weight of the new material including the structural steel, bolts and welds and does not include the weight of the existing material removed.

533.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
TRUSS BRACING REPAIR TYPE TB11	KILOGRAM
TRUSS CHORD REPAIR TYPE TC11	KILOGRAM

Truss bracing repair and truss chord repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Truss bracing repair and truss chord repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Truss bracing repair and truss chord repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 534 – HOLE REPAIR

534.01 Description.

This work shall consist of the construction of hole repairs for the12th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the hole repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

534.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

534.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

534.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

534.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
7. Cut and remove existing structural steel as shown on the drawings.

8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
15. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
16. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
17. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

534.06 Method of Measurement.

Hole Repair in Web Type W11 will be measured by the square meter. Hole Repair in Channel Type CH11 will be measured by the linear meter.

534.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
HOLE REPAIR IN WEB TYPE W11	SQUARE METER
HOLE REPAIR IN CHANNEL TYPE CH11	LINEAR METER

Hole repair in web, hole repair in flange and hole repair in channel shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Hole repair in web, hole repair in flange and hole repair in channel shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Hole repair in web, hole repair in flange and hole repair in channel shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 535 - COLUMN REPAIR

535.01 Description.

This work shall consist of the construction of column repairs for the12th Street Viaduct where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the fabrication and installation of temporary supports prior to commencing the column repairs. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the hole repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

535.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

535.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

535.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

Design calculations and working drawings for temporary supports shall be submitted by the Contractor to the Engineer for approval. These design calculations and working drawings shall be prepared and sealed by a Professional Engineer registered in New Jersey. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. The fieldwork shall not begin until written approval of these calculations and working drawings has been given by the Engineer.

535.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. The existing concrete deck in the construction stage which contributes dead load to the column shall be removed prior to beginning the repair.
3. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
4. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and

shall be based on field measurements.

5. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
6. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
7. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets are removed.
8. Cut and remove existing structural steel as shown on the drawings.
9. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
10. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
11. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
12. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
13. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
14. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
15. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
16. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
17. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
18. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

535.06 Method of Measurement.

Column Repair Type C14 will be measured by the kilogram. Column Repair Types C11, C12, and C13 will not be measured and payment will be made on a unit basis. Column repair measured by the kilogram includes the weight the new material including the structural steel, bolts, and welds and does not include the weight of the existing material removed.

535.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
COLUMN REPAIR TYPE C11	UNIT
COLUMN REPAIR TYPE C12	UNIT

COLUMN REPAIR TYPE C13	UNIT
COLUMN REPAIR TYPE C14	KILOGRAM

Column repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said hole repairs, complete and in place, as shown on the Contract Drawings and Working Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. Column repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Column repair shall include the payment for the design, fabrication and installation of temporary support systems. Column repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 536 – BENT BRACING REPAIR

536.01 Description.

This work shall consist of the construction of bent bracing repairs for the12th and 14th Street Viaducts where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall consist of the furnishing, fabrication, erection and painting of new structural steel and associated new elements which are composed of structural steel such as high strength bolts, nuts and washers. This work shall include the removal and disposal of existing structural steel and rivets. This work shall include saw cutting the existing structural steel to remove corroded steel at locations where shown on the drawings. The work shall consist of drilling of holes in the existing structural steel for additional high strength bolts where indicated on the drawings. This work shall include field measurements of existing bridge members prior to the fabrication of new structural steel. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the bent bracing repair.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

536.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

536.03 Inspection and Testing.

Inspection and testing shall conform to Section 6 of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code as modified by Section 503.

536.04 Submittals.

Working drawings for the proposed structural steel shall be submitted by the Contractor to the Engineer for approval prior to fieldwork. The working drawings shall be based on field measurements and shall be in accordance with Subsection 105.04 of the Standard Specifications. A detailed removal and erection plan shall be included in the working drawing submission. The field work shall not begin until the Engineer has approved the working drawings in writing.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

536.05 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Dimensions of the existing structural steel shall be field measured to determine the required proposed structural steel dimensions at each repair location. Field measurements shall be submitted to the Engineer for approval prior to ordering proposed materials.
3. Working drawings shall be furnished in accordance with Subsection 105.04 of the Standard Specifications and shall be based on field measurements.
4. Fabrication and welding of proposed structural steel shall be in accordance with Subsection 503.05 of the Standard Specifications.
5. Shipping, handling and erection of proposed structural steel shall be in accordance with Subsection 503.07 of the Standard Specifications.
6. Existing rivets shall be removed as required, as shown on the drawings, and in accordance with Subsection 538.04 of the Special Provisions. Damage shall be avoided to the existing structural steel when existing rivets

are removed.

7. Cut and remove existing structural steel as shown on the drawings.
8. Additional holes shall be field drilled in the existing structural steel as required for high-strength bolts to attach proposed structural steel at locations as indicated on the drawings in accordance with the following:
    a. Field drilled holes shall be cylindrical and perpendicular to the member. They shall be clean-cut without torn or ragged edges. Burrs on the outer surfaces shall be removed.
    b. The offset in any field drilled hole reamed 6mm in any ply of material measured from an outer ply after the hole has been finished for bolting, shall not exceed 2mm. Not more than 10 percent of the holes shall be offset as much as 2mm.
    c. The offset in any hole reamed 3mm full size, in any ply of material, measured from an outer ply after the hole has been finished for bolting, shall not exceed 3mm. Not more than 10 percent of the holes shall be offset as much as 3mm.
    d. Where approved by the Engineer, holes may be overreamed to meet these requirements, and larger bolts installed.
9. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
10. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
11. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
12. The surface of existing structural steel in areas to receive the proposed structural steel plates shall be cleaned in accordance with Section 514 of the Standard Specifications.
13. The existing structural steel shall be removed as indicated on drawings. The base metal to remain during the removal operations shall not be damaged. Any damage to the steel to remain, as determined by the Engineer, shall be repaired by the Contractor, to the satisfaction of the Engineer, and at no additional cost to the State.
14. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
15. In preparation of the repair, the existing structural steel shall be saw cut to remove corroded steel at locations where shown on the drawings. Flame cutting to remove corroded steel shall be prohibited.
16. Repair additional existing structural steel and/or extend the limits of the specified repairs as directed by the Engineer.
17. Kinks and deformations in existing structural steel shall be repaired by flame straightening or a combination of flame straightening and jacking. Flame straightening shall be done by personnel approved by the Department with a minimum of three years of prior documented experience.

536.06 Method of Measurement.

Bent Bracing Repair Types BB12 and BB13 will be measured by the kilogram. Bent Bracing Repair Types BB1, BB2, BB3 and BB11 will not be measured and payment will be made on a unit basis. Bent bracing repair measured by the kilogram includes the weight the new material including the structural steel, bolts, and welds and does not include the weight of the existing material removed.

536.07 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
BENT BRACING REPAIR TYPE BB1	UNIT
BENT BRACING REPAIR TYPE BB2	UNIT
BENT BRACING REPAIR TYPE BB3	UNIT
BENT BRACING REPAIR TYPE BB11	UNIT
BENT BRACING REPAIR TYPE BB12	KILOGRAM
BENT BRACING REPAIR TYPE BB13	KILOGRAM

Bent bracing repair shall include payment for furnishing all labor, materials, tools, equipment, and incidentals involved for removal and disposal of existing structural steel and rivets and all work involving furnishing, testing, and installing said bent bracing repair, complete and in place, as shown on the Contract Drawings and Working Drawings, as

required by these Special Provisions and the Specifications, and as directed by the Engineer. Bent bracing repair shall include payment for drilling holes in the existing structural steel where indicated on the drawings and shall include payment for furnishing and installing high strength bolts. Bent bracing repair shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 537 – CONCRETE REPAIRS

537.01 Description.

This work shall consist of the construction of concrete repairs for the existing north face of the South Ramp Arch Structure, Spans 34 through 47, adjacent to the 12th Street Viaduct West Abutment and other locations as directed by the Engineer. The work shall be repairs of existing concrete by implementation of Type CR11 and Type CR12 repairs. Concrete repairs shall be in accordance with the details as shown on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall include the removal and disposal of existing concrete. Working drawings shall be submitted to the Engineer for approval prior to construction in accordance with Subsection 105.04 and shall include the Contractor's work plan, construction method and sequence of construction for the concrete repair.

Finishing concrete surfaces shall be performed on the north face of the South Ramp to provide uniform appearance after concrete repairs are performed.

537.02 Materials.

Class B Concrete shall conform to Section 914.

Epoxy Bonding Coat shall conform to Subsection 919.12

Reinforcement Steel shall conform to Subsection 915.01.

Pneumatically applied mortar shall conform to Subsection 507.02. Additional products will be considered for approval.

Epoxy coated steel mesh shall conform to AASHTO M55 with an epoxy coating in conformance with Subsection 915.01 (F).

Anchors for attaching steel reinforcement shall be power driven fasteners as manufactured by one of the following suppliers:

Hilti, Inc.
Tulsa, Oklahoma

Ramset Fastening Systems
Route 139
Bradford, Connecticut

Remington
25000 S. Western Avenue
Park Forest, Illinois

537.03 Submittals.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

537.04 Construction Requirements.

A. <u>Repair of Concrete Unit</u>

Repairs of existing concrete shall be performed at areas outlined as either Type CR11 or Type CR12 on the plans, or at locations designated by the Engineer. The application of each type shall be based on the depth actually encountered in the field after the removal of loose and deteriorated concrete.

Repair areas which are formed shall be saw cut to a depth of 20mm with a power saw capable of making straight cuts prior to removal of deteriorated concrete. If any area is to be repaired with pneumatically applied concrete, the edges of the repair area shall be chiseled.

All deteriorated or unsound concrete shall be removed to sound concrete or as directed by the Engineer. Minimum depth of concrete removal shall be 25mm. If deteriorated or unsound concrete appears to extend below existing ground, the existing ground shall be excavated as required to allow

for removal of all unsound or deteriorated concrete. The cost of excavating and backfilling of the existing ground will be included in the cost for Foundation Excavation, Regulated Waste. Concrete may be removed by means of approved hand held pneumatic chipping hammers and chisels, not exceeding 14 Kilograms with the bit removed. Pneumatic tools should not be placed in direct contact with reinforcement steel. Extreme care shall be taken when reinforcement steel is uncovered so as not to damage the steel or its bond in the surrounding sound concrete. Reinforcement Steel or other embedded items damaged during concrete removal shall be repaired by the Contractor, as directed by the Engineer, at no cost to the State. If reinforcement bars are exposed, the removal shall continue until at least ½ of the bar's circumference is exposed. If unsound concrete is encountered at or below the one-half-depth of reinforcement bars, removal shall extend to at least 25mm beyond the bars. The limits of the cavity for deep, narrow repairs (depth equals or exceed twice the width) shall be undercut to lock the repair in place.

After removal of unsound concrete, the surfaces of the remaining concrete shall be cleaned by flushing or scouring with compressed air jets to assure removal of all loose concrete, dust, and other foreign material. Embedded items shall be cleaned of all loose adhering concrete, rust and scale. Adhering concrete shall be removed from exposed reinforcement steel.

For Type CR11 and CR12 repairs, deteriorated reinforcement shall be replaced with epoxy coated reinforcement in accordance with the plans and as directed by the Engineer. For Type CR11 and Type CR12 repairs epoxy coated welded wire mesh (4 x 4 - W2.0 x 2.0) shall be securely fastened to the existing reinforcing steel or adequately anchored into sound concrete as directed by the Engineer. The Contractor shall provide 50mm of cover over the welded wire mesh. No separate payment will be made for the welded wire mesh.

After completion of the removal and cleaning operations, and immediately prior to the placement of repair material, the surfaces shall receive a coating of the bonding compound applied in accordance with the manufacturer's recommendations and as directed by the Engineer.

The pot-life of the epoxy bonding compound, mixing period, maximum time lapse between mixing compound and placing of the new concrete, are all dependent on the temperature, humidity, and wind conditions. The Contractor shall acquaint himself with such information as recommended by the manufacturer and shall schedule his operations accordingly.

Whatever means of placing the patch material is employed, it shall be such that the material will completely fill the space to be replaced, be thoroughly compacted, and free of air pockets.

Placement of pneumatically applied mortar shall conform to the requirements of Subsection 507.04.

Patch materials shall be placed immediately while the compound is still tacky. If the bonding compound dries before the new concrete is placed, existing exposed concrete shall be completely cleaned and a new coat of epoxy bonding compound shall be applied, as herein described at no additional cost to the State. After the new concrete is in place, normal finishing operations shall be completed.

All details of design, such as V-grooves, chamfers, joints, etc. shall be duplicated in the repair work under this Section.

Placing of concrete, forming, removal of forms, finishing and curing of the new concrete shall conform with the applicable requirements of Section 501.

Any damage to the concrete during the cleanup procedure shall be repaired in a manner satisfactory to the Engineer, at no additional cost to the Authority.

B. Finishing Concrete Surfaces.

After concrete repairs have been performed, the entire north face of the South Ramp shall be finished as specified herein to attain a uniform color appearance. The finishing shall be applied to the limits shown on the plans.

Finishing of the surfaces shall consist of rubbing the surfaces with burlap and grout composed of equal parts of cement and clean shape sand to produce a smooth uniform color. The grout shall be tinted to match as closely as possible the color of the existing concrete. Color samples of the tint shall be submitted for approval.

537.05 Method of Measurement.

Concrete Repair Type CR11 will be measured by the Square Meter. Concrete Repair Type CR12 will be measured by the Cubic Meter. Concrete finishing shall be measured by the square meter.

537.06 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
CONCRETE REPAIR TYPE CR11	SQUARE METER
CONCRETE REPAIR TYPE CR12	CUBIC METER
CONCRETE FINISHING	SQUARE METER

No separate payment will be made for saw cutting edges of repairs, or supplementing reinforcement steel but all costs thereof shall be included in the various repair items.

No separate payment will be made for removal and disposal of deteriorated concrete and reinforcement steel, but all costs thereof shall be included in the various repair items.

For Concrete Repair Type CR11 or Type CR12, final payment for each designated repair location will be made for only one of the two repair types. Repair type will be determined by the Engineer from the final depth as measured in the field after preparation of the area and prior to placement of the patching material, regardless of the original designation or preparatory work for another repair type.

SECTION 538 – RIVET REPLACEMENT

538.01 Description.

This work shall consist of the construction of rivet replacements for the12th and 14th Street Viaducts where indicated on the drawings, in accordance with these Special Provisions and the Standard Specifications, and as directed by the Engineer. This work shall include the removal and disposal of existing structural steel rivets and furnishing and installing high strength bolts in the existing holes at locations not included in other retrofit and repair work items.

This work shall also consist of the cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements. The cleaning and painting of existing and proposed structural steel, metal surfaces and associated elements shall conform to Section 514. There shall be no separate pay item for cleaning and painting of existing and proposed structural steel.

538.02 Materials.

Structural Steel shall conform to Subsection 917.10.
Bolts and Bolting Materials shall conform to Subsection 917.01.
Inorganic Zinc Coating System for shop structural steel painting shall conform to Subsection 912.13.
Organic Zinc Coating System for field structural steel painting shall conform to Subsection 912.15.

538.03 Submittals.

Certification shall be submitted by the Contractor to the Engineer that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

538.04 Construction Requirements.

A. General.

Work shall be performed in accordance with the drawings, this section and the following:

1. This work shall be accomplished during the appropriate construction stage as indicated on the drawings. Work shall be performed at only one location at a time. Any portion of the procedure at another location shall not be started until the preceding procedure is completely finished and approved by the Engineer.
2. Rivet heads shall be flame-cut 2 mm above the base metal using a rivet scarfing tip or other method approved by the Engineer that will not damage the material to remain. The cut rivet shank shall be driven out using a pneumatic punch.
3. If, in the opinion of the Engineer, rivet shanks can not be removed by punching without damaging the base metal, the rivet shank shall be removed by drilling.
4. Existing rivets shall be removed as required and replaced with high-strength bolts. Damage shall be avoided to the existing structural steel when existing rivets are removed.
5. Where approved by the Engineer, reaming of existing rivet holes in the existing structural steel to fit the new high strength bolts is allowed. The minimum edge distance or bolt spacing requirements as specified by AASHTO, Division I, Chapter 10.24 shall not be violated.
6. The existing structure is painted with lead based paint. The removal, containment, collection and disposal of existing paint from areas to be repaired, as required shall be in accordance with Section 514 of the Standard Specifications. The existing and proposed structural steel shall be painted in accordance with Section 514 of the Standard Specifications.
7. Temporary material, as required, need not be painted, except for a spot of bright paint to indicate temporary material.
8. The installation of high-strength bolts shall be in accordance with Subsection 503.09 of the Standard Specifications.
9. Extend the limits of the rivet replacement areas as directed by the Engineer.

538.05 Method of Measurement.

Rivet replacement will not be measured and payment will be made on a lump sum basis.

538.06 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
RIVET REPLACEMENT	LUMP SUM

Rivet replacement shall include payment for furnishing all labor, materials, tools, equipment, and incidentals for the removal and disposal of the existing rivets and all work involving furnishing and installing high strength bolts in the existing hole, complete and in place, as shown on Contract Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. If the total number of rivets to replace exceeds ten percent of the quantity shown on the drawings, approval shall be received from the Engineer prior to the additional rivet replacements required above the quantity shown on the drawings. Rivet replacement shall also include payment for the cleaning and painting of existing structural steel, metal surfaces and associated elements, including but not limited to a lead health and safety plan, containment, waste disposal and testing, if and where directed, in accordance with Section 514.

SECTION 539 – HIGH PERFORMANCE CONCRETE (HPC) – DECK SLABS

539.01 Description.

This work shall consist of the construction of cast-in-place portland cement concrete deck slabs with the use of High Performance Concrete (HPC). HPC is defined as concrete that meets special performance and uniformity requirements that cannot always be obtained by using conventional ingredients, normal mixing procedures and typical curing practices.

539.02 Materials.

Materials, admixtures and methods of construction not specifically covered in the plans and these Special Provisions shall conform to the AASHTO Standard Specifications for Highway Bridges and as stated herein. If the project is designed according to the AASHTO LRFD Bridge Design Specifications, conformance shall be to the AASHTO LRFD Bridge Construction Specifications and as stated herein.

In order to achieve the desired resistance to chloride penetration, an appropriate pozzalonic material; such as, silica fume, flyash or ground granulated blast furnace slag shall be provided in the mix design.

Pozzalonic material maximum percentage limitations that are stated in Subsection 914.02 and 919.18 may be waived for the development of HPC mix designs.

539.03 Submittals.

The Contractor shall submit to the Engineer certification that the products and materials supplied meet the requirements specified in this section.

539.04 Mix Design and Fabrication of the HPC.

1. **Fabrication Requirements.** For the construction of the HPC items of work, the HPC shall be fabricated in accordance with the requirements of Section 501 - or as stated within this Section.

2. **Mix Design Verification.** In the development of the HPC mix design, the following performance requirements, in accordance with the indicated test method, shall be achieved. A report to document these results shall be provided to the NJDOT Regional Materials Office. The Contractor shall obtain the results of these standard tests from an AASHTO Accredited testing agency, that is approved for Portland Cement concrete testing, at no cost to the Department.

Performance Characteristic	Standard Test Method	Performance Required
Scaling Resistance (x = visual rating of the surface after 50 cycles)	ASTM C 672	x = 3 max
Freeze-Thaw Durability (x = relative dynamic modulus of elasticity after 300 cycles)	AASHTO T 161 ASTM C 666 Proc. A	x = 80% minimum
Chloride Permeability 56 days (coulombs)	AASHTO T 277 ASTM C1202	1000 maximum
56 Day Compressive Strength (Verification Strength)	AASHTO T 22 ASTM C 39	37 MPa (5400 psi) minimum

Note: For the Scaling Resistance performance testing, as prescribed in the Standard Test Method, specimens shall be moist cured for 14 days and then air cured for 14 days.

a. If the compressive strength requirement has been achieved in 28 days, the strength requirement shall be considered acceptable. If the required compressive strength is not achieved in 28 days, the HPC sample shall be tested at 56 days.

b. If the chloride permeability requirement has been achieved in 28 days, the chloride permeability shall be considered acceptable. If the required chloride permeability is not achieved in 28 days, the HPC sample shall be tested at 56 days.

c. At least 90 calendar days prior to the planned start of the concrete placement, the mix design shall be submitted for approval and verification in accordance with Subsection 914.02. The submission shall include the results of the required Performance testing specified above.

d. In accordance with the above referenced AASHTO T277 test, at 28 and 56 day intervals, the Department will perform chloride permeability testing to document the quality of the HPC mix design and to verify the results submitted in the above referenced Report.

The Contractor shall submit four (4) additional cylindrical samples to the Department Laboratory, for performance of this testing. These samples shall be 100 millimeters (4 inches) in diameter and at least 200 millimeters (8 inches) in length. The test value shall be the result of the average value of tests on two (2) specimens for each mix design.

539.05 Production HPC.

1. As per the provisions of 501.12, Subpart 5., a plan of operation for placement of the HPC deck slab, shall be submitted for review and approval by the Engineer.

2. The Contractor is advised that curing of the HPC shall be performed in accordance with the provisions of Subsection 501.17. Furthermore, wet burlap, for the curing of the deck slab concrete, shall be placed within ten (10) minutes after the concrete is struck off. Also, upon completion of the 7 day wet curing period, the HPC deck slab shall be further cured according to the provisions of Subsection 405.14, Subpart 1. for an additional 7 days.

   If it is anticipated that the ten (10) minute limitation will not be met, the concrete placement operation shall be stopped. A cold joint shall be formed and the Contractor shall submit a revised plan of operation for review and approval by the Engineer before resumption of the HPC placement.

3. The finishing machine equipment shall be set up so that the HPC is placed only 1.8 to 2.4 meters (6 to 8 feet) ahead of the machine.

4. To demonstrate that the Contractor can place, finish and cure the HPC, a trial HPC placement of a minimum of 4.6 cubic meters (6 cubic yards) of the HPC shall be placed at the Project site at a location that is acceptable to the Engineer.

   The location shall not be a structural element that is to remain in place. The trial HPC shall be placed, finished and cured in accordance with these Specifications at least 7 calendar days prior to the start of HPC placement. After the initiation of final HPC placement, the trial HPC shall be removed. If the Engineer believes that there is sufficient knowledge that the HPC can be placed and cured according to these Specifications, then this requirement may be waived.

539.06 HPC Acceptance Requirements.

1. With the exception that compression testing may be conducted at 56 days, the requirements specified in Subsection 914.02 for control and acceptance testing of Class A concrete shall be adhered to in the fabrication of the HPC elements.

2. Acceptance testing performance measures shall consists of the following parameters:

Performance Characteristic	Standard Test Method	Performance Required
Percent Air Entrainment *		6.0 ± 1.5 (# 57 Aggregate) 6.0 ± 1.5 (# 67 Aggregate) 7.0 ± 1.5 (# 8 Aggregate)
Slump (millimeters) *		75 ± 25
Chloride Permeability ** 56 days (coulombs)	AASHTO T 277 ASTM C1202	2000 maximum
56 Day Compressive Strength *** (Retest Limit)	AASHTO T 22 ASTM C 39	30 MPa (4400 psi) minimum

*As per the guidance stated in Subsection 501.03, a Type F water-reducing, high range admixture will be permitted in accordance with Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the Slump and Air Content values for the HPC shall be as follows:

Slump: 150 ± 50 millimeters (6 ± 2 inches)
Air Content: increase both the target value and tolerance percentages by 0.5

** For chloride permeability testing, 4 additional cylinders shall be provided to the Department Laboratory. Two cylinders each from two randomly selected delivery trucks shall be taken for testing at 28 day and 56 day intervals.

*** For compressive strength testing, the Initial Sampling Rate for the HPC shall be 6/Lot.

3. The HPC shall be a Non-Pay-Adjustment Item. In accordance with the provisions of Subsection 914.02 F., the HPC shall be accepted for strength according to the requirements of a Class A concrete item.

4. A test for chloride permeability shall consist of two test specimens. The results of the two specimens shall be averaged to determine the test result. There will be two tests performed on each lot from samples taken from two randomly selected delivery trucks. The lot is eligible for 100 percent payment provided that all test results are equal to or below 2000 coulombs.

   Whenever one or more individual test results exceed 2000 coulombs at 28 days, the lot shall be re-evaluated at the same testing rate at 56 days. If, upon testing at 56 days, one or more individual test results exceed 2000 coulombs, the Engineer may:

   a. Require the Contractor to remove and replace the defective lot at no cost to the State,

   b. Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State.

539.07 Method of Measurement.

High Performance Concrete (HPC) – Deck Slabs will be measured by the Cubic Meter.

539.08 Basis of Payment.

Payment for HPC in the cast-in-place deck slab will be made under:

Pay Item	*Pay Unit*
CONCRETE IN SUPERSTRUCTURE, DECK SLABS - HPC	CUBIC METER

SECTION 540 – LONGITUDINAL DECK JOINT

540.01 Description.

This work shall consist of furnishing all labor, equipment, technical assistance and materials necessary to install the temporary supports, deck joint steel angles, studs, backer rod, primer and silicone joint sealant for the 12th and 14th Street Viaducts and the 14th Street Shoulder Structure where indicated on the drawings, in accordance with these Special Provisions and Standard Specifications and as directed by the Engineer. This work shall also consist of cleaning and sandblasting surfaces for preparation prior to longitudinal deck joint installation.

540.02 Materials.

(a) Silicone Joint Sealant. The silicone joint sealant shall be rapid cure, self-leveling, cold applied, two component, 100 percent silicone sealant. The sealant, upon curing, shall demonstrate resilience, flexibility and resistance to moisture and puncture. The sealant shall also demonstrate excellent adhesion to portland cement concrete and steel over a range of temperatures from –34 to 54°C (-30 to 130°F) while maintaining a watertight seal. The sealant shall not contain any solvents or diluents that cause shrinkage or expansion during curing. Acid cure sealants are not acceptable. The date of manufacture shall be provided with each lot. Materials twelve months old or older from the date of manufacture will not be accepted. The manufacturer shall certify that the sealant meets or exceeds the following test requirements before installation begins. The Department reserves the right to test representative samples from material proposed for use.

Physical Properties:

Each component as supplied:	
Specific Gravity (ASTM D1475)	1.3-1.4
Extrusion Rate (MIL-S-8802)	200–550 grams per minute
Flow	Self-leveling
Durometer Hardness, Shore (ASTM D 2240) "00" (0° and 25°C ± 1°C (32°F and 77 ±3°F.)	40-80
Ozone and U.V. (ASTM C 793) Resistance	No chalking, cracking or bond loss after 5,000 hours.
After Mixing:	
Tack Free Time (ASTM C679)	60 minutes max.
Joint Cure Rate (% of total cure)	50% within 4-6 hours 75% within 24 hours 100 % within 48 – 160 hours
Upon Complete Cure: (ASTM D 3569) *See Note 1	
Skin-over time at 25°C (77°F) (MIL-S-8802)	20 min max.
Joint Elongation (adhesion to concrete/steel)	600% min
Joint Modulus	21-83 kPa (3-12 psi) @ 100% elongation

*Note 1: Modified; Sample cured 2 days at 25 ±1°C (77±2°F) 50±5% relative humidity

(b) Backer Rod. The backer rod shall conform to ASTM D5249, Type 3.
(c) Structural Steel shall conform to Subsection 917.10.
(d) Bolts and Bolting Materials shall conform to Subsection 917.01.

540.03 Submittals.

The Contractor shall submit to the Engineer certification that the products and materials supplied meet the requirements specified in this section and Section 503 of the Standard Specifications.

540.04 Construction Requirements.

General. Technical assistance provided by the manufacturer during surface preparation and installation shall be furnished at no additional cost to the Department. The Contractor shall furnish the Engineer with the manufacturer's written product information, installation procedures, and instructional video at least two weeks prior to installation. The Contractor, the manufacturer's representative, and the Engineer shall meet to review and clarify installation procedures, and requirements prior to starting the work. A technical representative must be present for the start of surface preparations and installation for at least one day. The Contractor shall contact the manufacturer at least two weeks prior to installation.

When placing the silicone against concrete, the concrete surface shall be dry. For newly placed concrete, the concrete shall be fully cured and allowed to dry out a minimum of 7 additional days prior to placement of the silicone. Cold, wet, inclement weather will require an extended drying time.

(a) Preinstallation:

1) Prior to work of any kind pertaining to Joint Sealant Contract, the contractor, in combination with the Engineer and sealant manufacturer/representative, shall meet and discuss method of installation. Contractor must assure Engineer that he/she is properly trained to install selected sealant manufacturer's product prior to beginning same.

(b) Surface Preparation:

(1) Sandblasting. Both faces of the joint shall be sandblasted. A separate pass for each face for the full length of the joint and to the design depth of the center of the backer rod will be required. The nozzle shall be held at an angle of 30-90 degrees to the joint face, at a distance of 25-50 mm (1 –2 in.).

For portland cement concrete and polymer concrete surfaces, sandblasting will be considered acceptable when both joint faces have a roughened surface with clean, exposed aggregate. The surface shall be free of foreign matter or plastic residue.

For steel surfaces, sandblasting will be considered acceptable when the steel surfaces have been cleaned to an SSPC-SP10 degree of cleanliness.

After sandblasting is completed, the joint shall be cleaned of debris using compressed air with a minimum pressure of 620 kPa (90 psi). The air compressor shall be equipped with traps to prevent the inclusion of water and/or oil in the air line.

(2) Priming. This operation will immediately follow sandblasting and cleaning and will only be permitted to proceed when the air and substrate temperatures are at least 5°C (41°F) and rising. Sandblasting, priming and sealing must be performed on the same day. The entire sandblasted surface shall be primed using a brush applied primer. The primer shall be allowed to dry a minimum of one hour or more until it is thoroughly dry, whichever is longer, before proceeding. For steel surfaces, the minimum drying time shall be extended to 90 minutes when the substrate temperature is below 15°C (60°F).

For portland cement concrete and polymer concrete, the primer shall be in accordance to the manufacturer's recommendations. For steel surfaces, the primer shall be rust inhibiting primer recommended by the sealant manufacturer.

The primer shall be supplied in original containers and shall have a "use-by" date clearly marked on them. Only primer, freshly poured from the original container into clean pails will be

permitted. The primer must be used immediately. All primer left in the pail after priming shall be disposed of and shall not be reused.

(c) Joint Installation

(1) Joints shall be inspected for proper width, depth, alignment, and preparation, and shall be approved by the Engineer prior to installation of sealant.

(2) Backer Rod Placement. The backer rod shall be installed to a uniform depth as specified on the plans and as recommended by the manufacturer. All splices in the backer rod shall be taped to prevent material loss during sealing. The backer rod shall be installed to within 3 mm (1/8 in.) tolerance prior to sealing.

(3) Sealant Placement. Sealant shall be installed in accordance with the manufacturer's recommendations. The sealant shall be 25mm (1in.) thick within ±3 mm (1/8 in.) tolerance as measured in the center of the joint at the thinnest point. The sealant thickness shall be measured during installation every ± 600 mm (±2 ft). Adjustments to correct sealant thickness to within tolerance shall be made immediately before the sealant begins to set up. Sealant placement will only be permitted when the air and substrate temperatures are above 5° C 9 (41°F) and 2.8°C (5°F) above the dew point. The joint must be kept clean and dry during sealing. If the joint becomes wet and/or dirty during sealing, the operation will be halted until the joint has been restored to a clean and dry state.

Sealing shall be performed using a pneumatic gun approved by the sealant manufacturer. Prior to sealing, the gun shall be inspected to insure that it is in proper working order and that it is being operated at the recommended air pressure.

The gun must demonstrate proper mixing action before sealant will be allowed into the joint. Unmixed sealant will not be permitted in the joint. All unmixed sealant found in the joint will be removed and replaced at the Contractor's expense.

After the Engineer has determined that the pneumatic gun is functioning properly, the joint shall be sealed to the thickness and depth as shown on the plans. The sealant must be allowed to achieve initial set before opening the joint to traffic.

End of seal treatment at vertical faces of curbs, sidewalks or parapet shall be as recommended by the manufacturer and as shown on the plans.

Sealant placed incorrectly shall be removed and replaced by the Contractor at no additional cost to the Department.

Manufacturer's representative, if deemed necessary, shall assist the Engineer in performing a general inspection of installed sealant for the purpose of determining correctness of same.

The longitudinal deck joint shall provide a watertight joint.

(4) Field Testing. A minimum of one joint per bridge per joint configuration will be tested by the Engineer by performing a Pull Test. The sealant shall be allowed to cure for a minimum of 24 hours before testing. The locations for the tests will be determined by the Engineer. The tests will be performed per the manufacturer's written instructions. As part of the test, the depth and thickness of the sealant will be verified. All joint system installations failing to meet the specifications shall be removed and replaced, by the Contractor, to the satisfaction of the Engineer at no additional cost to the Department. In addition, the "Pull Test" is a destructive test, the Contractor shall repair the joint after completion of the test per the manufacturer's written instructions at no additional cost to the Department.

(d) Equipment:

All equipment necessary for the proper construction of this work shall be on the project in first class working condition. The equipment shall be as recommended by the sealant manufacturer and approved by the Engineer before construction is permitted to start.

540.05 Method of Measurement.

The installed joint sealer will be measured in meters along the centerline of the joint.

540.06 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
25 MM LONGITUDINAL DECK JOINT	LINEAR METER
50 MM LONGITUDINAL DECK JOINT	LINEAR METER

The 25mm longitudinal deck joint and 50mm longitudinal deck joint shall include payment for furnishing all labor, materials, tools, equipment, and incidentals for installing temporary supports, silicone joint sealant, steel angles, studs, backer rod, and primer complete and in place, as shown on Contract Drawings, as required by these Special Provisions and the Specifications, and as directed by the Engineer. The 25mm longitudinal deck joint and 50mm longitudinal deck joint shall also include payment for the cleaning and sandblasting surfaces prior to joint installation.

SECTION 541 – RAPID SET LATEX MODIFIED CONCRETE

541.01 Description.

This work shall consist of the removal and disposal of loose and disintegrated concrete, the preparation of the surface, cleaning or replacement of reinforcement steel and complete construction or repair of deck slab concrete with the use of Rapid Set Latex Modified Concrete (RSLMC).

Except as amended herein, the provisions of Section 914 for furnishing Class A concrete shall be followed for furnishing RSLMC. The RSLMC shall be uniform in composition and consistency and shall conform to the mix design requirements stated below. Mixing capability shall be such that placing and finishing can be accomplished in one continuous operation without any delay before the formation of the plastic surface film.

Trial batches shall be prepared of the same materials and proportions required by the mix design. Department personnel will be present during verification batching to ensure that the proportions and ingredients batches are in accordance with the mix design.

541.02 Furnishing and Installation.

Furnishing and installation of the RSLMC shall conform to provisions of Section 518, and as amended herein.

1. Storage of Materials. When the concrete materials are stored on the Project site, they shall be maintained in accordance with Subsection 405.07.

   Admixtures shall be stored in enclosures that can protect them from freezing, or from prolonged exposure to temperatures in excess of 29 degrees C. The manufacturer's recommendations shall be followed.

2. Curing Hour. A curing hour is defined as any hour, beginning with the hour of placement, during which the ambient air temperature at the concrete surface remains at or above 10 degrees C, as measured by a recording thermometer.

541.03 Materials.

Materials shall conform to Subsections 501.02 and Sections 405 and 914 and the following:

1. Coarse Aggregate. Coarse aggregate shall comply with the requirements of Subsection 901.12, Item (A). Coarse aggregate shall be size number 57 with a maximum 13 mm size, not exceed ½ the thickness of section to be placed and be broken stone or crushed gravel.
2. Fine Aggregate. Fine aggregate shall comply with the requirements of Section 901.12, Item (B).
3. Concrete Admixtures. Admixtures shall comply with the requirements of Section 905, and AASHTO M194.
4. Curing Materials. Wet burlap shall conform to Subsection 905.03.

Chemical admixtures as per the requirements of Subsection 905.02 may be used to control the working time. Sand should be clean and conform to the requirements of ASTM C33 for Concrete Sand. The supplier's recommendations should be followed in the fabrication of the RSLMC.

RSLMC shall consist of rapid set cement manufactured by CTS Cement Manufacturing Company, Cypress, CA, or approved equal. Materials should be of recent manufacture (within one year) and free from lumps.

The latex emulsion admixture product is available from the following supplier:

Dow Modifier A as produced by Dow Chemical USA
Functional Products and Systems Department
Midland, MI 48640

A certified copy of the test properties for the latex material shall be furnished as required in Subsection 919.10

The RSLMC shall have the following properties or limitations:

Rapid Set Cement ……..……..……..…….. 390 Kilograms/Cubic Meter
Latex Emulsion Admixture ……..……13.25 Liters/bag
Fine Aggregate ……..…….+/- 1009 Kilograms/Cubic Meter
Coarse Aggregate ……+/- 771 Kilograms/Cubic Meter
Water ……..……..…….100 Kilograms/Cubic Meter
Air Content ……..…….. 6% +/- 2%
Slump ……...……...……52 ± 50 Millimeters

541.04 Equipment.

The equipment used to place the RSLMC shall comply with the requirements of 405.08, Item No. 4. The following criteria shall also be adhered to:

1. The equipment should provide positive control of the flow of water and admixture into the mixing chamber. Water flow should be indicated by flow meter and be readily adjustable to provide for minor variations in aggregate moisture. The admixture discharge pipe shall be readily accessible for determining proportioning accuracy.
2. The Mixing Type Truck Mixers should be self-propelled and be capable of carrying sufficient unmixed dry cement, sand, coarse aggregate, Modifier A, and water to produce on the site not less than 4.6 cubic meters of concrete.
3. The Mixers should be calibrated to accurately proportion the specific mix. Where placements involve more than 76.5 Cubic Meters, calibration of cement and latex should be checked at intervals of 76.5 Cubic Meters.
4. The Spreading and Finishing equipment shall conform to the provisions of 405.03 B. The Contractor shall make equipment that is to be used to place the concrete in skewed areas or, areas where the machinery cannot be used, available.
5. As per the requirements of Subpart 541.09, the Contractor shall supply fog misting equipment to control the evaporation rate.
6. The operation of equipment or vehicles on or over the deck shall be in conformance with the requirements of Subsection 405.17. Runways shall be provided when concrete transporting devices are expected to operate over exposed reinforcing steel.
7. A sufficient number of stiff nylon bristle push brooms, nylon bristle straight brooms and pails shall be provided.

541.05 Design, Control and Acceptance Testing Requirements.

Design, Control and Acceptance Requirements shall conform to the requirements of Subsection 914.02 with the exception that verification batching cylinders shall be tested for a 3 hour strength of 17.2 Mpa and a 6 hour strength of 27.6 Mpa.

541.06 Stockpiling Aggregates.

Aggregate stockpiles shall be maintained in accordance with the requirements of Subsection 901.02.

541.07 Construction Plan.

At least 30 days prior to the proposed start of placement of the RSLMC, the Contractor shall submit a plan for the construction of the RSLMC for approval by the Engineer. The written plan shall include the following:

1. The proposed method of operation
2. Equipment descriptions
3. Number of mixing trucks to be used
4. A plan for discontinuing placement and protecting the RSLMC during unfavorable weather conditions

5. Contingency plan for interruptions of pours, work schedules, limits of pours and for protecting the RSLMC in the event that stoppages prevent completion of the placement before opening to traffic
6. List of material's suppliers
7. Knowledge level of Contractor's or Subcontractor's work force
8. Maintenance and protection of traffic

At the time of submission, the Contractor shall request a pre-construction meeting with the Engineer to discuss the written plan. The plan should demonstrate the ability of the Contractor to place, finish, texture, and cover the RSLMC within thirty minutes of placement on the deck and in accordance with the equipment and manufacturer's recommendations. A representative from the supplier of the RSLMC shall be present at this meeting.

541.08 Placing and Finishing.
Placing and finishing shall conform to the following:

1. The finishing machine shall make a dry run over the entire area to assure that the minimum thickness of prescribed RSLMC is attained.
2. The RSLMC placement shall be continuous. The Contractor is advised that, due to the rapid setting nature of the RSLMC, no delays will be permitted in the placement. The placement operation shall be planned accordingly.

3. As per the conditions stated in Subpart 541.09 below, fog misting shall begin immediately after placement and shall continue after the finishing operation until the placement of wet burlap.

4. The RSLMC supplier shall supply guidance to the Contractor and/or the subcontractor concerning finishing and handling of the concrete. The supplier shall have ACI certified concrete technicians on the site for the full day of the initial construction. Recommended methods and operational techniques based on prevailing climatic and job conditions shall be provided.

541.09 Weather and Temperature Restrictions.
Placement of the RSLMC shall comply with the weather and temperature restrictions stated in 518.06 Subpart 11.

541.10 Curing.
The Contractor is advised that curing of the RSLMC shall be performed in accordance with the provisions of Subsection 501.17. Furthermore, wet burlap shall be placed within ten (10) minutes after the RSLMC is struck off. The burlap and polyethylene shall remain until four hours minimum of wet curing has occurred. The burlap shall be kept continuously wet for the 4 hour duration.

The finishing machine equipment shall be set up so that the RSLMC is placed only 1.8 to 2.4 meters ahead of the machine.

541.11 Acceptance Testing.
For the production RSLMC, the compressive strength testing requirement shall be 27.6 Mpa in 6 hours. In accordance with AASHTO T23, a minimum of two test cylinders, for compression testing, will be made for each lot. This is with the exception that demolded cylinders are to be air cured. The samples shall be prepared, cured and delivered in accordance with AASHTO T23, except that the demolded cylinders shall be delivered to the Department laboratory where they will be tested for the 6 hour compressive strength.

The RSLMC shall be a non-pay adjustment item. In accordance with the provisions of Subsection 914.02 F., the RSLMC will be accepted for strength based on its achieving a final compressive strength of 27.6 MPa at the 6 hour duration.

The production RSLMC shall meet a chloride permeability requirement reading of 2000 coulombs (maximum) when tested according to the AASHTO T 277 test method. For this testing, 4 additional cylinders shall be provided to the Department Laboratory. Chloride permeability testing shall be performed at 28 day and 56 day intervals. The test for chloride permeability shall consist of two test specimens. The results of the two specimens shall be averaged

to determine the test result. There will be two tests performed on each lot from samples taken from two randomly selected delivery trucks. The lot is eligible for 100 percent payment provided that all test results are equal to or below 2000 coulombs.

Whenever one or more individual test results exceed 2000 coulombs at 28 days, the lot shall be re-evaluated at the same testing rate at 56 days. If, upon testing at 56 days, one or more individual test results exceed 2000 coulombs, the Engineer may:

1. Require the Contractor to remove and replace the defective lot at no cost to the State,

2. Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State.

The provisions of 518.06 D. shall be followed to determine acceptance of the RSLMC when evaluating any surface crack development and in performing a delamination survey to determine bonding between the RSLMC and substrate concrete.

541.12 RSLMC Surface Texture Finish.

The RSLMC shall be textured with an artificial turf drag. The provisions of 501.15, Subpart 1, shall be followed for this work.

541.13 Method of Measurement. The provisions of Subsection 518.08 shall be followed for the measurement of RSLMC as a Concrete Deck Overlay Protective System.

541.14 Basis of Payment. Payment will be made under:

Pay Item	*Pay Unit*
RAPID SETTING LATEX MODIFIED CONCRETE OVERLAY	CUBIC METER

The provisions of Subsection 518.09 shall be followed for the payment of the RSLMC as a Concrete Deck Overlay Protective System.

SECTION 542 - GEOTECHNICAL INSTRUMENTATION

542.01 Description.

The contractor shall furnish all labor, materials, tools and equipment and perform all operations necessary for furnishing, installing, maintaining and monitoring geotechnical instrumentation, reporting, reduction and plotting the data and protecting the instrumentation from damage. The work also includes any additional instrumentation and monitoring required as part of the response actions.

The geotechnical instrumentation monitoring data will be utilized by the contractor to ascertain conformance with specified criteria and to indicate whether construction procedures and methods require modification in order to assure the safe and secure execution of work.

The implementation of the monitoring program specified herein shall not relieve the contractor of its sole responsibility to ensure that the work proceeds in a safe and secure manner and in conformance with the Contract Documents. The contractor shall install and monitor such additional instrumentation, as necessary to fulfill his responsibility.

Settlement points are fixed markers placed on structures. All settlement points are monitored by optical survey methods to determine vertical displacements, if any occur during construction.

A licensed land surveyor, registered in the State of New Jersey shall provide for layout and verification of all settlement points, elevations and locations.

542.02 Materials

Settlement points shall be used to monitor vertical and horizontal deformations as specified herein. The minimum number of settlement points at structure locations shall be as specified in Table 1.

TABLE 1
Minimum Requirements for Settlement Points

Structure Location	Settlement Points
Refrigeration Building	6
14th Street Viaduct Bent 15 Foundation	4
14th Street Viaduct Bent 17 Foundation	4
14th Street Viaduct Bent 19 Foundation	4
14th Street Viaduct Bents 20 to 24 Foundation	4*
14th Street Viaduct Bent 26 Foundation	4

*at each bent location

Note: A minimum of one (1) settlement point is required at each corner of the structure. The actual locations shall be approved by the Engineer prior to installing settlement points.

The contractor shall submit material to be used for settlement points. The settlement points shall be of a material that allows a survey level rod to sit on a flat head. Chisel cuts or paint markings on structures shall not be allowed.

The following type of settlement point shall be acceptable to monitor deformation:

Settlement point shall consist of a 9.3 mm diameter x 50 mm long stainless steel socket head cap bolt, screwed into a 9.3 mm diameter x 25 mm long tamp in screw anchor. A 100 mm or longer bolt may be used where overhanging obstructions prevent the placement of the level rod on the settlement point. The longer bolt shall be replaced by a 50 mm long bolt when readings are not being taken.

The settlement point shall be installed typically into vertical surfaces of buildings and structures. Where removal and patching is not required after construction, the bolts may be installed with epoxy or polyester adhesive in lieu of tamp in screw anchors.

542.03 Submittals.

1. Within 30 days after notice to proceed the contractor shall submit to the Engineer manufacturer's product data to review.
2. Within 30 days of notice to proceed the contractor shall submit to the Engineer for review, the resumes of the surveyors to perform the work.
3. Within 30 days of notice to proceed the contractor shall submit to the Engineer for review, the step by step procedure for installing the type of instrument. The installation shall be as per manufacturer's recommendations.
4. A detailed step by step procedure for conducting optical survey measurements to the specified accuracies, including types of surveying equipment as specified herein.
5. Before any instrumentation installation, submit working drawings showing the location and elevation of settlement points, as well as a benchmark to be used outside of construction operations along with its elevation.
6. Within 5 days after installing each instrument, the contractor shall submit to the Engineer an installation record sheet for that instrument, including its as-built location and reference elevation as specified herein.
7. The contractor shall submit to the Engineer weekly monitoring reports for the duration of construction activities at structure locations shown on Table 1.

542.04 Schedule of Work

Settlement points shall be installed on existing structures and formal initial readings made 10 working days prior to performing construction work in the affected area. Monitoring at selected points in active construction sites, generally weekly, but not less frequently than once per month shall be required.

Settlement points shall be protected from damage due to construction operations. Access shall be maintained to the monitoring points where necessary to assure that the monitoring points will be monitored at frequencies specified.

542.05 Instrument Monitoring

The contractor shall be responsible for all monitoring. The contractor shall obtain initial readings on all settlement points. The initial readings shall be proven by taking three separate readings on each instrument and yielding consistent results.

Use standard survey methods for instrument readings as specified for survey control. Survey control shall be defined as a system of precise field measurements of the types and kinds specified herein, utilizing suitable methods and equipment and utilizing qualified personnel, for determination of elevations, coordinates and distances for the prosecution of this work. Obtain initial and subsequent elevations of instruments by running circuits started and closed at benchmarks.

542.06 Monitoring Data

The contractor shall submit to the Engineer monitoring data within 24 hours of readings being taken.

The contractor shall submit a weekly interpretive report. The report shall include a data summary of all instruments monitored. The weekly report shall state whether a threshold response value or limiting response value had been exceeded. The weekly report shall be submitted to the Engineer within 48 hours of the last day of the weekly reading cycle.

Plots of settlement data at monitoring points shall show absolute vertical settlement versus time and include incremental settlement versus time.

542.07 Purpose of Instrument Monitoring

The geotechnical instrumentation monitoring is to provide reliable information to assess the impact of construction activities on structures. To permit timely implementation of proper remedial measures when and as required to prevent damage to structures. Remedial measures may include modification to construction procedures. To document structure movement if any that may occur as a result of construction activities.

542.08 Response Levels:

The Engineer shall interpret the geotechnical instrumentation monitoring report provided weekly by the contractor. Interpretation shall include correlation between instrumentation data and specific construction activities. Instrumentation data shall be evaluated to determine whether the response to construction activities is reasonable.

The Review and Alert levels for instrumentation to monitor the work are specified in Table 2 and are the differences between the measured values at a given time and the corresponding baseline reading. These values shall be defined collectively as response values. The actions associated with these response values are defined herein. Plans for such actions are referred to as plans of action and actual actions are referred to as response actions. Response values are subject to adjustment by the Engineer as indicated by prevailing conditions or circumstances.

If a Review level is reached, the contractor shall:

a) Meet with the Engineer to discuss the need for response actions.
b) Submit a detailed specific plan of action if directed by the Engineer during the above meeting. Within 24 hours of receiving instrumentation data indicating that a Review level has been reached the contractor shall submit a detailed specific plan of action.
c) Install additional instrumentation as directed by the Engineer.

If directed by the Engineer, the contractor shall implement response actions within 24 hours of submitting a detailed specific plan of action, so that the Alert level is not reached.

Take all necessary steps so that the Alert level is not exceeded. Contractor may be directed to suspend activities in the affected area with the exception of those activities necessary to avoid exceeding the Alert Levels.

If an Alert level is reached, the contractor shall:

a) Meet with the Engineer to discuss the need for response action(s).
b) If directed by the Engineer during the above meeting, that a response action is needed, within 24 hours of receiving instrumentation data indicating that an Alert Level is reached, the contractor shall submit a detailed specific plan of action, based as appropriate on the generalized plan of action submitted previously as specified herein.
c) If directed by the Engineer implement response action(s) within 24 hours of submitting a detailed specific plan of action, so that the Alert Level is not exceeded.

When in the Engineers judgment the instrumentation data indicates potentially damaging structure displacements, the contractor shall modify the construction procedure and take other action, as approved by the Engineer at no additional cost to the Contract to reduce structure displacement.

TABLE 2
Review and Alert Levels

Structure Location	Review Level, mm	Alert Level, mm
Refrigeration Building	8	15
14th Street Viaduct Bent 15 Foundation	8	15
14th Street Viaduct Bent 17 Foundation	8	15
14th Street Viaduct Bent 19 Foundation	8	15
14th Street Viaduct Bents 20 to 24 Foundation	8	15
14th Street Viaduct Bent 26 Foundation	8	15

542.09 Quality Control

A. Regulatory Requirement: National Institute of Standards and Technology (NIST).
B. Provide certifications that indicate that the test equipment used for this purpose is calibrated within the past 6 months and maintained in accordance with the test equipment manufacturer's calibration requirements and that, where applicable calibrations are traced back to NIST.
C. Qualifications of Contractors Instrumentation Personnel:

The person in responsible charge of the surveyors shall be a Registered Professional Land Surveyor in the State of New Jersey with a minimum of 3 years of experience in deformation measurements of the type and accuracies specified herein. The field survey party chief shall have a minimum of one year of experience in deformation survey measurements of the types and accuracies specified herein.

D. Contractor shall:
    a. Furnish, install and monitor at the frequencies specified herein, all components of instrumentation that are to be installed during construction.
    b. Protect from damage and maintain instrumentation and monitoring points.
    c. Coordinate with the Engineer to verify consistency of collected data.
    d. Interpret the data and evaluate conformance with the requirements of the Contract Plans and Specifications.
E. Tolerances
    a. Establish the elevation of the benchmark to 0.0003 meters.
    b. Establish the elevation of the settlement reference point to the nearest 0.0003 meters.
    c. Establish the initial coordinates of the settlement points to the nearest 0.003 meters.
    d. Record the subsequent elevations to the nearest 0.0015 meters.

542.10 Project Conditions

Contractor shall protect from damage due to construction operations, weather, traffic and vandalism all instrumentation, survey reference and control points**.**

Contractor shall, **e**xcept where otherwise specified, maintain access to all monitoring facilities. Temporary stoppage of work may be required to monitor and take readings.

542.11 Method of Measurement

Geotechnical Instrumentation will not be measured and payment will be made on a lump sum basis

542.12 Basis of Payment.

Payment will be made under:

Pay Item	Pay Unit
Geotechnical Instrumentation	Lump Sum

SECTION 543 - DRILLED SHAFT FOUNDATIONS

543.01 Description.

This work shall consist of the construction and testing of drilled shaft foundations for support of the 14th Street Shoulder Structure and Overhead Sign Structures No. 1 and No. 2 where indicated on the Contract Documents. The testing of the drilled shafts shall include Osterberg Cell Load Testing (O-Cell) and Crosshole Sonic Logging (CSL). The Contractor shall complete one test boring at each drilled shaft location and submit to the Engineer for approval prior to any construction and fabrication of materials. The test boring shall include rock coring and extend to a minimum depth of 3.0 meters below estimated bottom of rock socket. Completed test boring logs approved by the Engineer shall be included in the Drilled Shaft Work Plan submittal. The drilled shafts shall be installed using permanent steel casing in the locations and to the depths shown on the Plans. The length of drilled shaft foundation shall be adjusted in the field as required. This work shall include furnishing of all equipment, materials and labor necessary for constructing and testing drilled shaft foundations. This work shall also include excavation, installing permanent steel casings with carbide teeth, soil and rock drilling, pre-drilling, control slurry (polymer or bentonite) if the contractor chooses, drilling to penetrate through obstructions, cutting and removal or drilling through existing timber piles, installing steel reinforcement, concrete, finished shaft preparation, and disposal of drill cuttings, excavated soil, rock, and slurry. Existing timber piles shall not be cut or disturbed except those piles that conflict with the drilled shaft foundations. This work shall be in accordance with the Contract Plans and Specifications, and in compliance with requirements of NJDOT, and as directed by the Engineer.

Foundation excavation of Regulated Waste and Regulated Waste, Hazardous as shown on the Contract Documents or as directed by the Engineer, shall be performed in accordance with Special Provisions Subsection 202.04 Management of Regulated Waste, Subsection 202.13 Off-Site Management of Regulated Waste and Off-Site Management of Regulated Waste, Hazardous, and Subsection 212.06 Soil Erosion and Sediment Control Measures.

MATERIALS

543.02 Materials.

Portland cement concrete shall be Class A concrete conforming to Section 914. Class A concrete for Drilled Shaft Foundations shall have a minimum slump of 200 +/- 25 mm. The Contractor shall submit a mix design to the Engineer for approval prior to construction. The Contractor shall perform slump loss tests as directed by the Engineer to verify that the concrete is workable with 100 mm minimum slump at all times during concreting operations.

Steel casing shall meet the requirements of ASTM A252 Grade 2 or 3. Casings shall have inside diameters not less than indicated shaft sizes. Casings shall be seamless and fabricated of sufficient strength to withstand drilling and handling stresses, concrete pressures, and surrounding earth or fluid pressures and shall have a minimum thickness as indicated on the Plans. No appurtenances, reinforcement, or holes shall be added to the casing without the approval by the Engineer.

Shop and field welding shall conform to Section 503.

Steel reinforcement shall meet the requirements of Section 915.01. The steel reinforcement shall be in accordance with the sizes, spacing, dimensions, and the details as indicated on the Plans.

If the contractor chooses to use control slurry, the slurry used for construction of the shafts shall have the following properties:

Item To Be Measured	Results At 19 Deg. C.	Test Methods
Density, Before Concreting, For Slurry 0.3 Meters From Shaft Bottom	993 to 1009 kg/m^3 Polymer Slurry 1025 to 1105 kg/m^3 Bentonite Slurry	API 13B, Section 1 (Mud Balance) ASTM D4380
Marsh Funnel Viscosity	28 to 45	API 13B,

For Entry Slurry And Shaft Slurry	Sec/L (Marsh Funnel and Cup)	Section 2
Sand Content By Volume, Before Concreting For Slurry 0.3 Meters From Shaft Bottom	1% Max, Polymer Slurry 4% Max Bentonite Slurry	API 13B, Section 4 (Sand Screen Set) ASTM D4381
Ph, During Excavation	8 To 11	API 13B, Section 6 (Paper Test Strips or Glass-Electrode Ph Meter)

The controlled slurry shall be obtained from sources approved by the Engineer. The slurry shall be mixed, stored, and transported using equipment made for these purposes.
The Contractor and/or specialized shaft Subcontractor shall provide any physical or chemical treatment of the water or the slurry that is necessary to meet the above specifications.

EQUIPMENT

543.03 Equipment.

Drilled shafts shall be installed with approved modern equipment. The proposed shaft installation equipment shall include the drilling capability as needed to work in a congested urban area beneath and adjacent to existing buildings and structures. In areas of existing occupied buildings, the equipment shall be designed and/or operated in such a manner so as not to introduce excessive vibration or exhaust fumes to the surrounding buildings or other occupied areas adjacent to the work area. The methods and equipment shall be subject to the approval of the Engineer, and approval shall be secured before mobilization. Approval by the Engineer shall not relieve the Contractor and/or specialized shaft Subcontractor of the responsibility to provide equipment with sufficient power, downward thrust and torque, materials, and methods to adequately perform the work in a safe, timely, workmanlike manner. Approval shall not be reason to hold the State and/or the Engineer responsible for the Contractor's or specialized shaft Subcontractor 's failure to perform the work.

Shaft installation equipment shall be capable of installing shafts using the permanent casing method as indicated on the plans. Wet rotary drilling methods shall employ sufficient fluid pressure to provide complete removal of the cuttings from the hole. The Contractor and/or specialized shaft Subcontractor shall provide a weighted bar with slender tip and attached to a thin cable with calibrated depth marker, metal tape, or other approved equipment suitable for confirming the completeness of de-sanding and muck bucket cleaning operations.

If the Contractor and/or specialized shaft Subcontractor chooses to use control slurry he shall provide all materials and equipment necessary for production of polymer or bentonite slurry in conformance with the material specifications and all equipment required for proper disposal of the slurry and excavated soil and rock.

The Contractor and/or Specialized Shaft Subcontractor shall provide all equipment, including concrete pumps or tremie pipes required for the placement of concrete into the shafts in accordance with the Plans and Specifications. The minimum inside diameter of concrete pump lines or tremie pipe shall be greater than six times the maximum aggregate size.

CONSTRUCTION

543.04 Work Plan and Calculations.

A. Work Plan. At least 30 calendar days prior to the proposed start of drilled shaft installation and in accordance with the requirements in Subsection 105.09, the Contractor shall submit six copies of the following items to the Engineer for approval:

1. Records documenting a minimum of five (5) years experience in shaft construction and a minimum of five (5) previous shaft construction jobs of similar or greater scope. Name and experience record of drilled shaft superintendent or foreman in responsible charge of drilled shaft operations. Names of individuals (with address, affiliation, title, and telephone number) who can attest to the adequacy of the work done on these projects shall also be submitted.

2. Equipment list and size of proposed equipment including cranes, drills, augers, bailing buckets, final cleaning equipment, de-sanding equipment, slurry pumps, concrete pumps, casing, slurry sampling and testing equipment.
3. Details of equipment and procedures for shaft installation, including drawings showing consecutive steps of shaft installation and drawings with measurements showing that the Contractor and/or specialized shaft Subcontractors proposed equipment can perform the specified work. Included in the drawings shall be shown the areas that are planned to be used for staging, layout drawings showing the proposed sequence of shaft installation, details of placement, splicing, and centering devices for steel reinforcing.
4. Mill certificates stating the chemical composition, yield point, and ultimate strength of the steel, concrete mix design and documentation from an independent laboratory certified by the State of New Jersey and approved by NJDOT showing that the mix design conforms to the submitted mix and meets the strength requirements set by the Engineer. The mix design and documentation should be submitted for approval at least 45 calendar days prior to use.
5. Details of slurry including proposed methods of mixing, placing, circulating, and removal of cuttings from the slurry.
6. Details of environmental control procedures.
7. Details of shaft excavation and casing installation methods.
8. Details of proposed methods to clean shaft after initial excavation.
9. Procedures for excavation control and removal of spoils in accordance with the Contract Documents including the Special Provisions for Management of Regulated Waste.
10. Details of shaft steel reinforcement, including methods to ensure centering and required cover, reinforcement integrity during placement, placement procedures, and support of reinforcement.
11. Details of concrete placement including proposed operational procedures for concrete tremie or pump including initial placement, raising during placement, and overfilling of the shaft concrete, and provisions to ensure final shaft cutoff elevation.
12. The qualification records of the testing organization to perform the Osterberg Cell Load Test and the Crosshole Sonic Logging of the drilled shaft foundations.
13. Details of procedures for performing the Osterberg Cell Load Test and the Crosshole Sonic Logging of the drilled shaft foundations.
14. Details of test borings and boring logs completed at each drilled shaft location.

The Engineer will evaluate the drilled shaft work plan for conformance with the Contract Documents and these Special Provisions. Within 20 working days after receipt of the work plan, the Engineer will notify the Contractor of any additional information required and/or changes that may be necessary in the opinion of the Engineer.. Any part of the work plan that is unacceptable will be rejected and the Contractor shall submit changes agreed upon for reevaluation.

The Engineer will notify the Contractor within seven working days after receipt of proposed changes of their acceptance or rejection. All approvals given by the Engineer shall be subjected to trial and satisfactory performance in the field.

Actual shaft location data shall be submitted to the Engineer within one working day after a shaft is installed. The Contractor and/or specialized shaft Subcontractor shall provide the Engineer's on-site representative with written tabulations of the following information:

1. Shaft location and number.
2. Elevation of top of shaft measured to the nearest 10 millimeters.
3. Deviation from design plan location measured to the nearest 3 millimeters.
4. Plumbness (deviation from vertical).

Within seven working days after the completion of installation of all the shafts, and before removing the drilled shaft installation equipment from the site, the Contractor shall provide the Engineer with a plan certified by a Professional Land Surveyor registered in the State of New Jersey showing the as-built location of all drilled shafts installed to the tolerances indicated in these specifications and as shown on the plans.

The Contractor shall submit Osterberg Cell Load Test results and the Crosshole Sonic Logging results within three working days after completion of the tests.

B. Demonstration Drilled Shaft. Demonstration drilled shafts must be undertaken for the purpose of demonstrating that the Work Plan methodology will achieve the specified drilled shaft acceptance criteria.

1. The demonstration drilled shaft shall be installed at the location as shown on the Plans, and shall be the first drilled shaft constructed.
2. The length of the demonstration drilled shaft shall be equal to or greater than as shown in the plans. In addition to the demonstration drilled shaft being installed in accordance with the approved Work Plan, the following criteria or requirements must be complied with:

    a. The Engineer may approve changes or modifications to the drilled shaft installation method, at the Contractor's request, in order to successfully install the demonstration shaft to the required acceptance.
    b. An Osterberg Cell Load Test, in accordance with the provisions specified in Subsection 543.06, shall be utilized for the demonstration shaft installed. The O-Cell load test shall be loaded to the test load shown on the plans. The result of the load test will be reviewed by the Engineer to both determine the acceptance of the demonstration shaft and to verify the required rock socket excavation depth at that location.
    c. The Contractor shall revise, modify or amend the Work Plan and or type of equipment that is to be used in accord with the comments of the Engineer after such review, prior to the commencement of production drilled shaft installation.
    d. Upon acceptance of the test shaft by the Engineer, the drilled shaft shall be left in a condition suitable for use as a production shaft in the finished structure.

3. The successful installation of the demonstration shaft shall be judged by its acceptance. The result of the O-Cell load test, performed in accordance with Subsection 543.06 and the Crosshole Sonic Logging, in accordance with the provisions specified in Subsection 543.07 shall be used to determine the acceptance. The Engineer shall be the sole judge in determining the acceptance of the demonstration shaft.
4. In the event that the method used to install the demonstration drilled shaft produces an unacceptable shaft because of damage, failure to advance the permanent casing through obstructions, mislocation, misalignment, failure to install the shaft to the proper bearing stratum or the results of the Crosshole Sonic Logging indicate defects, the Engineer may order, at no additional cost to the Contract, the installation of an additional demonstration drilled shaft. The unaccepted demonstration drilled shaft will not be measured for compensation.
5. The approved Work Plan shall be revised, modified or amended by reason of any change or modification to the installation method found necessary to install the demonstration drilled shaft to required acceptance criteria. Before any production drilled shaft work begins, the revised modified or amended Work Plan shall be resubmitted for review by the Engineer for approval.

If and when approved, the revised, modified or amended Work Plan shall constitute the Work Plan and shall be followed in the installation of any additional demonstration drilled shafts and production shafts. If as a result of necessity, during production shaft installation, the Engineer finds that the approved Work Plan needs to be revised, modified or amended, such revisions, modifications or amendments shall be submitted for review and approval prior to continuing production shaft installation. The revised Work Plan shall then be re-submitted for approval as the Work Plan for the installation of the remaining demonstration drilled shafts and production drilled shaft foundations.

The Contractor shall demonstrate the adequacy of proposed methods and equipment during construction of the demonstration drilled shaft. Failure to demonstrate the adequacy of methods or equipment to the Engineer is cause for the Engineer to require appropriate alterations in equipment and/or method by the Contractor to eliminate unsatisfactory results. Any additional testing required to demonstrate the adequacy of methods or equipment shall be at the Contractor's expense. No changes in methods or equipment will be made after initial approval without the consent of the Engineer.

543.05 Shaft Drilling.

The Contractor shall perform the excavations required for the shafts through whatever materials are encountered, including foundation excavation of Regulated Waste and foundation excavation of Regulated Waste, Hazardous, obstructions and existing timber piles to the dimensions and elevations shown in the plans or otherwise required by Contract Documents and these Special Provisions. The Contractor's methods and equipment shall be suitable for the intended purpose and the materials encountered. The Contractor shall provide equipment capable of constructing shafts to a depth equal to the deepest shaft shown in the plans plus 3 meters or plus three times the shaft

diameter, whichever is greater, except when the plans instruct the Contractor to provide equipment capable of constructing shafts to a greater depth.

An approved fixed template, adequate to maintain shaft position and alignment during all excavation and concreting operations, shall be provided for all drilled shafts.

The Contractor shall install a permanent steel casing for the full depth of the drilled shaft at the locations shown on the Plans. The minimum casing length and thickness shall be as shown on the Plans. The permanent casing shall be installed by use of either rotary drilling or spinning the casing. Driving of permanent casing is not permitted. Predrilling with slurry and/or over-reaming to the outside diameter of the casing will be allowed to depths equal to the top of any adjacent existing footing. Drilling of an uncased hole below an adjacent existing footing will not be permitted. Installation of the permanent steel casing by vibratory methods will not be permitted.

The Contractor and/or Specialized Shaft Subcontractor shall protect existing utilities to remain within the drilled shaft installation work zone in accordance with the requirements of authorities having jurisdiction over same. The Contractor shall repair or replace any construction-induced damage to the satisfaction of the governing authority at the Contractor's expense.

The Contractor and/or Specialized Shaft Subcontractor shall employ within his contract bid price, a licensed Professional Land Surveyor, experienced in this type of work, who shall establish lines and grades. The Contractor shall be responsible for the correct location of drilled shafts and keeping a record of drilled shafts installed. A base line and datum elevation have been established for this Contract.

Shafts shall be located and staked by the Contractor and prior to the start of installation work. The Contractor shall maintain all location stakes and shall establish all elevations required.

Unless the accuracy and precision of other methods are demonstrated to the satisfaction of the Engineer, the plan position of the center of each shaft shall be determined by optical survey measurements to a minimum of four points arranged around the shaft casing perimeter at the four compass directions. These measurements are to be geometrically averaged to calculate the best-fit mathematical center of the shaft at the measurement elevation. Then the calculated center of the shaft at the measurement level shall be reduced to calculate the mathematical center of the shaft at the proposed final shaft top elevation by adjustment using the shaft plumbness measurement information.

Existing column bent foundations within five (5) shaft diameters of the proposed shaft location, shall be continuous survey monitoring for horizontal and vertical movement of the existing foundations during shaft construction in accordance with the Contract Documents and Special Provisions Section 542 Geotechnical Instrumentation.

543.06 Construction Tolerances

All shafts shall meet the required construction tolerance criteria and be installed in accordance with the dimensions and lengths as shown on the Plans, or as directed by the Engineer. Drilled shafts not constructed within the required tolerances are not acceptable.

A. The top center of completed drilled shaft shall not vary radially from the plan location by more than 76 millimeters. The top elevation of the drilled shaft concrete shall be no more than 25 millimeters above and no more than 76 millimeters below plan elevation.
B. At the top of the drilled shaft, the reinforcement shall be concentric and not vary in plan distance from the plan position by more than 25 millimeters. After placing all the concrete, the top of the reinforcement shall be no more than 152 millimeters above and no more than 76 millimeters below plan position.
C. The drilled shaft shall not vary from vertical alignment by more than 2.0 percent of its length, as measured at the ground line. The plumbness shall be checked by plumbing the Contractor's extended Kelly Bar with a full size drill bucket when it is down to the bottom of the shaft with an accurate carpenter's level placed against the exposed part of the Kelly Bar, followed by measurements of offset from the Kelly Bar to the permanent casing in four compass directions.

543.07 Slurry

If the contractor chooses, the shafts may be advanced using control slurry to maintain and clean out the excavation. A permanent casing shall be used as shown on the plans. The fluid level inside the hole shall be maintained above the ground water level at all times during installation and cleaning out.

The properties of the premixed slurry must be checked as slurry is introduced and obtain slurry samples at a rate of, four (4) sets within the first eight (8) hours and, when consistent behavior is reached, one (1) set every four (4) hours thereafter, including a final check of a bottom sample just prior to concreting to see that the density and sand

content are within the limits of proper slurry displacement during concreting. Prior to placing concrete in any shaft excavation, the specialized subcontractor shall ensure that contaminated suspensions, which could impair the free flow of concrete from the tremie pipe, has not accumulated in the bottom of the shaft. Samples of the fluid in the shaft shall be taken from the base of the shaft and at intervals not exceeding 3 meters up the shaft, using an approved sampling tool. The density and sand content of the fluid in the shaft excavation shall be in accordance with the slurry specifications in Section 543.02, "Materials." The excavation shall be cleaned by using methods submitted in the drilled shaft work plan and approved by the Engineer in accordance with Subsection 543.04.

If the slurry remains in the hole for more than three hours or if mud caking develops, the hole shall be re-reamed with appropriate new bottom cleaning and slurry testing prior to concreting. Concrete placement in a shaft shall be completed on the same day that the shaft is drilled. Concreting of the shafts shall provide complete filling of the shaft with a minimum of segregation.

All excavated material, slurry and slurry-contaminated materials shall be removed and disposed of off-site in an appropriate manner by the Contractor and/or Specialized Shaft Subcontractor. Disposal of waste and spoil on local streets and in sewers is not permitted.

543.08 Rock Socket

Shafts shall be socketed into rock as shown in the Contract Documents. Minimum rock socket lengths are shown on the plans. Top of rock shall be defined as follows:

A. Material that cannot be drilled with a conventional earth auger and requires the use of rock augers, core barrels, air tools, and/or other methods of hand excavation.
B. The Engineer shall be the sole judge as to when top of rock has been encountered in the excavation, based upon the above criteria. Rock socket lengths shall then be provided below this top of rock elevation as shown on the plans or as ordered by the Engineer.

543.09 Shaft Concrete.

The handling, measuring, proportioning, mixing, and placing of concrete shall conform to Section 501 and this section. Concrete shall be placed only in the presence of the Engineer.

Concrete shall be placed using concrete pump or a tremie pipe from the bottom of the excavation upward so as to avoid segregation. Concrete shall not be allowed to fall freely through slurry or water. Neither air, water, nor slurry shall be injected into the shaft concrete during placement. A disposable foam or rubber plug shall be used in the concrete pump line or tremie pipe to separate the fresh concrete from the slurry at the start of concrete placement. The plug shall be placed in the concrete pump or tremie line at the hopper end, not the discharge end. The plug shall be inserted so that the first flow of concrete pushes the plug out of the pipe and prevents slurry mixing and contamination as the initial concrete travels down the pump or tremie pipe. The concrete pump line or tremie pipe shall consist of a tube constructed in section having flanged couplings fitted with gaskets. The means of supporting the concrete pump line or tremie pipe shall be such as to permit free movement of the discharge end over the entire top of the concrete and to permit its being lowered rapidly when necessary to choke off or retard the flow. The tremie, if used, shall be filled by a method that prevents washing of the concrete. The discharge end shall be completely submerged in concrete, a minimum of 5 feet is required between the bottom of the tremie pipe and the top of concrete at all times after initiation of concrete placement flow and the concrete line shall contain sufficient concrete to prevent any water entry. Maintain the concrete level at the top of the drilled shaft until the concrete has set.

A. If concrete flow is halted and the concrete line's discharge end is for any reason raised out of the shaft concrete, flow shall be reinitiated only after fully recharging the concrete line with fresh concrete by: Inserting a foam or rubber plug or pig into the concrete line at the concrete hopper end.
B. Placing the discharge end approximately 150 millimeters above the top of the shaft concrete.
C. Resuming concrete flow, recharging the pump line or tremie pipe and depositing what will be classified as waste concrete on the top of the previously placed shaft concrete.
D. Discharging waste concrete until the line is fully recharged with fresh concrete and the pig is pushed completely through the line.
E. Without halting the flow of fresh concrete plunging the discharge end of the concrete line into the shaft concrete to within 150 millimeters or less of the shaft bottom or to a level as directed by the Engineer.
F. Continuing concrete placement without further interruption.

G. Placing a final volume of additional concrete in the shaft no less than the volume of waste concrete placed to recharge the line in the process of resuming concrete flow.

This procedure shall be applied without exception as necessary to avoid injecting any air, any water, any slurry, or any concrete that has flowed through a line filled with air, water, or slurry into the shaft concrete. The elapsed time from beginning of concrete placement in the shaft to the completion of placement shall not exceed 2 hours, unless the Engineer approves a concrete retarder.

Final concrete placement elevation details shall be as specified herein for shaft top preparation. For at least 48 hours after shaft concrete has been placed, no construction operations that would cause soil movement adjacent to the shaft shall be conducted.

A hole shall not be progressed within five drilled shaft diameters of a previously installed drilled shaft until the concrete has been in place for a minimum of 24 hours.

543.10 Shaft Construction Timing.

Every effort shall be made by the Contractor in planning, coordinating, and carrying out the work to minimize the time between the start of excavation of rock sockets (i.e. the uncased portion of the drilled shaft below the top of rock) and completion of shaft concrete placement. Each step in the process of initially drilling, satisfactorily cleaning the shaft bottom, placing reinforcement, and completing concrete placement shall be coordinated to avoid delays during or between each work step. In general, the time between initial excavation into uncased rock socket zones and completion of concrete placement is expected to be twelve (12) continuous hours or less.

For cases where twelve (12) or more continuous hours elapse between initial excavation into uncased bearing zones and commencement of concrete placement, any reinforcement already placed in the shaft shall be removed, the uncased shaft side walls shall be prepared by roughening or over-reaming as specified elsewhere herein, the shaft bottom shall be satisfactorily cleaned, reinforcement immediately placed in the shaft, and concrete placement immediately commenced.

Shaft holes shall be fully covered and properly secured when not being worked on and at completion of shaft concrete placement.

543.11 Reinforcement Construction.

Reinforcement shall be free of mud, oil, or coatings other than that as required on the Plans. The reinforcement cage shall be designed as a structural element and internally braced to retain its configuration throughout installation and placement of concrete.

A. Placement. Completely assemble and place as a unit the cage of reinforcing steel, consisting of longitudinal bars, ties, and cage stiffener bars, immediately after the Engineer inspects and accepts the shaft excavation and immediately prior to placing concrete. Tie all intersections of drilled shaft reinforcing steel with cross ties or "figure 8" ties. Use double strand ties or ties with larger tie wire when necessary. The Engineer will give final approval of the cage construction and placement subject to satisfactory performance in the field.

B. Splices. Make splices in reinforcement as shown on the Plans unless otherwise approved by the Engineer. If the bottom of the constructed shaft elevation is lower than the bottom of the shaft elevation in the plans, extend a minimum of one-half of the longitudinal bars required in the upper portion of the shaft the additional length. Continue the tie bars for the extra depth, spaced on 600 millimeter centers, and extend the stiffener bars to the final depth. The Contractor may lap splice these bars or use unspliced bars of the proper length. Do not weld bars to the planned reinforcing steel unless shown in the Contract Documents.

C. Support and Alignment. Tie and support the reinforcing steel in the shaft so that the reinforcing steel will remain within allowable tolerances as specified herein. Use concrete wheels or other approved non-corrosive spacing devices near the bottom and intervals not exceeding 3.0 meters up the shaft to ensure concentric spacing for the entire length of the cage. Do not use block or wire type spacers. If reinforcing bar support chairs are used to center the reinforcing steel in the shaft, the support chairs shall be epoxy coated. Use a minimum of one spacer per 750 millimeters of circumference of cage with a minimum of three at each level. Provide concrete spacers, , at the bottom of the drilled shaft reinforcing cage to maintain the specified distance between the bottom of the cage and the bottom of the shaft. Use the number of bottom spacers as required to maintain the specified distance. Use spacers constructed of approved material equal in quality and durability to the concrete specified for the shaft. The Engineer will approve spacers subject to satisfactory performance in the field. Check the elevation of the top of the steel cage before and after placing the concrete. If the reinforcing cage is not maintained within the specified tolerances,

correct it as directed by the Engineer. Do not construct additional shafts until modifying the reinforcing cage support in a manner satisfactory to the Engineer.

543.12 Shaft Rock Socket Preparation.

Shaft rock sockets shall be prepared for concrete placement by roughening with approved drill tools or by over-reaming with approved tools as directed by the Engineer. Sidewall roughening tools shall include but not be limited to properly designed and approved drum tools fitted with numerous short, stiff, large diameter wire rope pieces fastened to and projecting outward from the drum. Approved roughening tools shall be rotated vigorously against the full rock socket area as directed by the Engineer to entirely remove any accumulated slurry cake, scale off any loose rock fragments, and roughen the finished rock socket surface.

543.13 Shaft Top Preparation – Waste Concrete.

The top most concrete placed in the shaft shall be considered waste concrete and shall be either:

1. Pushed upward and ejected completely out of the top of the casing and wasted as final concrete is placed.
2. Pumped upward to a level at least 600 millimeters clear distance above the plan shaft top level and allowed to cure in place for removal later.

Waste concrete shall be considered to be the top 600 millimeters of initial concrete placed, plus the height of any additional volume of waste concrete deposited in the shaft where concrete placement was halted and restarted, plus any additional amount necessary to produce full strength concrete, non-segregated concrete at the plan shaft top level.

Where waste concrete Alternative No. 1 is selected, waste concrete must be allowed to evenly overflow the full top circumference of the casing, and may not be channeled or bleed off by notches or holes cut in the casing top. Any fresh concrete in the casing at a level above the plan shaft top level after ejecting all waste concrete may be dipped or pumped out to the plan top elevation while still plastic by methods and equipment approved by the Engineer, or allowed to cure in place for removal later. In no case will dipping or pumping to remove the top waste concrete be permitted.

Final Shaft Top Preparation: Final shaft top preparation may commence only once the drilled shaft concrete obtains an average unconfined compression strength of at least 17 MPa, or, in lieu of concrete strength testing, beginning seven (7) full days after completion of concrete placement. Final top preparation steps shall consist of:

1. Cutting off any extra casing above the top of casing elevation.
2. Cutting off any cured overpour concrete to the plan shaft top elevation by approved methods.
3. Dressing the final shaft top surface.
4. Verification by the Engineer that the exposed concrete consists of full strength concrete with a typical, non-segregated mortar and aggregate distribution.
5. Approved non-destructive strength testing by the Contractor where required by the Engineer to verify that concrete has full design strength.
6. Removal of additional concrete below the plan shaft top level as necessary to reach full-strength, non-segregated concrete.
7. Preparation of the shaft top key recess.
8. The shaft casing and/or top of concrete shall not extend above the top of rail.

543.14 Osterberg Cell Load Test.

A. Description.

The work of this Subsection consists of the requirements for Osterberg cell (O-Cell) load testing on selected drilled shaft foundations prior to installing production shaft foundations, as shown on the Contract Drawings and as directed by the Engineer. The instrumentation for the above tests shall be installed on the selected drilled shafts as designed by the experienced independent testing firm approved by the Engineer. The O-Cell load tests are non-destructive tests, and the O-Cell tested shafts shall be left in a condition suitable for use as production shafts in the finished structure. The purpose if the load test is to determine the friction/adhesion resistance of the rock socket. The Contractor shall allow up to four weeks after completion of the final load test to allow the analysis of the load

test data and revisions to foundation lengths and installation procedures required, based on the results of the load test.

Prior to shaft excavation, the Contractor shall perform a test boring at the Osterberg Cell Load Test shaft location. The test borings and O-Cell load testing should be performed in the presence of the representative of the Engineer. Boring logs shall be submitted to the Engineer as part of the work plan. The instrumentation locations shown on the approved work plans are subject to change following the completion of the Demonstartion Drilled Shaft excavation, as directed by the Engineer.

The work shall consist of furnishing all materials and labor necessary for conducting Osterberg cell load tests and reporting the results. The Contractor shall supply all material and labor necessary prior to, during and after the load test as hereinafter specified.

B. Test Borings at Drilled Shaft Locations.

Prior to shaft excavation, the Contractor and/or approved Specialized Shaft Subcontractor, shall perform test borings at each drilled shaft location and Demonstration Drilled Shaft locations. The test borings shall extend a minimum of 3 m below the tip elevation of the drilled shaft and provide detailed information on the underlying bedrock. Information and sampling of the soil overburden shall be obtained using standard penetration test techniques and equipment in accordance with ASTM-American Society for Testing and Materials, including ASTM D 420 and ASTM D 4220.

The drilling shall be done with standard core drilling machinery of the rotary type with either screw or hydraulic feed, actuated by an internal combustion engine and equipped with N-series size double-tube or split core barrel and diamond bits, capable of producing cores with a minimum diameter of 54 mm. Casing shall be used in the overburden soil and be seated into the bedrock to prevent caving or seepage from the overburden into the hole from which a core is to be taken. Drilling shall be continued in runs not exceeding 1.5m until the total depth required by the Engineer has been reached. It is important that the percentage of recovery of the cores shall be as large as possible and the Contractor shall regulate the speed of his drill and remove the core frequently to maintain a maximum percentage of recovery, special care being taken where the character of rock being penetrated is uncertain.

The Contractor shall exercise particular care in recording water losses, rod jets, rod drops, changes in rotation speed and other unusual coring experience that will serve to supplement the core record and data regarding the nature and the extent of any fracturing, soft seams, voids and any other characteristics of the formations being cored. The test boring logs shall include rock description, Rock Quality Designation (RQD), and Rock Core Recovery. The Contractor shall obtain soil samples above rock.

The Contractor shall submit the qualifications of the test boring Subcontractor to the Engineer for approval. The resultsof the test borings shall be submitted to the Engineer for approval prior to any construction and fabrication of materials.. Completed test boring logs approved by the Engineer shall be included in the Drilled Shaft Work Plan submittal.

C. Quality Assurance.

Reference Standards: American Society for Testing and Materials (ASTM): D 1143, Method of Testing Piles Under Static Axial Compressive Load.

The Contractor shall employ an independent testing firm, which has successfully completed no less than three Osterberg Cell load tests to design and perform the testing and report preparation. The qualifications of the testing firm shall be submitted to the Engineer for approval.

D. Submittals.

1. The Contractor shall submit a testing plan, which outlines the test set-up, data collection system and procedures to the Engineer for approval.
2. Load test report.

E. Materials.

1. Osterberg Cell: The Contractor shall provide Osterberg cells as required for the load test program.

2. The Osterberg cells to be provided should have a test capacity of three times the design capacity (**NOTE:** Design capacity equals 8600 kN per shaft) in each direction and shall be equipped with all necessary hydraulic lines, fittings, pressure source, pressure gauge, strain gauges, and telltale devices.
3. The Contractor shall supply all equipment and materials required to install and monitor the Osterberg cell and strain gauges, conduct the load test, and monitor the reference system. The Contractor shall also supply the materials for construction of a stable beam system for monitoring movements of the drilled shaft during testing, supported at a minimum distance of three diameters from the center of the drilled shaft to prevent disturbance of the reference system. The Contractor shall construct the aforementioned stable reference beam system.

F. General Procedures.

The Contractor shall construct the drilled shaft selected for testing as shown on the Plans using the approved drilled shaft installation techniques. The Osterberg cell, hydraulic supply and other attachments shall be assembled.

When the test drilled shaft has been constructed, inspected and accepted by Engineer, a seating layer of concrete shall be placed by an approved method, in the base of the drilled shaft. The Contractor shall then install the Osterberg cell in the test-drilled shaft (while the concrete is still fluid) so that the Osterberg cell is resting firmly in the concrete. The Contractor shall use the utmost care in handling the placement/test equipment assembly so as not to damage the instrumentation during installation. The Contractor should provide a cage designed for the Osterberg cell to be mounted on it.

After seating the Osterberg cell assembly, the drilled shaft shall be concreted in the manner specified for production drilled shafts from the bottom of the rock socket to the top of rock elevation only. If approved by the Engineer, the Contractor may use high early cement (Type III) in the mix to reduce the time between concrete and mixing. At least six concrete compression test cylinders shall be molded from the concrete used in the test-drilled shaft. At least one of these cylinders shall be tested prior to the load test and at least two cylinders shall be tested on the day of the load test. The Osterberg cell test shall not commence until the minimum concrete design compressive strength if 21 MPa has been achieved.

No additional drilled shaft installation shall take place until the Osterberg cell load test has been successfully completed. If during the period required to perform the load test, the test apparatus shows signs of negative effects due to construction activities, such activities shall cease immediately.

After the completion of the load test, and at the direction of the Engineer, the Contractor shall grout the interior of the Osterberg cell using grouting techniques approved by the Engineer. The drilled shaft shall then be concreted to the required top of shaft elevation in accordance with the approved work plan.

After the completion of the load test, and at the direction of the Engineer, the Contractor shall remove any equipment, material and waste, which are not to be a part of the finished structure.

G. Post-Test Grouting Procedures.

The Contractor shall grout the interior of the Osterberg Cell and annular space around the outside of the Osterberg Cell in order to reconnect the upper and lower shaft sections. The grout shall be as specified in 914.03 of these Specifications and shall consist of Portland cement and water only and shall not include sand.

The grout shall be fluid and pumpable. An initial mix consisting of four to six gallons of water per 43kg bag of cement is recommended with adjustments to water to obtain the desired consistency. The mixing should be thorough to ensure that there are no longer lumps of dry cement. The grout shall be passed through a window screen mesh before pumping. The Contractor shall provide an accurate flow meter to measure the amount of grout from the pump.

Grouting Osterberg Cell: Connect grout pump outlet to one hydraulic line of the Osterberg cell. Open the other line to allow hydraulic fluid to bleed. Pump grout through hydraulic line while collecting the effluent from the bleed line. Monitor characteristics of effluent material and when it becomes equivalent to grout being pumped, stop pumping, take three samples of grout for compression testing at 28 days.

Grouting Annular Space Around Osterberg Cells: Pump water to “blow out” the bottom caps of the plastic grout lines (two on each drilled shaft). Pump the fluid grout through one of the plastic pipes until grout is observed flowing from the second grout pipe or until 1.5 times the theoretical volume has been pumped. If no return of grout is observed from the second grout pipe, transfer the pump to the second pipe and pump grout through it until 1.5 times the theoretical volume has been pumped. Take three samples of each type of grout for compression testing at 28 days. The entire grouting operation must be completed before the set time for the initial grout has elapsed.

H. O-Cell Load Testing and Reporting.

The O-Cell load testing shall be performed in accordance with ASTM D 1143, Standard Test Method for Piles under Static Axial Compressive Load. The loading procedures shall be in accordance with Quick Load Test Method, indicated in ASTM D 1143, Section 5.6. The loads shall be applied in increments equaling ten percent of the anticipated ultimate capacity of the test-drilled shaft. Direct movement indicator measurements shall be made of the following:

1. Downward drilled shaft end-bearing movement (minimum of two indicators required).
2. Upward top-of-drilled shaft movement (minimum of two indicators required).
3. Shaft compression (minimum of two indicators required).

Loads shall be applied at the prescribed intervals until the ultimate capacity of the drilled shaft is reached in side shear, or until the maximum capacity or maximum stroke of the Osterberg cell is reached, unless otherwise directed by the Engineer. In addition to requirements of ASTM D 1143, at each load increment, or decrement, movement indicators shall be read at one, two and four minute intervals while the load is held constant. Strain gauges readings shall be concurrent with shaft movement readings. Additional cycles of loading and unloading using similar procedures may be required by the Engineer following the completion of the initial test cycle.

Dial gauges, digital gauges or LVDT's used to measure end bearing and side shear movement and shaft compression should have a minimum travel of 200 mm and be capable of being read to the nearest 0.025 division. End bearing movement may be alternately monitored using LVDT's capable of measuring the expansion of the Osterberg Cell (150 mm). The reference beam selected should have a minimum length to six times the drilled shaft diameter and should be monitored for movement during load testing using surveyor's level.

A report providing all data readings and plots of the readings, the details of the load test and set-up, as well as a determination of the friction/adhesion of the rock shall be submitted to the Engineer for review prior to the Engineer granting approval for commencement of production drilled shafts.

543.15 Crosshole Sonic Logging (CSL) of Drilled Shaft.

All completed drilled shaft foundations including the demonstration drilled shaft shall be tested with the nondestructive testing (NDT) method, Crosshole Sonic Logging (CSL) after at least 1 day (24 hours) of curing time has elapsed to allow the concrete to harden sufficiently. The Engineer may specify a longer minimum time if special retarders, mix designs, or other factors result in slower setting concrete. All CSL testing must be completed within 45 calendar days of concrete placement for steel access tubes. The CSL tests shall be undertaken by an experienced independent testing organization.

The CSL test measures the time it takes for an ultrasonic pulse to travel from a signal source in one access tube to a receiver in another access tube. In uniform, good quality concrete, the travel time between equidistant tubes will be relatively constant and correspond to a reasonable concrete pulse velocity from the bottom to the top of the foundation. In uniform, good quality concrete the CSL test will also produce records with good. signal amplitude and energy. Longer travel times and lower amplitude/energy signals indicate the presence of irregularities such as poor quality concrete, voids, honeycombs and soil intrusions. The signal will be completely lost by the receiver and CSL recording system for the more severe defects such as voids and soil intrusions.

The Contractor shall employ an independent testing firm which has successfully completed no less than three CSLs, to perform the testing and report preparation. The qualifications of the testing firm shall be submitted to the Engineer for approval.

The cost of performing CSL testing shall be included in the cost of the drilled shafts. No separate payment will be made for CSL testing.

A. Drilled Shaft Preparation. A number of tubes, typically between 2 to 6, shall be installed in each shaft to permit access for CSL. The number of tubes installed will be as designated on the design drawings for each foundation. If the number and placement of the tubes are not specifically called out on the drawings, then the general guidelines in the table below should be followed:

Shaft Diameter	Recommended Number of Tubes	Tube Spacing
D < 750 mm	2 minimum	180 Degrees
750 < D < 1050 mm	3 minimum	120 Degrees
1050 < D < 1500 mm	4 minimum	90 Degrees
1500 < D < 2400 mm	6 minimum	60 Degrees
2400 mm < D	8 minimum	45 degrees

The tubes shall be 37.5 mm to 50 mm inside diameter schedule 40 steel pipe. The pipes shall have a round, regular internal diameter free of defects or obstructions, including any at pipe joints, in order to permit the free, unobstructed passage of 34 mm or smaller diameter, typically 150 mm to 250 mm long, source and receiver probes. The tubes shall be watertight and free from corrosion with clean internal and external faces to ensure passage of the probes and to ensure a good bond between the concrete and the tubes.

The pipes shall each be fitted with a watertight shoe on the bottom and a removable cap on the top. The pipes shall be securely attached to the interior of the reinforcement cage with a minimum cover of 75 mm. The tubes shall be installed in each shaft in a regular, symmetric pattern such that each tube is spaced the maximum distance possible from each adjacent tube, with a spacing in degrees around the perimeter of the cage to correspond to the design drawings or that called out in the table above for the selected number of tubes. The tubes are typically wire-tied to the reinforcing cage every 900 mm or otherwise secured such that the tubes stay in position during placement of the rebar cage and concrete placement.

The Contractor shall submit to the Engineer his selection of tube material and size, along with his proposed method to install the tubes prior to construction. The tubes shall be as near to vertical and parallel as possible. The rubes shall extend from 150 mm above the shaft bottoms to at least 900 mm above the shaft tops. Under no circumstance should the tubes be allowed to rest on the bottom of the drilled excavation. If the shaft top is below the subsurface, the tubes shall extend at least 600 mm above the ground surface. Any joints required to achieve full length tubes shall be made watertight. Care shall be taken during reinforcement installation operations in the drilled shaft hole not to damage the tubes.

After placement of the reinforcement cage; the pipes shall be filled with clean water as soon as possible (immediately before or after concrete placement but no later than 4 hours after placement) and the pipe tops capped or sealed to keep debris out of the pipes. Care shall be exercised in the removal of caps or plugs from the pipes after installation so as not to apply excess torque, hammering, or other stresses which could break the bond between the pipes and the concrete.

Upon completion of CSL testing and acceptance of the shaft by the Engineer, all water shall be removed from the access pipes and any other drilled holes. The pipes and holes shall than be completely filled with an approved grout. The pipes shall not be filled with grout until all testing is completed in a particular drilled shaft. Anomalies/defects indicated by longer pulse arrival times and significantly lower amplitude/energy signals should be reported to the Engineer and any further tests carried out as required to evaluate the extent of such anomalies/defects.

B. Test Equipment. The CSL equipment consists of the following components:

1. A microprocessor based CSL system for display of individual CSL records, analog-digital conversion and recording of CSL data, analysis of receiver responses and printing of CSL logs.
2. Ultrasonic source and receiver probes for 37.5 mm to 50 mm ID. pipe, as appropriate.
3. An ultrasonic voltage pulsar to excite the source with a synchronized triggering system to start the recording system.
4. A depth measurement device to determine record depths.
5. Appropriate filter/amplification and cable systems for CSL testing.

C. CSL Logging Procedures. Information on the shaft bottom and top elevations and/or length, along with construction dates should be provided to the approved testing organization before or at the time of the CSL tests. CSL

tests shall be conducted between pairs of tubes, with the determination of which pairs to be tested are to be made as part of the testing contract. Typically, perimeter and/or major diagonal tube pairs are tested. Additional logs may be conducted in the event any anomalies are detected in the specified logs. The full depth of all pipes shall be used for conducting CSL tests unless approved otherwise by the Engineer. Should an access tube be blocked, the Engineer shall determine what action should be taken in response.

The CSL tests shall be performed with the source and receiver probes in the same horizontal plane unless test results indicate potential anomalies/defects in which case the questionable zone may be further evaluated with angled tests (source and receiver vertically offset in the tubes). CSL measurements shall be made at depth intervals of 750 mm or less, and shall be done from the bottom to the top of each shaft. The probes shall be pulled simultaneously, starting from the bottoms of the tubes, over the depth measuring device. Any slack shall be removed from the cables prior to pulling to provide for accurate depth measurements in the CSL records. Any anomalies/defects indicated by longer pulse arrival times and significantly lower amplitude/energy signals should be reported to the Engineer and any further tests carried out as required to evaluate the extent of such anomalies/defects.

D. CSL Results. The CSL results shall be presented in a report. The test results shall include CSL logs with analyses of:

1. Initial pulse arrival time or compression wave velocity versus depth.
2. Pulse energy/amplitude versus depth.
3. A CSL log shall be presented for each tube pair tested with any anomaly/defect zones discussed in the report, as appropriate.

543.16 Acceptance of Completed Drilled Shaft Foundations.

A comparison of the computed volume of the excavation (theoretical) with the volume of concrete placed (actual) shall be made. A plot of depth versus volume shall be computed. The contractor shall provide cooperation and whatever assistance necessary to accurately monitor the volume of concrete placed at all times during the pour.

Unaccepted drilled shafts are drilled shafts that are rejected by the Engineer because of damage, failure to advance through obstructions, mislocation, misalignment, or failure to install the drilled shaft to the proper bearing stratum, or when the results of the Crosshole Sonic Logging indicates defects. Rejection of a shaft based on the Crosshole Sonic Logging shall require conclusive evidence that a defect exists in the shaft, which will result in inadequate or unsafe performance under service loads. If the Crosshole Sonic Logging records are complex or inconclusive, the Engineer may require additional testing to confirm the location of the defect. The Engineer may also require coring of the shaft to verify shaft conditions. The minimum diameter of produced concrete core sample shall be 50 millimeters and the maximum diameter shall be 100 millimeters. The Contractor shall grout the core hole upon completion. The grout type and method shall be submitted to the Engineer for approval. The Contractor shall provide an accurate flow meter to measure the amount of grout.

If a defect is confirmed, the Contractor shall pay for the additional testing and all coring costs, including grouting of all core holes.

Once the Engineer has rejected a drilled shaft, the construction of all other drilled shaft foundations shall be discontinued until the Contractor demonstrates the adequacy of the shaft construction method and any subsequent method changes to the satisfaction of the Engineer.

In the case that any shaft is determined to be unacceptable, the Contactor shall submit a plan for remedial action to the Engineer for approval. The drilled shaft shall be repaired, augmented or replaced to the satisfaction of the Engineer. To mitigate and/or to remedy unaccepted drilled shafts, the Contractor and/or specialized shaft Subcontractor may be required to provide additional drilled shafts or supplement drilled shafts to meet specified requirements at no additional cost to the Contract.

Any modifications to the foundation shafts and load transfer mechanisms caused by the remedial action will require calculations and working drawings stamped by a Professional Engineer registered in the State of New Jersey for all foundation elements affected. All labor and materials required to perform remedial shaft action shall be provided at no additional cost to the Contract and with no extension of the Contract time.

When otherwise acceptably installed drilled shafts exceed the specified tolerances (location, elevation, or dimensions), the Contractor and/or specialized shaft Subcontractor shall provide an accurate as-built survey to the Design Engineer. The Design Engineer will then analyze the total loads on individual drilled shaft based on the

survey data. If the load on any drilled shaft exceeds 10 percent of the specified load capacity, corrections shall be made, at no additional cost to the Contract in accordance with a design provided by the Design Engineer.

COMPENSATION

543.17 Method of Measurement.

Drilled Shaft Foundations: Drilled shafts of the various diameters will be measured by the linear meter. For payment purposes, each drilled shaft will be divided into two segments: payment for drilling and excavation through soil and concreting the shaft above the top of bedrock will be made at the soil drilled cost, while payment for drilling and excavation through rock and concreting the shaft from the top of rock to the bottom of the rock socket will be made at the rock drilled cost.

Foundation Excavation, Regulated Waste, which includes the handling, stockpiling, on-site transport and off-site transport of regulated waste shall be measured by the cubic meter.

The height of shaft above the bottom of footing shall be formed with pre-prepared formwork matching the shaft diameter set centered over the drilled shaft. The form shall be set and the concrete poured to the top of the form while the concrete is still fluid.

Where shafts do not have a footing on top of them, the limits for payment will be as shown on the Plans, either to 150 millimeters above or below the existing elevation or as otherwise shown on the Plans.

Permanent Steel Casing for 1829 mm Diameter Shaft will be measured by the linear meter.

Furnishing Equipment for Drilled Shaft Installation, including mobilization and demobilization for drilled shaft installation will not be measured and payment will be made on a lump sum basis.

Demonstration Drilled Shaft: Demonstration drilled shaft shall be measured on a lump sum basis, the costs of which shall include the cost of all material, labor, equipment and all other items necessary for an incidental to the cost of completing the work as required under this section, including all costs of installing the demonstration drilled shaft.

Osterberg Cell Load Test: Measurement for the drilled shaft Osterberg cell load test shall be by the unit and shall include any material, labor and equipment, required to perform the O-Cell load test. This item shall include all necessary work, including but not limited to, all costs of design, assembly and installation of the equipment, conducting the test, removing the load test equipment, grouting the cell and the annular space around the cell, and providing a report of the load test to the Engineer.

Crosshole Sonic Logging (CSL): Measurement for the drilled shaft Crosshole Sonic Logging (CSL) shall be by the unit and shall include any and all material, labor and equipment, required to test at each drilled shaft. In addition, this item shall include all necessary work to assemble, install, conduct CSL, and providing a test report of the CSL results to the Engineer.

Concrete Coring at Drilled Shaft: Measurement for concrete coring at drilled shaft shall be by linear meter and include any and all material, labor and equipment required to core the shaft to a depth below any identified defects or anomalies, as requested by the Engineer. This item shall include all necessary to coring, grouting after coring, and providing a report of the coring result. If the coring confirms a defect in the drilled shaft then measurement will not be made and the contractor shall bear the cost of the coring.

543.18 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
DEMONSTRATION DRILLED SHAFT	LUMP SUM
DRILLED SHAFTS, 1829 MM DIAMETER, IN SOIL	LINEAR METER
DRILLED SHAFTS, 1676 MM DIAMETER, IN ROCK	LINEAR METER
PERMANENT STEEL CASING FOR 1829 MM DIAMETER SHAFT	LINEAR METER
FURNISHING EQUIPMENT FOR DRILLED SHAFT INSTALLATION	LUMP SUM
OSTERBERG CELL LOAD TEST	UNIT

CROSSHOLE SONIC LOGGING (CSL) OF DRILLED SHAFT	UNIT
CONCRETE CORING AT DRILLED SHAFT, IF AND WHERE DIRECTED	LINEAR METER

No separate payment will be made for steel reinforcement and concrete within the drilled shaft limits. The costs thereof shall be included in the appropriate drilled shaft pay item.

The contract items and unit price bids set forth in the bid schedules shall include all services, permits, labor, equipment, transportation, materials, testing, and supplies for the complete work, including, without limitation, mobilization and demobilization for completion of the work. No payment will be made for drilled shafts abandoned because of defects in the work or other fault of the Contractor and/or specialized shaft Subcontractor. No separate payment will be made for steel reinforcement in drilled shaft foundations except for steel reinforcement that extends down into the drilled shaft from the column above, where shown on the plans. The cost of any steel reinforcement and/or materials required for testing purposes shall be included in the drilled shaft pay item.

The completed and acceptable Osterberg Cell Load Test shall be paid for at the Contract unit price per each, which price shall constitute full compensation for all costs incurred during the procurement, installation, conducting of the test, subsequent removal of test apparatus and appurtenances, grouting of the cell, and preparation of the load test report.

The completed Crosshole Sonic Logging (CSL) of Drilled Shaft shall be paid for at the Contract unit price for each drilled shaft. Such payment shall be full compensation for all costs related to the performance of the Crosshole Sonic Logging (CSL) at each drilled shaft.

The item “Concrete Coring at Drilled Shaft” shall be paid for if the work associated with this item has been requested by the Engineer. No payment will be made if the coring confirms a defect in the drilled shaft.

No separate payment shall be made for cost of test borings. All costs of performing the test borings including mobilization and demobilization shall be included in pay item “Furnishing Equipment for Drilled Shaft Installation”.

The cost of cutting and removal or drilling through existing timber piles encountered during installation of the drilled shaft foundations shall be included in pay item “Drilled Shafts, 1829 MM Diameter, In Soil”.

No separate payment will be made for foundation excavation of Regulated Waste and foundation excavation of Regulated Waste, Hazardous, in accordance with these Special Provisions. Payment for Foundation Excavation, Regulated Waste and Foundation Excavation Regulated Waste, Hazardous, shall be included in the pay item “Drilled Shafts, 1829mm Diameter, In Soil”.

No separate payment shall be made for the cost of predrilling, material, labor and equipment for control slurry, or penetrating through obstructions. The cost thereof shall be included in the appropriate drilled shaft pay item.

SECTION 544 - MICROPILES

544.01 Description.

This work shall consist of furnishing all materials, products, accessories, tools, equipment, services, transportation, labor, supervision, and manufacturing techniques required for testing and installation of micropiles, pile-top attachments and components described herein and as shown on the Contract Plans.

The micropile contractor shall install a micropile system that will provide the load capacities as indicated on the drawings. The micropile load capacities shall be verified by testing as required and specified herein.

The micropile contractor may submit an alternative design that meets the design and performance requirements stated herein. The contractor will be required to submit to the Engineer working drawings, calculations, installation procedures, and specifications in accordance with Section 105.04 and this section to the Engineer for review. No micropile work shall commence unless approved by the Engineer.

The micropile contractor shall be fully experienced in all aspects of micropile design and construction, and shall furnish all necessary plant, materials, skilled labor, and supervision to carry out the contract. The micropile contractor shall provide the Engineer details of successfully completed at least five projects in the previous five years of similar scope and size. He must also provide resumes of key personnel who will be present on site (and will be materially involved) and who will each have at least three years of relevant micropile experience. These personnel include superintendent, driller, and project engineer/manager. The superintendent shall have completed at least five micropile projects.

MATERIALS

544.02 Materials.

Water for mixing grout will be potable or shall be tested for use with the cement and results submitted for approval with information required in this section.

Admixtures shall conform to the requirements of AASHTO M 194. Admixtures which control bleed, improve flowability, reduce water content and retard set may be used in the grout subject to the review and acceptance of the Engineer. Expansive admixtures shall only be added to the grout used for filling sealed encapsulations. Accelerators will not be permitted. Admixtures shall be compatible with the grout and mixed in accordance with the manufacturer's recommendations. Their use will only be permitted after appropriate field tests on fluid and set grout properties.

All cement shall be Portland cement conforming to AASHTO M 85, Type I or Type II and shall be the product of one manufacturer. If the brand or type of cement is changed during a project, additional grout mix tests shall be conducted to ensure consistency of quality and performance in situ.

All reinforcing steel shall be epoxy coated deformed bars in accordance with AASHTO M 275 Grade 1035.

Bar couplers, if required, shall develop the ultimate tensile strength of the bars without evidence of any failure.

Permanent steel casing/pipe shall meet the Tensile Requirements of ASTM A252, Grade 3, except the yield strength shall be a minimum of 550 MPa as used in the design submittal. New "Structural Grade" (a.k.a. "Mill Secondary") steel pipe without Mill Certification may be used meeting the following:

1. Tensile Requirements,
2. Free from defects (dents, cracks, tears), and
3. Two coupon tests per truckload delivered to the fabricator.

Structural steel plates and shapes for pile top attachments shall conform to AASHTO M 183 or AASHTO M 223 Grade 350.

Centralizers and spacers shall be fabricated from schedule 40 PVC pipe or tube, steel, or material that is non detrimental to the reinforcing steel. Wood shall not be used. Centralizers and spacers shall be securely attached to the reinforcement; sized to position the reinforcement with 10 mm of plan location from center of pile; sized to grout tremie pipe insertion to the bottom of the drillhole; and sized to allow grout to freely flow up the drillhole and casing and between adjacent reinforcing bars.

Encapsulation (double corrosion protection) shall be shop fabricated using high-density, corrugated polyethylene tubing conforming to the requirements of AASHTO M 252 with a nominal wall thickness of 0.8 mm. The inside annulus between the reinforcing bars and the encapsulating tube shall be a minimum of 5 mm and be fully grouted with non-shrink grout.

The minimum thickness of epoxy coating applied electrostatically to the reinforcing steel shall be 0.3 mm. Epoxy coating shall be in accordance with ASTM A 775 or ASTM A 934. Bend test requirements are waived. Bearing plates and nuts encased in the pile concrete footing need not be epoxy coated.

If sand-cement grout is used, sand shall conform to AASHTO M 45.

Provide a minimum 25 mm grout cover over bare or epoxy coated bars (excluding bar couplers) or minimum 12 mm grout cover over the encapsulation of encapsulated bars.

For permanent casing/pipe that will be welded, the following material conditions apply:

1. The carbon equivalency (CE) as defined in AWS D1.1, Section X15.1, shall not exceed 0.45, as demonstrated by mill certifications.
2. The sulfur content shall not exceed 0.05%, as demonstrated by mill certifications.

For permanent casing/pipe that will be shop or field welded, the following material conditions apply:

1. The steel pipe shall not be joined by welded lap splicing.
2. Welded seams and splices shall be complete penetration welds.
3. Partial penetration welds may be restored in conformance with AWS D1.1.
4. The proposed welding procedure certified by a welding specialist shall be submitted for approval.

Threaded casing joints shall develop at least the required nominal resistance used in the design of the micropile.

When a bearing plate and nut a required to be threaded onto the top end of reinforcing bars for the pile top to footing anchorage, the threading may be continuous spiral deformed ribbing provided by the bat deformations (e.g., Dywidag to Williams continuous threadbars) or may be cut into the reinforcing bar. If threads are cut into a reinforcing bar, the next larger bar number designation from that shown on the plans shall be provide, at no additional cost.

Smooth plastic sheathing, including joints, shall be watertight. Polyvinyl chloride (PVC) sheathing shall conform to ASTM D 1784, Class 13464-B.

The following publications form a part of this specification to the extent indicated by the references. The latest publication as of the issue of this specification shall govern, unless indicated otherwise.

A. American Society for Testing and Materials (ASTM).

A 252 Specification for Welded and Seamless Steel Pipe Piles
A 775 Specification for Epoxy-Coated Reinforcing Steel Bars
A 934 Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars
D 1143 Standard Test Method for Piles Under Static Axial Compressive Load
D 1784 Polyvinyl Chloride (PVC) Pipe (Class 13464-B)
D 3689 Standard Test Method for Individual Piles Under Static Axial Tensile Load

B. American Welding Society (AWS)

D.1.1 Structural Welding Code - Steel
D.1.2 Structural Welding Code - Reinforcing Steel

C. American Association of State Highway and Transportation Officials (AASHTO)

M 31 Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement
M 45 Specification for Aggregate for Masonry Mortar
M 80 Specification for Concrete Aggregates
M 85 Specification for Portland Cement
M 183 Specification for Structural Steel
M 194 Specification for Chemical Admixtures for Concrete
M 223 Specification for Structural Steel
M 252 Specification for Polyethylene Corrugated Tubing
M 275 Specification for Uncoated High Strength Bar for Prestressing Concrete
T 26 Quality of Water To Be Used in Concrete
T 106 Compressive Strength of Hydraulic Cement Mortar

D. American Petroleum Institute

5CT (N-80) Specification for Casing and Tubing

EQUIPMENT

544.03 Equipment.

Micropiles shall be installed with approved drilling equipment. The proposed micropile installation equipment and methods shall be subject to the approval of the Engineer and approval shall be secured before mobilization. Approval by the Engineer shall not relieve the Contractor or micropile subcontractor of his responsibility to provide equipment with sufficient power, downward thrust and torque, materials, and methods to adequately perform the work in a safe, timely, workmanlike manner. Approval shall not be reason to hold the State and/or the Engineer responsible for the Contractor's or micropile subcontractor's failure to perform the work.

Micropile installation equipment shall be capable of installing micropiles with the use of casing through all in situ materials, with a close fit to the borehole. Wet rotary drilling methods shall employ sufficient fluid pressure to provide complete removal of the cuttings from the hole. The Contractor shall provide a weighted bar with slender tip and attached to a thin cable with calibrated depth marker, metal tape, or other approved equipment suitable for confirming the completeness of the final cleaning operations.

The Contractor or his specialized subcontractor shall provide all equipment, including concrete pumps or tremie pipes required for the placement of concrete into the micropiles in accordance with the plans and specifications. The minimum inside diameter of concrete pump lines or the tremie pipe shall be greater than six times the maximum aggregate size.

CONSTRUCTION

544.04 Design and Performance Criteria.

The micropiles shall be designed to meet the specified loading as shown on contract drawings, or specified herein. Design of the micropiles and pile top to footing connections shall use the Service Load Design (SLD) procedures contained in the FHWA "Micropile Design and Construction Guidelines Manual", Report No. FHWA-SA-97-070. The required geotechnical safety factors/strength factors (for SLD Design) shall be in accordance with the FHWA manual, unless specified otherwise. Micropile design capacities, known utility locations, easements, right-of-ways, and other applicable design criteria will be as shown on the plans or specified herein. Structural design of any individual micropile structure elements not covered in the FHWA manual shall be by the service load design method in conformance with appropriate articles of the most recent Edition of the AASHTO Standard Specifications for Highway Bridges, including current interim specifications. Any proposed alternatives that do not meet the design and performance criteria shall not be approved. The calculations and drawings required from the micropile contractor shall be submitted to the Engineer for review and acceptance in accordance with this section.

Steel pipe used for external encasement for micropiling shall incorporate an additional 1.6 mm thickness of sacrificial steel for corrosion protection.

The overall length of a micropile will be selected such that the required capacity is developed by skin friction between grout and competent rock.

The geotechnical capacity shall not rely on bond from clayey soils and fractured or decomposed rock layers above the competent rock. The Engineer and the micropile contractor will agree on the depth of the top of competent rock, i.e. the top of the bond zone during installation of each pile.

When required as shown on the plans, corrosion protection of the internal steel reinforcing bars, consisting of either encapsulation, epoxy coating, or grout, shall be provided in accordance with this section. Where permanent casing is used for a portion of the micropile, encapsulation shall extend at least 1.5 meters into the casing.

A. Allowable Stresses. The allowable stresses at working load shall not exceed the following values:

1. Compression Loads. The allowable stress on the cement grout shall be thirty-three (33) percent of the twenty-eight (28) day unconfined compressive strength (UCS).

The allowable stress on the steel reinforcing, including permanent steel casing, shall be forty (40) percent of the minimum specified yield strength.

The maximum allowable stress on the steel shall be 550 MPa. [This is provided for strain compatibility at ultimate load.]

The reinforcing steel shall be designed to carry not less than sixty (60) percent of the design compression load.

2. **Tension Loads.** The allowable stress on the steel reinforcing shall be sixty (60) percent of the minimum specified yield strength.

The allowable tension stress on the cement grout shall be zero.

B. Ultimate Structural Capacity. The ultimate structural capacity shall be determined by the following equations.

1. **Compression**

$Puc = (0.85*f'c*A_{grout}+fy_{casing}*A_{casing}+fy_{bar}*A_{bar})$

where: $f'c$ = UCS of grout
A_{grout} = area of grout
fy_{casing} = yield strength of casing up to 550 MPa
A_{casing} = area of steel casing (at threaded joints if applicable)
fy_{bar} = yield strength of rebar up to 550 MPa
A_{bar} = area of rebar

The maximum useable strength of the steel of 550 MPa is based on the typical ultimate concrete strain of 0.003 (200000 MPa * 0.003 = 550 MPa). 550 MPa is also the maximum steel strength used in ACI 318.

2. **Tension**

$Put = (fy_{casing}*A_{casing}+fy_{bar}*A_{bar})$

where: fy_{casing} = yield strength of casing
A_{casing} = area of steel casing (at threaded joints if applicable)
fy_{bar} = yield strength of rebar
A_{bar} = area of rebar

C. Micropile Top Attachment. The micropile top attachment shall effectively distribute the design load (DL) to the concrete footing, grade beam, and/or pile cap such that the concrete bearing stress does not exceed ACI Building Code and the bending stress in the steel plates does not exceed AISC Allowable stresses for steel members.

544.05 Ground Conditions.

The test borings as shown on the boring location plan and logs of borings are believed to be representative of the conditions likely to be encountered on the site, and are to be used as the basis for micropile design.

The subsurface information at the site is presented on the boring logs. Contractor shall be aware that the subsurface conditions may include the presence of boulders, cobbles, and other obstructions that must be penetrated by the bored piles.

If an obstruction is encountered during installation of a pile that prevents the advancing of the hole while using wet rotary percussive internal duplex drilling methods, the hole shall be abandoned and filled with grout. A new pile shall be drilled at locations to be determined by the Engineer.

Contractor shall protect nearby structures from damage. All methods of protection shall be submitted to the Engineer for approval. All construction-induced damage shall be repaired to the satisfaction of the Engineer at no additional expense.

Contractor shall inspect the site to evaluate the surface and subsurface conditions affecting the work. No claim for additional costs will be allowed because of lack of knowledge of any existing site and subsurface conditions discernible from observation at the site, adjoining property, and available sources of information.

Contractor shall probe the micropile locations prior to drilling.

Contractor shall visit the site to review all details of the work and working conditions, to verify dimensions in the field including headroom and interference from adjacent or existing structures, and shall advise the Engineer of any discrepancy before performing any work.

Contractor shall consult Contract Drawings and official records of existing utilities, both surface and subsurface, and excavate test pits at work locations to observe existing conditions and limitations as they apply to this work and its relation to other construction work.

Contractor shall protect existing utilities to remain within the pile installation work zone in accordance with the requirements of authorities having jurisdiction over same. Contractor shall repair or replace any construction-induced damage to the satisfaction of the utility owners and Engineer at no additional cost to the Contract.

544.06 Pre-Construction Work Plan Submittals.

The micropile contractor shall prepare working drawings and relevant structural design calculations for the micropile system for submittal to the Engineer for review. The submittal shall be stamped by a Licensed Professional Engineer in the State of New Jersey. The micropile contractor shall allow the Engineer 20 working days to review the working drawing submittal after a complete set has been received. Work shall not begin until the appropriate submittals have been received, reviewed, and accepted in writing by the Engineer.

The working drawings and design calculations submittal(s) shall include the following:

1. Micropile details for each pile type (load) showing:
    a. Micropile Design Load,
    b. Type and Size of Permanent Casing and Reinforcing Steel,
    c. Minimum Total Bond Length,
    d. Total Micropile Length, and
    e. Micropile Top Attachment.
2. Micropile numbering system for records.
3. Grout mix designs, and the procedure for placing the grout. Include documentation indicating proposed mix design has been successfully used for similar installations. Include air entrainment if environment requires useage. Design mix data shall include slump and all admixtures proposed for this project.
4. Details of equipment and procedures for pile installation including, but not limited to, consecutive steps and the approximate time required for each step.
5. Procedures for advancing through soil, boulders, and other materials or obstructions including sealing the casing into the top of competent rock.
6. Methods to be used to control and verify pile position and alignment.
7. Procedures for control and removal of all spoil.
8. Shop drawings shall show the required working areas as site conditions warrant for installing the piles at the locations shown on the Contract Plans.
9. Procedures and equipment for placing grout.
10. Details for post-grouting including the method, procedure, and equipment to be used.
11. Layout drawings showing the proposed sequence of pile installation. Coordinate this sequence with the proposed phasing and scheduling.
12. Methods to flush the drilled hole and methods and equipment for measuring volumes of grout placed in each hole.
13. Include details of placement, splicing and centering devices for steel reinforcing.
14. Detailed plans for the method proposed for the testing of the micropiles prior to beginning the tests. This shall include all necessary drawings and details to clearly describe the method.
15. Plan describing how surface water, drill flush, and excess waste grout will be controlled and disposed.

Contractor shall submit the grout mix design, documentation from an independent testing laboratory, and the procedures for placing the grout to the Engineer for review before use.

Contractor shall submit manufacturer's information, model, size, and type of equipment to be used for installing bored piles with appropriate manufacturer's literature for the Engineer's review.

Work shall not begin until the appropriate submittals have been received, reviewed, and approved in writing by the Engineer. Contractor shall allow the Engineer 10 working days to review the revised shop drawing submittal after a complete set has been received.

544.07 Construction Records Submittals.

The micropile contractor shall submit the following information during construction.

1. The Contractor shall submit certified mill test reports, properly marked, for the reinforcing steel, as the materials are delivered, to the Engineer for review. The ultimate strength, yield strength, elongation, and material properties composition shall be included. For steel pipe used as permanent casing, the Contractor shall submit a minimum of two representative coupon tests or mill certifications (if available) on each load delivered to the project.
2. Test results for permanent casing.
3. Calibration reports for each test jack, pressure gauge and master pressure gauge to be used. The calibration tests shall have been performed within 60 calendar days of the date submitted.

544.08 Installation Records.

The micropile contractor shall prepare and submit to the Engineer installation records for each pile installed. The records shall be submitted within 24 hours after installation is completed for the pile. The records shall include the following minimum information:

1. Pile number designation.
2. Pile materials and dimensions.
3. Elevation of top of pile.
4. Elevation of the top of the bond length.
5. Bond Length.
6. Pile drilling duration.
7. Final tip elevation.
8. Cut-off elevation.
9. Design load capacity.
10. Description of unusual installation behavior or conditions.
11. Grout pressures attained.
12. Post-grouting details, if required.
13. Grout quantities pumped.
14. Time required for each operation.

Upon the completion of the pile installation, as-built drawings showing the location of the piles, their depth and inclination shall be prepared and submitted.

544.09 Testing Records.

The micropile contractor shall prepare and submit to the Engineer all submittals required in this section. The records shall be submitted within 24 hours after each pile load test is complete.

544.10 Allowable Tolerances.

1. Centerline of piling shall not be more than 75 mm from indicated plan position.
2. Pile alignment shall be within 1% of design alignment.
3. Top elevation of pile shall be within 50 mm of the design vertical elevation.
4. Centerline of core reinforcement shall not be more than 15 mm from centerline of piling.

544.11 Micropile Installation.

The micropile installation technique shall be such that it is consistent with the geotechnical, logistical, environmental, and load carrying conditions of the project. The micropile contractor shall select the drilling method, the grouting procedures, and grouting pressure used for the installation of the micropiles, subject to the approval of the Engineer. The micropile contractor will advance the pile through clay seams, voids and fractured or decomposed rock to the required depth to seal the casing into competent rock as determined by the Engineer. The procedure will allow near intimate contact to be maintained between the drill casing and the borehole wall. The entire length of the

micropile above the bond zone shall remain cased as the pile is advanced. No external grouting around the casing will be allowed. Upon completion of advancing the casing to the determined pile tip elevation, the internal rods will be withdrawn and the pile will be filled internally with grout. Once the grout has stabilized in the bond zone, the centralized reinforcing steel is placed.

The drilling equipment and methods must provide a cased borehole to the defined nominal diameter, full length, prior to placing grout and reinforcement.

Centralizers shall be provided on central equipment. The upper most centralizer shall be located 1.5 meters of the reinforcement.

The central reinforcement steel with centralizers shall be lowered into the stabilized drill holes to the desired depth without difficulty. Partially inserted reinforcing bars shall not be driven or forced into the hole.

The grout should be injected beginning at the lower end of the drilled borehole. The pipe casing shall be filled with a 28 MPa minimum compressive strength grout without voids from bottom to top of micropile.

The micropile contractor shall check pile top elevations and adjust all installed micropiles to the planned elevations.

No open hole drilling shall be allowed. Open hole drilling is defined as predrilling the borehole and allowing the hole stand open and uncased until the structural casing is placed in the drill hole.

Each rig must complete a bored pile including placement of cement grout before beginning drilling for the next bored pile.

The contractor shall control and properly dispose of drill flush and construction related waste, including grout, in accordance with the specifications and all applicable local codes and regulations. Provide positive control and discharge of all surface water that will affect construction of the micropile installation. Maintain all pipes or conduits used to control surface water during construction. Repair damage caused by surface water at no additional cost. Upon completion of the work, remove surface water pipes or conduits from the site. Alternatively, with the approval of the Engineer, pipes and conduit that are left in-place, any be full grouted and abandoned or left in a way that protects the structure and all adjacent facilities from migration of fines through the pipe or conduit and potential ground loss. Immediately contact the Engineer if unanticipated existing subsurface drainage structures are discovered during excavation or drilling. Suspend work in these areas until remedial measures meeting the Engineer's approval are implemented. Cost of remedial measures or repair work resulting from encountering unanticipated subsurface drainage structures will be paid for as extra work.

During construction, the contractor shall observe the conditions vicinity of the micropile construction site on a daily basis for signs of ground heave or subsidence. Immediately notify the Engineer if signs of movements are observed. Contractor shall immediately suspend or modify drilling or grouting operations if ground heave or subsidence is observed, if the micropile structure is adversely affected, or if adjacent structures are damaged from the drilling or grouting. If the Engineer determines that the movements require corrective action, the contractor shall take corrective action necessary to stop the movement or perform repairs. When due to the contractor's methods or operations or failure to follow the specified/approved construction sequence, as determined by the Engineer, the costs of providing corrective actions will be borne by the contractor. When due to differing site conditions, as determined by the Engineer, the costs of providing corrective actions will be paid for as extra work.

A. Micropile Drilling and Excavation.

1. Position and align the drill casing at the bored pile location.
2. Pre-drilling more than one hole in advance of pressure grouting shall not be permitted. Once a pile is drilled to the proper depth it shall be immediately pressure grouted.
3. Advance the hole using internal duplex drilling methods and reverse circulation within the drill casing. Positive circulation or flushing, a method of progressing and cleaning out a hole for a bored hole wherein water is injected into the hole and returned upward along the outside of the drill casing will not be allowed. The use of air pressure to clean the casing will not be allowed.
4. Perform drilling and excavation in such a manner to prevent collapse of the hole. The drill tool shall be kept no further than 150 mm away from the end of the drill casing at all times. The cutting shoe used for advancing the casing, the cutting shoe diameter shall not exceed the outer diameter of the casing plus 6.25 mm. Drill fluid and cuttings shall be controlled by diverters, or other methods approved by the Engineer, that produce a closed system allowing all drill spoil to be placed in settling tanks for separation of fluid and solids for eventual disposal. It is the Contractor's responsibility to provide non-displacement drilling methods and equipment capable of attaining the required pile depth and capacity. Use of bentonite or polymer slurry will not be

permitted. The casing shall extend to and seal into the top of competent rock. Air rotary drilling will not be permitted.

5. If obstructions, such as boulders, timber are encountered during excavation for a pile, progress through them by means of coring, using a tri-cone roller bit, or appropriate cutting drill bit. Use of drop type impact hammers, air rotary drills and blasting will not be permitted.
6. The vibration level induced by any approved equipment must not exceed the vibration levels as specified in Section 545.
7. Controlling the procedures and operations to preclude undermining, disturbance, or settlement to adjacent structures or utilities. If any disturbance occurs, halt operations and modify the equipment and/or procedures so that no further disturbance occurs. Repair any disturbance to the satisfaction of the Engineer and at no additional cost.
8. Controlling the procedures and operations so as to prevent the soil at the bottom of the casing from flowing into the casing. Maintain the fluid level inside the hole above the ground water level at all times during installation and cleaning out. Monitor and record the rate of fluid flow used to progress the hole. The in situ materials and subsurface conditions shall not be weakened after installation of micropiles
9. Waste and spoil shall be disposed of in an appropriate manner. Deposition of waste and spoil on local streets and in sewers will not be permitted.

544.12 Grouting.

The micropile contractor shall have means and methods of measuring the grout quality and quantity during the grouting operations. The micropile contractor shall keep records showing the quantities and test data for inspection by the Engineer.

Micropiles shall be primary grouted within 4 hours of the load transfer bond length is drilled. The micropile contractor shall use a stable neat cement grout or a sand cement grout with a minimum 28-day unconfined compressive strength of 28 MPa. Admixtures, if approved by the Engineer, shall be mixed in accordance with manufacturer's recommendations. The micropile contractor is totally responsible for the appropriate mix design including, but not limited to, strength, slump, and admixture requirements.

The pump shall be equipped with a pressure gauge to monitor grout pressures. The pressure gauge shall be capable of measuring pressures of at least 1 MPa or twice the actual grout pressures used by the Contractor, whichever is greater. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The grout should be kept in constant agitation prior to pumping.

The grout shall be injected from the lowest point of the drill hole (by tremie methods) until clean, pure grout flows from the top of the micropile. The tremie grout may be pumped through grout tubes, hollow stem augers, or drill rods. Subsequent to tremie grouting, all grouting operations associated with, for example, extraction of drill casing and pressure grouting, must ensure complete continuity of the grout column. The use of compressed air to directly pressurize the fluid grout is not permissible. The grout pressures and grout takes shall be controlled to prevent excessive heave in cohesive soils or fracturing of soil or rock formations. The entire pile shall be grouted to the design cut-off level.

Upon completion of grouting, the grout tube may remain in the hole, but it shall be filled with grout.

The grouting equipment shall produce a colloidially mixed grout free of lumps and undispersed cement. The grouting equipment shall be sized to enable the grout to be pumped in one continuous operation. The mixer shall be capable of continuous agitation of the grout.

Grout within the micropiles shall be allowed to attain adequate strength prior to load testing.

If the Contractor uses a post-grouting system, all relevant details including grouting pressure, volume, location and mix design, shall be submitted as part of Section 544.06.

544.13 Bar Coupler.

Bar couplers shall be machine threaded to develop the required design strength of the steel reinforcement bar. Welded splices are not allowed.

544.14 Unacceptable Piles.

Unacceptable piles are piles that are rejected by the Engineer because of damage, failure to advance through obstructions, mislocation, misalignment, failure to meet load test acceptance criteria, failure to install the pile using the approved equipment and procedures, or failure to install the pile to the proper depth. Submit a written plan of action to the Engineer for approval, showing how to correct the problem and prevent its reoccurrence. Repair or augment the pile to the satisfaction of the Engineer to make it acceptable. To mitigate and/or to remedy unaccepted piles, Contractor may be required to provide additional piles or supplement piles to meet specified requirements. Any associated work required due to unacceptable piles shall be at no additional cost.

544.15 Grout Testing.

During production, samples selected at random of grout mix shall be taken daily (two sets of samples per pile). The Engineer will control sample selection. Contractor shall be responsible for such testing, the cost of same deemed to be included in the cost of bored piles.

The 50 mm grout cube samples shall be molded, cured in a properly constructed curing box supplied by Contractor, tested in accordance with AASHTO T 106, and shall reach a compressive strength after seven days equal to at least 60 percent of the design strength. The compressive strength shall be the average of the 3 cubes tested.

If this requirement is not met, Contractor shall modify the proportions of the mix subject to the approval of the Engineer. If the required design strength is not attained after 28 days then Contractor shall install replacement pile(s) as required. Any associated work required due to unacceptable piles shall be at no additional cost to the Contracting Party or the Authority.

The Engineer may also require Contractor to modify the mix design if an excessive amount of grout is lost from a pile hole into voids in the in-place materials. Materials shall be accurately measured by weight or volume before mixing.

Each batch of grout shall have the same volume and contain the same whole number of sacks of cement, unless a modification is approved by the Engineer. Time of mixing shall be not less than three minutes.

If agitated continuously, the grout may be held in the mixer or agitator for a period not exceeding three hours at temperatures below 21 degrees Celsius and for a period not exceeding two hours at higher temperatures.

If there is a lapse in pumping of the grout, the grout shall be recirculated through the pump or through the mixer drum (or agitator) and pump.

Retempering of grout will not be permitted.

544.16 Pile Load Tests.

Perform the following tests in accordance with FHWA “Micropile Design and Construction Guidelines Manual”, Report No. FHWA-SA-97-070.

A. Verification Load Tests. Verification load tests shall be performed on a sacrificial pile in accordance with the plans to verify the load carrying capacity of the pile system and the construction procedures prior to installing production piles. The location of the pile to be tested is indicated on the Plans. Test piles with reaction piles or anchors shall be constructed immediately prior to the commencement of the installation of the production micropiles.

The micropile load test results shall verify the micropile contractor’s design and will be reviewed and accepted by the Engineer prior to beginning production micropiles.

The micropile contractor shall submit for review and acceptance the micropile load-testing program. The testing program submittal shall be provided two weeks prior to starting the load testing. This micropile verification load testing proposal shall indicate the minimum following information:

1. Type and accuracy of apparatus for measuring load,
2. Type and accuracy of apparatus for applying load,
3. Type and accuracy of apparatus for measuring the pile deformation,
4. Type and capacity of reaction load system, and
5. Hydraulic jack calibration report.

The drilling and grouting methods, casing diameter, and depth of embedment of the test pile shall be identical to the production piles.

The tested micropiles shall be loaded to 250 percent of the compression and tension design load (DL). The jack shall be positioned at the beginning of the test such that the unloading and repositioning of the jack during the test will not be required. Piles shall be tested under compression loads prior to testing under tension loads.

Axial pile load tests shall be made by loading the micropile in the following steps and recording the head movement at each step:

AL = Alignment Load DL = Design Load		
	LOAD	**HOLD TIME**
1	AL (0.05 DL)	1 minute
2	0.25 DL	1 minute
3	0.50 DL	1 minute
4	AL	1 minute
5	0.25 DL	1 minute
6	0.50 DL	1 minute
7	0.75 DL	1 minute
8	AL	1 minute
9	0.25 DL	1 minute
10	0.50 DL	1 minute
11	0.75 DL	1 minute
12	1.00 DL	1 minute
13	AL	1 minute
14	0.25 DL	1 minute
15	0.50 DL	1 minute
16	0.75 DL	1 minute
17	1.00 DL	1 minute
18	1.33 DL	**60 minutes (Creep Test Load Hold)**
19	1.75 DL	1 minute
20	2.00 DL	1 minute
21	2.25 DL	1 minute
22	**2.50 DL (Maximum Test Load)**	10 minutes
23	AL	1 minute

The test load shall be applied in increments of 25 percent of the DL load. Each load increment shall be held for a minimum of 1 minute. Pile top movement shall be measured at each load increment. The load-hold period shall start as soon as each test load increment is applied. The verification test pile shall be monitored for creep at the 1.33 DL. Pile movement during the creep test shall be measured and recorded at 1, 2, 3, 4, 5, 6, 10, 20, 30, 50, and 60 minutes. The alignment load shall not exceed 5 percent of the DL. Dial gauges shall be reset to zero after the initial AL is applied.

The acceptance criteria for verification load tests are:

1. The pile shall sustain the compression and tension design loads (1.00 DL) with no more than 12.5 mm total vertical movement at the top of the pile.
2. At the end of the 1.33 DL creep test load increment, test piles shall have a creep rate not exceeding 1 mm/log cycle time (1 to 10 minutes) or 2 mm/log cycle time (6 to 60 minutes or the last log cycle if held longer). The creep rate shall be linear or decreasing throughout the creep load hold period.
3. Failure does not occur at the 2.5 DL maximum test load. Failure is defined as the load at which attempts to further increase the test load simply result in continued pile movement.

The micropile contractor's engineer will give the Engineer written confirmation concerning micropile construction and the results of the load test within 3 working days after the completion of the verification load tests. This written confirmation will either confirm the capacities and bond lengths as shown in the drawings for micropiles or reject the piles based upon the results of the verification tests.

When a micropile fails, the micropile contractor shall modify the design, the construction procedure, or both. These modifications include, but are not limited to installing replacement micropiles, modifying the installation methods, increasing the bond length, or changing the micropile type. Any modification which requires changes to the structure shall have prior review and acceptance of the Engineer. Any modifications of design or construction procedures shall be at the micropile contractor's expense.

B. Proof Load Tests. Test piles designated for tension proof load testing to a maximum test load of 1.67 times the micropile Design Load are shown on the plans. Proof load tests shall be made incrementally loading the micropile in accordance with the following schedule:

AL = Alignment Load DL = Design Load		
	LOAD	**HOLD TIME**
1	AL	1 minute
2	0.25 DL	1 minute
3	0.50 DL	1 minute
4	0.75 DL	1 minute
5	1.00 DL	1 minute
6	1.33 DL	**10 or 60 minutes (Creep Test)**
7	**1.67 DL (Maximum Test Load)**	1 minute
8	AL	1 minute

Depending on performance, either a 10 minute or 60 minute creep test shall be performed at the 1.33 DL Test Load. Where the pile top movement between 1 and 10 minutes exceeds 1 mm, the Maximum Test Load shall be maintained an additional 50 minutes. Movements shall be measured and recorded at 1, 2, 3, 5, 6, 10, 20, 30, 50, and 60 minutes. The alignment load shall not exceed 5 percent of the DL. Dial gauges shall be reset to zero after the initial AL is applied.

The acceptance criteria for proof load tests are:

1. The pile shall sustain the compression and tension design loads (1.00 DL) with no more than 12.5 mm total vertical movement at the top of the pile.
2. At the end of the 1.33 DL creep test load increment, test piles shall have a creep rate not exceeding 1 mm/log cycle time (1 to 10 minutes) or 2 mm/log cycle time (6 to 60 minutes or the last log cycle if held longer). The creep rate shall be linear or decreasing throughout the creep load hold period.
3. Failure does not occur at the 1.67 DL maximum test load. Failure is defined as the load at which attempts to further increase the test load simply result in continued pile movement.

COMPENSATION

544.17 Method of Measurement

Micropiles of various diameters will be measured by the linear meter.

Furnishing equipment, mobilization and demobilization for installation of micropiles of various diameters will not be measured and all costs shall be included in the appropriate micropile pay item.

Verification Load Tests and Proof Load Tests will not be measured and all costs shall be included in the appropriate micropile pay item.

544.18 Basis of Payment

Payment will be made under:

Pay Item	*Pay Unit*
MICROPILES IN SOIL, 178 MM DIAMETER	LINEAR METER
MICROPILES IN ROCK, 146 MM DIAMETER	LINEAR METER
MICROPILES, SACRIFICIAL TEST PILE	LUMP SUM

No separate payment will be made for admixtures, cement, casing, within the micropile limits shown on the plans. The costs thereof shall be included in the appropriate micropile pay item.

The contract items and items and unit price bids set forth in the bid schedule shall include all services, permits, labor, equipment, transportation, materials, testing, and supplies for the complete work including, without limitation, mobilization and demobilization for completion of the work. No payment will be made for micropiles abandoned because of defects in the work or other fault of the Contractor or his micropile subcontractor.

No separate payment will be made for Verification Load Tests, all costs shall be included in the pay item, “Micropiles, Sacrificial Test Pile”.

No separate payment will be made for Proof Load Tests, all costs shall be included in the pay item, “Micropiles in Rock, 146 mm Diameter”. No separate payment will be made for disposal of waste and spoil but all costs shall be included in the item “Micropiles in soil, 178mm Diameter”. The waste and spoil shall be managed in accordance with the requirements of the item “Foundation Excavation, Regulated Waste”.

SECTION 545 - VIBRATION MONITORING

545.01 Description.

Vibration monitoring consists of the monitoring of vibration levels and the control of means and methods of construction within a radius of 36.5 meters of the historic Seaboard Terminal and Refrigeration Building. Under this item the contractor shall monitor the historic Seaboard Terminal and Refrigeration Building located on Monmouth Street between the 12th and 14th Street Viaducts during construction operations. These operations include demolition work, temporary sheeting installation, installation of piles and installation of drilled shafts. This work shall consist of the following:

1. Pre-construction and post-construction inspection of the historic refrigeration building.

2. The contractor shall develop a construction operations program to limit the maximum ground vibrations during construction to a maximum peak particle velocity of 12.5 mm/sec. within the vibration monitoring area.

545. 02 Quality Assurance.

The Contractor shall hire a specialty firm to conduct ground vibration monitoring. The specialty firm shall have a minimum of five years experience in work of this nature. All work shall be performed under the direct supervision of a professional engineer registered in the State of New Jersey.

A minimum of two operable continuous monitoring seismographs to measure and record the peak particle velocities shall be provided. A certificate of calibration, dated in the last twelve months, shall be furnished for the seismograph being used, with the calibration being directly traceable to the US Bureau of Standards. The seismographs shall be capable of measuring and recording three components of ground vibration, and have both a visual and paper (or electronic) readout.

545.03 Scope of Work.

A. Pre-construction Inspection.

The Contractor shall obtain written permission to enter the Seaboard Terminal and Refrigeration Building for the purposes of taking photographs, performing a visual inspection and measurements, to assess vibration susceptibility. The Contractor shall make a detailed pre-construction inspection of the inside and outside of the Seaboard Terminal and Refrigeration Building located on Monmouth Street between the 12th and 14th Street Viaducts.

The Pre-construction inspection shall include the following:

1. Detailed description with dimensions for all cracks, displacements, and other evidence of existing damage or structural deficiencies;

2. Notes of type of construction, apparent condition of the structure, and other information as required to assess vibration susceptibility;

3. Complete interior and exterior photographs of the walls with close-ups of existing damage displacements;

4. Other items as directed by the Engineer.

The Pre-construction inspection report shall be 8 ½ x 11 inch format including an index, names and responsibilities of the inspection party, notes, and three by five inch color prints of photographs with dates and

location captions. Seven copies of the report shall be submitted to the Engineer for review 20 days prior to installation of piles, sheeting and/or drilled shafts within the vibration monitoring area.

B. Vibration Monitoring and Control Program.

The contractor shall prepare a vibration monitoring and control program as follows:

1. Install receptors in the existing structures that are to be influenced by the construction operations to measure and record peak particle velocity. The monitoring should be conducted before and during construction operations in three mutually perpendicular directions. The results of the monitoring shall be reported to the Engineer on a daily basis.

2. Assess the vibration susceptibility of the buildings within the vibration monitoring area in relation to predicted construction vibration levels.

3. The vibration monitoring and construction control program report shall include the following:

    (a) Assessment of vibration susceptibility of the building at the time of inspection including estimated damage threshold particle velocity.
    (b) Predicted construction vibrations at these locations, demonstrated by engineering calculations or measurement data for similar situations.
    (c) Description of limitations or modifications of construction equipment or methods.
    (d) Description of monitoring program for vibration susceptible structures.

The contractor shall perform construction operations and vibration monitoring in accordance with the approved program. Changes in the program where conditions are not as anticipated must be approved by the Engineer.

The contractor shall submit seven copies of the report to the Engineer for review 20 days prior to the start of construction activities in the vibration monitoring area.

C. Post-Construction Inspection.

The contractor shall obtain written permission to enter the Seaboard Terminal and Refrigeration Building for the purposes of taking photographs and for visual inspection and measurements to assess the post-construction condition of the building. The contractor shall make a detailed post-construction inspection of the inside and outside of the structures in the same areas of the pre-construction inspection.

The post-construction report shall be the same format as the pre-construction report with the following inclusions:

1. Note any change or damage or the absence of change or damage to the structures.

2. Include photographs of any change or damage. In the case of change or damage, note the cause and the remedial action to be undertaken.

3. The contractor shall submit seven copies of the report to the Engineer for review.

4. The contractor shall submit negatives of all photographs upon completion of work.

D. Vibration Limit Restrictions

A maximum peak particle velocity of 12.5 mm/sec. shall be maintained at all times. There shall be a warning threshold of 9 mm/sec., at this point the Engineer shall be notified to meet with the contractor to discuss the need for response actions. The contractor shall proceed with additional precautionary actions as directed by the Engineer and take all necessary steps so that the vibration limit is not exceeded.

545.04 Method of Measurement.

Vibration Monitoring will not be measured and payment will be made on a lump sum basis.

545.05 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
Vibration Monitoring	Lump Sum

SECTION 546 – PERMANENT ROCK BOLTS

546.01 Description.

This work shall consist of the design, installation and testing of permanent, prestressed rock bolts for the construction of the West Abutment Anchor Bracket Assembly at the 12th and 14th Street Viaducts. The permanent rock bolts shall consist of zinc coated (galvanized) threaded bar tendon that shall develop the full design load of 200 kN. Materials and methods not specifically covered herein shall conform to FHWA and USACOE requirements, and NJDOT and AASHTO Standard Specifications for Highway Bridges.

Difficult installation conditions are anticipated due to the presence of groundwater, fractured and decomposed rock, overhead obstructions, underground utilities and existing drainage piping. The Contractor shall design the permanent rock bolts and determine the installation procedures necessary to meet the acceptance criteria specified herein.

546.02 Definitions.

The following definitions shall apply:

Bond Length. That portion of the embedded prestressing tendon that is bonded to fast set resin or primary grout.
Free Length. That portion of the embedded prestressing tendon that is bonded to slow set resin or secondary grout.
Exposed Length. That portion of the prestressing tendon including components that is not embedded and extends to complete the connection.

The full length of prestressing tendon shall be zinc coated (galvanized).
The embedded length of prestressing tendon shall be fully anchored using resin or grout.
The exposed length shall be a dual coating system of zinc coating (galvanizing) and coal tar epoxy-polyamide paint.

546.03 Applicable Publications.

The following Specifications and Standards referred to in this Section and listed below, including the addenda, amendments, and errata, form a part of this Specification to the extent of the references thereto.

A. American Society for Testing and Materials (ASTM):

A 36M	Structural Steel
A722	Uncoated High-Strength Steel Bars for Prestressed Concrete
C 39	Compressive Strength of Cylindrical Concrete Specimens
C 150	Portland Cement

B. Engineering and Design Manual, Rock Reinforcement, U.S. Army Corps of Engineers (USACOE), 1980.

C. Standard Specifications for Highway Bridges, American Association of State Highway and Transportation Officials (AASHTO), 16th Edition, 1996.

D. Standard Specifications for Road and Bridge Construction, New Jersey Department of Transportation, 2001.

E. Geotechnical Engineering Circular No.4, Ground Anchors and Anchored Systems, Federal Highway Administration (FHWA), 1999.

546.04 Submittals.

A. Certified mill report for threaded bar tendon.
B. Certified mill report for stressing head assembly.
C. Manufacturer's data sheet for polyester resin cartridges.
D. Corrosion protection certification for zinc coating (galvanizing) and coal tar epoxy-polyamide paint.
E. Working Drawings as described herein.
F. Qualifications as described herein.

546.05 Qualifications.

The specialty subcontractor shall show experience in permanent rock bolt anchor design, installation and testing of a minimum of three (3) rock anchoring jobs of similar or larger scope as qualification for this project. Names of individuals (with address and telephone number) who can attest to the adequacy of the work done on these projects shall be provided.

MATERIALS

546.06 Description.

A. Steel Tendons: Prestressed rock bolts shall be:

1. Continuously threaded "Uncoated High-Strength Steel Bars for Prestressed Concrete" – ASTM Designation A722.
3. The bond length of a tendon shall not be less than 1.000 m.
5. The free length of a tendon shall not be less than 2.000 m.
6. The exposed length shall be as required to complete the connection to the Anchor Bracket Assembly.
7. Bond length and free length shall have zinc coating (galvanizing) corrosion protection.
8. The exposed length shall have double corrosion protection of zinc coating (galvanizing) and coal tar epoxy-polyamide paint.
9. The working stress at design load in the tendons shall not exceed 60% of the guaranteed ultimate tensile strength (GUTS). All anchors shall be sized to allow testing to 80% of the GUTS.

B. Steel: Except prestressed steel bar tendons, shall conform to the requirements of ASTM A36M or A572.

C. Cement: Cement shall by type I or type II conforming to the requirements of ASTM C150. The type of cement shall be approved by the Engineer.

1. Cement that has been in storage more than 30 days shall not be used.
2. Cement shall be kept under cover and in a dry condition.
2. Water-cement ratio for cement-based grout shall range between 0.35 and 0.55.
3. The lowest practical water cement ratio with acceptable workability shall be used.

D. Grout: Shall be non-shrink neat cement grout or sand cement grout with no ASTM C827 shrinkage and non-metallic composition or approved equal.

1. Grout shall have a minimum 7 day cube strength of not less than 28 MPa.
2. Grout cube tests shall be collected and tested in accordance with ASTM C109M. Prepare test specimens by pouring grout into 560 by 50 by 50 mm cube molds.
3. Cast a minimum of nine (9) cubes during each 8-hour shift and for each batch of grout.
4. Test three cubes at 3 days; three at 5 days; and three at 7 days.

E. Bearing Plates: Bearing plates shall be sized so that the bending stresses in the plates should not exceed the allowable stresses described in Article 10.3 of Division II Construction, of AASHTO Standard Specifications for Highway Bridges.

F. Centralizers: Shall be fabricated from steel or material, which is not detrimental to either the prestressing steel, polyester resin or grout and installed in accordance with manufacturer's recommendations.

G. Polyester Resin Cartridges: The resin shall be high-strength polyester containing nonreactive inorganic aggregate filler. The catalyst shall contain nonreactive inorganic filler. The compressive strength of the mixed and cured resin shall be 96.5 MPa when tested in accordance with ASTM C 39. The material shall be thixotropic and of such viscosity that the steel bar tendons can adequately mix the material. The relative cure time between fast set anchor cartridges and slow set encapsulating cartridges should provide adequate time to place and test the steel bar tendons as required in the specifications and as shown on the drawings. All cartridges shall be inspected before insertion to see that the polyester resin components have not hardened. Resin cartridges that are older than six (6) months shall not be used.

CONSTRUCTION

546.07 Working Drawings.

Working drawings shall conform to Subsection 105.04.

A. Working drawings shall be prepared and submitted by the Contractor, and approved by the Engineer prior to proceeding with the work. Shop drawings shall indicate dimensions, kind and quality of materials, construction, connections, specifications, location and details of prestressed rock bolts and polyester resin, accessories, grouting, prestressing testing, calibration certificates for jacks and gages, and all details required to complete the work.

B. The Engineer will require 20 working days to approve the submission after all pertinent information is received by the Engineer. No work shall begin prior to the Engineer's approval.

C. The Contractor shall submit proposed methods for prestressed rock bolt installation for review by the Engineer. Procedures shall provide for safe conduct of the work and shall include a detailed description of the methods and equipment to be used for each operation, and shall indicate the sequence of operation.

1. Review by the Engineer of the methods and procedures, or the failure of the Engineer to require any change in the methods, or to call attention to improper calculations or inadequate methods, shall not relieve the Contractor of his responsibility for the performance of this work as provided herein and in the Contract Documents.

D. The Contractor may submit working drawings and calculations for furnishing an alternative permanent prestressed rock bolt that provides the same design load and distribution of design force as provided by the planned permanent prestressed rock bolt. Complete alternative design details shall be furnished for approval by the Engineer. Alternative working drawings and calculations shall conform to Subsection 105.04.

546.09 Drilling.

A. The drilling method used shall:

1. Be core drilling, rotary drilling and percussion drilling that causes minimum disturbance to the surrounding rock mass and not result in any ground loss.

2. Not result in collapse of the hole during drilling.

3. Be by methods that will not shatter or damage the concrete facing between adjacent holes.

4. Be able to maintain the position and inclination of the drilled hole within the tolerances specified herein, allow the hole to reach the design depth, and achieve the design diameter of the drilled hole. The drilled hole diameter shall be in accordance with manufacturers recommendations.

B. The deviation of the hole shall be within an angle tolerance of 3 degrees of the planned inclination and the straightness shall be such that the maximum deviation from a straight line between the top and bottom of the hole shall not exceed 25 mm.

C. The hole shall extend at least 300 mm beyond the length of the bar tendon to be installed.

D. Rock conditions encountered as the work progresses may require the actual pattern, sizes, and lengths to vary from the planned installation. The specific location, inclination, size, and length of each rock bolt is subject to adjustment in the field as directed by the Engineer.

E. Any damage to existing site conditions by such operations shall be cause for immediate halting of operations and repair to the satisfaction of the Engineer. The Contractor shall immediately revise his operations to prevent reoccurrence of such damage.

F. Water Tightness: Prior to installation of the bar tendon, the drill hole should be tested for water tightness by filling it with water and subjecting it to a pressure of 35 kPa. If, as determined by the Engineer, water loss over a period of 10 minutes is excessive, the hole shall be consolidation grouted, redrilled and retested. If necessary, this procedure shall be repeated until water tightness reaches a satisfactory level.

No water tightness tests shall be made where the water would affect the strength of the rock or the bond between resin and rock.

G. Cleaning: All drilled holes shall be blown clean with compressed air, minimum of 345 kPa introduced at the back of the hole, upon completion of drilling. In addition, inclined holes shall blown clean immediately before installation of the resin or grout.

546.10 Steel Tendons.

A. Centralizers shall be placed at 1.0 m intervals starting at the end of tendon to ensure a clearance of at least 13 mm all around. Multiple element tendons or strands shall not be used. The free length tendon shall be free to move during stressing.

B. The double corrosion protection includes the anchor head assembly and components. Alternate details acceptable to the Engineer may be used.

546.11 Grouting Alternate.

A. The grouting operation shall be carried out as soon as possible after the steel bar tendon has been inserted.

B. For bond between rock and tendon in the bond length zone, the grouting shall commence at the lower end of the anchor. The hole shall be filled from bottom to top to prevent air voids. The bottom 300 mm shall not be considered as part of the bond length as it may contain debris from the drilling operation. The grouting pressure and method shall be based on existing rock conditions and required anchor testing acceptance criteria in accordance with the design loads.

C. The grout in the free length zone shall be the same as that for bond zone.

D. The free length secondary grouting shall be done by gravity or low pressure. The secondary grout shall be brought up to the anchor plate upon completion of stressing and testing. The Contractor shall provide the fittings or components needed to accomplish this.

E. Upon completion of grouting, the grout tube may remain in the drill hole provided it is filled with grout.

F. After grouting, the tendon shall not be loaded for a minimum of 3 days.

546.12 Performance Testing.

A. These tests shall be performed as specified herein. A minimum of 5 percent of the permanent prestressed rock bolts shall be performance tested.

B. Jack travel shall be long enough so that no more than 80% of full travel is needed for full elongation of the tendons. Maximum permitted travel shall be 90% of the full ram travel. A hydraulic jack and pump shall be used to apply the test load. The hydraulic pump shall be capable of applying the full load in 1 minute. The jack and a calibrated pressure gage shall be used to measure the applied load. Tendons shall be concentrically located in the center hole jack. Gage readings shall be recorded during testing. The weight of the jack shall be supported externally and not by the tendon. Use a dial gage (0.03 mm sensitivity) aligned perpendicular to the loading head to measure deflection. The dial gage shall be supported on an independent reference point and shall be in contact with the tendon head or an extension of the tendon head.

C. The performance test shall proceed by placing and recycling test load as follows:

P = design load for production rock bolts
AL = alignment load necessary to maintain alignment of stressing and testing equipment. (AL shall not exceed 0.10 design load)
* = Graph required, see paragraph F.

Cycle	Load
1	AL 0.25 P *
2	AL 0.25 P 0.50 P *
3	AL

	0.25 P 0.50 P 0.75 P *
4	AL 0.25 P 0.50 P 0.75 P 1.00 P *
5	AL 0.25 P 0.50 P 0.75 P 1.00 P 1.20 P
6	AL 0.25 P 0.50 P 0.75 P 1.00 P 1.20 P 1.33 P * (Max. test load) Adjust to transfer load.

Each load shall be applied in less than 30 seconds from the time the jack pump is started.

D. Maintain each increment for at least 1 minute.

E. Maintain the maximum test load (1.33 P) for 10 minutes. The load-hold period shall start as soon as the maximum test load is applied and record deflection measurements at 1, 2, 3, 4, 5, 6, and 10 minutes. If the movement is 1 mm or less, between 1 minute and 10 minutes, the creep test may be terminated. Otherwise, the creep test shall be continued for an additional 50 minutes and record deflection measurements at 15, 20, 30, 45, and 60 minutes. The acceptance criteria are 2 mm or less elongation between 5 minute and 50 minute readings.

F. A graph shall be constructed showing a plot of steel bar tendon movement versus load for each load increment marked with an asterisk (*) in the performance test schedule and a plot of the residual movement of the tendon at each alignment load versus the highest previously applied load. Graph format shall be submitted to the Engineer prior to use.

546.13 Proof Testing.

A. All rock bolts not performance tested shall be proof tested. The requirements for loading and monitoring are the same as for the performance test except, that the load sequence shall be AL, 0.25P, 0.5P, 0.75P, 1.0P, 1.20P and 1.33P.

B. Maintain each increment or decrement for at least 1 minute, continuing in accordance with the criteria given under ™Performance Test."

C. Where, in the opinion of the Engineer, significant differences are indicated from previous performance tests, run additional performance test on the next adjacent rock bolt to be installed.

546.14 Acceptance Criteria.

A. Deflections of the steel bar tendons shall be measured with respect to a fixed independent reference.

B. The following three criteria shall be satisfied.

1. Deflection of the tendon shall be greater than 0.8 PL_s/AE where,

   P = applied load
   L_s = length from jack pulling head to bottom of free length specified
   A = total cross sectional area of steel tendons
   E = modulus of elasticity

2. Deflection of the tendon shall be less than $(P (L_s + L_b /2)) / AE$ where,

   L_s = length from jack pulling head to bottom of free length specified
   L_b = bond length of tendon

3. Creep per cycle (D2 - D1) / log T2/T1 shall be less than 2 mm where,

   D1 = measured deflection at time T1

   D2 = measured deflection at time T2

   T1 = time of first deformation measurement (5 minutes for performance test and 0.5 minutes for proof test)

   T2 = time of second deformation measurement (5 minutes for proof test and 50 minutes for performance test)

C. Anchors not meeting Criteria 1 shall not be incorporated into the structure. Those not meeting Criteria 2 or 3 may be accepted at less than design values based on load tests.

D. Retesting of a rock bolt will not be permitted, except that regrouted rock bolts may be retested.

E. When a rock bolt fails, the Contractor shall modify the design or the installation procedures. These modifications may include, but are not limited to, installing a replacement rock bolt, reducing design load by increasing the number of rock bolts, modifying the installation methods, increasing the bond length, or changing the rock bolt type. Any modification that requires changes to the Anchor Bracket Assembly shall be submitted for review by the Engineer. All modifications of design or construction procedures shall be without additional cost to the Department and without extension of contract time.

546.15 Transfer of Load to Structure.

After the successful completion of an anchor test the transfer load shall be applied, and shall include an allowance for seating and long-term losses, so that the design lock-off load is achieved.

Transfer load = 0.05 P

546.16 Lift-off Tests.

A. After transferring the load and prior to removing the jack, a lift-off load reading shall be made. The lift-off load shall be within 10 percent of the specified lock-off load. If the load is not within

10 percent of the specified lock-off load, the anchorage shall be reset and another lift-off load reading shall be made. This process shall be repeated until the desired lock-off load is obtained.

Lock-off load = 0.05 P

546.17 Construction Control.

A. The permanent prestressed rock bolts and components shall be stored in a protected location. There shall be no damage to steel. The steel bar tendon shall conform to specified dimensions and corrosion protection.

B. The steel bar tendon shall be properly inspected before placing into the borehole. While inserting the rock bolt into the hole it shall be protected from any damage, especially to the corrosion protection media.

C. The steel bar tendon shall be capable of being inserted to the prescribed length in the hole. They shall not be driven into the hole or cut off for insertion.

D. The tendon shall be concentric in the hole.

E. Polyester resin cartridges shall be installed in accordance with manufacturer's recommendations.

F. Grout pressure shall be measured at the point of injection. The grout gage mechanism shall be cleaned prior to and periodically during the project to prevent clogging.

G.. Grout components shall be mechanically mixed for 5 to 10 minutes to ensure proper dispersion of cement.

H. The established water cement ratio shall be carefully controlled.

I. Pumping and injection of the grout shall commence immediately after mixing. The water shall be potable quality.

J. Grouting shall continue until the grout of the same composition as that mixed emerges or escapes from the hole.

546.18 Record of Work

All work done for each permanent rock bolt installation shall be recorded carefully. This shall include drilling and cleaning of the steel bar tendon hole, location and inclination, resin cartridge placement, grouting, testing, and stressing of steel bar tendon.

COMPENSATION

546.19 Method of Measurement.

Permanent rock bolts will be measured by the unit for each rock bolt installed, tested and approved. Includes design, installation and testing of the permanent rock bolts and components as specified herein. The Contractor shall supply all labor, equipment and material necessary to properly design and complete the installation and testing of the permanent rock bolts to attain the specified load capacities identified in the contract documents. The quantity for payment under this item shall be by the unit of permanent rock bolts successfully installed, tested and accepted by the Engineer. The work shall include, but is not limited to:

A. Providing materials and equipment for, and installing, permanent rock bolts to carry the design loads.
B. Providing and installing rock bolt bearing plates and connection components for all steel bar tendons.
C. Prestressing all rock bolts and testing as specified herein.

546.20 Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
PERMANENT ROCK BOLT	UNIT

No separate payment will be made for drilling, steel bar tendon and components, polyester resin, grout, corrosion protection and testing as specified herein. The costs thereof shall be included in the "Permanent Rock Bolt" pay item.

The contract items and unit price bids set forth in the bid schedules shall include all services, permits, labor, equipment, transportation, materials, testing, and supplies for the complete work, including, without limitation, mobilization and demobilization for completion of the work. No payment will be made for permanent rock bolts abandoned because of defects in the work or other fault of the Contractor and/or Specialized Rock Bolt Subcontractor. The cost of any steel reinforcement and/or materials required for testing purposes shall be included in the "Permanent Rock Bolt" pay item.

No change in the number of permanent rock bolts to be paid for will be made because of the use of an alternative number of permanent rock bolts by the Contractor and/or Specialized Rock Bolt Subcontractor.

DIVISION 600 - INCIDENTAL CONSTRUCTION

SECTION 602 - PIPES

602.11 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE DELETED:

___ X ___ MM REINFORCED CONCRETE CULVERT PIPE ARCH, CLASS ___	LINEAR METER
___ X ___ MM REINFORCED CONCRETE SEWER PIPE ARCH, CLASS ___	LINEAR METER

SECTION 605 - CURBS

605.01 Description.

THE FOLLOWING IS ADDED:

The Precast Concrete Median Barrier Curb shall consist of the construction of Portland cement concrete curbs at the locations as indicated on the drawings. The Portland cement concrete shall be High Performance Concrete (HPC) in accordance with Section 539 of the Special Provisions. The minimum length of the Precast Concrete Median Barrier Curb shall be 1.524 M (5'-0").

The Variable Height and Width Concrete Barrier curb shall consist of the construction of Portland cement concrete barrier curbs at the locations as indicated on the drawings. The Portland cement concrete shall be High Performance Concrete (HPC) in accordance with Section 539 of the Special Provisions.

The Single Face Concrete Construction Barrier shall consist of the construction of Portland cement concrete curbs at the locations as indicated on the drawings. The Portland cement concrete shall be High Performance Concrete (HPC) in accordance with Section 539 of the Special Provisions.

605.11 Basis of Payment.

THE FOLLOWING PAY ITEMS ARE ADDED:

Pay Item	*Pay Unit*
PRECAST CONCRETE MEDIAN BARRIER CURB	LINEAR METER
VARIABLE HEIGHT AND WIDTH CONCRETE BARRIER CURB	LINEAR METER
SINGLE FACE CONCRETE CONSTRUCTION BARRIER	LINEAR METER

SECTION 607 - SIDEWALKS AND DRIVEWAYS

607.02 Materials.
THE ENTIRE SUBSECTION TEXT IS CHANGED TO:

HMA shall conform to Section 903 except that the composition of the mixture for the top layer may also include up to 20 percent of RAP. Portland cement concrete shall conform to Section 914 except that driveways shall attain a strength of not less than 21 megapascals in three days. Other materials shall conform to the following Subsections:

Soil Aggregate 901.09
Prime Coat:
Cut-back Asphalt, Grade MC-30 or MC-70 ..... 904.02
Tack Coat:
Cut-back Asphalt, Grade RC-70 or RC-T 904.02
Emulsified Asphalt, Grade RS-1, SS-1, or SS-1h 904.03
Cationic Emulsified Asphalt, Grade CSS-1 or CSS-1h 904.03
Curing Materials 905.03
Preformed Expansion Joint Filler 908.01
Reinforcement Steel 915.03
Detectable Warning Surfaces 905.06

Dense-graded aggregate for base course used with HMA sidewalk shall conform to Subsection 901.08.

607.06 Concrete Sidewalks, Driveways, and Public Sidewalk Curb Ramp Delineation.
THE HEADING IS CHANGED TO:

607.06 Concrete Sidewalks, Driveways, and Detectable Warning Surfaces.

607.06 Concrete Sidewalks, Driveways, and Detectable Warning Surfaces.
SUBPART 5 HEADING AND ENTIRE TEXT ARE CHANGED TO:

5. **Detectable Warning Surfaces.** Immediately before installing safety red color and Detectable Warning Surfaces, the designated area shall be thoroughly cleaned and dried according to the manufacturer's recommendation. The installation of Detectable Warning Surfaces shall be according to the corresponding construction details and the manufacturer's recommendation. The background surface upon which the detectable warning surface is installed, silicon carbide 60 grit shall be evenly broadcast at a rate of 38 grams per square meter for skid resistance.

   A list of approved manufacturers can be found at :

   http://www.state.nj.us/transportation/eng/technology/NTP/NTPDB.shtm

   All areas determined to have been damaged or not to be in conformance with the Specifications or the Plans shall be removed and replaced at no additional compensation to the State.

607.07 Method of Measurement.
THE THIRD PARAGRAPH IS CHANGED TO:

Detectable Warning Surfaces will be measured by the square meter.

607.08 Basis of Payment.
THE FOLLOWING PAY ITEM IS DELETED:

Pay Item	*Pay Unit*
PUBLIC SIDEWALK CURB RAMP DELINEATION	SQUARE METER

THE FOLLOWING PAY ITEM IS ADDED:

Pay Item	*Pay Unit*
DETECTABLE WARNING SURFACES	SQUARE METE

SECTION 617 - TRAFFIC CONTROL

617.02 Materials.

THE ENTIRE SUBSECTION IS CHANGED TO:

Materials shall conform to the following Subsections:

Removable Wet Weather Pavement Marking Tape and Removable Black Line Masking Tape 912.12
Temporary Pavement Markers.....912.16

617.03 Traffic Control Devices.

3. Illuminated Flashing Arrows. The solar powered arrow boards approved for use on projects are:

a. Work Area Protection – Arrowmaster Model WAAW–15-SB
b. Solar Technology Inc. – Silent Sentinel
c. Trafcon Industries Inc. – Model TC1-15S
d. Protect-O-Flash Inc. – Model No. M-90 (LED bulbs only)
e. TRACOM (Trailer Component Mfg., Inc.)

THE FOLLOWING IS ADDED TO THE FIRST PARAGRAPH:

Traffic Control devices shall be NCHRP-350 crash test compliant by the NJDOT implementation dates stated in the table below and shall be duly certified, if necessary.

Traffic Control Device Category	Commonly used NJDOT Traffic Control Devices	AASHTO/FHWA implementation date for newly purchased Devices	NJDOT implementation date for newly purchased Devices	NJDOT deadline By which devices must be NCHRP-350 compliant
1	Traffic cones, drums and delineator guide posts	10/1/1998	1/1/2003	8/15/2003
2	Vertical panel, portable sign supports, and type III barricades	10/1/2000	1/1/2003	8/15/2003
3	Truck mounted attenuators and traffic barriers-impact attenuators (crash cushions), barrier terminals, and longitudinal barriers	10/01/1998 attenuators 10/01/2002 temporary barriers	10/01/1998	3/15/2005
4	Portable, usually trailer-mounted, devices such as lighting supports, flashing arrows panels, temporary traffic signals, and changeable message signs used in or adjacent to the traveled way	to be announced	6/15/2005	6/15/2007

Note: Resident Engineer's approval shall be obtained to use traffic control devices that are certified NCHRP 350 compliant, but not listed in the table.

Newly purchased devices shall be NCHRP-350 compliant. A list of NCHRP 350 compliant and FHWA approved devices can be found at:

http://www.fhwa.dot.gov/safety/fourthlevel/pro_res_road_nchrp350.htm

NCHRP-350 non-compliant, yet adequately serviceable category 3 traffic control devices, such as truck-mounted attenuators (TMA) purchased prior to 10/01/1998, will be allowed to be used until 03/15/2005 upon submitting new purchase documentation to the Resident Engineer.

617.15 Removable Pavement Marking Tape.

THE SUBSECTION HEADING AND ENTIRE TEXT ARE CHANGED TO:

617.15 Removable Wet Weather Pavement Marking Tape.

Removable wet weather pavement marking tape shall be installed at designated locations and according to the Manufacturer's recommendations. The tape shall be white or yellow and shall be installed in single or double lines, as designated.

The surface upon which the tape is to be installed shall be prepared according to Subsection 618.05. Removable wet weather marking tape shall be installed on dry surfaces, when the surface temperature is between 10 ºC and 65 ºC and when the ambient temperature is 10 ºC and rising, and when the weather is otherwise favorable as determined by the Engineer. The tape shall not be overlapped, and only butt splices shall be used.

To ensure maximum adhesion, the tape shall be tamped and a truck shall be driven slowly over the tape several times. The tape shall be removed when no longer required for traffic control.

Removable tape that has become damaged and is no longer serviceable shall be replaced immediately and will not be measured for payment. Tape that is damaged by construction operations shall also be replaced without additional compensation.

617.16 Method of Measurement.

THE SIXTEENTH PARAGRAPH IS CHANGED TO:

Removable wet weather pavement marking tape will be measured by the linear foot of 100-MM wide strips, deducting the gaps.

617.17 Basis of Payment.

DELETE THE FOLLOWING PAY ITEM:

Pay Item	*Pay Unit*
REMOVABLE PAVEMENT MARKING TAPE	LINEAR METER

ADD THE FOLLOWING PAY ITEM:

Pay Item	*Pay Unit*
REMOVABLE WET WEATHER PAVEMENT MARKING TAPE	LINEAR METER

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

MOVABLE CONCRETE BARRIER

Description

This work shall consist of furnishing, installing and removing Movable Concrete Barrier (MCB) at the locations shown on the plans. Furnishing and installing barrier mounted delineators is also included in this item. The MCB shall be composed of continuous segments that can be moved from a set position to a lateral and parallel position across the roadway by using a specially designed transfer vehicle. The MCB shall be compatible with the specially designed transfer vehicle specified under the specification for the item Transport and Transfer Vehicle.

This work shall consist of the continual relocation of MCB by the Contractor in order to provide rearrangement of the traffic lanes to accommodate morning and evening peak hour traffic requirements, as well as special events which may occur on weekdays, evenings, nights, holidays and weekends. The bidder should expect to move the MCB at least twice each calendar day for the entire time that the MCB is installed on the project.

MATERIALS

The contractor shall provide product data to the Engineer for approval and submit certification that the MCB conforms to the FHWA specified requirements.

The contractor shall submit certification that the MCB is approved by FHWA for use on Federal Aid Highways or Projects and satisfies the evaluation criteria for Test 10 and 11, Table 3.1 of NCHRP Report 350. The lateral movement of the barrier in Test 10 shall not exceed four (4) feet.

The MCB need not be new but shall be in good condition, as approved by the Engineer. The MCB shall conform to the following material specifications:

Concrete:	As specified in Section 914
Reinforcing Bars:	Grade 40 or 60
Steel Hinges:	ASTM A36
Through Rods:	ASTM A36
Nuts:	IFI 7/8 UNC STD HEX NUT
Washers:	IFI 7/8 MEDIUM DUTY SPRING LOCK WASHERS
Hinge Pin:	AISI 4140 or 4142
Barrier Mounted Delineators – yellow:	As specified in Sub-Section 617.03
Paint	As specified in Section 912

Galvanize all steel hardware.

The barrier shall have the ability to be moved laterally across the road quickly and safely, in one continuous length operating at minimum speed of 5 miles per hour. At its ends, the barrier shall be capable of achieving a smooth radius flare of 15 feet without disassembly or addition or subtraction of parts. Design the barrier section shape and the hinge pin design to permit the connected sections to be picked up off the road bed and rotated a minimum of 18 degrees so that they can be transferred across the roadway by a transfer vehicle.

The MCB shall be of reinforced precast concrete sections made in accordance with the FHWA's criteria. Minimum concrete 28-day compressive strength shall be 4,000 psi. All surface voids or honeycombing shall be repaired. Surface "bugholes" caused by trapped air bubbles shall be permitted.

The barrier section shall be 810mm high, 600mm wide at the base, and 940mm long; the nominal length of the barrier pin to pin shall be 1m long. The top of the barrier shall be "T" shape to permit it to be picked up by the transfer equipment. The MCB shall have a minimum weight of 633 kilograms per meter of length (425 pounds per foot of length). The basic shape of the barrier shall be the "New Jersey Shape" modified at the top with the "Tee-Head".

Provide four (4) 22mm (7/8 inch) threaded bolts extending the length of each section that will accommodate four (4) steel hinges – two (2) on each end – set into recesses formed in the barrier. Connect the sections by a 28mm (1 1/8 inch) hinge pin that fits through the barrier forming a continuous wall of the desired length.

Provide each barrier section with four replaceable rubber feet extending a minimum of 6mm below the bottom surface of the concrete.

CONSTRUCTION

The MCB shall be placed as shown on the plans for all phases of construction, aligned and connected into a longitudinal string. Attach barrier-mount delineaters every 12 meters along the MCB line by use of pressure-sensitive adhesive or epoxy, as recommended by the manufacturer. 100mm wide yellow reflectorized pavement marking paint shall be placed longitudinally on both sides of the bases of each MCB section.

Upon project completion and/or when directed, remove the MCB from the project.

The Engineer may reject any MCB section or barrier-mount delineators having damage, defects in the concrete or the joint connections that could affect the performance of the system or is not within reasonably close conformity to the plans and specifications as determined by the Engineer. Such work and/or material will be declared defective.

Replace rejected units with acceptable replacement units within 24 hours. Maintain a stockpile of 20 acceptable reserve MCB sections on site at all times.

The Contractor shall paint solid white or yellow edge line(s), as applicable, on the side(s) of the barrier section(s) facing traffic prior to each stage of construction as shown on the contract drawings.

The Contractor shall use the Transport and Transfer Vehicle (TTV) to move the MCB to the positions as shown on the Contract Drawings and additional moves as required.

The Contractor shall maintain the MCB throughout the duration of the contract. The maintenance shall include repairs, replacement, maintaining and replacing delineators and pavement marking restoration.

The Contractor shall replace damaged MCB units.

For overnight, weekends and holidays ensure that the MCB is in place for the morning peak hour traffic pattern.

The Contractor shall ensure that only licensed and trained operators drive the TTV. Operating personnel may perform other tasks when not operating the TTV.

Place wheel chocks under the front and rear wheels of the TTV to prevent motions in either direction when parked.

The Contractor shall use an acceptable method to assure the MCB and TTV are free from freezing and are completely operational at all times.

In the event that the MCB is frozen to the deck and in judgement of the Engineer, there is no reasonable non-destructive method to free the barrier, then the MCB will remain in place until such time as the situation can be remedied.

The Contractor shall use a shadow vehicle to escort the TTV at all times except when the TTV is actually moving the barrier.

COMPENSATION

Method of Measurement.

Moveable Concrete Barrier will be measured by the linear meter

Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
MOVABLE CONCRETE BARRIER	LINEAR METER.

TRANSPORT AND TRANSFER VEHICLE

Description

This work shall consist of furnishing, operating, maintaining and removing a Transport and Transfer Vehicle (TTV) to relocate the movable concrete barrier as specified under the specification for the item Movable Concrete Barrier.

EQUIPMENT

The contractor shall provide product data to the Engineer for approval and submit certification that the TTV conforms to the specified requirements, and that the transfer vehicle meets or exceeds all Federal and State of New Jersey safety, health, lighting and noise regulations and standards in effect and applicable to equipment furnished at the time of manufacture.

Submit certification that the equipment furnished under these specifications is the latest improved model in current production, as offered to commercial trade, and shall be of quality workmanship and material. Used, shopworn, demonstrator, prototype, or discontinued models are not acceptable.

The Contractor shall provide a Transport and Transfer Vehicle (TTV) to be used to reposition continuous segments of Movable Concrete Barrier (MCB) from a set position to a constant lateral and parallel distance of up to 4 meters (13 feet) and a vertical distance variable between 0 and 5i0 millimeters (0 and 20 inches) by means of a roller transfer system. The TTV shall safely operate in all circumstance of weather, and on variable surfaces such as concrete and asphalt. The TTV shall not encroach upon adjacent travel lanes while making a variable lateral transfer of the MCB and must be able to reposition MCB when deflection of less than 4 feet has occurred due to impacts. The TTV shall be equipped with two (2) operator's stations, one (1) located at each end of the vehicle. The

minimum service life of the vehicle shall be not less than 10 years. The TTV must operate in both forward and reverse direction in order to reposition the MCB without turning the vehicle around. The TTV must accomplish t he continuous lateral transfer of the MCB at a minimum working speed of 8 kmh (5 mph). Top travel speed of the TTV shall not be less than 30 kmh (20 mph). The TTV furnished to these specifications must meet or exceed all requirements herein.

The TTV frame shall be constructed of high-strength steel and have front, rear, and side structural members for impact protection. Provide the TTV with dimensions as follows:

Out to out width dimension of the tire: 9'-0"
Out to out width dimension of the machine: 12'-2"
Length of the machine: 47'-6"
Ground clearance: 18"
Height from ground to top of highest cab: 13'

The unload weight of the vehicle shall not exceed 30,000 pounds. The loaded weight (when moving barrier segments) shall not exceed 50,000 pounds. The capacity rating shall be 30,000 pounds at the machine's top travel speed of 30 kmh (20 mph) and 50,000 pounds at the top working speed of 8 kmh (5 mph).

The TTV shall be equipped with a roller transfer system which picks up, literally transfers, and places MCBs a constant distance that may be set between 6 and 13 feet. Provide a roller transfer system that lifts the MCB approximately 0 to 20 inches off the road surface, pass the barrier diagonally through the intermediate roller section of the TTV to the opposite side, and lower the barrier to the road surface a predetermined lateral distance parallel from the barrier's original pick-up position.

No power, other than that required to propel the TTV, shall be required to transfer the MCB.

All equipment shall comply at all times with applicable Federal, State and local laws, provisions, and policies governing safety and health including Federal Construction Safety Act (Publication Law 91-54), Federal register, Chapter XVII, Part 1926 of Title 29 Code of federal Regulations, Occupational Safety and Health Regulations for construction and subsequent publications updating these regulations.

Each end of the TTV shall be equipped with headlights, turn signals, clearance lights, running lights, stop lights, and flashing yellow warning lights in conformance with New Jersey construction vehicle lighting requirements. The TTV is to have two (2) lighting circuits. Each cab shall have separate lighting circuit which controls headlights, turn signals, rear brake and tail lamps when unit is traveling in a forward direction. Both ends of the TTV shall be equipped as follows:

Red tail lamp, red stop lamp, turn indicator and red reflector on each side. The lamps and/or reflectors may be incorporated, and shall be screw or bolt-mounted at the same level and as widely spaced as practicable. The lamps shall be located at a height of not less than 15 inches nor mote than 72 inches above the ground.

Two (2) white, halogen, high-low sealed beam headlights, located at a height of not more than 54 inches nor less than 24 inches above the road surface.

Two (2) amber clearance lamps and two (2) red clearance lamps. Only one (1) set of clearance lights to be powered at a times, depending on direction of the TTV. The clearance lamps shall, so far as practicable, be mounted on the permanent structure of the TTV in such a manner as to indicate the extreme height and width of the TTV.

Turn signal controls in each cab – 4 – way flasher type for off, flash off, flash left, flash right and flash both lights.

A communication system shall be provided within the TTV to allow operators to communicate internally between both cabs and externally with vehicles involved in the barrier transfer operation.

The Contractor shall completely assemble, adjust, and install all equipment including standard and supplemental equipment, and make the TTV ready for continuous operation. Furnish all parts not specifically mentioned which are necessary for the TTV to be complete and ready for operation or which are normally furnished as standard equipment. All parts shall conform in strength, quality and workmanship to the accepted standards of the industry.

The Contractor shall maintain the TTV so that there shall be no delay or disruption to its operation and shifting of the MCB during the life of the contract. The Contractor shall ensure that the temperature of the hydraulic fluid will be such that the TTV will function as required during freezing and hot weather conditions.

COMPENSATION

Method of Measurement.

Transport and Transfer vehicle will be measured by the number of months.

Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
TRANSPORT AND TRANSFER VEHICLE	MONTHS

ABSORB 350 SYSTEM – TEMPORARY IMPACT ATTENUATOR

Description

This work shall consist of furnishing the ABSORB 350 TL-2 System. The ABSORB 350 TL-2 System is a non-redirective, gating, crash cushion in accordance with the definitions in the National Cooperative Highway Research Program Report 350 (NCHRP 350). The system is designed to be attached to the moveable barrier installed as part of this contract.

MATERIALS

The contractor shall provide product data to the Engineer for approval and submit certification that the ABSORB 350 TL-2 System conforms to the specified requirements, and it meets or exceeds all Federal and State of New Jersey safety and health regulations and standards in effect and applicable to equipment furnished at the time of manufacture.

Submit certification that the equipment furnished under these specifications is the latest improved model in current production, as offered to commercial trade, and shall be of quality workmanship and material. Used, shopworn, demonstrator, prototype, or discontinued models are not acceptable.

The ABSORB 350 TL-2 System shall be made up of the following components and the system shall be fabricated from materials conforming to the following specifications:

1. ABSORB 350 Energy Absorbing Element – Each element of the system shall be composed of a plastic container, steel side bars, end plate/hinge assemblies, an evaporation prevention cap with tether and appropriate fasteners. The overall dimensions of the assembled element are 610 wide, 812mm tall and 1000mm long. Each element of the system shall weigh approximately 50 kg when empty and 325 kg when filled. The first element of the assembled system should always be empty of fluid with the evaporation cap installed. All other elements of the system should be filled with fluid in accordance with the installation instructions and the evaporation prevention cap securely installed. All elements shall be attached in accordance with the installation instruction and drawings supplied by the manufacturer.
    a. The plastic elements shall be molded from liners low density polyethylene.
    b. All steel sidebars, end plates/hinge assemblies shall be fabricated from mild steel in conformance with ASTM A-36 specifications.
    c. The evaporation prevention cap shall be molded from liners low density polyethylene.
2. ABSORB 350 Nose Piece – Each ABSORB 350 system shall contain one nose piece at the front of the system. The nose piece is approximately 620mm wide, 825mm tall and 610mm long. The nose piece shall weight approximately 60kg and shall be attached to the first Energy Absorbing Element in accordance with the installation instructions and drawings supplied by the manufacturer.
    a. The nose piece shall be fabricated from mild steel in conformance with ASTM A-36 specifications.
    b. The nose piece shall also have an aluminum skin on the front portion to provide an aesthetic cover and a place for attaching traffic control signage if needed. This skin shall be fabricated from 5052 H32 in conformance with ASTM B209 and shall be attached to the steel portion of the nose piece with adhesives and pop rivets.

3. ABSORB 350 Transition Hardware is to be fabricated from mild steel in conformance with ASTM A-36 specifications and as per the manufacturers drawings. The steel components shall weight approximately 60 kg. The hardware shall be attached to a custom section of the moveable barrier that has the front portion of the "T" top removed

Attachment of the ABSORB 350, TL-2 system to the movable barrier shall require five (5) Energy Absorbing Elements. Assembly should be in compliance with the manufacturers drawings and written instructions.

The ABSORB 350 system shall be refurbished after an impact in less than 1 hour. The contractor shall have on hand an adequate fluid supply and the necessary refurbishment materials to perform this function.

The system installed shall not require attachment to a foundation.

The system shall be assembled and filled in accordance with the manufacturers instruction. During low temperatures, proper antifreeze agents should be used in accordance with local standards and environmental regulations to prevent freezing.

Highway safety appurtenances should be applied to hazardous sites in accordance with the guidelines and recommendations in the American Association of State Highway Transportation Officials (AASHTO). "Roadside Design Guide" 1989 and other Federal Highway Administration and NJDOT requirements.

COMPENSATION

Method of measurement

The ABSORB 350 TL-2 System will be measured by the number of units. A unit is defined as a fully functioning system with as many elements as called for on the plans.

Basis of Payment

Payment will be made under:

Pay Item	*Pay Unit*
TEMPORARY CRASH CUSHIONS, ABSORB 350 TL-2, FIVE ELEMENT SYSTEM.	UNIT.

There will be no separate payment for repairs or refurbishment of the ABSORB 350 System due to impacts.

EMERGENCY TOWING SERVICE

Description.

Emergency towing service shall be provided during those periods of time when construction operations require closure of a lane or lanes of traffic or as directed by the Engineer.

Where traffic is restricted by the Contractors operation, the Contractor shall provide emergency towing service for vehicles which may become disabled. This towing service shall be provided for the full time that such restriction exists.

Emergency towing service shall consist of providing personnel and equipment capable of promptly towing disabled vehicles from the construction zone to the nearest location that will permit the disabled vehicle to be legally parked without interfering with traffic. Emergency Towing Service shall respond on notice of the Engineer and/or Contractor Personnel of a disabled vehicle during those periods of lane closure specified herein.

Tow trucks shall be the type approved by the Engineer, equipped with power winches, and capable of moving any vehicle, including trucks. The Contractor shall provide adequate tow trucks and operators nearby the project at locations approved by the Engineer, so as to be promptly available for towing any disabled vehicle.

The Contractor shall be required to provide an Emergency Towing Plan, to be approved by the Engineer, listing names of contracted services with 24 hour phone numbers, including the estimated response time. Failure to respond to required towing, which necessitates the Engineer to use another towing service, shall cause the charg4es for such service to be deducted from contractor payments.

Method of Measurement.

Emergency towing service will be measured by the number of towing trips with disabled vehicle in tow.

Basis of Payment.

Payment will be made under:

Pay Item	*Pay Unit*
EMERGENCY TOWING SERVICE	TOW TRIP

SECTION 618 - TRAFFIC STRIPES AND MARKINGS

618.01 Description.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

Removal of pavement reflectors and castings consists of the removal and disposal of existing raised pavement markers, including the lense when still intact.

Removal and replacement of pavement reflector lenses consists of the removal of existing pavement reflector lenses and installing new mono–directional or bi–directional pavement reflector lenses.

618.10 Defective Stripes or Markings.

STEP 2 OF SECOND SUBPART 2 IN THE THIRD PARAGRAPH IS CHANGED TO:

Step 2: All retroreflectance measurements taken with a LTL2000 Retrometer will be made on a clean, dry surface.

618.12 Removal of Traffic Stripes or Traffic Markings.

SUBSECTION IS RENAMED AND CHANGED TO:

618.12 Removal and Replacement of Traffic Delineation Devices.

A. Removal of Traffic Stripes, Markings, or Reflectors and Castings. The Contractor shall remove all types of traffic stripes or traffic markings by methods that do not damage the integrity of the underlying pavement or adjacent pavement areas, and that do not cause gouging, or create ridges or grooves in the pavement that may result in compromising vehicular control. Obliterating stripes or markings by painting over them shall not be permitted.

Before starting removal operations, the Contractor shall demonstrate the proposed method to accomplish the complete removal of the reflectors and castings and the removal of approximately 95 percent of the stripe or marking without the removal of more than 2 millimeters of pavement thickness. Area of removal includes the area of the stripe or marking plus 25 millimeters on all sides. Removal operations shall not be permitted until the method of removal has been approved.

Debris from the removal of traffic stripes and markings shall be disposed of according to Subsection 201.10.

Disposal of pavement reflectors and castings shall be in conformance with Subsection 201.10.

B. Removal and Replacement of Pavement Reflector Lenses. The Contractor shall remove existing pavement reflector lenses and install new mono–directional or bi–directional pavement reflector lenses within the limits of construction or as directed by the Engineer. The reflector adhesive used in the bonding of the reflector lenses to the casting shall be in conformance with Subsection 912.17.

The Contractor shall remove and replace pavement reflector lenses by methods that do not damage the underlying castings.

Disposal of pavement reflectors lenses shall be in conformance with Subsection 201.10.

SECTION 619 - SIGNS

CONSTRUCTION

619.03 Regulatory and Warning Signs.

THE FIRST PARAGRAPH IS CHANGED TO:

Regulatory and warning signs shall be fabricated of flat aluminum sheets and shall be covered with ASTM D 4956 Type III retroreflective sheeting. Legends, borders, and accessories shall be Type B unless otherwise designated. Signs shall be fabricated according to Subsection 916.08.

619.04 Guide Signs.

THE FIRST PARAGRAPH IS CHANGED TO:

Guide signs fabricated of extruded aluminum sheets shall be covered with ASTM D 4956, TYPE III, Type VIII or Type IX retroreflective sheeting depending on the following:

1. Guide signs on steel "U" posts shall be fabricated of flat aluminum sheets and shall be covered with ASTM D 4956 Type III retroreflective sheeting. Legends, borders, and accessories shall be Type B unless otherwise designated.
2. Guide signs on overheads and breakaway or non-breakaway posts shall be fabricated of extruded aluminum panels covered with ASTM D 4956 Types VIII or IX retroreflective sheeting. Legends, borders, and accessories shall be Type A.

SECTION 620 - DELINEATORS

CONSTRUCTION

620.03 Ground Mounted Flexible Delineators.

THE SECOND PARAGRAPH IS CHANGED TO:

Retroreflective sheeting, ASTM D 4956 Types VII or VIII shall be pre-applied to the front (surface facing traffic) of the unit by the manufacturer. The retroreflective sheeting shall cover a minimum area of 75 by 300 millimeters, beginning a maximum of 50 millimeters from the top of the post. The color shall be white when the delineator is located on the right side to the direction of traffic and shall be yellow when the delineator is located on the left side to the direction of traffic.

620.04 Guide Rail Mounted Flexible Delineators.

THE SECOND PARAGRAPH IS CHANGED TO:

Retroreflective sheeting, ASTM D 4956 Types VII or VIII shall be applied to the upper portion of the flexible delineator panel. The retroreflective sheeting shall cover a minimum area of 115 by 115 millimeters (115 by 230 millimeters for deceleration and acceleration lanes). The color shall be white when the delineator is located on the right side to the direction of traffic and shall be yellow when the delineator is located on the left side to the direction of traffic.

620.05 Barrier Curb Mounted Flexible Delineators.

THE THIRD PARAGRAPH IS CHANGED TO:

Retroreflective sheeting, ASTM D 4956 Types VII or VIII shall be applied to the upper portion of the flexible delineator panel facing traffic and perpendicular to the top of the concrete barrier curb. The retroreflective sheeting shall cover an area of 90 by 90 millimeters. The color shall be white when the delineator is located on the right side to the direction of traffic and shall be yellow when the delineator is located on the left side to the direction of traffic.

DIVISION 700 – ELECTRICAL

SECTION 701 - COMMON PROVISIONS

701.01 Description.

THE FIRST PARAGRAPH IS CHANGED TO:

These provisions are common to the work of traffic signals, highway lighting, sign lighting, and Intelligent Transportation System.

701.09 Junction Boxes

THE FOLLOWINGS IS ADDED TO THIS SUBSECTION:

965 mm junction boxes shall be installed only in non-traveled ways, such as grass/dirt areas unless otherwise approved by the engineer. Conduit entries to the junction boxes shall be positioned so that the minimum bend radius of cables is not violated during installation, splicing, and racking.

701.12 Bonding and Grounding.

THE FOLLOWING IS ADDED TO THIS SECTION:

All ITS, traffic signal and highway lighting facilities shall be grounded in accordance with the requirements of national electrical code Ground rods shall be one standard size and shall be installed in accordance with the requirements of national electrical code and by methods approved by NJDOT. Ground rods shall include a No. 6 AWG bare copper conductor and ground clamps.

Where space is available, several shorter ground rods may be installed rather than attempt to install one long rod. The installation of two or more ground rods connected in parallel provides a means of reducing the grounding system resistance. When two or more vertical-driven ground rods are installed, they should be separated by not less than 1.8 m (6 feet), in accordance with NEC, and preferably at least twice the rod length, to minimize mutual resistance. Ground rods shall only be driven into undisturbed earth or thoroughly compacted filled areas.

The ground system resistance-to-ground shall be measured as the installation is completed, and shall not be higher than 25 Ohms. The resistance to ground shall be measured by a ground tester approved by the Engineer. The measured ground resistance shall be recorded and reported to the Engineer. The other requirements of bonding and grounding shall be as described below:

a. Surge Protection General Requirements. By definition, the term Transient Voltage Surge Suppression (TVSS) describes the equipment necessary for the protection of all AC electrical circuits and twisted pair communications circuits. The TVSS system shall consist of an Electrical Protection Module (EPM) for each electrical power service rated 600 volts or less, and a Communications Protection Module (CPM) for metallic conductor cable communications, and a Data Protection Module (DPM) for metallic conductor data communications and control systems. TVSS components shall have the following specifications:

Maximum continuous operating voltages of any system component shall not be less than 115 percent of the nominal system operating voltage.

All TVSS components shall be rated with an operating temperature range of minus 100 degrees F to plus 170 degrees F; relative humidity between 5 to 95 percent, non-condensing.

All TVSS module components shall be connected in parallel with the system they are protecting. Series-connected components shall not be used.

All TVSS equipment shall be UL 1449 listed and bear the UL label.

b. Electrical Protection Module (EPM). The EPM shall be associated with electrical power feeds to electronic equipment, and shall provide the following capabilities and features:

Integral fuses for field-replacement within the module.

The module shall not short circuit or crowbars the power flow that would result in an interruption to the load.

The module shall not require interruption of building power for maintenance.

Scheduled parts replacement or preventive maintenance shall not be required.

The module shall be furnished with terminal blocks capable of accepting up to No. 2 AWG conductors.

The module shall have independent primary and secondary suppression stages. The primary stage shall be a silicon avalanche diode (SAD) circuit, which shall be fused and field replaceable. The secondary stage shall be a metal oxide varistor (MOV) suppression circuit, which shall be fused and field replaceable. Both the primary and secondary circuits shall be in parallel with the lines that are protected. No switching components, such as silicon control rectifiers (SCR), shall be used to place the secondary circuit on line. Clamping levels of the SAD circuit shall be 25 percent higher than peak line voltage, and the clamping level of the MOV circuit shall be 30 percent higher than peak line voltage. Hybrid designs using SAD and MOV working simultaneously shall not be used.

The TVSS shall not experience degradation from original specifications over an indefinite period of time, providing system performance parameters are not exceeded.

The EPM must be tested with ANSI C62.41-1991 waveshapes for B3 and C1 location categories, achieving a 330 Vpk clamping level and 330 Vpk UL clamp level for 120/240 VAC single phase service.

The primary and secondary transient suppression circuits shall be bipolar and bi-directional and treat both the positive and negative impulses identically.

The primary circuit suppression path shall not be to ground.

c. Communications Protection Module (CPM). The CPM shall be associated with metallic communications and data line conductors, and shall provide a clamping voltage of 200 Vpk or less between the conductors and ground. SAD technology shall be used.

d. Data Protection Module (DPM). The DPM shall be associated with metallic data line conductors, and the clamping voltage shall be 10 Vpk or less between the conductors, and 50 Vpk or less between the conductors and ground. SAD technology shall be used.

701.17 Painting.

THE FIRST PARAGRAPH IS CHANGED TO:

Ungalvanized exposed steel for poles and structures, installed on or in structures shall be painted with one shop coat of rust-inhibitive primer. In addition, all such steel shall be painted with a field coat of rust inhibitive primer tinted to distinguish it from the shop or initial field coat, and a final coat of paint. Lighting standards shall be painted as specified in the plans and under lighting standard specifications.

SECTION 703 – HIGHWAY LIGHTING

703.02 Materials and Equipment.

THE FOLLOWING IS ADDED TO THE SUBSECTION OF LIGHTING STANDARD ASSEMBLIES:

2. Lighting Standard Assemblies. Lighting Standard Assemblies, Type L-1.8-8.0-SB-HD-S-X shall be provided with decorative concrete pole, decorative mast arm and decorative tear drop type 3 Short Globe Luminaire. The lighting standard pole, base and mast arm shall be manufactured by the same manufacturer. Luminaire mounting hardware shall be included. The decorative concrete lighting pole shall be of 8.382 meters high, Model No. KCH275-G-E40 as manufactured by "THE STRESSCRETE GROUP" or approved equal. It shall be provided with steel base box at the base for providing 292MM dia. bolt circle. The lighting standard shall be suitable for installation on bridge parapet. The base box shall be base Model No. C30 as manufactured by "THE STRESSCRETE GROUP" or approved equal. The decorative mast arm shall be 1.8 meters long Model No. S/F KA11-S-6 (MOD) as manufactured by "THE STRESSCRETE GROUP" or approved equal. Luminaire shall be No. TF5-P-B-KS-3-N-G-150S-G as manufactured by HADCO or approved equal. Mast arm and Luminaire shall be black finish by the manufacturers.

Lighting Standard Assemblies, Type L-1.8-8.0-SB-HD-L-X shall be provided with decorative steel pole, decorative mast arm and decorative tear drop type 3 Long Globe Luminaire. The lighting standard pole and mast arm shall be manufactured by the same manufacturer. The lighting standard shall be suitable for installation on bridge parapet. The decorative concrete lighting pole shall be of 9.375 meters (30'-9") high as manufactured by "UNION METAL CORPORATION" Drawing No. N40243-B47 or approved equal. The decorative mast arm shall be 1.8 meters long Model No. S/F KA11-S-6 (MOD) as manufactured by "UNION METAL CORPORATION" or approved equal. Luminaire shall be No. TF5-P-B-KL-3-N-G-150S-G as manufactured by HADCO or approved equal. Pole, mast arm and Luminaire shall be black finish by the manufacturers.

Lighting Standard Assemblies, Type L-2.4-HD-S-X shall be NJDOT standard pole (7.9 meter high) and NJDOT standard mast arm (2.4 meter) provided with decorative tear drop type 3 Short Globe Luminaire. Luminaire shall be No. TF5-P-B-KL-3-N-G-150S-G as manufactured by HADCO or approved equal. Pole, mast arm and Luminaire shall be black finish by the manufacturers.

LIGHTING STANDARD ASSEMBLIES

Type	Nominal Arm Length (meters)	Arms	Luminaires	Lamp Size
L-1.8-8.0-SB-HD-S-X	1.8	1	1	150W-HPS
L-1.8-8.0-SB-HD-L-X	1.8	1	1	150W-HPS
L-2.4-HD-S-X	2.4	1	1	150W-HPS

The contractor shall submit detailed drawings and design calculations of lighting standard assemblies showing all connection details for Engineer's approval. . Drawings and design calculations shall be signed and sealed by a Professional Engineer registered in the State of New Jersey. All submittals for lighting standard assembly shall be made as a unit.

THE FOLLOWING IS ADDED TO THIS SUBSECTION:

8. Reinstall Lighting Standard Assembly. Reinstall Lighting Standard Assembly shall include removing existing lighting standard assembly from the existing location to new location along New Jersey Turnpike Northbound Ramp as shown in the plans. It also includes making this light operational to the satisfaction of the Engineer. The contractor shall be responsible for any damage occurring to the lighting standard assembly and any other lighting facility/facilities due to construction activities. The contractor shall be responsible for matching the anchor bolt circle diameter and pattern to the base of existing lighting standard assembly. The lighting standard assembly relocation shall be accomplished the same day unless otherwise directed by the Engineer. The existing illumination levels for Turnpike ramp shall be maintained at all times.

No separate payment will be made for reconnecting the conduit and wiring to new junction box. All cost associated with connecting the existing conduit and cable to the new junction box shall be included into bid pay item "Reinstall Lighting Assembly".

THE FOLLOWING IS ADDED TO THE SUBSECTION OF LIGHTING ARM ASSEMBLIES:

3. Lighting Arm Assemblies. Lighting Arm Assemblies designated with letters "HD-S" shall be provided with decorative mast arm and decorative tear drop type 3 Short Globe luminaire. The mast arm shall be as manufactured by the manufacturer of decorative concrete pole and shall be similar to concrete pole mast arm except for arm length. Luminaire shall be Model No. TF5-P-B-KS-3-N-G-150S-G as manufactured by HADCO or approved equal. Luminaire mounting hardware shall be included. Luminaire and mast arm shall be black finish by the manufacturers.

LIGHTING ARM ASSEMBLIES

Type	Nominal Arm Length (meters)	Luminaires	Lamp Size
L-1.2A-HD-S-X	1.2	1	150W – HPS

The contractor shall submit detailed drawings and design calculations of lighting arm assemblies showing all connection details for Engineer's approval. Drawings and design calculations shall be signed and sealed by a Professional Engineer registered in the State of New Jersey. All submittals for lighting arm assembly shall be made as a unit.

703.06 Method of Measurement.

THE FOLLOWING IS ADDED TO THIS SECTION:

Reinstall lighting standard assembly will not be measured and payment will be made on lump sum basis.
Temporary highway lighting system will not be measured, and payment will be made on lump sum basis.

703.07 Basis of Payment.

THE FOLLOWING IS ADDED TO THIS SECTION:

Payment will be made under:

Pay Item	*Pay Unit*
TEMPORARY HIGHWAY LIGHTING SYSTEM	LUMP SUM
REINSTALL LIGHTING STANDARD ASSEMBLY	LUMP SUM

No separate payment will be made for anchor bolts, removing and storing the existing lighting standard, removing one existing mast arm, measuring the old bolt circle, and any other additional or incidental material, labor, work related with item Reinstall Lighting Standard assembly. All cost shall be included into lump sum price of bid pay item "Reinstall Lighting Standard Assembly".

DELETE THE LAST PARAGRAPH IN THIS SUBSECTION ABOUT TEMPORARY HIGHWAY LIGHTING SYSTEM PAYMENT.

SECTION 706 - INTELLIGENT TRANSPORTATION SERVICES FACILITIES

706.01 Description.

THE TEXT IN THIS SUBSECTION HAS BEEN REPLACED WITH THE FOLLOWING:

This work shall consist of furnishing, installing and making operational a completely wired and fully functional intelligent transportation system (ITS facilities) as shown in the plans and as described in the specifications. It shall include but not limited to the following subsystems:

Dynamic Message Signs (DMSs)

Traffic Surveillance System (CCTV)

Reader Assembly (Transmit detectors)

Fiber optic Communications System in the field (including a communication cabinet)

T-1 Telephone service communications between NTOC and communication cabinet in the field.

Modification at NTOC for integrating the proposed ITS facilities into existing operating system at NTOC.

Upgrading the existing MIST software at NTOC for DMS NTCIP protocol compliance.

A dedicated telephone line between TRANSCOM office in Jersey City and Reader Assembly cabinet in the field.

The ITS equipment shall consists of specialty equipment and software. All ITS facilities, except Reader Assembly, shall be integrated into the existing equipment, control and software at North Traffic Operations Center (NTOC). NTOC is located in Elmwood Park. The contractor shall be responsible for furnishing proper equipment, control, and software by coordinating his efforts with the NJDOT's ITS and NTOC personnel. Equipment, control and software installed and furnished shall conform to NTCIP requirements and shall integrated into the equipment, control and software at the NTOC. The proposed communication cabinet in the field and modification at NTOC shall be able to transmit and receive information from the proposed ITS field equipment to the existing equipment, control and software located at the NTOC. The contractor shall be responsible for providing any additional equipment and cables at NTOC and integrating the proposed ITS facilities into the existing (MIST) operating system at the NTOC. The integration of the proposed ITS facilities into the existing operating system shall satisfy the operating requirements of the NTOC and shall be as directed by the Engineer. The contractor shall be responsible for procuring services of a qualified software developer for upgrading the existing MIST software for compliance to NTCIP protocol for dynamic message signs.

The reader assembly will be monitored, controlled and operated from the TRANSCOM office in Jersey City. The contractor shall be responsible for furnishing and installing equipment for a functional reader assembly as described in the plans and specifications. TRANCOM will provide reader antenna to contractor for installation in the field. The contractor shall be responsible for coordinating the antenna installations with TRANCOM. The ETTM equipment will be furnished and installed by TRANSCOM.

Prior to start of any work, the contractor shall prepare and submit a block diagram showing all the equipment, control and software layout being provided under this project, to the Engineer for his approval. The package shall also include the qualifications of contractor's system integrator and software developer. The system integrator will perform the system integration of the proposed ITS facilities into the existing operating system at the NTOC . The software engineer will upgrade the existing MIST software at NTOC for compliance to DMS NTCIP protocol. The contractor shall also certify that the proposed equipment is in accordance with the project specifications, and is compatible with the existing equipment, control and software at the NTOC and will perform all the functions described in the specifications. Once approved, the contractor cannot deviate from the layout shown in the block diagrams without the written approval of the Engineer. The contractor shall coordinate with the TRANSCOM, New Jersey Turnpike Authority (NJTA), Port Authority of NY & NJ, and NJDOT's ITS and NTOC personnel to verify all the existing equipment, equipment locations and operating requirements.

A completely wired intelligent transportation system installation consists of two systems: 1) one the hardware support system and 2) the operational system. The hardware support system installation consists of conduits, junction boxes, foundations, cabinets, camera standards, and overhead sign support structure. The operational system installation consists of Dynamic Message Sign (DMS) assembly, CCTV assembly, video and data transceivers, T-1 multiplexers, data port sharer, power and fiber optic wires, jumper cables, wiring, bonding and grounding, and telephone service. It also includes the Documentation, Software, Upgrade MIST software, Integration and Testing and Acceptance of Intelligent Transportation System.

In general provisions of Sections 701 and 706 shall apply.

This work includes but not limited to:

- Installing and furnishing a three line LED Dynamic Message Sign Assembly (DMS #1) mounted on new overhead sign support structure over 14th Street Viaduct as shown in the plans and described in the specifications.
- Installing and furnishing two full matrix LED Dynamic Message Sign Assemblies (DMS #2 &3) mounted on two cantilever sign structure along 14th Street as shown in the plans and described in the specifications. The cantilever sign structure supports to be provided by others under Port Authority Contract.
- Installing and furnishing a Reader Assembly mounted on new overhead sign support structure over 14th Street Viaduct as shown in the plans and described in the specifications.
- Installing and furnishing two CCTV assemblies with pan, tilt & zoom (PTZ) camera controls. One assembly mounted atop a 4.0 meter high pole (CCTV Standard) attached to overhead sign structure support along 14th Street. The other assembly mounted atop 12.2 meter high pole (CCTV Standard) attached to bridge parapet along 12th Street.
- Installing and furnishing a communication cabinet in the field equipped with communications and electrical equipment. Communication cabinet shall be able to transmit and receive data between ITS facilities in the field and NTOC in Elmwood Park. The electronic equipment includes but not limited to T-1 multiplexer, video and data transceivers, data port sharer and other electronic equipment, control and software compatible with the existing equipment, control and software at NTOC.
- Installing and furnishing conduits, power, ground wires, fiber optic cables, jumper cables, junction boxes, meter cabinets, and foundations and all other equipment as shown in the plans.
- Upgrading the existing MIST software at NTOC for compliance to NTCIP protocol for dynamic message signs. The current version of MIST software does not comply to NTCIP protocol for dynamic message signs. The contractor shall procure a software developer for upgrading the existing MIST software at no additional cost to this project.
- Providing modification at NTOC. It shall include installing and furnishing new equipment at NTOC as identified in the specifications and shown on the plans. Modifications at NTOC also includes procuring a system integrator for integrating the proposed ITS facilities in the field into existing/upgraded operating system (MIST software) at NTOC. Proposed equipment at NTOC shall also include installing and furnishing a T-1 multiplexer and associate connectors and cables to provide communications between the proposed field ITS facilities with the existing facilities located at NTOC through a T-1 telephone service from local telephone company. The contractor shall procure a system integrator for integrating the proposed facilities into existing MIST operating system at no additional cost to this project or NJDOT. The MIST software shall be upgraded as described above prior to integrating the new facilities into the MIST operating system.
- Integration of DMS and CCTV subsystems into the existing operating system at the NTOC, to provide comprehensive operational DMS and CCTV subsystems, to satisfy NTOC's operating requirements and in compliance with NTCIP requirements and project specifications. The contractor shall procure a system integrator for integrating the proposed facilities into existing MIST operating system. The MIST software shall be upgraded as described above prior to integrating the new facilities into the existing operating system.
- Obtaining and maintaining the T-1 telephone service from NJDOT approved local telephone company for communicating between the communication cabinet in the field and the NTOC until the service is transferred over to the NJDOT account. It will also include furnishing and installing telephone service cabinet as per telephone company requirements for obtaining T-1 telephone connections.
- Documentation, Software, Integration, Training ,and Testing and Acceptance of ITS facilities. Testing shall be performed for all ITS equipment, subsystems and complete system in compliance with the specifications. Testing shall demonstrate compliance with the project specifications.

One ground mounted sign controller (field controller) shall be provided as part of each DMS assembly. DMS data exchange between DMS controller and communication cabinet shall be through a fiber optic cable and between the communication cabinet and the existing DMS computer at the NTOC shall be via a T-1 telephone service provided from a NJDOT's approved local telephone company. The same T-1 service will also transmit CCTV video and data. The DMS equipment, control and software shall be as described in Sub Sections 906.26, 906.27 and shall conform to NTCIP protocol requirements and shall be integrated into the MIST software.

Detector Assembly shall transmit detector data from reader antennas to reader cabinet through coaxial cable in the filed. Communications between TRANSCOM and reader cabinet in the field shall be through a dedicated telephone line. In general reader assembly shall be as described in the plans and Sub Section 906.28.

Video images and data from camera locations shall be transmitted via fiber optic cable to the communication cabinet and from the communication cabinet to NTOC via the T-1 telephone service. The video image and PTZ control data shall be transmitted simultaneously. The viewing and the remote control of the pan/tilt/zoom at CCTV camera locations shall be selectable by computer keyboard or mouse in Traffic Operation Central or local control cabinet. A video switch compatible with NTOC operation shall be provided. It shall be able to accommodate at least sixteen (16) future cameras in the field. Two videos shall be transmitted simultaneously.

The video signal and the signals from other cameras monitored at these locations are fed into an existing matrix switch at NTOC. The switch sends selected video signals to the existing monitors in the NTOC and also sends selected video signals to the STOC and to the NJDOT headquarters. In addition, it sends a selected video signal to the existing video cassette recorder. Between each monitor and the associated switch are a titler and a screen splitter. The screen splitter enables the user to display either one full-screen image or four quarter-screen images. The splitter also prevents vertical roll of the picture when the user switches from one camera to another. The user shall control both switching and the camera pan, tilt, and zoom (PTZ) from his workstation. When CCTV computer receives a command from user, it sends corresponding commands to the switcher to produce the result desired by the user. The CCTV computer also sends commands to the proper titler to superimpose the appropriate title on the picture.

The T-1 multiplexer shall be straightforward point to point communication and shall be equipped with FXS, LAN channels in addition to channels for video and data from CCTV, DMS, communication cabinet diagnostics and T-1 multiplexer diagnostics.

The installation and integration of new equipment and software into the existing system or modifications to the existing equipment and software shall not intervene with the operations of the existing system at the NTOC and TRANSCOM. The downtime if necessary shall be as approved by the NTOC and TRANSCOM officials.

T-1 telephone service will require one T-1 line from the local telephone company between the communication cabinet in the field and the NTOC in Elmwood Park. The contractor shall coordinate with the NJDOT and local telephone company for obtaining the telephone service and shall maintain it until the service is transferred over to NJDOT account. The NJDOT contact for Verizon account in New Jersey is: Deborah M. Snyder - Phone: (609) 530-3659; 1035 Parkway Ave. CN600, Trenton, NJ 08625.

Each installed resource shall be subjected to installation testing to verify proper operation of the individual resource. Resources that have been identified for installation testing based on the testing standard include:

Communication	–	Testing of fiber optic cables
Communication	–	Testing of T-1 multiplexer and other equipment in field and NTOC
CCTV	–	Local camera operation (includes PTZ operation)
CCTV	-	Remote camera operation (including PTZ operation) and viewing video from NTOC
DMS	–	Local message display and control
DMS	-	Remote message display and monitoring and control from NTOC
Reader Assembly	-	Local Operation
Upgrade MIST Software for NTCIP DMS Protocol	-	Testing of upgraded software for DMS NTCIP protocol compliance

706.02 Material and Equipment.

THE FOLLOWING IS ADDED TO THIS SECTION:

Materials and equipment shall conform to the plans, Section 906, and shall meet all the requirements of the applicable NJDOT Electrical Materials Specifications and as specified below unless otherwise approved by the Engineer.

Fiber Optic Cable Connectors..... 906.03
Coaxial Cable.....906.03 & 906.28
6 Pair #19 Telephone Cable.....906.03
Electronic Equipment Racks.....906.22
Wire Management.....906.23
Cable Ladder.....906.23
T-1 Data Multiplexer..... 906.24
Data Port Sharer.....906.25
Three Lines LED Dynamic Message Sign Assembly.....906.26
Full Matrix LED Dynamic Message Sign Assembly..... 906.27

Reader Assembly……..... 906.28

Shop drawings and catalog cuts shall be provided to the Engineer for approval for all contractor's furnished material and equipment, in accordance with subsection 105.04. Shop drawings and catalog cuts for each operational sub system shall be presented as a unit along with block diagram and qualifications of the contractor's system integrator and software developer. The contractor shall include a Compliance Matrix with each ITS material approval submission in addition to requirements of Section 105.04. The contractor shall provide with the working/shop drawings, a tabular narration stating compliance to each of the requirements stated in these specifications. The compliance matrix shall cross reference to the appropriate page(s) in the documentation manuals submitted, which verifies, documents and confirms compliance to each requirement of the specifications. The documentation manuals shall be numbered for cross reference with the compliance matrix. The compliance matrix shall be submitted for T-1 data multiplexer, data port sharer, DMSs, Reader Assembly, CCTV assembly, communication cabinet, modifications at NTOC, upgrade MIST software for DMS NTCIP protocol, testing criteria for acceptance of systems and qualifications of system integrator and software developer.

The number of copies sent shall be a minimum of eight. The documentation submitted shall demonstrate that the proposed materials and equipment fully comply with the contract documents. All submittals for the ITS equipment shall be submitted and approved as a unit.

Material and equipment supplied for this project shall conform to applicable NTCIP requirements and shall be compatible with operation of the existing material and equipment, control and software (MIST) located at the North Traffic Operations Center (NTOC) in Elmwood Park.

THE FOLLOWING TEXT IS ADDED AT THE END OF THIS SECTION:

Other material and equipment shall conform to the following:

1. **DMS Assembly.** DMS Assembly shall conform to Sub Sections 906.26 and 906.27 and shall include but not limited to a three line or full matrix variable message sign with enclosure, all mounting support to attach to sign support structure, ground mounted sign controller, controller enclosure, enclosure foundation, anchor bolts, DMS cables between controller and sign panel, warranty, training, testing, and acceptance, documentation. The DMS assembly shall be NTCIP compliance and shall be integrated into the operating system (MIST) at NTOC. DMS Assembly, No. 1 shall provide a functional three line LED variable message sign, on an overhead sign structure, as specified under Sub Section 906.26. DMS Assemblies, No. 2 and No. 3 shall provide functional full matrix LED variable message signs, on Port Authority Cantilever signs, as specified under Sub Section 906.27. Cantilever signs support structures will be provided under Port Authority contract by others. Coordination with port authority contractor and contract drawing will be required.
2. **Reader Assembly.** Reader Assembly shall conform to Sub Section 906.28 and shall include but not limited to three reader antennas, antenna mounting supports to sign structure, a reader cabinet with all necessary equipment, UPS, ETTM equipment (reader equipment), equipment racks, cabinet foundation, anchor bolts, and coaxial cables between reader cabinet and reader antennas, warranty, training, testing, and acceptance, documentation. Reader assembly installation will require coordination with TRANSCOM. Reader antennas will be provided by TRANSCOM (by others) and installed by the contractor, as described in Sub Section 906.28. ETTM equipment will be furnished and installed by TRANSCOM (by others). However the contractor shall be responsible for coordinating all installations with TRANSCOM. The telephone service between TRANCOM and Reader Assembly will be ordered by TRANSCOM.
3. **6 Pair #19 Telephone Cable** 6 pair #19 telephone cable shall be used as data cable connecting the reader cabinet utility company manhole/pole for establishing a dedicated telephone connection. 6 pair #19 telephone (data cable) shall conform to Sub Section 906.03. The contractor shall procure all permits, pay all charges, fees and give all notices necessary to and incidental and lawful prosecution of the work to initiate the process for making a manhole entry connection of telephone cable.
4. **CCTV Standard, 12.2 M High.** CCTV standard, 12.2 M High shall be 12.2 meter high steel pole, round or polygonal with a minimum of 18 sides, tapered for structural use, constructed from steel conforming to ASTM specification A53M, Type E or S, Grade B or ASTM A252M Grade 2 with minimum yield strength of 240 MPA.

   Anchor bolts shall conform to ASTM F1554 with minimum yield strength of 724 MPA. Anchor bolts shall be galvanized per ASTM A153. All structural steel plates shall conform to ASTM A36/A36M. The entire unit shall be galvanized per ASTM A123 after fabrication.

Steel pole shall consist of a maximum of two individual tapered steel sections with each section a minimum of 5 meter long. Each section shall be free of circumferential welds or slip joints.

Structural design shall conform to current AASHTO standard specifications for structural supports for highway signs, luminaries and traffic signals.

Additional design criteria are as follows:

Weight of camera and drive unit – Approximately 450 KN

V = 129 Kilometers Per Hour

CD (Wind Drag Coefficient) = 1.2 (for camera and drive unit)

Maximum horizontal deflection at the top of the pole, completely assembled with CCTV camera and all equipment attached, due to a 129 kilometers per hour wind (V) shall not exceed 0.50 percent of the total shaft height.

Working drawings of the pole and base, including design calculations, shall be submitted, for Engineer's approval, in accordance with subsection 105.04. Drawings and design calculations shall be signed by a professional engineer registered in State of New Jersey.

The maximum overturning moment of the base shall be clearly identified in the computations.

The pole manufacturer shall have AISC shop certification for Category Number 1.

All miscellaneous hardware, including nuts, bolts and washers shall be stainless steel conforming to ASTM A320M, Grade B8,

Class 2, strain hardened. Bolt head and nuts shall be hexagonal.

5. **CCTV Standard, 4.0 M High.** CCTV standard, 4.0 M High shall be 4.0 meter high round steel pole constructed from steel conforming to ASTM specification A53M, Type E or S, Grade B or ASTM A252M Grade 2 with minimum yield strength of 240 MPA. It shall be suitable for installation atop proposed sign structure (box) no. 1. Pole base shall be coordinated with the bolt pattern (for pole mounting) of sign structure (box).

   Bolts shall conform to ASTM F1554 with minimum yield strength of 724 MPA. Anchor bolts shall be galvanized per ASTM A153. All structural steel plates shall conform to ASTM A36/A36M. The entire unit shall be galvanized per ASTM A123 after fabrication.

   Structural design shall conform to current AASHTO standard specifications for structural supports for highway signs, luminaries and traffic signals.

   Additional design criteria are as follows:

   Weight of camera and drive unit – Approximately 450 KN

   V = 129 Kilometers Per Hour

   CD (Wind Drag Coefficient) = 1.2 (for camera and drive unit)

   Maximum horizontal deflection at the top of the pole, completely assembled with CCTV camera and all equipment attached, due to a 129 kilometers per hour wind (V) shall not exceed 0.50 percent of the total shaft height.

   Working drawings of the pole and base, including design calculations, shall be submitted, for Engineer's approval, in accordance with subsection 105.04. Drawings and design calculations shall be signed by a professional engineer registered in State of New Jersey.

   The maximum overturning moment of the base shall be clearly identified in the computations.

   The pole manufacturer shall have AISC shop certification for Category Number 1.

   All miscellaneous hardware, including nuts, bolts and washers shall be stainless steel conforming to ASTM A320M, Grade B8,

   Class 2, strain hardened. Bolt head and nuts shall be hexagonal.

6. **CCTV Assembly.** The CCTV Assembly shall conform to the current version of EBM-CCTV-COLOR and shall include but not limited to the followings:

EQUIPMENT	QUANTITY
CCTV Camera	1
Motorized Zoom Lens	1
Environmental Housing	1
Receiver/Driver	1
Heavy Duty Pan/Tilt	1
24 VAC Power Supply	1
F.O. Data/Video Transceiver	1
NEMA Enclosure	1
Back Panel	1

F.O. Patch Panel..... 1
400 Watt Blower type Heater Kit W/ Thermostat..... 1
Blower Fan Kit (22 CFM, 14 Watt) 1
Terminal Block.....1
ROFU Surface Single Gang Box.....3
GFCI Receptacle w/cover plate.....1
Duplex Receptacles..... 2
15 Amps Circuit Breakers..... 3

The CCTV Assembly shall also include: Power and control cables between the equipment in the NEMA enclosure and camera assembly equipment atop the CCTV standard. These cables shall comply with the equipment manufacturer's recommendations for outdoor installations. Blower heater kit shall be as manufactured by Hoffman Model No. DAH 4001B or approved equal. At the camera end, each cable shall be equipped with weatherproof connector(s) and strain relief. All weatherproof connectors and cable assemblies shall be factory assembled and tested in accordance with the equipment manufacturer's requirements and instructions. Pan/tilt/zoom control shall be compatible with the existing control system at the NTOC. The state shall have the right to publish the protocol in the course of competitively procuring additional control/receivers for other projects. If the CCTV assembly provided is substantially identical to one that passed the factory and prototype testing described in Section VII for another NJDOT project, the requirements of Section VIII are waived for this project. Otherwise, a single prototype assembly must pass the requirements of Section VIII. Section IX, training, is deleted.

7. **Communication Cabinet.** Communication cabinet consists of installing and furnishing a ground mounted field terminal cabinet, all communications and control equipment inside of the cabinet, and all other material and equipment including miscellaneous fittings and hardware. Equipment and cabinet details shall be as shown in the plans and as described in the specifications. Communication cabinet shall include but not limited to the followings:

COMMUNICATIONS EQUIPMENT..... QUANTITY
T-1 Multiplexer.....1
F.O. Data Transceivers..... 1
F.O. Data/Video Transceivers.....2
Data Port Sharer.....2
Video Switch.....1

FIELD TERMINAL CABINET..... QUANTITY
24VAC Power Supply..... 1
3000VA UPS……. 1
NEMA 3R Enclosure.....1
Back Panel..... 1
483 mm Equipment Rack..... 2
F.O. Patch Panel.....3
400 Watt Blower type Heater W/Thermostat..... 1
Air Conditioner W/Thermostat.....1
15 Watt Type T-12 Lamp Fixtures..... 2
Terminal Block..... 1
GFCI Receptacle w/cover plate..... 5
Duplex Receptacles.....5
100 amp Main Circuit Breaker in NEMA 1 Enclosure.....1
20amp Circuit Breaker (for A/C).....1
15 amp Circuit Breakers..... 6
Light Switch.....4
Door Alarm Switch.....4

The field terminal cabinet shall conform to the NJDOT Material Specification EBM-FTC-2. It shall also include distribution shelves, jumper cables, anchor bolt assembly and all incidental material and hardware. The contractor shall submit detailed drawings showing all equipment for Engineer's approval. The contractor shall be responsible for providing proper anchor bolts and bolt circle. The anchor bolt design calculations shall be submitted. UPS (uninterruptible power supply) shall be as manufactured by

Powerware Model No. 5125-3000RM or as approved equal. Blower heater kit shall be as manufactured by Hoffman Model No. DAH 4001B or approved equal.

8. **Upgrade MIST Software for DMS NTCIP Protocol.** Upgrade the existing MIST software at NTOC for DMS NTCIP protocol compliance to accommodate the proposed NTCIP compliance dynamic message signs. In general it shall include procuring a software developer for upgrading the existing software. The software developer shall be familiar with existing MIST operating software and DMS NTCIP protocol. Software developer's qualifications shall be submitted to the Engineer for approval. The contractor's software development task leader shall meet regularly with the department's representatives to discuss the software modifications. The software developer shall have a minimum of five (5) years experience on similar projects at least one project at NTOC. The software developer shall prepare plan for upgrading the software and submit to the engineer for review. The plan shall also include testing and acceptance requirements and schedule. All work shall finish prior to integrating the proposed ITS facilities into the MIST operating system. Once the plan is approved the contractor can not deviate from that plan without written authorization by the engineer. The contractor will be held responsible for any delay occurring in integrating the new facilities at NTOC or any damage to existing facilities or obstruction in their operation at NTOC. The contractor is advised that existing DMSs connected to existing MIST operating system are not NTCIP compliance and their operation shall not be disturbed or hindered in any way during or after the upgrade of the MIST software. For more information on existing MIST software, the contractor shall contact PB Farradyne Inc of New York at 212.465.5000.
9. **Foundations, Type Comm.** Foundation, type comm. shall be furnished and installed in the field as shown on the plans. This foundation will be used for installing communication cabinet. The construction shall be responsible for coordinating the bolt circle and anchor bolts to the communication cabinet base.
10. **Telephone service cabinet and foundation.** Telephone service cabinet and foundation shall be constructed and furnished as and where shown on the plans. Telephone Company will provide T-1 telephone service termination equipment inside the cabinet. The contractor will be responsible for preparing the cabinet for telephone service termination as per telephone company requirements.
11. **Modifications at NTOC.** Modifications at NTOC shall be as shown in the plans and shall include but not limited to the following:

    Furnishing and installing ITS equipment for monitoring and controlling the proposed ITS facilities in the field from NTOC building located in Elmwood Park. In general it includes but not limited to control and monitoring of VMS data and CCTV video and CCTV PTZ data control, Communication cabinet diagnostic, telephone and LAN communications and communications diagnostic. The work shall be as discussed in these specifications, shown in the plans, and as directed by the Engineer. The contractor shall provide one T-1 multiplexer at the NTOC with all necessary electronic cards for proper operation of the proposed system. The contractor shall connect the VMS data, CCTV video, FXO channel, LAN channels and diagnostics data channels to the existing equipment as shown in the plans and as directed by the Engineers. Provide a new CCTV port sharer and connect to CCTV PTZ data for connections to the existing CCTV control computer. New FXO card may also be required. NTOC is currently using MIST operating softare for controlling and monitoring various ITS facilities. The proposed facilities shall be integrated into MIST operating software. The integration of proposed facilities into existing operating system shall fully meet the operational requirements of the NTOC. The contractor shall supply all power connections, interconnect cables and other hardware and software required for the proper installation and operation of all the proposed equipment at the NTOC. Additional electronic equipment such as digi board may be required to integrate the new field equipment at the NTOC. The additional equipment shall be as approved by the Engineer and shall be provided at no additional cost to this contract.

    The installation and integration of new equipment, control and software into the MIST operating system or modifications to the existing equipment, control and software shall not intervene with the operations of the existing system at NTOC.

    The existing operating software (MIST Software) shall be upgraded as discussed above prior to integrating the proposed facilities into operating system at NTOC. The proposed ITS facilities shall be integrated into the upgraded existing operating system and any modifications to the control shall be provided under this item. The contractor shall procure a qualified system integrator to perform the integration of the proposed ITS facilities into the existing operating system at the NTOC at no additional cost to this project. System integrator's qualifications shall be submitted to the Engineer for approval. The contractor's system integrator shall meet regularly with the department's representatives to discuss the

system integration. The system integrator shall have at least five (5) years of experience on similar projects and shall be familiar with the existing NTOC equipment, control and software and operating requirements.

12. **6 Pair #19 Telephone Cable.** 6 pair #19 telephone cable shall conform to Subsection 906.03.
13. **Termination Cable, 8 Fibers.** Termination cable, 8 fibers shall be a 8 fiber (fiber-optic) cable and shall conform to NJDOT Material Specification EBM-FOC-SMLTT-1.
14. **Distribution Cable, 12 Fibers.** Distribution cable, 12 fibers shall be a 12 fiber (fiber-optic) cable and shall conform to NJDOT Material Specification EBM-FOC-SMLTSJ-1.
15. **Distribution Cable, 36 Fibers.** Distribution cable, 36 fibers shall be a 36 fiber (fiber-optic) cable and shall conform to NJDOT Material Specification EBM-FOC-SMLTSJ-1. It shall consist of six (6) bundles with six (6) fibers in each bundle.
16. **Trunk Cable, 48 Fibers.** Trunk Cable, 48 fibers shall be a 48 fiber (fiber-optic) cable and shall conform to NJDOT Material Specification EBM-FOC-SMLTSJ-1. It shall consist of four (4) bundles with twelve (12) fibers in each bundle.
17. **Rigid Multiduct Conduits.** Rigid multiduct conduits are for fiber optic conduit installations. Rigid metallic and rigid nonmetallic multiduct conduits shall be installed and furnished where shown in plans. Minimum bending radius shall be maintained. The contractor shall eliminate/modify any conduit bends which may obstruct any future installation of optical fiber cables.

    Rigid metallic multiduct conduits - Rigid metallic multiduct conduits shall conform to NJDOT Material Specification EBM-MULTI-3.

    Rigid metallic multiduct conduit, type S shall be installed in bridge parapet/barrier curb/wing wall/concrete structure or mounted on to bridge structure as shown in the plans for fiber optic cable installation. When two conduits need to be installed, the conduits shall be installed side by side as shown in the bridge details.

    In general type S conduits shall be installed inside the bridge parapet. However conduits going from lower level junction boxes to bridge parapet shall be installed exposed attached to bridge piers (concrete/steel). The exposed conduits shall be fastened to bridge steel/concrete using proper conduit mounting support hardware as approved by the Engineer. Conduit mounting support spacing shall not be more than 1.5 meters.

    The expansion fittings shall be provided at all expansion joints. The expansion fittings shall provide a minimum of 100 mm straight line movement (50 mm in either direction from center), and also provide radial movement. The movement shall be sufficient to cover the full width of the expansion joint.

    Rigid metallic multi-duct conduit, Type S shall include, but not limited to, furnishing and installing rigid metallic multi-duct conduit inside bridge parapet/barrier curb/wing wall/concrete structure or mounted to the bridge structure and furnishing, conduit mounting support hardware, installing one #14 AWG conductor type THHN / THWN in one inner duct, expansion fittings and proper couplings for connections to rigid nonmetallic conduits. The installation shall be as noted in the plan and as recommended by the manufacturere.

    Rigid Non-metallic Multiduct Conduit - Rigid nonmetallic multiduct conduit shall conform to NJDOT Material Specification EBM-MULTI-1.

    Rigid nonmetallic multiduct conduits shall be installed under existing/proposed roadways and grass/dirt areas. Two conduits shall be installed side by side horizontally. Variations in the conduit depth profile will be permitted, as approved by the engineer, to avoid conflicts with existing underground utilities, including residential and commercial services, traffic signal system facilities, survey monuments, culverts and other drainage structures. If any of these underground facilities are damaged or removed during conduit installation, the contractor shall replace or repair them without additional compensation. The contractor shall take caution to avoid damaging existing utility services, and shall be responsible for all resulting damage from service disruption. The contractor, after determining a conflict exists by digging test pits as described under Sections 105.09 - cooperation with utilities and 207 - subsurface structure excavation, shall propose to the engineer a satisfactory path around the obstruction. If the proposed conduit depth is less than 610 mm, then the contractor shall encase the conduit in concrete with the approval of the engineer. The cost of the concrete encasement shall be paid for under Section 613 - miscellaneous concrete. If the proposed conduit depth is greater than 1.5 meter, the extra excavation, with the approval of the engineer, shall be paid for under the item roadway excavation, unclassified in Section 202.

    The contractor shall install conduit markers in grass areas, along conduit route every 75 meter along the path. The contractor shall install in the grass areas conduit markers every 3 meter for a distance of 10 meter, beginning from a point behind the curb or edge of pavement, when crossing from grass to pavement

or from pavement to grass. In areas of guide rail, conduit markers shall be installed over the conduit where it crosses the guide rail. The conduit markers shall be polycarbonate construction, 150 mm minimum diameter, vandal-proof, and flush mounted with the soil. The marker shall indicate the location of the conduit path, the owner and call one phone number. The conduit markers shall be as approved by the Engineer.

Rigid nonmetallic multiduct conduit, type MCB shall include, but not limited to, excavation, furnishing and installing rigid non-metallic multiduct conduit in a rehabilitated / reconstructed concrete shoulder or bituminous shoulder, traveled way or ramp area, furnishing and installing one #14 AWG conductor type THHN / THWN in one inner duct, backfilling and compaction in accordance with the Electrical Details.

Rigid nonmetallic multiduct conduit, type MGA shall include, but not limited to, excavation, furnishing and installing rigid non-metallic multiduct conduit in grass/dirt area, furnishing and installing one #14 AWG conductor type THHN / THWN in one inner duct, backfilling and compaction in accordance with the Electrical Details.

706.03 Construction Requirements.

TEXT IN THIS SUBSECTION IS REPLACED WITH THE FOLLOWING TEXT:

The provisions of 701 and 702 shall apply unless otherwise stated.

The contractor shall contact the NJDOT authorities having jurisdiction, prior to start of any construction or testing activities, to arrange access to the sites and coordinate the work activities. The contractor shall schedule his work accordingly. It will be contractor's responsibilty that operation of any existing system or equipment operation is not compromised in any way. This includes traffic signal system equipment in the field and other existing installations located at NTOC in Elmwood Park and TRANSCOM in Jersey City. Any damage caused by the contractor to the existing systems or equipment shall be repaired at contractor's expense.

The Contractor shall procure a Software Developer for upgrading the MIST software for DMS NTCIP protocol compliance and a System Integrator to ensure proper integration of the proposed ITS facilities into the existing/upgraded operating system (MIST) at the NTOC except Reader Assembly. The Software Developer/System Integrator shall have on staff, professionally certified personnel that are assigned to work on this project. The personnel shall meet the current network, cabling and systems certification requirements of a recognized agency or manufacturer, including BICSI, Cisco, Microsoft and TIA the Telecommunications Industry Association. Software Developer personnel shall be familiar with the existing MIST software and shall provide applicable software industry certifications and trainings. System Integrator shall perform work at the various critical stages of the project. The Engineer will review the personnel qualifications and certifications before permitting the Software Developer/System Integrator's staff to do any work on the project. The integration of the proposed ITS facilities into the existing/upgraded operating system (MIST software) shall provide for remote operation, control, and monitoring of various ITS facilities furnished under this project from NTOC. Remote operation, control, and monitoring shall be as defined under various items in these specifications.

The reader assembly shall be integrated into existing operating system at TRANSCOM building in Jersey City. The reader assembly integration will be provided by TRANSCOM (by others). Reader assembly installation shall be as described under subsection 906.28. The contractor shall coordinate with TRANSCOM for installation, testing and acceptance of various items installed by contractor as part of reader assembly

The Contractor shall provide data cable at the reader locations in accordance with the Plans and Specifications. The data cable shall be 6 pair #19 telephone cable and installed in underground rigid metallic conduit between the utility manholes or utility poles and proposed reader cabinets as identified on the plans. A cable slack of three feet and a RJ connector shall be supplied in the reader cabinets for connection to the field CSU/DSU communication units. A cable slack of ten feet shall be supplied to the utility company for connection in the manholes or utility poles. The utility company will be responsible for the manhole or utility pole connection. The Contractor shall be responsible for the complete communication drop including work performed by the utility company at the manhole or utility pole. Testing of data cable shall be as described in subsection 701.16. The contractor shall procure all permits, pay all charges, fees and give all notices necessary to and incidental and lawful prosecution of the work to initiate the process for making a manhole entry connection of telephone cable.

The DMS assembly, No. 1 shall be mounted over the 14th Street roadway at overhead sign structure no. 1 Three static signs will also be mounted on same sign structure. The contractor shall be responsible for properly locating the DMS location so that the other sign locations are not compromised. For sign locations, the contractor

shall follow sign structure and signing plans. The contractor's method of installation shall be approved by the Engineer. The contractor shall also provide ground mounted sign controller as described in the specifications and as shown on the plans. The contractor shall be responsible for proper size of foundation and mounting of controller cabinet. Foundation, anchor bolts and mounting details along with design calculations shall be submitted to the Engineer for approval prior to start of any work. The controller foundation details shall be signed and sealed by a professional engineer registered in the State of New Jersey.

DMS Assemblies, No. 2 and 3 will be provided on cantilever sign structure supports. The cantilever sign structure supports will be provided under Port Authority Contract by others. The contractor shall submit a plan for approval to Engineer for installing method to be used for installing the DMS assemblies on Port Authority sign structures. The contractor shall also be responsible for coordinating the details of installation, construction and schedule with the Port Authority Contractor. The contractor shall also provide ground mounted sign controller as described in the specifications and as shown on the plans.. The contractor shall be responsible for proper size of foundation and mounting of controller cabinet. Foundation, anchor bolts and mounting details along with design calculations shall be submitted to the Engineer for approval prior to start of any work. The controller foundation details shall be signed and sealed by a professional engineer registered in the State of New Jersey.

DMS Installation Support: The factory certified technician shall be present for assisting in the installation and diagnostic testing of the software product on the PC platform at the NTOC in Elmwood Park at no additional cost to this contract or the NJDOT. The factory trained technician shall be present during the installation of the Dynamic Message Sign Assemblies at the site.

DMS Maintenance: General – The contractor shall perform Preventive Maintenance at six (6) month intervals and Emergency Maintenance on an as needed basis during the two (2) year warranty. The two-year warranty period start date will be the date of final acceptance of project construction or January 1, 2008 which ever comes first unless otherwise approved by the Engineer.

Maintenance:

I. Making all factory repairs to the equipment of returned units/parts
II. Replacement of defective equipment
III. Replace equipment with units from stock
IV. Parts and special supplies needed for Preventive Maintenance
V. Cost of shipping to and from (second day ground) the repair facility and the contractor's inventory

Preventive Maintenance:

I. Preventative Maintenance checklist based upon 6-month intervals
II. Block equipment and wiring diagrams
III. Schematic wiring diagrams
IV. Line replaceable part/unit information including assemblies/components, manufacturer and model number
V. Required test equipment

EMERGENCY: Troubleshooting guidelines that identify symptoms rank their possible causes in order of highest probability and recommend remedial actions and required test equipment

The connections of the bonding wire to the bases of the camera standards and Dynamic Message Sign structure shall be provided by means of grounding rods. All electrical and electronic equipment shall be equipped with surge protection as recommended by the equipment manufacturer and as directed by the Engineer.

Camera standards shall be securely bolted in a vertical position. Shims of 6 millimeters maximum thickness shall be installed, if necessary. Camera assemblies and cabinets shall be securely attached to poles as shown in the plans and as approved by the Engineer.

Fiber optic cables (distribution/terminations cables) shall be installed without any splicing and shall be terminated inside the equipment cabinets and communication cabinet, unless otherwise directed by the Engineer.

Prior to installing any conduit, junction boxes, or fiber optic cable for fiber optic installations, the contractor shall submit to the engineer a fiber optic cable splicing plan that shows the proposed location of every splice. The plan shall include optical budget calculations that demonstrate that the signal losses from all sources are at least 5 db below the maximum loss budget specified by the manufacturer of the equipment that the contractor proposes. Once the engineer approves the splice plan, the contractor may not deviate from it without written permission from the engineer.

Before any fiber optic cable installation is performed, the contractor shall provide the engineer with four (4) copies of the cable manufacturer's recommended and maximum pulling tensions for each cable size and type. These pulling tensions shall be specified for pulling from the cable's outer jacket. Included with these pulling tensions

shall be a list of the minimum allowable cable bending radius and the cable manufacturer's approved pulling lubricants and guidelines for their application. Only Polywater F lubricants will be permitted. The cost of providing this analysis and documentation is incidental to the cost of building the cable network and will not be paid separately. The fiber assignment diagrams in the plans will be provided to the contractor on a MSDOS compatible 3.5 inch computer diskette. These may be used for the connection of roadside equipment and communication hubs, but the contractor shall have ultimate responsibility to ensure that all equipment is properly connected and operating. The contractor shall provide as-built fiber assignment diagrams and tables similar to those shown in the plans.

Personnel involved in the installation, splicing, and termination of the fiber optic cables shall meet the following minimum requirements:

Three (3) years experience in the installation of fiber optic cables, including splicing, terminating, and testing of single mode fibers. Experience in having installed three (3) networks where fiber optic cables are installed in outdoor conduits, and where those networks have been in continuous satisfactory operation for at least two (2) years. At least thirty (30) days prior to the installation of fiber optic cable, the contractor shall submit, to the engineer, documentation indicating the qualifications and experience of the splicing personnel to be involved in the installation, splicing, and termination of the fiber optic cable. The documentation shall include names, addresses, and telephone numbers of the three (3) network owners, who may be contacted by NJDOT regarding these installations. No fiber optic cable shall be installed until the engineer in accordance with the minimum requirements specified above has approved the installation personnel.

The fiber cable installation system to be used shall be inspected and approved by the engineer. All installation activities shall be done in the presence of the engineer or his designated representative. Cables shall be pulled in conduit with a cable grip designed to provide a firm holds on the exterior covering of the cable. The contractor shall take every precaution to ensure that the fiber optic cable is not damaged during storage and installation. Workers shall not step on the fiber optic cable, nor run over the cable with any vehicle or equipment. The cable shall not be pulled along the ground, over edges or corners, over or around obstructions, or through unnecessary curves or bends. Approved cable guides, feeders, shoes, and bushings shall be used to prevent damage to the cable during installation. The contractor shall establish adequate voice communications between the cable feeding location and the cable pulling equipment prior to commencing any pulling operations. The cable reels shall be set up on the same side of the junction box as the conduit section in which the cable is to be placed. The reel shall be made level and brought into proper alignment with the conduit section such that the cable will pass from the top of the reel in a long smooth bend into the duct without twisting. The cable shall not be pulled from the bottom of the reel. The cable shall be fed by manually rotating the reel. An approved cable feeder guide shall be used between the cable reel or storage stack and the face of the duct to protect the cable, and to guide the cable into the duct as it is payed off the reel or from the storage stack. The dimensions and set-up of the feeder guide shall be such that the cable does not bend at any location to a radius less than the cable's minimum allowable bending radius. This minimum bending radius of the cable shall not be exceeded at any time during cable installation. Cable ends shall be kept sealed at all times during installation, using an approved cable end cap. Tape shall not be used to seal the cable end. The cable end shall remain sealed until termination takes place. The allowable pulling tension shall be the cable manufacturer's recommended pulling tension for that cable for pulling by the outer jacket, or 80 percent of the manufacturer's maximum pulling tension for pulling by the outer jacket, whichever is less. The contractor shall ensure that the allowable pulling tension is not exceeded at any time during cable installation by using one of the following methods, as approved by the engineer.

If pulling the fiber cable by hand: Attaching an approved strain gauge to the pulling line at the cable exit location, and at a sufficient distance from the take-up device, such that the strain gauge can be read throughout the entire cable pulling operation. The strain gauge shall be calculated as per the manufacturer and as directed by the engineer. Polywater F lubricant, in the amount recommended by the cable manufacturer, shall be used to facilitate pulling the cable. The cable shall be lubricated as it passes from the cable reel or storage stack into the cable feeder. An approved cable lubricator (funnel) shall be placed around the cable just ahead of the cable feeder to facilitate proper lubrication of the cable. After the cable has been installed, the exposed cable in a manhole, junction box, or cabinet shall be wiped clean of cable lubricant with a cloth before leaving the junction box or cabinet.

Fiber optic patch panels shall be used to terminate the termination cables in cabinets. Fiber optic jumper cables, with factory installed connectors, shall be used to connect the connector of the termination cable to the connector on the associated fiber optic transceiver. The fiber optic jumper cables shall meet all requirements for single mode fiber optic cable. All fiber optic connectors, whether on pigtails, jumpers, distribution shelves, or equipment, shall be labeled to preclude improper connection. Pigtails and jumpers shall be labeled using machine-printed, self-laminating, self-adhesive labels. The attenuation at each connector must be below 0.5 db and the average attenuation of all connectors must be less than 0.3 db. Connector losses at communications hub and

operations center fiber optic distribution shelves shall not exceed 0.3 db. The reflection at each connector shall be less than minus 55db.
The minimum amount of slack for termination cable to be stored in junction boxes is shown below:

Location	Slack
965 mm junction box	20 meter
Junction box other than 965 mm	4 meter
Communication cabinet	4 meters
Equipment Enclosure	2 meters

The control and communications equipment shall be installed in the field (communication cabinet and DMS enclosure, CCTV NEMA enclosure) and in the NTOC building in Elmwood Park. All the equipment shall be interconnected to transmit receive the information back and forth, between the communication cabinet in the field and the NTOC building in Elmwood Park, for remote control and monitoring of various field ITS facilities constructed as part of this project from NTOC building in Elmwood Park. Communications between reader assembly in the field and TRANSCOM will be through a dedicated telephone line and will be established by TRANSCOM (by others).

Electrical feeder or branch circuit conductors shall not occupy the same conduit or enclosure with fiber optic trunk and distribution cables. This is to avoid damage to fiber optic trunks and system-wide failures due to burn-off of underground electrical conductors..

EXCEPTION: Conductors for a branch circuit to a device may occupy the same conduit as the fiber optic termination cable to only that device.

All communications cables shall be installed in sealed conduits and junction boxes. 450 by 900 mm junction boxes or other Junction boxes with underground openings or vent holes in covers shall not contain fiber optic trunk cables. Multi-duct fiber conduit inner ducts, whether occupied or empty, shall have their ends sealed with plugs or bushings designed for the purpose. Standard rigid metallic and non-metallic conduits containing fiber optic cables shall have both ends sealed as follows: A one inch layer of “Nixalite” copper rodent repellant mesh shall be packed tightly into the end of the conduit, and around the cables, to depth of no more than 2”. The copper mesh shall be thoroughly wetted with an application of “Ropel” rodent repellant agent. The end of the conduit shall then be sealed, flush with the edge of the conduit or bushing, with standard duct seal.

Minimum bending radius of all multiduct conduit installation shall be maintained. Conduit installation details provided in the plans are only conceptual.

Installation Tests. Each installed resource shall be subjected to testing to verify proper operation of the individual resource. Resources that have been tentatively identified for individual testing include:

CCTV assembly: Local camera operation. (Includes PTZ operation)

Communications: Demonstration of proper communication of voice, video and data between all interconnected locations.

DMS assembly: Testing of DMS assemblies shall be as described in Sub Section 906.26 and 906.27.

Reader Assembly: Local operation

The Contractor shall develop a test plan for all equipment that shall include a list of tests to be performed, test schedule, personnel assignments and the equipment to be tested. The test plan shall be submitted to the Engineer for review and approval at least 30 days prior to the scheduled date of the start of the tests. This test plan shall, as a minimum, contain the following elements; requirements for test initiation, the test objective, success criteria, test description, test conditions, test data requirements, test equipment/facilities, methodology, data collection/analysis, test schedule, discrepancy notation, discrepancy tracking, action(s) taken to correct discrepancies, re-test data and criteria for successful exit from the test. The test plan shall contain samples of all data sheets and performance records to be used during the test.

The Engineer will approve or request modifications to the test plan and all test forms to be used within 15 days of the Contractor's submittal. The installation test will not be authorized to start without the approval of the test plan and forms. The Engineer, or his designee, shall be invited to monitor all tests. Any failures shall be documented and repairs made.

If the Engineer determines that the equipment provides consistent operation that is in conformance with the installation test plan and the Contract Documents, the Engineer will issue written test approval. The amount to be authorized for payment shall not exceed 70 percent of the Contract price for the associated Pay Item. The Contractor shall continue to meet the requirements in Section 109.06 Materials Payments. If in the Engineer's

determination, the installation test is not successful, the Contractor shall not continue with the work nor invoice for payment until testing is completed and the performance meets the requirements of the Contract plans and specifications.

Acceptance Tests. The system shall be subjected to testing to verify proper operation of the subsystems. Subsystem acceptance testing shall include:

CCTV: Local camera operation. (Includes PTZ operation)

Communications: Demonstration of proper communication of voice, video and data between all ITS components in the field, communication cabinet and NTOC as described on the plans and specifications. It shall provide for control and monitoring of DMS assemblies, CCTV assemblies and communication cabinet and equipment in the field from the NTOC.

DMS assembly: Testing of DMS assemblies shall be as described in Sub Section 906.26 and 906.27.

Reader Assembly: Testing of Reader Assembly shall be described under Sub Section 906.28.

Upgrade MIST software: Demonstrate compliance to DMS NTCIP protocol. Also demonstrate that the upgraded software can monitor and control both existing new NTCIP protocol compliance DMSs and existing DMSs which are not NTCIP compliance.

The purpose of the subsystem acceptance tests is to verify that all equipment, communication links, components, sub-components and the total system all are operational per the requirements stated in the approved subsystem acceptance test plan. Subsystem tests shall be modeled after the factory acceptance tests for OEM equipment stated previously.

The Contractor shall develop a test plan for each subsystems that shall include a list of tests to be performed, test schedule, personnel assignments and the equipment to be tested. The test plan shall be submitted to the Engineer for review and approval at least thirty (30) days prior to the scheduled date of the start of the tests. This test plan shall, as a minimum, contain the following elements; requirements for test initiation, the test objective, success criteria, test description, test conditions, test data requirements, test equipment/facilities, methodology, data collection/analysis, test schedule, discrepancy notation, discrepancy tracking, action(s) taken to correct discrepancies, re-test data and criteria for successful exit from the test. The test plan shall contain samples of all data sheets and performance records to be used during the test.

The Engineer will approve or request modifications to the test plan and all test forms to be used within 15 working days of the Contractor's submittal. The subsystem acceptance test will not be authorized to start without the approval of the test plan and forms. The Engineer, or his designee, shall be invited to monitor all tests. Any failures shall be documented and repairs made.

Upon completion of the tests, the Engineer and the Contractor will review all applicable test documentation. Any and all discrepancies, failures or changes shall be resolved by the Contractor. The Engineer reserves the right to have the Contractor re-schedule and execute any or all portions of the test that failed to achieve an acceptable level of performance or demonstrate all of the functional requirements of the approved subsystem acceptance test plan.

All test results and supporting documentation shall be compiled and organized by the Contractor in a logical fashion in 3-ring binders and submitted to the Engineer after testing is completed and accepted.

If the Engineer determines that the equipment provides consistent operation that is in conformance with the subsystem acceptance test plan and the Contract Documents, the Engineer will issue written test approval and authorization to pay up to 100% of the Contractor's invoice cost of installed equipment as can be shown to have been paid by the Contractor on a documented invoice from the supplier. The amount to be authorized for payment shall not exceed 85 percent of the Contract price for the associated Pay Item. The Contractor shall continue to meet the requirements in Section 109.06 Materials Payments. If in the Engineer's determination, the installation test is not successful, the Contractor shall not continue with the work nor invoice for payment until testing is completed and the performance meets the requirements of the project specifications.

The warranty period will begin upon acceptance of Test Approval and delivery of the OEM test software except for dynamic message signs (DMSs). The two-year warranty period start date for DMS assemblies will be as described under DMS Maintenance in the beginning of this Section.

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Instructions, Manufacturer Documentation and Guarantees. Two sets of complete schematics and maintenance manual of the equipment shall be supplied with each type of equipment furnished. The maintenance manual shall include a complete sub-component parts listing.

System Documentation shall be supplied by the Contractor in Intergraph CADD format or AutoCAD format with the permission of ITS Engineering. System Documentation shall include CADD drawings for the following:

1) Equipment Layout
2) System Block Diagram
3) Fiber Optic
    a) Cable layout and splice connections
    b) Patch panels
    c) Terminations and connectors
    d) References to OTDR and Power readings
    e) Calculated optical budget for each fiber (end to end)
4) Software upgrades
5) Rack profiles, connections and cross connects
6) Communications subsystem
7) CCTV subsystem
8) DMS subsystem
9) All wiring diagrams for the various subsystems

Catalog Cuts and manufacturer information for all equipment.

The contractor shall certify that all as-built plans, schematic diagrams, and other system documentation are accurate and complete in all respects. For a period of five years after acceptance of the project by the State, the contractor shall agree to correct and reprint or duplicate any documentation found to erroneous, at the request of NJDOT.

Five copies of the final documentation for the above shall be supplied on CDROM. Also included on the CD will be all electronic files associated with the OTDR readings, power readings, video performance, detector configurations in the field, system upgrades inside the NTOC and optical budget analysis.

The system control and auxiliary equipment shall carry a two-year guarantee from the date of acceptance against any imperfections in workmanship or materials.

The Contractor shall make available for their use, any and all equipment that they deem necessary for full and proper testing of the system control equipment. All software used for testing shall be turned over to NJDOT for use in equipment maintenance.

Any repairs made by a manufacturer or representative shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All warranty repairs must be made within the warranty period. The Contractor shall keep a complete record of all repairs made to each unit.

All ITS field devices and components (such as poles, cabinets, etc.) shall be located behind guide rail and/or other structures to avoid accidental vehicle damage.

706.04 Method of Measurement.

TEXT IN THIS SUBSECTION IS REPLACED WITH THE FOLLOWING:

In general provisions of Section 701, 702 and 703 shall apply.

No measurements will be made for the Dynamic Message Sign (DMS) Assemblies and payment will be paid on a lump sum basis for each DMS assembly installed and furnished. The lump sum price of each DMS assembly shall include furnished and installed variable message sign with enclosure, sign mounting supports, ground mounted sign controller with enclosure and a digital/sign control unit, sign controller enclosure foundation, anchor bolts, , DMS cables between controller and sign enclosure, portable data input, spare parts, all testing and acceptance, performance bonds, two (2) year warranty, on site installation/testing of sign controller and integration of the sign into the existing/upgraded central operating software (MIST) at the NTOC. It shall also include installation support and maintenance support, as described in the specifications, furnished by factory certified technician, including travel to and from the site, transportation and subsistence, lodging, telecommunications cost and electronic test equipment. It shall also include all items discussed in this Section including all hardware, software, integrations, testing, presence of manufacturer's technician, and labor necessary to finish this work as specified in the plans and specifications.

No measurements will be made for the Reader Assembly and payment will be paid on a lump sum basis. The lump sum price shall include furnished and installed three reader antennas, antenna mounting supports, one reader cabinet with auxiliary equipment, UPS, equipment racks, cabinet foundation, anchor bolts, coaxial cables between reader cabinet and reader antennas and all other incidental hardware, documentation, testing and acceptance. It shall include all items discussed in the specifications and plans including coordination with TRANCOM and NJDOT. The

Lump Sum cost shall not include equipment cost of three antennas as the antennas will be purchased by TRANSCOM (by others) and provided to contractor for installation. Electronic toll and traffic management (ETTM) equipment for reader assembly will not be part of this item as TRANCOM (others) will furnish and install the ETTM equipment.

Camera standards, 12.2 M High will be measured by the number of units. It includes installing and furnishing steel camera pole, 12.2 m long with hand holes, air terminal, anchor bolt assembly, cap and mountings for camera assembly and NEMA enclosure as shown in the plans or specified in the specifications. It shall also include all necessary incidental material and hardware.

Camera standards, 4.0 M High will be measured by the number of units. It includes installing and furnishing steel camera pole, 4.0 m long with hand holes, air terminal, anchor bolt assembly, cap and mountings for camera assembly and NEMA enclosure as shown in the plans or specified in the specifications. It shall also include all necessary incidental material and hardware.

CCTV assemblies will be measured by the number of units furnished and installed. It includes but not limited to the CCTV assembly (CCTV camera, pan-tilt drive, vide/data transceiver, air terminal, cables from CCTV camera assembly to NEMA enclosure, NEMA enclosure etc) and all incidental material and hardware, labor, testing, warranty, and documentation.

Communication cabinet will be paid on a lump sum basis in which no measurement shall be made. It includes but not limited to cabinet and all power and electronic equipment as shown in the plans and specifications,. including T-1 Multiplexer, fiber optic video and data transceivers, data port sharers, fiber optic patch panels, circuit breakers, power outlets, anchor bolts assembly, incidental equipment, equipment racks, distribution selves, cable ladders, cables, all incidental mounting hardware, labor, testing, warranty, and documentation necessary to meet these specifications.

Foundations, Type Comm. will be measured by the number of units. The unit price shall include furnishing and installing foundation, type comm. for installation of communication cabinet in the field as shown on the plans. The unit price shall include any incidental work and hardware including anchor bolts.

Telephone service cabinet and foundation will be measured by the number of units. The unit price shall include furnishing and installing one telephone service cabinet and its foundation including all auxiliary equipment and anchor bolts at each location as shown on the plans. It shall also include any preparations required to comply with the utility company requirements.

Upgrade MIST software for DMS NTCIP Protocol will be paid on a lump sum basis and no measurement will be made. It shall include upgrading the existing MIST software for DMS NTCIP Protocol compliance as specified in these specifications. It includes but not limited to procuring a software developer for upgrading the software, coordination with NJDOT and NTOC, labor, testing and acceptance, software, warranty, and documentation necessary to meet these specifications.

No separate measurement will be made for procuring a software developer for upgrading the existing MIST software at NTOC. This item will be considered incidental to the Pay Item “UPGRADE MIST SOFTWARE FOR DMS NTCIP PROTOCOL”.

Modifications at NTOC will be paid on a lump sum basis in which no measurement shall be made. It includes but not limited T-1 multiplexer, additional equipment as and if required, interconnect cables connecting the existing equipment, control and software to the proposed equipment, power cables, incidental equipment, equipment racks, distribution selves, cable ladders, cables, all incidental mounting hardware, labor, testing, integration, software, warranty, and documentation necessary to meet these specifications. It shall also include the services provided by system integrator for integrating the proposed ITS facilities into the existing/upgraded central operating system (MIST) at the NTOC.

No separate measurement will be made for procuring a system integrator to perform the system integration of the proposed ITS facilities into the existing/upgraded central operating system at the NTOC. This item will be considered incidental to the Pay Item “MODIFICATIONS AT NTOC”.

T-1 telephone service will be paid on a lump sum basis in which no measurement shall be made. It shall include connection charges and monthly payment of bill until the service is transferred over to NJDOT. It shall also include any preparations required to comply with the utility company requirements. For estimating purposes, the contractor shall assume 12 month period for maintaining T-1 telephone service.

6 pair #19 telephone cable will be measured by the linear meter furnished and installed. The contract unit price per linear meter shall include furnishing all material, hardware, and labor necessary to make a complete and accepted installation. All cable ties, clamps, jumpers, connectors, splice hardware, splice enclosures, testing, caps, consumables, and documentation shall be included.

Termination/distribution/trunk cables of various kinds will be measured by the linear meter furnished and

installed. The contract unit price per linear meter for termination/distribution cables shall include furnishing all material, hardware, and labor necessary to make a complete and accepted installation. All cable ties, clamps, jumpers, connectors, splice hardware, splice enclosures, testing, caps, consumables, and documentation shall be included.

Rigid multiduct conduits of various kinds shall be measured by the linear meter furnished and installed. The contract unit price per linear meter for multiduct conduit shall include furnishing all material, hardware, and labor necessary to make a complete and accepted installation. All conduit ties, clamps, jumpers, connectors, splice hardware, testing, caps, sealing and plugging conduits, consumables, and documentation shall be included.

Measurement of meter cabinets, meter cabinet foundations, conduits, lighting and grounding wires and junction boxes will be made as described in Section 701.

Measurement of drilled shafts and overhead sign structure will be made as described in Division 500.

Separate measurement for surge protection devices will not be made, but shall be included in the bid prices for different bid items where the devices are installed.

Separate measurement for ground testing and additional grounding will not be made, but shall be included in the bid prices for different bid items where the devices are installed.

Separate measurement will not be made for flexible conduits, fittings, mounting devices, guard strips, expansion joint coupling and other incidental items associated with exposed conduit installations on structures, but these costs shall be included in conduit items.

Separate measurement will not be made for system integration, documentation, warranties and certifications, software,. testing, factory tests, installation and acceptance test or any other test. These costs shall be included into the bid price of pay item for each device or assembly.

Separate measurement will not be made for procuring all permits, pay all charges, fees and give all notices necessary to and incidental and lawful prosecution of the work to initiate the process for making a manhole entry connection of telephone cable or power cable. All cost shall be included into respective bid pay items.

706.05 Basis of Payment.

TEXT IN THIS SUBSECTION IS REPLACED WITH THE FOLLOWING:

In general provisions of Section 701and 702, 703 shall apply.

Payment will be made under following items:

Pay Item	*Pay Unit*
DMS ASSEMBLY NO. 1	LUMP SUM
DMS ASSEMBLY, NO. 2	LUMP SUM
DMS ASSEMBLY, NO. 3	LUMP SUM
READER ASSEMBLY	LUMP SUM
CCTV STANDARDS, 12.2 M HIGH	UNIT
CCTV STANDARDS, 4.0 M HIGH	UNIT
CCTV ASSEMBLIES	UNIT
COMMUNICATION CABINET	LUMP SUM
FOUNDATIONS, TYPE COMM.	UNIT
TELEPHONE SERVICE CABINET AND FOUNDATION	UNIT
UPGRADE MIST SOFTWARE FOR DMS NTCIP PROTOCOL	LUMP SUM
MODIFICATIONS AT NTOC	LUMP SUM
T-1 TELEPHONE SERVICE	LUMP SUM
6 PAIR #19 TELEPHONE CABLE	LIN. METER
TERMINATION CABLE, 6 FIBERS	LIN. METER
RIGID NONMETALLIC MULTIDUCT CONDUIT, TYPE MCB	LIN. METER
RIGID NONMETALLIC MULTIDUCT CONDUIT, TYPE MGA	LIN. METER
RIGID METALLIC MULTIDUCT CONDUIT, TYPE S	LIN. METER
TERMINATION CABLE, 8 FIBERS	LIN. METER
DISTRIBUTION CABLE, 12 FIBERS	LIN. METER
DISTRIBUTION CABLE, 36 FIBERS	LIN. METER
TRUNK CABLE, 48 FIBERS	LIN. METER

Payment for each DMS/CCTV ASSEMBLY or subsystem will adhere to the following payment schedule:

- Fifty (50%) upon installing and furnishing the complete assembly or subsystem at the field site.
- Thirty-five percent (35%) upon successful completion of local device (field) testing.
- Fifteen (15%) at complete subsystem operation from the NTOC.

Payment for meter cabinets, meter cabinet foundations, conduits, lighting and grounding wires and junction boxes will be made under Section 701 unless otherwise specified.

Payment for drilled shafts and overhead sign structure will be made under Division 500.

Separate payment for surge protection devices will not be made, but the cost shall be included in the bid prices for different bid items where the devices are installed.

Separate payment for ground testing and additional grounding will not be made, but the cost shall be included in the bid prices for different bid items where the devices are installed.

Separate payment will not be made for flexible conduits, fittings, mounting devices, guard strips, expansion joint coupling and other incidental items associated with exposed conduit installations on structures, but these costs shall be included in respective conduit items.

Separate payment will not be made for fiber optic splicing equipment and splice boxes used for fiber optic cable splicing, but all costs thereof shall be included into bid price of fiber optic cables (termination/distribution cables).

Separate payment will not be made for documentation, software, testing, factory tests, installation and acceptance test or any other test. These costs shall be included into the bid price of pay item for each device or assembly.

Separate payment will not be made for procuring a software developer for upgrading the existing MIST software at the NTOC. The cost shall be included into the lump sum bid price of pay item "UPGRADE MIST SOFTWARE FOR DMS NTCIP PTOTOCOL".

Separate payment will not be made for any integration costs for any work required at Traffic Operations North, due to involvement/integration of new ITS components. All cost shall be included into lump sum bid price of pay item "MODIFICATIONS AT NTOC".

Separate payment will not be made for procuring a system integrator and integrating the proposed ITS facilities into the existing/upgraded central operating system at the NTOC. The cost shall be included into the lump sum bid price of pay item "MODIFICATIONS AT NTOC".

Payment for "T-1 Telephone Service" will be made on lump sum basis. It will be made based upon actual cost as evidenced by paid bills from the contractor to the telephone company. An estimated amount to cover these reimbursements shall be included in the bid proposal.

No separate payment will be made for furnishing and installing any additional equipment as directed by the Telephone Company for terminating the T-1 service inside the telephone service cabinet. All cost related to T-1 telephone service shall be included into unit price of bid pay item " TELEPHONE SERVICE CABINET AND FOUNDATION".

No payment for dedicated telephone service for reader assembly will be made. Telephone service will be arranged by TRANSCOM (by others).

No separate payment will be made for expansion fittings, location wire, trenching, warning tape, conduit markers, backfill, restoration of the disturbed areas, furnishing and installation of fiber optic conduit markers, and all labor, equipment and materials necessary and incidental thereto. All costs shall be included into bid prices of respective rigid metallic/nonmetallic conduit items.

No separate payment will be made for pull rope/ location wire, trenching, warning tape, conduit markers, backfill, jacking and steel pipes for crossing under existing roadways, restoration of the disturbed areas, and all labor, equipment and materials necessary and incidental thereto. All costs shall be included in unit bid prices of respective rigid metallic/nonmetallic conduit items.

Separate payment will not be made for procuring all permits, pay all charges, fees and give all notices necessary to and incidental and lawful prosecution of the work to initiate the process for making a manhole entry connection of telephone cable or power cable. All cost shall be included into respective bid pay items.

DIVISION 900 - MATERIALS

SECTION 901 – AGGREGATES

901.08 Dense-Graded Aggregate.

C. Production from Mixture with RAP.

6.

THE SECOND SENTENCE IS CHANGED TO:

When AASHTO T 310 (Direct Transmission Method, nuclear gauge method for measuring density and moisture content) is used to perform Compaction Acceptance Testing (Subsection 301.05, Subpart 2), a representative sample of five tests for each 4 000-square meter lot will be taken.

SECTION 902 - BEAM GUIDE RAIL

902.02 Posts, Timber and Routed Timber Spacers, and Recycled / Synthetic Spacers.

The approved manufacturers are Lifetime Lumber and Mondo Polymer Technologies, Polylumber.

SECTION 903 – HOT MIX ASPHALT

903.01 Composition of Mixtures.

For this Project, the 25 percent or less RAP requirements shall govern.

SECTION 904 – BITUMINOUS MATERIALS

904.01 Asphalt Binder.

THE FIRST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

Asphalt binder shall conform to AASHTO M320, "Performance-Graded Asphalt Binder".

904.06 Temperature-Volume Correction Factors.

SUBSECTION IS CHANGED TO:

Temperature-volume correction factors that shall be used to convert the volume of bituminous materials, measured at the temperature at the point of use, to the volume at 15 **ºC** are found in the following tables:

Table 904-1 Temperature-Volume Correction Factors for Bituminous Materials

Asphalt Binder, All Grades.
Cut-Back Asphalt, Grades RC-800, RC-3000, MC-800, and MC-3000.
Inverted Emulsified Asphalt, Grade IEMC-800.

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
5	1.006 3	30	0.990 6	55	0.975 1	80	0.959 7
6	1.005 7	31	0.990 0	56	0.974 5	81	0.959 1
7	1.005 0	32	0.989 3	57	0.973 8	82	0.958 5
8	1.004 4	33	0.988 7	58	0.973 2	83	0.957 9
9	1.003 8	34	0.988 1	59	0.972 6	84	0.957 3
10	1.003 1	35	0.987 5	60	0.972 0	85	0.956 7
11	1.002 5	36	0.986 9	61	0.971 4	86	0.956 1
12	1.001 9	37	0.986 2	62	0.970 8	87	0.955 5
13	1.001 3	38	0.985 6	63	0.970 1	88	0.954 9
14	1.000 6	39	0.985 0	64	0.969 5	89	0.954 2
15	1.000 0	40	0.984 4	65	0.968 9	90	0.953 6
16	0.999 4	41	0.983 7	66	0.968 3	91	0.953 0
17	0.998 7	42	0.983 1	67	0.967 7	92	0.952 4
18	0.998 1	43	0.982 5	68	0.967 1	93	0.951 8
19	0.997 5	44	0.981 9	69	0.966 5	94	0.951 2
20	0.996 9	45	0.981 3	70	0.965 8	95	0.950 6
21	0.996 2	46	0.980 6	71	0.965 2	96	0.950 0
22	0.995 6	47	0.980 0	72	0.964 6	97	0.949 4
23	0.995 0	48	0.979 4	73	0.964 0	98	0.948 8
24	0.994 4	49	0.978 8	74	0.963 4	99	0.948 2
25	0.993 7	50	0.978 2	75	0.962 8	100	0.947 6
26	0.993 1	51	0.977 5	76	0.962 2	101	0.947 0
27	0.992 5	52	0.976 9	77	0.961 6	102	0.946 4
28	0.991 8	53	0.976 3	78	0.960 9	103	0.945 8
29	0.991 2	54	0.975 7	79	0.960 3	104	0.945 2

Table 904-1 (Continued)

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
105	0.944 6	130	0.929 6	155	0.914 5	180	0.900 2
106	0.944 0	131	0.929 0	156	0.914 2	181	0.899 6
107	0.943 4	132	0.928 4	157	0.913 6	182	0.899 0
108	0.942 8	133	0.927 8	158	0.913 0	183	0.898 4
109	0.942 2	134	0.927 2	159	0.912 4	184	0.897 9
110	0.941 6	135	0.926 6	160	0.911 9	185	0.897 3
111	0.941 0	136	0.926 0	161	0.911 3	186	0.896 7
112	0.940 4	137	0.925 4	162	0.910 7	187	0.896 1
113	0.939 8	138	0.924 8	163	0.910 1	188	0.895 5
114	0.939 2	139	0.924 2	164	0.909 5	189	0.895 0
115	0.938 6	140	0.923 6	165	0.908 9	190	0.894 4
116	0.938 0	141	0.923 1	166	0.908 3	191	0.893 8
117	0.937 4	142	0.922 5	167	0.907 8	192	0.893 2
118	0.936 8	143	0.921 9	168	0.907 2	193	0.892 6
119	0.936 2	144	0.921 3	169	0.906 6	194	0.892 1
120	0.935 6	145	0.920 7	170	0.906 0	195	0.891 5
121	0.935 0	146	0.920 1	171	0.905 4	196	0.890 9
122	0.934 4	147	0.919 5	172	0.904 8	197	0.890 3
123	0.933 8	148	0.918 9	173	0.904 2	198	0.889 8
124	0.933 2	149	0.918 3	174	0.903 7	199	0.889 2
125	0.932 6	150	0.917 7	175	0.903 1	200	0.888 6
126	0.932 0	151	0.917 1	176	0.902 5	201	0.888 0
127	0.931 4	152	0.916 6	177	0.901 9	202	0.887 5
128	0.930 8	153	0.916 0	178	0.901 3	203	0.886 9
129	0.930 2	154	0.915 4	179	0.900 8	204	0.886 3

Table 904-2 Temperature-Volume Correction Factors for Bituminous Materials

Cut-Back Asphalt, Grades RC-T, RC-70, RC-250, MC-30, and MC-250.
Inverted Emulsified Asphalt, Grade IEMC-250.

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
5	1.007 2	30	0.989 3	55	0.971 7	80	0.954 3
6	1.006 5	31	0.988 6	56	0.971 0	81	0.953 6
7	1.005 7	32	0.987 9	57	0.970 3	82	0.953 0
8	1.005 0	33	0.987 2	58	0.969 6	83	0.952 3
9	1.004 3	34	0.986 5	59	0.968 9	84	0.951 6
10	1.003 6	35	0.985 8	60	0.968 2	85	0.950 9
11	1.002 9	36	0.985 0	61	0.967 5	86	0.950 2
12	1.002 2	37	0.984 3	62	0.966 8	87	0.949 5
13	1.001 4	38	0.983 6	63	0.966 1	88	0.948 8
14	1.000 7	39	0.982 9	64	0.965 4	89	0.948 2
15	1.000 0	40	0.982 2	65	0.964 7	90	0.947 5
16	0.999 3	41	0.981 5	66	0.964 0	91	0.946 8
17	0.998 6	42	0.980 8	67	0.963 3	92	0.946 1
18	0.997 9	43	0.980 1	68	0.962 6	93	0.945 4
19	0.997 1	44	0.979 4	69	0.961 9	94	0.944 7
20	0.996 4	45	0.978 7	70	0.961 2	95	0.944 1
21	0.995 7	46	0.978 0	71	0.960 5	96	0.943 4
22	0.995 0	47	0.977 3	72	0.959 9	97	0.942 7
23	0.994 3	48	0.976 6	73	0.959 2	98	0.942 0
24	0.993 6	49	0.975 9	74	0.958 5	99	0.941 3
25	0.992 9	50	0.975 2	75	0.957 8	100	0.940 7
26	0.992 1	51	0.974 5	76	0.957 1	101	0.940 0
27	0.991 4	52	0.973 8	77	0.956 4	102	0.939 3
28	0.990 7	53	0.973 1	78	0.955 7	103	0.938 6
29	0.990 0	54	0.972 4	79	0.955 0	104	0.937 9

Table 904-2 (Continued)

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
105	0.937 3	130	0.920 5	155	0.904 0	180	0.887 7
106	0.936 6	131	0.919 8	156	0.903 3	181	0.887 1
107	0.935 9	132	0.919 1	157	0.902 6	182	0.886 4
108	0.935 2	133	0.918 5	158	0.902 0	183	0.885 8
109	0.934 6	134	0.917 8	159	0.901 3	184	0.885 1
110	0.933 9	135	0.917 1	160	0.900 7	185	0.884 5
111	0.933 2	136	0.916 5	161	0.900 0	186	0.883 9
112	0.932 5	137	0.915 8	162	0.899 4	187	0.883 2
113	0.931 9	138	0.915 2	163	0.898 7	188	0.882 6
114	0.931 2	139	0.914 5	164	0.898 1	189	0.881 9
115	0.930 5	140	0.913 8	165	0.897 4	190	0.881 3
116	0.929 8	141	0.913 2	166	0.896 8	191	0.880 7
117	0.929 2	142	0.912 5	167	0.896 1	192	0.880 0
118	0.928 5	143	0.911 8	168	0.895 5	193	0.879 4
119	0.927 8	144	0.911 2	169	0.894 8	194	0.878 7
120	0.927 2	145	0.910 5	170	0.894 2	195	0.878 1
121	0.926 5	146	0.909 9	171	0.893 5	196	0.877 5
122	0.925 8	147	0.909 2	172	0.892 9	197	0.876 8
123	0.925 1	148	0.908 6	173	0.892 2	198	0.876 2
124	0.924 5	149	0.907 9	174	0.891 6	199	0.875 5
125	0.923 8	150	0.907 2	175	0.890 9	200	0.874 9
126	0.923 1	151	0.906 6	176	0.890 3	201	0.874 3
127	0.922 5	152	0.905 9	177	0.889 6	202	0.873 6
128	0.921 8	153	0.905 3	178	0.889 0	203	0.873 0
129	0.921 1	154	0.904 6	179	0.888 4	204	0.872 4

Table 904-3 Temperature-Volume Correction Factors for Bituminous Materials

Emulsified Asphalt, All Grades.

Temp (ºC)	Factor	Temp (ºC)	Factor	Temp (ºC)	Factor
5	1.004 5	31	0.992 8	57	0.981 4
6	1.004 0	32	0.992 3	58	0.981 0
7	1.003 6	33	0.991 9	59	0.980 5
8	1.003 1	34	0.991 4	60	0.980 1
9	1.002 7	35	0.991 0	61	0.979 7
10	1.002 2	36	0.990 5	62	0.979 2
11	1.001 8	37	0.990 1	63	0.978 8
12	1.001 3	38	0.989 7	64	0.978 4
13	1.000 9	39	0.989 1	65	0.977 9
14	1.000 4	40	0.988 8	66	0.977 5
15	1.000 0	41	0.988 4	67	0.977 1
16	0.999 5	42	0.987 9	68	0.976 6
17	0.999 1	43	0.987 5	69	0.976 2
18	0.998 6	44	0.987 1	70	0.975 8
19	0.998 2	45	0.986 6	71	0.975 3
20	0.997 7	46	0.986 2	72	0.974 9
21	0.997 3	47	0.985 8	73	0.974 5
22	0.996 8	48	0.985 3	74	0.974 1
23	0.996 4	49	0.984 9	75	0.973 6
24	0.995 9	50	0.984 4	76	0.973 2
25	0.995 5	51	0.984 0	77	0.972 8
26	0.995 0	52	0.983 6	78	0.972 4
27	0.994 6	53	0.983 1	79	0.972 0
28	0.994 1	54	0.982 7	80	0.971 5
29	0.993 7	55	0.982 3	81	0.971 1
30	0.993 2	56	0.981 8		

SECTION 905 - CONCRETE ADMIXTURES AND CURING MATERIALS

THE FOLLOWING SUBSECTION IS ADDED:

905.06 Detectable Warning Surfaces.

Materials for Detectable Warning Surfaces shall be safety red and appear uniform in color after curing. The surface coating material shall be an abrasion, UV and chemical resistant and shall be capable of adhering to existing or new portland cement concrete surfaces. The minimum final dry coat thickness shall be 1 millimeter.

The cured coating shall exhibit the following minimum coefficients of friction when tested according to ASTM D 1894.

Static coefficient of friction	**Dynamic coefficient of friction**
Dry 0.95 – 0.99	Dry 0.91 – 0.95
Wet 1.39 – 1.42	Wet 1.27 – 1.36

The Detectable Warning Surfaces shall be installed according to the manufacturer's recommendations.

SECTION 906 – ELECTRICAL MATERIALS

906.03 Cable and Wire.

THE FOLLOWING PARAGRAPHS ARE ADDED:

A. Fiber Optic Cable Connectors. All fiber optic connectors on the trunk and distribution cables, and one end of the termination cables, shall be "ST" type. The ST connectors shall be factory installed on pigtails which shall be spliced on the ends of the distribution, and termination cables. The ST type connectors shall meet the bureau of electrical engineering specification EBM-FOC-ST-1, except training which shall be coordinated with and conform to Subsection 701.22.

B. Coaxial Cable.

Coaxial cable for CCTV installations shall be used for interconnection of equipment transmitting and receiving base band video. The CCTV coaxial cable shall have the following performance specifications and features:

RG-59 Coaxial Cable

RG-11 Coaxial Cable

Coaxial cable for Reader Assembly shall be as described under Subsection 906.28.

C. 6 Pair #19 Telephone Cable. 6 pair #19 telephone cable shall meet the following criteria:

- Single 6 pair #19 AWG
- Twisted pair with each pair individually shielded
- Jelly filled and for outdoor installations
- Rated for 600 volts

906.22 Equipment Mounting.

THE FOLLOWING TEXT IS ADDED:

A. Electronic Equipment Racks. The electronic equipment racks shall be EIA telephone-type relay racks, compatible with communication cabinet width for equipment in communication cabinet and for equipment at the NTOC width as directed by the Engineer. The electronic equipment racks shall have the following performance specifications and features:

- Fully tapped EIA mounting angles, double side drilled for 1 and 3/4 rack unit mounting plates
- Floor standing and self-supporting, with dust cover between supporting floor brackets
- Bolted steel fabrication, with guard rails and grounding bar
- Outlet power strips as shown in the plans
- Color: gray or black.

THE FOLLOWING SUBSECTION IS ADDED:

906.23 Cable Management.

The fiber optic and metallic cables installed at field cabinets and NTOC shall be routed through and secured with cable management ladders, wiring channels, and jumper rings. Cable management will provide for mechanically secure jumper connections among equipment, easy tractability of interconnections, and the ability to add and remove cabling in the future with a minimum disruption to other wires and cables.

The contractor shall make use of existing cable management ladders, wiring channels, and jumper rings where they are available, with the approval of the engineer.

A. Cable Ladder. A cable ladder shall be installed above the electronic equipment racks to facilitate the routing of cables to the racks and between the racks. The cable ladder shall have the following performance specifications and features:

- The ladder shall be of channel type construction 9 inches wide with tubular sidebars.
- The ladder rungs shall be spaced every 225 mm. Standard lengths shall be joined together with splice clamps to span the required distance.
- The cable rack ends shall be supported with wall brackets, or closed with corner clamps. The cable rack span shall be supported every five feet by ceiling hanger brackets, or shall be supported by auxiliary framing from the electronic equipment racks.

B. Wire Management. Wire management hardware shall be installed along the height of the electronic equipment racks to facilitate the organized routing of wire and cable up and down the rack, and to provide mechanically secure attachment of the cables to relieve strain on end connectors. The contractor may use several alternative methods to provide wire management, which shall have the following performance specifications and features:

Wire management hardware shall be installed along the height of the electronic equipment racks to facilitate the organized routing of wire and cable up and down the rack, and to provide mechanically secure attachment of the cables to relieve strain on end connectors. The contractor may use several alternative methods to provide wire management, which shall have the following performance specifications and features:

- Cable brackets installed on electronic equipment rack rails, equivalent to Newton Instrument Company Figure No. 4041, spaced every 150 mm.
- Plastic wiring duct with snap-on covers installed on the electronic equipment rack rails, equivalent to Panduit Corporation Panduct Products.
- Cable binding and harnessing shall be used that is easily re-enterable, such as purse locks (SPC Technology Voltrex TWT Series Twist Type), removable wire ties (SPC Technology Voltrex Bt Series Beaded Wire Ties) Polyethylene Spiral Cable Wrapping.
- Permanent binding hardware shall not be used, such as nylon lacing twine and screw-mounted cable clamps.

THE FOLLOWING SUBSECTION IS ADDED:

906.24 T-1 Multiplexer.

The T-1 multiplexer shall be equipped with all equipment as shown in block diagrams on the plans and shall conform to Electrical Material Specification EBM-SMF-MUX with the following revisions to the EBM specifications:

GENERAL -1

1-1 General Requirements. The T-1 multiplexer shall be designed for point-to-point transmission of CCTV video and data (DMS+CCTV) over a leased T-1 telephone line from the local telephone company, between the communication cabinet in the field and the NTOC in Elmwood Park.

The T-1 multiplexer inside the communication cabinet shall include but not limited to power supply, chassis, 4 port data & adapter, Ethernet bridge, voice adapter, talk battery/ring generator, CSU and all interface connectors and cables.

The T-1 multiplexer inside the NTOC cabinet shall include but not limited to power supply, chaises, CSU, 4 port data & adapter, Ethernet bridge, voice adapter, and CSU and all interface connectors and cables.

The data transmission multiplexer shall employ a framing technique which maintains frame synchronization in the presence of noise such that the quality of the signal over the optic path can deteriorate to as poor a signal as a Bit Error Rate (BER) of 10-3 BER and the MUX will maintain ESF framing for more than 10 hours.

The equipment which makes up the data transmission system (T-1 multiplexer) must be standard commercial off-the-shelf products, must be fully compatible with each other and the exiting control, software and equipment at the NTOC, packaged as a single unit or multiple units and must include built-in CSU's.

DISTRIBUTION MULTIPLEXER – II

2-1 Multiplexer Speed. The T-1 multiplexer shall operate at standard rates over leased T-1 telephone line from the local telephone company. Selection of the data rate shall be accomplished by the insertion of a single common module plug-in.

2-9 Required Interface Cards.

A. RS-232/RS-422 Ports:

A new version of the asynchronous data cards shall be provided to interface simultaneously up to four full duplex RS-232/422 circuits at any rate from 0 bps to 38.4 kbps. For simplicity during installation and freedom from having to select and set start bits, stop bits, or parity, the channel card must employ a technique such as transitional coding which allows transmission of any asynchronous data rate up to and including the user's data rate setting.

B. Field Telephone circuit:

FXS card shall be provided in the filed communication cabinet and FXO card shall be provided at the NTOC. The NTOC card shall be connected to the existing PBX network. The field card shall be equipped with a user interface card, and a talk battery and ringer the channel cards must provide a

two-wire circuit for direct connection to a standard POTS telephone instrument, digitizing and transmission of a nominal 3 kHz analog voice circuit over a digital transmission system, and automatic ringing at one end when the other end is off-hook.

Specifications:

Analog frequency:

Response:	300-3000 Hz, +0,5 to –1.0 dB
Level:	nominal 0 dBm in, 0 dBm out
Impedance:	selectable 600 ohms or 900 ohms
Idle channel noise:	less than 23 dBrncO
ARD:	with VF-16 at both ends – ring 2 seconds ON, 4 seconds OFF
Network Interface VF-16:	μ-law PCM, 64 kb/s per voice channel

G. Video Codec Plug-in Module

Video codec plug-in module must be available for the digitizing and compression of NTSC video and the transmission over selected DS-0 time slots of T-1 circuit. The compression algorithm shall be ITU H.261. There shall be the ability to change the transmission bandwidth remotely and in service to apportion bandwidth to obtain the greatest resolution.

2-10 Diagnostic Card. The new version of the data transmission system shall have a firm-ware package installed on the common module to allow the obtaining of status and configuration information for channel cards installed in any multiplexer in the network. One time slot will be assigned for the purpose of communicating over the transmission link between common modules. A PC or dumb terminal shall be used as the GUI (Graphic User Interface). Capability must be provided to incorporate the new data transmission system into a larger all-inclusive network management system through the use of an SNMP (Simple Network Management Protocol) proxy agent.

THE FOLLOWING SUBSECTION IS ADDED:

906.25 Data Port Sharer.

The data port sharer shall be consists of an EIA-232 port sharing device compatible with the T-1 multiplexer and the fiber optic transceivers. It shall conform to the following:

- APPLICATION. The EIA-232 port sharing device shall enable up to seven (7) polled slave data transceivers to share one EIA-232 data circuit port on the sub rate data circuit card in the T-1 data multiplexer. The multiplexer data circuit port shall be connected to the master port on the port sharing device, and four slave date transceivers shall be connected to the user channel ports on the port sharing device. All required control and data leads of the EIA-232 interfaced shall be passed through the port sharing device.
- ENVIRONMENT. All electronic equipment and power supplies shall operate in the temperature range of minus 20 degrees Celsius to plus 60 degrees Celsius, and a relative humidity of 5 to 95 percent non-condensing. The manufacturer must supply certification by an independent technical laboratory confirming that the equipment complies with these environmental specifications.
- ELECTRICAL POWER. All equipment defined in this section shall operate on either 24 V AC or 120 VAC electrical service. The equipment shall be configured according to the plans, or at the direction of the Engineer.
- OPERATION. The device shall monitor the RTS or DCD lead in the EIA-232 connections and provide contention control, connection between the master port and the user channel ports, and non activity disconnection. The port sharing device shall automatically lock out any ports that begins stream.
- CONTROL AND INDICATION. The device shall provide port disable switches or programming for each of the user channel ports. LEDs shall indicate: power, user channel port disabled, and user channel port data activity and/or streaming. The device shall support EIA-232 interface leads numbered 1 through 10, 15, 17, 20 and 22. The device shall support data synchronization from an internal clock, or external from the master port, or external from the first user channel port.
- DATA FORMAT. The device shall support synchronous or as synchronous data, full or half duplex, and transparently pass any data protocol or data code. The device shall operate any data rate up to 19.2 kbps.

- CONNECTORS. The device shall have female DB25 connectors for all EIA-232 ports. Straight through EIA-232 cables shall be provided.
- MOUNTING. The device shall be rack mounted and shall fit in the communication cabinet. The device shall be mounted and oriented to conserve vertical rack space.
- The EIA-232 port sharing device shall be located in the communication cabinet in the field. The quantity and configuration shall be as specified in the plans and specifications or shall be determined from the number of data circuits that are shown in the plans.

THE FOLLOWING SUB SECTION IS ADDED:

906.26 Three Line LED Dynamic Message Sign Assembly.

General Description – 101.

101-1 The purpose of this specification is to describe the minimum acceptable design and operating requirements for a three (3) line LED Dynamic Message sign assembly to be utilized for travelers information. The Three Line LED Dynamic Message Sign Assembly shall include, but not limited to, a three line LED variable message sign (VMS) with enclosure, mounting supports to sign structure, ground mounted sign controller with enclosure, controller foundation, DMS cables between sign controller and sign, sign software and other equipment and material as specified in this Sub Section and any incidental equipment and material required for furnishing a functional DMS assembly. The variable message sign is also referred as sign or DMS in these specifications.

101-2 The Dynamic Message Sign (DMS) Assembly shall utilize discrete Light Emitting Diode (LED) technology and shall be furnished with all necessary equipment. The LED DMS Assembly shall consist of a light emitting diode Dynamic Message Sign and a digital control unit with auxiliary equipment. The entire DMS Assembly shall be housed in a complete and fully wired aluminum weatherproof cabinet meeting American Association of State Highway and Transportation Officials (AASHTO) structural standards. The DMS shall provide a clear readable message in all normally encountered weather and lighting conditions. The LED DMS Assembly shall be designed for a 20 year life.

101-3 No changes or substitutions in these requirements will be acceptable unless authorized in writing. Inquiries regarding this equipment shall be addressed to the Manager, New Jersey Department of Treasury, Trenton, New Jersey 08625.

101-4 All major components shall be identified with a metal plate containing the serial number with a bar code identification conforming to Code 39 and Code 128 industry standards.

Qualifications – 103.

103-1 The contractor shall submit references four (4) different states that have been successfully operating an LED DMS Sign Assembly that completely meets these specifications, for a period of not less than three (3) years.

103-2 The LED DMS Signs Assembly shall be fabricated by an established DMS manufacturer having the minimum of 10 years experience, under the current corporate name, in the design and manufacturing of State Highway or Interstate Highway, permanently mounted, overhead dynamic message signs and central control systems installed in freeway service. These 10 years of experience shall include the complete design and manufacturing of all aspects of the dynamic message signs, including the electronic hardware, software and sign housings.

103-3 The contractor shall submit documentary evidence and reference data for the above requirements for approval. Reference data shall include the name and address of the organization, and the name and telephone number of an individual from the organization who can be contacted to verify the above requirements. Failure to furnish the above references will be sufficient reason for rejection of the supplier's equipment.

103-4 The complete DMS Assembly shall conform to the requirements of current National Electrical Manufacturers Association (NEMA) Standards No. TS-1, section 2, Environmental Standards and Test Procedures, except as amended and supplemented hereinafter. The manufacturer/contractor shall supply certification for equipment compliance with NEMA environmental standards in accordance with NEMA testing procedures.

103-5 Materials not specifically covered in these specifications shall be in accordance with the accepted standards of the National Electrical Manufacturers Association, The Underwriters' Laboratories, Inc.(UL), The National Electrical Code (NEC), or the American Society for Testing and Materials (ASTM).

103-6 All welding shall be by an inert gas process in accordance with the American Welding Society (AWS) Standards, American National Standards Institute (ANSI)/AWS D1.2-97. The LED DMS Assembly

manufacturer's welders and welding procedures shall be certified by an ANSI/AWS Certified Welding Inspector to the 1997 ANSI/AWS D1.2-97 Structural Welding Code for Aluminum. Proof of certification of all the LED DMS Assembly manufacturer's welders and applicable welding procedures shall be supplied with the submittals. The name, phone number and address of the ANSI/AWS Certified Welding Inspector that certified the LED DMS Assembly manufacturer's welders and procedures shall also be provided with the submittals.

Product Warranty – 104.

104-1 All equipment shall carry a two-year warranty from the date of operation and acceptance against any imperfections in workmanship or materials. It shall also include DMS Maintenance as defined under Section 706.03. Contractor/manufacturer shall repair any damaged equipment/material and provide DMS maintenance during two-year warranty period. All repairs and general maintenance during warranty period shall be performed at no additional cost to NJDOT including any traveling expense.

NTCIP Standards – 105.

105-1 The DMS Assembly shall adhere to the latest National Transportation Communications for ITS Protocol (NTCIP) standards. All DMS Assembly functions and features shall be supported via NTCIP protocols. The manufacturer/contractor shall provide certification from an outside testing laboratory for conformance to the Engineer for approval. The NTCIP requirements shall be as defined in **Appendix – NTCIP Requirements** at the end of this Sub Section.

105-2 The communications between the sign controller and the central controller / laptop computer shall comply with the NTCIP protocol as defined under NTCIP Requirement in **Appendix – NTCIP Requirements**.

Communications Protocol. Access to the sign controller is provided via two possible techniques, via the dial-up telephone network and via the local serial ports. This document shall clearly describe the communications protocol that must be used to gain access via each of the two techniques.

Operator's Manual. This document shall fully describe the operation of the DMS using the Windows platform that may run on the portable computer. This document shall clearly define all functions that are supported by the software. The manual shall define the normal operation of the signs and the software including resetting and restarting the software package.

Maintenance Procedure Manual. This manual shall document the preventive and corrective maintenance procedures that should be followed to maintain the DMS at the highest level of operational efficiency. The manual shall include step-by-step field and bench trouble-shooting procedures to isolate and repair faults. The document shall include descriptions of normative waveforms and test voltages. A detailed parts list shall be included. For each part or assembly, a circuit diagram or pictorial shall be provided.

Equipment Drawings and Diagrams. A pictorial drawing showing the physical location and identification of each component shall be provided for each different electronic assembly and each different subassembly. Wiring diagrams shall be provided for each sign enclosure. These diagrams shall depict the location and interface of all components located within the sign enclosure.

Electrical Schematic Diagrams. An electrical schematic, wiring diagram, and a logic diagram shall be provided for each different type of equipment. A stage-by-stage explanation of the circuit theory shall be provided with the circuit wiring diagrams. Connection diagrams for each DMS subsystem including block diagrams, terminal numbers, and conductor color codes shall be provided. Three copies of these diagrams shall be supplied.

MATERIALS, ELECTRICAL & ELECTRONIC EQUIPMENT, COMPUTER HARDWARE & SOFTWARE AND COMMUNICATIONS-200

General – 201.

201-1 The presence of ambient radio signals, magnetic or electromagnetic interference, including those from power lines, transformers, or motors that are within one foot of any components of the system, shall not impair the performance of the system. The system shall not radiate any electrical or electromagnetic signals that could adversely affect any other electrical or electronic device.

Light Emitting Diode Display – 202.

202-1 The LED shall be a high power AlInGap Lamp manufactured by Hewlett Packard, part number LHMP-EL18

UX000, or manufactured by Panasonic part number 5TYDCDV. The light emitted by the LED display shall be amber, with a peak wavelength centered at approximately 592 nanometers.

202-2 Each pixel shall be 40 candela at 20 mA. Forty candela shall be attained by the sum of the brightness of the individual LEDs in each pixel. The brightness of each LED shall be measured in accordance with the CIE Test Method A, as described in CIE 127-1997, "Technical Report: Measurement of LED's."

202-3 Certification shall be provided, with the submittals, from the LED manufacturer/contractor that demonstrates that the LEDs were tested in accordance with CIE Test Method A.

202-4 The LEDs used in the display shall be obtained from batches sorted for luminous output, where the highest luminosity LED shall not be more than fifty percent more luminous than the lowest luminosity LED. The sign shall be bright in all lighting conditions for optimum viewing. It shall be bright enough to have a good target value, but not to the point where the pixels bloom, especially in low ambient light level conditions. The brightness and color of each pixel shall be uniform over the entire face of the sign within the 30 degree cone of vision from 335 m to 30 m in all lighting conditions. Non-uniformity of brightness or color over the face of the sign under these conditions shall be cause for rejection of the sign. The sign assembly shall be designed to operate in roadway configurations of at least five lanes.

202-5 The contractor shall document the procedure to be utilized to comply with the above requirement as part of the shop drawing submittal.

202-6 The viewing angle of the discrete LED shall be a minimum cone of 30 degrees.

202-7 The LED Mean Time Before Failure (MTBF) shall be at minimum 100,000 hours of permanent use at an operating temperature of 100 degrees Celsius or below. The LED MTBF shall be given for the specific forward current used to drive the LED.

202-8 The LED manufacturer's technical specification sheet shall be supplied to document the technical requirements.

202-9 The LED display shall have a minimum refreshment rate of approximately 100 frames per second.

202-10 Continuous current drive shall be used at the maximum brightness level. Pulse width modulation (PWM) should be used to dim the sign to achieve the proper brightness level for a given condition. The pixel current waveform shall have a frequency of 100 +/- 5 Hertz at nighttime brightness levels and 2400 +/- 120 Hertz at daytime brightness levels with an adjustable duty cycle of 0.03 to 99.9% in 0.5% or finer increments. As part of the shop drawing submittal, a complete schematic of the LED power and driver circuits shall be provided for review by the Engineer. Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in 1% increments. Brightness control shall be able to be returned to automatic from the sign controller front panel and the central computer. The sign controller shall monitor the photo cell circuits in the sign and convert the measured light intensity into the desired pixel brightness. The photo circuit readings shall be correlated with a brightness table in the sign controller. The brightness table shall have a minimum of 255 brightness levels. Automatic adjustment of the LED driving waveform duty cycle shall occur in small enough increments so that brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. The brightness table in each individual sign controller shall be adjustable from the central controller and can be customized according to the requirements of the installation site. Each sign shall have its own, independent brightness table.

202-11 The LEDs shall be grouped in pixels consisting of discrete LEDs arranged in a continuous matrix per line. Each LED shall be individually installed and separately connected to the circuit board. The matrix shall be organized as a continuous display with individual pixel addressability. Each character shall be 457 mm high and shall consist of a minimum of 7 rows (Horizontal) by 60 columns (Vertical) pixel matrix for a line matrix DMS. The centers of all pixels shall be spaced so as to maintain the same horizontal and vertical clearance between adjacent pixels. The LED grouping and mounting angle within a pixel shall be optimized for maximum readability.

202-12 Each pixel shall have the same number of LEDs. The electronics for the display line shall be fully configured to drive this number of LEDs. The LEDs shall be powered in groups not exceeding six (6) LEDs. The failure of an LED in one group shall not affect the operation of any other group within the pixel. The power driver circuitry shall be designed to minimize power consumption. The sign controller shall have the ability to detect the failure of an LED group. Via the sign controller, the communication protocol shall include an ability to remotely identify any failed LED groups.

202-13 Each pixel shall have a device attached to the printed circuit board (PCB) to hold and protect the LEDs. These devices shall:

1. Hold the LEDs perpendicular to the display modules within 0.5 degree,
2. Prevent the LEDs from being crushed or bent during handling,

3. Protect the LEDs from damage when the display module is laid on the front surface (the side that the LED lamps are located),
4. Be easily removable from the display module PCB without any tools,
5. Not put any stress on the LEDs due to differentials of expansion and contraction between the device and the LEDs over the herein specified temperature range,
6. Not become loose or fall off during handling or due to vibrations,
7. Not block airflow over the leads of the LEDs,
8. Securely hold each LED while allowing a gap between the device and a minimum of 95% of the body of each LED for airflow,
9. Not block the light output of the LEDs at the required viewing angle,
10. Be black in color to maximize contrast.

202-14 Two separate types of pixel status feedback shall be provided to the central controller from the local sign controller. These include a pixel test and a pixel read. Pixel Test: The pixel test shall be programmable by time of day and be performed from the central controller on command and automatically once a day. During a pixel test, the full operational status of each string of LEDs in each pixel shall be tested and then transmitted to the central controller or laptop computer. A list of defective pixels shall be provided, listing pixel status, line number, module number, column number and row number for each defective pixel. The pixel test may briefly disturb the displayed message for less than 0.5 seconds.

Pixel Read: The pixel read shall be performed during a message download and during every sign poll from the central controller or laptop computer. The pixel read shall perform a real-time read of the displayed message and shall return the state of each pixel to the central controller as it is currently displayed to the motorist, including any errors. This shall allow the central controller operator to see what is visibly displayed to the motorist on an individual pixel basis. During a pixel read, the state of each pixel (full-on, half-on or off) in the sign shall be read by the sign contr oller to allow the central controller or laptop computer to show the actual message, including static, flashing and alternating messages, that is visibly displayed on the sign in a What You See Is What You Get (WYSIWYG) format. This pixel reading shall take place while a message is displayed on the sign without disturbing the message in any way. Any flashing, flickering, blinking, dimming, or other disturbance of the message during this pixel read shall be cause for rejection of the sign.

202-15 The LED display shall have the capability of displaying 3 main lines of 457 mm high characters.

202-16 The LEDs shall be protected from degradation due to sunlight. The method utilized shall not obstruct the view of the display from the roadway. The pixel construction technique shall not reduce the display viewing angle below that provided by the LED. The device utilized to protect the sign from Ultra Violet (UV) radiation shall be constructed in a manner that prevents warping, sagging, and distortion for a period of 20 years or more.

Printed Circuit Boards – 203.

203-1 Printed Circuit Board (PCB) design shall be such that components may be removed and replaced without damage to boards, traces or tracks.

203-2 Only FR-4 0.062 inch material shall be used. Inter-component wiring shall be copper clad track having a minimum weight of 0.61 kg per square meter with adequate cross section for current to be carried. Jumper wires will not be permitted, except from plated-through holes to component. The maximum number of jumper wires allowed per circuit board is two.

203-3 All PCBs shall be finished with a solder mask and a component identifier silk screen.

203-4 All Printed Circuit Boards (PCBs), except for the LED mother board, power supply PCBs and 170E PCBs, shall be completely conformal coated with a 0.25 mm minimum thickness silicone resin conformal coat. The LED mother boards shall be completely conformal coated, except at the pixels on the front of the PCB, with a 0.25 mm minimum thickness silicone resin conformal coat. The material used to coat the PCBs shall meet the military specification: MIL-I-46058C Type SR.

Power Supply – 204.

204-1 The LED display shall be operated at low internal DC voltage not exceeding 24 Volts.

204-2 The LED display shall be powered by independent rack mounted power supplies. A maximum of six power supplies per line shall be utilized. An even number of power supplies shall always be utilized. The power supplies shall be rated for at least 50% spare capacity over that required to light every pixel on the line. The power supplies shall be wired in groups of two. A power supply group shall drive a specific portion of the line. Upon failure of one power supply in the group, the second power supply shall be capable of driving the

portion of the line assigned to that group. The sign controller shall be capable of sensing the failure of each individual supply. The power supply status shall be reportable by the sign controller to any of the command ports via the protocol. When one of the power supplies in a group has failed, the sign controller shall be capable of monitoring the number of pixels that are required for each display. If this number exceeds the degraded capacity of the remaining supply, that portion of the line shall be disabled. The failure condition shall be reportable by the sign controller via the protocol. The power supplies shall operate within an input range of 190 to 260 volts AC. The voltage to the LED modules and associated electronics shall not exceed 25 VDC. The power supplies shall be paralleled in a diode or configuration such that one supply may completely fail and the sign will still be supplied with enough power to run 40% of all pixels at 100% duty cycle at 65 degrees C. Functioning supplies shall current-share to within 10%. The combined effect of line (97 to 135 VAC) and load (10% to 100%) on the power supplies shall not exceed 1.0%. The efficiency of the power supplies shall be 80% or greater at 120 VAC from 50% to 100% of maximum load. The power supplies shall have a power factor of 0.95 or greater at 120 VAC from 50% to 100% of maximum load.

204-3 All LED module power supply voltages shall be continuously measured by the sign controller. The sign controller shall provide these voltage readings to the central controller or laptop computer when the sign controller is polled by the central controller or laptop computer.

204-4 There shall be a power distribution system that connects each display module to all power supplies and minimizes the voltage drop over the face of the sign. The voltage measured at the display modules shall not vary more than 50 millivolts over all the display modules in the sign with 17 pixels on at 100% intensity in each and every display module.

204-5 The Power Supplies shall be short circuit protected by Direct Current (DC) power OFF, and shall reset automatically after 5 seconds of Alternating Current (AC) power OFF. The power supplies shall also be protected by an overload allowance ranging from 105% up to 135% and by a suitable inrush current allowance to be recommended by their manufacturer.

204-6 The Power Supplies shall have an efficiency rating of at least 75%.

204-7 The LED display operating range shall be –40 to +70 degrees Celsius.

204-8 The technical data sheet for the power supply shall be supplied to document the technical requirements of Subsections 204-1 to 204-6.

204-9 The components utilized in the Power Supplies shall be UL listed. Copies of UL product cards shall be supplied to document the listing.

Electronics – 205.

205-1 All electronics shall be of 100% Solid State technology.

205-2 All high voltage (Exceeding 24 Volt DC) electronic and electrical components used in the LED display or the digital control unit shall be UL listed. Copies of the UL product cards shall be supplied on request of the Engineer to document the listings.

205-3 The LED driver electronics shall not be mounted on the same board as the LEDs. The driver board shall utilize socket mounted chips which can be easily changed in the field. The driver board shall be easily separated from the LED board in the field using simple hand tools. Such update shall not require the use of solder. The mounting design shall utilize mechanical fasteners which are resistant to vibration.

Sign Controller Enclosures – 206.

206-1 The Sign Controller Enclosure shall consist of : an adequately sized aluminum NEMA 3R cabinet enclosure, complete with an adjustable shelf with slide out tray for keyboard; a fluorescent light with switch; thermostatically controlled fan and strip heater; a panel board with circuit breakers within a NEMA 1 enclosure without door; six ground fault duplex receptacles, conduit and wiring. The primary electrical service panel shall be rated for 100 amperes minimum. The panel shall have an interrupt rating of not less than 10kA. All necessary equipment to protect all of the components of the dynamic message sign assembly from electric and electromagnetic surges shall be supplied. All devices shall be readily accessible for ease of replacement and not mounted behind any panel or enclosure. Such equipment shall consist of at a minimum, but not be limited to:

A. A two stage surge protector and radio interference filter shall be installed as a precautionary measure for the LED Display and digital control unit to guard against possible damage resulting from voltage surges on all incoming power lines. The single phase surge protector shall incorporate a series choke at a maximum clamp voltage of 340V at 20 KA with a 5 ns response. In addition, the surge protector shall have the capability of removing high energy surges and block high speed transients.

The surge protector shall comply with the following specifications:

Peak Current:	20,000 amps (8X20 us wave shape)
Occurrences:	20 times at peak current
Minimum Series Inductance:	200 micro henries
Continuous Series Current:	Consistent with Sign Needs
Temperature Range:	-40^0C to $+85^0$C

A surrestor shall be installed for all communication lines. The surrestor shall comply with the following specification:

Peak Surge Current:	10 kA amps (8X20 us wave shape)
Occurrences at 2000 amps:	50 typical
Response Time:	<5 ns
Voltage Clamp:	8, 12, 20, 30, or special
Series Resistance:	24 ohms total
Operating Temperature:	-40^oC to $+85^o$C
Primary Protector:	Three element gas tube, 10 kA, 8X20US, per side
Secondary Protector:	Solid state clamps, 1.5 kW minimum

All components, circuits and accessories considered necessary by the manufacturer to adequately protect the controller assembly and associated equipment from damage due to voltage surge shall be furnished. All devices shall be readily accessible for ease of replacement and shall not be removable with the use of simple hand tools.

A radio interference filter, shall be connected as to completely filter controller and auxiliary equipment, and shall have a minimum rating of 50 amps. This capability may be supplied as an integral part of the surge suppresser.

B. Lightning Arrestor for the LED display and the digital control unit.

C. **RS232 Data Line Protector.** The system power shall be protected by two stages of transient voltage suppression devices as required in the AC Power Section of this specification. Tripping of each stage (or both if tripped simultaneously) of the surge protection shall cause the sign controller to call central and report the error condition (for dialup operation) or report the error condition to central on the next poll (for multi-drop operation). There shall be an option that is either enabled or disabled and is selected and downloaded from the central controller to the sign controller. When this option is enabled, tripping of the second stage of surge protection shall prevent power from reaching any components of the sign until the surge protection has been replaced. When this option is disabled, the sign will continue to function normally after the second stage of surge protection is tripped.

206.2 Cabinet and cabinet door shall be constructed of 5052-H32 alloy aluminum, 3.175 millimeters thick, and shall be unpainted. A vent with screen and air filters and cooling fans shall be installed as required for proper ventilation. Sun shielding shall be provided as necessary. Thermostats shall be installed at the top of cabinet.

206.3 Cabinet door shall be equipped with an one piece stainless steel handle and assembly utilizing three point latching (top, bottom & side) and a Corbin Lock No. 2-NJIVHS type, or equal. Door handle shall rotate inward. A continuous neoprene gasket shall be secured to the cabinet door to insure dust-tight and weather proof protection under all weather conditions. Door shall be held open with a positive locking mechanism.

206.4 The cabinet is to be equipped with a metal hasp so that the door can be padlocked in addition to the lock integral to the door.

206.5 Electrical conductors for the cabinets shall be a minimum of #12 AWG copper.

Sign Enclosure – 207.

207-1 The sign enclosure shall be a weatherproof enclosure. The sign enclosure shall be attached to and become an integral part of the support structure. The total weight of the sign and enclosure shall not exceed 800 kilograms.

207-2 The nominal dimensions of the sign enclosure shall be approximately 5.0 meters in length, 2.5 meters in height and 0.4 meters deep. The front shall be sloped to enhance the viewing angle of the sign at typical driver level and viewing distances.

207-3 The housing shall be designed to accommodate mounting on the rear vertical plane. The angular alignment of the sign housing shall be adjustable in the vertical direction from zero (0) degrees to ten degrees down in one degree

increments to optimize the viewing angle.

207-4 Access to all electrical and electronic components and the air filters shall be through panels on the front face of the sign enclosure. The access panels shall be hinged, open outward and shall be held in both the opened and closed positions with positive locking mechanisms. The positive locking mechanism shall be capable of holding the panel open at a 90 degree angle in a 97 kilometer per hour wind acting at an angle perpendicular to the plane of the panel. Gasketing shall be provided on all openings and shall be dust-tight. Gaskets shall be 6.35 millimeters minimum thickness closed cell neoprene and shall be permanently bonded to the metal. The mating surface of the gasketing shall be covered with a silicone lubricant to prevent sticking to the mating metal surface. A gasket top channel shall be provided to support the top gasket on the opening (prevent gasket gravitational fatigue). Access panels shall be equipped with latching devices to discourage unauthorized entry.

207-5 The sign enclosure ventilation shall include intake, exhaust, filtration, fan assembly and environmental control.

A. **Louvered Vents.** Louvered vents shall be installed in the back wall of the sign enclosure, near the bottom. The louvered vent depth shall be a maximum of 6.4 mm. The number and size of the vents shall be determined by the supplier to be of sufficient size to provide adequate ventilation.

B. **Air Filters.** A removable, two-stage, air filter system shall be installed behind each louvered vent. The filter filtration area shall completely cover the vent opening area. A shell shall be used to provide mechanical support for the filter. The shell shall be louvered to direct the incoming air downward. The shell sides and top shall be bent over a minimum of 6.4 mm to house the filter. The filter resident in its shell shall be held firmly in place with a bottom bracket and a spring loaded upper clamp. No incoming air shall bypass the filter. The bottom filter bracket shall be formed into a waterproof sump with drain holes to the outside housing. The two-stage filter shall remove all particles 500 microns in diameter and larger.

C. **Electric Fan.** The sign enclosure shall be equipped with electric fans with ball or roller bearings. The capacity of each fan and the number of fans shall be sufficient to ensure at least 25% spare capacity over that required to support the ambient temperature range over which the DMS shall operate. In addition, the spare capacity shall be sufficient to maintain adequate ventilation, if one fan becomes inoperable. An analysis shall be presented in the submittal material which shall document that the proposed system meets these requirements. The fans shall be mounted within the housing and vented. The number, placement, and size of the electric fans shall be determined by the manufacturer.

D. **Thermostatic Control.** The fans shall be controlled from outputs driven by the sign controller. The sign controller shall include control parameters in the database which will specify the turn-on temperature and the shut-down temperature. Both parameters shall be in the range of 20 to 80 degrees C. The ventilation system shall be activated by multiple temperature sensors. There shall be a minimum of one sensor located near the middle of each module line, at the top of the display module in the exhaust stream from the cavity between the display module and the lens panel. There shall be an additional temperature sensor located to accurately measure the ambient temperature outside the sign housing. The temperature sensors shall have an accuracy of +/- 1.5 degrees C and a range from -40 to +70 degrees C.

The temperatures from the sensors shall be continuously measured and monitored by the sign controller. A temperature reading greater than a user selectable critical temperature shall cause the sign to go to blank and the sign controller shall report this error message to the central controller.

The ventilation system shall be equipped with a manual override timer to provide ventilation for service personnel. The timer will have a maximum on-time of 1 hour.

The LED modules and electronic equipment shall be protected by a fail-safe, back-up fan control system in the event of an electronic fan control failure or shutdown of the sign controller.

E. **Humidity Control.** A humidity sensor shall be provided and sensed by the sign controller from zero percent to 100 percent relative humidity in one percent or fewer increments. The sensor shall operate and survive from 0 percent to 100 percent relative humidity. The sensor shall have an accuracy that is better than +/- five percent relative humidity.

The sign controller shall read the internal temperature sensors, external ambient temperature sensor and the humidity sensor. The sign controller shall use these readings in an algorithm that turns on the heat tape and/or the fans at the appropriate times to reduce either frost on the face of the sign or condensation on the display modules and other electronic circuitry.

207-6 No moving parts shall be used in the Dynamic Message Sign Enclosure construction, except for the cooling fans.

207-7 The Sign Enclosure shall be assembled from a continuously welded aluminum skin of at least 3.8 mm. The enclosure shall meet or exceed all AASHTO structural standards. Internal supports shall be of extruded aluminum members welded to form a support structure to provide rigidity and structural integrity. All metallic parts shall be protected against corrosion. The sign case and facial area shall be treated with a flat-black, factory-applied, kynar flouropolymer resin based coating providing a minimum life span of 20 years. As part of the shop drawing

submittal, the vendor may propose an alternate means of protecting the metal surfaces. Such alternates shall be subject to the approval of the engineer and shall provide equivalent protection.

207-8 The front face of the sign enclosure shall be made of clear LEXAN polycarbonate panels of at least 6.4 mm thickness, and feature the following minimal mechanical characteristics:

A. Resistance to traction: 55 N/mm^2
B. Elasticity in flexion: 2 200 N/mm^2.
C. Elongation at the limit of elasticity: 6%
D. Elongation before rupture: 100%
E. Hardness: 95 N/mm^2
F. UL94 fire rating: VO
G. The pigmentation of the polycarbonate and its optical characteristics shall guaranty the transmission of at least 95% of the light emitted by the LEDs.
H. The external face shall feature a non-glare finish.
I. The manufacturer's technical data sheet for the material utilized for the front face shall be provided as part of the submittal package.
J. The manufacturer shall consider darkening portions of the face through which the LEDs do not radiate. As an alternate, a metal screening constructed of dark metal may be utilized to improve LED contrast. However, such application shall not reduce the viewing angle of the LED display. The manufacturer shall include an analysis of both techniques in the submittal which shall document the advantages and disadvantages of either approach. The engineer reserves the right to direct the shading alternative to be utilized at no additional cost, based on the data presented and accepted industry standards.

207-9 In order to increase contrast, the LEDs shall be arranged on a black non glossy background or protected with a dark screening. All clearly visible electronic components shall be of black color or shall be coated with black non-glossy paint. There shall be a 229 mm spacing between the lines. The spacing between the lines and the cabinet frame shall be 305 mm.

207-10 The rear face shall be made of one or several panels of aluminum with all seams continuously welded. The panels shall be at least 3.2 mm thick.

207-11 The Sign Enclosure shall be weatherproof, and drainage holes shall be drilled at the base of the enclosure. The bottom panel of the housing shall have a minimum of four drain holes, with snap-in, drain filter plug inserts, in each section formed by internal structural members. Water drain filter plug inserts shall be replaceable.

207-12 Each line shall be assembled with modular LED boards of approximately 305 mm in length.

207-13 The structural design of the LED sign enclosure shall conform to current AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals. Additional design criteria are as follows:

Wind Velocity = 129 kilometers per hour.
Gust Factor = 1.3

207-14 The performance and stability of the sign shall not be impaired due to vibration, wind, vacuum, pressure, and/or other normally encountered forces created by the effects of traffic.

207-15 Certification by a professional structural engineer, licensed in the State of New Jersey, shall be supplied. This includes design calculations that verify that the sign enclosure meets all design criteria specified in this document.

207-16 The LED display shall be equipped with three external light sensors. One sensor shall point downward. The other two sensors shall be oriented in opposite directions, perpendicular to the sign face. These sensors shall be scaled for up to 100,000 lux. Three (3) photocells shall be installed on the sign. These devices shall permit automatic light intensity measurement of light conditions at each sign location. These photocells shall be mounted in a manner to measure front, rear and ambient light conditions. The sensors shall be located in an easily accessible location for maintenance. All light sensors shall be mounted in a way that permits adjustment of the aiming angle. The controller shall be able to automatically adapt the intensity of the LED display to match the environmental luminosity by utilizing the PWM (Pulse Width Modulation) technique or other approved method. Automatic adjustment of the LED brightness shall occur in small enough increments so that the brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. Provision shall be made to prevent perceivable brightening of the sign due to stray headlights shining upon the photo sensors at night. The adjustable range for dimming shall be from 10 to 100% on a linear basis, and it shall be possible to disable the dimming via commands to the sign controller. The sign controller shall monitor the photocell circuits in the sign and convert the measured light intensity into the desired pixel brightness. The photo circuit readings shall be correlated with a brightness table in the sign controller. The brightness table shall have a minimum of 255 brightness levels. The brightness table in each individual sign controller shall be adjustable from the central controller and can be customized according to the requirements of the installation site. Each sign shall have its own, independent brightness table.

207-17 **Physical Properties.**

A. **Maintenance Access.** Access for all maintenance shall be from the front of the sign enclosure. The sign

enclosure design shall allow unobstructed and convenient access to all serviceable components between the sign display and the sign display cover.

B. **Modular Components.** All serviceable components shall be modular, interchangeable, and removable from the front of the sign enclosure. Each line of the sign display shall be composed of identical and readily interchangeable display modules. Each display module shall contain one or more display pixels. The replacement of any display module shall not require the use of any tools. All wiring interconnecting individual display modules shall be modular harness assemblies with latching push-on/pull-off or twist on/off connectors.

C. **Display Module Removal.** The removal of any combination of one or more display modules shall not alter the structural integrity of the sign display assembly, nor of the sign enclosure. Nor shall the removal of any combination of display modules affect the operation of the remaining operational modules in any way. The display modules shall be removable without the use of any tools.

207-18 **Environment.** The DMS shall be constructed to operate properly in accordance with these specifications under environmental conditions normally encountered on a freeway in New Jersey to include the following:

-Ambient Temperature of –40 to +70 degrees C
-Humidity of 0% to 100% non-condensing

Digital Control Unit/sign Controller/field controller – 208.

208-1 **General Functions.** The sign controller shall control the operation of all equipment housed at the site. The sign controller shall be installed within its own ground mounted NEMA 3R Enclosure. The sign controller shall respond to the direct commands from the system computer, and it shall respond to commands from the portable, field test computer.

A. **Computer Commands.** The sign controller shall receive and interpret commands sent by a host device and cause the requested message to be displayed on the sign, and shall provide a return message to the computer that provides information concerning the status of the sign, including:

1. Actual message that is visibly displayed on the sign on an individual pixel basis (full-on, half-on or off).
2. Current sign illumination level.
3. Local Control Panel switch position (central, local or local override mode).
4. Error and failure reports.
5. Temperature readings.
6. LED power supply voltage levels.
7. Origin of display message transmission (laptop, sign controller or central).
8. Heat tape status.
9. Uninterruptible power supply status.
10. Surge protection status.

B. **Error and Failure Reports.**

1. Power failure
2. Power recovery.
3. Pixel string failure.
4. Fan failure.
5. Over a user selectable critical temperature.
6. Power supply failure.

C. **Critical Error and Failure Reports.** In dial-up mode, the sign controller shall initiate a call to the central controller and report any severe error conditions. In multi-drop mode, the sign controller shall report severe error conditions to the central controller during the next polling.

The severe error conditions are:

1. AC power failure.
2. AC power recovery.
3. Surge protection has been tripped.
4. The sign housing door is open

D. **Operation Monitoring.** The sign controller shall continuously monitor command messages from the system computer. When a computer system poll is not received within a user defined threshold period, the controller shall blank the message if the retention parameter is exceeded.

E. **Sign Messages.** The sign controller shall maintain a library of not less than 60 different display messages and related parameters. These messages shall be retained in non-volatile electronic memory.

The sign controller shall support uploading and downloading the message library.

F. **LED Temperature Monitoring.** The sign controller shall monitor the temperature of the LED circuit board and shall reduce light output (DC forward current) when the temperature exceeds unacceptable thresholds. At least three temperature levels, settable via the system interface, shall be supported which result in increasingly lower power output to the LEDs. The sign controller shall perform an automatic sign shutdown when the temperature exceeds an absolute threshold. The sign controller shall use an analog to digital converter to capture the current LED temperature. Current temperature shall be reportable to the central or portable computer via the sign controller interface. At least one analog temperature sensor shall be mounted towards the vertical center of the line on the LED circuit board. The sensors shall be equally spaced to cover each end and the middle of the sign. The controller shall utilize the most extreme temperature recorded. However, the individual readings shall be reportable via the RS232 interface.

G. **Electrical Power Monitoring.** The sign controller shall be capable of detecting power failures. Power failure is defined when the power is out of limits for 3 or more cycles. When a power failure is detected, the active message shall be retained in non-volatile memory. When power is restored, the last message displayed shall be restored, if the outage is less than a user specified period or if the retention parameter specified when the message was implemented has not elapsed. Upon receiving the next status request from the central, the sign controller shall report the occurrence of the power failure and its duration. The sign display shall be blanked, if the power failure exceeded the user defined length.

H. **Photocell Monitoring.** The sign controller shall monitor the photo cell circuits in the sign and convert the measured light intensity into the desired pixel brightness. The photo circuit readings shall be correlated with a brightness table in the sign controller. The brightness table shall have a minimum of 255 brightness levels. Automatic adjustment of the LED driving waveform duty cycle shall occur in small enough increments so that brightness of the sign changes smoothly, with no perceivable brightness change between adjacent levels. The brightness table in each individual sign controller shall be adjustable from the central controller and can be customized according to the requirements of the installation site. Each sign shall have its own, independent brightness table.

Brightness shall be manually settable from the front panel of the controller and remotely from the central computer in one percent increments from one to 99 percent.

There shall be a means to adjust how rapidly the sign responds to changes in ambient light as measured by the photocells. This can be used, for example, to prevent the sign from changing its brightness due to a vehicle's headlight momentarily hitting the sign. The adjustment shall be made from the central controller or laptop computer and shall have two different settings, one for daytime control and one for nighttime control, with the day/night ambient light threshold also being an adjustable value. In addition, there shall be a means to specify different weighting factors for each photocell, to specify how prominently each photocell figures in the calculation of nighttime ambient light.

I. **Pixel Status Monitoring.** The operational status of each pixel in the sign shall be automatically tested **once a day and tested** when a pixel test is requested from the central controller or laptop computer. A list of defective pixels shall then be transmitted to the central controller or laptop computer, listing pixel status, module number, column number and pixel number. This pixel status test shall distinguish the difference between half-out, full-out, half stuck-on and fully stuck-on pixels. This test shall not affect the displayed message for more than 0.5 seconds.

When the sign controller is polled or a message is downloaded from the central controller or laptop computer, each pixel in the sign shall be read and its current state (full-on, half-on or off), for the current displayed message, shall be returned to the central controller. This will allow the central controller or laptop computer to show the actual message that is visibly displayed on the sign on an individual pixel basis in a WYSIWYG format. (This is different from the pixel test listed above.) This pixel status read shall not affect the displayed message in any way.

There shall be no perceivable blinking, flickering or ghosting of the pixels at any time, except for during a pixel test as described above. The displayed message will not be affected in any way at any time for the pixel status read as described above.

J. **Power Supply Monitoring.** All LED module power supply voltages shall be continuously measured by the sign controller. The sign controller shall provide these voltage readings to the central controller or laptop computer when the sign controller is polled by the central controller or laptop computer.

K. **Surge Suppression Monitoring.** The system power shall be protected by two stages of transient voltage suppression devices as required in the AC Power Section of this specification. Tripping of each

stage (or both if tripped simultaneously) of the surge protection shall cause the sign controller to call central and report the error condition (for dialup operation) or report the error condition to central on the next poll (for multi-drop operation). There shall be an option that is either enabled or disabled and is selected and downloaded from the central controller to the sign controller. When this option is enabled, tripping of the second stage of surge protection shall prevent power from reaching any components of the sign until the surge protection has been replaced. When this option is disabled, the sign will continue to function normally after the second stage of surge protection is tripped.

Communication lines shall be protected by two stages of transient voltage suppression devices as required in the Sign Controller Communication Interface Section of this specification. Tripping of each stage (or both if tripped simultaneously) of the surge protection shall cause the sign controller to call central and report the error condition (for dialup operation) or report the error condition to central on the next poll (for multi-drop operation). There shall be an option that is either enabled or disabled and is selected and downloaded from the central controller to the sign controller. When this option is enabled, tripping of the second stage of surge protection shall disconnect the communication lines until the surge protection has been replaced. When this option is disabled, the sign will continue to function normally after the second stage of surge protection is tripped.

208-2 The digital sign controller shall be housed in the sign controller enclosure specified in under 206 of this Sub section.

208-3 The sign controller shall be microprocessor-based and contain multiple RS232 interface ports for access by a fiber optic modem, and a local port and a dial-up mode.

The sign controller shall be programmed to receive sign control commands from the central controller or laptop computer, transmit responses as requested to the central controller or laptop computer, monitor sign and message status and control sign operation and message displays.

208-4 An Uninterrupted Power Supply (UPS) shall be provided to allow the sign controller to notify the central controller when an improper power condition at the DMS persists for longer than 30 seconds.

The UPS shall meet the following minimum specifications:

1. Full load runtime: 3.5 minutes
2. Input voltage range: 95 to 135 VAC
3. Overload capacity: 120% +/- 10%
4. Transfer time: less than ½ cycle
5. Output voltage waveform: regulated step wave
6. Output protection: electronically limited
7. Input protection: circuit breaker
8. Recharge time (to 95% capacity): 8 hours maximum
9. Lightning & surge protection: ANSI/IEEE C62.41 categories A & B, IEC801.4, 801.5
10. Surge energy capacity: 450 joules
11. Efficiency: >95% on line

208-5 The digital control unit shall support the following software capabilities in addition to those specified in other sections:

A. Password protection.
B. Fully programmable parameters for all functions.
C. One year schedule of program timing
D. Variable message flash rate.
E. Negative inversion - amber on black or black on amber.
F. Auto centering on text insertion for sign.
G. Retention Threshold specified when a message is commanded which defines how long the current message should remain in effect, in the absence of communication with the central.

208-6 The base character fonts supplied with the controller shall be proportional and shall allow all Printable ASCII Characters as implemented in MSDOS computers. The controller shall support at least five additional downloadable fonts which can be transferred into non-volatile memory from any communication port. Messages shall allow the selection of multiple fonts in a given sign display.

208-7 The LED display shall be able to implement variable flashing rates ranging from three flashes per second to 1 flash per minute. This parameter shall be programmable by line.

208-8 The sign controller shall support a sequencing capability by line. A message group may contain up to five message segments. A parameter shall be specified as part of each message which will determine how long each message segment will be displayed. This parameter shall range from 1 to 60 seconds. The sign controller will sequence through each message segment. After all segments are displayed, the first segment will be re-displayed until the sign controller is directed to bring-up another display.

208-9 The sign controller shall be able to store at least 60 messages. These messages shall be downloadable via the RS232 interface and stored in permanent memory. Via the software protocol, these messages shall be indirectly selectable for immediate implementation. In addition, the messages shall be selectable from the manual control panel of the sign controller. The message protocol shall include the ability to directly control each pixel. In addition, the sign controller shall allow a direct download of an entire message for immediate implementation on the sign. As part of the command to implement a particular message, a retention threshold shall be specified which will define how long that message can be displayed, in the absence of subsequent communication with the central.

208-10 **Manual Reset.** The sign controller shall have a momentary contact switch, which can be used to reset the sign controller.

208-11 **Manual Test Switch.** The sign controller shall have a switch that initiates a manual test of each pixel in the sign.

208-12 **Functional Circuitry.** The sign controller shall have circuitry and the required software to perform the following functions:

- Drive the sign display
- Determine ambient lighting levels
- Control pixel luminance levels
- Monitor the temperature of the LED boards at three points
- Control the Ventilation System
- Positive Monitoring/Confirmation of each pixel group independent of the output circuitry.

208-13 **Hardware Watchdog Timer.** The sign controller shall have a hardware watchdog timer that shall check its own operation. While the sign controller program is running, the hardware watchdog timer shall be periodically reset . If the watchdog timer is not reset, the watchdog timer shall reset the sign controller.

208-14 **Portable Field Computer Interface.** In addition to the normal system computer interface, access shall be provided to the sign controller from two separate locations using a standard RS-232-C port. One location shall be from within the sign controller enclosure; the other location shall be from an interface enclosure mounted on the support pole for all the support structure.

The enclosure shall be mounted as indicated on the plans and shall meet NEMA 3-R requirements. This typically will be on the sign support structure pole.

The pole mounted interface enclosure shall contain the following assemblies:

- Power-on indicator
- Waterproof local/remote switch
- Local control LED indicator
- Sign to ground voice communication RJ-11 jack
- RS-232 connection for the portable laptop computer
- RS-232 cable a minimum of 1.5 meters long to connect the laptop computer
- For dialup installations, an RJ-11 jack for connecting the dialup phone line shall be installed
- 120 VAC GFI outlet

The enclosure dimensions shall be approximately 356 mm high by 356 mm wide by 229 mm deep.

There shall be a hinged shelf which folds from inside the enclosure and is suitable for the laptop computer to rest on.

The enclosure shall be a NEMA 3R single-door enclosure.

The enclosure shall be constructed using unpainted sheet aluminum with a minimum thickness of 3 mm. Material used in the cabinet shall meet NEMA standards.

The enclosure shall be completely weatherproofed to prevent the entry of water. All exterior seams for enclosures and doors shall be continuously welded. All exterior welds shall be smooth.

The enclosure shall be provided with one full size door to provide access to the enclosure. The door shall be provided with a full length stainless steel piano hinge, with a stainless steel pin spot welded at the top. The hinge shall be mounted so that it is not possible to remove it from the door or enclosure without first opening the door.

The door and hinges shall be braced to withstand a 45 kg per vertical meter of door height load applied vertically to the outer edge of the door when standing open. There shall be no permanent deformation or impairment of any part of the door or enclosure body when the load is removed.

The enclosure door shall be fitted with a number 2 Corbin lock. Two keys shall be provided for each enclosure.

The door opening shall be double flanged on all four sides.

A gasket shall be provided to act as a permanent dust and weather resistant seal at the enclosure door facing. The gasket material shall be closed-cell neoprene and shall maintain its resiliency after exposure to the outdoor

environment. The gasket shall show no sign of rolling or sagging and shall ensure a uniform dust and weather resistant seal around the entire door facing.

The voice / data / control cable shall be terminated with a single CHAMP type IDC connector on each end.

The power-on indicator shall show when the display system interface circuits are energized.

All shop drawings of the enclosure, as described in this specification and the plans, shall be submitted to the Engineer for approval before installation.

All markings and identification shall be silk screened on the panel and sealed with a clear sealer or as approved by the Engineer.

The Contractor shall be responsible for all phone, data, control and confirmation connections between the sign and ground control box and for any required wiring harnesses and connectors.

The ground control box and its sub-assemblies shall be designed for continuous operation over an outside temperature range of -40 degrees C to +65 degrees C.

Cables between the sign and the ground control box shall be provided for operation of the sign.

Signal control and data cables shall be 22 or 24 AWG, stranded, twisted pair, 300 V, shielded cable. These cables shall terminate using CHAMP IDC type connectors.

208-15 Communications. The sign controller shall include separate serial interfaces for communication with the central controller and the laptop computer. The communication line circuits shall be fiber optic line to communication cabinet and then on T-1 telephone service to NTOC and shall be suitable for full duplex asynchronous data transmission. The Contractor shall provide necessary modems at the sign location.

The communications between the sign controller and the central controller or laptop computer shall comply with the NTCIP Standards Publications NTCIP 1101 (Simple Transportation Management Framework), NTCIP 1201 (Global Objects), and NTCIP 1203 (Dynamic Message Sign Objects). The software shall also comply with NTCIP 2101, NTCIP 2201 and NTCIP 2301, Unless otherwise stated, the software shall comply with the versions of the relevant NTCIP standards that are current at the date of this document.

The sign controller shall support all NTCIP conformance levels, conformance groups, objects, and minimum storage sizes and ranges specified in **APPENDIX - NTCIP Requirements**.

In addition to the standard Management Information Base (MIB) objects, the sign shall include any additional manufacturer-specific MIB objects required to support all of the sign and central software functionality defined elsewhere in this specification.

The DMS shall support three distinct modes.

A. **System Control.** This is the normal mode of operation. The sign controller responds to commands from the system computer.

B. **Local Control.** This is the mode of operation that is used to test the sign operation. In this mode, the sign controller responds to commands from a portable computer that is interfaced to the sign controller via the second RS232 port. This state shall be reportable via the RS232 interface.

C. **Failed Condition.** This is the mode of operation that is used when the hardware watchdog timer or the communications watchdog timer is not reset, or an error is detected by the sign controller. In this mode, the sign face is blank (all pixels are off). This state shall be reportable via the RS232 interface.

The sign controllers shall have a unique, changeable address number set by dip switches or other means approved by the engineer. The sign shall only act upon commands containing its ID, and shall include its ID in all response and status messages that it sends.

Portable Data Input Unit – 209.

209-1 One portable data input unit shall be provided with each LED DMS Assembly. The portable data input unit shall consist of a digital microprocessor unit with built-in keyboard, monitors, carrying case, and data storage. The portable data input unit shall also consist of a portable printer and applications software.

209-2 The complete portable data input unit shall be fully debugged and shall be capable of operation in the following environment:

Air temperature, 5 to 35 degrees C.

Humidity, 20% to 80%

209-3 The portable data input unit shall be supplied with an AC adapter which will power the unit while line voltage is within the range of 100 to 140 volts AC at 50-60 Hz. The unit shall also include a Lithium Ion battery for field operation and a spare battery.

209-4 The portable data input unit shall utilize a Pentium III microprocessor with an Intel 80387 math co-processor. The clock speed shall be a minimum of 400 MHz. The unit shall be manufactured by Panasonic, Dell, IBM, Gateway or Compaq.

209-5 The portable data input unit shall be provided with an internal 2400 baud Hayes compatible modem.

209-6 The unit shall include 64 MB of random access memory, expandable to 128 MB with additional memory modules.

209-7 The data storage shall include as a minimum the following:

A. One (1) 1.4 Mbyte 90 mm "Floppy Disk Drive"
B. One (1) 2.0 GB Minimum Internal Hard Disk Drive
C. One (1) 12X CD-ROM Drive

209-8 The unit shall have video resolution of at least 800 X 600 and display 65000 colors.

209-9 The unit shall include a mouse port and a mouse.

209-10 The unit shall allow one (1) Type I PCMCIA card or two (2) Type II PCMCIA cards.

209-11 One RS232 ports and One Parallel Port

209-12 Null Modem Cable of at least 6m For Connection to Sign Controller

209-13 Custom Padded Carrying Case with Accessory Compartment

Sign Control Test Software – 210.

210-1 **General.** The sign control software shall operate on the monitor unit as defined under 209 of this Sub Section or any other comparable MSDOS computer. The software shall be Windows based and operate in Version 3.1 or higher. The software and data files shall require 10 Mb or less of hard disk storage. The software shall interface with the sign controller using an RS232-C serial port and a null modem cable. One copy of the diagnostic program shall be supplied for each sign assembly procured on 88.9 millimeter floppy disks. NJDOT shall have the right to make an unlimited number of copies for use with the sign controllers acquired for this project. The sign software shall be made to interface with the existing central operating software (MIST) at NTOC.

210-2 **Number of Users.** The software shall permit access by up to 100 users. Each user shall be identified by name, password and access rights.

210-3 **Test Pattern.** The software shall initiate a test pattern that energizes and verifies each individual pixel in the sign. The software shall be able to report any failed pixels and shall utilize both a graphic and text display to identify the failures. The test pattern shall be supported by a test report that documents the results of the test. The test report shall also be directed to a standard text file.

210-4 **Communications Monitoring.** The software shall support a system monitoring function that will display on the screen of the portable computer the commands received by the sign controller from the system computer. It shall also display the response transmitted by the sign controller to the system computer.

This function shall be real-time and be functional when the sign controller is operating in the system control mode.

210-5 **Dial-up Communications.** The sign control test software shall be capable of interfacing with a dial-up modem and establishing a communications link with any DMS equipped with a dial-up modem.

A. Security-The logon dialog shall include recording the user identification and password. The software shall allow the user three attempts to key in the proper password. If the user fails three attempts to enter the proper password, the telephone line shall be disconnected. The software shall immediately dial-up the system computer and report the failed logon attempt. In addition, the sign controller shall not accept subsequently logon attempts for a user programmable parameter ranging from 0 to 180 minutes. A binary encrypted security log-on shall be provided that can be utilized by the system and/or diagnostic program to quickly gain access to the sign.
B. Message Database-The software shall support uploading and downloading the message library. The software shall support displaying, creating, editing, and deleting all messages. The software shall keep a record of all changes to the database in a logging file.
C. Display Commands-The software shall support commanding the display of any message in the library.
D. Diagnostics-The software shall support the running of sign controller and display diagnostics. At a minimum, the software shall initiate a test pattern that energizes and verifies each individual pixel in the sign. The test pattern shall be supported by a test report that documents the results of the test. Optionally, the test report shall be written to disk with ASCII characters.

210-6 The sign control test software shall include a real-time graphic emulation of the current sign display. In addition, the graphic shall have the ability to display failed pixels.

210-7 The software shall include a facility for creating and updating fonts. The font creation program shall allow the user to define the grid pattern for each ASCII symbol. The program shall allow the specification of a different horizontal width (in pixels) for each character. The program shall allow the fonts to be created off-line via a user friendly graphical interface and stored in a disk based library. This library

shall be easily transferable between MSDOS computers via a floppy disk interchange. Once a font has been completed and stored in the library, the program shall allow it to be retrieved and downloaded to one or more individual sign controllers for storage in non-volatile memory in the controller.

Testing – 302.

All DMS Assemblies shall be subject to factory testing as subsequently described.

302-1 **Test Plan.** The manufacturer shall provide a test plan for factory testing. The test plan shall clearly identify each element being tested, the setup conditions, the steps to be followed during the test, and the anticipated test results. The test plan shall exercise all functions of the hardware and software.

A. **Test Equipment.** The test plan shall clearly identify all test equipment required to perform the tests. This equipment shall be made available for the duration of the testing program.

B. **Test Reports.** The Supplier shall maintain a complete record of each test performed including the results of the test and a record of who witnessed the test. At the completion of each test, the test forms shall be completed and provided to the Engineer for review. This document shall be the basis for acceptance or rejection. All test reports shall be signed by the Supplier's authorized representative.

C. **Test Performance.** The Supplier shall conduct all tests. All tests shall be performed in the presence of the Engineer. The Engineer may waive the right to witness certain tests.

D. **Modified Units.** If a unit is modified as a result of any test or demonstration failure, a report shall be prepared and delivered to the Engineer prior to shipment of the unit. The report shall describe the nature of the failure and the corrective action taken. If a failure pattern, as defined by the Engineer, is identified, the Engineer may direct the modifications be made to all similar units without additional cost or time extensions.

E. **Test Witnessing.** Neither the witnessing of a test by the Engineer, nor the waiving of the right to witness a test, will relieve the Supplier of the responsibility of providing DMS equipment that is in compliance with this specification. The witness of any tests by the Engineer, or a representative of the Engineer, will not be deemed as acceptance of the equipment or systems under test.

302-2 **Factory Acceptance Test.** The purpose of this test is to demonstrate that each type or category of equipment to be supplied is in conformance with these specifications. Factory acceptance tests shall be performed at the equipment manufacturer's facility. The test shall be performed on a unit to be supplied. This test shall demonstrate every function of the hardware and/or software component under test. In addition, the test shall include procedures for verifying the environmental soundness of the assembly and the operation of the temperature and lighting monitor circuits under the range of weather conditions normally encountered in New Jersey.

The following is a typical, but non-exhaustive, list of the type of requirements that the Factory Acceptance Test shall verify:

- Downloading uploading, displaying, entering, editing, and deleting sign messages and fonts.
- Displaying of all characters, all messages, and all symbols on the sign.
- Switching between several different messages and blinking a part on one line of a message.
- Recovery from simulated communications errors, simulated watchdog timer errors, and simulated sign controller errors.
- Demonstration of the operation of the thermostatically controlled fans, automatic LED temperature shutdown and dimming, and heat related LED power reductions.
- Demonstrate the accuracy of all diagnostic feedback, including pixel test, real-time pixel read, power supply sensing, temperature sensing, air-flow testing, etc.
- Demonstration of automatic restart after a simulated short-term and simulated long-term power failure.
- Demonstration of the operation of the variation of the LED intensity based on various levels of ambient light.
- Demonstration of the operation of all manual switches and optional modes of operation.

Appendix - NTCIP Requirements

National Transportation Communications for ITS Protocol (NTCIP) requirements for DMS assemblies shall be as described below:

The sign controller and central computer software shall comply with the referenced National Transportation Communications for ITS Protocol (NTCIP) Standards when installed. The software shall comply with the versions of the relevant NTCIP standards that are current at the date of this document, or a later version. The following standard NTCIP documents shall be supported.

- NTCIP 1201 – Global Object Definitions (Amendment 1)
- NTCIP 1203 – Object Definitions for Dynamic Message Signs (Amendment 1)
- NTCIP 2101 – Point-to-Multi-Point Protocol (PMPP) Using RS-232 Subnet Profile
- NTCIP 2103 – Point-to-Point Protocol (PPP) Using RS-232 Subnet Profile
- NTCIP 2201 – Transportation (Null) Transport Profile
- NTCIP 2202 – Internet (TCP/IP and UDP/IP) Transport Profile
- NTCIP 2301 – Simple Transportation Management Framework (STMF)

1. NTCIP Framework. The software shall comply with basic framework NTCIP 1101, Simple Transportation Management Framework, and shall meet the requirements for Compliance Level 2.

2. NTCIP Global Objects. The software shall implement all mandatory objects of the mandatory conformance group defined in NTCIP 1201, Amendment No. 1, dated November 2, 1998, Global Object Definitions, as follows:

- Configuration Conformance Group
- Security Conformance Group (new in Amendment 1)

The software shall implement all mandatory objects of the optional conformance groups defined in NTCIP 1201, Global Object Definitions, as follows:

- Time Management Conformance Group
- Time Base Event Schedule Conformance Group
- Report Conformance Group
- STMP Conformance Group
- PMPP Conformance Group

The software shall implement the following optional objects defined in NTCIP 1201, Global Object Definitions, as follows:

- globalSetIDParameter
- eventConfigLogOID
- eventConfigAction
- eventClassDescription

3. NTCIP Dynamic Message Sign Objects. The software shall implement all mandatory objects of all mandatory conformance groups defined in NTCIP 1203, Amendment #1, dated July 3, 2001, Object Definitions for Dynamic Message Signs, as follows:

- Sign Configuration Conformance Group
- Message Table Conformance Group
- Sign Control Conformance Group

The software shall implement all mandatory objects of the optional conformance groups as defined in NTCIP 1203, Object Definitions for Dynamic Message Signs, as follows:

- GUI Appearance
- Font Definition
- DMS Sign Configuration
- MULTI Configuration
- Default Message
- MULTI Error
- Illumination/Brightness
- Scheduling
- Auxiliary I/O

- Sign Status
- Status Error
- Pixel Error Status
- Fan Error Status
- Temperature Status

The software shall implement the following optional objects defined in NTCIP 1203, Object Definitions for Dynamic Message Signs, as follows:

- dmsMessageBeacon
- dmsSWReset
- dmsMessageTimeRemaining
- dmsShortPowerRecoveryMessage
- dmsLongPowerRecoveryMessage
- dmsShortPowerLossTime
- dmsResetMessage
- dmsCommunicationsLossMessage
- dmsTimeCommLoss
- dmsPowerLossMessage
- dmsEndDurationMessage
- dmsMultiOtherErrorDescription
- dmsStatDoorOpen
- fanFailures
- fanTestActivation
- tempMinCtrlCabinet
- tempMaxCtrlCabinet
- tempMinAmbient
- tempMaxAmbient
- tempMinSignHousing
- tempMaxSignHousing

The software shall implement manufacturer specific objects where standard objects do not support the functionality specified in the LED DMS specification. The features specified in the LED DMS specification shall not be limited by the standard objects of NTCIP.

4. Sizes and Ranges. All objects required by these procurement specifications shall support all values within its standardized range, unless otherwise approved by the PROJECT ENGINEER. The standardized range is defined by a size, range, or enumerated listing indicated in the object's SYNTAX field and/or through descriptive text in the object's DESCRIPTION field of the relevant standard. The following provides the current listing of known variances for this project.

OBJECT	MINIMUM PROJECT REQUIREMENTS
NTCIP 1201	
maxTimeBaseScheduleEntries	7
maxDayPlans	7
maxDayPlanEvents	7
maxEventLogConfigs	50
eventConfigMode	2, 3, and 4
maxEventLogSize	200
maxEventClasses	7
maxGroupAddress	1
NTCIP 1203	
numFonts	4
maxFontCharacters	127
defaultBackgroundColor	0
defaultForegroundColor	9 (amber)

defaultJustificationLine	2, 3, 4
defaultJustificationPage	2, 3, 4
dmsNumPermanentMsg	50
dmsMaxChangableMsg	50
dmsControlMode	2, 4, and 5
numActionTableEntries	15

5. MULTI Message Language. The software shall implement the following tags (opening and closing where defined) of MULTI as defined in the NTCIP 1203, Object Definitions for Dynamic Message Signs:

- Field
- Flash
- Font
- Hexadecimal Character
- Justification Line
- Justification Page
- Moving Text
- New Line
- New Page
- Page Time
- Spacing – Character

6. Communications Protocols. DMS assemblies shall also meet communications protocol profiles as specified under NTCIP 2101 Amendment #1, dated November 2, 1998, (point to pint protocol), NTCIP 2201(transportation transport profile), NTCIP 2301(STMF application profile), NTCIP 2103 and NTCIP 2202.

7. Documentation. The software shall be supplied with full documentation, including a 3.5in. floppy disk(s) and/or CD-ROM containing ASCII versions of the following MIB files in ASN.1 format:

- The relevant version of each official NEMA/NTCIP Standard MIB Module referenced by the device functionality
- If the device does not support the full range of any given object within a NEMA/NTCIP Standard MIB Module, a manufacturer specific version of the official NEMA/NTCIP Standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX field of the OBJECT-TYPE macro. The filename of this file shall be the same as the standard MIB filename with the extension ".man".

Additionally, the software shall

- Be supplied with full documentation, including 90 millimeter floppy disk(s) and/or CD-ROM containing ASCII versions of any and all manufacturer-specific objects supported by the device in ASN.1 format in a manufacturer-specific MIB with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.

THE FOLLOWING SUBSECTION IS ADDED:

906.27 Full-Matrix LED Dynamic Message Sign Assembly.

101. General Description.

In general all requirements of Sub Section 906.26 – "Three Line LED Dynamic Sign Assembly" shall also apply to Full Matrix LED Dynamic Message Sign Assembly except for modifications described below or otherwise noted in the plans and specifications.

The purpose of this specification is to describe the minimum acceptable design and operating requirements for a full matrix LED Dynamic Message sign assembly to be utilized for travelers information. The Full Matrix LED Dynamic Message Sign Assembly shall include, but not limited to, a full matrix LED variable message sign (VMS) with enclosure, mounting supports to sign structure, ground mounted sign controller with enclosure, controller foundation, DMS cables between sign controller and sign, sign software and other equipment and material as specified in this Sub Section and any incidental equipment and material required for furnishing a functional DMS assembly.

102. Variable Message Sign. The variable message sign shall be a full matrix LED sign not a three line LED sign. The full matrix variable message sign (VMS) shall approximately 3.45 meter (11'-4") wide by 2.23 meter (7'-4") high. The sign size exact shall be coordinated with Port Authority of NY & NJ and as approved by the Engineer. The variable message sign (VMS) is also referred as sign or DMS in the specifications. The VMS shall be Model No. VF-1350-48x80-9-F (48 pixel high by 80 pixel wide) as manufactured by Daktronics, Inc or approved equal.

102.1 Material, Process, and Design Standards.

- **Aluminum** – Sign housing structural members shall be alloy 6061-T6. Sheet aluminum shall be alloy 5052-H34.
- **Aluminum Welding** - The housing shall be fabricated, welded and inspected in accordance with the requirements of the ANSI/AWS D1.2-90 Structural Welding Code-Aluminum (1990).
- **Communications Protocol** - The field controller shall communicate via NTCIP (National Transportation Communications for ITS Protocol), per standards 1101:1997, 1201:1997, and 1203:1997.
- **Electrical Items**- High-voltage components (120 VAC) shall be wired and color-coded per the NEC.
- **Maintenance Access** - The LED display and other internal sign components shall be accessed through doors on the front of the sign housing.
- **Structural Integrity** - The housing shall be designed to withstand a wind loading of 167 kilometers per hour (100 miles per hour), with a 30% gust factor.

102.2 Display Capability. The variable message sign shall be a full matrix monochrome amber LED display containing a minimum of '48' pixel rows by '80' pixel columns. Depending on the matrix size and character fonts used to form a message, the sign shall be able to display one or more lines of alphanumeric character font text, as well as graphic images. It shall display a nominal character height (14 pixels tall) of 18 inches (460 mm).

102.3 Communication Modes. The sign shall be controlled from NTOC using T-1 and fiber connections to the filed controller. A stand-alone local sign control computer, which is hereafter referred to as the *field controller shall be provided*. The controller shall receives its instructions in the following ways:

- **Remotely** - via non-switched or dial-up communications from the Central Control Software (MIST). The communications backbone should provide an RS-232 input signal, with a baud rate between 1200 BPS and 56.6 kBPS.
- **Locally** - via direct laptop computer connection (RS-232) to the field controller.

The field controllers shall not require continuous communication with the Central Control Software, in order to perform most DMS control functions.

102.4 Message Display Modes. The DMS shall be able to display the following message types:

- **Static Message** – The selected message shall be displayed continuously on the sign face until the field controller blanks the sign or affects the display of another message.
- **Flashing Message** – All or part of a message shall be displayed and blanked alternately at rates from as fast as 3 flashes per second to as slow as 1 flash per 10 seconds. The flash rate shall be programmable in increments of 0.1 seconds.
- **Multiple-Frame Message** – The displayed message shall consist of up to six different frames, with each frame containing up to three lines of text. Each message frame shall be displayed in user-programmable durations of 0.5 seconds or greater, adjustable in increments of 0.1 seconds.

102.5 Display of Alphanumeric Character Fonts and Graphic Images. The DMS shall be capable of displaying messages composed of alphanumeric character fonts, punctuation symbols, and graphic pictures. This shall include~~s~~ the following character fonts and punctuation:

- "A" through "Z" - as upper and lower case letters, having a vertical height of five (5) pixels and higher
- "0" through "9" - as decimal digits, having a vertical height of five (5) pixels and higher
- A blank or space
- Punctuation shall mark~~s~~ as follows: . , ! ? - ' ' " " / ( )
- Special characters as follows: # & * + < >

102.6 Character Font Styles. The sign shall initially be able to display the following alphanumeric character fonts:

- 7x4 single stroke - seven (7) pixel rows high by four (4) pixel columns wide, with a single-pixel stroke width and two pixel columns of inter-character spacing
- 7x5 single stroke - seven (7) pixel rows high by five (5) pixel columns wide, with a single-pixel stroke width and two pixel columns of inter-character spacing
- 11x7 double stroke - eleven (11) pixel rows high by seven (7) pixel columns wide, with a two-pixel stroke width and two pixel columns of inter-character spacing.
- 14x10 double stroke – fourteen (14) pixel rows high by ten (10) pixel columns wide with a two pixel columns of inter-character spacing.

102.7 Diagnostic and Status Features. The functional status of field controller communications and major components shall be capable of being reported to the Existing Central Control Software (MIST) at NTOC and the Laptop (Local) Control Software. This shall includes:

- **Field Controller Communications** - as "normal or "failed"
- **DMS Display Status** - as {name of message being displayed}, "off", or "disabled due to overheating"
- **Maximum Pulse Width Modulation (PWM) Level** - the maximum usable portion of the maximum possible LED forward current pulse width; this shall be a user programmable value and shall be presented as a percentage value of 50% to 100%, in minimum increments of 1%.
- **LED Intensity Level** - the percentage of the "Maximum PWM Level" which is either automatically selected by the DMS field controller or is manually selected by a Central Control Software or Laptop Control Software operator
- **LED Intensity Control Method** - as "automatic" or "manual"
- **LED Pixel Status** - displayed upon operator request, in a bit-map graphic format - as "on" "failed"
- **Regulated DC Power Supply Output** - as "normal" or "failed"
- **Internal Temperature** - LED pixel board temperature as measured by an internal sensor - presentable in degrees F and C
- **Ambient Site Temperature** - outdoor air temperature as measured by an external temperature sensor - presentable in degrees F and C

102.8 Response to Errors. In the event of communication error between the field controller and the system central computer, the "communications loss message" shall be displayed. This shall be factory set to blank.

In the event of a power failure, the "power recovery message" shall be displayed. This shall be factory set to blank.

The field controller shall contain a hardware watchdog that automatically resets the controller processor in the event of a controller lock-up.

102.9 Dynamic Message Sign Construction.

102.9.1 Display Matrix. LED display pixels shall be located on 34 mm 91.33-inch) horizontal and vertical centers. The display shall be a continuous and unbroken matrix of pixels, both horizontally and vertically.

DMS text messages shall be legible to a viewing distance of 305 meters (1,000 feet) from the DMS face. This legibility distance shall apply:

- For character font heights of 460 mm (18 inches) displayed during all normally encountered weather and lighting conditions
- During dawn and dusk hours when sunlight is shining directly on the display face or when the sun is shining from directly behind the DMS
- When the sign is viewed by motorists and travelers having 20-20 corrected vision.

Nine-inch tall text shall have a nominal legibility distance of approximately 500 feet.

102.9.2 General Specifications. The sign weight and housing dimensions shall be noted on the DMS shop drawing.

The required incoming power service shall be 120/240 VAC, single phase.

Total AC power requirement shall be calculated and submitted for approval. This includes the following fully loaded circuits:

- LED display (all pixels on at maximum drive current)
- Sign environmental control (ventilation fans, DMS traffic cabinet and control equipment, etc.)

Sign and field controller components shall be 100% solid-state, except for the ventilation fans.

All sign and field controller components shall properly operate throughout a minimum temperature range of -40 to +140° F (-40 to +60° C) and a relative humidity range of 0 to 99%. All sign and field controller components shall not be damaged by temporary exposure to temperatures of -50 to +185° F (-45 to +85° C).

High voltage electrical components (exceeding 24 volts DC) used in the DMS and the field controller shall be UL (Underwriter's Laboratory) listed.

Sign component mounting hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from stainless steel, aluminum, nylon, or other durable corrosion-resistant materials suitable for the roadway signage application.

The presence of ambient radio signals, magnetic or electromagnetic interference, including that from power lines, transformers, and motors, shall not impair performance of the DMS system. The DMS system shall not radiate electro-magnetic signals that adversely affect any other electronic device.

102.9.3 Discrete Light Emitting Diodes (LEDs). LEDs used in the display matrix shall be Agilent part number HLMP-AL16 or approved equal. The LED shall conform to the following requirements:

- High-intensity, solid-state lamp utilizing Indium Gallium Aluminum Phosphide (InGaAlP) technology.
- LED lens shall be non-tinted and non-diffusing.
- LED lens diameter shall be 5 millimeters (also known as T 1-3/4).
- LEDs shall be sorted by Agilent for luminous intensity and color. The dimmest LED in the DMS shall emits no less than half the luminous intensity of the brightest LED.
- LED luminous intensity shall be 1.7 candelas, typical, and 1.5 candelas, minimum, when driven with a 20 milli-amp forward current.
- Peak wavelength of emitted light shall be 590 ±5 nanometers.
- LED operating temperature range shall be -30 to +85° C (-22 to +185° F), and storage temperature range shall be -40 to +120° C (-40 to +248° F).

- LED viewing cone shall be 70° horizontal/30° vertical.
- LED package style shall be the through-hole flush-mount type.

102.9.4 LED Pixel Circuit Board. The sign shall be constructed with multiple display circuit boards, each of which shall contain sixty-four (64) LED pixels. Each pixel, which shall be the smallest programmable portion of the display matrix, shall consist of a cluster of four (4) closely spaced discrete LEDs and shall conform~~s~~ to the following requirements:

- The distance from the center of one pixel to the center of all adjacent pixels, both horizontally and vertically, shall be 34 mm (1.33 inches).
- Each LED pixel shall be protected from handling damage by a polycarbonate plastic frame, which surrounds each pixel.
- Each pixel shall consist of one string of four (4) LEDs. Current to each pixel shall be regulated by a constant-current drive circuit.
- The failure of an LED pixel shall not cause the failure of any other pixel in the DMS.
- Each LED pixel shall emit~~s~~ a minimum luminous intensity of 73.2 lux (6.8 candelas) when driven with a forward current of 20 milliamps DC. This shall create~~s~~ an overall display matrix luminance of more than 62408 lux (5,800 candelas) per square meter.
- LED pixel forward voltage drop, measured from the DC power supply output to ground, shall be 12 volts DC, including the driver circuit voltage drop and internal DC line loss.
- Discrete LEDs shall be mounted perpendicular to their PC boards. The DMS shall exhibit~~s~~ a uniform appearance of both color and intensity from pixel to pixel.
- The LED module printed circuit laminate shall be FR-4 fiberglass and shall have a minimum thickness of 1.5 mm (0.062 inches). The printed circuit board shall be plated on each side with a minimum copper trace thickness of 59.1 mL per 0.093 square meters (two ounces per square foot) of plated area. Printed circuit board through-holes are plated with 29.6 mL per 0.093 square meters (one ounce of copper per square foot) of plated area.
- The printed circuit board through-hole for each LED cathode lead shall be connected to a large copper trace pad having a minimum surface area of 25.8 mm (0.04 square inches). The trace pads shall dissipate heat from the LEDs and shall present on both the front and back sides of the LED pixel board. The cathode lead shall be the heat dissipation path for InGaAlP LEDs.
- All exposed metal on the rear side of the LED pixel board, except the power connector, shall be protected from water and humidity exposure by a thorough application of acrylic conformal coating. The front of each LED pixel shall be potted with Dow Sylgard® 170 silicone potting material. Bench level repair of individual pixels ~~is~~ shall be possible.
- The field controller shall be able to measure the forward current of each LED pixel and determine if the pixel shall be functioning normally. This information shall be reportable to both the Central Control Software (MIST) and the Laptop (Local) Control Software.

102.9.5 LED Drive Method. LEDs shall be driven using Pulse Width Modulation (PWM) of a nominal 30 milliamp forward current, where pulse width shall be used to achieve the proper LED intensity level for a given ambient lighting condition.

The current pulse shall be modulated from a 10-millisecond period, and pulse amplitude shall not exceed 30 milliamps per LED string.

One electronic driver circuit board ~~is~~ shall be provided for each 8x8 LED module and individually controls all 64 pixels on that module. LED drive electronics shall be mounted on a separate printed circuit board and shall not located on the same circuit board as the LED pixels. In the event of driver circuit failure, LED pixels ~~do~~ shall not have to be discarded.

Failure of an 8x8 driver board shall not cause the failure of any 8x8 LED display module, except the one that it drives.

Driver printed circuit board laminate shall be FR-4 fiberglass having a minimum thickness of 1.5 mm (0.062 inches). The printed circuit board shall be plated on each side with a minimum copper trace thickness of 59.1 mL per 0.093 square meters (two ounces per square foot) of plated area. Printed circuit board through-holes shall be plated with 29.6 mL per 0.093 square meters (one ounce of copper per square foot) of plated area.

All exposed metal on both sides of the LED driver circuit board, except the power and signal connectors, shall be protected from water and humidity exposure by a thorough application of acrylic conformal coating.

The LED display shall have a minimum refresh rate of 100 frames per second.

102.9.6 LED Display Module. The variable message sign shall contain multiple 8x8 LED display modules, which shall be constructed as follows:

- LED pixel circuit boards shall be mounted within a black polycarbonate plastic frame to form an 8-pixel high by 8-pixel wide LED display module.
- Plastic module frames shall be designed to protect the LEDs, as well as to provide them with a high-contrast background. Pixel openings in the frame shall be sized so they do not block any portion of the LED viewing cone.
- One LED driver circuit board shall be mounted to the back of each 8x8 LED display module using durable, non-corrosive hardware that requires basic hand tools for removal and replacement.
- Display modules mount securely to a support frame and shall be easily replaceable from the front of the DMS housing. Module removal and replacement shall be accomplished with the use of a 1/8-inch Allen wrench.
- Display module electrical connections shall be the quick-disconnect locking connector type.
- Removal of an 8x8 LED module from the sign shall not affect the display functionality of any other portion of the sign, nor shall it affect sign structural integrity.

102.9.7 Regulated Power Supplies. The LED display matrix ~~is~~ shall be powered by multiple regulated DC power supplies, which operate from 120 VAC/60 Hz input power and have a nominal output of 12 volts DC. Power supplies shall be wired in a redundant parallel configuration that uses three (3) 300-watt supplies per display "bay". A bay is defined as a display section that contains 20 to 25 8x8 LED modules (exact module quantity is dependent on the pixel matrix size, so 'bay' size varies slightly from model to model). All bays shall be wired in an identical manner.

Regulated power supplies shall have a "current sharing" capability that allows them to provide equal amounts of current to their bay. Power supplies shall be rated such that if one supply fails, the remaining supplies will be able to operate 100% of the pixels in the bay under full load conditions (all pixels on at maximum drive current) and when the internal DMS temperature is +140° F (+60° C).

Power supplies shall operate within a temperature range of -40 to +140° F (-40 to +60° C). Power supply output at an ambient temperature +140° F shall not be less than 65% of its room temperature (+70° F / 23° C) output. Power supply efficiency shall be 74%. Power supplies shall have a power factor rating of 0.95. Power supplies shall be short circuit protected by DC power off and shall reset automatically after 5 seconds of AC power on. Power supplies shall be protected by a minimum overload allowance of 105%.

The DMS field controller shall be capable of monitoring the operational status ("normal" or "failed") of each individual DC power supply by reading a diagnostic signal located on the supply's DC output. The operational status of all power supplies shall be communicated to the Central Control (In-Station) Software and the Laptop (Local) Control Software.

Identical power supplies (manufacturer and model number) shall be used in DMS Assemblies No. 2 and No. 3. DMS provided. The power supply is UL listed.

102.9.8 Sign Housing and Mounting Member Construction. The Sign housing shall provides front service access for all LED display modules, electronics, power supplies, environmental control equipment, air filters, wiring, and other internal DMS components.

DMS housing exterior sheets shall be aluminum alloy number 5052-H34, and shall have a thickness of 3.1 mm (0.125 inches). Exterior sheet seams shall be continuously welded and waterproof. DMS housing structural frame members (I-beams, C-channels, Zee-extrusions, and bar stock) shall be extruded from aluminum alloy number 6061-T6.

The housing shall be fabricated, welded and inspected in accordance with the requirements of ANSI/AWS D1.2-90 Structural Welding Code-Aluminum (1990). Compliance with this requirement includes:

- The documentation and use of certified welding procedures in the factory.
- All manufacturing personnel who perform welding on the DMS housing are certified to *AWS D1.2-90* for all weld types required for housing fabrication.
- A Certified Welding Inspector (CWI) inspects all DMS housing welds on a daily basis.

Structural mounting hardware (nuts, bolts, washers, etc.) shall be stainless steel and shall be appropriately sized for the application.

The housing shall be constructed to present a clean, neat appearance, and the components located within shall be protected from rain, snow, dirt, and corrosion. Sign housing floors shall contain small weep holes for draining any water that accumulates due to internal condensation. Weep holes shall be screened to prevent the entrance of insects.

The housing shall be designed such that it can be shipped and temporarily stored without damage or undue stresses occurring prior to its installation on an overhead support structure.

102.9.9 Sign Housing Serviceability. The sign housing and all of its components shall be designed and constructed so that maintenance is performed from the front. Service doors located on each side of the housing contain a stop to retain them in a fully open position. Doors shall be furnished with keyed locks.

All equipment, components, modular assemblies and other materials located within the sign housing shall be removable, transportable, and capable of being installed by a single technician.

102.9.10 Sign Housing Structural Design. The sign housing, structural framing, face covering, and mounting members shall be designed to withstand a wind velocity of 167 kph (100 mph) with a 30 percent gust factor.

Lifting eyebolts shall be provided for transporting and installing the DMS and shall be attached to the housing structural frame. **Note:** When using a lifting beam, lifting forces should be applied vertically and equally to all of the lift points provided.

102.9.11 Exterior Finish. Aluminum surfaces on the sign front face shall be painted with black acrylic urethane topcoat over an epoxy primer. All other housing surfaces shall be unpainted and have a natural mill aluminum finish.

102.9.12 Wiring. Wiring for LED display module control and other components shall be installed in the sign housing in a neat and professional manner, and shall not impede the removal of LED modules, power supplies, environmental control equipment, or other sign components. Insulation color and numerical labeling of all conductors shall corresponds to DMS power and signal schematics.

Wiring diagrams shall be provided in the DMS maintenance manual.

102.9.13 Interior Environment Control. Interior sign housing air temperature shall be thermostatically controlled. This system shall be designed to maintain the internal DMS temperature at or below +140° F (+60° C) when the outdoor ambient temperature is at or below +115° F (+46° C). The DMS environmental control system shall consists of three subsystems as follows:

Housing Cooling System - The sign housing shall contains a cooling system that circulates outside air into the housing whenever the internal temperature exceeds a user-settable threshold. This system shall consists of multiple 220-cfm fans. Fans shall be the ball-bearing type, and shall be mounted to the rear wall of the housing. One filtered air intake port shall be provided for each exhaust fan and shall be located directly below each exhaust fan. Air intake ports shall contain a removable filter that traps airborne particles measuring 500 microns in diameter and larger. The housing cooling system shall activates whenever internal sign air temperature exceeds +100° F (+38° C), and it shall deactivates whenever the temperature falls below +95° F (+35° C). Each air intake and exhaust port shall be covered on its top, front, and sides by a shroud fabricated from 2.3 mm (0.090-inch) aluminum sheeting. Shrouds shall be securely fastened to the sign housing, and all shroud-to-housing interfaces shall be gasketed to prevent water from entering the sign. Air filters and fans shall be removable from inside the housing.

102.9.14 Ambient Light and Temperature Sensor System. Sensors that measure outdoor ambient light levels and the outdoor ambient temperature at the site shall be mounted in-line on the housing walls. The system shall consists of three (3) photoelectric sensors and one (1) temperature sensor. Photoelectric sensor output shall be continuously reported to the DMS field controller. Two of the photo-sensors shall be placed such that they measure ambient light levels striking the front and rear of the sign housing and the third photo-sensor shall face the ground.

Ambient temperature sensor output shall be continuously reported to the DMS field controller.

102.9.15 Transient Protection. DMS and field controller signal and power inputs and outputs shall be protected from electrical spikes and transients.

103. Field Controller Hardware.

103.1 Field Controller. Each VMS shall be furnished with a ground mounted sign controller (filed controller). The field controller and associated communication equipment shall be installed in a ground-mounted control equipment cabinet located near the sign. The field controller shall have the following characteristics:

- Stand-alone microprocessor-based unit containing its own regulated DC power supply.
- Mounts in a standard EIA 19-inch (480 mm) equipment rack.
- Maximum weight is 20 pounds, including its enclosure.
- Includes multiple NTCIP-compliant RS232 communication ports
- Operating system is Microsoft Windows® CE.
- Operates successfully throughout a temperature range of -40°to 176° F (-40° to +80° C).
- Drives the LED modules
- Includes VMS-specific control software (firmware) that handles all external and internal sensors and communication inputs and drives the display modules as directed by external control software.

103.2 Single Board Computer. The single board computer shall be the base of the field controller. It shall have the following characteristics:

- 586-133 MHz CPU
- 16 MB DRAM
- Windows™ CE operating system
- 32 MB of solid-state IDE flash drive
- Five serial ports
- PC/104 bus interface
- Clock/calendar with battery backup
- 2 MB capacitor backed SRAM
- Industrial temperature rated

103.3 **Data Bus.** The field controller shall be the PC104 data bus. PC104 shall be a compact version of the IEEE P996 standard that is specially designed for embedded applications.

Key differences between PC104 and IEEE P996 shall include reduced form factor, no back plane/card cage requirements and reduced bus drive for low power consumption.

103.4 **Memory**. The field controller shall have permanent and changeable memory with the following specifications:

Permanent messages shall be stored in the field controller include a high priority blank message, a low priority blank message, and a test message showing the alphabet.

Non-volatile changeable memory shall be in the form of SRAM integrated circuits with a capacitor backup circuit that shall retain the data in memory for a minimum of 30 days following a power failure. This changeable memory shall be used to store messages, schedules, and sensor values. The field controllershall currently store up to 200 changeable messages.

In the event that the field controller loses power for longer than the 30-day backup limit, all messages and other data in the SRAM shall be lost and memory shall be initialized to a default state.

103.5 **Communication Ports.** Each field controller shall contain three (3) NTCIP-compatible RS232 communication ports. These ports shall support many types of communication interfaces, including direct null-modem (for local laptop control), dial-up and leased-line modems, various types of radio systems, various cellular modems, fiber optics, and others.

The baud rate, connection type, and NTCIP communication protocol shall be configurable. The baud rate for each port shall be set to any typical serial baud rate ranging from 1200 to 115,200.

Each port's default settings shall be as listed below. Refer to 105: NTCIP Communications for more information on the NTCIP protocol.

Port	Label	Baud Rate	Connection Type	NTCIP Subnetwork Interface
COM1	"J31"	9600	Modem	NTCIP 2103 – PPP Profile
COM2	"J32"	9600	Direct	NTCIP 2101 – PMPP Profile
COM3	"J33"	9600	Direct	NTCIP 2101 – PMPP Profile

103.6 **Smart Driver Display Interface.** The Smart Driver Interface (SDI) card shall transmit~~s~~ and receive~~s~~ data packets to and from each line of driver boards in the sign using the CAN (controller area network) protocol. These data packets shall tell the driver boards which pixels should be turned "on" or "off." They shall also contain brightness values, which are used to control pixel intensity. This network shall also read the field controller's address and monitor various other inputs.

These signals shall be sent through a connector on the front of the field controller.

104.7 **Clock.** The field controller shall contain~~s~~ a computer-readable clock/calendar device that shall have a lithium battery backup. The battery shall keep the clock operating properly for 10 years without external power. The clock shall automatically adjust for daylight savings time and leap year. The clock shall be set by the field controller's microprocessor, and shall be accurate to within one minute per month.

104.8 **Field Controller Addressing.** Three ten-position rotary thumb-wheel switches shall be installed on the face of the field controller. These switches shall be used to select a three-digit network address for each VMS field controller. This shall be used as the network address on NTCIP (2103 – PMPP) networks.

104. Field Controller Software.

104.1 **Message Presentation on the LED Display.** The field controller shall instruct the LED driver circuitry in a manner that shall cause the desired message to display on the sign. Software shall handle such details as centering text on a display line, right justification, left justification and legible spacing of letters and words. The software shall include a mechanism to allow the selection of a particular font style.

Field controller software shall supports a flashing feature, as well as alternating between frames of a multiple-frame message.

104.2 Display of Alphanumeric Text. The field controllers and control software shall support the storage and use of up to eight (8) character font sets (also known as font files), from which messages can be created. A font file typically shall includes multiple characters, such as:

- The letters "A" through "Z", in both upper and lower case.
- Decimal digits "0" through "9".
- A blank space.
- Eight (8) directional arrows.
- Punctuation marks, such as: . , ! ? – ‘ ’ “ ” : ;
- Special characters, such as: # & * + / ( ) [ ] < > @

During the creation of a VMS messages, an individual character font shall be selectable with a single computer keystroke.

The operator shall be able to easily install any of these fonts in the VMS. A font editor shall be included so that the user shall be able to create custom fonts from scratch or by modifying any of these existing fonts.

Font Name	Character Height	Character Width (avg.)	Variable or Fixed Width	Stroke Weight
7x4	7	4	Variable	Single (1)
7x5	7	5	Fixed	Single (1)
7x6	7	6	Variable	Double (2)
Graphic 7	7	N/A	Variable	N/A
8x4	8	4	Variable	Single (1)
8x6	8	6	Variable	Double (2)
9x6	9	6	Variable	Double (2)
11x7	11	7	Fixed	Double (2)
14x8	14	8	Fixed	Double (2)
14x10	14	10	Variable	Double (2)
Graphic 15	15	N/A	Variable	N/A

104.3 Display of Graphic Images. At present, the NTCIP protocol does not currently support the communication and display of graphic image data. However, graphic images shall be created and communicated to a VMS field controller as font (text) files. This shall be achieved using the local control software as well as existing central operating control software (MIST) at NTOC.

104.4 Message Display Modes. The sign shall display the following types of messages:

- Static Message – The selected message displays continuously until the field controller blanks the sign or causes the display of another message.
- Flashing Message – All or part of a message is displayed and blanked alternately at rates from as fast as five (5) flashes per second as to slow as one (1) flash per ten (10) seconds. The flash rate is user programmable in increments of 0.1 seconds.
- Scrolling Message – A message that moves across the display face from one side to the other.
- Multiple-Frame Message – A message consists of up to six (6) different frames of information, with each frame filling the pixel matrix. Each frame's display time is user programmable from 0.1 to 25.5 seconds in increments of 0.1 seconds.

The end user shall be able to use a combination of the above effects for maximum presentation effectiveness.

104.5 Message Activation. Messages shall be activated on the sign in three ways:

- **Manual.** An operator using the existing central operating control software (MIST) at NTOC and or local control software at filed controller manually instructs a particular message to be activated.
- **Schedule.** The internal time-based scheduler in the VMS may be configured to activate messages at programmable times and dates. Prior to activation, these messages and their activation times and dates must be configured using the Vanguard control software.
- **Events.** Certain events, like a power loss, may trigger the activation of pre-configured messages when they occur. These events must be configured using the Vanguard control software.

Normally, a displayed message remains on the sign until either a command to change the current message is received, or the sign's schedule indicates that it is time for a different message to be activated. The priority of the message to be activated must be equal to or higher than the priority of the currently active message.

104.6 Intensity Control System. The signs shall include an LED intensity control system which uses pulse width modulation (PWM). Over 100 intensity levels shall be available. This system shall control the intensity automatically or shall be manually set to specific intensity levels. The intensity mode and level (for manual mode) shall be set using the local and or central control software.

In automatic mode, the field controller shall monitor three (3) light sensors, which measure the ambient light levels. It shall use these measurements to automatically determine which LED intensity level will provide the best legibility for the given ambient light condition.

104.7 Diagnostics and Status Monitoring.

LED Diagnostics. Upon command from either a remote computer or local laptop running central control software, the field controller shall be able to test the operation of all LED pixels and determine whether they are operating as "normal," "stuck on," "stuck off," or if there is a "general electrical error." This diagnosis shall be accomplished via an A/D conversion of each pixel's forward voltage drop. The resulting data shall then be viewed using existing central control software (MIST).

If any pixels fail, the field controller shall be configured to log the details. The control software shall then retrieve the failure data.

Power Supply Diagnostics. VMS shall display include circuitry which monitors the diagnostic outputs of all DC power supplies in the VMS cabinet. The field controller uses this information shall be able to determine if any of the power supplies have failed.

If any power supplies fail, the field controller shall be configured to both log the details and transmit a failure warning to the operator and control software.

Over Temperature Shutdown. VMS shall displays include an internal temperature sensor circuit which shall be monitored by the field controller. The VMS shall be configured to automatically blank the sign face if the internal temperature of the VMS exceeds a configurable threshold. If this occurs, the field controller shall also notify the central control system.

105. NTCIP Communications.

105.1 Supported Standards. NTCIP requirements shall be compliance with **Section 905.26 Appendix – NTCIP Requirements**. The following NTCIP standards documents shall be supported:

- NTCIP 1201 – Global Object Definitions (Amendment 1)
- NTCIP 1203 – Object Definitions for Dynamic Message Signs (Amendment 1)
- NTCIP 2101 – Point-to-Multi-Point Protocol (PMPP) Using RS-232 Subnet Profile
- NTCIP 2103 – Point-to-Point Protocol (PPP) Using RS-232 Subnet Profile
- NTCIP 2201 – Transportation (Null) Transport Profile
- NTCIP 2202 – Internet (TCP/IP and UDP/IP) Transport Profile
- NTCIP 2301 – Simple Transportation Management Framework (STMF)

105.2 Warning "Traps". The field controller shall be capable of automatically informing the existing central operating control system (MIST) that an important event or subsystem failure has occurred.

This shall be handled via NTCIP "traps." When one of these events occurs, the field controller shall create a data packet for transmission to the central controller that contains details about the event.

Traps may be generated for the following events:

- Field controller restart – Indicates that the field controller restarted due to a power interruption, intentional restart, or other event.
- Power supply failure – Indicates that a diagnostic sensor detected a power supply is not operating correctly.
- Door open – Indicates that one of the doors on the VMS housing or control equipment cabinet has been opened. Note: This feature requires that an optional sensor be installed in the sign.
- Over Temperature Shutdown – Indicates that the maximum safe operating temperature has been reached or exceeded, resulting in a blanking of the display.

106. Product Warranty. All equipment shall carry a two-year warranty from the date of operation and acceptance against any imperfections in workmanship or materials. It shall also include DMS Maintenance as defined under Section 706.03. Contractor/manufacturer shall repair any damaged equipment/material and provide DMS maintenance during two-year warranty period. All repairs and general maintenance during warranty period shall be performed at no additional cost to NJDOT including any traveling expense.

THE FOLLOWING SUBSECTION IS ADDED:

906.28 Reader Assembly.

1. General Requirements.

1.1. **System Description.** Roadside equipment shall be furnished and installed along 14th Street viaduct as shown in the project plans or as directed by Engineer. The equipment shall include three reader antennas, UPS, reader cabinet, cabinet foundation, coaxial cable, the TRANSMIT reader electronics, CSU/DSU and all other required equipment as specified in the specification or in the plans. All equipment will be furnished and installed by the contractor except for reader antennas and electronic toll and traffic management (ETTM) equipment. The reader antennas will be purchased by TRANSCOM (by others) and shall be installed by the contractor. The ETTM equipment will be furnished and installed by the TRANSCOM (by others). The contractor shall be responsible for coordinating all construction and equipment with TRANSCOM, contact person is Chris D'Agosto. The TRANSCOM address and telephone number is provided below:

New Port Financial Center
111 Pavonia Ave - 6th floor
Jersey Cit, NJ 07310-1755
Telephone: (201) 963-4033

1.2. **Vertical Clearance.** The Contractor shall position the proposed antenna reader equipment such that the minimum vertical under clearance is not less than as specified on sign structure plans.

1.3. **New Equipment.** All components, parts, interconnecting cable and other items used in the manufacture and installation of equipment under this specification shall be new and unused. All parts and components shall be the latest, proven model in current production.

1.4. **Quality of Materials.** All parts, equipment and materials supplied under this specification shall be of the best quality and shall be controlled and incorporated into the system in such a manner as to produce a complete product which is acceptable and properly functional in every detail. All exposed parts shall be made of corrosion resistant material such as plastic, stainless steel, anodized aluminum or brass, weathering steel, and shall be protected from fungus growth and moisture deterioration. All external screws, nuts and locking washers shall be stainless steel. Self-tapping screws shall not be used.

1.5. **Unspecified Parts.** All parts, even if not specified, which are necessary for the TRANSMIT equipment to be complete and ready for operation, or which are normally included as standard

equipment, shall be furnished and installed by the Contractor. All unspecified parts supplied shall conform to the requirements of these specifications and to the accepted standards of the industry.

1.6. **Electrical Materials.** Electrical materials and fittings shall conform to the requirements of the National Electrical Code. Electrical fittings shall be watertight and weatherproof. An inert dielectric material shall separate dissimilar metals.

1.7. **Verification of Site Conditions.** It shall be the Contractor's responsibility to check the environmental, electrical, and physical conditions at the equipment installation sites to ensure that the TRANSMIT equipment furnished and installed will operate as specified. This requirement encompasses every aspect of TRANSMIT.

1.8. **Wiring and Connections.** The Contractor shall furnish and install all wiring, conduit and connections required for complete operation of the Reader Assembly (Transmit Detectors). All wiring, conduit, and connections shall conform to accepted industry standards and to the standards of the States of New Jersey and shall be labeled to identify contacts (e.g. electrical, communications) voltages and circuit identifications. Labeling shall be permanent and weatherproofed.

1.9. **Testing.** All equipment defined in this specification shall be subject to factory testing as subsequently described. The factory test shall demonstrate or provide confirmation that all of the equipment meets the overall specifications.

The contractor shall be responsible for submitting a test plan that has been designed to exercise and monitor the equipment for the purpose of demonstrating compliance with the specifications.

All equipment and software furnished shall be subject to monitoring and testing to determine conformance with all applicable requirements and to ensure an orderly implementation of the system. Documentation to demonstrate component performance and operation in conformance with these specifications shall be furnished as part of the project. Each hardware/software component shall be examined and tested to verify that the materials, design, construction, operation, performance, and workmanship comply with these specifications.

Each component shall be examined carefully to verify that the materials, design, and construction, markings and workmanship comply with the requirements of these specifications. Visual inspections shall be performed on all components and subassemblies to determine any physical defects, such as cracking, scaling, poor fastening, incorrect component values, etc. Complete electrical testing shall be performed on each component and subassembly to determine compliance to the designed function. Housing, chassis, and connection terminals shall be inspected and mechanical sturdiness, and harnessing to sockets, shall be electrically tested for proper wiring sequence. Any missing mounting hardware, screws, bolts, or loose connections shall be noted. All such conditions shall be corrected prior to the conclusion of the test.

As part of the factory acceptance test, the complete configuration shall be integrated and activated. The test shall demonstrate that all of the components are operational and can communicate over the leased communication system. Each port shall be tested to insure that all of the equipment is operational. Diagnostics shall be run on each memory component to verify that the correct internal memory is available.

1.10. Other Requirements

- No changes or substitutions in these requirements will be acceptable unless authorized in writing.
- The Contractor agrees to, upon the request of the NJDOT/TRANSCOM, a sample of each assembly to be supplied in compliance with these specifications for inspection and test before acceptance. After completion of the test, the sample shall be returned.
- The contractor shall furnish any and all equipment, which they deem necessary for safe and reliable field operation of the equipment as part of the quoted price for the specified equipment.
- All components furnished under this specification shall be current production equipment and of recent manufacture. Untried or prototype units shall not be considered for acceptance.
- All major components shall be identified with a metal plate containing the serial number identification.
- Any repairs made by a manufacturer or representative shall be documented and returned with units when warranty repaired. This documentation shall include an explanation of the exact repairs made and identification of parts replaced by part number and circuit number. All

warranty repairs shall be completed within thirty days of delivery of the equipment to the designated repair depot.

2. Roadside Communication Equipment .

2.1. **General Description.** Roadside communication equipment to be installed by the Contractor shall include reader antennas, coaxial cables, UPS, reader equipment cabinets, communication and power interconnections, and any incidentals necessary for the communication system ready. Work shall include but not limited to terminating the coaxial cables, providing electrical service and the installation of reader antennas as specified in the plans and directed by the Engineer.

2.2. Reader Antennas.

2.2.1. **General Requirements. The reader antennas will be purchased by TRANSCOM and supplied to contractor for installation.** The reader antennas will be used to broadcast and receive RF signals at the field equipment locations. The Contractor shall be responsible for installing the reader antennas as well as attachment hardware for each reader antenna as specified in the plans and as required. The Contractor is responsible for furnishing the attachment hardware, installation and interconnection as shown on the plans or as directed by the Engineer. The Contractor is also responsible for the testing of the equipment as described in the specifications.

2.2.2. **Product Identification.** The reader antennas shall be a Type 2 patch Panel Antenna, Part No. 1009-0397-401, as manufactured by Phazar Antenna Corp or approved equal.

2.2.3. **Reader Antenna Characteristics.** The reader antennas shall have the following characteristics:

Electrical Specifications

- Frequency range: 902 MHz. to 930 MHz.
- Gain: 10 dB. (plus or minus 1 dB.)
- VSWR: 2:1 Nom.
- Vertical Beam width 60 Degrees (Typ)
- Horizontal Beam width 44 Degrees (Typ)
- Polarization Horizontal
- Cross Polarization <16 Db
- Front to Back Ratio >30 dB
- Power Input 50 Watts
- Lightning Protection Center conductor grounded

Mechanical Specifications

- Dimensions H x W x D 438x260x38 (mm) [17.25 X 10.25 X 1.5 (inches)]
- Weight: 4 lbs max
- Termination Type N female w/pg-tail cable
- Max Wind Speed 125 mph
- Radome Panel UV resistant ABS, Standard color is white

2.2.4. **Connection.** Reader antennas shall be supplied with a 13 mm (1/2 inch) type-N female connector for a coaxial cable connection.

2.2.5. **Mounting.** Reader antennas shall be installed on overhead sign structure as shown in the plans. The Contractor shall position the proposed reader antennas and attachment hardware such that the minimum vertical under clearance is not less than the one indicated on sign structure plans. Contractor shall furnish and install all supports, clamps, cables, connections and other materials necessary to secure the reader antennas at the selected locations and with the following mounting requirements:

- All reader antennas shall be mounted over vehicle travel lanes facing downwards and towards traffic.
- For overhead reader antennas on main vehicle travel lanes, the reader antennas shall be mounted with a 5 to 15 degrees tilt with the horizontal axis.

- For overhead reader antennas on exit lanes, the reader antennas shall be mounted at a perpendicular with the vertical axis and the horizontal axis.
- For side fired reader antennas, the reader antennas shall be mounted at 30 degrees angles between all three axes.

All reader antenna installations shall be field verified by the Engineer.

2.2.6. **Lane Coverage.** Reader antennas shall be installed and adjusted by the Contractor so as to minimize the number of reader antennas required to achieve full coverage of all lanes as shown in the project plans. Normally two reader antennas will be installed above three lanes of vehicle travel. The exception shall be at specified entrance and exit ramp sites where one reader antenna per lane shall be used.

2.2.7. **Operating Environment.** The interconnection and installation of the reader antennas shall ensure a five (5) year life span and corrosion resistance in severe environmental conditions.

2.2.8. **Testing.** The Contractor shall test each reader antenna and interconnection to ensure that the reader antenna and coaxial cable has not been damaged during installation. Prior to connecting the reader antenna and coaxial cable at the site, the Contractor shall successfully test each item separately. The Contractor shall submit a test procedure for approval by the Engineer that includes the following as a minimum:

Prior to Reader Antenna Installation:

- Physical Inspection
- Reader Antenna VSWR Test
- Impedance Measurement

After Reader Antenna and Coaxial Cable Interconnection -

- Physical Inspection
- TDR Test
- Frequency Sweep for the 850 to 950 MHz. bandwidth.

2.3. Coaxial Cable

2.3.1. **General Description.** The Contractor shall furnish and install coaxial cables and connectors to interconnect each reader antenna as shown in the plans or as directed by the Engineer. Coaxial cable and connectors shall be for outdoor use and shall be provided with lightning surge protection and electrical noise filtering. The Contractor shall use Coaxial Cable, Type 1 for coaxial cable length less than 300 feet between antenna and reader electronics. For coaxial cable length more than 300 feet between antenna and reader electronics, coaxial cable, Type II shall be used and shall be approved by the engineer before furnishing and installing the cable.

2.3.2. **Coaxial Cable, Type I Characteristics.** The coaxial cable shall have the following characteristics:

Physical

- Diameter over jacket - 14 mm (0.55 inch), maximum
- Diameter over outer conductor - 12 mm (0.48 inch)
- Cable Weight - 0.14 lb./foot
- Center Conductor - Copper Clad Aluminum
- Outer conductor - Corrugated Copper
- Color - Black

Mechanical

- Cable Tensile Strength - 175 lbs.
- Minimum Bending Radius - 32 mm (1.25 inches)
- Bending Moment - 2.0 lbs.-ft.

Electrical

- Impedance - 50 ohms, plus or minus 2 ohms
- Velocity of Propagation - 81%
- Max. Attenuation at 1000 MHz. and 75 degrees Fahrenheit - 3.7 dB / 100 feet
- Center conductor DC Resistance at 68 degrees Fahrenheit - 0.85 ohms per 1000 ft.
- Capacitance - 25.5 picofarads per foot

2.3.3. **Coaxial Cable, Type II Characteristics.** The coaxial cable shall have the following characteristics:

Physical

- Diameter over jacket - 14 mm (0.55 inch), maximum
- Diameter over outer conductor - 12 mm (0.48 inch)
- Cable Weight - 0.15 lb./foot
- Center Conductor - Copper Clad Aluminum
- Outer conductor - Corrugated Copper
- Color - Black

Mechanical

- Cable Tensile Strength - 250 lbs.
- Minimum Bending Radius - 51 mm (2 inches)
- Bending Moment - 2.8 lbs.-ft.

Electrical

- Impedance - 50 ohms, plus or minus 2 ohms
- Velocity of Propagation - 81%
- Max. Attenuation at 1000 MHz. and 75 degrees Fahrenheit - 2.34 dB / 100 feet
- Center conductor DC Resistance at 68 degrees Fahrenheit - 0.85 ohms per 1000 ft.
- Capacitance - 23.1 Pico farads per foot

Environmental

- Installation & Operating Temperature range: -40 to +140 degrees Fahrenheit

2.3.4. **Connectors.** The Contractor shall install weatherproof coaxial connectors at each end of the coaxial cable with the following specifications:

Coaxial Cable End

At the reader antenna:	Type -	N connector male
	Size -	13 mm (½ inch)
	Impedance -	50 ohms
	Plating coat -	silver plated body and gold plated pin
At Reader Cabinet:	Type -	N connector male
	Size -	compatible with surge protector
	Impedance -	50 ohms
	Plating coat -	silver-plated body and gold plated pin

At the end of the 13mm (½ inch) coaxial cable in the reader cabinet attach a surge suppressor as specified in section 2.6.11.

2.3.5. **Installation.** The Contractor shall install coaxial cable as shown on the plans or as directed by the Engineer. The installation techniques and procedures of the coaxial cable shall not degrade the electrical and mechanical characteristics of the coaxial cable in any manner. The contractor shall use appropriate cable hoisting grips, lubricant, and entry guide chutes, winch and corner rollers as specified by the cable manufacturer. The Contractor shall submit coaxial cable installation techniques and procedures for approval by the Engineer prior to any cable installation.

All coaxial cable runs shall be continuous from reader antennas to reader cabinets without any intermediate connectors or splices. A cable slack of three feet shall be supplied in the reader cabinet for each coaxial cable run. A weatherproof and permanent label shall be attached to each coaxial cable end at the reader cabinet so that each coaxial cable can be identified to a reader antenna. The Contractor shall submit a label sample and labeling procedure for approval by the Engineer prior to the installation of any coaxial cable or reader antenna installation.

Provide a weatherproof coating at the reader antenna connection by applying a sealant and shrink tubing.

2.3.6. **Testing.** The Contractor shall perform the following tests as a minimum to ensure that the reader antenna and coaxial cable are ready for communications:

- Reel Test: At the Contractor's shop, each coaxial cable reel shall be inspected for any physical damage and a DC resistance test, a megger test and a TDR test shall be performed. A frequency sweep shall also be performed for the 850 to 950 MHz. bandwidth.
- Stand Alone Test: Prior to connecting the reader antenna and coaxial cable at the location, the Contractor shall successfully test each item separately. The Contractor shall submit a test procedure for approval by the Engineer that includes the following as a minimum:
    1. Coaxial cable and reader antenna physical inspection for any damage during transport and installation.
    2. Coaxial Cable Time Domain Reflectory (TDR) Test, DC ohm test and megger test as recommended by the coaxial cable manufacturer.
    3. Reader Antenna Impedance Measurement.
- Interconnection Test: After installation of the coaxial cable and providing end connectors and the connection to reader antenna, inspect coaxial cable for any damage and complete a frequency sweep for the 850 to 950 MHz. bandwidth and a TDR test from the cabinet.

Tests and results shall comply with the manufacturers' specifications. The Contractor shall inform the Engineer three days prior to performing any tests so that Engineer may witness tests and approve the coaxial cable for payment.

2.4. Uninterrupted Power Supply.

2.4.1. **General Description.** The Smart uninterrupted power supply (UPS) shall provide backup to the commercial power supply for operation of the field equipment, and shall provide lighting and surge protection and electrical noise filtering.

2.4.2. **Backup Power.** The UPS shall provide battery backup to the commercial power supply. When fully charged, battery backup shall be capable of powering normal operation of the field communication equipment and future electronic load, a total of 400 watts for a minimum of six (6) minutes at full load runtime.

2.4.3. **Switching Time.** During loss of commercial power, the UPS shall switch to backup power in four (4) milliseconds or less.

2.4.4. **Lightning and Surge Protection.** The UPS shall provide lightning and surge protection in accordance with ANSI/IEEE C62.41 Categories A and B and shall be UL 1449 listed.

2.4.5. **Noise Isolation.** The UPS shall provide RF noise isolation of at least thirty-three (33) dB common-mode and forty-seven (47) dB normal-mode.

2.4.6. **Input.** The UPS shall accept input from commercial power sources in the range of 95 to 135 VAC and 57 to 63 Hz., providing 110 to 120 VAC alternating current at a nominal frequency of 60 Hz.

2.4.7. **Output Waveform.** The UPS shall provide a sine wave output waveform.

2.4.8. **Output Protection.** The UPS shall provide automatic current and over voltage output protection.

2.4.9. **Safety.** The UPS shall be UL listed, CSA certified and FCC class A and B listed.

2.4.10. **Operating Environment.** The UPS shall operate normally in the temperature range thirty-two degrees Fahrenheit to one hundred thirteen degrees Fahrenheit (32oF to 113oF), and at all relative humidities up to ninety-five (95) percent, non condensing. The Contractor shall provide temperature control equipment to ensure that the UPS continues to operate as specified over the full range of temperatures normally experienced in the area of installation.

2.4.11. **Reliability.** Each piece of UPS equipment supplied under this specification shall comply with the following minimum reliability requirements:

Mean time between failures..... Two (2) years
Mean time between maintenance/corrective actions.....One (1) year
Mean time to repair, measured from the time of arrival
At the site of a service technician with the necessary
Equipment and being provided necessary access.....two (2) hours

To minimize individual unit failures, the above requirements will be based on the number of units received by Authorities' Representative not the Contractor's overall equipment inventory.

2.4.12. **Remote Monitoring.** UPS shall be able to provide remote monitoring of UPS and site power condition.

2.5. Reader Cabinet.

2.5.1. **General Description.** The Contractor shall furnish and install reader cabinet at the location shown in the plans and as directed by the Engineer. Reader cabinet shall house and protect the field CSU/DSU communications units, UPS, TRANSMIT reader electronics, and all ancillary components from the environment and vandalism.

2.5.2. **NEMA Rating.** The reader cabinets shall meet the minimum acceptable requirements for a NEMA Type 4X weatherproof cabinet.

2.5.3. **Equipment Rack.** Reader cabinets shall be equipped with a four hundred eighty three millimeters (nineteen inch) equipment rack and 10 mounting screws with each cabinet to mount the field CSU/DSU unit, UPS and provide additional twenty 560 mm (22 inches) in height and 330mm (13 inches) in depth of space for the installation of ETTM equipment. **ETTM equipment will be furnished and installed by TRANSCOM (by others).** All equipment shall be mounted in the equipment rack of the cabinet with twenty five millimeters (one inch) of space in between. A minimum clearance of fifty one millimeters (two inches) shall be provided between each side of the cabinet wall and equipment mounted in the equipment rack. The rack standard shall be EIA RS-310C.

2.5.4. **Equipment Installation.** The Contractor shall furnish and install all necessary panels, racks, suppressors and other materials to secure the electronics, UPS, temperature control equipment, cable and wiring terminations, and other items within the cabinet. Equipment installation performed by the Contractor shall be of high quality. This includes, but is not limited to, direct, convenient access to equipment and cables, clear, concise and visible equipment labeling and provision of maintenance manuals and wiring diagrams within each cabinet.

2.5.5. **Materials.** The reader cabinet shall be constructed of 14 gauge type 304 stainless steel. All inside and outside edges shall be free of burrs.

2.5.6. **Mounting.** The reader cabinets shall be mounted as shown in the plans. Mounting will range from base standards to structure mounting with most of the installations requiring mounting on wall abutments and sign structures.

2.5.7. **Access.** The reader cabinet shall include a continuous hinged door equipped with a neoprene gasket to provide a weatherproof and dust proof seal when the door is closed and locked. Two (2) No. 2 brass Corbin keys and one (1) ½" hex removable handle shall be provided with each cabinet. All cabinets shall be keyed alike.

2.5.8. **Internal Dimensions.** The Contractor shall furnish and install cabinets capable of accommodating the required equipment elements at the field installations and providing six hundred sixty (660) millimeters [twenty-six (26) inches] of additional rack space for future equipment installations. The reader cabinets shall have minimum internal dimensions of nine hundred fourteen (914) millimeters [thirty-six (36) inches] in height, seven hundred sixty two (762) millimeters [thirty (30) inches] in width and five hundred eight (508) millimeters [twenty (20) inches] in depth.

2.5.9. **Electrical Connections.** The cabinets shall be equipped with a grounding bar and with a barrier terminal block having sufficient terminals to support complete operation of the system and one 20-ampere main circuit breaker. Each terminal shall be numbered. The cabinet shall be provided with a 10- ampere circuit breaker wired to a duplex utility receptacle, a radio interference filter wired to the load side of the circuit breaker, and lightning suppressor. Circuit breakers shall be provided to protect equipment from the cabinet heater, fan, and utility duplex receptacle as shown on the plans.

Cabinet grounding shall be in accordance with of the New Jersey Department of Transportation Standard Specifications.

2.5.10. **Ventilation.** The cabinets shall be provided with vent openings to allow adequate convection cooling of the electronic components. Vents shall be located and designed to prevent the entry of water and to minimize the infiltration of dust and insects. The intake vent openings shall be covered fully with a commercially available type filter of a standard size. The vent and filter support shall prohibit air passage around the sides of the filter. All necessary conditioning equipment to insure that the equipment is operating within the specified operating environment shall be provided.

2.5.11. **Lightning and Surge Protection.** The Contractor shall equip the reader cabinets with adequate lightning and surge protection (e.g. built-in grounding mechanism, electrical dispersion/discharge capabilities, etc.) to ensure that potential damage to hardware and/or software system components is at a minimum.

Suppressors shall be provided in the reader cabinet for each coaxial connection to reader electronics and between the electric service connection and the utilities as shown on the plans, drawing MD-5.

Coaxial Surge Suppressors

The coaxial surge suppressors shall have the following minimum specifications:

1. Attenuation- 0.5 dB at 1000 MHz
2. Frequency range - 100 to 1000 MHz
3. Response Time - 10 nanoseconds
4. Turn on voltage - 1200 volts
5. Surge current - 50 kA
6. Housing - stainless steel
7. Connectors - compatible with ½" coaxial cable connectors And terminating with N type female connections.

AC Line Surge Suppressors

The Contractor shall furnish and install AC surge suppression between the entry of the AC power line into the cabinet and the main circuit breaker. The suppressor shall have the following features:

1. No Follow Current
2. 5 nanosecond response time
3. Automatic recovery
4. 120 VAC, 60 Ampere service

5. Epoxy encapsulated

In addition, the AC surge suppressor shall meet the following specifications:

1. Repetitive Peak Surge - 15000 Amp (8x20 us)
2. Peak Surge Voltage - 680 Volts
3. Energy Handling - 220 Joules
4. Power Dissipation Rate - 1.5 watts max.
5. Continuous AC Voltage - 130 VAC RMS
6. Initial Breakdown - 12 Volts
7. Typical Capacitance - 4000 picofarads

Data Communication Line Surge Suppressor

The Contractor shall furnish and install data surge suppressor between the Verizon Telephone network interface and CSU/DSU units. The suppressor shall be a dual pair (four wires) module implementing three-stage hybrid technology. The module shall address over voltage transients with gas tubes and solid state components. In addition, sneak and fault currents shall be mitigated with resettable fuses. The resettable fuses shall increase resistance several orders of magnitude when over currents exceed safe levels. A normal state shall resume when over currents are removed.

The data communication surge suppressor shall meet the following requirements:

1. Peak Surge Current (minimum 10 times) 8x20us, 10 kA, 10x700us, 500A per line
2. Life Expectancy - 8x20us(2kA) or 10x700us (400A) >100 occurrences
3. Response time - <1 nanosecond
4. Voltage Clamp - 200 VDC
5. Technology - Solid State
6. Resistance - The protector shall not introduce a series on shunt impedance to the signal path such that it interferes with the operation of the equipment.
7. Capacitance (Average) –1500 picofarad

The surge suppressor shall be installed according to manufacturer specifications at locations specified on the plans.

2.5.12. **Cabinet Mock-up.** The Contractor shall demonstrate a typical reader cabinet with all equipment, panels and wiring to the Engineer for approval two weeks before the installation of any equipment in the field.

3. Leased Data Line Service.

3.1. **Data Cable.** The Contractor shall provide data cable at described under Sub Section 906.03. **Leased data line telephone service will be ordered by TRANSCOM (by others).**

SECTION 908 – JOINT MATERIALS

908.02 Joint Sealers.

THE FIRST PARAGRAPH IS CHANGED TO:

Hot-poured joint sealer for joints and cracks in both HMA and portland cement concrete surface course shall be sealant conforming to Subsections 908.06, 908.07, and ASTM D 6690 as follows:

1. Type II Sealant shall be used when sealing cracks in HMA.
2. Type IV Sealant shall be used when sealing joints and cracks in Portland cement concrete pavements and HMA saw and seal applications.

SECTION 909 – LANDSCAPING MATERIALS

909.10 Topsoil.

A. Unacceptable Topsoil Sources.

ITEM 1. IS CHANGED TO:

1. Soils having less than 4.1 pH value, or greater than 8.0 pH value.

SECTION 912 - PAINTS, COATINGS, AND MARKINGS

912.10 Pavements Stripes or Markings.

C. Thermoplastic.

THE SECOND AND THIRD SUBPARTS ARE CHANGED TO:

2. For white, the composition of the mixture shall be as follows:

Component	**Percent by weight**
Resin/Binder	22-26 percent
Glass Beads (pre-mix)	30 percent minimum
WhitePigment	10 percent minimum
Calcium Carbonate and Inert Fillers (shall not contain silica other than as glass beads)	34-38 percent

3. Only yellow non-lead formulas shall be used, the composition of the mixture shall be as follows:

Component	**Percent by weight**
Resin/Binder	22-26 percent
Glass Beads (pre-mix)	30 percent minimum
Yellow Pigment	2 percent minimum
Calcium Carbonate and Inert Fillers (shall not contain silica other than as glass beads)	42-46 percent

The yellow material's combined totals of lead, cadmium, mercury, and hexavalent chromium shall not exceed 100 parts per million.

The thermoplastic manufacturer shall certify, according to Subsection 106.04, that the material will meet the requirements specified.

912.12 Removable Pavement Marking Tape and Removable Black Line Masking Tape.

THE SUBSECTION HEADING AND SUBPART A IS CHANGED TO:

912.12 Removable Wet Weather Pavement Marking Tape and Removable Black Line Masking Tape.

A. Removable Wet Weather Pavement Marking Tape. The removable wet weather pavement marking tape shall consist of polymeric, conformable backing materials with a retroreflective surface designed to provide retroreflectivity in wet conditions. The underside of the tape shall be precoated with a pressure sensitive adhesive which bonds the tape to the roadway surface so as to be able to withstand traffic immediately after installation. Primers shall be used to promote tape adhesion to the pavement only in accordance with the tape manufacturers recommendations.

Daylight color of the white tape shall be no darker than color No. 37778 of FED-STD-595B. Daylight color of the yellow tape shall conform to the FHWA color tolerance chart for highway yellow.

When measured with an Advanced Retro Technology (ART) model MX-30 handheld retroreflectometer, the tape shall have initial, minimum retroflectance values conforming to:

Dry Condition – ASTM D 1710
Entrance Angle = 88.76°

Observation Angle	**Specific Luminance**	
(Degrees)	**White**	**Yellow**
1.05	950	500

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

Continuous Wet Condition – ASTM E 2176
Entrance Angle = 88.76°

Observation Angle	Specific Luminance	
(Degrees)	White	Yellow
1.05	750	300

Note: Specific luminance is measured in millicandelas per square foot per foot-candles.

The removable tape shall be capable of being removed manually, intact or in large pieces, at temperatures above 4 °C without the use of solvents, burning, grinding, or blasting. Only tape that has previously received the approval of the Department Bureau of Materials shall be used. Certification of Compliance shall be furnished according to Subsection 106.04.

912.13 Inorganic Zinc Coating System.

A complete coating system of an inorganic zinc-rich primer, a high-build epoxy intermediate coat, and a urethane finish coat shall be selected from one of the approved coating systems listed below. All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be as follows, or from the current Bureau of Materials Qualified Paints List (QPL):

Code #	Manufacturer	Primer	Intermediate	Finish
IEU-3	Kop-Coat	No. 701	No. 200 HB Epoxy	No. 1122 BRS
IEU-7	Devoe	Catha-Coat (302 A)	Bar-Rust 235	Devthane 359
IEU-11	Valspar Corporation	MZ-7 Inorganic Zinc Rich, 13-F-12 Green	Val-Chem Hi-Build Epoxy 89 Series	Urethane Enamel V40 Series
IEU-13	Con-Lux	Zinc-Plate 21, Type 2	Epolon Multi-Mill	Acrolon II
IEU-14	Carboline	Carbo Zinc 11 HS	Carboline 893	Carbothane 134 HS
IEU-17	Ameron	Dimetcote 21-9	Amercoat 383 HS	Amercoat 450 HS
IEU-18	Elite Coatings Co.	P-159 Inorganic Zinc Primer	E-375 Polyrox High Build Epoxy	Shinethane Urethane LS-5436/LS-5437
IEU-19	International Protective Coatings	Interzinc 22 HS	Intergard 475 HS	Interthane 990 HS

Drying time between coats shall be per the manufacturer's recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 4 liter sample for each coat of paint in the system.
2. Infrared curves (2.5 to 15 micrometers) for each coat. Curves for the dry film of the vehicle (binder) of each component and for the mixed paint shall be included.
3. Weight per liter, at 25 °C, for each coat. Variance shall be within plus or minus 50 grams of the normal weight per liter of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 25 °C, for each coat. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of each coat.
6. Percent of metallic zinc by weight in the dry film of the cured zinc primer coat. This percentage shall be greater than or equal to that of the sample that was approved and placed on the QPL.
7. Percent of metallic zinc by weight in the zinc pigment component.
8. Finish coat color chips for selection of color by the Engineer.
9. The required curing time and dry film thickness for the qualification of the zinc primer for slip-critical connections in conformance with the requirements of AASHTO, Division I, Table 10.32.3C for Class of Surface B. A certified test report with the slip coefficient tested according to AASHTO Division 1, Article 10.32.3.2.3.

10. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer's requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.
11. Mixing and thinning directions.
12. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer's recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Each **c**ontainer of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in liters or the weight of zinc powder in kilograms. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

912.14 Epoxy Mastic Coating System.

A complete coating system of an aluminum epoxy mastic primer and a urethane finish coat shall be selected from one of the approved coating systems listed below. All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be as follows, or from the current Bureau of Materials Qualified Paints List (QPL):

Code #	Manufacturer	Primer	Finish
EU-4	Devoe	Bar-Rust 235	Devthane 359
EU-6	Kop-Coat	Aluminum Epoxy Mastic	No. 1122 BRS
EU-7	Con-Lux	Epolon 81 Aluminum	Acrolon II-2200 Series
EU-9	Carboline	Carbomastic 90 Aluminum	Carbothane 134 HS
EU-10	MAB	Ply-Mastic 101	Ply-Thane 890 HS
EU-11	Birk	Birk Aluminum Mastic Coating No. 50	Birk Aliphatic Polyurethane No. 30
EU-12	Ameron	Amerlock 400 AL	Amercoat 450 HS
EU-13	Sherwin Williams	Epoxy Mastic Aluminum	Hi-Solids Polyurethane B65 Series
EU-14	Mercury Paint	Mermas 100 Epoxy Mastic	Merthane 300 Urethane
EU-15	Valspar	75-A-1 Alumapoxy	Urethane Enamel V40 Series

Drying time between coats shall be per the manufacturer's recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 4 liter sample for each coat of paint in the system.
2. Infrared curves (2.5 to 15 micrometers) for each coat. Curves for the dry film of the vehicle (binder) of each component and for the mixed paint shall be included.
3. Weight per liter, at 25 °C, for each coat. Variance shall be within plus or minus 50 grams of the nominal weight per liter of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 25 °C, for each coat. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of each coat.
6. Finish coat color chips for selection of color by the Engineer.
7. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer's requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.
8. Mixing and thinning directions.
9. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer's recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Each container of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in liters or the weight of zinc powder in kilograms. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

912.15 Organic Zinc Coating System.

A complete coating system of an organic zinc-rich primer, a high build epoxy intermediate coat, and a urethane finish coat shall be selected from one of the approved coating systems listed below. All products for the complete system, including thinners and solvents, shall be from the same manufacturer and shall be as follows, or from the current Bureau of Materials Qualified Paints List (QPL):

Code #	Manufacturer	Primer	Intermediate	Finish
OEU-3	Devoe	Catha-Coat 315	Bar-Rust 235	Devthane 359
OEU-7	Porter International	Interzinc 52	Interplus 770	Interthane PSY 999
OEU-15	Valspar	MZ-4 Epoxy Zinc Rich, 13-F-4 Green	Val-Chem Hi-Build Epoxy 89 Series	Urethane Enamel V40 Series
OEU-16	Con-Lux	Zinc-Plate 49, Type 2	Epolon Multi-Mill	Acrolon II
OEU-17	Con-Lux	Zinc-Plate 72e Epoxy Prime	Epolon Multi-Mill	Acrolon II
OEU-18	Carboline	Carboline 858	Carboline 893	Carbothane 134 HS
OEU-19	MAB	Ply-Tile Zinc Rich Primer 520-A-331	Ply-Tile 520-W-360 or Ply-Tile 520-W-45	Ply-Thane 890 HS
OEU-20	Birk	Birk Zinc Rich Epoxy Primer No. 60	Birk High Build Epoxy Coating No. 70	Birk Aliphatic Polyurethene No. 30
OEU-21	Ameron	Amercoat 68 HS	Amercoat 383 HS	Amercoat 450 HS
OEU-22	Sherwin Williams	Zinc Clad IV	Heavy Duty Epoxy B67 Series	Hi-Solids Polyurethane B65 Series
OEU-23	Elite Coatings Co.	P-281 Epoxy Zinc Rich	E-375 Polycrox High Build Epoxy Primer	Shinethane Urethane LS-5436/LS-5437

Drying time between coats shall be per the manufacturer's recommendations.

The following information shall be submitted for the system selected at least one month before painting is anticipated:

1. A 4 liter sample for each coat of paint in the system.
2. Infrared curves (2.5 to 15 micrometers) for the zinc primer, intermediate, and finish coats to include curves for the dry film of the vehicle (binder) of each component and for the mixed paint.
3. Weight per liter, at 25 °C, for the zinc primer, intermediate, and finish coats. Variance shall be within plus or minus 50 grams of the nominal weight per liter of the sample that was approved and placed on the QPL.
4. Viscosity in Krebs Units, at 25 °C, for the zinc primer vehicle and the intermediate and finish coat paints. Variance shall be within plus or minus 5 Krebs Units, or equivalent units of another viscometer, of the viscosity of the sample that was approved and placed on the QPL.
5. Percent of solids by weight of the zinc primer vehicle and the intermediate and finish coat paints.
6. Percent of metallic zinc by weight in the dry film of the cured zinc primer coat. This percentage shall be greater than or equal to that of the sample that was approved and placed on the QPL.
7. Percent of metallic zinc by weight in the zinc pigment component.
8. Finish coat color chips for selection of color by the Engineer.
9. The required curing time and dry film thickness for the qualification of the zinc primer for slip-critical connections in conformance with the requirements of AASHTO, Division I, Table 10.32.3C for Class of

Surface A. A certified test report with the slip coefficient tested according to AASHTO Division 1 Article 10.32.3.2.2.

10. Technical data sheets, MSDS, and specific application instructions for all coats. In the event of a conflict between the data/instruction sheets and these Specifications, with the approval of the Engineer, the manufacturer's requirements shall govern. Work shall not be allowed to proceed until the information is received and approved.
11. Mixing and thinning directions.
12. Recommended spray nozzles and pressures.

The Contractor shall submit the manufacturer's recommended repair procedures to correct damage such as that caused in handling and shipping, deficient or excessive coating thickness, removal of zinc salts and other contaminants that would be detrimental to succeeding coats, and procedures for surface preparation and painting of rust spots.

The Contractor shall provide the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during operations.

Each container of paint shall be labeled to show the name of the manufacturer, the trade name designation of the contents, the lot or batch number, the date of manufacture, and the volumetric contents in liters or the weight of zinc powder in kilograms. Each container shall be labeled according to the Code of Federal Regulations for flammables and shall contain all information necessary to comply with NJSA 34:5A-1 New Jersey Worker and Community Right To Know Act.

SECTION 913 - PIPE

913.03 Ductile Iron Water Pipe.

THE FIRST SENTENCE OF THE FIRST PARAGRAPH IS CHANGED TO:

Ductile iron water pipe shall conform to ANSI/AWWA C151/A21.51.

SECTION 914 – PORTLAND CEMENT CONCRETE, MORTOR, AND GROUT

SECTION IS RENAMED TO:

SECTION 914 - PORTLAND OR BLENDED HYDRAULIC CEMENT CONCRETE, MORTAR, AND GROUT

914.01 Composition of Portland Cement Concrete.
SUBSECTION IS RENAMED AND CHANGED TO:

914.01 Composition of Portland or Blended Hydraulic Cement Concrete.
Portland cement concrete shall be composed of portland cement or blended hydraulic cement, coarse aggregate, fine aggregate, admixtures, and water. Portland cement concrete except white concrete may include fly ash, Ground Granulated Blast Furnace Slag or Silica Fume. Materials shall conform to the following Subsections:

Aggregates.....901.12
Admixtures:
Air-Entraining.....905.01
Chemical.....905.02
Mineral
Fly Ash 919.07
Silica Fume ..... 919.10(b)
Ground Granulated Blast Furnace Slag 919.18
Portland Cement 919.11
Water.....919.15

Chemical admixtures conforming to the requirements of Subsection 905.02 may be used in the mix design of structural concrete items.

914.02 Portland Cement Concrete Design, Control, and Acceptance Testing Requirements
SUBSECTION IS RENAMED TO:

914.02 Portland or Blended Hydraulic Cement Concrete Design, Control, and Acceptance Testing Requirements

B. Proportioning and Verification.
THE SECOND SENTENCE OF THE THIRD PARAGRAPH IS CHANGED TO:

At least six 100 by 200 millimeter test cylinders shall be prepared from each batch and cured according to AASHTO T 23 or AASHTO T 126.

THE FIRST SENTENCE OF THE TENTH PARAGRAPH IS CHANGED TO:

Classes A and B concrete may be designed to achieve early strength requirements by increasing the Cement content.

C. Acceptance Testing Procedures for Slump and Air Entrainment.
THE FIRST SENTENCE OF THE FOURTH PARAGRAPH IS CHANGED TO:

Following any permitted additions, the drum shall be rotated at the recommended mixing speed for a minimum of 30 revolutions without exceeding 300 total revolutions, the original test results shall be disregarded, and a single test for both slump and air entrainment performed.

D. General Acceptance Testing Requirements for Strength.
THE FOLLOWING IS ADDED AFTER THE SECOND PARAGRAPH:

Concrete test specimens which are to be used for determination of early strengths for form removal, opening to traffic, or otherwise placing the concrete into service shall be cured according to the field curing provisions in AASHTO T-23.

E. Acceptance Testing for Strength for Pay-Adjustment Items.
THE ENTIRE TEXT OF THIS SUBPART AFTER THE FIRST PARAGRAPH IS CHANGED TO:

The amount of pay-adjustment in dollars is the product of the Pay Item base price times the lot quantity times the percent pay-adjustment (expressed as a decimal) given by Equation 1 or Equation 2.

Equation 1 and Equation 2:

Quality	Pay-adjustment (Percent)	
PD < 50	PPA = 3.0 - 0.3 PD	Equation 1
PD ≥ 50	PPA = 26.0 - 0.76 PD	Equation 2

Where: PPA = Percent Pay-adjustment
PD = Percent Defective (Estimate of percent of lot below the class design strength by the use of Equation 3 and Subsection 914.05, Table 914-5)

Equation 3:

$$Q = (ALS - CDS) / S$$

Where: Q = Quality index for pay-adjustment computations
ALS = Average lot strength in psi
CDS = Class design strength in psi
S = Standard deviation of the strength test results in psi for the lot as computed by Equation 4

Equation 4:

$$S = \sqrt{\frac{\Sigma(Xi - ALS)^2}{N-1}}$$

Where: Σ = Summation
Xi = Individual test result (average strength of a test cylinder pair)
N = Number of test results for the lot

Note: When only a single test result is available, the standard deviation "S" is assumed to equal 2 Mpa.

For lots having percent defective (PD) levels less than 10 percent, Equation 1 provides positive adjustments to the contract price. For lots having exactly 10 percent defective, there is no adjustment to the contract price. For lots having greater than 10 percent defective, Equations 1 or 2, as appropriate, subtract progressively larger amounts from the contract price.

If, based on the initial series of tests, the lot quality of a pay-adjustment item is estimated to be PD = 50 or greater, or if any individual test value (average of a cylinder pair) falls below the retest limit for non-pay-adjustment concrete in Subsection 914.05, Table 914-4, the Engineer has the option to reevaluate by coring or other suitable means. When this provision is applied to Class P concrete, each beam or pile in the steam bed will be evaluated separately.

If the Department elects not to core, the Contractor may accept the pay-adjustment of (PPA) calculated by Equation 2 or, when approved by the Engineer, may take cores according to Subsection 914.05, Table 914-4 at no cost to the Department. The Contractor must take the cores within 60 days from

notification of the option to core. As an aid in making this decision, the Contractor will be permitted to perform nondestructive testing using a method or device approved by the Engineer.

When re-evaluation is accomplished by a method other than coring, the results will be used only to determine what further action is to be taken. If any of the non-core tests results are below the class design strength, the Engineer has the option to core. If this option is waived, the Contractor may elect to core, at no cost to the State and within 60 days after being presented with this option, or to accept the pay-adjustment computed from the initial test cylinder results. If the Contractor elects to core, the coring shall be performed as directed and the Department will test the cores. If none of the non-core test results is below the class design strength, the Engineer may elect either to core or to accept the lot at 100 percent payment.

If, based on the core results, the lot is determined to be at a quality level of PD < 75, the pay-adjustment shall be computed by Equation 1 or Equation 2, as appropriate. If the lot is confirmed to be at a quality level of PD = 75 or greater, the lot is considered to be rejectable and the Engineer may:

1. Require the Contractor to remove and replace the defective lot at no cost to the State,
2. Allow the Contractor to leave the defective lot in place and receive a percent pay-adjustment (PPA) computed by Equation 2, or
3. Allow the Contractor to submit a plan, for approval, for corrective action to be performed at no cost to the State. If the plan for corrective action is not approved, either option 1 or 2 above may be applied.

F. Acceptance Testing for Strength for Non-Pay-Adjustment Items.
THE ENTIRE TEXT OF THIS SUBPART IS CHANGED TO:

All concrete items not specifically designated as pay-adjustment items as described in Subsection 914.02, Subpart E are considered to be non-pay-adjustment items, but may be accepted by pay-adjustment under certain circumstances. Such an item is eligible for 100 percent payment (PA = 0) provided the retest limit of Subsection 914.05, Table 914-4 is met. If this requirement is not met, the item will be treated as a pay-adjustment item according to Subsection 914.02, Subpart E, and all pay-adjustment provisions shall apply except that the item bid price will be used instead of an item base price in the computation of the pay-adjustment.

When a pay-adjustment is computed for any of the following items, which are only partially composed of concrete, the amount of pay-adjustment, if any, will be multiplied by the Estimated Percentage of Concrete (expressed as a decimal) as indicated below:

Pay Item	**Estimated Percentage of Concrete**
INLETS, TYPE ___	30
INLETS, TYPE ___, USING EXISTING CASTING	30
INLETS, TYPE B- ___	40
INLETS, TYPE B- ___, USING EXISTING CASTING	40
INLETS, TYPE ___ MODIFIED	40
INLETS, TYPE ___ MODIFIED, USING EXISTING CASTING	40
INLETS, TYPE ES	50
INLET CASTINGS, TYPE ES	40
MANHOLES	30
MANHOLES, ___ MM DIAMETER	30
MANHOLES, USING EXISTING CASTING	30
MANHOLES, SANITARY SEWER	30
MANHOLES, SANITARY SEWER, USING EXISTING CASTING	30
GRANITE CURB	25
RESET GRANITE CURB	25
BEAM GUIDE RAIL ANCHORAGES	25
CHAIN-LINK FENCE, ___ M HIGH	25
CHAIN-LINK FENCE, ALUMINUM-COATED STEEL, ___ M HIGH	25
CHAIN-LINK FENCE, PVC-COATED STEEL, ___ M HIGH	25
CHAIN-LINK FARM-TYPE FENCE	25
GATES, CHAIN-LINK FENCE, ___ M WIDE	25
GATES, CHAIN-LINK FENCE, ALUMINUM-COATED STEEL, ___ M WIDE	25

GATES, CHAIN-LINK FENCE, PVC-COATED STEEL, ___ M WIDE	25
GATES, CHAIN-LINK FARM-TYPE FENCE, ___ M WIDE	25
RESET FENCE	25
TEMPORARY CHAIN-LINK FENCE, ___ M HIGH	25
GUIDE SIGNS, TYPE GA, BREAKAWAY SUPPORTS	20
GUIDE SIGNS, TYPE GA, NON-BREAKAWAY SUPPORTS	20

The amount of pay-adjustment for pay items not listed above is the product of the unit bid price times the lot quantity times the percent pay-adjustment given by Equation 1.

B. Proportioning and Verification.

THE SECOND SENTENCE OF THE THIRD PARAGRAPH IS CHANGED TO:

At least six 100 by 200-millimeter compression test cylinders shall be prepared from each batch and cured according to AASHTO T 23 or AASHTO T 126.

914.04 Sampling and Testing Methods.

THE FOLLOWING AASHTO TEST METHOD IS ADDED:

T303	Standard Test Method for Accelerated Detection of Potentially Deleterious Expansion of Mortar Bars Due to Alkali-Silica Reaction.

914.05 Tables.

TABLES 914-1, 914-3, AND 914-4 ARE CHANGED TO:

Table 914-1 Requirements for Roadway Concrete Items

	Concrete Class	Slump (mm)	Percent Air Entrainment for Coarse Aggregate Size Numbers				
			357	467	57	67	8
Cast-in-Place Items							
Surface Course, Bridge Approach Slabs, Bridge Approach Transition Slabs	B	50±25	5.0±1.5	5.0±1.5	6.0±1.5	6.0±1.5	7.0±1.5
Base Course	B	50±25	5.0±1.5	5.0±1.5	6.0±1.5	6.0±1.5	7.0±1.5
Inlet and Manhole Walls, Headwalls, Miscellaneous Concrete	B	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Inlet and Manhole Top Slabs, Sidewalks, Driveways, Islands	B	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Slope Gutters, Vertical Curb, Sloping Curb, Barrier Curb and Base	B	100±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Concrete and White Concrete Vertical, Sloping and Barrier Curb, Concrete and White Concrete Islands	B	100±25	----	----	7.0±2.0	7.0±2.0	8.0±2.0
Foundations for:							
Inlets and Manholes	B	75±25	6.5 max	6.5 max	7.5 max	7.5 max	8.5 max
Electrical Items	B	75±25	----	----	7.5 max	7.5 max	8.5 max
Signs	B	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Junction Boxes	B	75±25	----	----	7.5 max	7.5 max	8.5 max

Table 914-1 (Continued)

	Concrete Class	Slump (mm)	Percent Air Entrainment for Coarse Aggregate Size Numbers				
			357	467	57	67	8
Cast-in-Place Items (continued)							
Footings for Fence Posts, Guide Rail End Treatment	B	75±25	----	----	7.5 max	7.5 max	8.5 max
Culverts	A	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Monuments	A	75±25	----	----	7.5 max	7.5 max	8.5 max
Slope Protection	B	50±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Precast Items							
Culverts	A	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Inlets and Manholes, Junction Boxes, Headwalls, Reinforced Concrete End Sections (See note 2)	B	75±25	----	----	6.0±1.5	6.0±1.5	7.0±1.5
Concrete and White Concrete Barrier Curb	B	75±25	----	----	7.0±2.0	7.0±2.0	8.0±2.0

Note 1: According to Subsection 501.03, a Type F water-reducing, high range admixture will be permitted according to Subsection 905.02 and Subsection 914.02, Subparts B and C. When a Type F admixture is used, the table Slump and Air Content values for the given concrete item shall be changed as follows:

Slump: 150 ± 50 millimeters

Air Content: Increase both the target value and tolerance percentages by 0.5.

Note 2: For the items in this category, the slump may be reduced to zero (dry cast) provided that adequate consolidation, acceptable to the Engineer, is achieved.

Table 914-3 Mix Design Requirements

	Class of Concrete					
	A	**B**	**S**	**P**	**P-1**	**P-2**
Class Design Strength (28 days, Mpa Note 3)	32	26	14	38	42	45
Verification Strength (28 days, Mpa Note 3)	37	31	--	42	45	48
Maximum Water/Cement Ratio (Note 2)						
kg/kg	0.443	0.488	0.577	Note 1	Note 1	Note 1
L/bag	19	21	25	Note 1	Note 1	Note 1
Minimum Cement Content						
kg/m^3	363	335	391	Note 1	Note 1	Note 1
$bags/m^3$	8.5	7.8	9.2	Note 1	Note 1	Note 1

Note 1: According to PCI Manual, except as indicated in Note 2.

Note 2: The maximum water/cement ratio for all classes of concrete except for Classes P, P-1 and P-2, when a Type F water-reducing, high range admixture is used according to Tables 914-1 and 914-2, shall be reduced by 0.40 kg/kg (17.0 L/bag).

Note 3: All concrete test results shall be recorded to the nearest 0.10 Mpa.

Note 4: To successfully meet the requirements of this specification, the target production strength must be higher than the Class Design Strength by an amount proportional to the Producer's within-lot standard deviation.

Table 914-4 Lot Sizes, Sampling Rates and Retest Limits

	Class of Concrete					
	A	**B**	**S**	**P**	**P-1**	**P-2**
Lot Size (maximum)	One Day's Production			One Day's Production of a Single Steam Bed		
Pay-Adjustment Items						
Initial Sampling Rate	5/Lot	5/Lot	--	5/Lot	5/Lot	5/Lot
Retest Sampling Rate (minimum)	5/Lot	5/Lot	--	5/Unit or Load Test		
Non-Pay-Adjustment Items						
Initial Sampling Rate	3/Lot	2/Lot	1/Lot	3/Lot	3/Lot	3/Lot
Retest Limit (Mpa)	30	25	14	37	41	44
Retest Sampling Rate	5/Lot	5/Lot	5/Lot	5/Lot	5/Lot	5/Lot

Note 1: The lot sizes are maximums and, at the option of the Engineer, any lot may be subdivided into two or more smaller lots. When such a subdivision is made, the specified sampling rate applies to each of the smaller lots.

Note 2: An initial strength test result is defined as the average strength of two 100 by 200 millimeter compression test cylinders, cured for 28 days, and tested in the Department Laboratory except for Classes P, P-1, and P-2 cylinders which may be tested at the fabricator's plant under the supervision of the Engineer.

Note 3: A retest result is defined as the strength of an individual test result obtained by coring or other suitable means. If retest is performed by coring, each retest result is defined as the corresponding nominal core strength divided by 0.85.

Note 4: The specified sampling rates shall apply except that no more than one test per truckload or batch of concrete will be required (except for air and slump tests when retempering). It is expected that each structural component will have a representative sample taken. At the option of the Engineer, nonstructural concrete lots consisting of 15 cubic meters or less may be accepted without strength tests.

Note 5: No lot shall include more than one class of concrete nor include concrete of the same class having different specified levels of slump or air entrainment.

Note 6: For prestressed concrete, if more than one bed is used or if more than 60 cubic meters of concrete are used, the production shall be subdivided as equally as possible into two or more lots.

Note 7: Retest limit for non-pay-adjustment roadway and structural items requiring the use of Class B, white concrete, shall be 21 Mpa.

SECTION 916 - SIGN MATERIALS

916.04 Retroreflective Sheeting.

THE ENTIRE TEXT IS CHANGED TO:

As stated herein, the terms reflective sheeting and retroreflective sheeting are synonymous.

Retroreflective sheeting shall conform to ASTM D 4956 based upon results obtained and reported through testing performed by the National Transportation Product Evaluation Program (NTPEP).

Flourescent retroreflective sheeting shall be selected from the approved products list as follows:

3M Co. ldp-3963 flourescent yellow-green (for school advanced-warning and non-motorized crossings only)

3M Co. vip-3983 flourescent yellow-green (for school advanced-warning and non-motorized crossings only)

3M Co. vip-3981 flourescent yellow (for w-8 chevron warning signs only)

3M Co. scotchlite diamond grade series 3910 flourescent orange (for use on reboundable plastic traffic control devices only)

1. General Requirements.

a. Retroreflectance. All retroreflective sheeting shall have the minimum coefficient of retroreflection (R_A) in conformance with ASTM D 4956.

b. Color. The colors of the retroreflective sheeting, except for fluorescent colors shall conform the color requirements of ASTM D 4956.

c. Fluorescent Colors. The daytime fluorescent color of retroreflective sheeting shall be determined according to ASTM E 991.

In addition, the color shall be equally distinguishable in daylight and at night under artificial headlight illumination. The color shall have a consistent chromaticity across all signs of the same color. Noticeable deviation from the shades that would affect the required performance shall be a cause for rejection of any sheeting or completed sign at any time before acceptance. For sheeting that is directional, the datum mark (arrow) imprinted on the face of the sheeting shall be the datum mark for test purposes.

d. Product Performance Requirements. The retroreflective sheeting manufacturer shall meet the following requirements for their products.

(1) Type III Sheeting – Sheeting shall be required to have a service life span of at least 12 years.

(2) Types VI, VII, VIII AND IX Sheeting – Sheeting shall be required to have a service life span of at least 10 years.

(3) The performance requirements shall be such that there is: no loss of retroreflectivity; no loss of colorfastness; no cracking; and no other conditions inherent to the sheeting including inks and overlay film that causes it to be incapable of performing as required.

2. Certification of Compliance. The manufacturer shall submit a certification of compliance according to Subsection 106.04 for each lot of sheeting supplied for use on the Project.

916.05 Legends, Borders, and Accessories.

THE FOLLOWING IS ADDED AFTER THE SECOND PARAGRAPH:

All finished signs shall be clear and legible without smudging, blisters, delamination, loose edges or other blemishes.

1. Type A Demountable.

THE FIRST AND SECOND PARAGRAPHS ARE CHANGED TO:

The demountable sign letters, digits, arrows, borders, and alphabet accessories shall be reflectorized and shall consist of ASTM D 4956 Type VIII OR IX wide angle prismatic retroreflective sheeting applied to 10-millimeter cutout aluminum plates conforming to ASTM B 209, Alloy 6061-T6 or 5052.

All shields and symbols to be mounted to sign types GO, GOX, and GA on breakaway tubular posts shall consist of ASTM D 4956 Type VIII OR IX wide angle prismatic retroreflective sheeting applied to 5-millimeter cutout aluminum plates conforming to ASTM B 209, Alloy 6061-T6.

2. Type B Direct and Permanently Applied Retroreflective Sheeting Copy.
SUBPART D, E & F ARE DELETED AND C IS CHANGED TO:

c. When the background is ASTM D 4956 Type III sheeting, ASTM D 4956 Type III sheeting shall be used for copy.

916.08 Fabrication.

8. Shop Painting and Reflectorization.

a. Application.
THE LAST SENTENCE IN THE THIRD PARAGRAPH IS CHANGED TO:

Sheeting applied to extruded sections shall extend over top edges and down side legs a minimum of 2 millimeters; except that where ASTM D 4956 Type VIII or IX sheeting is used, it shall be cut at the top edges according to the manufacturer's recommendation.

c. Screen Process Printing.
THE THIRD SENTENCE IN THE FIRST PARAGRAPH IS CHANGED TO:

Transparent screen process paint, after application to the retroreflective sheeting and thoroughly dry shall conform to the color requirements ASTM D 4956.

9. Packaging, Storage, and Shipping.
THE FIRST SENTENCE IN THE FIRST PARAGRAPH IS CHANGED TO:

PACKAGING, STORAGE, AND SHIPPING OF SIGNS PRODUCED USING RETROREFLECTIVE SHEETING SHALL BE ACCORDING TO THE SHEETING MANUFACTURER'S RECOMMENDATIONS.

916.10 Breakaway Steel "U" Post Sign Supports.
THE HEADING AND ENTIRE TEXT IS CHANGED TO:

916.10 Steel "U" Post Sign Supports.
The steel "U" post sign supports shall conform to ASTM A499. Signs shall be secured to the steel "U" post by means of 18-8 stainless steel M8 x 1.25 hexagonal headed bolts and nuts conforming to ASTM A 320M, Grade B8 Class 1. Sign mounting bolts shall extend beyond the end of each nut but not more than 20 millimeters when fully tightened.
The steel "U" posts shall be straight and have a smooth finish, free of burrs.
The list of the approved products will be provided by the Bureau of Materials Engineering and Testing.

916.14 Flexible Delineators.

2. Composition.
THE FIRST PARAGRAPH IS CHANGED TO**:**

For ground mounted flexible delineators, the portion of the unit above ground shall be one component, or shall be bonded together if it consists of two or more components. The shape of the ground mounted post shall have a concave, fluted or similarly shaped cross section conducive to the protection of the retroreflective sheeting from abrasion. Delineator post cross sections that are predominantly convex, which will allow the retroreflective sheeting to come in direct contact with the impacting vehicle or impacting surface shall not be allowed.

10. Mowability.

THE ENTIRE SUBPART IS DELETED

11. Sampling Rate
THE SUBPART NUMBER IS CHANGED TO

10. Sampling Rate.

916.17 Tables.
THE ENTIRE SUBSECTION IS DELETED.

SECTION 919 - MISCELLANEOUS

919.07 Fly Ash.

THE FIRST PARAGRAPH IS CHANGED TO:

Fly ash for portland cement concrete shall conform to ASTM C 618, Class C or Class F except that the loss on ignition shall not be more than three percent. Fly ash used to control alkali-silica reactivity shall be Class F and shall comply with Supplementary Optional Chemical Requirements of ASTM C 618, Table 2. Before each source of fly ash is approved, certified results of tests conducted by a testing agency shall be submitted to and verified by the Department. Accompanying the certification shall be a statement from the supplier listing the source and type of coal, the methods used to burn, collect, and store the fly ash, and the quality control measures employed.

919.11 Portland Cement

SUBSECTION IS RENAMED AND CHANGED TO:

919.11 Portland or Blended Hydraulic Cement

Portland cement shall conform to the following:

Masonry Cement ..... ASTM C 91
Portland Cement, Type I, II, and Type III (see Note 1) ..... ASTM C 150
White Portland Cement, Type I and III (see Note 2) ..... ASTM C 150
Blended Hydraulic Cement (see Note 3)..... ASTM C 595

Note 1: Type III may be used only for prestressed or precast items.

Note 2: Shall not contain more than 0.55 percent by weight of ferric oxide (Fe_2O_3).

Note 3: Only types IS, I(PM), and I(SM) may be used. Portland cement, may be pre-blended with a maximum of 15 percent fly ash, by weight, or a maximum of 10 % silica fume by weight, or with a maximum of 50% GGBFS by weight. If more than 30% GGBFS is used, a scaling test conforming to ASTM C 672 must be completed on the mix design and the concrete must have a visual rating less than 3 as based on ASTM C672 10.1.5 after 50 cycles.

When blended portland cement is used, no additional mineral admixtures shall be added.

Different brands of cement, the same brand of cement from different mills or different types of cement shall not be mixed.

Suitable means shall be provided for storing and protecting the cement against dampness. Cement which for any reason has become partially set or which contains lumps of caked cement will be rejected. The temperature of the cement at the time of delivery to the mixer shall not exceed 71 °C.

919.18 Ground, Granulated Blast Furnace Slag.

THE SECOND PARAGRAPH IS CHANGED TO:

Ground, granulated blast furnace slag may be used as a replacement for portland cement as specified in Subsection 919.11 up to a maximum replacement level of 50 percent by weight. Replacement of portland cement greater than 30 percent will require a scaling test on the mix design conforming to ASTM C 672 with a visual rating less than 3.

919.19 Sampling and Testing Methods

Sampling and testing will be performed according to the following:

THE FOLLOWING IS ADDED:

Mineral Admixtures .....4-kilograms from each source
Blended Hydraulic Cement……ASTM C 595

THE FOLLOWING NEW SUBSECTION IS ADDED:

919.22 Controlled Low Strength Material (CLSM).

CLSM shall conform to the following:

Fine Aggregate..... 901.12
Chemical Admixtures..... 905.02
Portland Cement, Type I, II, III..... 919.11
Water..... 919.15

CLSM shall consist of a mixture of portland cement, water, fine aggregate and chemical admixtures. Fly ash shall not be permitted in mixes intended for trench backfilling. The CLSM mixture shall be proportioned to provide a backfill material that is self-compacting and capable of being excavated with hand tools at a later date. CLSM shall be proportioned to produce a 28-day compressive strength of 345 to 1 035 kilopascals. An accelerating admixture shall be used to produce a fast setting flowable mixture as required. The CLSM shall have a permeability of $1.7 \times 10^{-3} \pm 0.2 \times 10^{-3}$ centimeters per second according to ASTM D5084 for backfilling of conduits and piping.

At least 45 days prior to the start of any CLSM placement, trial batches of CLSM shall be prepared of the same materials and proportions proposed for use on the project. Each mix design shall be submitted on portland cement concrete mix design forms furnished by the Department, naming the sources of materials and test data.

Department personnel will be present at the time of verification batching to confirm that the proportions and materials batched are according to the proposed mix designs. At least six 150 X 300 millimeters compression test cylinders shall be prepared for each batch according to ASTM 5971-96 for 28-day strengths except for fast setting mixes, which shall be tested at the specified cure time.

APPENDIX

ASBESTOS MANAGEMENT

1.01 ASBESTOS MANAGEMENT

This section covers the management of potential hazards relating to materials previously determined to be asbestos-containing materials (ACMs) and all material determined to be ACM during the course of the project, pursuant to applicable regulations. **No milling of asbestos-containing asphalt overlay shall be allowed on the bridge deck at anytime.**

1.02 DEFINITIONS

"Asbestos Management Work": shall be defined as that Work which encompasses the specified removal or any other treatment of asbestos-containing materials, all preparatory and cleaning activities associated with or otherwise motivated by the removal activities, and the handling, transportation, and disposal of asbestos-containing and asbestos-contaminated materials; as well as all activities related to the coordination of asbestos-related work to be performed by others. The term "Work" may be utilized in this Section to refer to Asbestos Management Work.

"Air Monitoring firm" means the firm retained by the NJDOT to perform air monitoring throughout the course of the asbestos management:

PMK Group
65 Jackson Drive
Cranford, New Jersey 07016
908/497-8900 – Telephone
908/497-8943 – Fax
Robert Kingsbury – Project Director

"Amended water" means water to which a surfactant has been added.

"Authorized personnel" means the owner, the owner's representative, asbestos abatement contractor personnel, asbestos safety control monitor personnel, emergency personnel, or a representative of any Federal, state, or local regulatory agency or other personnel under contract for or having jurisdiction over the project.

"Background sample" means air samples which are collected prior to the start of asbestos management activities.

"Certificate of Completion" means the certificate issued by the Air Monitoring Firm signifying the asbestos hazard abatement work has been completed in conformance with the specifications.

"Contractor" means the Asbestos Removal Contractor licensed by the New Jersey Department of Labor.

"Decontamination Unit" means a serial arrangement of rooms or spaces for the purpose of cleaning of personnel and equipment, upon exiting the work area.

"Employee" means an asbestos abatement worker having a valid work permit issued by the New Jersey Department of Labor and employed by the contractor.

"Encapsulation" means the treatment of asbestos-containing materials, with material that surrounds or embeds asbestos fibers in an adhesive matrix to prevent the release of fibers, as the encapsulation creates a membrane over the surface (bridging encapsulant).

"Engineer" means the NJDOT Resident Engineer.

"Engineering controls" means all methods used to maintain low fiber counts in work areas and occupied space including, but not limited to, air management, barriers to ensure public safety and methods to confine airborne asbestos fibers to the work area.

"EPA/USEPA" means the United State Environment Protection Agency.

"Flame-resistant polyethylene sheet" means a single polyethylene film in the largest sheet size possible to minimize seams, nominal six mil thick, conforming to requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Films.

"HEPA" means High Efficiency Particulate Air filter, capable of fiber efficiency of 99.97 percent down to 0.3 um (microns).

"Isolation Barrier" means "site" isolation barriers constructed to isolate the "work area" and "staging area" from the traveling public.

"NESHAP" means the National Emission Standards for Hazardous Air Pollutants (40 CFR part 61).

"NIOSH" means the National Institute for Occupational Safety and Health.

"NJDOT" mean the New Jersey Department of Transportation.

"Non-friable" means material which when dry may not be crumbled, pulverized, or reduced to powder by hand pressure.

"PCM" means Phase Contrast Microscopy.

"Polyethylene sheeting" means a single nominal six mil thick polyethylene film.

"Progress air sample" means air samples collected during asbestos management activities.

"Removal" means the taking out or the stripping of asbestos-containing material.

"Sealant" means a liquid solution to be used as a binding agent, such as a diluted encapsulant or a water based paint, on dried exposed surfaces from which asbestos containing material has been removed. The color the coat shall be separate and distinct form the underlying substrate.

"Staging area" means a portion of the space within the isolation barriers, adjacent to the work area where equipment, waste container and the decontamination unit are located.

"State" means the State of New Jersey.

"TEM" means Transmission Electron Microscopy.

"Wet Cleaning" means the process of eliminating asbestos contamination from building surfaces and objects by using cloths, mops or other cleaning utensils which have been dampened with amended water or a removal encapsulation and afterward thoroughly decontaminated or disposed of as asbestos contaminated waste.

"Work area" means the portion of the space within the isolation barriers where active removal is being conducted.

1.03 DESCRIPTION OF WORK

Work shall consist of furnishing all labor, materials, services, training, indemnifications, insurance, and equipment as needed to complete the removal and handling of asbestos-containing and asbestos-contaminated materials on the 12th Street Viaduct at locations shown in the contract plans related to performing the other work of this Contract.

The Contractor is responsible for its own construction safety work practices in accordance with all applicable OSHA standards.

The Engineer shall have the authority to stop the abatement work if a determination is made that conditions are not within the applicable regulations. Work stoppage shall continue until conditions have been corrected to the satisfaction of the Engineer. Time and costs required to resolve the problems shall be at the Contractor's expense.

A. Work Scope: Remove the following ACM:

TYPE OF ACM	LOCATION
Black asphaltic overlay/pavement with associated residue and membrane (8-15% Chrysotile Asbestos)	12th Street Viaduct; refer to project drawings for extent of ACM

B. Provide asbestos abatement work plan detailing all ACM removal, decontamination and disposal activities and controls, protection and training requirements to the Engineer as part of the project submittal process.

C. Secure any permits that may be required to complete the asbestos removal work.

1.04 DOCUMENTS

The current issue of each document incorporated by reference herein shall govern. Where conflict among requirements or with the specification exists, the more stringent requirements shall apply.

A. OSHA regulations:

1. 29 CFR 1910 (general industry).
2. 29 CFR 1910.134 (respiratory protection)
3. 29 CFR 1910.141 (sanitation)
4. 29 CFR 1910.300-399 (electrical)
5. 29 CFR 1910.1001 (asbestos)
6. 29 CFR 1910.1200 (hazard communication)
7. 29 CFR 1926 (construction safety)
8. 29 CFR 1926.52 (noise)
9. 29 CFR 1926.62 (lead)
10. 29 CFR 1926.1101 (asbestos)
11. 29 CFR 1926.59 (hazard communication)
12. 29 CFR 1926.40-449 (electrical)
13. 29 CFR 1926.450-452 (ladders and scaffolding)

B. EPA regulations:

NESHAP: Asbestos National Emission Standards for Hazardous Air Pollutants. 40 CFR 61, Subparts A (General Provisions, Sections 01-10) and M (Asbestos, Sections 140-157).

DOT regulations: Hazardous Materials Regulations, 49 CFR 171-180, in particular:

1. 49 CFR 171.14(b)(4) (placarding)
2. 49 CFR 172.300-308, 324 (marking)
3. 49 CFR 174.400, 466 (labeling)
4. 49 CFR 172.500, 504, 560 (placarding)

C. Other Standards

American National Standards Institute

1. ANSI Standard Z9.2 Fundamentals Governing the Design and Operation of Local Exhaust Systems.

2. ANSI Standard A40.8 National Plumbing Code.

National Fire Protection Association

NFPA 70 National Electrical Code

NFPA 70E Standard for Electrical Safety Requirements for Employee Workplaces.

D. New Jersey Regulations

1. N.J.A.C. 12:120 and N.J.A.C. 8:60 (licensing).
2. N.J.A.C. 7:26-1 et.seq. (waste transport).

1.05 SUBMITTALS

Working drawings shall be furnished and approved according to subsection 105.04 before initiation of any work in this section.

A. Submittals before Abatement Begins:

1. Work schedule and plan identifying firm start and end dates, the hours to be worked on a daily basis, and the Contractor's plans for complete the Work, including:
2. Scope of Work; Defined in written and graphic form.
3. Sequencing; Sequencing of asbestos work.
4. Shifts; Length and projected times of day of work shifts.
5. Interfacing; Interface of trades involved in the work.
6. Special procedures; A detailed description of any proposed methods of special asbestos abatement procedures.
7. Copies of all notifications as required by these Specifications including identification of the Contractor's waste hauler, the hauler's NJDEP identification number ("NESHAPS"), and the intended disposal site of the contaminated wastes, and all applicable permits.
8. Copies of the Contractor's New Jersey Asbestos "A" license and respiratory protection program.
9. The name of the testing laboratory and independent firm providing the Contractor's OSHA compliance monitoring.
10. The name and qualifications of the individual who will act as the project supervisor during the asbestos abatement portion of this Project.
11. Information, including copies of applicable certificates and licenses from training agencies and/or manufacturers, concerning the qualifications of the Contractor, and Subcontractor, either's personnel, relative to their ability to execute the asbestos abatement work, electrical, plumbing, and mechanical installation or dismantlement directly specified or otherwise necessary to complete the specified Work.
12. Material Safety Data sheets for all hazardous chemicals to be used on the Project.
13. Copies of valid asbestos abatement worker and supervisor permits issued by the New Jersey Department of Labor.
    a. The individual acting as the supervisor must provide proof of a minimum of three years of experience as an asbestos abatement supervisor.
14. Submit a Health and Safety Plan addressing:
    a. Toxic Effects from vapors or residues from wetting agents, etc. used
    b. Chemical/Biological Hazards –training of workers
    c. Physical Hazards
    d. OSHA compliance
    e. Accident Prevention
    f. Emergency Response
    g. Workmen Protection
    h. Hazard Communication Act information
15. Proof of current medical surveillance program for all of the personnel to work on the project.
16. Completed and notarized Certificate of Worker's Release for each asbestos abatement worker, workers of other trades, or supervisory personnel who enter the work area or otherwise contact ACM.
17. Proof of a respiratory protection program.

18. Proof that a landfill site has been located which accepts the ACM and arrangements have been made for the transport and disposal of ACM.
19. Sample of the daily log to be used. At a minimum the log should include the date(s) and time(s) when personnel enter and leave the work area(s).
20. Shop drawings showing the construction of isolation barriers.
21. Shop drawings/plans describing the waste water collection and filtration system to be utilized.

B. Submittals during the Asbestos Management Activities

1. Change in work schedule proposed by the Contractor shall be submitted to the Engineer for approval no later than seven days prior to the commencement date of the change. A revised schedule shall be submitted 48 hours before the proposed change.

C. Post Project submittals

1. Copies of the daily log showing the date(s) and time(s) of entrance to and exit from the work areas(s) for all persons.
2. Compilation of all completed and signed Waste Shipment Record forms, bills of lading or disposal receipts pertaining to this project.

D. Requirements and Qualifications

1. Provide evidence of at least two asbestos abatement projects in the last five years of complexity comparable to this project.
2. Provide evidence of experience and training of supervisors, foremen and workers. All must have valid New Jersey Department of Labor asbestos abatement worker/supervisor licenses
3. Worker Medical surveillance examinations in accordance with 29 CFR1926.1101(m).

1.06 PERFORMANCE REQUIREMENTS

A. Project/site conditions

Any damages or loss of value caused during the performance of asbestos abatement or other activities shall be repaired by the Contractor to the satisfaction of the Owner NJDOT as soon as possible and at no additional expenses to the State of New Jersey.

B. Provide decontamination and related protocols:

Wastewater handling - All water used by the Contractor during asbestos abatement activities shall be either collected and disposed of as asbestos-containing or filtered and handled appropriately. Contactor shall be responsible for contacting the proper person/agency for the proper disposal of wastewater which is filtered. Contractor shall be responsible for providing piping, pumps, water filtration systems and other items necessary to collect, transport, filter and dispose of the wastewater. Provide a written plan for waste water handling as part of the project submittal process.

Equipment – All equipment, machinery, etc. shall be thoroughly cleaned and decontaminated prior to removal from the work area. This decontamination shall include the removal of any air filters that may be present on motorized equipment.

C. Health and Safety:

Contractor shall provide materials, equipment and training to his workers to ensure their protection from known hazards on the site including ACM and debris and any other hazards which may be identified during the course of the work.

D. Qualifications

Prior to beginning any work under this item, the Contractor shall supply the Engineer with proof that the firm performing the work has a valid asbestos handling license; that its insurance coverage whether provided by the

Contractor or the Asbestos Subcontractor, is consistent with the project requirements and includes an asbestos specific occurrence type policy with no deductible or sunset clause; that its project supervisor is a NJDOL certified asbestos project supervisor; that all employees engaged in the work are properly certified and have current physical examinations and respirator fit tests; and that the proper notification of work beginning on the asbestos project has been give to USEPA. Also, after the work is completed, the Contractor shall provide the Engineer with a written certification ("Waste Shipment Record that the material was disposed of in an approved waste disposal site. The certification shall include the name and address of the waste site disposal or sites used.

Unless indicated otherwise, the Contractor shall arrange and pay for all OSHA monitoring required for regulatory compliance. The firm and persons engaged shall be properly licensed and certified; independent of the Contractor or the Asbestos Contractor performing the asbestos work specified.

Asbestos containing material shall be disposed of in accordance with 40 CFR Part 61, NJAC 7:26-1 and all other requirements and laws, rules and regulations of Federal, State or local agencies. Disposal sites which accept asbestos-containing materials for disposal shall be permitted by the New Jersey State Department of Environmental Protection to accept such material for disposal. If disposed of out-of-state, the rules, regulations, and laws of that state shall apply.

In the event of a conflict between these specification requirement s and laws, rules and regulations of Federal, State, or local agencies, the more restrictive of the specification or the laws, rules or regulations shall apply.

Two copies of Daily logs, Visitor Logs, and OSHA Air Monitoring record shall be provided to the Engineer.

1.07 PRODUCTS - GENERAL

A. Deliver all materials in the original packages, containers, or bundles, bearing the name of the manufacturer, the brand name and any Material Safety Data Sheets which pertain to the materials.

B. Store all materials subject to damage off the ground, away from wet or damp surfaces, and under cover sufficient to prevent damage or contamination.

C. Damaged or deteriorating materials shall not be used and shall be removed from the premises. Materials that become contaminated with asbestos shall be disposed of in accordance with applicable regulations.

D. No materials, equipment or tools belonging to the Owner shall be used by the Contractor, except in case of an emergency and upon explicit authorization by the Owner.

1.08 MATERIALS

A. All materials/supplies utilized on this Project must meet the requirements of all safety and environmental regulations, and the New Jersey Department of Transportation.

B. For work area preparation, utilize materials (e.g., polyethylene sheeting, lumber, etc.) rated to be fire retardant, as tested by ASTM Standard E-84. Additionally, utilize polyethylene sheeting conforming to the requirements set forth by the National Fire Protection Association Standard 701, Small Scale Fire Test for Flame-Resistant Textiles and Firms.

1.09 TOOLS AND EQUIPMENT

A. Utilize tools and equipment meeting the requirements of all safety and environmental/regulations and the New Jersey Department of Transportation.

1.10 WORK AREA PREPARATION - GENERAL

A. Post adequate warning signs denoting the potential danger of airborne asbestos at designated entrances to work areas including, as a minimum, those described in the OSHA Asbestos Standard 29 CFR 1926.1101.

B. Maintain adequate portable fire extinguisher equipment within the staging area, meeting at least the requirements of 29 CFR 1910.157 and State occupational safety and health regulations and fire safety regulations.

C. Provide temporary electrical service as needed to complete the work. If generators are to be utilized, their use must meet all applicable NJDOT and local requirements.

1.11 DISPOSAL AND WASTE TRANSPORT

A. Provide a copy of the waste manifest indicating the chain of custody, final disposal site and date to the Engineer for each waste container or truck containing asbestos-containing or asbestos-contaminated waste within 15 days from when the container or truck leaves the worksite.

B. Promptly containerize and label debris. Maintain waste in a secure waste container located within the staging area.

1.12 WORK AREA ISOLATION AND PROCEDURES

A. Construct movable "isolation" barriers to enclose work area. The purpose of this barrier is to act as a site/view barrier for the traveling public, it is not meant to form an airtight enclosure around the work area.

1. Construct isolation barriers of sufficient size to fully enclose the work area from the view of the traveling public. Barrier must be constructed a minimum of 8' high or higher, if needed to block view of the work area.

2. Isolation barrier to be constructed of reinforced polyethylene sheeting and 2"x4"lumber framework, or approved equipment. Barrier must be constructed to be weather resistant.

3. Isolation barrier shall be movable in order to allow it to be moved as the work progresses and to allow equipment to pass into and out of the work area.

4. Isolation barriers to be constructed to enclose an area large enough to include the actual "Work area" and a "Staging area" adjacent to the work area. The decontamination unit, supplies, equipment and waste container/dumpster to be located in the staging area. Staging area to be isolated from the work area by the installation of caution tape.

5. The staging area shall encompass approximately 25% of the space within the isolation barriers while the work area shall encompass the remaining 75%.

6. No non-abatement related work of any type shall be conducted within 100 feet of the isolation barriers.

7. Submit "shop drawings" for construction of isolation barriers, prior to initiation of abatement activities. Shop drawings to be approved by the Engineer prior to construction.

1.13 Removal of Asbestos-Containing Black Asphaltic Overlay/ Pavement

A. Post OSHA approved asbestos hazard warning signs at the perimeter of the abatement area. Control access into the area within the isolation barriers to properly trained and protected personnel only.

B. Provide OSHA personal air monitoring during all aspects of the removal work as per 29 CFR 1926.1101.

C. Provide and maintain a decontamination unit within the staging area as workers are required to shower after performing asbestos related Work. Decontamination unit to be moved along with the isolation

barrier as work progresses. Maintain the unit of sufficient size, equipped with hot and cold water, soap, and towels so that personnel can properly shower. The shower facility shall be located within the decontamination unit constructed in accordance with the OSHA standard (29 CFR1926.1101).

D. Utilize work methods and equipment which will keep the airborne fiber operations inside the work area below acceptable levels as defined below in Section 1.16 measured by Phase Contrasts Microscopy (PCM). The air monitoring firm shall conduct PCM air sampling within the work area during the removal work.

E. Remove the black asphaltic overlay/pavement specified utilizing removal methods in accordance with the OSHA Asbestos Standard and the NESHAP regulations. Utilize methods to prevent "visible emissions" during removal. Amended water to be utilized at all times during removal.

F. Continually mist the materials with amended water during removal and disposal operations. All debris and water/wetting agents to be collected and disposed of with waste.

G. Promptly containerize and label debris. Utilize appropriate waste containers fitted with properly sized and fitted "bladder bags". Provide proof from the landfill that the waste will be accepted in this manner.

H. Following completion of bulk removal, utilize manual scraping methods to remove any material/residue remaining in place. Mist all materials with amended water during removal. All water/wetting agents to be collected and disposed of with waste.

I. Personnel and equipment to be decontaminated in accordance with 29 CFR1926.1101. All machinery equipment, etc. to be decontaminated prior to exiting the space within the isolation barrier.

J. At the completion of each shift, perform a reconnaissance of the work area space and all spaces adjacent to and beneath the work area. Promptly containerize and dispose any fugitive asphalt overlay/pavement debris.

1.14 CLEARANCE REQUIREMENTS

A. Isolation barriers shall not be moved until the following items are all met:

- Air sample results are within the acceptable levels as indicated in 1.16 B;
- The on-site representative of the air monitoring firm has performed a visual inspection; and
- Written authorization has been granted by the air monitoring firm to move the isolation barriers.

1.15 WEATHER CONDITIONS

A. Work shall be stopped if sustained wind gusts above 25 miles per hour (m.p.h.) as measured by the on-site representative of the air monitoring firm are achieved. Work shall not be resumed until wind speed is maintained below 25 m.p.h.

B. Work shall be stopped if freezing and/or precipitation conditions hinder the contractor's ability to collect and handle all water within the work area space.

1.16 AIR MONITORING

A. The air monitoring firm shall collect a minimum of five background samples utilizing PCM prior to the start of each phase of work by the air monitoring firm. The air monitoring firm may, at its option collect background samples more frequently.

B. The removal work area shall be subject to progress air sampling protocols utilizing (PCM). The air monitoring firm shall collect two samples per workshift within the actual work area, one within the staging area and two samples outside of the isolation barriers (one upwind and one downwind). The results of these samples shall be considered unacceptable when the results are not higher than 0.01 f/cc greater than the background samples collected for that particular phase. The air monitoring firm retained

by the NJDOT shall conduct this monitoring.

C. The Contract shall respond to unacceptable progress air sample results obtained by the air monitoring firm during any portion of the Work and a revised work plan shall be submitted to the Engineer. Should unacceptable air sample results be obtained, the air monitoring firm reserves the right to analyze such samples utilizing Transmission Electron Microscopy (TEM).

1.17 PERSONNEL PROTECTION EQUIPMENT (PPE)

A. Hard hats, safety glasses, safety boots and reflective vests to be worn at all times. Double tyvek suits to be worn at all times within the work area. The outer suit may be removed while within the staging area.

B. Respiratory protection to be determined and utilized in accordance with 29 CFR1926.1101(h). P.A.P.R. respirators to be worn initially until personal air monitoring data supports a lower form of protection.

C. Maintain extra PPE on-site at all times for use by authorized visitors. Authorized visitors to include the Engineer and the Engineer's Consultants. Any personnel entering the work area space must be properly trained in the use of PPE.

D. "Double" tyvek suits to be worn at all times within the work area.

1.18 BASIS OF PAYMENT

Asphalt overlay/pavement removal will be measured by the Square Meter. Asphalt overlay/ pavement disposal will be measured by the Megagram.

Payment will be made under:

Pay Item	*Pay Unit*
Asphalt overlay/pavement removal	Square Meter
Asphalt overlay/pavement disposal	Megagram