STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

ROY COOPER
GOVERNOR

J. ERIC BOYETTE
SECRETARY

March 10, 2021

Addendum No. 2
RE: Contract # C204202
WBS # 15BPR.20
STATE FUNDED
Henderson County
I-26/US-74 WEST BOUND LANES AND EAST BOUND LANES OVER GREEN RIVER.

March 16, 2021 Letting

To Whom It May Concern:

Reference is made to the plans and proposal form furnished to you on this project.

The details of the revisions contained in this addendum are included for the Bidder's convenience. All reasonable care was taken to ensure its accuracy. The NCDOT makes no claim that the information contained in the explanation of revisions is 100% accurate or complete. The Bidder is responsible for reviewing the final plans and proposal form to prepare their bid and should not rely on the synopsis for such.

The following revisions have been made to the Structure plans.

Sheet No.	Revision
S-7	Deleted post-tensioning bar corrosion protection pay item from BILL OF MATERIALS
S-117	Changed post tensioning bars from metallized to stainless steel. Removed post tensioning bar corrosion protection pay item. Added note about painting contact surfaces where weathering steel contacts stainless steel

Please void the above listed Sheets in your plans and staple the revised Sheets thereto.

Mailing Address:
NC DEPARTMENT OF TRANSPORTATION
CONTRACT STANDARDS AND DEVELOPMENT
1591 MAIL SERVICE CENTER
RALEIGH, NC 27699-1591

Telephone: (919) 707-6900
Fax: (919) 250-4127
Customer Service: 1-877-368-4968

Website: www.ncdot.gov

Location:
1020 BIRCH RIDGE DR.
RALEIGH, NC 27610

The following revisions have been made to the proposal:

Page No.	Revisions
Proposal Cover	Note added that reads "Includes Addendum No. 2 Dated 03-10-2021"
New Pages TC-1 thru TC-26	The Unit Project Special Provision entitled **WORK ZONE DIGITAL SPEED LIMIT SIGNS** was revised as follows: • Under Materials, 3rd paragraph, modified the LED panel size. Added 3 paragraphs at the beginning of TC-4. • Removed 'Optional Equipment/Capabilities' section. • Added 'Digital Speed Limit Displays' section. • Removed 'Construction Methods' section. • Added 'Other Construction Methods' section Detail on TC-6 was replaced The Unit Project Special Provision **HIGH VISIBILITY** entitled **DEVICES** was revised as follows: • Under Materials, modified drum sheeting material specifications, under Materials, bullet list under 2nd paragraph, removed Type XI fluorescent orange sheeting after 'Drums' • 3rd paragraph, changed Type XI fluorescent orange sheeting to Grade B flexible, fluorescent orange sheeting The Unit Project Special Provision entitled **DYNAMIC ZIPPER MERGE SYSTEM** was revised as follows: • under Construction Methods, B. Dynamic Zipper Merge System Deployment, removed second sentence 'Each PCMS shall be in new condition when delivered to the project site.'

Page No.	Revisions
New Pages ST-1 thru ST-115	The Unit Project Special Provision entitled Submittal of Working Drawings was revised to update contact information. A weblink was revised in the Unit Project Special Provision entitled Asbestos Assessment for Bridge Demolition and Renovation Activities. Revised Unit Project Special Provision entitled All-Lightweight Concrete as follows: a. Allowed higher plastic weight if additional weight is compensated by reduction in 50psf construction allowance weight. b. Added verbiage allowing modulus of elasticity to be measured with fibers. c. Added note about splitting tensile strength as a laboratory test. d. Changed flexural strength to 550 psi at 28 days. e. Clarified the determination of equilibrium density. f. Clarified that air content is determined at the point of concrete placement. g. Allowed ASTM C138 for determination of plastic density. h. Deleted provision requiring concrete to be placed in 90 minutes. Revised Unit Project Special Provision entitled Post-Tensioning System as follows: Changed corrosion protection from metallizing to stainless steel. Deleted corrosion protection pay item. Added language requiring NCDOT approval of the post-tensioning system The Unit Project Special Provision entitled Thermal Sprayed Coatings (Metallization) was replaced by a different version. Weblinks were revised in the Unit Project Special Provision entitled Painting Existing Weathering Steel Structure

The entire existing Unit Project Special Provision for Traffic Control is replaced by this addendum. Please void existing Pages TC-1 thru TC-26 in your proposal and staple New Pages TC-1 thru TC-26 after existing page PM-4 in your proposal.

The entire existing Unit Project Special Provision for Structures is replaced by this addendum. Please void existing Pages ST-1 thru ST-116 in your proposal and staple New Pages ST-1 thru ST-115 after existing page ITS-105 in your proposal.

On the item sheets the following pay item revision has been made:

Item	Description	Old Quantity	New Quantity
0173-8860000000-N-SP	POST-TENSIONING BAR CORROSION PROTECTION	LUMP SUM	DELETED

The Contractor's bid must include this pay item revision.

The electronic bidding file has been updated to reflect this revision. Please download the Addendum File and follow the instructions for applying the addendum. Bid Express will not accept your bid unless the addendum has been applied.

The contract will be prepared accordingly.

Sincerely,

DocuSigned by:
Ronald E. Davenport, Jr.
F81B6038A47A442...

Ronald E. Davenport, Jr., PE
State Contract Officer

RED/jjr
Attachments

cc: Mr. Lamar Sylvester, PE
Mr. Brian Burch, PE
Mr. Boyd Tharrington, PE
Mr. Jon Weathersbee, PE
Mr. Ken Kennedy, PE
Project File (2)
Mr. Ray Arnold, PE
Ms. Jaci Kincaid
Ms. Lori Strickland
Mr. Mike Gwyn
Ms. Penny Higgins
Mr. Kyle Kempf

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH, N.C.

PROPOSAL

INCLUDES ADDENDUM No.2 DATED 03-10-2021

DATE AND TIME OF BID OPENING: **MARCH 16, 2021 AT 2:00 PM**

CONTRACT ID	C204202
WBS	15BPR.20

FEDERAL-AID NO.	STATE FUNDED
COUNTY	HENDERSON
T.I.P. NO.	
MILES	0.743
ROUTE NO.	I 26
LOCATION	I-26/US-74 WEST BOUND LANES AND EAST BOUND LANES OVER GREEN RIVER.
TYPE OF WORK	GRADING, DRAINAGE, PAVING, AND STRUCTURE REHABILITATION.

NOTICE:

ALL BIDDERS SHALL COMPLY WITH ALL APPLICABLE LAWS REGULATING THE PRACTICE OF GENERAL CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA WHICH REQUIRES THE BIDDER TO BE LICENSED BY THE N.C. LICENSING BOARD FOR CONTRACTORS WHEN BIDDING ON ANY NON-FEDERAL AID PROJECT WHERE THE BID IS $30,000 OR MORE, EXCEPT FOR CERTAIN SPECIALTY WORK AS DETERMINED BY THE LICENSING BOARD. BIDDERS SHALL ALSO COMPLY WITH ALL OTHER APPLICABLE LAWS REGULATING THE PRACTICES OF ELECTRICAL, PLUMBING, HEATING AND AIR CONDITIONING AND REFRIGERATION CONTRACTING AS CONTAINED IN CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA. NOTWITHSTANDING THESE LIMITATIONS ON BIDDING, THE BIDDER WHO IS AWARDED ANY FEDERAL - AID FUNDED PROJECT SHALL COMPLY WITH CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA FOR LICENSING REQUIREMENTS WITHIN 60 CALENDAR DAYS OF BID OPENING.

BIDS WILL BE RECEIVED AS SHOWN BELOW:

THIS IS A ROADWAY & STRUCTURE PROPOSAL

5% BID BOND OR BID DEPOSIT REQUIRED

TC-1

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WORK ZONE TRAFFIC CONTROL
Project Special Provisions
Table of Contents

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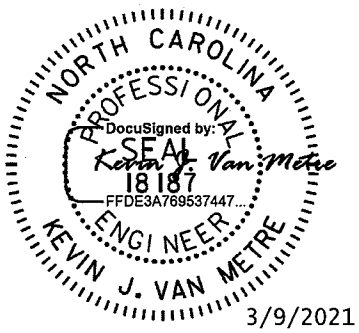
Connected Lane Closure Devices	TC-14
Dynamic Zipper Merge System	TC-16
Traffic Control Supervisor	TC-24
Covering of Signs	TC-25



SEQUENTIAL FLASHING WARNING LIGHTS:

(10/08/2016)

Description

Furnish and install Sequential Flashing Warning Lights on drums used for merging tapers during nightly work activities.

The purpose of these lights is to assist the motorist in determining which direction to merge when approaching a lane closure. It's also designed to reduce the number of late merges resulting in devices being struck and having to be reset to maintain positive guidance at the merge point. The successive flashing of the lights shall occur from the upstream end of the merging taper to the downstream end of the merging taper in order to identify the desired vehicle path.

Materials

The Sequential Flashing Warning Lights shall meet all of the requirements for warning lights within the current edition of the Manual of Uniform Traffic Control Devices (MUTCD).

Each light unit shall be capable of operating fully and continuously for a minimum of 200 hours when equipped with a standard battery set.

Each light in the sequence shall be flashed at a rate of not less than 55 times per minute and not more than 75 times per minute. The flash rate and flash duration shall be consistent throughout the sequence.

Supply a Type 3 Certification (Independent Test Lab results) documenting all actual test results for the specified parameters contained in the Institute of Transportation Engineer's (ITE's) *Purchase Specification for Flashing and Steady Burn Warning Lights*. The laboratory shall also identify all manufacturer codes and part numbers for the incandescent lamp or LED clusters, lenses, battery, and circuitry, and the total width of the light with the battery in place. The complete assembly shall be certified as crashworthy when firmly affixed to the channelizing device.

All Sequential Flashing Warning Lights shall be on the NCDOT Work Zone Traffic Control Approved Products List.

Construction Methods

Sequential Flashing Warning Lights are to be used for night time lane closures.

These lights shall flash sequentially beginning with the first light and continuing until the final light.

The Sequential Flashing Warning Lights shall automatically flash in sequence when placed on the drums that form the merging taper.

The number of lights used in the drum taper shall equal the number of drums used in the taper.

Drums are the only channelizing device allowed to mount sequential flashing warning lights.

The Sequential Flashing Warning Lights shall be weather independent and visual obstructions shall not interfere with the operation of the lights.

The Sequential Flashing Warning Lights shall automatically sequence when placed in line in an open area with a distance between lights of 10 to 100 feet. A 10 foot stagger in the line of lights shall have no adverse effect on the operation of the lights.

If one light fails, the flashing sequence shall continue. If more than 1 light fails, all of the lights are to be automatically turned to the "off" mode. Non-sequential flashing is prohibited.

When lane closures are not in effect, the Sequential Flashing Warning Lights shall be deactivated.

Measurement and Payment

Sequential Flashing Warning Lights will be measured and paid as the maximum number of sequential flashing warning lights satisfactorily installed and properly functioning at any one time during the life of the project.

TC-3

15BRP.20 Henderson County

This includes all materials and labor to install, maintain and remove all the Sequential Flashing Warning Lights.

Pay Item	**Pay Unit**
Sequential Flashing Warning Lights	Each

WORK ZONE DIGITAL SPEED LIMIT SIGNS:

(9/30/2019)

Description

Furnish and install Work Zone Digital Speed Limit Signs on interstates and freeways with speed limits greater than 55 MPH and or facilities that have significant traffic volumes and impacts. These signs are regulatory speed limit signs with LED displays for the speed limit numbers.

The purpose of Digital Speed Limit signs is to easily change work zone speed limits between activities that necessitate the need for a lower speed limit and the ones that do not.

Materials

Digital Speed Limit Signs shall be a minimum 36" wide x 48" high. The speed limit sign (R2-1) shall be black on white with high intensity white prismatic sheeting.

The Digital Speed Limit sign shall be mounted such that the bottom of the sign is 7' above roadway.

The LED panel shall be a minimum of 28" wide x 18" high. The display on the LED panel shall be amber or white.

The LED numbers shall have a minimum 5 wide by 7 high pixel array with a minimum height of 18".

The LED panel shall have auto brightness/dimming capability.

The black on orange "WORK ZONE" sign shall be mounted above the Speed Limit sign. It shall be 36" wide x 24" high with high intensity prismatic orange sheeting.

The black on white "$250 FINE" sign shall be mounted below the Speed Limit sign. It shall be 36" wide x 24" high with high intensity prismatic white sheeting.

All digital speed limit systems shall have operational software and wireless communications that allows for remote operation and data monitoring. It shall be configured to allow access by the Engineer or his designee to change each sign independently or change the speed limit on all signs at once from a PC, tablet or cellular phone application.

Radar equipment to detect approaching speeds on the digital speed limit systems is optional. However, if the systems have radar, they will be equipped to store the detected speed data, this information should be available in a spreadsheet format and accessed remotely from a secure cloud location.

The Work Zone Digital Speed Limit systems shall have flashing beacons. The beacons are to be a minimum of 8" diameter LED circular yellow. They may be mounted either above/below or beside the sign assemblies and are to be centered. The beacons shall alternately flash at rates not less than 50 or more than 60 times per minute.

In addition, the flashing beacons shall be mounted in such a manner that the $250 Speeding Fine sign is not obscured when in operation.

Digital Speed Limit Signs may be trailer mounted or stationary mounted. The unit shall be Solar powered and have the ability to operate continuously. It shall be supplemented with a battery backup system which includes a 110/120 VAC powered on-board charging system.

The batteries, when fully charged; shall be capable of powering the display for 20 continuous days with no solar power. The unit shall be capable of being powered by standard 110/120 VAC power source.

Store the battery bank and charging system in a lockable, weather and vandal resistant box.

All Work Zone Digital Speed Limit equipment shall be on the NCDOT Work Zone Traffic Control Approved Products List.

Digital Speed Limit Displays

The Speed Limit shall be continuously displayed on the signs. All other stationary speed limit signs shall be covered when Digital Speed Limit systems are in operation.

Reduced Speed Limit Displays

The Digital Speed Limit systems shall have beacons activated when the work zone speed limit is reduced. Otherwise, the beacons are to remain off.

IF THE DIGITAL SPEED LIMIT SYSTEM IS EQUIPPED WITH RADAR: The Digital Speed Limit systems shall display the reduced work zone speed limit without flashing the LED speed limit number unless approaching speeds are detected to be 6 MPH or higher than the displayed Speed Limit. If speeds are detected 6 MPH or above the displayed Speed Limit, then the LED shall flash the Speed Limit until the speeds are within the 6 MPH tolerance.

Existing Speed Limit Displays

When the existing Speed Limit is displayed on the Digital Speed Signs, the beacons are to remain off.

IF THE DIGITAL SPEED LIMIT SYSTEM IS EQUIPPED WITH RADAR: The Speed Limit number is not to flash unless the approaching speeds are detected to be 6 MPH or higher than the displayed Speed Limit.

Other Construction Methods

The speed limits are the sole authority of the NCDOT. All speed limits are to be ordinanced by the State Traffic Engineer in order to have a lawfully enforceable speed limit.

The Regional Traffic Engineering Office and the Division Construction Engineer in coordination with the Work Zone Traffic Control Section will provide all Work Zone Speed Limit recommendations based on activities and conditions.

The Contractor will be responsible for coordinating with the Engineer when the Work Zone Speed Limits are to be changed and will have to seek approval by the Engineer or his designee before the Speed Limit is changed.

Whenever possible, each trailer mounted unit shall be placed on the paved shoulder and shall have the capability of being leveled.

Measurement and Payment

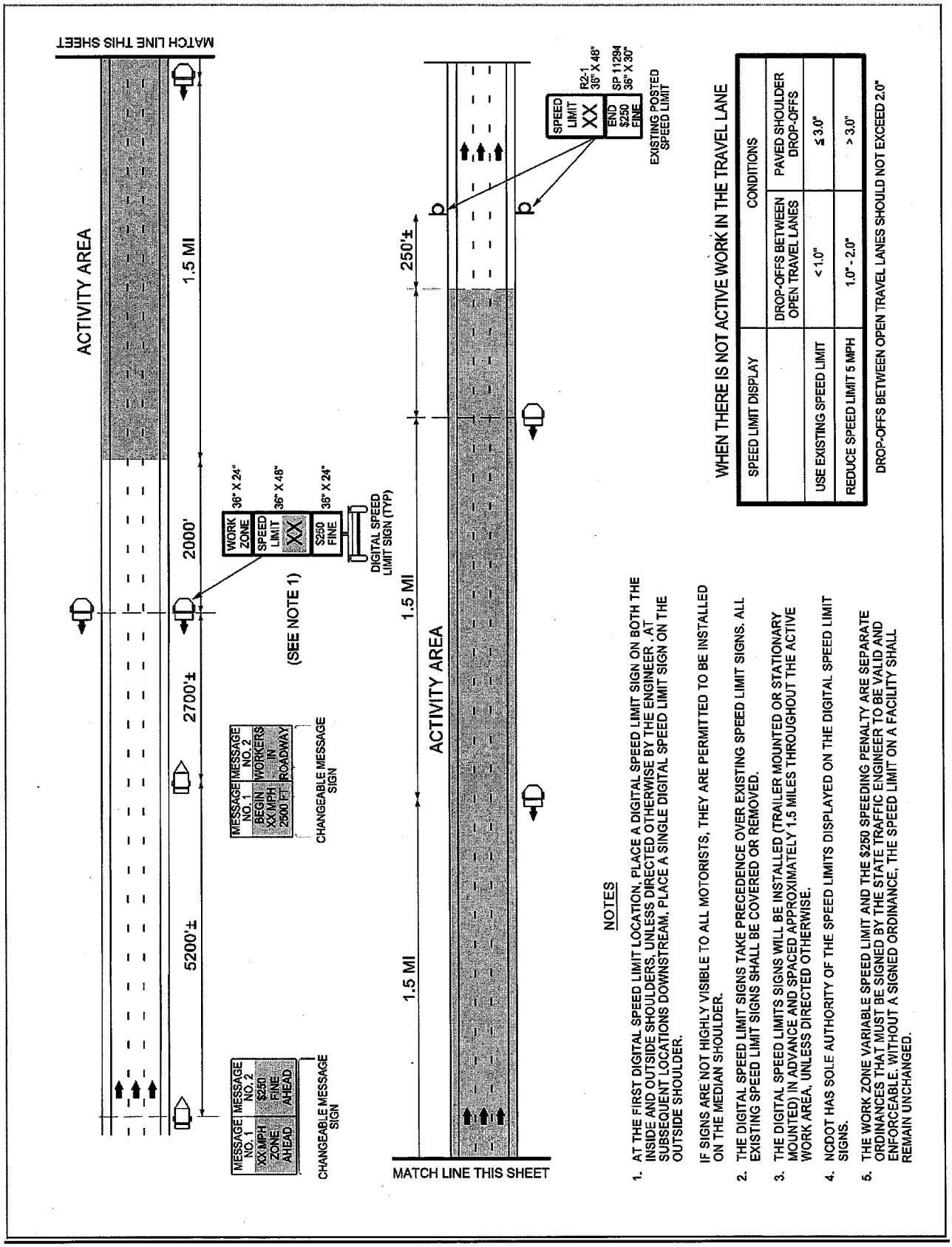
The measurement for the Work Zone Digital Speed Limit Signs is made according to the number of Work Zone Digital Speed Limit signs required per the spacing requirements according to the attached drawing. Payment will be made for the maximum number of Work Zone Digital Speed Limit signs satisfactorily installed and properly functioning at any one time during the life of the project.

This includes all materials and labor to install, maintain and remove all the Work Zone Digital Speed Limit Units.

Pay Item	**Pay Unit**
Work Zone Digital Speed Limit Signs	Each

TC-6

15BRP.20 Henderson County



NOTES

1. AT THE FIRST DIGITAL SPEED LIMIT LOCATION, PLACE A DIGITAL SPEED LIMIT SIGN ON BOTH THE INSIDE AND OUTSIDE SHOULDERS, UNLESS DIRECTED OTHERWISE BY THE ENGINEER . AT SUBSEQUENT LOCATIONS DOWNSTREAM, PLACE A SINGLE DIGITAL SPEED LIMIT SIGN ON THE OUTSIDE SHOULDER.

   IF SIGNS ARE NOT HIGHLY VISIBLE TO ALL MOTORISTS, THEY ARE PERMITTED TO BE INSTALLED ON THE MEDIAN SHOULDER.
2. THE DIGITAL SPEED LIMIT SIGNS TAKE PRECEDENCE OVER EXISTING SPEED LIMIT SIGNS. ALL EXISTING SPEED LIMIT SIGNS SHALL BE COVERED OR REMOVED.
3. THE DIGITAL SPEED LIMITS SIGNS WILL BE INSTALLED (TRAILER MOUNTED OR STATIONARY MOUNTED) IN ADVANCE AND SPACED APPROXIMATELY 1.5 MILES THROUGHOUT THE ACTIVE WORK AREA, UNLESS DIRECTED OTHERWISE.
4. NCDOT HAS SOLE AUTHORITY OF THE SPEED LIMITS DISPLAYED ON THE DIGITAL SPEED LIMIT SIGNS.
5. THE WORK ZONE VARIABLE SPEED LIMIT AND THE $250 SPEEDING PENALTY ARE SEPARATE ORDINANCES THAT MUST BE SIGNED BY THE STATE TRAFFIC ENGINEER TO BE VALID AND ENFORCEABLE. WITHOUT A SIGNED ORDINANCE, THE SPEED LIMIT ON A FACILITY SHALL REMAIN UNCHANGED.

WHEN THERE IS NOT ACTIVE WORK IN THE TRAVEL LANE

SPEED LIMIT DISPLAY	CONDITIONS	
	DROP-OFFS BETWEEN OPEN TRAVEL LANES	PAVED SHOULDER DROP-OFFS
USE EXISTING SPEED LIMIT	< 1.0"	≤ 3.0"
REDUCE SPEED LIMIT 5 MPH	1.0" - 2.0"	> 3.0"

DROP-OFFS BETWEEN OPEN TRAVEL LANES SHOULD NOT EXCEED 2.0"

TC-7

15BRP.20 Henderson County

WORK ZONE PERFORMANCE PAVEMENT MARKINGS:
(10/08/2016)
(Rev. 10/9/18)

Description

Furnish and install Work Zone Performance pavement markings that delineate the travel way for work zone traffic patterns on interstates and freeways along with the ramps and loops. They may also be used on roadways with significant alterations of traffic patterns. The purpose of Work Zone Performance pavement marking is to provide a more durable work zone pavement marking that lasts the full duration of a traffic pattern without requiring replacement or reapplication for a period of up to 12 months. Work Zone Performance pavement markings shall also provide a higher performance level in terms of retroreflectivity throughout the required 12 month duration than standard traffic paints to improve nighttime work zone visibility.

Materials

A) General

Use materials in accordance with the Manufacturer's recommendations that will retain both durability and a minimum retroreflectivity as described elsewhere in this RFP for a period of at least 12 months.

The Work Zone Performance pavement markings shall be manufactured to bond successfully to both concrete and asphalt pavements. The following are approved materials to be used for Work Zone Performance pavement markings:

- Polyurea
- Thermoplastic (Extruded and Sprayed)
- Epoxy
- Polymer (Single System)
- Cold Applied Plastic (Type IV)

B) Material Qualifications/Certifications

Use Work Zone Performance pavement marking materials, as listed above, which are on the NCDOT Approved Products List at the time of installation.
In accordance with Article 106-3, and Section 1087-4 of the 2018 NCDOT Standard Specifications for Roads and Structures, provide a Type 3 Material Certification for all materials and a Type 3 and Type 4 certification for all reflective media.

(C) Performance

Poor performance of a Work Zone Performance pavement marking material at any site, whether or not related to a specific contract, may be grounds for removing the material from any project under contract and the NCDOT Approved Products List.

Construction Methods

Do not use hand applied methods or any other non-truck mounted application equipment /device to install Work Zone Performance pavement markings for applications longer than 1000 feet.

All Work Zone Performance pavement markings are to be installed in a single application. Multiple passes are not allowed.
"No track" dry times shall be 10 minutes or less. Traffic shall not be placed on any material until it's sufficiently dry/cured to eliminate wheel tracking.

A) Testing Procedures

All Work Zone Performance pavement marking installations will be tested by the Department through an independent Mobile Retroreflective Contractor. The Work Zone Performance pavement markings will be scanned to ensure the retroreflectivity requirements in Section C below are met.

B) Application Equipment

Application equipment shall be in accordance with Section 1205 of the 2018 NCDOT Standard Specifications for Roads and Structures.

C) Material Application

The Work Zone Performance pavement marking material shall be applied at the following minimum thicknesses:

Polyurea =	20 mils wet
Epoxy =	20 mils wet
Thermoplastic =	50 mils (Extruded or Sprayed)
Polymer =	20 mils wet
Cold Applied Plastic (IV) =	Manufacturer's recommendation

The Work Zone Performance pavement marking line widths for interstates and freeways shall be as follows:

Edge lines, Solid Lane Lines, Skip and Mini-Skip Lines =	6"
Gorelines =	12"

All other facilities shall utilize 4" line widths.

D) Retroreflectivity Requirements

Retroreflectivity Requirements for Work Zone Performance Pavement Markings

Color	Initial	6 Months	12 Months
White	375 mcd/lux/m2	275 mcd/lux/m2	150 mcd/lux/m2
Yellow	250 mcd/lux/m2	150 mcd/lux/m2	100 mcd/lux/m2

The minimum level of retroreflectivity for any Work Zone Performance pavement marking system selected shall meet the initial requirements in the chart above. In addition, the Work Zone Performance pavement markings shall maintain the corresponding retroreflectivity requirements for a period of up to 12 months.

The Contractor shall notify the Engineer a minimum of 7-10 days prior to the installation of Work Zone Performance pavement markings.

The Department will measure initial retroreflectivity within 30 days after placement to ensure compliance with the initial retroreflectivity levels in the chart above.

If the markings appear to be non-performing, the Engineer may request additional retroreflectivity readings. If measured and found to be noncompliant, the Contractor shall replace the Work Zone Performance pavement markings at no cost to the Department. Non-compliant retroreflectivity occurs when the average readings for the project are more than 15% below the requirements in the chart. Pay deductions are appropriate for deficiencies up to the 15% level.

If the Work Zone Performance pavement markings need to remain in place longer than 12 months, the markings are to be scanned by the Mobile Retroreflective Contractor to determine if they are meeting the minimum retroreflectivity levels. If they remain at or above these levels, the Work Zone Performance pavement markings may remain in place. If not, they shall be replaced by the Contractor within 15 days of the 12 month duration and compensation will be made at the contract unit price.

If and when this becomes necessary, the same notification procedure as described above shall be used to have the Work Zone Performance pavement markings scanned for the required retroreflectivity.

E) Snowplow Damage

All Work Zone Performance pavement markings shall be durable enough to withstand a single snow event requiring snow plowing without showing excessive fatigue in either bonding or retroreflectivity.

The Contractor shall replace the Work Zone Performance pavement markings if a single snowplow occurrence results in more than 25% of the pavement marking edgelines or skips being physically

removed and/or the Work Zone Performance pavement markings do not meet the following minimum retroreflectivity values:

Retroreflective Requirements for Work Zone Performance Pavement Markings after a Single Snowplow Occurrence

Color	MINIMUM
White	150 mcd/lux/m2
Yellow	100 mcd/lux/m2

Unless the temporary traffic pattern is to be modified within 30 days, the Contractor shall replace all non-compliant Work Zone Performance pavement markings within 30 days of determining they are non-compliant.

If the work zone experiences more than one snow event requiring snow plowing, the retroreflectivity values in the chart above will no longer apply. The Engineer will determine if the pavement markings are performing adequately and/or if replacement is necessary due to excessive damage caused solely by snowplow activities.

If the Work Zone Performance pavement markings are found to be deficient, they shall be replaced. In such case, compensation will be made at the contract unit price. Unless the temporary traffic pattern is to be modified within 30 days, the Contractor shall replace all Work Zone Performance pavement markings damaged due to multiple snowplow events within 30 days.

F) Surface Preparation

Prior to installation, all pavement surfaces to receive Work Zone Performance pavement markings shall be swept clean and prepared in accordance with the Manufacturer's recommendation.

G) Temperature and Weather Limitations

Work Zone Performance pavement markings shall only be applied unless the ambient air temperature and the pavement temperature is 50°F or higher for thermoplastic and is 40°F or higher for all other materials. Do not install unless the pavement surface is completely dry and not within 4 hours of a heavy rain event such as a thunderstorm with rainfall intensities greater than 1 inch/per hour.

In the event a traffic shift has to take place when the air and pavement temperatures are below the required minimums or if a rain event occurs prior to or during a planned traffic shift, upon approval by the Engineer, an acceptable alternative is to install temporary pavement markings. Use 1 application of standard traffic paint to produce a 4" line at 15 mils (wet). Beads shall also be applied to provide proper retroreflectivity until the performance material can be installed. NCDOT

will provide compensation for the 4",15 mil temporary paint. The Work Zone Performance pavement markings shall be applied within 90 days of installation of the temporary pavement markings.

Maintenance

Replace any Work Zone Performance pavement material that prematurely fails due to debonding or excessive wearing where it doesn't maintain its retroreflectivity for the required 12 month duration. Any traffic control and Work Zone Performance pavement marking costs due to replacement is at no cost to the Department unless it's due to excessive damage caused by snowplow damage.

Measurement and Payment

Work Zone Performance pavement marking lines will be measured and paid by the linear foot that's satisfactorily placed and accepted by the Engineer. The quantity of Work Zone Performance pavement marking-solid lines, will be the summation of the linear feet of solid line measured end-to-end of the line. The quantity of skip or broken lines will be the summation of the linear feet derived by multiplying the nominal length of a line by the number of broken lines satisfactorily placed.

Work Zone Performance Pavement Marking *Symbols* will be measured as the actual number of pavement marking symbols satisfactorily placed and accepted by the Engineer. Payment for Work Zone Performance Pavement Marking *Symbols* will be made at the same contract unit price used for the Pavement Marking Symbol pay items used on the final wearing surface.

Work Zone Performance Pavement Marking *Characters* will be measured as the actual number of pavement marking characters satisfactorily placed and accepted by the Engineer. A character is considered to be one letter or one number of a word message. Payment for Work Zone Performance Pavement Marking *Characters* will be made at the same contract unit price used for the Pavement Marking Character pay item used on the final wearing surface.

Payment will be made under:

Pay Item	Pay Unit
Work Zone Performance Pavement Marking Lines, 4"	Linear Foot
Work Zone Performance Pavement Marking Lines, 6"	Linear Foot
Work Zone Performance Pavement Marking Lines, 12"	Linear Foot

TC-12

15BRP.20 Henderson County

HIGH VISIBILITY DEVICES:
(10/25/2019)

Description

Furnish and install High Visibility Devices for projects on Interstates and Freeways with durations of 24 months or more. High Visibility Devices include drums, stationary work zone signs and rigid portable work zone signs. All of these devices shall be new. Used devices are not acceptable.

The purpose of High Visibility Devices is to enhance the conspicuity of the devices in order to improve both safety and mobility through the Interstate and Freeway work zones. In addition, using new devices help to ensure they remain in compliance with required retroreflective properties for the full life of the project and to improve the overall appearance of significant work zones throughout the State.

Materials

A) General

Use materials in accordance with the Manufacturer's recommendations that will retain both durability and retroreflectivity as described elsewhere in this specification for a period of at least 36 months.

The following are required High Visibility Devices to be used for work zone performance applications.

- Drums
- Stationary Work Zone Signs
- Rigid Portable Work Zone Signs

All drums shall be new and meet the existing requirements of Section 1089-5 of the North Carolina Standard Specifications for Roads and Structures and shall have Grade B flexible, fluorescent orange sheeting that meets the retroreflective requirements of Section 1092-2.

All stationary work zone signs shall be new and meet the existing requirements of Section 1089-1. Legend overlays are prohibited and shall not be accepted on the Interstate/Freeway or associated intersecting roadways. Vertical sign post reflector strips shall be added to all stationary sign supports. Use Grade B fluorescent orange for work zone signs and Grade B fluorescent yellow for exit sign supports. Install strips a minimum of 6' in length on sign supports with one sign mounted and a minimum of 4.5' in length for sign supports with two or more signs mounted vertically.

All portable work zone signs shall be new and have composite substrates as described in Section 1089-1. The remainder of the existing requirements of Section 1089-1 remain. Used sign stands are acceptable.

B) Material Qualifications/Certifications

Only use materials as listed above that are on the NCDOT Approved Products List. In addition, provide a Type 3 Material Certification for all materials in accordance with Section 106-3 and Section 1087-4.

(C) Performance

Poor performance of any device or sign at any site, whether or not related to a specific contract may be grounds for removing the material from the NCDOT Approved Products List and/or removing from any project under contract.

Construction Methods

All requirements of Section 1110-3 and Section 1130-3 shall apply except roll up signs are not permitted for use.

The use of skinny drums are prohibited for any nighttime lane closures on Interstates and Freeways.

Maintenance

Replace any sign or drum that prematurely fails due to any damage or defect that causes it to perform unsatisfactorily with an "in kind" device of similar quality and age according to the guidelines set forth in the American Traffic Safety Service Association's (ATSSA) Quality Guidelines for Work Zone Traffic Control Devices. An "in kind" replacement sign or drum is not required to be new, however, it shall be less than 1 year old and have 100% of its original sheeting area and at least 85% of the retroreflective qualities of a new device, so that it is undetectable adjacent to the original devices and signs placed on the project.

Measurement and Payment

High Visibility Drums will be measured and paid as the maximum number of drums placed and in use at any one time during the life of the project.

High Visibility Stationary Signs will be measured as the actual number of square feet satisfactorily installed at each location and accepted by the Engineer. Where a particular sign is used at more than one location, measurement will be made at each location.

High Visibility Work Zone Signs will be measured and paid as the actual number of square feet satisfactorily installed and accepted by the Engineer. Payment will be made for the initial installation only. Relocation of signs, will incidental the measurement of the quantity of signs.

No direct payment will be made for stationary work zone sign supports or portable work zone sign stands. All stationary work zone sign support or portable work zone sign stands will be incidental to the work of providing work zone signs.

TC-14

15BRP.20 Henderson County

Payment will be made under:

Pay Item:	**Pay Unit**
High Visibility Drums	Each
High Visibility Stationary Signs	Square Foot
High Visibility Portable Signs	Square Foot

CONNECTED LANE CLOSURE DEVICES:
(10/29/2018)

Description

Furnish, install, operate, maintain, relocate, and remove connected lane closure devices for use on Interstate and Freeway lane closures. The connected lane closure devices shall transmit the location of the lane closure to navigational companies such as WAZE, Google Maps, Inrix, Here, TrafficCast, TomTom, Apple Maps, Panasonic, the Statewide Transportation Operations Center, (STOC), and any other navigational companies that requests it. A connected lane closure device shall be installed on the flashing arrow board identifying the beginning of a lane closure, and another connected lane closure device shall be installed on a crashworthy traffic control device (such as a drum) at the end of the same lane closure.

Materials

The connected lane closure devices shall be designed and built to transmit the location of the lane closure to the navigational companies as well as the STOC. The format of the information received by each of these shall be approved by each entity, and at minimum, consist of an XML file. The connected lane closure devices shall be capable of obtaining wireless communication by either cellular or satellite technology.

The initial connected device shall be designed and attached to the flashing arrow board in such a manner that it is only activated when either the left or right arrows are displayed, not when the flashing arrow board is operated in caution mode. When the lane closure is removed, and the flashing arrow board turned off or changed to caution mode, the connected device shall automatically turn off simultaneously.

The second connected device in a lane closure shall be installed on a crashworthy traffic control device. It shall have an easily accessible power switch and a small status indicator light mounted such that it is visible when passing by in a vehicle at operating speed. When switched to the ON position, the light shall indicate that device has established communication and is transmitting. The light may be either steady burn or flashing and shall not exceed one (1) inch in diameter.

The devices shall have battery life sufficient to maintain operation for the duration of the lane closure, or have the ability to be recharged without deactivating the device.

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Construction Methods

Connected lane closure devices shall be used on all lane closures on freeways and interstates throughout the project.

Two connected lane closure devices shall be installed per grouping of lane closures (single, double, or triple); one attached and wired into the flashing arrow board at the beginning of the first taper, and the other at the last traffic control device at the end of the lane closure(s). Supplemental flashing arrow boards in advance of the first lane closure taper or flashing arrow boards in subsequent lane closures (for double and triple lane closures) shall not have connected devices. Subsequent lane closures occurring downstream of where all lanes have been reopened and lane closures in the opposite direction of travel will require additional connected devices.

The second connected lane closure device shall be manually turned ON and OFF by crews installing and removing the lane closure, unless the device can be controlled by the initial connected device. The unit shall be turned on immediately upon installation of the lane closure and turned off immediately upon removal of the lane closure.

Once installed, the Contractor shall verify that the connected lane closure devices are transmitting information prior to leaving the device unattended and re-verify transmission every 72 hours for long-term installations.

Technical Requirements

The connected devices shall be run continuously during any active lane closures for the length of the contract.

The GPS within the connected devices shall have a horizontal accuracy of 50 feet, 95% of the time.

The connected device information, including the location, transmission status, and battery status shall be transmitted within five (5) minutes of initiation and updated every fifteen (15) minutes. In addition to transmitting information to the Department, the Contractor shall keep the retain device information for one (1) year after the contract ends. Information shall include timestamps, device name, and GPS location. This information shall be made available to the Department upon request.

The battery voltage shall be collected at least once an hour. The information shall be stored and available for troubleshooting. The system shall transmit an alert if the battery voltage of a device is under a specified threshold.

The connected devices shall emit an audible an alert if a device is not transmitting its position for a period of 1 hour.

The outputs from the connected device on the arrow board and the downstream connected device at the end of the lane closure shall be easily identifiable as a single pair, either by sequential device IDs, identical project names, or other method as approved by the Engineer. Additional pairs on the

project shall have unique identifiable information such that it is not confused with another project pair.

Measurement and Payment

Connected Lane Closure Devices will be measured and paid as the maximum number of connected devices acceptably placed and in use at any one time during the life of the project. Each group of lane closures will require two (2) connected lane closure devices; one connected to the flashing arrow board and the other on a crashworthy device at the downstream end of the lane closure. No payment will be made for either device unless both devices are satisfactorily installed.

The price for each connected lane closure device will cover all material, labor, maintenance, relocation, removal, and communication costs required for the duration of the project.

Flashing Arrow Boards will be measured and paid in accordance with Section 1115.

Crashworthy devices (such as drums) used to mount the downstream connected lane closure device shall be considered be incidental.

Pay Item	Pay Unit
Connected Lane Closure Device	Each

DYNAMIC ZIPPER MERGE SYSTEM:
(12/10/2019)

Description

Provide, install, program, relocate, operate, maintain, and remove an automated, stand-alone, real-time Dynamic Zipper Merge System meeting the requirements noted herein, until project completion for the duration specified by the Engineer.

A Dynamic Zipper Merge System is a group of devices that work together using software to automatically detect traffic conditions and respond using preprogrammed response algorithms. The purpose of this system is to provide advance notification to motorists of traffic queues in advance of long-term lane closures in order to reduce the likelihood of high-speed crashes and to encourage either early or late lane merges depending on live traffic conditions.

The Dynamic Zipper Merge System shall detect the presence of a lane closure and slow/stopped traffic queues that develop in advance of the lane closure and display lane closure or slowed/stopped and driver merge instruction messages on the integrated message boards.

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15BRP.20 Henderson County

Materials and System Operational Requirements

A. General

These specifications cover the general operational requirements for the Dynamic Zipper Merge System. The Dynamic Zipper Merge System shall be positioned at locations indicated in the contract or designated by the Engineer.

Provide physical and electronic/software protections for all components of the system and processes pertaining thereto prevent access by unauthorized parties.

Provide the following for this project:

- Customized website integrated with each Dynamic Zipper Merge System for NCDOT and project partners.
- Traffic Management Software capable of analyzing data and accurately supplying the indicated information.

Provide the following equipment for each Dynamic Zipper Merge System:

- 8 Traffic Speed Sensors
- 5 Portable Changeable Message Signs
- 2 Full Matrix Display Portable Changeable Message Signs, capable of displaying a flashing arrow indication
- Communication equipment for all above devices to include all components and communication methods necessary to allow each device to send and receive data to and from the website and Traffic Management Software.
- Integration equipment to receive lane closure status from Connected Lane Closure Devices (see separate Special Provision).

B. Documentation

Provide a set of complete specifications and literature on the selected Dynamic Zipper Merge System. Address all the requirements of the Contract Documents in the submittal. Provide documents for each device containing all information necessary to determine product specification compliance. Provide the detailed security plan and protocol used to protect data and communications of the Dynamic Zipper Merge System to the Engineer for approval at least 10 days prior to the delivery of the Dynamic Zipper Merge System. This plan includes physical locking mechanisms where the locks are unique for this Dynamic Zipper Merge System (a key to be provided to NCDOT), password handling techniques, and limited static IPs for remote access to equipment.

C. Power Source

Provide power for devices for continuous operation, as defined in the section Malfunctions, Maintenance, and Inspection below. All utility hookups, solar panels, batteries and other power sources are incidental.

D. Installation

Locate and aim the devices to ensure data accuracy. Coordinate installation locations and details with the Engineer prior to installation.

E. Traffic Sensors

Provide sensors to withstand and operate in, without deterioration, inclement weather and visibility conditions including sunlight, light precipitation, temperature, light, fog, darkness, excessive dust and road debris.

Provide sensors which:

- Collect and report individual vehicle data;
- Collect and report data on a per lane basis;
- Collect speed, volume, and lane occupancy data, for the required direction(s) of traffic; and
- Communicate data to the Traffic Management Software at least once per minute.

Install and maintain sensors to continuously detect all public traffic on **I-26 WESTBOUND**. Configure sensors to allow active and inactive collection zones, so that construction traffic is differentiated from public traffic. At a minimum, detect speed, volume, and occupancy levels in each lane, each minute. Summarize data in 5 minute bins for data storage and transfer. Do not block or shield critical locations from the sensor. Test each sensor and re-test as needed to confirm the accuracy of the data reported.

Collect and report data to the Traffic Management Software which meets the following requirements at any given time during testing and operation:

- Per direction volume accuracy: greater than 90%;
- Per lane volume accuracy: greater than 90%; and
- Per direction average speed accuracy: greater than 90%.

F. Portable Changeable Message Signs (PCMS)

Provide and maintain Portable Changeable Message Signs (PCMS) capable of displaying the traffic queue length and travel time advisories to motorists. Provide PCMS that meet or exceed the material and functional requirements as described in the Contract Documents. The PCMS shall be capable of communicating wirelessly with and being controlled by the Traffic Management Software. Provide signs which display messages and log the date, time and text of the messages when being controlled by the Traffic Management Software.

No more than 1 pixel illumination failure on the board shall be allowed at any given time during testing and operation. Continuously monitor PCMS status. Include in the monitoring procedure an evaluation of power levels, communication connections, and the number of unlit pixels. Also, use a human observer periodically to document that the correct message is displayed with the correct date and time.

G. Traffic Management Software

The software has three main functions: Queue Warning, Driver Merge Instructions, and Lane Closure Notification. Use software that meets or exceeds the following requirements for each function:

Queue Warning

The intent of the Queue Warning function is to detect traffic congestion and queue formation and notify approaching drivers of the conditions. Queue Warning is the most critical function of the system. Continuously monitor traffic and report the required operational characteristics to the software each minute. Use a combination of real-time speed and percent lane occupancy information reported by traffic sensors, compared with configurable thresholds, to initiate a slow, stopped, or driver merge instruction message. Display configurable messages on the PCMS located upstream of sensors that detect changes in speed and lane occupancy in such a way that approaching drivers see a slow message before a stopped message, and a stopped message before a late merge message. Include accurate distance until the condition in the slow and stopped messages, and round distances to the nearest ½ mile. Message examples include "SLOW TRAFFIC 2 MILES/WATCH FOR SLOW TRAFFIC," "STOPPED TRAFFIC 1 MILE/PREPARE TO STOP," and "USE BOTH LANES/TO MERGE POINT."

Configure Queue Warning messages to override all other messages on a PCMS. Send communication to project personnel when traffic conditions violate predetermined thresholds. Data collected by the Dynamic Zipper Merge System will be owned by NCDOT and must be in a file format compatible with the STOC's operating platform.

Include human observation in the monitoring procedure to document posted messages and times during an actual event. Compare those messages with the information available from the software. Complete software monitoring as needed and when requested by the Engineer.

Driver Merge Instructions

The intent of the Driver Merge Instructions function is to detect traffic congestion and queue formation and convert the lane closure from a traditional early merge scenario to a late lane merge condition. Driver Merge Instructions is another critical function of the system. Continuously monitor traffic and report the required operational characteristics to the software each minute. Use a combination of real-time speed and percent lane occupancy information reported by traffic sensors, compared with configurable thresholds, to initiate the appropriate driver merge instruction message. Display configurable messages on the PCMS located upstream of sensors that detect changes in speed and lane occupancy in such a way that approaching drivers see an early merge message when queueing is less than one mile in advance of the taper, and a late lane merge message when queueing extends beyond one mile in advance of the merge taper. Message examples include "RIGHT LANE CLOSED/1 MILE AHEAD," "USE BOTH LANES/TO MERGE POINT." and "MERGE HERE/TAKE TURNS."

Configure Queue Warning messages to override all other messages on a PCMS. Send communication to project personnel when traffic conditions violate predetermined thresholds. Data collected by the Dynamic Zipper Merge system will be owned by NCDOT and must be in a file format compatible with the STOC's operating platform.

Include human observation in the monitoring procedure to document posted messages and times during an actual event. Compare those messages with the information available from the software. Complete software monitoring as needed and when requested by the Engineer.

Lane Closure Notification
The intent of the lane closure notification function is to detect active lane closures when no queues are present and notify approaching drivers of the conditions. Lane closure notification is a secondary function and serves as the default function when Queue Warning is inactive. An example message for this function is "RIGHT LANE CLOSED/3 MILES AHEAD."

When no lane closures are in place and no queues are present, each PCMS shall display flashing dots in all four corners to indicate the system is operating correctly.

Include human observation in the monitoring procedure to document posted messages when a Queue Warning event is not occurring.

Reporting and Operational Requirements
Communicate with and/or control all of the devices belonging to the Dynamic Zipper Merge System. Poll the sensors and PCMS a minimum of once per minute. Collect from each device, as applicable, and store in configurable bins the following data: device name and location, 50th percentile and 85th percentile speeds, volume, lane occupancy, message sign history, as well as battery status and communication status. Make historical data available to NCDOT staff at all times for the duration of work zone activity. Provide an electronic copy of all data, including date and duration of system malfunctions, to NCDOT staff after all work zone activity is completed and the Dynamic Zipper Merge System has been removed.

H. Website

The purpose of the website is to be a real time traffic operations dashboard showing current traffic conditions, real time speeds, and posted messages to the nearest minute. Display a full color map of the project area, using Google Maps or equivalent, which shows roadways impacted by project activities and for which data is being collected. Display current average speed at each traffic sensor for which data is available. Display a representation of each device in its approximate location, relative to the roadway and other nearby features, and indicate the operational status of each device. Display the messages posted on the message signs. Refresh information at least once per minute. In the event devices are moved to a new location in the field, automatically reflect these changes to the system layout on the website.

I. Traffic Control Devices

Provide traffic control devices as needed to set up, operate, maintain and tear down the Dynamic Zipper Merge System as shown in the Contract Documents. Coordinate device placement with other Contractors as needed to meet or exceed placement requirements in the Contract Documents.

If applicable, all PCMS used for advance notice of a variable speed zone within the Dynamic Zipper Merge System shall be removed and replaced with double indicated "VARIABLE SPEED ZONE AHEAD" static sign as shown on the detail.

J. Malfunctions, Maintenance, and Inspection

Operate the Dynamic Zipper Merge System, including all components listed above, continuously (24 hours per day, 7 days per week) when deployed on the project, for the duration specified by the Engineer.

In addition, the Contractor shall have portable mounted lane closure signs as detailed in Roadway Standard Drawing 1101.02, Sheet 4, available on site to be used in the case of a system malfunction. These static lane closure signs shall not be visible to traffic except in the case of a system malfunction and will remain in place until the system is fully functional again.

Continuously operate the Dynamic Zipper Merge System with no major malfunctions throughout its operation. System malfunctions include, but are not limited to; the inability of the equipment to provide accurate, real-time traffic data, inability of the equipment to determine lane closure status from connected lane closure devices; inability to withstand a construction roadside environment or normal weather conditions; or interference from construction equipment. Monitor and inspect equipment and data, and on a regular basis to avoid malfunctions. Upon discovery or notification of a system malfunction, the Contractor shall immediately make the pre-staged static lane closure signs visible to traffic and make all necessary corrections to the components of the system such that system malfunctions are corrected within a 24-hour period through repair or replacement of the equipment.

Components include sensors, message signs, communications equipment and all hardware and software required to place the real time information on the devices to operate according to Contract Documents.

It is the responsibility of the Contractor to detect data malfunctions. Monitor, inspect, and maintain sensors so that malfunctions in data collection can be detected as soon as possible. Causes of malfunction may include high winds, shifting earth beneath or around the device, or interference by construction equipment. Monitoring, at a minimum, includes evaluation and documentation of power levels, communication connections, and accuracy of data provided to the Traffic Management Software. Monitoring data accuracy may include re-calibration and aiming of the device or retesting accuracy using human observers. Monitor as needed and when requested by the Engineer.

K. Complete and Operational System

Direct and indirect costs associated with operating the Dynamic Zipper Merge System are incidental to this bid item and may include FCC licensing, cellular communication, wireless data networks, satellite and internet subscription charges, solar power system support and battery charging and maintenance.

Construction Methods

A. System Manager

Provide one person, available 24 hours per day, as the System Manager for the Dynamic Zipper Merge System. Provide this person's 24-hour contact information to the Engineer. Provide a system manager who is locally available to supervise, monitor, and maintain the system components including the website, relocate devices as necessary, and respond to emergencies.

B. Dynamic Zipper Merge System Deployment

Deliver all of the required devices to the place and time designated by the Engineer and confirm they are in good condition and in working order. Coordinate with the Engineer to determine final sensor locations, then deploy and install sensors. Complete stand-alone tests, system operational tests, final deployment, and system initiation prior to impacting traffic.

System Logic and Programming

The Contractor shall use the logic provided by NCDOT to program the Dynamic Zipper Merge System. This logic indicates what each PCMS will display in response to changing traffic conditions according to each speed sensor. Coordinate with the Engineer, Work Zone Traffic Control, and the State Traffic Operations Center staff prior to system installation to verify the system programming is accurate. Coordinate with the Engineer in the event system programming adjustments are necessary due to field conditions.

Stand-alone Testing

Conduct stand-alone tests of each device. Test sensors from their installed locations. PCMS may be tested in other locations. Turn all PCMS away from traffic during testing.

Complete a stand-alone test for each PCMS prior to installation, and to verify that the unit operates as specified. Include in the stand-alone test procedure tests for the following functions:

- Turning the sign on and off;
- Displaying and removing a test message;
- Counting pixels not illuminated (no more than 1 malfunctioning pixel);
- Checking message logs for accuracy; and
- Measuring sign legibility and visibility.

If a unit fails to pass the stand-alone test, repair or replace the unit, and repeat the test until successful.

System Operational Testing

Provide a System Operational Testing Plan to the Engineer for approval, at least 7 days prior to beginning testing. The Plan shall detail a five-day operational test procedure of the System Operational Requirements. Include in the plan procedures operation of the software using real time information from sensors already tested and installed and tested signs located in an off-project location. Begin testing 14 days prior to implementation to verify the system operates in a fully functional manner and as described.

Provide complete operations support from the Software supplier during the operational test, if applicable. Provide verification that the reported drive times, speeds, and volumes through the work zone accurately reflect actual field conditions. Use a human observer to monitor and document the posted messages. Post test messages two times per day during the test period to verify functionality and communications and verification that proper messages are being posted to the PCMS. If any equipment malfunctions occur for a combined period of two hours or more during the operational test on any day, restart the five-day test and no credit will be given for that day of the operational test period.

The Contractor shall be responsible for replacing all defective equipment at no additional cost to the Department.

Indicate the date and time of any activity necessary to maintain operation of the Dynamic Zipper Merge System during the operational test period. Include in each entry, at a minimum, the following information:

- A description of the malfunction;
- Identity of the malfunctioning equipment;
- Cause of equipment malfunction (if known);
- A description of the type of work performed; and
- Time and date of repair completion.

Once the operational test report is received and approved by the Engineer, the Dynamic Zipper Merge System will be considered operational, and the system will be accepted for use.

Measurement and Payment

Dynamic Zipper Merge System Deployment will be measured and paid on a Lump Sum basis upon completion of the first Dynamic Zipper Merge System delivered to the project site, installed, tested, and found to be fully operational.

Dynamic Zipper Merge System Relocation will be measured and paid on a per each basis upon completion of each system removal from one location on the project and installation to a different location on the project. Payment will be paid once the system is fully operational.

Dynamic Zipper Merge System will be measured and paid on a daily basis for each satisfactorily installed Dynamic Zipper Merge System, including all necessary labor, equipment, materials, communications, licensing, and software to maintain operation of the system. Each Dynamic Zipper Merge System is expected to operate continuously (24 hours per day, 7 days per week) with no major malfunctions. Monitor and maintain the system according to the Malfunctions, Maintenance, and Inspection section above.

All work zone signs will be paid for at the contract unit price according to Article 1110-04 in the 2018 Standard Specifications for Roads and Structures.

In the event of a system or data malfunction, payment will be made for the first day of the malfunction. If the malfunctioning Dynamic Zipper Merge System is not completely operational at the end of 24 hours, additional payment will not be made until the system's operation is fully restored.

Pay Item	**Pay Unit**
Dynamic Zipper Merge System Deployment	Lump Sum

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Dynamic Zipper Merge System Relocation Each
Dynamic Zipper Merge System Day

TRAFFIC CONTROL SUPERVISOR
12/12/2019

This provision supersedes the requirements of Article 1101-13.

Provide the services of at least 1 Traffic Control Supervisor for the project who is knowledgeable of TMP design, devices and application, and has full authority to ensure traffic is maintained in accordance with the plans and specifications and ensure all employees working inside NCDOT right of way have received the proper training appropriate to the job decisions each individual is required to make.

The Traffic Control Supervisor shall be on the project site overseeing all lane and road closures and median crossover operations to ensure traffic control devices are properly installed and adjusted as necessary. The Traffic Control Supervisor shall also make necessary changes to the traffic control operations and aide in the monitoring of traffic queuing.

At the Pre-Construction Conference, the Contractor shall identify a Traffic Control Supervisor that has the following qualifications:

(1) A minimum 24 months of On-the-Job Training in supervision and work zone set up and implementation on similar projects.

(2) Be certified by an approved NCDOT training agency or self-certified by the Contractor or their traffic control Sub-Contractor. If the Traffic Control Supervisor is self-certified by the Contractor or their traffic control Sub-Contractor, a notarized certification letter shall be furnished to the Engineer at the preconstruction meeting. The letter shall state the Traffic Control Supervisor is self-certified by the appropriate entity along with their certification and re-certification dates. It shall also state the Traffic Control Supervisor has the knowledge and experience as well as the authority to ensure traffic is maintained in accordance with the contract documents.

The Traffic Control Supervisor for the project shall perform the following:

(1) During construction, be available or on call 24 hours per day, 7 days per week to address mobility and / or safety concerns within the work zone and direct / make any necessary changes in the traffic control operations in a timely and safe manner. The Contractor shall provide NCDOT the name of the Traffic Control Supervisor and support personnel, and the phone number(s) where they can be reached 24 hours per day, seven days per week.

(2) Coordinate and cooperate with traffic control supervisors of adjacent, and overlapping construction projects, as well as construction projects in proximity to the subject project, to

ensure safe and adequate traffic control setup is maintained throughout the project at all times, including periods of construction inactivity.

(3) Coordinate with the Engineer, Law Enforcement, first responders, and other city and state agencies during emergencies.

(4) Provide traffic control setup that ensures safe traffic operations and workers' safety throughout the construction area.

(5) Attend all scheduled traffic control coordination meetings, as required by the Engineer.

(6) Monitor traffic delays and backups within the work zone.

COVERING OF SIGNS
(01/15/2020)

Cover the following existing overhead and shoulder mounted regulatory signs with opaque material on roads open to traffic but are not applicable during construction as specified in the Traffic Management Plan (TMP):

Sign Message	Location	Coordinates
NO TRUCKS 3 AXLES OR MORE THIS LANE	I-26 WB Overhead (Left Lane)	35.268764, -82.367428
NO TRUCKS 3 AXLES OR MORE LEFT LANE	I-26 WB Outside Shoulder	35.265433, -82.365573
NO TRUCKS 3 AXLES OR MORE LEFT LANE 1 MILE AHEAD	I-26 WB Outside Shoulder	35.256856, -82.353755
NO TRUCKS 3 AXLES OR MORE LEFT LANE 1 MILE AHEAD	I-26 WB Outside Shoulder	35.250870, -82.339961

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Notify the Engineer 30 days prior to sign covering. The covering of these signs requires the State Traffic Engineer to rescind the existing ordinance that does not permit trucks in the left lane.

Keep signs covered until instructed to remove the covering. Provide covering for entire signs by an approved method provided by sheeting manufacturer that will prevent the messages from being read or seen during both day and night conditions and that will cause no harm to the sheeting face.

Compensation:

Covering of Signs as described above shall be paid for at the contract price for each Sign.

Payment will be made under:

Pay Item	Pay Unit
Signs, Covering	EA

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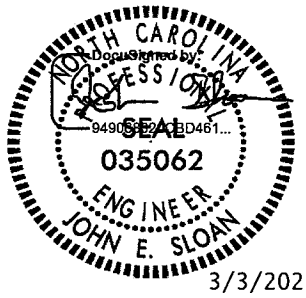

Special Provisions

Document not considered final unless all signatures complete.

FALSEWORK AND FORMWORK (4-5-12)

1.0 DESCRIPTION

Use this Special Provision as a guide to develop temporary works submittals required by the Standard Specifications or other provisions; no additional submittals are required herein. Such temporary works include, but are not limited to, falsework and formwork.

Falsework is any temporary construction used to support the permanent structure until it becomes self-supporting. Formwork is the temporary structure or mold used to retain plastic or fluid concrete in its designated shape until it hardens. Access scaffolding is a temporary structure that functions as a work platform that supports construction personnel, materials, and tools, but is not intended to support the structure. Scaffolding systems that are used to temporarily support permanent structures (as opposed to functioning as work platforms) are considered to be falsework under the definitions given. Shoring is a component of falsework such as horizontal, vertical, or inclined support members. Where the term "temporary works" is used, it includes all of the temporary facilities used in bridge construction that do not become part of the permanent structure.

Design and construct safe and adequate temporary works that will support all loads imposed and provide the necessary rigidity to achieve the lines and grades shown on the plans in the final structure.

2.0 MATERIALS

Select materials suitable for temporary works; however, select materials that also ensure the safety and quality required by the design assumptions. The Engineer has authority to reject material on the basis of its condition, inappropriate use, safety, or nonconformance with the plans. Clearly identify allowable loads or stresses for all materials or manufactured devices on the plans. Revise the plan and notify the Engineer if any change to materials or material strengths is required.

3.0 DESIGN REQUIREMENTS

A. Working Drawings

Provide working drawings for items as specified in the contract, or as required by the Engineer, with design calculations and supporting data in sufficient detail to permit a structural and safety review of the proposed design of the temporary work.

On the drawings, show all information necessary to allow the design of any component to be checked independently as determined by the Engineer.

When concrete placement is involved, include data such as the drawings of proposed sequence, rate of placement, direction of placement, and location of all construction joints. Submit the number of copies as called for by the contract.

When required, have the drawings and calculations prepared under the guidance of, and sealed by, a North Carolina Registered Professional Engineer who is knowledgeable in temporary works design.

If requested by the Engineer, submit with the working drawings manufacturer's catalog data listing the weight of all construction equipment that will be supported on the temporary work. Show anticipated total settlements and/or deflections of falsework and forms on the working drawings. Include falsework footing settlements, joint take-up, and deflection of beams or girders.

Provide adequate overhang falsework and determine the appropriate adjustments for deck geometry, equipment, casting procedures and casting conditions.

If the optional overhang falsework spacing is used, indicate this on the falsework submittal and advise the girder producer of the proposed details. Failure to notify the Engineer of hanger type and hanger spacing on prestressed concrete girder casting drawings may delay the approval of those drawings.

Falsework hangers that support concentrated loads and are installed at the edge of thin top flange concrete girders (such as bulb tee girders) shall be spaced so as not to exceed 75% of the manufacturer's stated safe working load. Use of dual leg hangers (such as Meadow Burke HF-42 and HF-43) are not allowed on concrete girders with thin top flanges. Design the falsework and forms supporting deck slabs and overhangs on girder bridges so that there will be no differential settlement between the girders and the deck forms during placement of deck concrete.

When staged construction of the bridge deck is required, detail falsework and forms for screed and fluid concrete loads to be independent of any previous deck pour components when the mid-span girder deflection due to deck weight is greater than ¾".

Note on the working drawings any anchorages, connectors, inserts, steel sleeves or other such devices used as part of the falsework or formwork that remains in the permanent structure. If the plan notes indicate that the structure contains the necessary corrosion protection required for a Corrosive Site, epoxy coat, galvanize or metalize these devices. Electroplating will not be allowed. Any coating required by the Engineer will be considered incidental to the various pay items requiring temporary works.

Design falsework and formwork requiring submittals in accordance with the 1995 AASHTO *Guide Design Specifications for Bridge Temporary Works* except as noted herein.

1. Wind Loads

   Table 2.2 of Article 2.2.5.1 is modified to include wind velocities up to 110 mph. In addition, Table 2.2A is included to provide the maximum wind speeds by county in North Carolina.

Table 2.2 - Wind Pressure Values

Height Zone feet above ground	Pressure, lb/ft^2 for Indicated Wind Velocity, mph				
	70	80	90	100	110
0 to 30	15	20	25	30	35
30 to 50	20	25	30	35	40
50 to 100	25	30	35	40	45
over 100	30	35	40	45	50

2. Time of Removal

   The following requirements replace those of Article 3.4.8.2.

   Do not remove forms until the concrete has attained strengths required in Article 420-16 of the Standard Specifications and these Special Provisions.

   Do not remove forms until the concrete has sufficient strength to prevent damage to the surface.

Table 2.2A - Steady State Maximum Wind Speeds by Counties in North Carolina

COUNTY	25 YR (mph)	COUNTY	25 YR (mph)	COUNTY	25 YR (mph)
Alamance	70	Franklin	70	Pamlico	100
Alexander	70	Gaston	70	Pasquotank	100
Alleghany	70	Gates	90	Pender	100
Anson	70	Graham	80	Perquimans	100
Ashe	70	Granville	70	Person	70
Avery	70	Greene	80	Pitt	90
Beaufort	100	Guilford	70	Polk	80
Bertie	90	Halifax	80	Randolph	70
Bladen	90	Harnett	70	Richmond	70
Brunswick	100	Haywood	80	Robeson	80
Buncombe	80	Henderson	80	Rockingham	70
Burke	70	Hertford	90	Rowan	70
Cabarrus	70	Hoke	70	Rutherford	70
Caldwell	70	Hyde	110	Sampson	90
Camden	100	Iredell	70	Scotland	70
Carteret	110	Jackson	80	Stanley	70
Caswell	70	Johnston	80	Stokes	70
Catawba	70	Jones	100	Surry	70
Cherokee	80	Lee	70	Swain	80
Chatham	70	Lenoir	90	Transylvania	80
Chowan	90	Lincoln	70	Tyrell	100
Clay	80	Macon	80	Union	70
Cleveland	70	Madison	80	Vance	70
Columbus	90	Martin	90	Wake	70
Craven	100	McDowell	70	Warren	70
Cumberland	80	Mecklenburg	70	Washington	100
Currituck	100	Mitchell	70	Watauga	70
Dare	110	Montgomery	70	Wayne	80
Davidson	70	Moore	70	Wilkes	70
Davie	70	Nash	80	Wilson	80
Duplin	90	New Hanover	100	Yadkin	70
Durham	70	Northampton	80	Yancey	70
Edgecombe	80	Onslow	100		
Forsyth	70	Orange	70		

B. Review and Approval

The Engineer is responsible for the review and approval of temporary works' drawings.

Submit the working drawings sufficiently in advance of proposed use to allow for their review, revision (if needed), and approval without delay to the work.

The time period for review of the working drawings does not begin until complete drawings and design calculations, when required, are received by the Engineer.

Do not start construction of any temporary work for which working drawings are required until the drawings have been approved. Such approval does not relieve the Contractor of the responsibility for the accuracy and adequacy of the working drawings.

4.0 CONSTRUCTION REQUIREMENTS

All requirements of Section 420 of the Standard Specifications apply.

Construct temporary works in conformance with the approved working drawings. Ensure that the quality of materials and workmanship employed is consistent with that assumed in the design of the temporary works. Do not weld falsework members to any portion of the permanent structure unless approved. Show any welding to the permanent structure on the approved construction drawings.

Provide tell-tales attached to the forms and extending to the ground, or other means, for accurate measurement of falsework settlement. Make sure that the anticipated compressive settlement and/or deflection of falsework does not exceed ½ inch. For cast-in-place concrete structures, make sure that the calculated deflection of falsework flexural members does not exceed 1/240 of their span regardless of whether or not the deflection is compensated by camber strips.

A. Maintenance and Inspection

Inspect and maintain the temporary work in an acceptable condition throughout the period of its use. Certify that the manufactured devices have been maintained in a condition to allow them to safely carry their rated loads. Clearly mark each piece so that its capacity can be readily determined at the job site.

Perform an in-depth inspection of an applicable portion(s) of the temporary works, in the presence of the Engineer, not more than 24 hours prior to the beginning of each concrete placement. Inspect other temporary works at least once a month to ensure that they are functioning properly. Have a North Carolina Registered Professional Engineer inspect the cofferdams, shoring, sheathing, support of excavation structures, and support systems for load tests prior to loading.

B. Foundations

Determine the safe bearing capacity of the foundation material on which the supports for temporary works rest. If required by the Engineer, conduct load tests to verify proposed bearing capacity values that are marginal or in other high-risk situations.

The use of the foundation support values shown on the contract plans of the permanent structure is permitted if the foundations are on the same level and on the same soil as those of the permanent structure.

Allow for adequate site drainage or soil protection to prevent soil saturation and washout of the soil supporting the temporary works supports.

If piles are used, the estimation of capacities and later confirmation during construction using standard procedures based on the driving characteristics of the pile is permitted. If preferred, use load tests to confirm the estimated capacities; or, if required by the Engineer conduct load tests to verify bearing capacity values that are marginal or in other high risk situations.

The Engineer reviews and approves the proposed pile and soil bearing capacities.

5.0 REMOVAL

Unless otherwise permitted, remove and keep all temporary works upon completion of the work. Do not disturb or otherwise damage the finished work.

Remove temporary works in conformance with the contract documents. Remove them in such a manner as to permit the structure to uniformly and gradually take the stresses due to its own weight.

6.0 METHOD OF MEASUREMENT

Unless otherwise specified, temporary works will not be directly measured.

7.0 BASIS OF PAYMENT

Payment at the contract unit prices for the various pay items requiring temporary works will be full compensation for the above falsework and formwork.

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SUBMITTAL OF WORKING DRAWINGS (1-29-21)

1.0 GENERAL

Submit working drawings in accordance with Article 105-2 of the *Standard Specifications* and this provision. For this provision, "submittals" refers to only those listed in this provision. The list of submittals contained herein does not represent a list of required submittals for the project. Submittals are only necessary for those items as required by the contract. Make submittals that are not specifically noted in this provision directly to the Engineer. Either the Structures Management Unit or the Geotechnical Engineering Unit or both units will jointly review submittals.

If a submittal contains variations from plan details or specifications or significantly affects project cost, field construction or operations, discuss the submittal with and submit all copies to the Engineer. State the reason for the proposed variation in the submittal. To minimize review time, make sure all submittals are complete when initially submitted. Provide a contact name and information with each submittal. Direct any questions regarding submittal requirements to the Engineer, Structures Management Unit contacts or the Geotechnical Engineering Unit contacts noted below.

In order to facilitate in-plant inspection by NCDOT and approval of working drawings, provide the name, address and telephone number of the facility where fabrication will actually be done if different than shown on the title block of the submitted working drawings. This includes, but is not limited to, precast concrete items, prestressed concrete items and fabricated steel or aluminum items.

2.0 ADDRESSES AND CONTACTS

For submittals to the Structures Management Unit, use the following addresses:

Via US mail:

Mr. B. C. Hanks, P. E.
State Structures Engineer
North Carolina Department
of Transportation
Structures Management Unit
1581 Mail Service Center
Raleigh, NC 27699-1581

Attention: Mr. J. L. Bolden, P. E.

Via other delivery service:

Mr. B. C. Hanks, P. E.
State Structures Engineer
North Carolina Department
of Transportation
Structures Management Unit
1000 Birch Ridge Drive
Raleigh, NC 27610

Attention: Mr. J. L. Bolden, P. E.

Submittals may also be made via email.

Send submittals to:

jlbolden@ncdot.gov (James Bolden)

Send an additional e-copy of the submittal to the following address:

eomile@ncdot.gov (Emmanuel Omile)

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mrorie@ncdot.gov (Madonna Rorie)

For submittals to the Geotechnical Engineering Unit, use the following addresses:

For projects in Divisions 1-7, use the following Eastern Regional Office address:

Via US mail:

Mr. David Hering, L. G., P. E.
Eastern Regional Geotechnical Manager
North Carolina Department of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
1570 Mail Service Center
Raleigh, NC 27699-1570

Via other delivery service:

Mr. David Hering, L. G., P. E.
Eastern Regional Geotechnical Manager
North Carolina Department of Transportation
Geotechnical Engineering Unit
Eastern Regional Office
3301 Jones Sausage Road, Suite 100
Garner, NC 27529

Via Email: EastGeotechnicalSubmittal@ncdot.gov

For projects in Divisions 8-14, use the following Western Regional Office address:

Via US mail or other delivery service:

Mr. Eric Williams, P. E.
Western Regional Geotechnical Manager
North Carolina Department of Transportation
Geotechnical Engineering Unit
Western Regional Office
5253 Z Max Boulevard
Harrisburg, NC 28075

Via Email: WestGeotechnicalSubmittal@ncdot.gov

The status of the review of structure-related submittals sent to the Structures Management Unit can be viewed from the Unit's website, via the "Drawing Submittal Status" link.

The status of the review of geotechnical-related submittals sent to the Geotechnical Engineering Unit can be viewed from the Unit's website, via the "Geotechnical Construction Submittals" link.

Direct any questions concerning submittal review status, review comments or drawing markups to the following contacts:

Primary Structures Contact: James Bolden (919) 707 – 6408
(919) 250 – 4082 facsimile
jlbolden@ncdot.gov

Secondary Structures Contacts: Emmanuel Omile (919) 707 – 6451
Madonna Rorie (919) 707 – 6508

Eastern Regional Geotechnical Contact (Divisions 1-7):
David Hering (919) 662 – 4710
dthering@ncdot.gov

Western Regional Geotechnical Contact (Divisions 8-14):
Eric Williams (704) 455 – 8902
ewilliams3@ncdot.gov

3.0 SUBMITTAL COPIES

Furnish one complete copy of each submittal, including all attachments, to the Engineer. At the same time, submit the number of hard copies shown below of the same complete submittal directly to the Structures Management Unit and/or the Geotechnical Engineering Unit.

The first table below covers "Structure Submittals". The Engineer will receive review comments and drawing markups for these submittals from the Structures Management Unit. The second table in this section covers "Geotechnical Submittals". The Engineer will receive review comments and drawing markups for these submittals from the Geotechnical Engineering Unit.

Unless otherwise required, submit one set of supporting calculations to either the Structures Management Unit or the Geotechnical Engineering Unit unless both units require submittal copies in which case submit a set of supporting calculations to each unit. Provide additional copies of any submittal as directed.

STRUCTURE SUBMITTALS

Submittal	Copies Required by Structures Management Unit	Copies Required by Geotechnical Engineering Unit	Contract Reference Requiring Submittal [1]
Arch Culvert Falsework	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Box Culvert Falsework [7]	5	0	Plan Note, SN Sheet & "Falsework and Formwork"
Cofferdams	6	2	Article 410-4
Foam Joint Seals [6]	9	0	"Foam Joint Seals"

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Expansion Joint Seals (hold down plate type with base angle)	9	0	"Expansion Joint Seals"
Expansion Joint Seals (modular)	2, then 9	0	"Modular Expansion Joint Seals"
Expansion Joint Seals (strip seals)	9	0	"Strip Seals"
Falsework & Forms [2] (substructure)	8	0	Article 420-3 & "Falsework and Formwork"
Falsework & Forms (superstructure)	8	0	Article 420-3 & "Falsework and Formwork"
Girder Erection over Railroad	5	0	Railroad Provisions
Maintenance and Protection of Traffic Beneath Proposed Structure	8	0	"Maintenance and Protection of Traffic Beneath Proposed Structure at Station ___"
Metal Bridge Railing	8	0	Plan Note
Metal Stay-in-Place Forms	8	0	Article 420-3
Metalwork for Elastomeric Bearings [4,5]	7	0	Article 1072-8
Miscellaneous Metalwork [4,5]	7	0	Article 1072-8
Disc Bearings [4]	8	0	"Disc Bearings"
Overhead and Digital Message Signs (DMS) (metalwork and foundations)	13	0	Applicable Provisions
Placement of Equipment on Structures (cranes, etc.)	7	0	Article 420-20
Precast Concrete Box Culverts	2, then 1 reproducible	0	"Optional Precast Reinforced Concrete Box Culvert at Station ___"
Prestressed Concrete Cored Slab (detensioning sequences) [3]	6	0	Article 1078-11
Prestressed Concrete Deck Panels	6 and 1 reproducible	0	Article 420-3

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Prestressed Concrete Girder (strand elongation and detensioning sequences)	6	0	Articles 1078-8 and 1078-11
Removal of Existing Structure over Railroad	5	0	Railroad Provisions
Revised Bridge Deck Plans (adaptation to prestressed deck panels)	2, then 1 reproducible	0	Article 420-3
Revised Bridge Deck Plans (adaptation to modular expansion joint seals)	2, then 1 reproducible	0	"Modular Expansion Joint Seals"
Sound Barrier Wall (precast items)	10	0	Article 1077-2 & "Sound Barrier Wall"
Sound Barrier Wall Steel Fabrication Plans [5]	7	0	Article 1072-8 & "Sound Barrier Wall"
Structural Steel [4]	2, then 7	0	Article 1072-8
Temporary Detour Structures	10	2	Article 400-3 & "Construction, Maintenance and Removal of Temporary Structure at Station ____"
TFE Expansion Bearings [4]	8	0	Article 1072-8

FOOTNOTES

1. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Articles refer to the *Standard Specifications*.
2. Submittals for these items are necessary only when required by a note on plans.
3. Submittals for these items may not be required. A list of pre-approved sequences is available from the producer or the Materials & Tests Unit.
4. The fabricator may submit these items directly to the Structures Management Unit.
5. The two sets of preliminary submittals required by Article 1072-8 of the *Standard Specifications* are not required for these items.
6. Submittals for Fabrication Drawings are not required. Submittals for Catalogue Cuts of Proposed Material are required. See Section 5.A of the referenced provision.
7. Submittals are necessary only when the top slab thickness is 18" or greater.

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GEOTECHNICAL SUBMITTALS

Submittal	Copies Required by Geotechnical Engineering Unit	Copies Required by Structures Management Unit	Contract Reference Requiring Submittal [1]
Drilled Pier Construction Plans [2]	1	0	Subarticle 411-3(A)
Crosshole Sonic Logging (CSL) Reports [2]	1	0	Subarticle 411-5(A)(2)
Pile Driving Equipment Data Forms [2,3]	1	0	Subarticle 450-3(D)(2)
Pile Driving Analyzer (PDA) Reports [2]	1	0	Subarticle 450-3(F)(3)
Retaining Walls [4]	1 drawings, 1 calculations	2 drawings	Applicable Provisions
Temporary Shoring [4]	1 drawings, 1 calculations	2 drawings	"Temporary Shoring" & "Temporary Soil Nail Walls"

FOOTNOTES

1. References are provided to help locate the part of the contract where the submittals are required. References in quotes refer to the provision by that name. Subarticles refer to the *Standard Specifications*.

2. Submit one hard copy of submittal to the Engineer. Submit a second copy of submittal electronically (PDF via email), US mail or other delivery service to the appropriate Geotechnical Engineering Unit regional office. Electronic submission is preferred.

3. The Pile Driving Equipment Data Form is available from:
https://connect.ncdot.gov/resources/Geological/Pages/Geotech_Forms_Details.aspx
See second page of form for submittal instructions.

4. Electronic copy of submittal is required. See referenced provision.

CRANE SAFETY (6-20-19)

Comply with the manufacturer specifications and limitations applicable to the operation of any and all cranes and derricks. Prime contractors, sub-contractors, and fully operated rental companies shall comply with the current Occupational Safety and Health Administration (OSHA) regulations.

Submit all items listed below to the Engineer prior to beginning crane operations. Changes in personnel or equipment must be reported to the Engineer and all applicable items listed below must be updated and submitted prior to continuing with crane operations.

CRANE SAFETY SUBMITTAL LIST

A. **Competent Person:** Provide the name and qualifications of the "Competent Person" responsible for crane safety and lifting operations. The named competent person will have the responsibility and authority to stop any work activity due to safety concerns.

B. **Riggers:** Provide the qualifications and experience of the persons responsible for rigging operations. Qualifications and experience should include, but not be limited to, weight calculations, center of gravity determinations, selection and inspection of sling and rigging equipment, and safe rigging practices.

C. **Crane Inspections:** Inspection records for all cranes shall be current and readily accessible for review upon request.

D. **Certifications:** Crane operators shall be certified by the National Commission for the Certification of Crane Operators (NCCCO) or the National Center for Construction Education and Research (NCCER). Other approved nationally accredited programs will be considered upon request. In addition, crane operators shall have a current CDL medical card. Submit a list of crane operator(s) and include current certification for each type of crane operated (small hydraulic, large hydraulic, small lattice, large lattice) and medical evaluations for each operator.

GROUT FOR STRUCTURES (12-1-17)

1.0 DESCRIPTION

This special provision addresses grout for use in pile blockouts, grout pockets, shear keys, dowel holes and recesses for structures. This provision does not apply to grout placed in post-tensioning ducts for bridge beams, girders, decks, end bent caps, or bent caps. Mix and place grout in accordance with the manufacturer's recommendations, the applicable sections of the Standard Specifications and this provision.

2.0 MATERIAL REQUIREMENTS

Unless otherwise noted on the plans, use a Type 3 Grout in accordance with Section 1003 of the Standard Specifications.

Initial setting time shall not be less than 10 minutes when tested in accordance with ASTM C266.

Construction loading and traffic loading shall not be allowed until the 3 day compressive strength is achieved.

3.0 SAMPLING AND PLACEMENT

Place and maintain components in final position until grout placement is complete and accepted. Concrete surfaces to receive grout shall be free of defective concrete, laitance, oil, grease and other foreign matter. Saturate concrete surfaces with clean water and remove excess water prior to placing grout.

4.0 BASIS OF PAYMENT

No separate payment will be made for "Grout for Structures". The cost of the material, equipment, labor, placement, and any incidentals necessary to complete the work shall be considered incidental to the structure item requiring grout.

BRIDGE DECK RIDEABILITY AND GROOVING AT STATION 35+30.22 –L– **(SPECIAL)**

1.0 GENERAL

This Special Provision shall govern the profilograph testing, diamond grinding, transverse grooving and all other related work associated with obtaining satisfactory rideability and surface texture of the lightweight concrete bridge deck surface in spans B through D and normal weight concrete bridge deck surface in the approach slabs and spans A and E, prior to placement of the PPC overlay. Tine the bridge deck during initial placement and provide a surface finish in accordance with Article 420-14(B) of the Standard Specifications in the locations in which diamond grinding is required. For PPC overlay rideability requirements, see Polyester Polymer Concrete Overlay Rideability (IRI) special provision.

2.0 PROFILOGRAPH TESTING REQUIREMENTS

Perform acceptance testing of the longitudinal profile of the finished bridge deck in each wheel path of each lane in the presence of the Engineer. It is the Contractor's responsibility to submit a proposed plan of action and schedule for profilograph testing. Use a certified independent provider, approved by the Engineer, to perform the profilograph test. Profilograph testing shall be completed at the end of each construction stage on each lane of the concrete bridge deck prior to the placement of the PPC overlay.

Prior to profilograph testing, placement of the bridge deck and barrier rail within the section to be tested shall be complete, with the exception of blockouts required for the installation of joints. Profilograph testing shall not take place until the full width of the deck and approach slabs, and concrete barrier rail are constructed, per construction stage. Temporary joints shall be installed, as required by the details for each stage, prior to the rideability testing. Temporary joints shall be of sufficient construction to facilitate operation of the profilograph and corrective equipment across the joint. Do not install final joints until the Engineer determines that the rideability requirements herein have been met. Remove all obstructions from the bridge deck and sweep the surface clean of debris prior to testing. If automated profilograph equipment is used, there shall be no radio transmissions or other activities that might disrupt the automated profilograph equipment during the testing.

Profilograph testing shall occur while the bridge is temporarily closed to traffic in both directions, by means of rolling road block or other means approved by the Engineer and permitted by the Contract Transportation Management Plans. Such operations shall be scheduled a minimum of 6 weeks prior to the testing date(s). All traffic control measures shall be approved by the Engineer and coordinated with all applicable agencies. Rolling road block shall occur at night between 9 pm and 7 am.

A plan of work shall be submitted to the Engineer for review and approval.

Ensure that the profilograph is in good operating condition per the manufacturer's

recommendations. Maintain tires free of debris and buildup during each test run. Operate the profilograph at a maximum speed of 2 miles per hour. If a propulsion vehicle is used, it shall be approved, and the gross vehicle weight shall not exceed 1,000 pounds.

At the beginning and end of each day's testing, and at other times determined to be necessary by the Engineer, operate the profilograph over a calibration strip so the Engineer can verify correct operation of the profilograph. The calibration strip shall be a 100 foot section of pavement that is reasonably level and smooth. Submit each day's calibration graphs with that day's test section graphs to the Engineer. Calibrate the profilograph in accordance with the current NCDOT procedure entitled "Determination of Profile Index". Copies of this procedure may be obtained from the NCDOT Construction Unit.

Plot each profilogram on a continuous graph at a horizontal scale of 25 feet per inch with the vertical scale plotted at a true scale. Station numbers shall be recorded on the profilogram at distances not to exceed 200 feet. Note joint locations on the profilogram.

Take profiles with the recording wheel in each wheel path of each lane. The wheel paths of a lane are considered parallel to and approximately 3.5 feet inside both edges of the travel lane. Take profiles over the entire length of the travel lanes on the bridge deck including approach slabs. Upon completion of testing, submit the profilograms for each wheelpath to the Engineer for analysis. The Engineer will retain the profilograms.

The Engineer will determine the Profile Index for each wheel path in accordance with the procedure entitled "Determination of Profile Index".

A test section is defined as a 600 foot length of each travel lane. The maximum allowable Profile Index per lane shall not exceed 25" per mile as determined with a 0.0" blanking band over any 600 foot test section. The Contractor will correct individual deviations in excess of 0.3" over any 25 foot length on the line tested by diamond grinding. Additionally, the entire deck surface shall meet a 0.125" in 10 feet straightedge check made atop the deck either transversely or longitudinally as deemed necessary by the Engineer.

3.0 DIAMOND GRINDING

If the deck does not meet the testing requirements, diamond grinding is required to make corrections. Diamond grind the full width of all lanes and shoulders in the direction of travel. Diamond grinding shall be performed in stages to maintain two lanes of traffic in each direction. All staging to perform diamond grinding shall be as permitted in the Contract Transportation Management Plans, the NCDOT Standard Specifications, and any requirements of the Engineer.

Diamond grinding shall be performed using a Boart Longyear PC 5000, a Target 3804 or an approved equal. Submit grinding equipment specifications to the Engineer for approval before any grinding is performed. Use a grinding machine capable of removing a minimum of 3 feet of width with each pass. Multiple passes may be needed to achieve the required depth of removal. In addition, hand grinding may be required to remove vertical steps between passes.

The ground surface shall consist of between 50 and 60 grooves per foot of width. The grooves shall be between 0.09" and 0.15" in width and 0.0625" in depth. The area between the grooves shall be between 0.06" and 0.13" in width. The final concrete texture shall be uniform.

Construct and operate the grinding machine such that it will not cause strain or damage to the deck surface, excessive ravels, aggregate fractures, spalls, or disturbance of transverse joints. Longitudinally grind the deck parallel to the roadway centerline.

Continuously remove all slurry or other debris resulting from the grinding operations by vacuum pick-up or other approved methods. Prevent the slurry from flowing into floor drains, onto the ground or into the body of water under the bridge. Dispose of all residues off the project.

In completing all corrective work on the deck surface to satisfy the rideability criteria stated herein, limit grinding such that the final reinforcement cover is not less than the plan cover minus ½ inch. In cases where this cannot be achieved, other corrective work may be required as directed by the Engineer.

Provide additional profilograph testing as necessary following grinding until the rideability requirements above are satisfied. Additional profilograph testing shall be performed in accordance with the guidance above.

4.0 GROOVING BRIDGE FLOORS

After the concrete surface profile has been accepted by the Engineer, groove the deck at areas where the grinding was required in accordance with Article 420-14(B) of the Standard Specifications. Grooving shall be performed in stages to permit 2 lanes of traffic in each direction. Grooving shall be consistent with the tining of the bridge deck during initial finish of the deck.

5.0 BASIS OF PAYMENT

No separate payment will be made for profilograph testing or diamond grinding of the bridge deck. The cost of the traffic control, testing procedure, equipment, grinding operation, and removal and disposal of slurry resulting from the grinding operation is considered incidental to the contract bid prices for "Reinforced Concrete Deck Slab" and "Reinforced Concrete Deck Slab (All-Lightweight Concrete)".

POLYESTER POLYMER CONCRETE OVERLAY RIDEABILITY (IRI) (2-8-19)

GENERAL

Perform the smoothness acceptance testing, diamond grinding, transverse grooving and all other related work associated with obtaining satisfactory rideability and surface texture of the Polyester Polymer Concrete (PPC) Overlay surface. Provide a surface finish in accordance with Article 420-14(B) of the *Standard Specifications*.

TESTING REQUIREMENTS

Perform smoothness acceptance testing using an Inertial Profiler of the longitudinal profile of the finished bridge deck and approach slabs in the presence of the Engineer. Submit a proposed plan of action and schedule for profiler testing to the Engineer.

Prior to smoothness testing, placement of the bridge deck, approach slabs, joints, and barrier rail within the section to be tested shall be complete. Remove all obstructions from the bridge deck and sweep the surface clean of debris prior to profiler testing.

Testing shall occur while the bridge is temporarily closed to traffic in both directions, by means of rolling road block or other means approved by the Engineer and permitted by the Contract Transportation Management Plans. Such operations shall be scheduled a minimum of 6 weeks prior to the testing date(s). All traffic control measures shall be approved by the Engineer and coordinated with all applicable agencies. Rolling road block shall occur at night between 9 pm and 7 am.

Use a profiler with line laser technology to perform this work. Use testing and recording software to produce International Roughness Index (IRI) and Mean Roughness Index (MRI) values and locate areas of localized roughness accurately. The Inertial Profiler shall conform to AASHTO M 328, *Standard Specification for Inertial Profiler.* Provide certification documentation that the profiler meets AASHTO M 328 to the Engineer prior to the first day the Inertial Profiler is used on the project.

Equip the Inertial Profiling system with automatic data reduction capabilities for determining the IRI values unless otherwise authorized by the Engineer. Provide IRI data in accordance with most current version of ASTM E 1926.

Provide a competent operator, trained in the operation of the Inertial Profiler and evaluation of the IRI. Operation of the Inertial Profiling system shall conform to AASHTO R 57, *Standard Specification for Operating Inertial Profiling Systems.*

Utilize a properly calibrated and documented Inertial Profiler. Provide the user selected Inertial Profiler settings to the Engineer for the project records. Certification of the Inertial Profiling system shall conform to AASHTO R 56, *Standard Specification for Certification of Inertial Profiling Systems.*

Perform equipment calibrations and verifications as described in AASHTO M 328. Do not use the profiler's internal IRI calculation mode. The profile data shall be filtered with a cutoff wavelength of 300 feet. The interval at which relative profile elevations are reported shall be one inch. Surface openings may be excluded in the IRI measurement by masking with dark non-reflective tape.

Operate the Inertial Profiler in the direction of the final traffic pattern. Collect IRI data from both wheel paths during the same run. Define a "wheel path" as 3 feet from the edge of the travel lane. MRI values are the average of the IRI values from both wheel paths. When using an inertial profiler that collects a single trace per pass, take care to ensure that the measurements from each trace in a travel lane start and stop at the same longitudinal locations. Unless otherwise specified, multiple runs are not necessary for data collection.

Operate the automatic triggering method at all times unless impractical. The profiler should reach operating speed before entering the test section. The runup and runout distances should be sufficient to obtain operating speed and to slow down after testing is completed. Operate the profiler at any speed as per the manufacturer's recommendations, however, the speed must be constant to within ± 3 MPH of the intended speed and any required acceleration should be as gradual as possible.

The evaluation of the profiles will be performed on a section basis. A section is 0.05 mile (264.0 feet) of a single travel lane.

After testing, transfer the electronic profile data from the profiler's portable computer hard drive to a USB flash drive or media approved by the Engineer. Submit electronic data on the approved media to the Engineer, labeled with the Project number, Contract number, Route, Bridge number, County, date of run(s), and termini of the profile data. This media will not be returned to the Contractor.

Use the most current version of ProVAL (***Pro***file *V*iewing and *A*na***l***ysis Software) to determine the IRI and areas of localized roughness. Perform smoothness tests on the finished surface of the completed project or at the completion of a major stage of construction as approved by the Engineer. Coordinate with and receive authorization from the Engineer before starting smoothness testing. Perform smoothness tests within seven days after receiving authorization and submit raw data results to the Engineer within 24 hours of data collection. Any testing performed without the Engineer's presence, unless otherwise authorized, may be ordered retested at the Contractor's expense.

Submit an evaluation for each section to the Engineer within ten days after completion of the smoothness testing. Submit the electronic files compatible with ProVAL and the evaluation in tabular form with each 0.05-mile segment occupying a row. Include each row with the beginning and ending station for the section, the length of the section, the IRI values from each wheel path, and the MRI value for the section. Each continuous run for a section will occupy a separate table and each table will have a header that includes the following: the project contract number, county, the roadway number or designation, a lane designation, bridge number, the dates of the smoothness runs, and the beginning and ending station of the continuous run.

Summarize each table at the bottom. The signature of the Operator shall be included with the submitted IRI trace and electronic files.

Traffic control and all associated activities included in the smoothness testing of the bridge deck surface will be the responsibility of the Contractor.

IRI and MRI numbers in inches per mile will be established for each 0.05-mile section (264.0 feet) for each travel lane of the bridge deck.

The following table provides the acceptance quality rating scale of the bridge deck and approach slabs, based on the final rideability determination.

MRI after Completion [Inches Per Mile]	**Acceptance Per Travel Lane (0.05-mile section)**
Less than or equal to 120.0	Acceptable
Greater than 120.0	Corrective Work Required

Localized Roughness:

Report local IRI values for each wheel path using IRI measurements and a 25-foot sliding baseline. Report areas of localized roughness for each wheel path. Areas of localized roughness are defined as being one of the following two types:

Type 1: Area having a local IRI value greater than 180 in/mile based on a 25-foot analysis segment not containing a bridge expansion joint.

Type 2: Area having a local IRI value greater than 250 in/mile based on a 25-foot analysis segment containing a bridge expansion joint.

Corrective Action Plan:

For areas of localized roughness and non-conforming segment roughness, submit a proposed corrective action plan to the Engineer for review. Include proposed repair locations, limits, and procedures. Repair procedures such as diamond grinding, full or partial deck replacement, joint replacement, etc. may be considered. In order to produce a uniform cross section, the Engineer may require correction to the adjoining traffic lanes or shoulders. Grinding may not be permitted to areas where it may be detrimental to the structure or to ride quality. Do not begin corrective action until submittal acceptance. Notify the Engineer 5 days prior to commencement of the corrective action. Following repair, repeat surface testing and submit IRI and MRI measurements to verify segment MRI is 120 in/mile or less and wheel paths no longer contain areas of localized roughness as defined herein.

Diamond Grinding

If the deck does not meet the smoothness acceptance testing requirements, and diamond grinding is required, diamond grind the full width of all lanes in the direction of travel. If 30 percent or more of the bridge deck surface requires corrective action, then the Contractor shall diamond grind the entire bridge deck surface.

Submit grinding equipment specifications to the Engineer for approval before any grinding is performed. Use a grinding machine with diamond tipped saw blades gang mounted on a power driven self-propelled machine capable of removing a minimum of 3 feet of width with each pass. Multiple passes may be needed to achieve the required depth of removal. In addition, hand grinding may be required to remove vertical steps between passes.

The ground surface shall consist of between 50 and 60 grooves per foot (305 mm) of width. The grooves shall be between 0.09" (2.3 mm) and 0.15" (3.8 mm) in width and 0.0625" (1.6 mm) in depth. The area between the grooves shall be between 0.06" (1.5 mm) and 0.13" (3.3 mm) in width. The final concrete texture shall be uniform.

"Fins" of PPC that remain after diamond grinding shall be removed in a manner and method acceptable to the Engineer. Contractor may proposed alternative methods for achieving specified rideability requirements and required concrete deck surface friction. Such proposed alternatives shall be approved by the Engineer prior to implementation and, if approved, shall be at no additional cost to the Department.

Construct and operate the grinding machine such that it will not cause strain or damage to the deck surface, excessive ravels, aggregate fractures, spalls, or disturbance of transverse joints. Do not perform corrective diamond grinding within 1.5 feet of a steel armored expansion joint system installed prior to the corrective action. Longitudinally grind the deck parallel to the roadway centerline.

Continuously remove all slurry or other debris resulting from the grinding operations by vacuum pick-up or other approved methods. Prevent the slurry from flowing into floor drains, onto the ground or into the body of water under the bridge. Dispose of all residues in accordance with the project permits, applicable local and federal laws, and as approved by the Engineer.

In completing all corrective work on the deck surface to satisfy the rideability criteria stated herein, limit grinding such that the final reinforcement cover is not less than the plan cover minus ½" (12mm). In cases where this cannot be achieved, other corrective work may be required as directed by the Engineer.

GROOVING BRIDGE FLOORS

After the final concrete surface profile has been accepted by the Engineer, groove the bridge deck in accordance with Article 420-14(B) of the *Standard Specifications*.

Grooving of the entire bridge deck surface will be required if less than 30 percent of the bridge deck has been corrected with diamond grinding. Grooving will not be required if the entire bridge deck surface is diamond grinded. Payment for grooving in accordance with Section 420

of the *Standard Specifications* will be made when grooving has been performed, or when diamond grinding of the entire bridge deck surface is performed, either condition being an acceptable, final riding surface.

BASIS OF PAYMENT

No separate payment will be made for smoothness testing, retesting or corrective action work required to meet the requirements established herein. The cost of the testing procedure, traffic control, equipment, grinding operation, and removal and disposal of slurry and debris resulting from the grinding operation or demolition is considered incidental to the contract bid price for "Polyester Polymer Concrete Materials".

ASBESTOS ASSESSMENT FOR BRIDGE DEMOLITION AND RENOVATION ACTIVITIES (12-30-15)

1.0 INSPECTION FOR ASBESTOS CONTAINING MATERIAL

Prior to conducting bridge demolition or renovation activities, the Contractor shall thoroughly inspect the bridge or affected components for the presence of asbestos containing material (ACM) using a firm prequalified by NCDOT to perform asbestos surveys. The inspection must be performed by a N.C. accredited asbestos inspector with experience inspecting bridges or other industrial structures. The N.C. accredited asbestos inspector must conduct a thorough inspection, identifying all asbestos-containing material as required by the Environmental Protection Agency National Emission Standards for Hazardous Air Pollutants (NESHAP) Code of Federal Regulations (CFR) 40 CFR, Part 61, Subpart M.

The Contractor shall submit an inspection report to the Engineer, which at a minimum must include information required in 40 CFR 763.85 (a)(4) vi)(A)-(E), as well as a project location map, photos of existing structure, the date of inspection and the name, N.C. accreditation number, and signature of the N.C. accredited asbestos inspector who performed the inspection and completed the report. The cover sheet of the report shall include project identification information. Place the following notes on the cover sheet of the report and check the appropriate box:

___ ACM was found
___ ACM was not found

2.0 REMOVAL AND DISPOSAL OF ASBESTOS CONTAINING MATERIAL

If ACM is found, notify the Engineer. Compensation for removal and disposal of ACM is considered extra work in accordance with Article 104-7 of the Standard Specifications.

An Asbestos Removal Permit must be obtained from the Health Hazards Control Unit (HHCU) of the N.C. Department of Health & Human Services, Division of Public Health, if more than 35 cubic feet, 160 square feet, or 260 linear feet of regulated ACM (RACM) is to be removed from a structure and this work must be completed by a contractor prequalified by NCDOT to perform asbestos abatement. RACM is defined in 40 CFR, Part 61, Subpart M. Note: 40 CFR 763.85 (a)(4) vi)(D) defines ACM as surfacing, TSI and Miscellaneous which does not meet the NESHAP RACM.

3.0 DEMOLITION NOTIFICATION

Even if no ACM is found (or if quantities are less than those required for a permit), a Demolition Notification (DHHS-3768) must be submitted to the HHCU. Notifications and Asbestos Permit applications require an original signature and must be submitted to the HHCU 10 working days prior to beginning demolition activities. The 10 working day period starts based on the post-marked date or date of hand delivery. Demolition that does not begin as originally notified requires submission of a separate revision form HHCU

3768-R to HHCU. Reference the North Carolina Administrative Code, Chapter 10A, Subchapter 41C, Article .0605 for directives on revision submissions.

Contact Information
Health Hazards Control Unit (HHCU)
N.C. Department of Health and Human Services
1912 Mail Service Center
Raleigh, NC 27699-1912
Telephone: (919) 707-5950
Fax: (919) 870-4808

4.0 SPECIAL CONSIDERATIONS

Buncombe, Forsyth, and Mecklenburg counties also have asbestos permitting and NESHAP requirements must be followed. For projects involving permitted RACM removals, both the applicable county and the state (HHCU) must be notified.

For demolitions with no RACM, only the local environmental agencies must be notified. Contact information is as follows:

Buncombe County
WNC Regional Air Pollution Control Agency
49 Mt. Carmel Road
Asheville, NC 28806
(828) 250-6777

Forsyth County
Environmental Affairs Department
537 N. Spruce Street
Winston-Salem, NC 27101
(336) 703-2440

Mecklenburg County
Land Use and Environmental Services Agency
Mecklenburg Air Quality
700 N. Tryon Street
Charlotte, NC 28202
(704) 336-5430

5.0 ADDITIONAL INFORMATION

Additional information may be found on N.C. asbestos rules, regulations, procedures and N.C. accredited inspectors, as well as associated forms for demolition notifications and asbestos permit applications at the N.C. Asbestos Hazard Management Program website:

https://epi.ncpublichealth.com/asbestos/ahmp.html

6.0 BASIS OF PAYMENT

Payment for the work required in this provision will be at the lump sum contract unit price for "Asbestos Assessment". Such payment will be full compensation for all asbestos inspections, reports, permitting and notifications.

MOLDED RUBBER SEGMENTAL EXPANSION JOINTS (SPECIAL)

1.0 DESCRIPTION

This work shall consist of the design and installation of a temporary joint system to protect the joint during construction, deck preparations for installing the proposed joint, including staged installation of proposed joint system as shown on the contract drawings and testing of the installed joint for water tight seal. All labor, equipment, expansion joint material and incidentals necessary for completing the tasks shall be included.

2.0 EQUIPMENT

If required, use the following surface preparation equipment:

- Power driven hand tools for removal of concrete are required that meet the following requirements:
  - Pneumatic hammers, 35 lb class.
  - Pneumatic hammer chisel-type bits that do not exceed the diameter of the shaft in width.
- Hand tools such as hammers and chisels for removal of final particles ofunsound concrete.

3.0 MATERIAL

The proposed expansion joint seal shall be *Watson Bowman Transflex reinforced elastomeric molded rubber expansion joint system Model 1300* or approved equal. The joint shall be stored in accordance with manufacturer guidelines.

The contractor shall confirm the joint opening and the joint seal manufacturer shall confirm the appropriate joint seal model, prior to ordering any materials and constructing the bridge joints. No demolition work may commence until bridge joint type and model are confirmed. Joints smaller than those shown on the Contract plans shall not be permitted without approval by the Engineer. Any changes to the detailing of the concrete deck, thickened end slab, or bent diaphragm resulting from changes in the type of joint shall be designed by the Contractor at no additional cost to the Department and submitted to the Engineer for review and acceptance prior to beginning construction.

4.0 PREPARATION FOR INSTALLATION

The surface of the concrete deck under the proposed expansion joint shall be finished to create a smooth, uniform surface parallel with the grade of the deck. This surface shall be finished to within tolerances specified by the joint manufacturer. Any such surface that does not meet the requirements of the joint manufacturer shall be repaired at no additional cost to the Department.

When concrete is cast, use a non-aluminum, 3 foot, true-to-line straight edge to check the

grade of the blockout on each side of the joint to ensure smooth transition between the two spans across the joint.

5.0 TEMPORARY JOINT INSTALLATION

The proposed final joint shall not be installed until after grinding of the bridge floor, PPC overlay surface preparation, PPC overlay placement, and grooving of the PPC Overlay. Prior to this, the Contractor shall install temporary joint at Bents 1 and 4 that permits expansion and contraction of the deck, prevents water intrusion below the deck surface, and carries vehicular traffic within acceptable serviceability limits during the various stages of construction.

The Contractor shall design and detail the temporary joint, and submit working drawings and calculations, signed by a licensed Professional Engineer in the State of North Carolina, that detail all materials, elements, and fabrication and installation methods. The Contract plans provide a schematic temporary joint for the convenience of the Contractor. This schematic does not relieve the Contractor of the responsibility to design the temporary joint. Working Drawings shall be submitted to the Engineer for review and approval in accordance with the Special Provision.

Temporary joints shall be designed to work with the concrete placed and blockouts formed that fit the final proposed joint. No modifications to the concrete will be permitted. Drilling into the proposed deck or blockout will not be permitted, except as necessary to install the final proposed joint. No welding of steel to the existing or proposed girder/floorbeam/stringer system will be permitted.

Any steel used in the joint shall by AASHTO M270 Grade 50W or as approved by the Engineer. Temporary joints shall be designed to permit movement, provide acceptable vehicular riding surface, and strength and serviceability requirements as specified in the *AASHTO LRFD Bridge Design Specifications*, latest edition, as modified and/or clarified by the North Carolina Department of Transportation Structures Management Unit *Design Manual.*

The Temporary Joint System shall be capable of being removed in stages that correspond to the Polyester Polymer Concrete overlay work. The temporary joint system shall be designed in such a way that it does not damage the finished concrete deck or blockout. Any damage shall be repaired to the satisfaction of the Engineer at no additional cost to the Department.

Temporary joints shall be adequately anchored to prevent deflection, vibration, uplift, shifting, or other aspect that would compromise the structural integrity, serviceability, and safety to vehicles, of the joint.

6.0 FINAL JOINT INSTALLATION

The final joint shall be installed immediately following the placement of the PPC overlay

during that stage of the construction. During installation of the final joint, a representative of the joint manufacturer shall be present on-site to inspect the construction operations.

The dimensions shown in the plans are for an installation temperature of approximately 60 degrees Fahrenheit and are based on the best available information of the existing structure. If the existing conditions of the structure indicate joint openings in deviation from those shown on the plans, such deviations shall be reported to the Engineer and work shall not commence for the installation of the final joint until necessary adjustments are made and, if needed, a different joint is required. If a joint different to that specified herein is required, it shall be at no additional cost to the Department.

The joint shall be installed to account for the ambient air temperature and any associated thermal expansions or contractions of the bridge deck. Tools, as allowed by the joint manufacturer, shall be utilized to compress or expand the proposed expansion joint to fit the contracted or expanded thermal state of the bridge deck. The contractor shall take special care to allow for this in the installation of the epoxy anchors.

After the joint has been installed in a stage, the joint surfaces shall be sealed to the concrete as specified by the joint manufacturer. Sealant materials and sealant placement shall be considered incidental to the cost of the joint and no separate payment will be made.

7.0 INSPECTION

The final joint shall be inspected by the Engineer at each stage prior to opening to traffic.

8.0 WATER INTEGRITY TEST

Upon completion of a portion of the expansion joint, perform a water test on the top surface to detect any leakage. Cover the roadway section of the joint portion that has been installed (generally from lane edge to curb or barrier, but for whatever portion of the seal that has been installed and completed) with water, either ponded or flowing, not less than 1 inch above the roadway surface at all points. Secure an un-nozzled water hose delivering approximately 1 gallon of water per minute to the inside face of the bridge railing, trained in a downward position about 6 inches above the deck, such that there is continuous flow of water across the deck and down the barrier rail face of the joint. Where a portion of the installed seal abuts and is spliced to a previously installed portion of the seal, a Watertight Integrity Test shall test that splice.

Maintain the ponding or flowing of water on the roadway and continuous flow across the deck for a period of 2 hours. At the conclusion of the test, the underside of the joint is closely examined for leakage. The expansion joint seal is considered watertight if no obvious wetness is visible to the Engineer.

If the joint system leaks, locate the place(s) of leakage and take any repair measures necessary to stop the leakage at no additional cost to the Department. Use repair measures recommended by the manufacturer and approved by the Engineer prior to beginning corrective work.

If measures to eliminate leakage are taken, perform a subsequent water integrity test subject to the same conditions as the original test. Subsequent tests carry the same responsibility as the original test and are performed at no extra cost to the Department.

9.0 MEASUREMENT AND PAYMENT

Molded Rubber Segmental Expansion Joints will be paid for at the contract lump sum price bid for "Molded Rubber Segmental Expansion Joints" and will be full compensation for furnishing all joint materials; all labor, materials, and equipment to install expansion joint hardware and seal and perform water integrity testing, including all materials, fabrication, and installation of temporary joints.

Pay Item	Pay Unit
Molder Rubber Segmental Expansion Joints	Lump Sum

TEMPORARY DECK DRAINAGE (SPECIAL)

1.0 DESCRIPTION

This provision covers the requirement of the Contractor to maintain deck drainage on the bridge during construction to limit hydraulic spread to shoulder areas.

2.0 HYDRAULIC SPREAD DESIGN REQUIREMENTS

At all times during construction, the contractor shall ensure that hydraulic spread is limited to shoulder areas and does not encroach into the travel lanes, except for times and locations as specifically permitted by the Engineer. For every state of construction, the Contractor shall demonstrate that hydraulic spread due to rainfall runoff will be limited to the shoulder. Such demonstrations shall include Working Drawings and calculations, signed by a professional engineer licensed in the State of North Carolina. Determination of spread shall be in accordance with the North Carolina Department of Transportation "Guidelines for Drainage Studies and Hydraulic Design", 2016, and any applicable memos or revisions.

Hydraulic spread calculations may assume 0% blocked area in any drain, slot, or scupper when calculating spread for temporary conditions. See item 4.0 below for maintenance of drains.

3.0 HYDRAULIC SPREAD CONSTRUCTION LIMITATIONS

Hydraulic spread is typically controlled by permitting gutter flow to exit the gutterline via drains, scuppers, or horizontal slots in the barrier. Such means of exit are spaced as necessary to remove water from the gutter as engineering design indicates.

The following methods may be utilized to limit spread on the deck during construction.

The existing bridge contains scuppers with deck drains at various spacings along the structure. If such existing scuppers are to be counted for deck drainage, each scupper and downspout shall be cleared of debris.

The contractor may, at the Engineer's approval, core horizontal holes through the existing concrete curb to permit drainage through the existing barrier for stages where traffic is on the existing decks.

The contractor may, at the Engineer's approval, core vertical holes through the existing deck to permit drainage through the existing deck, for stages where traffic is on the existing decks.

For construction stages where temporary barriers are placed adjacent to the existing gutterline over existing scuppers or contractor-drilled slots through the curb or contractor-drilled vertical holes through the deck, slots in the temporary barriers shall be matched to the existing scuppers. Hydraulic analysis shall demonstrate adequate capture and conveyance of runoff by the slots in the barrier and shall account for any bypass flow.

Ultimate spread during construction stages where temporary barriers are placed over existing and contractor-placed drains shall be based on whichever drain array (i.e. temporary barrier slots or deck drains) is more limiting.

When vehicular traffic is in the proposed Bay 2 Deck, slots in the temporary barriers shall permit water to sheetflow off the edge of the deck.

The proposed deck and barrier in the final-configuration left and right overhangs is shown in the Contract plans to contain vertical drains and horizontal slots through the barrier. The vertical drains as shown are permanent and are required. The horizontal slots in the barrier in the size and location as indicated are considered temporary for the duration of construction, and presented for the convenience of the contractor. These horizontal slots may be included in the Contractor's hydraulic spread analysis and design. At the Contractor's option, alternate methods for temporary drainage of the proposed deck during construction stages where the shoulder is narrowed may be proposed in the Hydraulic Spread Working Drawings. Slots through the barrier at a spacing of less than 5ft center-to-center will not be permitted. Additional vertical drains through the deck beyond those shown in the plans will not be permitted.

Vertical drains shall not discharge water within the plan limits of the bent caps plus 5ft on each side. The Contractor shall design a conveyance of any drains within those limits to connect to adjacent vertical drains. Vertical drains shall be as shown in the plans. The design shall provide a cleanout at the upstream end of a run of pipes. The design shall be submitted to the Engineer as working drawing for review and approval prior to beginning construction.

Any slots through the barriers, including those shown in the Contract plans, shall be closed at the completion of construction prior to placing of the Polyester Polymer Concrete Overlay, as detailed in the plans. Utilize epoxy material approved by the Materials and Tests Unit to close the slots.

4.0 Maintenance of Existing Deck Drains, Proposed Deck Drains, Temporary Barrier Slots, or Other Means of Draining the Deck

During all phases of construction, the Contractor shall be responsible for maintaining the free passage of water through any and all elements intended to drain the deck. Drainage elements shall be kept free of debris at all times.

5.0 Washing of the Deck Following Application of De-Icing Salts and Adverse Weather

During construction, deck runoff is not carried to below the bottom of the girders. After winter storm events where de-icing salts were applied to the deck, the Contractor temporarily plug all drainage elements and shall wash the deck with clean water and simultaneously vacuum wash water from the gutterlines to prevent wash water from leaving the deck surface. The Contractor shall make every effort to complete washing of the deck prior to the next rainfall event.

Such washing operations shall be designed to commence under a rolling road block or under lane closure as permitted by the Contract Transportation Management Plans and the Engineer. Washing operations shall not commence until after the winter storm has completed and shall be coordinated with NCDOT maintenance personnel. Washing operations may not take place during rain. Only drains in gutterlines adjacent to washing operations may be blocked temporarily, and drains must be opened to traffic immediately following the vacuuming of wash water.

Prior to construction, the Contractor shall submit to the Engineer for review and approval the methods for washing the deck, containing, and removing wash water.

6.0 MEASUREMENT AND PAYMENT

Maintenance of temporary deck drainage and hydraulic spread, maintenance of deck drainage elements during construction, and washing of the deck and containment of wash water shall be considered incidental to the construction. The Contractor shall receive no separate payment for any of these items.

TEMPORARY BARRIERS ON THE BRIDGE (SPECIAL)

1.0 DESCRIPTION

Comply with Section 1170 of the *Standard Specifications* as amended by this special provision.

Provide temporary barriers on the bridge in order to construct the bridge in a safe manner. Maintain the temporary barriers in a state of good repair throughout the duration of their use. Anchor all temporary barriers to the bridge deck.

For additional details regarding deck drainage near temporary barriers, see Temporary Deck Drainage special provision.

Temporary barriers may be moved and re-utilized at different times during the contract if they remain in good repair in the judgment of the Engineer.

Do not use water filled barriers.

2.0 MATERIALS

Contractor may use concrete or steel temporary barriers, or some combination of the two. All barriers shall be precast or prefabricated.

The base of concrete barriers shall have open areas to facilitate drainage. Open areas shall meet the following:

- Openings shall be 3" high.
- Openings shall extend for a minimum of one-third of the barrier segment length.
- Openings shall be located above existing deck drains when barriers are installed on the existing deck.
- Steel segments may be utilized to facilitate drainage and installation at deck drains, expansion joints, and transitions at bridge ends.

Steel barriers shall comply with the following:

- Barriers shall have a continuous clearance from the deck of 1¼" with intermittent supports as approved by the Engineer to allow water to flow under and across the barrier.
- Steel shall be galvanized in accordance with ASTM A123.
- Barrier width shall be a maximum of 2'-0" at the base.
- Barriers shall be approved by the Engineer.

Anchor barriers to the deck utilizing ASTM A325 high strength threaded bolts or ASTM F1554 threaded rods using an adhesive bonding system approved by NCDOT Materials and Tests Unit.

Exposed steel that projects from concrete barriers shall be galvanized in accordance with ASTM A123.

3.0 DESIGN CRITERIA

Submit design calculations and plans sealed by a professional engineer licensed in North Carolina for review by the Engineer. Submit shop drawings showing installation details and geometry. Include installation schedule and traffic control methods in the shop drawings.

All temporary barriers shall be crash tested TL-3 barriers in accordance with National Cooperative Highway Research Program Report 350.

Lateral deflection shall be 1" or less at the top of the temporary barrier under TL-3 loading.

Lateral deflection shall be zero at the base of the temporary barriers under TL-3 loading.

Temporary barriers shall weigh a maximum of 410 pounds per linear foot.

Temporary rails shall have a parapet geometry with a continuous uniform face. Do not place openings in the barrier, unless specifically authorized for drainage or barrier segment connections.

Do not extend barriers across expansion joints. Design and detail a joint in the barrier at the expansion joints.

Do not block deck drains with temporary barriers.

Do not outboard mount barriers on the edge of the concrete deck.

Do not anchor a single barrier segment on two sides of an expansion joint.

Contractor shall design temporary barriers in Stage I construction to resist loading without the aid of the existing concrete overhang curb and parapet as support. When the concrete overhangs are removed in Stage IB, barriers shall resist applied loading. Contractor may place additional bracing or supports for the barriers.

4.0 INSTALLATION

Install barriers within the guidelines allowed by the Transportation Management Plans.

Utilize a minimum of two anchor points per barrier segment.

Do not touch or impact steel elements of the existing bridge to install the barriers. This includes anchoring, welding, drilling holes, or other impacts. All connections and anchoring shall be made to the concrete elements of the existing and proposed bridge.

Do not block existing deck drains with temporary barriers.

5.0 MEASUREMENT AND PAYMENT

Temporary barriers at the bridge deck shall be included in the Traffic Management pay items for "Portable Concrete Barrier (Anchored)" and Reset Portable Concrete Barrier (Anchored)." For additional information, see Traffic Management Plans and Section 1170 of the Standard Specifications. No separate payment shall be made for utilizing steel barriers, as this substitution shall be considered incidental to the pay items.

GANTRY CRANE (SPECIAL)

1.0 DESCRIPTION

The Contractor may utilize a gantry crane running along the existing overhangs at girders 2 and 3. The contractor may utilize other means and methods to construct the bay 2 portions of the bridge.

2.0 DESIGN CRITERIA

Submit design calculations demonstrating the existing overhang can support the loading of the gantry crane and the weight of 1.5 times the heaviest required pick.

Submit working drawings showing all installation details and geometry.

The self-weight of the gantry crane and guide rails shall be included within the 50 psf allowable construction loading.

Contractor shall account for wind loading and other possible loadings on the gantry.

3.0 INSTALLATION & STORAGE

Utilize tracks, rails, or guides to support and align the gantry along the bridge. Design the supports to allow for differential or uniform deflections along the two bridges. Design the supports to prevent lateral movement of the gantry wheels, and prevent the wheels from slipping off of the overhang or into the traffic lanes.

Store the crane at the end of the bridge at the end of each work day. Do not leave the gantry crane unattended on the bridge.

Contractor may operate a maximum of 2 gantry cranes on the bridge at a time. Contractor shall use caution not to exceed the loading limit and shall keep the cranes separated by a sufficient distance in order to prevent overstress in the bridge.

No component of the crane shall be permitted to pass beyond the non-traffic face of the nearest barrier.

4.0 MEASUREMENT AND PAYMENT

No separate payment shall be made for the gantry crane, tracks, rails, installation, or storage as it is considered incidental to the various pay items in the work.

ALL-LIGHTWEIGHT CONCRETE (SPECIAL)

1.0 GENERAL

Use All-Lightweight Concrete in the reinforced concrete deck slab in Spans B through D (except at piers 1 and 4 closure pours) as shown on the Contract Plans. Use All Lightweight Concrete in the Concrete Barrier Rails and Concrete Median Barrier along the full length of the bridge and approach slabs as shown on the Contract Plans. All-lightweight concrete is composed of cement, lightweight fine aggregate, lightweight coarse aggregate, water, and admixtures. Lightweight concrete mixtures shall be proportioned using ACI 211.2, "Standard Practice for Selecting Proportions for Structural Lightweight Concrete," and may be produced using conventional admixtures and standard batching procedures and equipment.

Provide All-Lightweight Concrete that complies with the requirements of the 2018 *Standard Specifications* for Class AA normal weight concrete, with exceptions as noted in this special provision.

Include polyolefin fibers in the mix for the deck in Spans B through D. The concrete for the barrier rails and the median barriers does not require fiber reinforcement.

Design a lightweight, durable concrete mix and submit to the Engineer for review.

Install concrete in accordance with the principles stated in ACI 345.2R-13 and ACI 345R-11. Place the concrete in each bay during construction and cure the concrete. Place closure pours between each bay. Place and cure concrete in an efficient manner.

Prevent spalls, cracks, or damage from occurring in the hardened concrete due to weather, differential deflections, live load vibrations, or other factors.

Construct concrete barrier rail and concrete median barrier rail in accordance with section 460 of the *Standard Specifications*, while utilizing all lightweight concrete material as noted in this specification.

2.0 MATERIALS

The maximum plastic density of the concrete shall be 105 pounds per cubic foot (pcf), and the maximum hardened density shall be 100 pcf. The contractor may utilize a maximum plastic density larger than 105 pcf, but shall compensate for the weight above 105 pcf by reducing the 50 psf construction allowance by an equivalent loading during concrete placement until the concrete has cured. Contractor shall submit plastic density and allowable construction loading with concrete mix design.

Contractor shall minimize slump while maintaining pumpability and workability of the mix. Use a maximum slump of 3" after deposition from the concrete pump.

The concrete in the bridge deck shall contain fly ash or ground granulated blast furnace slag at the substitution rate specified in Article 1024-1 and in accordance with Articles

1024-5 and 1024-6 of the *Standard Specifications*. No payment will be made for this substitution as it is considered incidental to the cost of the Fiber Reinforced Concrete Deck Slab (All-Lightweight Concrete).

Use a maximum water/cement ratio of 0.4.

Modulus of elasticity shall be a minimum of 2500 ksi at 28 days. The modulus of elasticity may be measured with the prescribed fiber dosage in the concrete mix.

28-day compressive strength shall be a minimum of 4.5 ksi.

Splitting tensile strength without fibers shall be a minimum of 0.5 ksi measured according to ASTM C496. Splitting tensile strength may be laboratory tested for confirmation of design values and is not required for acceptance of field cast specimens.

Concrete 28-day flexural strength without fibers shall be a minimum of 550 psi when measured in accordance with ASTM C78.

Use a well graded aggregate with continuous distribution of particle sizes, with a maximum size of ¾".

Internally cure the concrete mix by utilizing aggregate conforming to ASTM C1761. Consult with the aggregate supplier to determine the optimal pre-dampening of aggregate in the mix. Utilize saturated surface dry aggregate or other moisture condition based on the recommendations of the supplier and concrete mix designer. Account for absorbed water in the mixture proportioning procedure.

3.0 FIBER REINFORCEMENT

Use macrosynthetic fibers in the all-lightweight concrete mix for the deck concrete in spans B through D.

Use fibers that conform to the following:

- Fibers shall be 2¼" long.
- Fibers shall be made of virgin polyolefins conforming to ASTM D7508 and ASTM C1116 Type III.
- Fibers shall have a minimum tensile strength of 50 ksi when tested in accordance with ASTM D3822 and a minimum modulus of elasticity of 400 ksi when tested in accordance with ASTM D3822.
- Dosage shall be 4 pounds of fibers per cubic yard of concrete.
- Use microfibers pre-blended with the macrofibers. Within the 4 LB/CY fiber dosage, substitute fibrillated polypropylene microfibers at a rate of 6.25% to 12.5% by weight, or at a rate approved by the Engineer.
- Crack reduction ratio shall be 85% or greater when measured according to ASTM C1579.

Observe the following for batching and mixing the concrete:

- Assume full responsibility for the mix proportioning.

- Adjust the mix design as required for yield, workability, air content, and unit weight.
- Obtain a good blend of fibers within the concrete mix and prevent fiber balling.
- Add the fibers slowly and progressively to a rotating drum with concrete in the drum. Do not add fibers as the first ingredient of the mix.
- Fiber packaging shall not be allowed in the concrete mix, unless approved by the Engineer.

Observe the following for placing and finishing concrete:

- When pumping concrete, use a grate equipped with a working vibrator that has round bars that are 1.5" in diameter, +/- 0.5".
- Manual movement of the concrete shall be handled by a hoe-like tool. Do not use a tined rake for moving or placing the concrete.
- Do not apply water to the top surface of the deck for finishing.
- Tine the deck surface in accordance with section 710-6 of the standard specifications, except do not use a burlap drag prior to tining the surface.
- Hold tines at a small angle relative to the horizontal surface to prevent lifting and exposing fibers.
- Pull the tool used to tine the deck in one direction only. Do not pull the tool in the opposite direction or across the established pattern.

4.0 CHANGES TO THE STANDARD SPECIFICATIONS

Add the following at the beginning of **Section 1000-4 – PORTLAND CEMENT CONCRETE FOR STRUCTURES AND INCIDENTAL CONSTRUCTION, (A) Composition and Design:**

Provide All-Lightweight Concrete that meets all requirements for the "Sand Lightweight" concrete mixture that appears in Table 1000-1 "Requirements for Concrete," with the following additional requirements:

Maximum Plastic Density.....105 lbs/ft^3
Maximum Approximate Calculated Equilibrium (E_c) Density.....100 lbs/ft^3

The contractor may utilize a maximum plastic density larger than 105 pcf, but shall compensate for the weight above 105 pcf by reducing the 50 psf construction allowance by an equivalent loading during concrete placement until the concrete has cured. Contractor shall submit plastic density and allowable construction loading with concrete mix design.

Add the following sentence to the third paragraph of the same section:

When submitting the mix design, include the source of the aggregates, cement and admixtures and the gradation, SSD specific gravity and fineness modulus (fine aggregate only) of the aggregates.

Replace the fourth paragraph of the same section with the following:

Accompany Materials and Tests Form 312U with a listing of laboratory test results of aggregate gradation, air content, slump, density and compressive strength. List the compressive strength of at least three 6" x 12" or 4" x 8" cylinders at the ages of 7 and 28 days.

Replace the fifth paragraph and list of laboratory tests in the same section with the following:

Perform laboratory tests in accordance with the following test procedures:

Property	**Test Method**
Aggregate Gradation	AASHTO T227
Air Content	AASHTO T152 – For normal weight concrete
	AASHTO T196 – For lightweight concrete
Slump	AASHTO T119
Compressive Strength	AASHTO T23 and T22
Density	AASHTO T121 and ASTM C567

Add the following as a third paragraph to **Section 1000-4 PORTLAND CEMENT CONCRETE FOR STRUCTURES AND INCIDENTAL CONSTRUCTION, (B) Air Entrainment:**

AASHTO T152 shall not be used for determining the air content of concrete mixtures containing lightweight aggregate. Determine air content at the point of concrete placement.

Add the following sub-sections to **Section 1000-4 – PORTLAND CEMENT CONCRETE FOR STRUCTURES AND INCIDENTAL CONSTRUCTION:**

(L) Density

Determine the plastic density (unit weight) of lightweight concrete in accordance with AASHTO T121or ASTM C138. If ASTM C138 is utilized, use a 0.5 cubic foot measure calibrated in accordance with ASTM C29.
Determine the approximate calculated equilibrium density (unit weight, E_c) of lightweight concrete in accordance with ASTM C 567-19 by measuring the oven-dry density (O_m) of a minimum of three 6"x12" cylindrical specimens in accordance with section 8.3 and calculating the approximate equilibrium density (E_c) in accordance with section 9.2 by adding 3pcf to the oven-dry density.

Perform density tests for acceptance of lightweight concrete after final corrections for entrained air and slump have been made. When a density test is made and the results of the test exceed the specified maximum, a check test is made immediately from the same batch or truck load of concrete. If the average of the 2 test results exceeds the specified maximum density, the batch or truck load that contains the batch is rejected.

(M) Moisture

Ensure that lightweight aggregate has an absorbed moisture content equal to the 24 hours absorption as determined by AASHTO T84 or T85 when it is proportioned and incorporated into the mix. Consult with the lightweight aggregate supplier regarding minimum absorption required for proper performance of aggregate in concrete mixtures.

(N) Resistance of Concrete to Rapid Freezing and Thawing

Conduct testing according to AASHTO T161, Procedure A, as modified by AASHTO M195.
Provide lightweight concrete with a minimum relative dynamic modulus of 80 percent.

Add the following paragraph to **Section 1005-1 – General:**

Conduct testing according to AASHTO T161, Procedure A, as modified by AASTHO M195. Provide lightweight concrete with a minimum relative dynamic modulus of 80 percent.

Add the following paragraph to **Section 1005-2 – Handling and Storing Aggregates**:

Ensure that lightweight aggregate has an absorbed moisture content equal to the 24 hours absorption as determined by AASHTO T84 or T85 when it is proportioned and incorporated into the mix. Consult with lightweight aggregate supplier regarding minimum absorption required for proper performance of aggregate in concrete mixtures.

Add the following paragraph to **Section 1005-3 – GRADATION**:

Grade standard sizes of lightweight aggregate to meet the requirements of AASTHO M195. In addition to these requirements, lightweight fine aggregate shall conform to the 2MS gradation and other requirements shown in Table 1005-2.

Add the following paragraph to **Section 1005-4 – Testing, (A) General**:

For lightweight aggregate, test the aggregate using the AASHTO T96 test method as modified by the Department.

Insert the following paragraph after the second paragraph of **Section 1014-1 – Fine Aggregate, (A) General**:

Where use of lightweight aggregate is specified to reduce the density of concrete, use expanded shale or slate lightweight aggregate that meets the requirements of AASHTO M195 in addition to the applicable requirements of this section. Ensure that lightweight aggregate has an absorbed moisture content equal to the 24 hours absorption as determined by AASHTO T84 or T85 when it is proportioned and incorporated into the mix. Consult with lightweight aggregate supplier regarding minimum absorption required for proper performance of aggregate in concrete mixtures.

Replace the existing paragraph in **Section 1014-1 – Fine Aggregate, (F) Gradation,** *with the following:*

Natural sand shall meet the gradation requirements for standard size No. 2S fine aggregate. Manufactured sand and lightweight fine aggregate shall meet the gradation requirements for standard size No. 2MS fine aggregate.

Add the following sub-section to **Section 1014-1 – Fine Aggregate:**

(H) Shrinkage

For lightweight aggregate, produce an additional mixture in accordance with AASHTO M195 to determine the drying shrinkage for qualification of the aggregate. Use lightweight aggregate that provides a maximum drying shrinkage for this mixture of 0.07%.

Insert the following paragraph after the second paragraph into **Section 1014-2 – Coarse Aggregate, (A) General:**

Where use of lightweight aggregate is specified to reduce the density of concrete, use expanded shale or slate lightweight aggregate that meets the requirements of AASHTO M195 in addition to the applicable requirements of the section. Ensure that lightweight aggregate has an absorbed moisture content equal to the 24 hours absorption as determined by AASHTO T84 or T85 when it is proportioned and incorporated into the

mix. Consult with lightweight aggregate supplier regarding minimum absorption required for proper performance of aggregate in concrete admixtures.

Insert the following paragraph after the first paragraph in **Section 1014-2 – Coarse Aggregate, (D) Resistance to Abrasion:**

For lightweight aggregate, test the aggregate using the AASHTO T96 test method as modified by the Department.

Replace the sixth paragraph in **Section 1014-2 – Coarse Aggregate, (E) Aggregate Sizes** *with the following:*

(6) Lightweight Aggregate
Use standard aggregate sizes specified in AASHTO M195

Add the following sub-sections to **Section 1014-2 – Coarse Aggregate:**

(F) Gradation

All coarse aggregate shall meet the gradation requirements for the standard size used, except lightweight aggregate shall meet the gradation requirements of AASHTO M195

(G) Shrinkage

For lightweight aggregate, produce an additional mixture in accordance with AASHTO M195 to determine the drying shrinkage for qualification of the aggregate. Use lightweight aggregate that provides a maximum drying shrinkage for this mixture of 0.07%.

Add the following paragraph to **Section 420-4 Placing Concrete:**

The Contractor shall procure a representative from the manufacturer of the lightweight aggregate to provide technical assistance in the production of the lightweight concrete at the batch plant and/or site for the first day of lightweight concrete mixing and placement operations.

Replace **Section 420-6 – Slump Tests** *with the following*:

420-6 Testing

(A) Slump

The slump of the concrete is determined in accordance with AASHTO T119.
When a slump test is made and the results of the test exceed the specified maximum, a check test is made immediately from the same batch or truck load of concrete. If the average of the two test results exceeds the specified maximum slump, the batch or truck load that contains the batch is rejected.

(B) Density (Unit Weight)

Determine the plastic density (unit weight) of lightweight concrete in accordance with AASHTO T121.
Determine the equilibrium (air-dry) density (unit weight) of lightweight concrete in accordance with ASTM C567.
Perform density tests for acceptance of lightweight concrete after final corrections for entrained air and slump have been made. When a density test is made and the results of the test exceed the specified maximum, a check test is made immediately from the same batch or truck load of concrete. If the average of the 2 test results exceeds the specified maximum density, the batch or truck load that contains the batch is rejected.

Replace the second paragraph in **Section 420-14 – Placing and Finishing Bridge Decks (A) Placing Concrete** *with the following*:

When noted on the plans, use all-lightweight concrete conforming to the requirements of the Special Provisions and Section 1000.

5.0 INSTALLATION

Submit to the Engineer for review a thorough plan for batching, delivering, pumping, installing, and curing deck concrete while traffic is on the bridge. Include schedule and plan details for each pour in the sequence. Include number of trucks and batches, truck schedules, plant location, pour rates, set times, cure times, pumping methods, equipment, and finishing methods.

Place concrete within allotted time shown in table 1000-2 for Class AA concrete, or more rapidly as required by the mix design.

The contractor's attention is brought to the fact that the bridge vibrates under live load. The contractor shall place and cure the deck in a manner that prevents excessive cracks from occurring in the deck for any reason, as determined by the Engineer.

Place the concrete between the hours of 10 pm and 4 am in order to minimize the live load vibrations on the bridge during curing. Stage operations and prepare so that placement operations begin promptly at 10 pm. Cancel operations for the night if operations do not begin by 11 pm.

Create a 10'-0" x 10'-0" x 7.25" thick mockup of the deck in spans B-D prior to pouring making any Stage I deck pours in spans B-D. Pour and cure the fiber reinforced all-lightweight concrete mockup in the allotted time frame. Tine the mockup in accordance with section 710-6 of the Standard Specifications and demonstrate batching, placing, and curing methods specified in the contract to the approval of the Engineer. If the initial mockup is un-satisfactory in the judgment of the Engineer, create additional mockups in order to demonstrate the capability of completing the deck construction in Spans B-D.

Place normal weight concrete in spans A and E (including approach slabs) prior to placing all-lightweight concrete in spans B-D. Contractor may stage pouring of spans B-D from spans A and E once the concrete has achieved the specified 28 day compressive strength with the approval of the Engineer.

Avoid the transfer of vibrations across the deck from cast concrete into wet concrete. Do not connect transverse reinforcing steel across closure pours until after the concrete on both sides of the closure have achieved a concrete strength of 3 ksi.

Contractor may use a volumetric mixer to batch the concrete on site with the approval of the Engineer.

6.0 MEASUREMENT AND PAYMENT

Fiber Reinforced Concrete Deck Slab (All-Lightweight Concrete) will be measured and paid as the number of square feet shown on the plans. This shall include all work necessary for the finished in place deck slab to comply with this special provision, the plans, and the *Standard Specifications* as amended by this provision. No separate payment will be made for furnishing and installing reinforcement, truck detours, couplers, staging, or formwork. No measurement or additional payment will be made for concrete, reinforcing steel, or shear studs due to a variation in camber of the girders from the assumed design camber or for additional quantities required by optional methods of forming.

Pay Item	**Pay Unit**
Fiber Reinforced Concrete Deck Slab (All-Lightweight Concrete)	Square Foot

43" high x 1'-6" wide *Concrete Barrier Rail* will be measured and paid for as the number of linear feet of concrete barrier rail provided on the plans. This shall include all work necessary for the finished in place rail to comply with this special provision, the plans, and the *Standard Specifications* as amended by this provision.

Pay Item	Pay Unit
Concrete Barrier Rail (All-Lightweight Concrete)	Linear Foot

33" high x 2'-0" wide *Concrete Median Barrier* will be measured and paid for as the number of linear feet of concrete barrier rail provided on the plans. This shall include all work necessary for the finished in place rail to comply with this special provision, the plans, and the *Standard Specifications* as amended by this provision.

Pay Item	Pay Unit
Concrete Median Barrier (All-Lightweight Concrete)	Linear Foot

MECHANICAL COUPLERS (SPECIAL)

1.0 DESCRIPTION

Use mechanical couplers in the bridge deck to provide reinforcement continuity at the edges of Stage I construction and the closure pour. Use mechanical couplers to connect the median barrier to the deck.

2.0 MATERIALS

Forge the coupler from deformed rebar material, free of external welding. Furnish with an integral nailing flange and threaded with UNC or UN thread to a depth equal to the nominal thread diameter, at a minimum.

Stage I couplers and flanges shall be galvanized in accordance with ASTM A767.

The dowel-in bar shall be fabricated from deformed rebar material with thread corresponding to the coupler.

Utilize ASTM A615 Grade 60 material for dowel bars and couplers.

At Stage Joints, Female threaded coupler with flange and integral reinforcement shall be Dayton Superior Model D101A or approved equal. Male threaded coupler with integral reinforcement shall be Dayton Superior Model D101 or approved equal.

At median barrier, couplers shall be Deyton Superior Model D310 or approved equal.

Male and female couplers and integral reinforcement lengths shall be of the same size, shape, and epoxy coating designation as indicated in the bar details. Male and female couplers shall be from the same manufacturer.

The contractor shall submit working drawings for the coupler system for all couplers. The contractor shall be responsible for ensuring that male and female threads match prior to installation and will be responsible for any additional cost associated with matching threads.

3.0 DESIGN CRITERIA

Couplers shall be engineered and tested to develop 1.25 times the yield strength of the bar.

4.0 INSTALLATION AT STAGE JOINTS

Utilize couplers with flanges in stage I construction and securely fasten the flanges to the formwork at the edge of the deck. Maintain clear cover from the top of the deck to the flange of 2" and from the bottom of the deck to the flange of 1". Prevent concrete and slurry from entering the open end of the coupler during concrete placement.

Protect the couplers from corrosion after forming and pouring Stage I. Fill the open end of the coupler with a stamped metal plug to prevent water intrusion and corrosion until the dowel is threaded into the coupler.

Do not install dowel-in bars in the closure pour until after the deck in Stage II or III has been poured and reached a minimum compressive strength of 3,000 psi.

5.0 INSTALLATION AT MEDIAN BARRIER

Utilize male-threaded hooked bars with standard double-ended female threaded couplers to anchor the median barrier to the deck as indicated in the plans. The bar pairs shall be delivered to the site loosely connected. Ensure that threads are greased to facilitate easy removal of the non-embedded bar after installation into the deck.

Install the bar pairs into the deck by pushing into green concrete. Place the bars so that the top of the plug will be flush with the finished surface of the concrete.

Once the concrete has cured, unthread the top-half bar and set aside. The Contractor shall ensure the bar will re-thread when constructing the median barrier.

Immediately after unthreading the top-half bar, fill the open end of the coupler with a threaded cap bolt and seal with silicone to prevent water intrusion and corrosion until the top-half bar is re-threaded later during construction. The system shall be installed such that the coupler, cap bolt, and any sealing silicone does not protrude beyond the finished surface of the concrete deck.

The Contractor shall submit a system for temporarily sealing the exposed top side of the coupler by use of a cap bolt.

6.0 MEASUREMENT AND PAYMENT

No separate payment shall be made for the mechanical couplers or dowel bars, but payment shall be included in the "Reinforced Concrete Deck Slab" pay item for couplers and dowels in spans A, E, and approach slabs at the stage joints; and payment shall be included in the "Reinforced Concrete Deck Slab (All Lightweight Concrete)" pay item for couplers and dowel bars in spans B through D at the stage joints.

The additional weight due to the coupler is considered incidental to the weight of the reinforcing.

Couplers for the median barrier shall be included the "Concrete Median Barrier (All-Lightweight Concrete)" pay item.

OVERLAY SURFACE PREPARATION FOR POLYESTER POLYMER CONCRETE (SPECIAL)

1.0 DESCRIPTION

This provision addresses the surface preparation activities required prior to the placement of polyester polymer concrete (PPC).

Work includes: removal of unsound bridge deck concrete as directed by the Engineer; preparation of repair areas prior to placement of PPC bridge deck repair material; bridge deck surface preparation prior to placement of PPC overlay; and any incidentals necessary to prepare the bridge deck for placement of PPC repair material or PPC overlay, as specified or as shown on the plans.

2.0 DEFINITIONS

Shotblasting shall consist of steel beads (or other materials as approved by the Engineer) "shot" out of a machine onto the bridge concrete deck concrete floor to remove soft or deteriorated concrete, and to clean the concrete deck surface for the application of the PPC overlay. Contractor shall vary the speed of the shotblaster or make multiple passes, as necessary, to achieve the required surface preparation for the PPC overlay. Areas inaccessible with shotblasting equipment may require surface preparation with sandblasting equipment and hand equipment.

3.0 EQUIPMENT

All equipment for cleaning the existing concrete surface and mixing and applying the overlay system shall be in accordance with the System Provider's recommendations, as approved by the Engineer prior to commencement of any work:

- Shotblasting and sandblasting equipment to adequately prepare the bridge deck substrate, as required in this provision. Provide equipment to supply oil-free and moisture-free compressed air for final surface preparation.
- Equipment capable of sawing concrete to the specified plan depth.
- Power driven hand tools for removal of unsound concrete are required that meet the following requirements:
  - Pneumatic hammers weighing a nominal 15 lbs. or less.
  - Pneumatic hammer chisel-type bits that do not exceed the diameter of the shaft in width.
- Hand tools, such as hammers and chisels, for removal of final particles of unsound concrete.
- Self-propelled vacuum capable of picking up dust and other loose material from prepared deck surface.
- Equipment to supply oil-free and moisture-free compressed air for final surface preparation.

The equipment must operate at a noise level less than 90 decibels at a distance of 50 feet.

4.0 MANAGEMENT AND DISPOSAL OF CONCRETE DEBRIS

All concrete debris shall become the property of the Contractor. The contractor shall be responsible for disposing of all debris generated by scarification, shotblasting, sandblasting, and any other surface preparation operations, in compliance with applicable regulations concerning such disposal.

All costs associated with management and disposal of all debris shall be included in the payment of other items.

5.0 OSP PLAN SUBMITTAL

Prior to beginning surface preparation activities, the Contractor shall submit for review and approval the Overlay Surface Preparation (OSP) Plan. The OSP Plan shall detail the type of equipment that is intended to be used and the means by which the Contractor will achieve the following requirements:

- Measure depth of scarification to show completed within limits.
- Measure depth of shotblasting to show completed within limits.

6.0 SURFACE PREPARATION

Prior to any construction, take the necessary precautions to ensure debris from bridge deck preparation and repairs is not allowed to fall below the bridge deck.

The Engineer shall be responsible for inspecting the bridge deck to determine which areas require Class II surface preparation. These repairs shall be incidental to the cost. Remove any unsound concrete to the satisfaction of the Engineer in accordance with this provision.

During surface preparation, precaution shall be taken to assure that traffic is protected from rebound, dust, and construction activities. Appropriate shielding shall be provided as required and directed by the Engineer. During surface preparation, the Contractor shall provide suitable coverings, as needed to protect all exposed areas not to receive overlay, such as the concrete barriers, median barrier, drains, etc. All damage or defacement resulting from surface preparation shall be repaired to the Engineer's satisfaction at no additional cost.

A. Sealing of Bridge Deck: Seal all expansion joints subject to run-off water from the shotblasting and PPC placement process with material approved by the Engineer, prior to beginning any demolition. The expansion joints shall remain sealed until it has been determined that water and materials from the scarification, shotblasting, and PPC placement operations cannot be discharged through them any longer. Take all steps necessary to eliminate the flow of water or materials through the expansion joints, and any other locations water or materials could leak from the deck.

   All deck drains in the immediate work area and other sections of the bridge affected by the work being performed shall be sealed prior to beginning scarification. Drains shall remain sealed until it has been determined by the Engineer that water and materials from the shotblasting and PPC placement operations cannot be discharged through them any longer.

B. Class II Surface Preparation (Partial Depth): At locations identified by the Engineer for Class II Surface Preparation, remove by chipping with hand tools all unsound concrete.

Thoroughly clean the newly exposed surface to be free of all grease, oil, curing compounds, acids, dirt, or loose debris in accordance with this special provision.

Dispose of the removed concrete, clean, repair or replace rusted or loose reinforcing steel, and thoroughly clean the newly exposed surface. Care shall be taken not to cut, stretch, or damage any exposed reinforcing steel.

In overhangs, removing concrete areas of less than 0.60 ft^2/ft length of bridge without overhang support is permitted unless the Engineer directs otherwise. Overhang support is required for areas removed greater than 0.60 ft^2/ft length of bridge. Submit details of overhang support to the Engineer for approval prior to beginning the work.

C. Preparation of Reinforcing Steel: Any damaged reinforcing shall be repaired to the satisfaction of the Engineer at no additional cost to the Department. Remove concrete as directed by the Engineer without cutting or damaging existing steel. Clean, repair, or replace rusted or loose reinforcing steel. Damaged reinforcing steel, such as bars with nicks deeper than 20% of the bar diameter, shall be repaired or replaced. Reinforcing steel which has a cross section reduced to 75% or less shall be replaced with new reinforcing steel of similar cross section area. Loose reinforcing shall be considered reinforcing which is not bonded to the surrounding concrete for a continuous distance of over ½ inch or a total of 3inches with any 5inch portion. Replacement bars shall be Grade 60 and meet the material requirements of Section 1070 of the Standard Specifications. Replacement bars shall be spliced to existing bars using either minimum 30 bar diameter lap splices to existing steel with 100% cross sectional area or approved mechanical connectors.

For reinforcing steel left unsupported by the concrete removal process, support and protect the exposed reinforcing steel against displacement and damage from loads, such as those caused by removal equipment and delivery buggies. All reinforcing steel damaged or dislodged by these operations shall be replaced with bars of the same size at the contractor's expense following the replacement criteria outlined above.

Reinforcing steel exposed and satisfactorily cleaned and prepared will not require additional cleaning, if encased in concrete within seven (7) days. Rebar exposed for more than seven (7) days shall be satisfactorily cleaned and prepared, prior to placement of the new concrete. The satisfactory cleanliness and preparation of the reinforcing steel shall be determined by the Engineer.

When large areas of the deck on composite bridges are removed resulting in the debonding of the primary reinforcing bars, the removal shall be performed in stages to comply with the construction sequence shown on the plans or as directed by the Engineer.

D. Concrete Deck Repair: Repair and fill the Class II surface preparation areas of the existing bridge concrete deck prior to the final surface preparation and application of the PPC overlay, at locations shown in the plans, or as determined by the Engineer, if necessary. Materials other than PPC may be used for concrete deck repairs, but shall be

approved by the PPC System Provider's Technical Representative and shall be applied and prepared as required by the PPC System Provider. For concrete deck repairs with PPC:

- removal and surface preparation of the repair area shall be in accordance with and shall be paid for under pay items in this special provision.
- materials, equipment, placement, and finishing of PPC used for concrete deck repairs shall meet the requirements of and shall be paid for under pay items in the Polyester Polymer Concrete Bridge Deck Overlay special provision.

PPC repair material may be placed up to one (1) hour prior to overlay placement.

All repairs shall be placed and finished to match substrate deck grade prior to PPC placement, in order to provide a uniform overlay thickness.

Concrete deck repairs with PPC may be utilized as a stand-alone item where required on structures not to receive a PPC overlay.

E. Surface Cleaning: The surface of concrete substrate and repaired areas shall be prepared for application of the overlay by shotblasting in order to remove all existing grease, slurry, oils, paint, dirt, striping, curing compound, rust, membrane, weak surface mortar, or any other contaminants that could interfere with the proper adhesion of the overlay system. The final prepared surface shall adhere to the following requirements:

1. Expansion joints shall be protected from damage from the shotblasting operation. Deck drains and areas of barrier above the proposed surface shall be protected from the shotblasting operation.
2. The areas to receive overlay shall be cleaned by shotblasting, or abrasive sandblasting in the event that the shotblaster cannot access areas to be prepared. Do not begin shotblasting until all grinding or milling operations are completed. Cleaning shall not commence until all work involving the repair of the concrete deck surface has been completed and the deck is dry. All contaminants shall be picked up and stored in the vacuum unit and no dust shall be created during the blasting operation that will obstruct the view of motorists in adjacent roadways. The travel speed and/or number of passes of the shotblasting unit shall be adjusted, so as to result in all weak or loose surface mortar being removed, aggregates within the concrete being exposed, and open pores in the concrete exposed, as well as a visible change in the concrete color. Cleaned surfaces shall not be exposed to vehicular traffic unless approved by the Engineer. If the deck becomes contaminated before placing the overlay, the Contractor shall shotblast or abrasive sandblast the contaminated areas to the satisfaction of the Engineer at no additional cost.
3. Prior to the overlay placement, any loose particles shall be removed by magnets and oil free compressed air and vacuuming, such that no trapped particles remain. Power washing will not be allowed.
4. The areas to be overlaid shall be blown off with oil and moisture free compressed air just prior to placement of the primer and shall be completely dry.

5. Cleaning methods other than those detailed by specification may be suggested by the PPC System Provider and approved by the Engineer.
6. All steel surfaces that will be in contact with the PPC overlay shall be cleaned in accordance with SSPC-SP No. 10, Near-White Blast Cleaning, except that wet blasting methods shall not be allowed.

F. Safety: Provide a containment system for handling expected and unexpected blow thru of the deck. The containment system shall retain runoff water and debris and protect the area under the bridge deck. The Contractor shall be responsible for any injury or damage caused by these operations. The containment system shall remain in place until the concrete has been cast and attained minimum strength.

Provide adequate lighting when performing deck preparation activities at night. Submit a lighting plan to the Engineer for approval prior to beginning work.

7.0 BASIS OF PAYMENT

Shotblasting Bridge Deck will be measured per square yard and paid for at the contract unit price bid per square yard and will be full compensation for the shotblasting and necessary sandblasting and handwork to prepare the entire concrete bridge deck, and removal and disposal of all waste material generated.

Class II Surface Preparation will be incidental to the cost of construction and no separate payment will be made for this work.

POLYESTER POLYMER CONCRETE BRIDGE DECK OVERLAY (SPECIAL)

DESCRIPTION

This work consists of furnishing and placing a Polyester Polymer Concrete (PPC) overlay system with a High Molecular Weight Methacrylate (HMWM) resin primer on concrete surfaces. The surface of the concrete shall be prepared and the PPC overlay system shall be applied in accordance with this special provision in conformity with the lines, grades, thickness, and typical cross-sections shown on the plans or as approved by the Engineer. Unless specifically mentioned below, all requirements specified for the bridge deck are also required for the approach slabs.

Work includes: placement of HMWM primer; placement of PPC surface patching and/or overlay; and any incidentals necessary to complete the project as specified or as shown on the plans.

The System Provider is the manufacturer that will provide the PPC system for the PPC overlay. The System shall include the necessary and appropriate PPC components, as well as the necessary and appropriate HMWM resin primer components. Contractor shall not change System Provider during project, without approval from the Engineer.

QUALIFICATIONS AND SUBMITTALS

The Contractor shall submit the following requested items and any other relevant documents at least two (2) weeks prior to the PPC Overlay Pre-placement Conference. These submittals are for approval and shall be directed to the Engineer.

(A) Overlay System: The Contractor shall submit two (2) copies of the System Provider's material information, written installation instructions, safety data sheets, and independent test results for approval.

(B) System Provider Qualifications: The Contractor shall install an overlay system with all components provided through a single System Provider with documented experience successfully supplying at least five (5) PPC overlay projects of similar size and scope within the past five (5) years. The Contractor shall submit documentation of the System Provider's project experience including the following:

(1) Project Location.
(2) Owner Agency.
(3) Project construction date.
(4) Overlay quantities.
(5) Reference name and contact information for owner representative.

(C) Contractor Qualifications: The Contractor shall submit documentation of successful projects placing structural concrete bridge decks, modified concrete bridge deck overlays, or PPC overlay systems to finished grade using similar equipment as specified herein within the past five (5) years. A minimum of two (2) employees on site must have the equivalent work experience qualifications of the Contractor The documentation of Contractors qualifications shall include the following:

(1) Project Location.
(2) Owner Agency.

(3) Project construction date.
(4) Overlay quantities.
(5) Reference name and contact information for owner representative.

(D) System Provider Technical Representative Qualifications: The System Provider Technical Representative shall have a minimum of five (5) years of experience with PPC and be completely competent in all aspects of the work, including surface preparation, mixing, placement, curing, and testing of the PPC Overlay System. The Technical Representative shall have experience on a minimum of five (5) successful projects of similar size and scope. The Contractor shall submit documentation of the System Provider Technical Representative's experience including the following:

(1) Years of Experience with PPC
(2) Project location
(3) Project construction date
(4) Overlay quantities
(5) Reference name and contact information for owner representative

The Technical Representative shall be available on site, for a minimum of three (3) days per project, to give the installer advice and guidance on the installation of PPC. This includes, but not limited to: deck concrete surface preparation, PPC materials, PPC application, PPC curing or any time there are questions or issues that may arise. The Technical Representative shall be on site for the first PPC overlay placement and shall remain on site until the Engineer is satisfied.

(E) Overlay Placement Plan: The Contractor shall submit an Overlay Placement Plan that includes the following:

(1) Schedule of overlay work and testing for each stage.
(2) Staging plan describing overlay placement sequence including:
  (a) Construction joint locations. Longitudinal construction joints between passes shall be located along the centerline of travel lanes or edge of travel lanes.
  (b) Sequence of placement.
  (c) Placement widths.
  (d) Anticipated placement lengths.
  (e) Placement direction.
  (f) Joint locations.
  (g) Location of proposed trial overlay(s).
(3) Description of equipment used for:
  (a) Surface preparation including grinding and shotblasting.
  (b) Applying HMWM primer resin.
  (c) Measuring, mixing, placing, and finishing the PPC.
  (d) Applying surface finish sand.
(4) Method of protecting and finishing inlets and bridge drains.
(5) Method for isolating expansion joints.
(6) Method for measuring and maintaining overlay thickness and profile.
(7) Cure time for PPC.
(8) Storage and handling of HMWM resin and PPC components.

(9) Procedure for disposal of excess HMWM resin, PPC, and containers.
(10) Procedure for cleanup of mixing and placement equipment.

(F) Equipment: The Contractor shall submit documentation of current certification that mixing equipment has been calibrated (Caltrans California test CT 109 or similar accepted). The Contractor shall submit a documented history of the use of the placement equipment to successfully place PPC overlays on bridge projects for review and approval by the Engineer.

MATERIALS

The PPC shall consist of polyester resin binder and aggregate as specified below. It shall also include a compatible primer which when mixed with other specified ingredients and applied as specified herein, is capable of producing a PPC meeting the requirements of this specification.

The unit weight of the PPC mixture shall be a maximum of 135lb/ft^3.

(1) Verification. The Contractor shall submit a Certified Test Report from independent labs for all of the materials associated with the PPC overlay in accordance with this special provision.
(2) Packaging and Shipment. All components shall be shipped in strong, substantial containers, bearing the manufacturer's label specifying batch/lot number, brand name, and quantity. If bulk resin is to be used, the contractor shall notify the Engineer in writing ten (10) working days prior to the delivery of the bulk resin to the job site. Bulk resin is any resin that is stored in containers in excess of 55 gallons.
(3) Sampling. NCDOT reserves the right to retain and test samples of components of the PPC overlay system. This includes requiring submittal of samples prior to the first installation or on-site sampling during construction.

(A) Polyester Resin Binder: Polyester resin binder shall have the following properties:
(1) Be an unsaturated isophthalic polyester-styrene co-polymer. The resin content shall be 12% +/-1% of the weight of the dry aggregate.
(2) Contain at least 1 percent by weight gamma-methacryloxypropyltrimethoxysilane, an organosilane ester silane coupler.
(3) Be used with a promoter that is compatible with suitable methyl ethyl ketone peroxide and cumene hydroperoxide initiators.
(4) Meet the required values for the material properties shown in Table 1, below.

Accelerators or inhibitors may be required to achieve proper setting time of PPC. They shall be used as recommended by the overlay System Provider.

Table 1
POLYESTER RESIN BINDER PROPERTIES
(Each lot sent to job shall be tested)

Property	Test Method	Requirement
Viscosity*	ASTM D 2196	75 – 200 cps (RVT No.1 Spindle, 20 RPM at 77 °F)
Specific Gravity*	ASTM D 1475	1.05 to 1.10 at 77 °F
Elongation	ASTM D 638	35 percent, minimum Type I specimen, thickness 0.25 ± 0.03" at Rate = 0.45 inch/minute.
	ASTM D 618	Sample Conditioning: 18/25/50+5/70

Tensile Strength	ASTM D 638	2,500 psi, minimum Type I specimen, thickness 0.25 ± 0.03" at Rate = 0.45 inch/minute.
	ASTM D 618	Sample Conditioning: 18/25/50+5/70
* Test shall be performed before adding initiator.		

(B) High Molecular Weight Methacrylate (HMWM) Primer: Primer for the substrate concrete surface shall be a wax-free, low odor, high molecular weight methacrylate primer, and consist of a resin, initiator, and promoter. The primer shall conform to requirements indicated in Table 2, below, and all components shall be supplied by the System Provider.

Initiator for the methacrylate resin shall consist of a metal drier and peroxide. If supplied separately from the resin, the metal drier shall not be mixed with the peroxide directly; a VIOLENT EXOTHERMIC REACTION will occur. The containers and measuring devices shall not be stored in a manner that allows leakage or spilling to contact the containers or materials of the other.

Table 2
HIGH MOLECULAR WEIGHT METHACRYLATE RESIN PROPERTIES
(Tested yearly)

Property	Test Method	Requirement
Viscosity**	ASTM D 2196	25 cps maximum (Brookfield RVT with UL adapter, 50 RPM at 77 °F)
Volatile Content**	ASTM D 2369	30 percent, maximum
Specific Gravity**	ASTM D 1475	0.90 minimum at 77 °F
Flash Point	ASTM D 3278	180 °F minimum
Vapor Pressure**	ASTM D 323	1.0 mm Hg, maximum at 77 °F
PCC Saturated Surface-Dry Bond Strength (Adhesive)	California Test 551, part 5	700 psi, minimum at 24 hours and 70 ± 1°F (with PPC at 12% resin content by weight of the dry aggregate), primed surface
**Test shall be performed before initiator is added		

(C) Aggregates: PPC aggregate shall have the following properties:

(1) No more than 45 percent crushed particles retained on the No. 8 sieve when tested in accordance with American Association of State Highway and Transportation Officials (AASHTO) Test Method T335.

(2) Fine aggregate consists of natural sand only.

(3) Weighted-average aggregate absorption of no more than 1.0 percent when tested under AASHTO Test Methods T84 and T85.

(4) At the time of mixing with resin, have moisture content of not more than one-half (½) of the weighted-average aggregate absorption when tested under AASHTO Test Method T255.

(5) Moh's hardness of seven (7) or greater.

(6) Comply with the requirements for the aggregate gradation indicated in Table 3, below:

Table 3
AGGREGATE GRADATION
(Tested yearly)

Sieve Size	Percent Passing
3/8"	100
No. 4	60-85
No. 8	55-65
No. 16	29-50
No. 30	16-36
No. 50	5-20
No. 100	0-7
No. 200	0-3

(D) Sand: Sand for abrasive sand finish shall have the following properties:

(1) Commercial-quality blast sand.
(2) Not less than 95 percent pass the No. 8 sieve and not less than 95 percent retained on the No. 20 sieve when tested under AASHTO Test Method T27.
(3) Shall be dry at the time of application.

(E) Composite system: The composite PPC system shall have the following properties indicated in Table 4, below:

Table 4
COMPOSITE PROPERTIES
(Tested every 2 years)

Property	Test Method	Requirement
PCC Saturated Surface Dry Bond Strength	CT 551	500 psi minimum at 24 hrs. and 70° F (without primer, at 12% resin content by weight of the dry aggregate, on Saturated Surface Dry Specimen)
Abrasion Resistance	CT 550	<2g weight loss (at 12% resin content by weight of the dry aggregate)
Modulus of Elasticity	ASTM C 469	1,000,000 psi to 2,000,000 psi (at 12% resin content by weight of the dry aggregate)

CONSTRUCTION REQUIREMENTS

(A) PPC Overlay Pre-placement Conference: A Pre-placement Conference shall be held before any overlay operations begin. Attendees shall include representatives from all parties involved in the work. If necessary, teleconferencing of attendees may be approved by the Engineer.

(B) Trial Application: Prior to constructing the overlay, one or more trial applications shall be placed on a previously constructed concrete base to demonstrate proper initial set time and the effectiveness of the mixing, placing, and finishing equipment proposed. The set time can be determined as the time elapsed from resin catalyzation until the in-place PPC cannot be deformed by pressing with a finger, indicating the resin binder is no longer in a liquid state. Each trial application shall be the planned paving width, at least ten (10) feet long, and the same thickness as the specified overlay. Conditions during the construction of the trial application(s) and equipment used shall be similar to those to be used for construction of the overlay. The location of the trial application(s) shall be approved by the Engineer. Trial applications shall be properly disposed of off-site by the Contractor, if removal is necessary.

The number of trial applications required shall be as many as necessary for the Contractor to demonstrate the ability to construct an acceptable trial overlay section and competency to perform the work. However, the installer or proposed equipment/techniques may be rejected if not shown to be acceptable after three (3) trials.

Overlay direct tension bond testing shall be performed in accordance with Section (F)(1) of this special provision. Acceptable test results shall be achieved on a trial application before the installation may proceed.

(C) Equipment: All equipment for cleaning the existing concrete surface and mixing and applying the overlay system shall be in accordance with the System Provider's recommendations, as approved by the Engineer prior to commencement of any work.

(1) Surface Preparation Equipment: Provide appropriate shotblasting, sandblasting and other equipment to adequately prepare the bridge deck substrate, as required in the Overlay Surface Preparation for Polyester Polymer Concrete special provision.

(2) Mixing Equipment: A continuous automated mixer shall be used for all PPC overlay applications. The continuous mixer shall:

(a) Employ an auger screw/chute device capable of sufficiently mixing catalyzed resin with dry aggregate.

(b) Employ a plural component pumping system capable of handling polyester binder resin and catalyst while maintaining proper ratios to achieve set/cure times within the specified limits. Catalyzed resin shall flow through a static mix tube for sufficient duration to completely mix the liquid system.

(c) Be equipped with an automatic metering device that measures and records aggregate and resin volumes. Record volumes at least every five (5) minutes, including time and date. Submit recorded volumes at the end of the work shift to the Engineer.

(d) Have a visible readout gage that displays volumes of aggregate and resin being recorded.

(e) Produce a satisfactory mix consistently during the entire placement.

A portable mechanical mixer of appropriate size for proposed batches, as recommended by the System Provider and approved by the Engineer, may be used for all PPC patching applications and for smaller area overlay applications if approved by the Engineer.

(3) Finishing Equipment: Finishing may be accomplished with a Self-Propelled Slip-Form Paving Machine or Vibratory Screed.

(a) Self-Propelled Slip-Form Paving Machine: A self-propelled slip-form paving machine, which is modified or specifically built to effectively place the PPC overlay in a manner that meets the objectives and requirements of the project, may be used for PPC overlay applications. The paving machine shall:

(i) Employ a vibrating pan to consolidate and finish the PPC.
(ii) Be fitted with hydraulically controlled grade automation to establish the finished profile. The automation shall be fitted with substrate grade averaging devices on both sides of the new placement; the device shall average 15 feet in front and behind the automation sensors; or the sensor shall be constructed to work with string-line control. It is acceptable to match grade when placing lanes adjacent to previously placed PPC.
(iii) Be calibrated for the projects requirements, and calibrated periodically following the manufacturers recommendations.
(iv) Have sufficient engine power and weight to provide adequate vibration of the finishing pan while maintaining consistent forward placement speed.
(v) Be capable of both forward and reverse motion under its own power.

(b) Vibratory Screed: A vibratory screed may be used for finishing PPC, but must be approved by the Engineer at least two (2) weeks prior to PPC placement.

(D) Concrete Deck Repairs and Surface Preparation: All areas that require removal of existing patches or unsound concrete shall be removed and prepared in accordance with the requirements of the Overlay Surface Preparation for Polyester Polymer Concrete special provision. Placement of Concrete for Deck Repair material shall be Polyester Polymer Concrete in accordance with this special provision. Prepare all concrete deck and repaired deck surfaces in accordance with the requirements of the Overlay Surface Preparation for Polyester Polymer Concrete special provision.

(E) Application of Overlay: Methods indicated in this special provision are typical of general installations and may be modified per the System Provider's recommendations as approved by the Engineer. The application of the overlay shall not begin until the concrete deck is completely surface dry in accordance with ASTM D4263, with a wait time revised from 16 hours to two (2) hours, or as directed by the System Provider's Technical Representative. The concrete surface temperature shall be between 40° and 100° F. Night work may be required when temperatures cannot be met during the day.

During overlay application, precaution shall be taken to assure that traffic is protected from rebound, dust, and construction activities. Appropriate shielding shall be provided as required and directed by the Engineer.

During overlay application, the Contractor shall provide suitable coverings (e.g. heavy duty drop cloths) as needed to protect all exposed areas not to receive overlay, such as curbs, sidewalks, parapets, etc. All damage or defacement resulting from this application shall be cleaned and/or repaired to the Engineer's satisfaction at no additional cost to the Department.

(1) HMWM Primer Application: Immediately before placing primer, all exposed surfaces shall be completely dry and blown clean with oil-free compressed air. Exposed surfaces shall be protected from precipitation and heavy dew during and after the application of the primer.

After the exposed surfaces have been prepared and are dry, primer shall be applied in accordance with the System Provider's recommendations. Primer shall be placed within five (5) minutes of mixing at approximately 90 ft^2/ gal or the rate acceptable to the Engineer.

Primer shall be applied by flooding and uniformly spread to completely cover surfaces to receive overlay. Care shall be taken to avoid heavy application that results in excess ponding. Excess material shall be removed or distributed to meet the required application rate. Primer shall be reapplied to any areas that appear dry prior to overlay placement.

Primer shall not be allowed to leak onto areas that have not received surface preparation.

(2) PPC Application: The PPC shall be applied during the interval between 15 minutes and two (2) hours after the primer has been applied. The PPC shall be placed prior to gelling and within 15 minutes following addition of initiator, unless otherwise recommended by the System Provider's Technical Representative.

The polyester resin binder shall be initiated and blended completely. Aggregate shall be added and mixed sufficiently when a portable mechanical mixer is used.

PPC shall have an initial set time of at least 30 minutes and at most 90 minutes. The set time can be determined in the field when the in-place PPC cannot be deformed by pressing with a finger, indicating that the resin binder is no longer in a liquid state. If the initial set is not within 30 to 90 minutes, the material shall be removed and replaced.

The overlay shall be consolidated and finished to the required grade and cross-section using PPC placement equipment as defined herein.

If a vibratory screed is used, prior to placing the PPC, place and fasten screed rails in position to ensure finishing the new surface to the required profile. Do not treat screed rails with parting compound to facilitate their removal. Prior to placing the overlay, attach a filler block to the bottom of the screed and pass it over the overlay area to check the thickness. The filler block thickness shall be equal to the design overlay thickness as shown in the plans. Remove all concrete that the block does not clear.

Place the PPC in one operation. Provide a minimum overlay thickness as shown in the plans.

Although the paver or screed may yield a finished or nearly finished surface, additional finishing may be necessary. PPC shall be finished, as necessary, through traditional concrete finishing methods, producing a slight resin bleed indicating complete consolidation of aggregates.

Finishing of PPC used as patching of an existing deck surface or overlay shall be completed and finished using traditional concrete hand finishing methods and hand concrete finishing tools. Such patches shall be placed flush with the top of the existing deck surface.

Resin content shall be as specified in the Materials section of this special provision and to yield a PPC consistency that requires surface applied consolidation and finishing to consolidate aggregates and yield a slight sheen of bleed resin on top surface, yet does not yield excess bleed resin.

A surface friction sand finish of at least 2.2 lbs/ yd^2 shall be broadcast onto the glossy surface immediately after sufficient finishing and before resin gelling occurs. To ensure adequate pavement friction, the completed PPC overlay surface shall be free of any smooth or "glassy" areas such as those resulting from insufficient quantities of surface aggregate. Any such surface defects shall be repaired by the Contractor in the manner recommended by the System Provider and approved by the Engineer at no additional cost to the Department.

After application of surface friction sand, unless otherwise indicated on the plans, groove the bridge floor in accordance with Subarticle 420-14(B) of the *Standard Specifications*. Vehicular traffic may travel across a deck surface that has not been grooved; however, the entire deck area shall be grooved after the PPC overlay achieves design strength and no later than seven (7) calendar days after completion of the overlay unless otherwise approved by the Engineer.

Before completion of the project, all deck joints shall be prepared, installed and sealed according to the details in the plans.

After the PPC material has set, the final saw cut near the end bent shall be made within 12 hours of setting. The joints shall be maintained as necessary to allow for traffic in accordance with the approved plan of work.

Upon approval by the Engineer, if traffic is to be returned to the site, but the overlay is not completed within the allowable lane closure time and is more than ¾ inch higher in elevation than the adjacent pavement, the PPC overlay edges shall be tapered. The leading edge of the overlay shall be tapered at a 4:1 (horizontal: vertical) slope. Tapered edges longitudinal to the direction of traffic and tapered edges on the trailing edge of the overlay and shall be at a 45 degree slope. Tapers of 45 degrees may remain, and PPC overlay may be placed adjacent. Tapers with a 4:1 (horizontal: vertical) slope shall be sawcut square to the overlay surface, prior to placing adjacent PPC overlay.

The Contractor shall collect a ticket for each pass or portion of a pass that is provided by each mixer, and ensure that the following information is shown on each ticket:

(a) Project Number.
(b) Bridge Number.
(c) Date and Time.
(d) Location of Placement (Lane and Station Limits or location and length of placement along the length of the bridge).
(e) Aggregate Weight.
(f) Polyester Resin Binder Weight.

The tickets shall be available on site for Inspection personnel to use in tabulating quantities.

Curing: The Contractor shall allow the overlay to cure sufficiently before subjecting it to loads or traffic of any nature that may damage the overlay. Cure time depends upon the ambient and deck temperatures as well as initiator/accelerator levels.

The overlay shall be considered cured to a traffic ready state when a minimum reading of 25 on a properly calibrated Swiss hammer is achieved. Other rebound hammers may be use as approved by the Engineer.

(F) Acceptance Testing: Acceptance of the deck repairs, surface preparation, and PPC overlay will be determined by the Engineer based on vertical axis bond tests, and smoothness quality testing performed by the Engineer, assisted by the Contractor.

(1) Overlay Direct Tension Bond Testing: Direct tension bond (pull-off) tests shall be performed after 24 hours by the Contractor in accordance to ASTM C1583. At a minimum, three (3) direct tension bond tests shall be performed on each bridge overlay. For bridges with deck areas greater than 25,000 square feet, additional tests shall be performed at a frequency of one test per 25,000 square feet of additional deck area, rounded up. Additional testing may be required as directed by the Engineer.

The test result shall be the average of the tests for each structure. Test cores shall be drilled a minimum of ½" below the bond line.

The average minimum bond strength of the PPC overlay system on normal weight concrete shall be 250 psi, with no individual test measured below 225 psi. An acceptable test will demonstrate that the overlay bond strength is sufficient by producing a concrete subsurface failure area greater than 50% of the test surface area, at a minimum depth of ¼". The Contractor shall repair all direct tension test locations with PPC overlay in accordance with this special provision.

Direct tension bond testing shall be performed by an independent testing firm and shall be arranged by the Contractor. The Contractor may perform the direct tension bond testing with the approval of the Engineer. Testing shall be performed using a calibrated tensile loading device, in the presence of the Engineer. The tensile loading device shall be calibrated annually. The cost of direct tension bond testing shall be included in the bid price for *Placing and Finishing PPC Overlay* item.

(2) Smoothness Quality Testing: As soon as practical after the PPC has hardened sufficiently, the Contractor shall test the finished surface to determine if rideability meets the requirements of the Polyester Polymer Concrete Overlay Rideability (IRI) special provision. Any corrective action that might be necessary shall follow the requirements of that special provision.

(G) Corrective Work

(1) Repair of Surface Defects: The repair materials and finishing methods for surface defects in the overlay shall be in accordance to those used for the application of the overlay. All surface defects shall be repaired to the satisfaction of the Engineer before acceptance of the work is made.

(2) Correction for Smoothness: Areas showing low spots of more than ⅛"in 10' shall be marked and a proposed repair procedure shall be submitted to the Engineer. The use of the proposed repair procedure shall be as recommended by the System Provider and approved by the Engineer.

(3) Replacement of Defective Overlay: A defective overlay, or portion thereof, resulting in failing overlay pull bond test results shall be removed and replaced at the Contractor's expense. The Contractor shall submit a written corrective work proposal to the Engineer, which shall include the methods and procedures that will be used. The Contractor shall not commence corrective work until the methods and procedures have been approved in

writing by the Engineer. The Engineers approval shall not relieve the Contractor of the responsibility of producing work in conformity with the Contract.

(4) Repair of Cracking: After a one-week cure period, if cracks are in the overlay, the Contractor shall fill the cracks with properly catalyzed and mixed HMWM primer material at no cost to the Department. Care shall be taken to fill the cracks only, and ensure minimal HMWM primer is left on the finished surface of the overlay.

MEASUREMENT AND PAYMENT

Concrete Deck Repair for PPC Overlay will not be paid for separately, as it is considered incidental to any Class II repairs on the proposed concrete deck.

Polyester Polymer Concrete Materials will be measured as the actual volume of PPC material complete-in-place. The volume shall include material used for overlay, patching of existing unsound concrete deck surface or overlays, and bridge deck concrete repairs as directed by the Engineer. Tickets provided to the project inspector, showing quantities of PPC produced, shall be sufficient to calculate volume of material placed. Materials placed for trial application(s) shall be included in this Pay Item if placed and remaining on the bridge deck as part of the permanent overlay. *Polyester Polymer Concrete Materials* will be paid for at the contract unit price per cubic yard and will be full compensation to furnish the PPC material, including HMWM primer, freight to the project site, receiving, storage, and disposal of any unused PPC overlay material. Payment by cubic foot will be based on a maximum 135 lbs/ft^3 unit weight and quantities recorded by calibrated mixer unit readouts.

Placing and Finishing PPC Overlay will be measured and paid for as the contract unit price bid per square yard of overlay placement and final surface finishing. Payment will be full compensation for all labor, equipment, and all incidentals necessary to complete the PPC overlay placement. Construction and removal (if required) of trial application(s), including concrete base surfaces, will not be measured and paid for separately, but shall be incidental to complete the work.

Payment will be made under:

Pay Item	**Pay Unit**
Polyester Polymer Concrete Materials	Cubic Yard
Placing & Finishing Polyester Polymer Concrete Overlay	Square Yard

ACCESS AND FALL PROTECTION (SPECIAL)

1.0 DESCRIPTION

Provide permanent catwalks, ladders, posting signs, and fall protection in order to safely access and inspect the underside of the bridge and girders in spans B through D.

Comply with all applicable federal, state, and local laws and standards.

The drawings shown on the plans of ladders, catwalks, and fall protection are schematics only and are not working drawings. Submit working drawings and final calculations sealed by a licensed professional engineer in the state of North Carolina for all items of the work.

Do not allow load transfer from the superstructure to the substructure via the catwalks. Provide joints and separation in the steps and catwalks so that dead and live loads are not transferred through the catwalks.

Do not connect the two pier caps together at the bents. Provide connections between the catwalks at the level of the superstructure.

Material storage on existing or new catwalks shall not be permitted during construction.

2.0 LADDERS

Provide ladders in order to access the catwalks at each column on west face of bent 4 and the east face of bent 1. Provide a permanent platform or scaffold on the face of the cap at the top of each ladder. The surface of the platform shall be located 3'-6" below the top of the cap, and two additional step ladders shall be placed at each end of the platform in order to access the top of the cap and the catwalks.

Provide access to the catwalks in all three bays at bents 1 and 4. Provide railings around the edge of the bent cap in order to provide fall protection from the top of the cap.

Install the platforms and ladders into the columns and caps using adhesive anchors. Do not hit or damage reinforcement while installing anchors. Provide railing around the platforms meeting legal requirements.

Provide protection over the post-tensioning bars at the location of the ladders from the platform to the top of the cap in order to prevent workers from stepping onto the bars. Provide a sign stating "Do Not Step on Post-Tensioning Bars."

Provide OSHA compliant anchor points for personal fall arrest systems at each ladder along the full height.

Provide means of preventing access to the platforms. Provide a lock with a key at discrete entry ports at the platform and submit the keys to the Engineer following installation.

3.0 CATWALKS IN BAY 2

In bay 2, provide two new catwalks along the full length of spans B through D. Place one catwalk along the face of girder 2 and one catwalk along the face of girder 3. Locate the catwalks as close as possible to the girder faces while avoiding contact with the girder stiffeners. The distance from the end of the stiffener to the near edge of the catwalk shall be a maximum of six inches. At bents 2 and 3, provide a catwalk transverse to the bridge that connects the two catwalks together.

Each Catwalk and fall protection system in bay 2 shall have a maximum self-weight of 25 pounds per linear foot including hangers and connections at discrete locations, averaged over the length of the catwalk span. The catwalk shall be designed for a minimum working live load of 200 pounds per linear foot.

The width of the catwalks in bay 2 shall be the same as the width of the existing catwalks in bays 1 and 3.

Post the live loading capacity at each catwalk at each end of the bridge. Regardless of the structural capacity of the catwalk, the weight posting shall not exceed the smaller of the design live load capacity of the catwalk or 300 pounds per linear foot, with a maximum of 800 lbs total live load (people, materials, and equipment) on any catwalk at a time.

4.0 CATWALKS IN BAYS 1 AND 3

In bays 1 and 3, provide access between existing catwalks at bents 2 and 3 that allows workers to move from one catwalk to another. Provide steps from the catwalks down to the top surface of the bent cap on each side allowing workers to move safely from one catwalk to another. Provide a rail around the edge of the bent cap.

Remove all attachments to the existing catwalks, including conduits, electrical outlets, and other ancillary items, with the approval of the Engineer.

Provide access from bays 1 and 3 into bay 2 at the location of piers 2 and 3. Provide platforms or ladders for workers to safely move from one bay to another.

5.0 FALL PROTECTION

Provide fall protection line at a level of 8'-0" above the floor surface of each catwalk, both existing catwalks and proposed catwalks for the full length of all longitudinal and transverse catwalks. Fall protection line shall be designed to support weights as required by all applicable regulations.

6.0 CONNECTIONS

Do not connect catwalks, ladders, rails, or fall protection to the girders. Connections shall be provided in the deck, floorbeams, piers, or stringers. Any connections to the deck shall be cast-in-place with the deck. Welding to steel members shall not be allowed.

No connections of the catwalk shall be made to any portion of the superstructure in spans A or E. All connections shall be made within Spans B-D and shall be made such that adequate clearance is provided for expansion of the superstructure in Spans B-D and Spans A and E, at Bents 1 and 4.

7.0 MATERIALS

Do not use corrosive materials for the catwalks.

If the catwalk material is aluminum or a metal other than weathering steel, electrically isolate the catwalks from the structural steel elements of the bridge and take all necessary precautions to prevent galvanic corrosion of the structural steel or catwalk.

8.0 MEASUREMENT AND PAYMENT

"Access and Fall Protection" shall be paid as a lump sum item for all materials, equipment, labor, and workmanship to complete the installation of the catwalks, ladders, connections, rails, fall protection, and other items necessary to complete the work.

Pay Item	Pay Unit
Access and Fall Protection	Lump Sum

POST-TENSIONING SYSTEM (SPECIAL)

1.0 GENERAL

Install the post-tensioning (PT) system at the bents, which consists of PT bars and PT anchorage. Remove the stay-in-place (SIP) forms at the ends of the caps, install adhesive anchors, PT anchorages, and PT bars. Provide stainless steel PT bars, washer plates, nuts, and any other required permanent hardware. Place a cover over the PT anchorage for protection and anchor the cover using chains and turnbuckles.

Inspect and evaluate the concrete in the pier columns as shown in the plans.

Follow the sequence noted in the plans. Install the post-tensioning system prior to placing formwork and pouring concrete in bay 2 superstructure.

2.0 CERTIFICATION OF POST-TENSIONING BAR SYSTEM

For the entire project, furnish post-tensioning bars, nuts, washer plates, and other miscellaneous hardware for the PT system from a single supplier.

Use only post-tensioning systems that are approved by the Department. Manufacturers seeking evaluation of their post-tensioning systems shall submit test results to the Department and include certified test reports from an independent laboratory audited by AASHTO Materials Reference Laboratory (AMRL) which shows the post-tensioning system meets all the requirements specified herein.

Prior to installing any post-tensioning hardware, furnish the Engineer with a certification from the post-tensioning supplier that the post-tensioning system chosen for the project meets the requirements of this provision and is a Department-approved post-tensioning system.

3.0 PERSONNEL QUALIFICATIONS

The project Superintendent/Manager shall have either a minimum of ten years of bridge construction experience or be a registered Professional Engineer with five years of bridge construction experience in which three years is in post-tensioned concrete construction. Experience shall include post-tensioning operations including at least one year in charge of post-tensioning related operations.

The foreman shall have a minimum of five years of bridge construction experience including two years in post-tensioning related operations and a minimum of one year as a foreman in charge of post-tensioning related operations.

Submit qualifications of personnel for review by the Engineer.

4.0 MATERIALS

PT bar mechanical properties shall be ASTM A722 Type II with a minimum tensile strength of 150,000 psi.

The stainless steel post-tensioning bars shall meet the chemical composition requirements of ASTM A564 for alloy S17400, Type 630, Condition H1025. All hardware shall have the chemical composition compatible with the bar and in accordance with ASTM A480 (for flat plates) or A564 (for bars and shapes). The material strengths shall be compatible with the post-tensioning system. The hardware shall be appropriately sized for the required loadings.

Structural steel plates and shapes for the anchorages shall be AASHTO M270 Grade 50W.

Anchors shall be stainless steel ASTM A193 316 B8M Class II.

Chain shall be 5/16" (minimum) Grade 80 with a working load limit of 4.5 kips minimum.

Chain and turnbuckle shall be ASTM A413 and shall be galvanized in accordance with ASTM A153.

Silicone sealant shall be Type NS and satisfy section 1028-3 of the standard specifications.

5.0 GALVANIC CORROSION PROTECTION

Where stainless steel plates contact weathering steel plates, shop coat both surfaces with NCDOT paint system 4.

6.0 INSTALLATION

Install PT system in accordance with the sequence shown on the plans and in accordance with all manufacturer's requirements.

Install the PT system at bents 1 and 4 prior to installing the PT system at bents 2 and 3.

Do not splice post-tensioning bars.

During construction, after removing the SIP steel formwork at the PT anchorage, prevent water intrusion into the concrete and between the SIP form and concrete. Place a stiff plastic cover over the SIP form and overlap the cover over the SIP form by a minimum of 1". Caulk around the cover and keep the cover in place until it can be removed for the installation of the PT anchorage.

Place a nylon cap over the PT bar ends following installation. Procure the cap from the PT bar manufacturer.

After installation of the PT system, place a brown, UV resistant stiff plastic permanent covering over each PT anchorage. Comply with the following:

1. Cover shall be a minimum of 1" thick and shall be sloped away from the pier at 2%.

2. Cover shall extend a minimum of 3" beyond all sides of the PT anchorage. Sides of cover shall turn down a minimum of ½" below the soffit of the cover.
3. Cover material shall be approved by the Engineer.
4. Connect chains to the bottom face of the cover at the location of the weep holes in the PT anchorage web. Extend the chains through the weep holes and connect them together using a turnbuckle.
5. The cover shall have a smooth uninterrupted top surface without holes or openings.
6. Chains shall be connected to the bottom surface of the cover without projecting through it.

Place a silicone sealant around the face of the cap at the PT anchorage base plate and around the anchorage cover. Place backer rod as required and place sealant to prevent water intrusion. Place sealant around the opening of the anchorage flange through which the PT bars project, at the joint between PT washer plate and the PT anchorage, and around the PT bar end caps.

7.0 BASIS OF PAYMENT

Payment for the work required in this provision will be at the lump sum contract unit pay items shown below. Such payment will be full compensation for all labor, materials, and equipment to complete the work. Cost of adhesive anchors, PT anchorage cover, and sealant shall be included in the post-tensioning anchorage pay item.

Pay Item	Pay Unit
Post-Tensioning Bars	Lump Sum
Post-Tensioning Anchorage	Lump Sum

THERMAL SPRAYED COATINGS (METALLIZATION) (12-1-2017)

1.0 DESCRIPTION

Apply a thermal sprayed coating (TSC) and sealer to metal surfaces in accordance with the Thermal Sprayed Coatings (Metallization) Program and as specified herein when called for on the plans or by other Special Provisions. Use only Arc Sprayed application methods to apply TSC. The Engineer must approve other methods of application.

The Thermal Sprayed Coatings (Metallization) Program is available on the Materials and Tests Unit website.

2.0 QUALIFICATIONS

Only use NCDOT approved TSC Contractors meeting the requirements outlined in the Thermal Sprayed Coatings (Metallization) Program.

3.0 MATERIALS

Use only materials meeting the requirements of Section 7 of the Thermal Sprayed Coatings (Metallization) Program.

4.0 SURFACE PREPARATION AND TSC APPLICATION

Surface preparation of TSC surfaces shall meet the requirements of Section 8 of the Thermal Sprayed Coatings (Metallization) Program. Apply TSC with the alloy to the thickness specified on the plans or as required by Thermal Sprayed Coatings (Metallization) Program.

5.0 INSPECTION AND TESTING

The TSC Contractor must conduct inspections and tests listed in the Thermal Sprayed Coatings (Metallization) Program.

6.0 REPAIRS

Perform all shop repairs in accordance with the procedures outlined in the Thermal Sprayed Coatings (Metallization) Program.

Repairs associated with field welding shall be made by removing the existing metallizing by blast or power tool cleaning. Affected areas shall be addressed as follows:

- For Marine Environments, incorporate a minimum surface preparation in accordance with SSPC SP-11 (Power Tool Cleaning to Bare Metal) and require an approved epoxy mastic coating applied in accordance with the manufacturer's recommendation. Apply a minimum of two (2) coats at a rate of 5-7 (WFT) per coat to the affected area.

- For Non-Marine Environments, incorporate a minimum surface preparation in accordance with SSPC SP-11 (Power Tool Cleaning to Bare Metal) and require an approved organic zinc-rich coating applied in accordance with the manufacturer's recommendation. Apply a minimum of two (2) coats at a rate of 5-7 (WFT) per coat to the affected area.

    1. Minor localized areas less than or equal to 0.1 ft^2 with exposed substrate shall be repaired as outlined above for marine and non-marine environments.

    2. Large localized areas greater than 0.1 ft^2 with exposed substrate shall require the Contractor to submit a detailed repair procedure to the Engineer for review and approval.

- Repair methods for areas where the substrate has not been exposed shall be mutually agreed upon between the Contractor and TSC Contractor as approved by the Engineer.

7.0 TWELVE MONTH OBSERVATION PERIOD

All TSC materials applied under the Thermal Sprayed Coatings (Metallization) Program shall be evaluated twelve (12) months after project acceptance for defective materials and workmanship.

8.0 BASIS OF PAYMENT

The contract price bid for the metal component to which the TSC is applied will be full compensation for the thermal sprayed coating.

STEEL REPAIRS (SPECIAL)

1.0 DESCRIPTION

This provision addresses certain repairs made to structural steel throughout the existing steel superstructure. Work includes removing or arresting cracks in welds, retrofitting existing weld crack-arrest holes, retrofitting the gusset plates, and removing pack rust at gusset plate connections. The various specific repair items and processes are described below with the respective pay items. Steel Repairs noted are based on various inspections and actual conditions may vary.

The Engineer shall inspect the structure as necessary to confirm the locations of Weld Repairs, Hole Repairs, and Pack Rust repairs. Locations indicated in the plans are provided for the convenience of the Contractor. The Contractor shall have no claim whatsoever against the Department or AECOM for differences in location and description of the repair areas shown in the Contract documents.

2.0 MATERIALS

All HRCSA penetrants/sealants and paints shall be on NCDOT's Approved Products List. HRSCA penetrants/sealants and paints shall all be from the same manufacturer and be compatible. Submit all products to the Engineer for review and approval prior to scheduling the work.

Under this Provision, no new steel material (including welds) is specified to be installed. Any further repairs due to poor workmanship, defect extents beyond what the various prior visual and NDT inspections noted, or other reason shall be as directed by the Engineer.

3.0 EQUIPMENT

Provide equipment necessary to complete the work. This includes grinders, saws, wirewheel brushes, drills, compressors, pressure washers, and other tools. For certain repairs, the Contractor shall assist the Engineer in cleaning and inspecting the area before and/or after the repair is complete. The Contractor shall furnish all NDT tools as directed by the Engineer.

Flame-torch cutting, plasma cutting, or similar means of cutting steel will not be permitted.

All tools shall be secured during repairs as required to prevent accidental damage to the existing structure, in addition to all applicable safety laws and requirements of the Contract.

All required grinding shall be performed in a manner that prevents accidental gouging of the steel beyond the desired depth. All grinders shall be equipped with guards or similar device to prevent accidental over-grinding.

All drills, bits, hole-saws, and metal saws shall be capable of making the required cuts as indicated in the plans or directed by the Engineer under the applicable pay item, completely

though the material in one pass. Equipment shall be secured to prevent accidental damage to surrounding materials. Equipment shall have guards to prevent over-cutting. All drilled holes and cuts shall proceed slowly to prevent over-heating of steel. Pilot holes may be drilled as needed with the approval of the Engineer.

Air blasting shall be permitted for certain repairs as indicated. Air blasting may include non-corrosive blasting media. Such media shall be contained.

The Contractor shall submit to the Engineer a list of all equipment used in the repair. Any equipment that contacts the steel shall the submitted specifically for this review. The Contractor shall indicate which repairs the equipment will be used for and shall demonstrate prior experience with each tool, in conjunction with the requirements below for qualified personnel.

4.0 QUALIFIED PERSONNEL AND WORKMANSHIP

Only qualified personnel shall perform the work. A person who performs the work uses the tools and techniques as shown on the Contract plans and at the direction of the Engineer to make the repairs. Supporting individuals, who may be involved in the process but are not directly performing the work, are not required to be submitted as part of this review but are still subject to all other requirements of the contract and all applicable laws. The Contractor shall submit to the Engineer for review the names of the individuals to perform the steel repairs. Each qualified individual shall have performed work of a similar manner within the past 5 years. The Engineer shall review all submitted names and coordinate the approval with the NCDOT Materials and Tests Unit. For each name submitted, the Contractor shall indicate which repair(s) the individual is designated to perform. The same person may be submitted to perform multiple repairs, and more than one person may be submitted for an individual repair. A maximum of sixteen names may be submitted for review. Substitutions may not be made without the permission of the Engineer. Names shall be submitted a minimum of 6 weeks prior to the scheduled work beginning.

All steel repair work shall be performed in a workmanlike manner. The individual(s) performing the work shall posses the experience and skill required to complete the repairs. The Contractor shall comply completely with all directions of the Engineer and shall ensure that the Engineer is present at all times during the set-up, performance of the repair, and break-down procedures.

All repair work shall be contained and no material, including removed steel, rust, penetrants, paint, or blasted material shall be allowed to fall below the bridge.

If, at any time during a repair, the stability of the structure appears to be compromised, work shall immediately stop and the Engineer notified.

All repairs shall be planned to occur while public vehicular traffic is on the bridge. Such traffic and other external loading conditions (including wind) may induce vibrations in the structure at the repair site. The repairs, and all equipment used, and the repair plan shall be planned to accommodate such vibrations. If the Engineer deems vibrations or other conditions exceed safe working limits, the Engineer reserves the authority to stop work

until conditions improve. Any cost resulting from delays due to site conditions shall be considered incidental to the various repairs and the Contractor shall have no claim against the Department to recover any such costs.

5.0 PLAN OF WORK

For each repair, the Contractor shall submit to the Engineer for review a repair work plan. This plan shall indicate, at a minimum, the approved names of the individuals performing the repair work, the schedule for when the work is proposed to take place, a description of all access equipment and falsework required, the approved specific equipment to be used, any containment systems necessary, repair process(es), and any other aspect or procedure of the repair as deemed necessary by the Engineer. Limitations of the repair equipment and processes shall be provided, including weather, temperature, vibration, and other factors which may impact the progress of the repair work. The Plan of Work shall be submitted at a minimum of 2 weeks prior to the scheduled repair work beginning. A Separate Plan of Work shall be submitted for each pay item.

6.0 GUSSET PLATE RETROFIT

The gusset plate retrofit consists of creating a 2" radius half-circle at the termination of each gusset plate as it connects to the web. The gusset plates are located near the bottom flange of the girder at the crossframe points. All gusset plates in all spans and at all girders shall be retrofitted. Form the radius of the half-circle by drilling. Do not saw cut, plasma cut, or flame cut the half-circles. Submit drill and bit information to the Engineer for approval.

The 2" radius of the half-circle shall be tangential to the face of the girder web and terminate flush with the web. Grind welds, girder webs, and gusset plates smooth in the vicinity of the retrofit and at the termination of the radius. Grind the half-circle smooth of jagged edges.

The Engineer shall inspect the vicinity of the retrofit for weld spatter, arc strikes, irregular weld profile, porosity, and tack welds. Contractor shall grind smooth any irregularities in the vicinity of the retrofit at the direction of the Engineer.

7.0 WELD REPAIR W1

Weld Repair W1 consists of repairing a cracked weld at Span D, Girder 2, approximately 12'-0" west of Panel Point 26, 118" above bottom flange. This work may occur at any time prior to pouring the deck in Bay 2. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the

Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

8.0 WELD REPAIR W2

Weld Repair W2 consists of repairing a cracked weld at Span D, Girder 2, west side of Panel Point 33, approximately 12" above the bottom gusset plate. This work may occur at any time prior to pouring the deck in Bay 2. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

If it is required to drill holes and cut the steel, the total length of the cut shall not exceed 12" without the specific direction of the Engineer.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

9.0 WELD REPAIR W3

Weld Repair W3 consists of repairing a cracked weld at Span C, Girder 4, at the bottom flange-to-web weld on the Bay 3 side, 5ft west of panel point 20. The repair of this weld shall occur prior to placement of any formwork or concrete in Bay 2. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

Holes shall not be drilled through the bottom flange. The maximum depth of material removal in the bottom flange shall be 1/8" over a width of no more than 1" without specific approval by the Engineer.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

10.0 WELD REPAIR W4

Weld Repair W4 consists of removing cracks in welds between the girders and stiffeners, or at welds between longitudinal and transverse stiffeners. Repairs in Girders 2 and 3 shall be completed prior to placing the bay 2 deck formwork. Repairs in Girder 1 shall be completed prior to pouring the deck in bay 1, and repairs in girder 4 shall be completed prior to pouring the deck in bay 3. The repair shall be performed at the direction of the

Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer and labeled with the location of the repair.

11.0 HOLE REPAIR (TYPE I)

Hole Repair (Type I) consist of retrofitting an existing weld-crack-arrest hole at the intersection of the top or bottom web longitudinal stiffener and web. Specific locations are indicated in the contract plans. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

Material removal in the longitudinal stiffener shall not exceed 3" from the exterior face of the web without specific direction of the Engineer. Exact dimensions of the repair cuts shall be at the direction of the Engineer.

After completion of the work at each repair location, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

12.0 HOLE REPAIR (TYPE II)

Hole Repair (Type II) consists of retrofitting 2 adjacent existing weld-crack-arrest holes at the intersection of the top or bottom web longitudinal stiffener and web. In general, the adjacent holes are less than 5" apart, measured center-to-center. The retrofit shall connect the holes in the web and stiffener into a single hole. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

Material removal in the longitudinal stiffener shall not exceed 2" from the exterior face of the web without specific direction of the Engineer. Exact dimensions of the repair cuts shall be at the direction of the Engineer.

After completion of the work at each repair location, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

13.0 HOLE REPAIR (TYPE III)

Hole Repair (Type III) consists of retrofitting a 2 adjacent existing weld-crack-arrest holes at the intersection of the top or bottom web longitudinal stiffener and web which have been previously connected by a cut through the web. In general, the adjacent holes are less than 5" apart, measured center-to-center. The retrofit shall connect the holes in the web and stiffener into a single hole and remove rough edges and improve other fatigue-prone conditions. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

Material removal in the longitudinal stiffener shall not exceed 2" from the exterior face of the web without specific direction of the Engineer. Exact dimensions of the repair cuts shall be at the direction of the Engineer.

After completion of the work at each repair location, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

14.0 PACK RUST REPAIR (TYPE I)

Pack Rust Repair (Type I) consists of removing pack rust between structural members at connections to gusset plates. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair process shown on the Contract plans.

Prior to beginning work, the Contractor shall photograph the repair area.

The Contractor shall clean the area with wirebrushing or other mechanical means, taking care not to damage sound material, and pressure washing with a salt-remover additive, to remove pack rust to the satisfaction of the Engineer. Air dry all washed surfaces with clean, oil-free high-pressure air. No removal of bolts or cutting shall be permitted, and no removal of members shall be permitted. The Engineer shall inspect the cleaned area prior to the next steps.

Apply an HRCSA penetrant/sealer into all gaps and crevices caused by pack rust. The penetrant shall be pressure-applied in accordance with manufacturer specifications and recommendations. Brush away excess material onto the surface of the steel.

Apply a one-step HRCSA primer/top-coat onto the prepared surfaces. Apply multiple coats as necessary to completely fill-in all gaps and crevices. Subsequent coats shall be applied prior to coat curing in accordance with manufacturer recommendations.

After completion of the work at each repair location, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

15.0 Pack Rust Repair (Type II)

Pack Rust Repair (Type II) consists of removing pack rust between structural members at connections to connection plates. The repair shall be performed at the direction of the Engineer, and, unless directed otherwise, shall follow the repair and documentation process as outlined for *Pack Rust Repair (Type I)*.

After completion of the work at each repair location, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

16.0 Nondestructive Testing (NDT) by the Engineer

Contractor shall provide the Engineer the opportunity and access to perform NDT following completion of the weld repairs and gusset plate retrofit. The Engineer shall perform liquid penetrant inspection using visible dye method in accordance with the following:

- All personnel performing this testing shall be qualified as NDT Level II in strict accordance with ASNT SNT-TC-1A.
- All personnel performing such testing shall have an approved procedure. The acceptance criteria in the procedure would reflect no cracking permitted.
- All personnel performing such testing shall have a current annual eye examination as outlined in ASNT SNT-TC-1A.
- The standard test methods shall be in accordance with ASTM E165.

Other testing criteria may be utilized instead of these criteria with the approval of the Engineer.

17.0 Measurement and Payment

All steel repairs shall be measured and paid for as follows. For each repair, payment shall be full compensation for all the work of the repair, including labor, tools, equipment, materials, and incidentals necessary to complete the repair work, and all access equipment, access measures, and preparatory work.

For *Weld Repair W1*, *Weld Repair W2*, and *Weld Repair W3*, measurement of the work shall be for the entire work to complete each repair as described on the plans and in the sections above, and shall be paid for at the contract lump sum price for "Weld Repair W1", "Weld Repair W2", and "Weld Repair W3", respectively.

For *Weld Repair W4*, measurement shall be for each location a weld is repaired of similar size, character, and orientation as shown and described in the plans. If a weld is repaired on opposite faces of a steel plate, this shall count as two separate repairs. Work shall be paid for at the Contract Unit Price per each repair for "Weld Repair W4."

For *Hole Repair Type I*, *Hole Repair Type II*, and *Hole Repair Type III*, measurement shall be for each repair/retrofit of an existing hole (For HR-1) or holes (for HR-2 and HR-3) of similar size as described in the plans, including all incidental work at that hole(s)' location. Work shall be paid for at the Contract Unit Price per each repair for "Hole Repair Type I", "Hole Repair Type II", and "Hole Repairs Type III", respectively.

For *Pack Rust Repair Type I* and *Pack Rust Repair Type II,* measurement for each repair shall be for all pack rust repairs at a single gusset plate or connector plate, regardless of the number of members connected to the plate and individual areas of rust on the plate. Work shall be paid for at the Contract Unit Price per each repair for "Pack Rust Repair Type I" and "Pack Rust Repair Type II".

Pay Item	**Pay Unit**
Gusset Plate Retrofit	Lump Sum
Weld Repair W1	Lump Sum
Weld Repair W2	Lump Sum
Weld Repair W3	Lump Sum
Weld Repair W4	Each
Hole Repair Type I	Each
Hole Repair Type II	Each
Hole Repair Type III	Each
Pack Rust Repair Type I	Each
Pack Rust Repair Type II	Each

BEARING REPAIRS (SPECIAL)

1.0 DESCRIPTION

This provision addresses repairs to the bearing retainer plates and tie rods, bearing plates, and anchor bolts.

The Engineer shall inspect the structure as necessary to confirm the locations of retainer plates to be cleaned, and retainer plate tie rods and anchor bolts to be repaired or replaced. This inspection shall take place a minimum of 8 weeks prior to the scheduled work. Locations indicated in the plans are provided for the convenience of the Contractor. The Contractor shall have no claim whatsoever against the Department for differences in location and description of the repair areas shown in the Contract documents.

All bearing repairs shall be performed prior to installation of post-tensioning of bent caps, and rehabilitation and strengthening of girders at the bearings.

2.0 MATERIALS

All steel plates shall conform to AASHTO M270 Grade 50W. Anchor bolts, nuts, washers, and tie rods shall be galvanized in accordance with the *Standard Specifications*.

Tie rods shall meet the requirements of ASTM A325. Anchor bolts shall meet the requirements of ASTM A449. Nuts shall meet the requirements of AASHTO M291-DH or AASHTO M292-2H. Washers shall meet the requirements of AASHTO M293. Shop drawings are not required for anchor bolts, nuts and washers. Shop inspection is required.

Epoxy for anchor bolt replacement shall be a Type 3A epoxy in accordance with the *Standard Specifications* and be on the NCDOT Approved Products list.

3.0 EQUIPMENT

Provide equipment necessary to complete the work, including grinders, saws, wirewheel brushes, drills, and other tools.

Flame-torch cutting, plasma cutting, or similar means of cutting steel shall not be permitted.

All tools shall be secured during repairs as required to prevent accidental damage to the existing structure, in addition to all applicable safety laws and requirements of the Contract.

All required grinding shall be performed in a manner that prevents accidental gouging of the steel beyond the desired depth. All grinders shall be equipped with guards or similar device to prevent accidental over-grinding.

The Contractor shall submit to the Engineer a list of all equipment used in the repair. Any equipment that contacts the steel shall the submitted specifically for this review. The

Contractor shall indicate which repairs the equipment will be used for and shall demonstrate prior experience with each tool, in conjunction with the requirements below for qualified personnel.

4.0 QUALIFIED PERSONNEL AND WORKMANSHIP

Only qualified personnel shall perform the work. Persons performing the work shall have appropriate experience with the tools and processes involved.

All bearing repair work shall be performed in a workmanlike manner. The individual(s) performing the work shall posses the experience and skill required to complete the repairs. The Contractor shall comply completely with all directions of the Engineer and shall ensure that the Engineer is always present during the set-up, performance of the repair, and break-down procedures.

All repair work shall be contained and no material, including removed steel, rust, or blasted material shall be allowed to fall below the bridge.

If, at any time during a repair, the stability of the structure appears to be compromised, stop work immediately and notify the Engineer.

All repairs shall be planned to occur while public vehicular traffic is on the bridge. Such traffic and other external loading conditions (including wind) may induce vibrations in the structure at the repair site. The repairs, and all equipment used, and the repair plan shall be planned to accommodate such vibrations. If the Engineer deems vibrations or other conditions exceed safe working limits, the Engineer reserves the authority to stop work until conditions improve. Any cost resulting from delays due to site conditions shall be considered incidental to the various repairs and the Contractor shall have no claim against the Department to recover any such costs.

5.0 PLAN OF WORK

For each repair, the Contractor shall submit to the Engineer for review a repair work plan. This plan shall indicate, at a minimum, the approved names of the individuals performing the repair work, the schedule for when the work is proposed to take place, a description of all access equipment and falsework required, the approved specific equipment to be used, any containment systems necessary, repair process(es), and any other aspect or procedure of the repair as deemed necessary by the Engineer. Limitations of the repair equipment and processes shall be provided, including weather, temperature, vibration, and other factors which may impact the progress of the repair work. The Plan of Work shall be submitted at a minimum of 6 weeks prior to the scheduled repair work beginning.

6.0 RETAINER PLATE REPAIR AND TIE ROD REPLACEMENT

As indicated in the Contract plans or as directed by the Engineer, the Contractor shall repair or replace the retainer plate tie rods, washers, and nuts. The dimensions of the plates and required tie rod lengths shall be confirmed prior to fabrication. Shop Drawings of the repair shall be submitted to the Engineer for review and approval prior to beginning work.

The retainer plate and tie rod repair and replacement process shall proceed as follows or as directed by the Engineer:

1. Prior to beginning work, the Contractor shall photograph the repair area.
2. The Contractor shall remove the nuts, tie rods, and retainer plates. The Contractor shall provide appropriate means to secure the removed elements.
3. The Engineer shall inspect the bearing for any further repairs necessary to removed plates and the existing bearing assembly, and Contractor shall make such repairs. Any surface corrosion shall be removed by wire brush or grinding as necessary.
4. If anchor bolt replacement is required, replace anchor bolts per the Section below.
5. The Contractor shall install cleaned retainer plates, new tie rods, and new nuts as indicated in the plans.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

No more than one bearing on the bridge may have the retainer plates removed at one time.

7.0 ANCHOR BOLT REPLACEMENT

At the direction of the Engineer, select anchor bolts and or anchor bolt nuts shall be replaced. If necessary, replacement of the bolts shall occur while retainer plates have been removed to facilitate drilling out of existing anchor bolts. The Contractor shall confirm the size of the existing anchor bolt and replace 1 ¾" diameter anchor bolts.

The existing anchor bolts shall be drilled out by appropriate means, taking special care not to damage the masonry plate, other portions of the bearing, or the girders and superstructure. Jacking of the bearing shall not be permitted. Drill an oversized hole through the bolt and masonry plate to remove the existing anchor bolt. Dry-fit the bolt to ensure proper length and fit. Fill the hole with adequate volume of epoxy and place the replacement anchor bolt. Remove excess epoxy that is displaced. Once the epoxy has cured, washer(s) and nut shall be installed. The top of the anchor bolt threads shall be burred with a sharp-pointed tool.

After completion of the work, the Engineer shall inspect the repair area and Contractor shall make any incidental repairs or finishing tasks as necessary to the satisfaction of the Engineer. The final repaired area shall be photographed. All photographs shall be submitted to the Engineer.

8.0 PAINTING OF BEARINGS

Repaired bearings shall be painted in accordance with the provisions for *Cleaning and Painting of Existing Weathering Steel.*

9.0 MEASUREMENT AND PAYMENT

Bearing Repairs shall be measured and paid for at the Contract Lump Sum price for "Bearing Repairs". Such payment shall be full compensation for all the work in the repairs, including labor, tools, equipment, materials, and incidentals necessary to complete the repair work, and all access equipment, access measures, and preparatory work.

Pay Item	Pay Unit
Bearing Repairs	Lump Sum

PAINTING EXISTING WEATHERING STEEL STRUCTURE (SPECIAL)

DESCRIPTION

This work shall consist of furnishing all labor, equipment, and materials necessary to clean and paint the weathering steel girders, stringers, bearings, zones of excessive corrosion, bent diaphragms, bent caps and piles, all bearings, anchor bolts, nuts, and washers of the existing structures as shown on the plans. Work includes: removal, containment and disposal of the existing paint system; preparation of the surface to be painted and applying the new paint system; a containment enclosure; and any incidentals necessary to complete the project as specified and shown on the plans.

SCOPE OF WORK

Bridge Nos. 440180 & 440112: These parallel bridges (440108 Westbound, 440112 Eastbound) carry I-26/US74 over the Green River. The existing superstructures of each bridge consist of 2 simple spans and 3 continuous spans with 2 lines of steel plate girders spaced @ 24'-0". There are 2 interior stringers between the girders @ 8'-0" supported by intermediate diaphragms. The total length of each bridge from fill face to fill face is 1049'-9". The concrete deck of each existing bridge is 34'-8½". Once stages I, II & III are complete, the two existing structures will have become one single structure consisting of 4 lines of girders with spacings of 24'-0", 30'-0", & 24'-0" with a total of 8 interior stringers @ varied spacing. The total deck width will be 89'-5".

Work shall not begin until all stages (I, II & III) of construction have been completed.

TWELVE-MONTH OBSERVATION PERIOD

The Contractor maintains responsibility for the coating system for a 12-month observation period beginning upon the satisfactory completion of all the work required in the plans or as directed by the Engineer. The Contractor shall guarantee the coating system under the payment and performance bond (refer to Article 109-10 of the *Standard Specifications*). To complete successfully the observation period, the coating system shall meet the following requirements after 12 months service:

(A) No visible rust, contamination or application defect is observed in any coated area.

(B) Painted surfaces have a uniform color and gloss.

(C) Painted surfaces have an adhesion that meets an ASTM D3359, 3A rating.

Final acceptance is made only after the paint system meets the above requirements.

SUBMITTALS

Submit all of the following to the Engineer for review and approval before scheduling the pre-construction meeting. Allow at least two (2) weeks for the review process.

(A) The existing paint systems include toxic substances such as red lead oxide, which are considered hazardous if improperly removed. The contractor shall be currently Society for Protective Coatings (SSPC) Quality Program (QP) 2, Category A certified, and have successfully completed lead paint removal and field painting on similar structures within 18 months prior to this bid. Lead abatement work completed within the 18 month period shall have been completed in accordance with contract specifications, free of citation from safety or environmental agencies. Lead abatement work shall include, but not be limited to: abrasive blasting; waste handling, storage and disposal; worker safety during lead abatement activities (fall protection, personal protective equipment (PPE), etc.); and containment. This requirement is in addition to the contractor pre-qualification requirements covered by Article 102-2 of the *Standard Specifications*.

The apparent low bidder shall submit a list of projects for which QP 2 work was performed within the last 18 months including owner contact information and submit to the Engineer a "Lead Abatement Affidavit". This form may be downloaded from: https://www.ncdot.gov/initiatives-policies/Transportation/bridges/Documents/leadabatementaffidavit.pdf

(B) Work schedule which shall be kept up to date, with a copy of the revised schedule being provided to the Engineer in a timely manner.

(C) Containment system plans and design calculations in accordance with SSPC Guide 6, Class 3A and other project requirements, signed and sealed by a Professional Engineer licensed by the State of North Carolina.

(D) Bridge wash water sampling and disposal plan.

(E) Subcontractor identification.

(F) Lighting plan for night work in accordance with Section 1413 of the *Standard Specifications*.

(G) Traffic control plan with NCDOT certified supervisors, flaggers and traffic control devices.

(H) Health and safety plan addressing at least the required topics as specified by the SSPC QP 1 and QP 2 program and including hazard communication, respiratory health, emergency procedures, and local hospital and treatment facilities with directions and phone numbers, disciplinary criteria for workers who violate the plan and accident investigation. The plan shall address the following: hazardous materials, personal protective equipment, general health and safety, occupational health and environmental controls, fire protection and prevention, signs signals, and barricades, materials handling, storage, use, and disposal, hand and power tools, welding and cutting, electrical, scaffolds, fall protection, cranes, derricks, hoists, elevators, and conveyors, ladders, toxic and hazardous substances, airless injection and high pressure water jet (HPWJ).

(I) Provide the Engineer a letter of certification that all employees performing work on the project have blood lead levels that are below the Occupational Safety and Health Administration (OSHA) action level.

(J) Provide the Engineer with Competent Person qualifications and summary of work experience.

(K) Environmental Compliance Plan.

(L) Quality Control Plan (Project Specific) with quality control qualifications and summary of work experience.

(M) Bridge and Public Protection Plan (Overspray, Utilities, etc. - Project/Task Specific).

(N) Abrasive Blast Media:

(1) Product Data Sheet.

(2) Blast Media Test Reports in accordance with Article 1080-12 of the *Standard Specification.*

(O) Coating Material:

(1) NCDOT HICAMS Test Reports (testing performed by NCDOT Materials and Tests Unit).

(2) Product Data Sheets.

(3) Material Safety Data Sheets.

(4) Product Specific Repair Procedures.

(5) Acceptance letters from paint manufacturer's for work practices that conflict with special provisions and/or paint manufactures product data sheets.

PRE-CONSTRUCTION MEETING

Submittals shall be reviewed and approved by the Engineer prior to scheduling the pre-construction meeting. Allow no less than two (2) weeks for a review process. When requesting a pre-construction meeting, contact the Engineer at least seven (7) working days in advance of the desired pre-construction date. The contractor's project supervisor, Competent Person, quality control personnel and certified traffic control supervisor shall be in attendance at the pre-construction meeting in order for the Contractor and NCDOT team to establish responsibilities for various personnel during project duration and to establish realistic timeframes for problem escalation.

CONTAINMENT SYSTEM

Prior to performing any construction or painting operations on the structure, the Contractor shall furnish the Engineer with plans and design calculations for a sufficiently designed containment system, which will provide access for any repairs on structural steel members, cleaning and surface preparations for structural steel members, and coating operations for structural steel members of the bridge. The containment system shall not be installed, and no work shall begin, until the Engineer has reviewed and approved, in writing, the submitted containment system plans and design calculations. Containment system plans and design calculations shall be prepared, sealed, and signed by a Professional Engineer licensed by the State of North Carolina. Allow a minimum of two (2) weeks for review of the containment plans and calculations.

The containment system shall meet or exceed the requirements of Class 3A containment in accordance with SSPC Guide 6. The Contractor shall determine the required capacity of the containment system, which, at a minimum, shall include loads due to wind, repair materials and repair operations, equipment, and tools; however, the capacity shall not be less than that required by Federal or State regulations. Design steel members to meet the requirements of the *American Institute of Steel Construction Manual*. Design timber members in accordance with the *National Design Specification for Stress-Grade Lumber and Its Fastenings* of the National Forest Products Association. The containment system shall be constructed of materials capable of withstanding damage from any of the work required on this project and shall provide a two (2) hour resistance to fire.

In the containment system plans, describe how debris is contained and collected. Describe the type of tarpaulin, bracing materials, and the maximum designed wind load. Design wind loads shall be in accordance with the Falsework and Formwork special provision. Describe the dust collection system and how a negative pressure of 0.03 inches of water column is maintained inside the enclosure, while blasting operations are being conducted. Describe how the airflow inside the containment structure is designed to meet all applicable OSHA Standards. Describe how water run-off from rain will be routed by or through the enclosure. Describe how wash water will be contained and paint chips separated. Describe what physical containment will be provided during painting application to protect the public and areas not to be painted.

Drilling holes in the superstructure for the purpose of attaching the containment system is prohibited.

The Contractor will be responsible for certifying the containment system has been constructed in accordance with the approved plans.

The containment system shall be cleaned after each workday.

Upon completion of work, remove all anchorages in the substructure and repair the substructure at no additional cost to the Department.

Protect non-metallic parts of bearings from blasting and painting (i.e.: Pot Bearings, Elastomeric Pads, and Disc Bearings).

WASH WATER SAMPLING AND DISPOSAL PLAN

All wash water shall be collected and sampled prior to disposal. Representative sampling and testing methodology shall conform to North Carolina Administrative Code 15A NCAC 02B.0103, "Analytical Procedures". Wash water shall be tested for pollutants listed in 15A NCAC 02B.0211(3), 15A NCAC 02T.0505(b)(1) and 15A NCAC 2T.0905(h). Depending on the test results, wash water disposal methods shall be described in the disposal plan. Wash water shall be disposed of in accordance with all current Federal and State regulations. See link for NCDOT Guidelines for Managing Bridge Wash Water: https://www.ncdot.gov/initiatives-policies/Transportation/bridges/Documents/WashWater.pdf

WASTE HANDLING OF PAINT AND ABRASIVES

Comply with all Federal, State, and local regulations. Failure to comply with the regulations could result in fines and loss of qualified status with NCDOT.

Comply with the Resource Conservation and Recovery Act (RCRA - 40 CFR 261 - 265) and the Occupational Safety and Health Act (OSHA - 29 CFR 1910 - 1926) regulations for employee training, and for the handling, storage, labeling, recordkeeping, reporting, inspections and disposal of all hazardous waste generated during paint removal.

A summary of Generator Requirements is available at the above NCDOT web link, which cites the specific regulations for each Generator category. Quantities of waste by weight and dates of waste generation shall be recorded. Waste stored at the project site shall be properly labeled. All waste, hazardous or non-hazardous, requires numbered shipping manifests.

The North Carolina Department of Environmental Quality (NCDEQ) have adopted RCRA as the North Carolina Hazardous Waste Management Rules and are responsible for enforcement. The *Hazardous Waste Generator Compliance Manual* is published by the Compliance Branch of the Division of Waste Management of NCDEQ, and can be found at: https://files.nc.gov/ncdeq/Waste%20Management/DWM/HW/Compliance/Generator%20Compliance%20Manual.pdf

Immediately after award of the contract, arrange for waste containers, sampling, testing, transportation, and disposal of all waste. No work shall begin until the Contractor furnishes the Engineer with a written waste disposal plan. Any alternative method for handling waste shall be pre-approved by the Engineer. Use an approved waste management company from the following link:
https://www.ebs.nc.gov/VendorDirectory/results.html?sap-params=cD0xJTIwJmN1cnJlbnRfc2VhcmNoX3BhZ2U9d2Mmc2VsZWN0aW9uX2Zpcm1fbmFtZT0mc2VsZWN0aW9uX2NlcnQ9JnNlbGVjdGlvbl9maXJtdHlwZT0meXNjX2Zpcm10eXBlPSZzZWxlY3Rpb25fd29ya2xvY2F0aW9uPSZ5c2Nfd29ya2xvY2F0aW9uPSZzZWxlY3Rpb25fYWRkcnN0YXRlPSZ5c2NfYWRkcnN0YXRlPSZzZWxlY3Rpb25fYWRkcmNvdW50eT0meXNjX2FkZHJjb3VudHk9JnNlbGVjdGlvbl93a2NvZGU9MDAzMDQwJnlzY193a2NvZGU9MDAzMDQwJTIwQ09OVEFNSU5BVEVEJTIwTUFURVJJQUxxTJTIwUkVNT1ZBTCZzZWxlY3Rpb25fZGlzYz0meXNjX2Rpc2M9JnNlbGVjdGlvbl9uYWljcz0meXNjX25haWNzPSZzZWxlY3Rpb25fY3R5cGU9MA%3d%3d

All removed paint and spent abrasive media shall be tested for lead following the SW-846 Toxicity Characteristic Leaching Procedure (TCLP) Method 1311 Extraction, as required in 40 CFR 261, Appendix 11, to determine whether it shall be disposed of as hazardous waste. Furnish the Engineer certified test reports showing TCLP results of the paint chips stored on site, with disposal in accordance with "Flowchart on Lead Waste Identification and Disposal" at: **http://portal.ncdenr.org/c/document_library/get_file?p_l_id=38491&folderId=328599&name=DLFE-9855.pdf**

All sampling shall be done in presence of the Engineer's representative.

The Competent Person shall obtain composite samples from each barrel of the wash water and waste generated by collecting two or more portions taken at regularly spaced intervals during accumulation. Composite the portions into one sample for testing purposes. Acquire samples after 10% or before 90% of the barrel has accumulated. The intent is to provide samples that are representative of widely separated portions, but not the beginning and end of wash water or waste accumulation.

Perform sampling by passing a receptacle completely through the discharge stream or by completely diverting the discharge into a sample container. If discharge of the wash water or waste is too rapid to divert the complete discharge stream, discharge into a container or transportation unit sufficiently large to accommodate the flow and then accomplish the sampling in the same manner as described above.

Comply with the NCDEQ *Hazardous Waste Compliance Generator Manual*. Record quantities of waste by weight and dates of waste generation. Until test results are received, store all waste, and label as "NCDOT Bridge Paint Removal Waste - Pending Analysis" and include the date generated and contact information for the Engineer. Store waste containers in an enclosed, sealed, and secured storage container protected from traffic from all directions. Obtain approval for the protection plan for these containers from the Engineer. If adequate protection cannot be obtained by use of existing guardrail, provide the necessary supplies and equipment to maintain adequate protection. Once test results are received and characterized, label waste as either "Hazardous Waste - Pending Disposal" or "Paint Waste - Pending Disposal".

Once the waste has been collected, and the quantities determined, prepare the appropriate shipping documents and manifests and present them to the Engineer. The Engineer will verify the type and quantity of waste and obtain a Provisional Environmental Protection Agency (EPA) ID number from:

Melodi Deaver
Division of Waste Management/Hazardous Waste Section
North Carolina Department of Environmental Quality
1646 Mail Service Center
Raleigh, NC 27699
Phone: (919) 707-8204, Email: melodi.deaver@ncdenr.gov

At the time of shipping, the Engineer will sign, date, and add the ID number in the appropriate section on the manifest. The maximum on-site storage time for collected waste shall be 90 calendar days. All waste whether hazardous or non-hazardous will require numbered shipping manifests. The cost for waste disposal (including lab and Provisional EPA ID number) is included in the bid price for this contract. Note NC Hazardous Waste Management Rules (15A NCAC 13A) for more information. Provisional EPA ID numbers may be obtained from NCDEQ.

Testing labs shall be certified in accordance with North Carolina State Laboratory Public Health Environmental Sciences. List of certified laboratories may be obtained at:
https://slphreporting.ncpublichealth.com/Certification/CertifiedLaboratory.asp

All test results shall be documented on the lab analysis as follows:

(A) For leachable lead:

(1) Soils/Solid/Liquid- EPA 1311/200.7/6010

Area sampling will be performed for the first two (2) days at each bridge location. The area sample will be located within five (5) feet of the containment and where the highest probability of leakage will occur (access door, etc.). Results from the area sampling will be given to the Engineer within 72 hours of sampling (excluding weekends). If the results of the samples exceed 20 $\mu g/m^3$ corrective measures shall be taken and monitoring shall be continued until two (2) consecutive sample results are less than 20 $\mu g/m^3$.

Time Weighted Average (TWA) may suspend the work if there are visible emissions outside the containment enclosure or pump monitoring results exceeding the level of 30 $\mu g/m^3$.

Where schools, housing and/or buildings are within 500 feet of the containment, the Contractor shall perform initial Total Suspended Monitoring (TSP) Lead monitoring for the first ten (10) days of the project during abrasive blasting, vacuuming and containment removal. Additional monitoring will be required during abrasive blasting two (2) days per month thereafter. Results of the TSP monitoring at any location shall not exceed 1.5 $\mu g/m^3$.

EQUIPMENT MOBILIZATION

The equipment used in any travel lanes and paved shoulder shall be mobile equipment on wheels that has the ability to move on/off the roadway in less than 30 minutes. All work conducted in travel lanes shall be from truck or trailer supported platforms and all equipment shall be self-propelled or attached to a tow vehicle at all times.

QUALITY CONTROL INSPECTOR

Provide a quality control (QC) inspector in accordance with the SSPC QP guidelines to ensure that all processes, preparation, blasting and coating application are in accordance with the requirements of the contract. The inspector shall have written authority to perform QC duties to include continuous improvement of all QC internal procedures. The presence of the engineer or

inspector at the work site shall in no way lessen the contractor's responsibility for conformity with the contract.

QUALITY ASSURANCE INSPECTOR

The quality assurance inspector which may be a Department employee or a designated representative of the Department shall observe, document, assess, and report that the Contractor is complying with all of the requirements of the contract. Inspectors employed by the Department are authorized to inspect all work performed and materials furnished. Such inspection may extend to all or any part of the work and to the preparation, fabrication, or manufacture of the materials to be used. The inspector is not authorized to alter or waive the requirements of the contract. Each stage in preparing the structure to be coated which includes but not limited to washing, blasting, coating testing and inspection shall be inspected and approved by the Engineer or an authorized representative.

SUBLETTING OF CONTRACT

Only contractors certified to meet SSPC QP 2, Category A, and have successfully completed lead paint removal and field painting on all similar structures within 18 months prior to this bid are qualified for this work. Work is only sublet by approval of the Engineer.

LIMITS OF ZONE PAINTING

If any girder has excessive corrosion along its bottom flange, beyond the distance of 1.5 times the depth of the beam or girder, at the bearing, the area of the affected girder indicated on the plans, and other girders as directed by the Engineer, shall be cleaned in accordance with the requirements of System 5 painting system. The horizontal limits of zone painting shall extend 12" beyond the maximum horizontal extent of web/flange corrosion. The vertical limits of zone painting shall extend 3" beyond the maximum vertical extent of web corrosion.

Areas designated for zone coating shall be primed and coated in accordance with System 5 as outlined in Article 442-8 of the *Standard Specifications.*

System 5 is one coat of primer, one intermediate acrylic coat, one stripe coat of paint, and one topcoat of paint and over non-weathering steel surfaces cleaned to an SSPC SP-6 finish.

Painting shall be performed in accordance with Section 442 and Section 1080 of the *Standard Specifications,* and/ or these special provisions; the more restrictive requirement shall apply. Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any spilled material.

PREPARATION OF SURFACES

Before any other surface preparation is conducted, all surfaces shall be power washed to remove dust, salts, dirt, and other contaminants. All wash water shall be contained, collected, and tested

in accordance with the requirements of NCDOT Guidelines for Managing Bridge Wash Water. Obtain approval of the Engineer and allow all cleaned surfaces to dry to the touch and without standing water before beginning surface preparation or painting activities.

Surface preparation is done with materials meeting Article 1080-12 of the *Standard Specifications*. No silica sand or other silica materials are permitted for use. The profile shall be between 1.0 and 3.0 mils when measured on a smooth steel surface. Conduct and document at least two (2) tests per beam/girder and two (2) tests per span of diaphragms/cross bracing.

Spread tarpaulins over all pavements and surfaces underneath equipment used for abrasive blasting as well as equipment and containers used to collect abrasive media. This requirement will be enforced during activity and inactivity of equipment.

Before the Contractor departs from the work site at the end of the workday, collect all debris generated during surface preparation and all dust collector hoses, tarps or other appurtenances containing blasting residue in approved containers.

Clean a 3" x 3" area at each structure to demonstrate the specified finish, and the inspector will preserve this area by covering it with tape, plastic or some other suitable means so that it can be retained as the Dry Film Thickness (DFT) gauge adjustment standard. An acceptable alternative is for the Contractor to provide a steel plate with similar properties and geometry as the substrate to be measured.

The contractor and or quality assurance representative shall notify the Engineer of any area of corroded steel that has lost more than 50% of its original thickness.

All parts of the bridges not to be painted and the travelling public shall be protected from overspray. Submit a plan to protect all parts of bridge that are not required to be painted and a plan to protect the traveling public and surrounding environment while applying all coats of paint to a structure.

Ensure that chloride levels on the surfaces are 7 $\mu g/cm^2$ or lower using an acceptable sample method in accordance with SSPC Guide 15. The frequency of testing shall be two (2) tests per span after all surface preparation has been completed and immediately prior to painting. Select test areas representing the greatest amount of corrosion in the span as determined by the Engineers' representative. Additional testing may be required if significant amounts of chloride are detected.

All weld splatter, slag or other surface defects resulting in a raised surface above the final paint layer shall be removed prior to application of primer coat.

PAINTING OF STEEL

Paint System 5, as specified in these special provisions and Article 442-8 of the *Standard Specifications*, is to be used for this work. System 5 is one coat of primer, one intermediate acrylic coat, one stripe coat of paint, and one topcoat of paint over non-weathering steel surfaces blast-cleaned surfaces in accordance with SSPC-SP-6 (Commercial Blasting). Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any

spilled material. The contractor is responsible for reporting quantities of thinner purchased as well the amounts used. No container with thinner shall be left uncovered, when not in use.

Apply 2" stripe coat, by brush or roller only, to all exposed edges of steel including fasteners before applying the finish coat. Locate the edge or corner in the approximate center of the paint stripe.

Any area where newly applied paint fails to meet the specifications shall be repaired or replaced by the Contractor, at no additional cost to the Department. The Engineer approves all repair processes before the repair is made. Repaired areas shall meet the *Standard Specifications*. The Contractor applies an additional finish coat of paint to areas where the tape adhesion test is conducted.

MATERIALS

Only paint suppliers that have a NCDOT qualified inorganic zinc primer may furnish paints for this project. All paints applied to a structure shall be from the same supplier. Before any paints are applied the Contractor shall provide the Engineer a manufacturer's certification that each batch of paint meets the requirements of the applicable Section 1080 of the *Standard Specifications*.

Color of the paint shall match that of the existing paint on the structure steel.

The inspector randomly collects a one pint sample of each paint product used on the project. Additional samples may be collected as needed to verify compliance to the specifications.

Do not expose paint materials to rain, excessive condensation, long periods of direct sunlight, or temperatures above 110°F or below 40°F. In addition, the Contractor shall place a device that records the high, low, and current temperatures inside the storage location. Follow the manufacturer's storage requirements if more restrictive than the above requirements.

INSPECTION

Surface Preparation for System 5 shall be in accordance with SSPC SP-6. Any area(s) not meeting the requirements of SSPC SP-6 shall be remediated prior to application of coating. Surface inspection is considered ready for inspection when all blast abrasive, residue and dust is removed from surfaces to be coated.

(A) Quality Assurance Inspection

The Contractor furnishes all necessary OSHA approved apparatus such as ladders, scaffolds and platforms as required for the inspector to have reasonable and safe access to all parts of the work. The contractor illuminates the surfaces to be inspected to a minimum of 50-foot candles of light. All access points shall be illuminated to a minimum of 20-foot candles of light.

NCDOT reserves the right for ongoing Quality Assurance (QA) inspection to include but not limited to surface contamination testing, adhesion pull testing, and DFT readings as necessary to assure quality.

Inform the Engineer and the Division Safety Engineer of all scheduled and unannounced inspections from SSPC, OSHA, EPA and/or others that come on site. Furnish the Engineer a copy of all inspection reports except for reports performed by a third party and or consultant on behalf of the Contractor.

(B) Inspection Instruments

At a minimum, furnish the following calibrated instruments and conduct the following quality control tests:

(1) Sling Psychrometer - ASTM E337 - bulb type

(2) Surface Temperature Thermometer

(3) Wind Speed Indicator

(4) Tape Profile Tester - ASTM D4417 Method C

(5) Surface Condition Standards - SSPC VIS-1 and VIS-3

(6) Wet Film Thickness Gage - ASTM D4414

(7) Dry Film Thickness Gage - SSPC-PA2 Modified

(8) Solvent Rub Test Kit - ASTM D4752

(9) Adhesion Test Kit - ASTM D3359 Method A (Tape Test)

(10) Adhesion Pull test - ASTM D4541

(11) Surface Contamination Analysis Kit or (Chloride Level Test Kit) SSPC Technology Guide 15

(C) Quality Control

Maintain a daily quality control record in accordance with Subarticle 442-12(D) of the *Standard Specifications* and make such records available at the job site for review by the inspector and submit to the Engineer as directed. In addition to the information required on Form M&T-610, submit all Dry Film Thickness (DFT) readings on a form equivalent to Form M&T-611. These forms can be found at:
https://connect.ncdot.gov/resources/Materials/Pages/Materials-Manual-by-Material.aspx?Order=MM-03-02

(1) Measure DFT at each spot on the attached diagram and at the required number of locations as specified below:

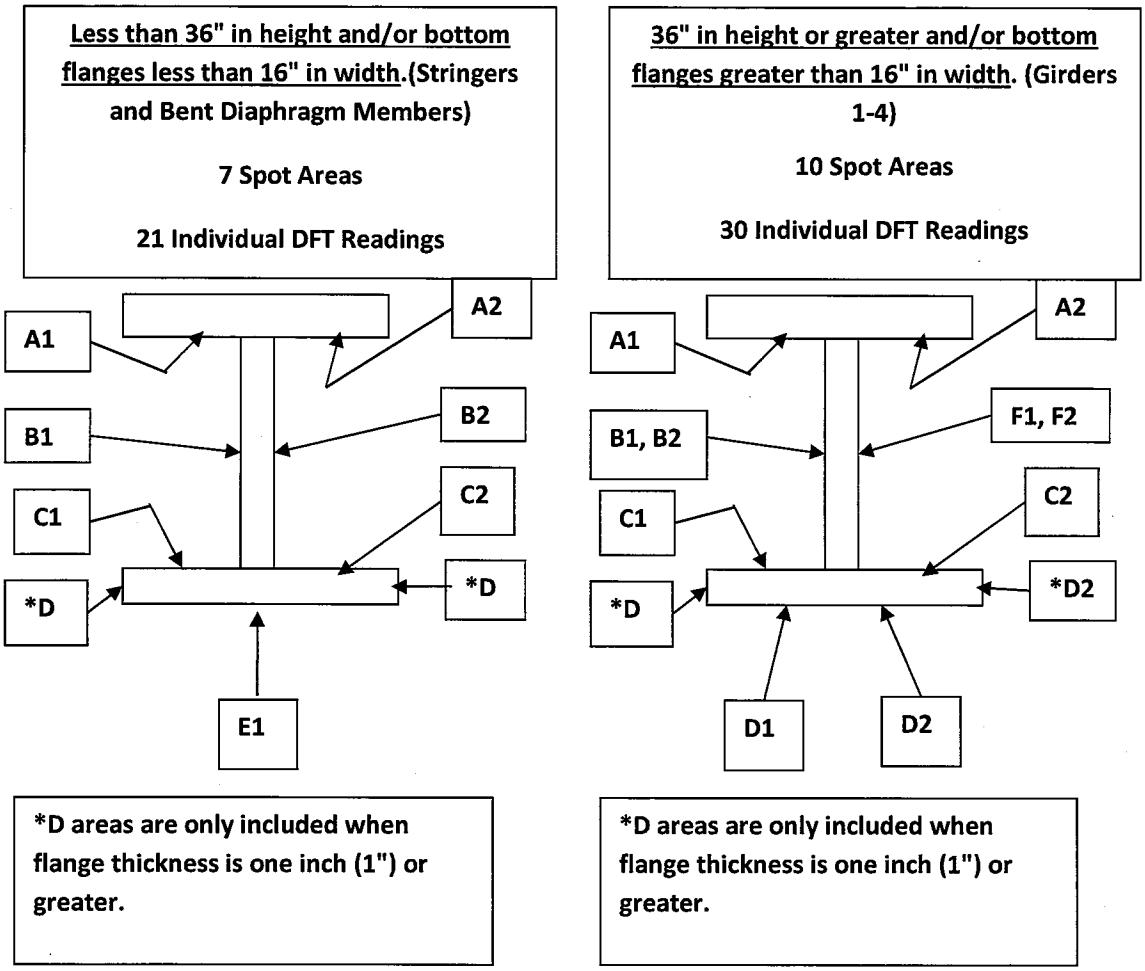
(a) For span members less than 45 feet; three (3) random locations along each girder in each span.

(b) For span members greater than 45 feet; add one additional location for each additional ten (10) feet in span length.

DFT measurements for the prime coat shall not be taken for record until the zinc primer has cured in accordance with ASTM D4752 (MEK Rub Test) with no less than a four (4) resistance rating.

Stiffeners and other attachments to beams and or plate girders shall be measured at no less than five (5) random spots per span. Also, dry film thickness is measured at no less than six (6) random spots per span on diaphragms/cross frames.

Each spot is an average of three (3) to five (5) individual gage readings as defined in SSPC PA-2. No spot average shall be less than 80% of minimum DFT for each layer applied; this does not apply to stripe coat application. Spot readings that are non-conforming shall be re-assessed by performing additional spot measurements not to exceed one-foot intervals on both sides of the low areas until acceptable spot averages are obtained. These non-conforming areas shall be corrected by the Contractor prior to applying successive coats.



(2) Two (2) random adhesion tests (1 test = 3 dollies) per span are conducted on interior surfaces in accordance with ASTM D4541 (Adhesion Pull Test) after the prime coat has been properly cured in accordance with ASTM D3363 (Pencil Hardness) with no less than 2H, and will be touched up by the Contractor. The required minimum average adhesion is 400 psi.

(3) Cure of the intermediate and stripe coats shall be accessed by using the thumb test in accordance with ASTM D1640 (Curing Formation Test) prior to the application of any successive layers of paint.

(4) One random Cut Tape adhesion test per span is conducted in accordance with ASTM D3359 (X-Cut Tape Test) on interior surface after the finish coat is cured. Repair areas shall be properly tapered and touched up by the Contractor.

ZONE PAINTING

If any girder has excessive corrosion along its bottom flange, beyond the distance of 1.5 times the depth of the beam or girder, at the bearing, the area of the affected girder indicated on the plans, and other girders as directed by the Engineer, shall be cleaned in accordance with the requirements of System 5 painting system. The horizontal limits of zone painting shall extend 12" beyond the maximum horizontal extent of web/flange corrosion. The vertical limits of zone painting shall extend 3" beyond the maximum vertical extent of web corrosion.

Areas designated for zone coating shall be primed and coated in accordance with System 5 as outlined in the *Structural Steel Shop Coatings Program.*

System 5 is one coat of primer, one intermediate acrylic coat, one stripe coat of paint, and one topcoat of paint and over non-weathering steel surfaces cleaned to an SSPC SP-6 finish.

Painting shall be performed in accordance with Section 442 and Section 1080 of the *Standard Specifications,* and/ or these special provisions; the more restrictive requirement shall apply. Perform all mixing operations over an impervious surface with provisions to prevent runoff to grade of any spilled material.

SAFETY AND ENVIRONMENTAL COMPLIANCE PLANS

Personnel access boundaries are delineated for each work site using signs, tape, cones, or other approved means. Submit copies of safety and environmental compliance plans that comply with SSPC QP 2 Certification requirements.

HEALTH AND SAFETY RESPONSIBILITIES

This project may involve toxic metals such as arsenic, lead, cadmium and hexavalent chromium. It is the contractor's responsibility to test for toxic metals and if found, comply with the OSHA regulations, which may include medical testing.

Ensure a "Competent Person" as defined in OSHA 29 CFR 1926.62; one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them; is on site during all surface preparation activities and monitors the effectiveness of containment, dust collection systems and waste sampling. Before any work begins, provide a written summary of the Competent Person's safety training.

Comply with Subarticle 442-14(B) of the *Standard Specifications*.

Comply with Subarticle 442-14(D) of the *Standard Specifications*. Ensure employee blood sampling test results are less than 50 micrograms per deciliter. Remove employees with a blood sampling test of 50 or more micrograms per deciliter from work activities involving any lead exposure.

An employee who has been removed with a blood level of 50 micrograms per deciliter or more shall have two (2) consecutive blood sampling tests spaced one week apart indicating that the employee's blood lead level is at or below 40 micrograms per deciliter before returning to work activities involving any lead exposure.

All OSHA recordable accidents that occur during the project duration are to be reported to the Engineer within twenty-four (24) hours of occurrence. In addition, for accidents that involve civilians or property damage that occurs within the work zone the Division Safety Engineer shall be notified immediately.

Prior to blasting operations, the Contractor shall have an operational OSHA approved hand wash station at each bridge location and a decontamination trailer at each bridge or between bridges unless the work is on the roadway, or the Contractor shall show reason why it is not feasible to do so and provide an alternative site as approved by the Engineer. The Contractor shall assure that all employees whose airborne exposure to lead is above the Permissible Exposure Limit (PEL) shall shower at the end of their work shift.

STORAGE OF PAINT AND EQUIPMENT

Provide a location for materials, equipment, and waste storage. Spread tarpaulins over all pavements and surfaces underneath equipment used for abrasive recycling and other waste handling equipment or containers. All land and or lease agreements that involve private property shall disclose to the property owner that heavy metals may be present on the Contractor's equipment. Prior to storing the Contractor's equipment on private property, provide a notarized written consent signed by the land owner received by the Engineer at least forty-eight (48) hours before using property. All storage of paint, solvents, and other materials applied to structures shall be stored in accordance with Subarticle 442-9(C) of the *Standard Specifications* or the manufacturers' requirements. The more restrictive requirements will apply.

UTILITIES

Protect all utility lines or mains that may be supported on, under, or adjacent to bridge work sites from damage and paint overspray.

MEASUREMENT AND PAYMENT

The cost of inspection, surface preparation and repainting the existing structure is included in the lump sum price bid for *Cleaning and Painting Existing Weathering Steel* This price is full compensation for furnishing all inspection equipment, all paint, cleaning abrasives, cleaning solvents and all other materials; preparing and cleaning surfaces to be painted; applying paint in the field; protecting work area, traffic and property; furnishing blast cleaning equipment, paint spraying equipment, brushes, rollers, any other hand or power tools and any other equipment.

Pollution Control will be paid at the contract lump sum price which will be full compensation for all collection, handling, storage, air monitoring, and disposal of debris and wash water, all personal protective equipment, and all personal hygiene requirements, and all equipment, material and labor necessary for the daily collection of the blast debris into specified containers;

and any measures necessary to ensure conformance to all safety and environmental regulations as directed by the Engineer.

Painting Containment will be paid at the lump sum contract price and will be full compensation for the design, materials, installation, maintenance, and removal of the containment system.

Payment will be made under:

Pay Item	**Pay Unit**
Cleaning and Painting Existing Weathering Steel	Lump Sum
Pollution Control	Lump Sum
Painting Containment	Lump Sum

SILANE TREATMENTS (SPECIAL)

1.0 DESCRIPTION

This work consists of preparation of the end bent surfaces and the furnishing and application of alkylalkoxysilane (silane) penetrant sealers, with 100% solids, to seal those surfaces and cracks. Prepare the surfaces and apply the silane treatments in accordance with this special provision and as indicated on the plans, or as approved by the Engineer.

The end bent shall include all the components of both the existing end bents and the widened section to be completed during stage I of construction (caps, backwalls, wingwalls, etc).

Work includes: substructure surface preparation, placement of silane penetrant sealer, appropriate removal and disposal of excess and waste material, and any incidentals necessary to complete the project, as specified or as indicated on the plans. Work is to not to begin until stages II and III of construction are completed.

2.0 SUBMITTALS

Submit for approval the following requested items and any other relevant documents:

- A safety data sheet (SDS) for each shipment of the silane materials.
- Silane material information and manufacturer's written preparation and application instructions.
- Certification from an independent testing laboratory that the materials meet the requirements of these provisions. Do not incorporate these materials into the project until the Engineer has accepted and approved the certification for the material.
- The dates of manufacture of the silane materials, their lot numbers and date of shelf-life expiration for each lot number.
- A table indicating the likely cure time, in minutes. Provide time for the allowable ambient temperature range, in increments of 10° F.
- A work plan for each structure that includes estimated times for surface preparation and silane application.

3.0 MATERIAL DELIVERY AND STORAGE

Store sufficient quantities of silane materials at the site to perform the entire application.

Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact. Ensure that each container is clearly marked by the manufacturer with the following information:

a. Manufacturer's name and address.
b. Product name.
c. Date of manufacture.
d. Expiration date.

e. LOT identification number.
f. Container serial number.

Provide the Engineer a certification from the manufacturer, confirming that the silane materials meet the requirements of this special provision. Do not incorporate these materials into the project until the Engineer has accepted and approved the certification for the material. Submit such certification for each LOT of material delivered to the project. In each certification, identify the serial or LOT numbers of the containers certified.

The Engineer may require samples from each LOT or container of materials delivered to the project or from containers at the point of use. When samples are required, furnish samples in accordance with the Engineer's instructions.

Store silane materials in unopened containers in a clean, dry area between 40° F and 90° F. Store containers in a manner that prevents leakage or spillage.

4.0 MANUFACTURER'S REPRESENTATIVE

Provide a manufacturer's representative on site for the duration of the surface preparation and silane application work, to provide expert assistance on surface preparation, storage, mixing, application, clean-up, and disposal of materials.

5.0 MATERIALS

Provide silane from a single manufacturer, and provide silane that conforms to requirements indicated in Table 1, below.

Table 1
SILANE PROPERTIES

Property	Test Method	Requirement
Silane Content		100%
VOC content	EPA method 24	Less than 350 g/l
Surface Appearance after Application		Unchanged
Flash Point	ASTM D3278	140° F, minimum
Resistance to Chloride Ion Penetration	AASHTO T259 and T260	Less than: 0.52 pounds/yd^3(criteria of 1.5) at 1/2 inch level; 0.00 pounds/yd^3(criteria of 0.75) at 1 inch level
Water absorption test	ASTM C 642	0.50% maximum/48 hours; 1.5% maximum/50 days
Scaling resistance	ASTM C 672	(non-air-entrained concrete) 0 rating "No Scaling" (100 cycles)

NCHRP 244		
Water weight gain	Series II - cube test	85% reduction, minimum
Absorbed chloride		87% reduction, minimum
Absorbed chloride	Series IV - Southern climate	95% reduction, minimum

6.0 SURFACE PREPARATION

Prepare the bridge existing end bent surfaces for application of the silane in order to remove all existing grease, slurry, oils, paint, dirt, striping, curing compound, rust, membrane, weak surface mortar, or any other contaminants that could interfere with the proper adhesion, penetration, and the curing of the silane material.

Prepare a final surface that adheres to the following requirements:

1) For areas to receive silane treatment, clean by sandblasting or shotblasting. Select the size of shot or sand, and travel speed of the equipment to provide a uniformly clean surface with a uniform profile. If the treatment surfaces become contaminated before placing the silane treatment, shotblast or abrasive sandblast the contaminated areas to the satisfaction of the Engineer, at no additional cost. Provide a containment system that will prevent blasting material from entering the water, surrounding environment, or vehicular areas
2) Powerwashing of surfaces will not be allowed.
3) Prior to silane application, protect cracks on treatment surfaces from materials that can interfere with the penetration and the curing of the silane material. Just prior to placement of the silane, remove, by magnets and oil-free compressed air and vacuuming, any loose particles, such that no excess particles remain.
4) Prior to silane application, treatment areas shall be completely dry.
5) The silane manufacturer may suggest cleaning and preparation methods other than those detailed by this special provision. The Engineer must approve such alternative methods prior to implementation.
6) The, Girders, Stringers, Diaphragms, Bearings, Deck soffit and adjacent substructure areas at the end bents not to receive treatment shall be protected during all preparation and silane application activities. Any damage caused to any member other than the existing end bents shall be repaired to the satisfaction of the Engineer at no additional cost to the Department.

7.0 SILANE APPLICATION

Test Area

- For each existing end bent location to be treated (test a small area of the surface (minimum 5 ft. by 5 ft.) before general application to ensure desired performance results, aesthetics, and application rates and to verify application technique. Allow 5–7 days for the product to react fully before evaluating. Application rates may vary depending on field conditions.
- Conduct at least one absorption test in the test area, using a Rilem Tube Test. Acceptable results are no loss of water in the Rilem tube over a period of 20 minutes. Adjust application to achieve required repellent performance.
- The manufacturer's representative shall assist the Contractor in determining the application rates. Use test applications on actual surfaces to determine accurate application rates. Extremely porous surfaces may require two coats of silane. This determination shall be made by the Engineer, and no additional compensation for a second coat will be paid.
- Do not begin production application of silane until Engineer has approved the test area, including approval of aesthetics, color, texture, and appearance.

Application Environment Requirements

- The surface, air, and material temperatures shall be between 40°F and 90°F during application.
- Do not apply silane materials during cold, hot, or wet weather conditions or when adverse weather conditions are forecasted within twelve (12) hours of the completion of the silane application. Correct any coating damaged by rain or moisture by an additional application or as required by the silane manufacturer.
- Application of sealant by spray methods will not be permitted when wind speeds are 20 mph or more, or if in the opinion of the Engineer, unsatisfactory results will be obtained. Other application methods or rescheduling will be required.
- Apply silane during the lowest temperature period of the day, typically between 1:00 a.m. and 9:00 a.m., when the cracks are open to the greatest extent.
- The surface to receive the treatment shall be dry for at least 48 hours before treatment and shall be free from sand, surface dust and dirt, oil, grease, chemical films, and other contaminants prior to application of the silane.

Protection of Surroundings

- Pick up and store all blast media and contaminants in a vacuum unit. Do not create dust during the blasting operation that will obstruct the view of motorists in roadways adjacent, above, below, or surrounding the silane treatment area. Store, handle, and dispose of blast media and contaminants in accordance with all applicable local, state, and federal requirements.
- Cover all adjacent steel members and bearings, seal cracks larger than 1/8in wide on substructure, and use other necessary protective measures to prevent leakage of silane beyond the end bent, to protect waterways, bridge components, pedestrians, vehicles, roadway, vegetation, and any other items or areas below or near the bridge.

- Protect traffic from rebound, dust, overspray, and construction activities. Provide appropriate shielding, as required and/or directed by the Engineer. Damages that occur due to the Contractors operations shall be the responsibility of the Contractor.
- The Contractor shall provide suitable coverings (e.g. heavy-duty drop cloths, suspended canopies, etc.) as needed to protect all exposed areas not to receive surface preparation and silane treatment. The contractor shall submit the plans to the Engineer for such measures prior beginning work.

Treatment Surface Conditions

- Immediately before placing silane, all exposed surfaces shall be completely dry and blown clean with oil-free compressed air to remove any loose dust and debris. Apply silane as soon as practical after the exposed surfaces have been properly prepared and conditions are satisfactory.
- Prior to application of any silane sealer, completely cure widened end bent portions and any repairs to the existing end bents. Surface repairs (epoxy coatings, and structural epoxy grout jacket) adjacent to silane treatments shall be completed and allowed to cure such that the silane will not damage them if overspray occurs.
- Protect prepared surfaces from precipitation and heavy dew during and after the application of the silane.
- Surfaces shall have cured a minimum of 28 days prior to silane application.

Application, Cleanup, and Incidentals

- Do not use silane material after the shelf life date.
- Do not return unused material in opened containers to storage for later use. Either apply such material to appropriate areas on barrier rail surfaces or remove and appropriately dispose of it at offsite locations provided by the Contractor.
- Avoid application with hand pump sprayers. For small areas of silane application, the use of hand pump sprayers might be allowed, but must be approved by the Engineer.
- Clean and/or repair all damage or defacement resulting from Contractor's operations to the Engineer's satisfaction at no additional cost to the Department.
- The equipment used for silane application must be clean of foreign materials and approved by the Engineer before use.
- Maintain operating pressures in sprayers used for application of the silane sealer material sufficiently low, so that atomization or misting of the material does not occur.
- Apply even distribution of silane. Avoid ponding of silane; take care when applying the silane, so that running or puddling does not occur.
- Apply silane in a single application to the treatment surface with enough material to saturate the surface. For decks and barriers, this shall apply to each span. For substructure, this shall apply to a face of bent column. Remove excess material with a roller or brush and dispose of excess material appropriately. If a second coat is required, it should be applied "wet on wet" before first coat dries.
- Conduct the work in a continuous operation, with the silane application as soon as practical following surface preparation.

- Clean up, dispose of any surplus material, and restore any disturbed areas unless otherwise directed.

Safety

- 100% Silane is a combustible liquid; take appropriate precautions during handling, storage, and operations. KEEP AWAY FROM OPEN FLAME.
- Work crews shall wear appropriate personal protection equipment and follow manufacturer's recommendations when applying silane. Refer to the SDS and all applicable local, state, and federal laws, and rules and regulations of authorities having jurisdiction over the project, for specific guidance for personal and environmental protection and safety requirements.

8.0 MEASUREMENT AND PAYMENT

Surface Preparation for Silane will be measured and paid for at the Contract unit bid price per square foot and will be full compensation for the shotblasting, sandblasting, or other necessary surface preparation and handwork to prepare all concrete surfaces indicated in the plans for Silane Treatment and removal and disposal of all blast media and waste material generated, including protection and containment.

Silane Treatments will be measured and paid for at the Contract unit bid price per square foot and will be full compensation for silane treatments to the existing end bents; including all silane materials; removal and disposal of excess and waste material generated; for protection of waterways, bridge, and other nearby surfaces, vehicles, and pedestrians; and for all labor, tools, and incidentals necessary to complete the work.

Pay Item	Pay Unit
Surface preparation for Silane	Square foot
Silane Treatments	Square foot

BRIDGE INSTRUMENTATION (SPECIAL)

1.0 DESCRIPTION

The contractor's attention is brought to the fact that the bridge will be instrumented during construction by the Engineer so that the Engineer can evaluate loads and stresses during the construction sequence. The contractor shall cooperate with the Engineer during construction and provide access for the Engineer to install instrumentation during the construction sequence. Instrumentation locations are noted within this provision, but the Engineer reserves the right to move, change, or adjust instrumentation locations and the number of sensors throughout this sequence.

A total of 66 sensors are estimated to be installed on existing steel before construction, and 12 additional sensors are estimated to be installed on proposed floorbeams in bay 2 during construction. All sensors are intended to communicate wirelessly to data acquisition gateways and are intended to remain on the structure until the completion of construction. Figure 1 shows a sample sensor (foil resistance strain gage) with a wireless transmitter and Figure 2 shows a sample wireless data acquisition gateway at a pier to be powered by a solar panel attached to an exterior girder bottom flange. Figure 3 shows a sample solar panel for the data acquisition gateway.

The contractor shall partially demolish, rehabilitate, and reconstruct the bridge in a manner that does not harm the instrumentation system (sensors, wireless transmitters, data acquisition gateways, solar panels, cables, etc.) or interfere with their performance and shall notify the Engineer immediately if any component is damaged or displaced.

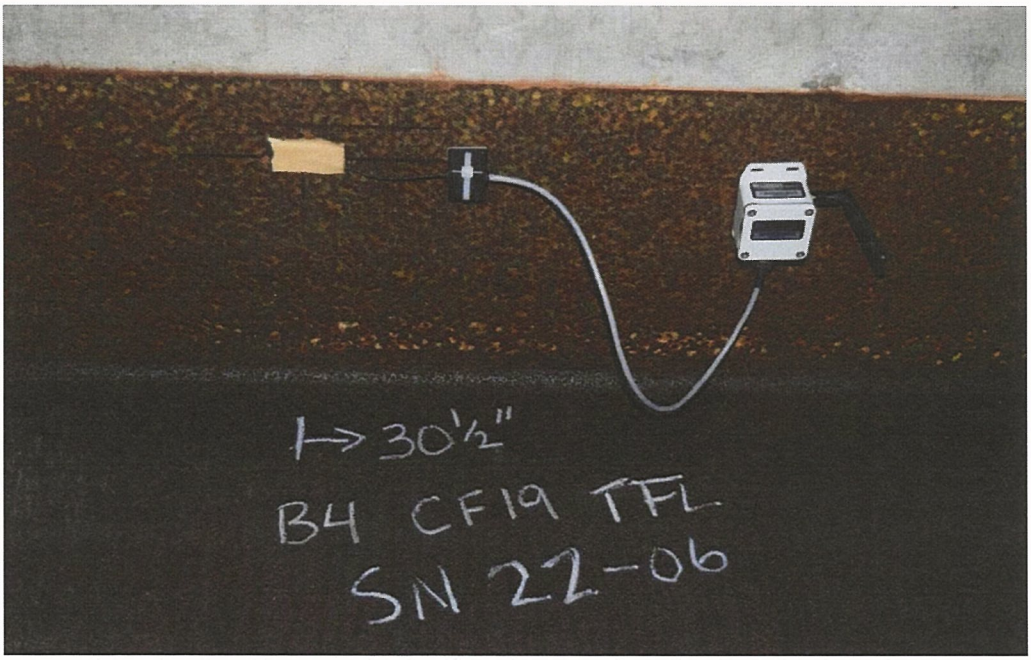


Figure 1. Sample Wireless Sensor (Strain Gage) with a Transmitter

Figure 2. Sample Wireless Data Acquisition Gateway Attached to a Solar Panel (Not Shown)

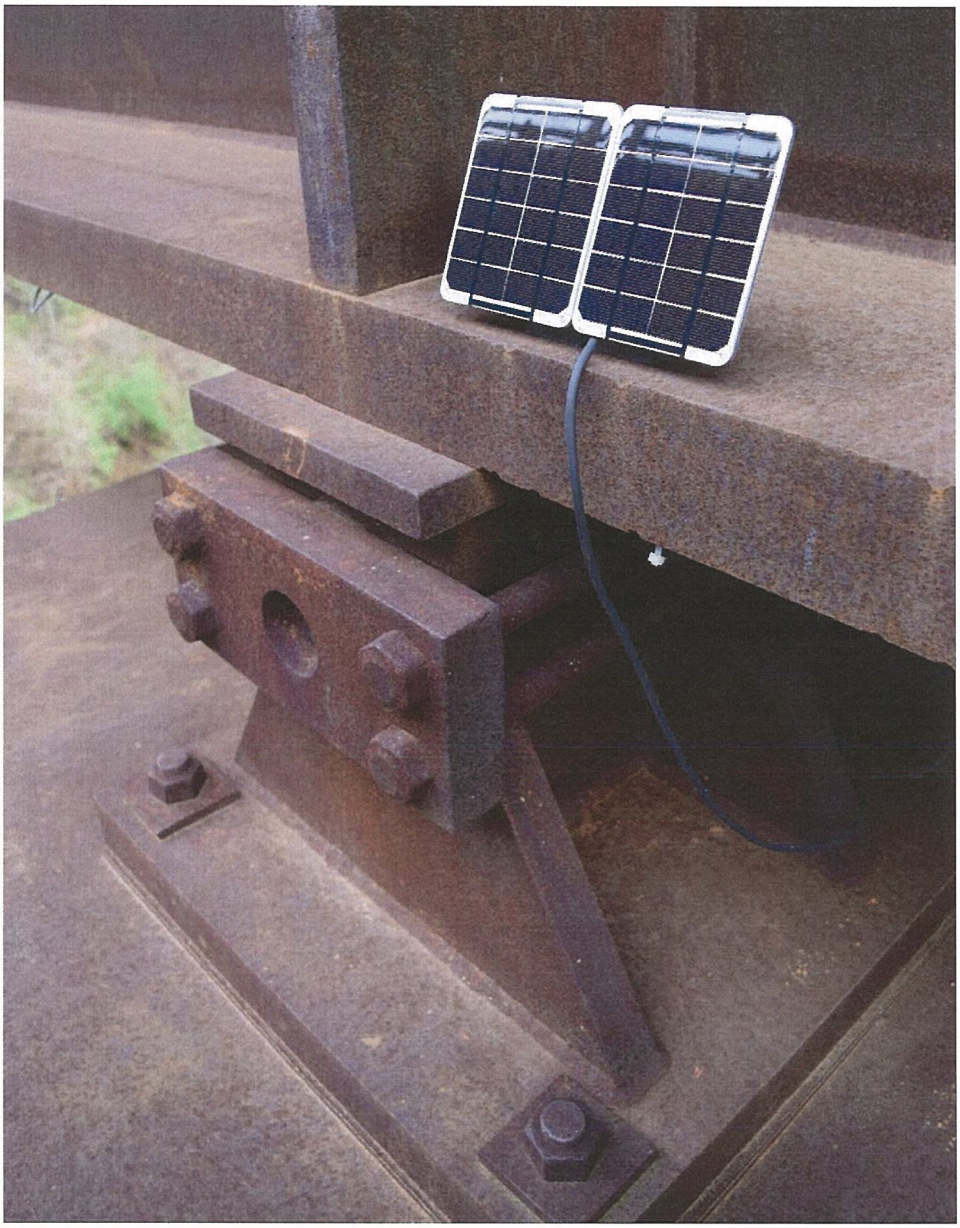


Figure 3. Sample Solar Panel for Wireless Data Acquisition Gateway (Not Shown)

2.0 INSTRUMENTATION LOCATIONS ON THE GIRDERS

Instrumentation will be located on all four girders at approximately five locations per girder. These locations include crossframes 6, 19, and 32, which represent the midspan of spans B-D. Additional locations include crossframes 12 and 26, which represent Piers 2 and 3. Sensors will be placed on both the top and bottom flanges of the girder at each location for a total of 40 sensor locations. Two additional sensors may be added to monitor thermal stresses and the performance of the instrumentation system.

3.0 INSTRUMENTATION LOCATIONS ON THE FLOORBEAMS

Floorbeams will be instrumented at crossframes 19, 26, and 32. Instrumentation will be placed in all three bays at the connection with each girder. Instrumentation will be placed on or near the top and bottom flange of each floorbeam for a total of 36 sensor locations.

4.0 INSTALLATION OF SENSORS ON EXISTING STEEL

Sensors will be installed on existing steel utilizing the existing catwalks. Contractor shall not interfere with installation to be performed by the Engineer.

Contractor shall use care not to damage the instrumentation when installing the floorbeam connection retrofit, the cover plates at piers 2 and 3, or during deck removal. Contractor shall notify the Engineer at least three weeks in advance of construction activities in these locations.

5.0 INSTALLATION OF SENSORS ON PROPOSED STEEL

The Engineer anticipates installing 12 sensors on proposed bay 2 floorbeams at crossframes 19, 26, and 32. Prior to installing these floorbeams, Contractor shall observe the following:

- Notify the Engineer at least three weeks in advance of installing these bay 2 floorbeams.
- After delivering the crossframes to the project site, setup the crossframes in a designated location at the end of the bridge at least one week prior to installation.
- Clearly label each floorbeam with its crossframe number. Label each end of the floorbeam with the girder number to which it will be connected.
- Provide the Engineer a window of at least one week to install sensors onto the crossframes.
- Install the floorbeams with care in order to prevent damages to the sensors and their wireless transmitters.

6.0 DATA ACQUISITION GATEWAY AND SOLAR PANEL LOCATIONS

It is anticipated that two data acquisition gateways will be installed with a solar panel for each gateway. One gateway will be located at pier 2 and one will be located at pier 3. These gateways and solar panels will be installed on the south side of the bridge near girder 1.

During Stages I and II construction, the Engineer will place the solar panel on top of the bottom flange of the girder on the south side of the web, as shown in Figure 3. The gateway will be placed on top of the cap inside of the girder.

During Stage III construction, the solar panel and gateway will be moved and placed on top of the post-tensioning system anchorage on the south side of the cap. This will allow for the installation of the girder 1 cover plates.

The contractor shall use caution to avoid damaging the solar panels and gateways and notify the engineer if any damage or malfunction is observed.

7.0 MEASUREMENT AND PAYMENT

No separate payment shall be made for Bridge Instrumentation, but it shall be included in the cost of other items.

BRIDGE WASHING (SPECIAL)

1.0 DESCRIPTION

The contractor shall wash the bridge deck, superstructure, and substructure after each time de-icing chemicals or salt ("brine") is placed on the deck due to inclement weather. Washing shall be with potable water and shall occur following the weather event and the melting of ice or snow.

2.0 SUBMITTALS

Submit equipment and procedures for washing the bridge within 90 days of the date of availability of the contract.

3.0 MATERIALS

All water used in the washing shall be potable.

4.0 EXECUTION

Washing is only required at those locations that have experienced brine application, either as intended or beyond the limits of the intended application.

Portions of the structure that are closed to traffic and do not experience brine application do not require washing. Portions of the structure that are covered by the deck and protected from the salt application do not require washing, as determined by the Engineer.

The contractor shall give special attention to washing the bridge in the vicinity of expansion joints.

Washing shall proceed from the highest portions of the bridge to the lowest portions in the following order:

1. Bridge deck (including clearing the deck drains)
2. Stringers
3. Floorbeams
4. Faces of girder webs, end bent backwalls, and wingwalls
5. Girder bottom flanges
6. Bearing assemblies
7. Caps
8. Bents 1 and 4 Columns

The contractor shall take special care to wash the top of girder bottom flanges at splice locations, if they have experienced brine application.

5.0 MEASUREMENT AND PAYMENT

Bridge Washing shall be measured and paid for at the Contract Price for Each Bridge Washing event. Contractor shall only complete a bridge washing at the direction of the Engineer. Payment shall be full compensation for all the work to complete the bridge washing, including labor, tools, equipment, materials, access measures, and incidentals necessary to complete the work.

Pay Item	Pay Unit
Bridge Washing	Each

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
			ROADWAY ITEMS			
0001	0000100000-N	800	MOBILIZATION	Lump Sum LS		
0002	0000400000-N	801	CONSTRUCTION SURVEYING	Lump Sum LS		
0003	0028000000-N	SP	TYPE I STANDARD APPROACH FILL STATION ********** (35+30.22 -L-)	Lump Sum LS		
0004	0043000000-N	226	GRADING	Lump Sum LS		
0005	0050000000-E	226	SUPPLEMENTARY CLEARING & GRUB-BING	1 ACR		
0006	0318000000-E	300	FOUNDATION CONDITIONING MATE-RIAL, MINOR STRUCTURES	140 TON		
0007	0320000000-E	300	FOUNDATION CONDITIONING GEO-TEXTILE	430 SY		
0008	0448200000-E	310	15" RC PIPE CULVERTS, CLASS IV	496 LF		
0009	0448300000-E	310	18" RC PIPE CULVERTS, CLASS IV	152 LF		
0010	0582000000-E	310	15" CS PIPE CULVERTS, 0.064" THICK	680 LF		
0011	0588000000-E	310	18" CS PIPE CULVERTS, 0.064" THICK	60 LF		
0012	0636000000-E	310	**" CS PIPE ELBOWS, ******" THICK (15", 0.064")	10 EA		
0013	0986000000-E	SP	GENERIC PIPE ITEM PIPE REHABILITATION CIPP LINER (15" ID HOST PIPE)	258 LF		
0014	0986000000-E	SP	GENERIC PIPE ITEM PIPE REHABILITATION CIPP LINER (18" ID HOST PIPE)	650 LF		
0015	0986000000-E	SP	GENERIC PIPE ITEM PIPE REHABILITATION CIPP LINER (24" ID HOST PIPE)	550 LF		
0016	0986000000-E	SP	GENERIC PIPE ITEM PIPE REHABILITATION CIPP LINER (8" ID HOST PIPE)	404 LF		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0017	0986000000-E	SP	GENERIC PIPE ITEM PREINSTALLATION INSPECTION	1,862 LF		
0018	0995000000-E	340	PIPE REMOVAL	75 LF		
0019	1121000000-E	520	AGGREGATE BASE COURSE	5,123 TON		
0020	1297000000-E	607	MILLING ASPHALT PAVEMENT, ***" DEPTH (4")	12,840 SY		
0021	1491000000-E	610	ASPHALT CONC BASE COURSE, TYPE B25.0C	4,130 TON		
0022	1503000000-E	610	ASPHALT CONC INTERMEDIATE COURSE, TYPE I19.0C	5,660 TON		
0023	1523000000-E	610	ASPHALT CONC SURFACE COURSE, TYPE S9.5C	1,440 TON		
0024	1524200000-E	610	ASPHALT CONC SURFACE COURSE, TYPE S9.5D	4,550 TON		
0025	1575000000-E	620	ASPHALT BINDER FOR PLANT MIX	725 TON		
0026	2190000000-N	828	TEMPORARY STEEL PLATE COVERS FOR MASONRY DRAINAGE STRUCTURE	5 EA		
0027	2253000000-E	840	PIPE COLLARS	0.7 CY		
0028	2275000000-E	SP	FLOWABLE FILL	7 CY		
0029	2286000000-N	840	MASONRY DRAINAGE STRUCTURES	31 EA		
0030	2308000000-E	840	MASONRY DRAINAGE STRUCTURES	32 LF		
0031	2352000000-N	840	FRAME WITH GRATE, STD 840.**** (840.36)	2 EA		
0032	2364200000-N	840	FRAME WITH TWO GRATES, STD 840.20	25 EA		
0033	2407000000-N	840	STEEL FRAME WITH TWO GRATES, STD 840.37	6 EA		
0034	2556000000-E	846	SHOULDER BERM GUTTER	2,998 LF		

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0035	2619000000-E	850	4" CONCRETE PAVED DITCH	172 SY		
0036	2703000000-E	854	CONCRETE BARRIER, TYPE ******* (T)	392 LF		
0037	2703000000-E	854	CONCRETE BARRIER, TYPE ******* (TI)	809 LF		
0038	2815000000-N	858	ADJUSTMENT OF DROP INLETS	2 EA		
0039	3001000000-N	SP	IMPACT ATTENUATOR UNITS, TYPE TL-3	1 EA		
0040	3030000000-E	862	STEEL BEAM GUARDRAIL	7,486 LF		
0041	3150000000-N	862	ADDITIONAL GUARDRAIL POSTS	5 EA		
0042	3210000000-N	862	GUARDRAIL END UNITS, TYPE CAT-1	2 EA		
0043	3287000000-N	SP	GUARDRAIL END UNITS, TYPE TL-3	2 EA		
0044	3317000000-N	SP	GUARDRAIL ANCHOR UNITS, TYPE B-77	4 EA		
0045	3360000000-E	863	REMOVE EXISTING GUARDRAIL	7,293 LF		
0046	3387000000-N	SP	TEMPORARY GUARDRAIL ANCHOR UNITS, TYPE ********** (B-77)	1 EA		
0047	3628000000-E	876	RIP RAP, CLASS I	425 TON		
0048	3649000000-E	876	RIP RAP, CLASS B	148 TON		
0049	3656000000-E	876	GEOTEXTILE FOR DRAINAGE	1,114 SY		
0050	4057000000-E	SP	OVERHEAD FOOTING	8 CY		
0051	4072000000-E	903	SUPPORTS, 3-LB STEEL U-CHANNEL	86 LF		
0052	4078000000-E	903	SUPPORTS, 2-LB STEEL U-CHANNEL	4 EA		
0053	4096000000-N	904	SIGN ERECTION, TYPE D	2 EA		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0054	4102000000-N	904	SIGN ERECTION, TYPE E	1 EA		
0055	4114000000-N	904	SIGN ERECTION, MILEMARKERS	4 EA		
0056	4155000000-N	907	DISPOSAL OF SIGN SYSTEM, U-CHANNEL	9 EA		
0057	4402000000-E	SP	HIGH VISIBILITY STATIONARY SIGNS	596 SF		
0058	4407000000-E	SP	HIGH VISIBILITY PORTABLE SIGNS	96 SF		
0059	4410000000-E	1110	WORK ZONE SIGNS (BARRICADE MOUNTED)	18 SF		
0060	4415000000-N	1115	FLASHING ARROW BOARD	2 EA		
0061	4420000000-N	1120	PORTABLE CHANGEABLE MESSAGE SIGN	2 EA		
0062	4423000000-N	SP	WORK ZONE DIGITAL SPEED LIMIT SIGNS	4 EA		
0063	4432000000-N	SP	HIGH VISIBILITY DRUMS	117 EA		
0064	4434000000-N	SP	SEQUENTIAL FLASHING WARNING LIGHTS	24 EA		
0065	4445000000-E	1145	BARRICADES (TYPE III)	24 LF		
0066	4465000000-N	1160	TEMPORARY CRASH CUSHIONS	5 EA		
0067	4480000000-N	1165	TMA	2 EA		
0068	4490000000-E	1170	PORTABLE CONCRETE BARRIER (ANCHORED)	9,200 LF		
0069	4505000000-E	1170	REMOVE & RESET PORTABLE CONC-RETE BARRIER (ANCHORED)	4,780 LF		
0070	4510000000-N	1190	LAW ENFORCEMENT	40 HR		
0071	4589000000-N	SP	GENERIC TRAFFIC CONTROL ITEM DYNAMIC ZIPPER MERGE SYSTEM DEPLOYMENT	Lump Sum LS		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0072	4600000000-N	SP	GENERIC TRAFFIC CONTROL ITEM CONNECTED LANE CLOSURE DEVICE	4 EA		
0073	4600000000-N	SP	GENERIC TRAFFIC CONTROL ITEM SIGNS, COVERING	4 EA		
0074	4609000000-N	SP	GENERIC TRAFFIC CONTROL ITEM DYNAMIC ZIPPER MERGE SYSTEM	172 DAY		
0075	4650000000-N	1251	TEMPORARY RAISED PAVEMENT MARKERS	739 EA		
0076	4688000000-E	1205	THERMOPLASTIC PAVEMENT MARKING LINES (6", 90 MILS)	12,319 LF		
0077	4847500000-E	SP	WORK ZONE PERFORMANCE PAVEMENT MARKING LINES, 6"	47,509 LF		
0078	4855000000-E	1205	REMOVAL OF PAVEMENT MARKING LINES (6")	17,550 LF		
0079	4875000000-N	1205	REMOVAL OF PAVEMENT MARKING SYMBOLS & CHARACTERS	16 EA		
0080	4890000000-E	SP	GENERIC PAVEMENT MARKING ITEM POLYUREA PAVEMENT MARKING LINES, 6", 20 MILS (STANDARD GLASS BEADS)	4,950 LF		
0081	4895000000-N	SP	GENERIC PAVEMENT MARKING ITEM NON-CAST IRON SNOWPLOWABLE PAVEMENT MARKER	77 EA		
0082	4900000000-N	1251	PERMANENT RAISED PAVEMENT MARKERS	32 EA		
0083	5255000000-N	1413	PORTABLE LIGHTING	Lump Sum LS		
0084	6000000000-E	1605	TEMPORARY SILT FENCE	11,035 LF		
0085	6006000000-E	1610	STONE FOR EROSION CONTROL, CLASS A	425 TON		
0086	6009000000-E	1610	STONE FOR EROSION CONTROL, CLASS B	540 TON		
0087	6012000000-E	1610	SEDIMENT CONTROL STONE	600 TON		
0088	6015000000-E	1615	TEMPORARY MULCHING	3 ACR		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0089	6018000000-E	1620	SEED FOR TEMPORARY SEEDING	200 LB		
0090	6021000000-E	1620	FERTILIZER FOR TEMPORARY SEEDING	1 TON		
0091	6024000000-E	1622	TEMPORARY SLOPE DRAINS	200 LF		
0092	6029000000-E	SP	SAFETY FENCE	200 LF		
0093	6030000000-E	1630	SILT EXCAVATION	430 CY		
0094	6036000000-E	1631	MATTING FOR EROSION CONTROL	7,000 SY		
0095	6037000000-E	SP	COIR FIBER MAT	100 SY		
0096	6038000000-E	SP	PERMANENT SOIL REINFORCEMENT MAT	500 SY		
0097	6042000000-E	1632	1/4" HARDWARE CLOTH	1,625 LF		
0098	6071020000-E	SP	POLYACRYLAMIDE (PAM)	145 LB		
0099	6071030000-E	1640	COIR FIBER BAFFLE	60 LF		
0100	6084000000-E	1660	SEEDING & MULCHING	2 ACR		
0101	6087000000-E	1660	MOWING	1 ACR		
0102	6090000000-E	1661	SEED FOR REPAIR SEEDING	50 LB		
0103	6093000000-E	1661	FERTILIZER FOR REPAIR SEEDING	0.25 TON		
0104	6096000000-E	1662	SEED FOR SUPPLEMENTAL SEEDING	50 LB		
0105	6108000000-E	1665	FERTILIZER TOPDRESSING	1.5 TON		
0106	6114500000-N	1667	SPECIALIZED HAND MOWING	30 MHR		
0107	6117000000-N	SP	RESPONSE FOR EROSION CONTROL	150 EA		
0108	6117500000-N	SP	CONCRETE WASHOUT STRUCTURE	4 EA		
0109	6123000000-E	1670	REFORESTATION	0.1 ACR		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0110	6132000000-N	SP	GENERIC EROSION CONTROL ITEM FABRIC INSERT INLET PROTECTION DEVICE CLEANOUT	72 EA		
0111	6132000000-N	SP	GENERIC EROSION CONTROL ITEM FABRIC INSERT INLET PROTECTION DEVICE	24 EA		
0112	7279000000-E	1715	TRACER WIRE	12,295 LF		
0113	7300000000-E	1715	UNPAVED TRENCHING (**********) (1, 2")	1,920 LF		
0114	7300000000-E	1715	UNPAVED TRENCHING (**********) (2, 2")	30 LF		
0115	7300000000-E	1715	UNPAVED TRENCHING (**********) (3, 2")	11,705 LF		
0116	7301000000-E	1715	DIRECTIONAL DRILL (**********) (1, 2")	225 LF		
0117	7301000000-E	1715	DIRECTIONAL DRILL (**********) (2, 2")	125 LF		
0118	7301000000-E	1715	DIRECTIONAL DRILL (**********) (3, 2")	270 LF		
0119	7516000000-E	1730	COMMUNICATIONS CABLE (**FIBER) (144)	27,580 LF		
0120	7528000000-E	1730	DROP CABLE	670 LF		
0121	7540000000-N	1731	SPLICE ENCLOSURE	4 EA		
0122	7552000000-N	1731	INTERCONNECT CENTER	4 EA		
0123	7566000000-N	1733	DELINEATOR MARKER	29 EA		
0124	7684000000-N	1750	SIGNAL CABINET FOUNDATION	3 EA		
0125	7980000000-N	SP	GENERIC SIGNAL ITEM 5/8" X 10' GROUNDING ELECTRODE	33 EA		
0126	7980000000-N	SP	GENERIC SIGNAL ITEM CCTV FIELD EQUIPMENT CABINET	3 EA		

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0127	7980000000-N	SP	GENERIC SIGNAL ITEM CCTV WOOD POLE	3 EA		
0128	7980000000-N	SP	GENERIC SIGNAL ITEM DIGITAL CCTV CAMERA ASSEMBLY	3 EA		
0129	7980000000-N	SP	GENERIC SIGNAL ITEM DMS ACCESS LADDER	1 EA		
0130	7980000000-N	SP	GENERIC SIGNAL ITEM DMS PEDESTAL STRUCTURE	1 EA		
0131	7980000000-N	SP	GENERIC SIGNAL ITEM DYNAMIC MESSAGE SIGN (TYPE 2C)	3 EA		
0132	7980000000-N	SP	GENERIC SIGNAL ITEM ELECTRONIC MARKER BALL	47 EA		
0133	7980000000-N	SP	GENERIC SIGNAL ITEM EQUIPMENT CABINET DISCONNECT	4 EA		
0134	7980000000-N	SP	GENERIC SIGNAL ITEM ETHERNET EDGE SWITCH	6 EA		
0135	7980000000-N	SP	GENERIC SIGNAL ITEM LIMITED ACCESS FACILITIES - JB W/CONCRETE COLLAR (OVERSIZED)	22 EA		
0136	7980000000-N	SP	GENERIC SIGNAL ITEM LIMITED ACCESS FACILITIES - JB W/CONCRETE COLLAR (SPECIAL OVERSIZED)	7 EA		
0137	7980000000-N	SP	GENERIC SIGNAL ITEM LIMITED ACCESS FACILITIES - JB W/CONCRETE COLLAR (STANDARD SIZE)	18 EA		
0138	7980000000-N	SP	GENERIC SIGNAL ITEM METER BASE/DISCONNECT COMBINATION PANEL	2 EA		
0139	7980000000-N	SP	GENERIC SIGNAL ITEM MODIFY EXISTING ELECTRICAL SERVICE EQUIPMENT	2 EA		
0140	7980000000-N	SP	GENERIC SIGNAL ITEM PCMS (IM)	3 EA		
0141	7980000000-N	SP	GENERIC SIGNAL ITEM PORTABLE CCTV CAMERA ASSEMBLY	3 EA		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0142	7980000000-N	SP	GENERIC SIGNAL ITEM SOLAR POWER ASSEMBLY	2 EA		
0143	7990000000-E	SP	GENERIC SIGNAL ITEM #4 SOLID BARE GROUNDING CONDUCTOR	750 LF		
0144	7990000000-E	SP	GENERIC SIGNAL ITEM 3-WIRE COPPER FEEDER CONDUCTORS	775 LF		
0145	7990000000-E	SP	GENERIC SIGNAL ITEM 3-WIRE COPPER SERVICE ENTRANCE CONDUCTORS	40 LF		
0146	7990000000-E	SP	GENERIC SIGNAL ITEM 4-WIRE COPPER FEEDER CONDUCTORS	1,390 LF		
0147	7990000000-E	SP	GENERIC SIGNAL ITEM BRIDGE MOUNTED CONDUIT	1,115 LF		
0148	7990000000-E	SP	GENERIC SIGNAL ITEM CONDUIT THROUGH ROCK (1 CONDUIT, 2")	384 LF		
0149	7990000000-E	SP	GENERIC SIGNAL ITEM CONDUIT THROUGH ROCK (2 CONDUITS, 2")	6 LF		
0150	7990000000-E	SP	GENERIC SIGNAL ITEM CONDUIT THROUGH ROCK (3 CONDUITS, 2")	2,341 LF		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0151	8035000000-N	402	REMOVAL OF EXISTING STRUCTURE AT STATION ********** (35+30.22 -L-)	Lump Sum LS		
0152	8065000000-N	SP	ASBESTOS ASSESSMENT	Lump Sum LS		
0153	8084000000-N	410	FOUNDATION EXCAVATION FOR END BENT ** AT STATION ********** (1, 35+30.22.-L-)	Lump Sum LS		
0154	8084000000-N	410	FOUNDATION EXCAVATION FOR END BENT ** AT STATION ********** (2, 35+30.22-L-)	Lump Sum LS		
0155	8096000000-E	450	PILE EXCAVATION IN SOIL	102 LF		
0156	8097000000-E	450	PILE EXCAVATION NOT IN SOIL	18 LF		
0157	8147000000-E	420	REINFORCED CONCRETE DECK SLAB	23,357 SF		
0158	8161000000-E	420	GROOVING BRIDGE FLOORS	85,495 SF		
0159	8182000000-E	420	CLASS A CONCRETE (BRIDGE)	52 CY		
0160	8217000000-E	425	REINFORCING STEEL (BRIDGE)	7,216 LB		
0161	8280000000-E	440	APPROX ..... LBS STRUCTURAL STEEL	1,087,000 LS		
0162	8328200000-E	450	PILE DRIVING EQUIPMENT SETUP FOR *** STEEL PILES (HP12 X 53)	12 EA		
0163	8364000000-E	450	HP12X53 STEEL PILES	240 LF		
0164	8391000000-N	450	STEEL PILE POINTS	12 EA		
0165	8860000000-N	SP	GENERIC STRUCTURE ITEM ACCESS & FALL PROTECTION	Lump Sum LS		
0166	8860000000-N	SP	GENERIC STRUCTURE ITEM BEARING REPAIRS	Lump Sum LS		
0167	8860000000-N	SP	GENERIC STRUCTURE ITEM CLEANING & PAINTING EXISTING WEATHERING STEEL	Lump Sum LS		

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0168	8860000000-N	SP	GENERIC STRUCTURE ITEM GUSSET PLATE RETROFIT	Lump Sum LS		
0169	8860000000-N	SP	GENERIC STRUCTURE ITEM MOLDED RUBBER SEGMENTAL EXPANSION JOINTS	Lump Sum LS		
0170	8860000000-N	SP	GENERIC STRUCTURE ITEM PAINTING CONTAINMENT	Lump Sum LS		
0171	8860000000-N	SP	GENERIC STRUCTURE ITEM POLLUTION CONTROL	Lump Sum LS		
0172	8860000000-N	SP	GENERIC STRUCTURE ITEM POST-TENSIONING ANCHORAGE	Lump Sum LS		
0174	8860000000-N	SP	GENERIC STRUCTURE ITEM POST-TENSIONING BARS	Lump Sum LS		
0175	8860000000-N	SP	GENERIC STRUCTURE ITEM WELD REPAIR W1	Lump Sum LS		
0176	8860000000-N	SP	GENERIC STRUCTURE ITEM WELD REPAIR W2	Lump Sum LS		
0177	8860000000-N	SP	GENERIC STRUCTURE ITEM WELD REPAIR W3	Lump Sum LS		
0179	8867000000-E	SP	GENERIC STRUCTURE ITEM CONCRETE BARRIER RAIL (ALL-LIGHTWEIGHT CONCRETE)	2,208 LF		
0180	8867000000-E	SP	GENERIC STRUCTURE ITEM CONCRETE MEDIAN BARRIER (ALL-LIGHTWEIGHT CONCRETE)	1,097 LF		
0181	8881000000-E	SP	GENERIC STRUCTURE ITEM POLYESTER POLYMER CONCRETE MATERIALS	285 CY		
0182	8892000000-E	SP	GENERIC STRUCTURE ITEM FIBER REINFORCED CONCRETE DECKSLAB (ALL-LIGHTWEIGHT CONCRETE)	75,343 SF		
0183	8892000000-E	SP	GENERIC STRUCTURE ITEM SILANE TREATMENTS	3,800 SF		
0184	8892000000-E	SP	GENERIC STRUCTURE ITEM SURFACE PREPARATION FOR SILANE	3,800 SF		

Contract Item Sheets For C204202

Line #	ItemNumber	Sec #	Description	Quantity Unit	Unit Bid Price	Amount Bid
0185	8893000000-E	SP	GENERIC STRUCTURE ITEM PLACING & FINISHING POLYESTER POLYMER CONCRETE OVERLAY	10,250 SY		
0186	8893000000-E	SP	GENERIC STRUCTURE ITEM SHOTBLASTING BRIDGE DECK	10,250 SY		
0187	8897000000-N	SP	GENERIC STRUCTURE ITEM HOLE REPAIR TYPE I	12 EA		
0188	8897000000-N	SP	GENERIC STRUCTURE ITEM HOLE REPAIR TYPE II	3 EA		
0189	8897000000-N	SP	GENERIC STRUCTURE ITEM HOLE REPAIR TYPE III	1 EA		
0190	8897000000-N	SP	GENERIC STRUCTURE ITEM PACK RUST REPAIR TYPE I	17 EA		
0191	8897000000-N	SP	GENERIC STRUCTURE ITEM PACK RUST REPAIR TYPE II	6 EA		
0192	8897000000-N	SP	GENERIC STRUCTURE ITEM BRIDGE WASHING	30 EA		
0193	8897000000-N	SP	GENERIC STRUCTURE ITEM WELD REPAIR W4	5 EA		

TOTAL AMOUNT OF BID FOR ENTIRE PROJECT **$0.00**

TOTAL BILL OF MATERIAL

	REMOVAL OF EXISTING STRUCTURES AT STA. 35+30.22 -L-	ASBESTOS ASSESSMENT	FOUNDATION EXCAVATION FOR END BENT 1 AT STA. 35+30.22 -L-	FOUNDATION EXCAVATION FOR END BENT 2 AT STA. 35+30.22 -L-	PILE EXCAVATION IN SOIL	PILE EXCAVATION NOT IN SOIL	REINFORCED CONCRETE DECK SLAB	GROOVING BRIDGE FLOORS	CLASS A CONCRETE	REINFORCING STEEL	APPROX 1,087,000 LBS. STRUCTURAL STEEL	CLEANING AND PAINTING EXISTING WEATHERING STEEL	POLLUTION CONTROL	PILE DRIVING EQUIPMENT SETUP FOR HP12X53 STEEL PILES	HP12X53 STEEL PILES	STEEL PILE POINTS
	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	LF.	LF.	SQ. FT.	SQ. FT.	CU. YD.	LBS.	LUMP SUM	LUMP SUM	LUMP SUM	EA.	LIN. FT.	EA.
SUPERSTRUCTURE							23,357	85,495								
END BENT 1					48	12			26	3,608				6	150	6
BENT 1																
BENT 2																
BENT 3																
BENT 4																
END BENT 2					54	6			26	3,608				6	90	6
REHABILITATION																
TOTAL	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	102	18	23,357	85,495	52	7,216	LUMP SUM	LUMP SUM	LUMP SUM	12	240	12

TOTAL BILL OF MATERIAL

	CONCRETE BARRIER RAIL (ALL-LIGHT WEIGHT CONCRETE)	CONCRETE MEDIAN BARRIER (ALL-LIGHT WEIGHT CONCRETE)	MOLDED RUBBER SEGMENTAL EXPANSION JOINTS	PAINTING CONTAINMENT	POST-TENSIONING BARS	POST-TENSIONING ANCHORAGE	ACCESS & FALL PROTECTION	POLYESTER POLYMER CONCRETE MATERIALS	PLACING AND FINISHING POLYESTER POLYMER CONCRETE OVERLAY	FIBER REINFORCED CONCRETE DECK SLAB (ALL-LIGHTWEIGHT CONCRETE)	SILANE TREATMENTS	SURFACE PREPARATION FOR SILANE
	LIN. FT.	LIN. FT.	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	CU. YDS.	SQ. YDS.	SQ. FT.	SQ. FT.	SQ. FT.
SUPERSTRUCTURE	2,207.50	1,097.25						285	10,250	75,343		
END BENT 1											1,900	1,900
BENT 1												
BENT 2												
BENT 3												
BENT 4												
END BENT 2											1,900	1,900
REHABILITATION												
TOTAL	2,207.50	1,097.25	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	285	10,250	75,343	3,800	3,800

TOTAL BILL OF MATERIAL

	BEARING REPAIRS	GUSSET PLATE RETROFIT	WELD REPAIR (W1)	WELD REPAIR (W2)	WELD REPAIR (W3)	WELD REPAIR (W4)	HOLE REPAIR (TYPE I)	HOLE REPAIR (TYPE II)	HOLE REPAIR (TYPE III)	PACK RUST REPAIR (TYPE I)	PACK RUST REPAIR (TYPE II)	SHOTBLASTING BRIDGE DECK	BRIDGE WASHING
	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	EA.	EA.	EA.	EA.	EA.	EA.	SQ. YDS.	EA.
SUPERSTRUCTURE												10,250	30
END BENT 1													
BENT 1													
BENT 2													
BENT 3													
BENT 4													
END BENT 2													
REHABILITATION						5	12	3	1	17	6		
TOTAL	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	LUMP SUM	5	12	3	1	17	6	10,250	30

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DGN: R:\Structures\04 Drawings\401_003_15BPR.20_SMU_005.dgn

DRAWN BY : H. ROSEMOND DATE : 02/2020
CHECKED BY : J. E. SLOAN DATE : 02/2020
DESIGNED BY : G. COLS DATE : 02/2020
DESIGN CHECKED BY : J. E. SLOAN DATE : 02/2020

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT NO. 15BPR.20
HENDERSON COUNTY
STATION: 35+30.22 -L-

SHEET 6 OF 6

AECOM
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NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 035062 JOHN E. SLOAN 3/2/2021

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

GENERAL DRAWING

FOR BRIDGE WIDENING AND REHAB ON I-26/US74 OVER GREEN RIVER BETWEEN US25 AND SR1142

REVISIONS					
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SHEET NO. S-7
TOTAL SHEETS 129

POST-TENSIONING SYSTEM CONSTRUCTION SEQUENCE

1. THIS SEQUENCE APPLIES TO BENTS 1 THRU 4.
2. USE A SAW TO CUT OUT THE STAY-IN-PLACE STEEL FORMWORK AT EACH END OF THE CAP AT THE LOCATION OF THE ANCHORAGE. MAINTAIN A BLADE DEPTH THAT DOES NOT CUT INTO THE EXISTING CONCRETE SUBSTRATE. PHOTOGRAPH THE CONCRETE SUBSTRATE AND DOCUMENT ITS CONDITION. SUBMIT THE PHOTOGRAPHS AND CONDITION REPORT TO THE ENGINEER. COMPLETE THE REMOVAL OF THE COLUMN STAY-IN-PLACE FORM AND EVALUATION OF THE BENT COLUMN CONCRETE IN PARALLEL WITH THIS STEP.
3. USING GROUND PENETRATING RADAR (GPR), DETERMINE THE LOCATION OF THE EXISTING REINFORCEMENT IN THE BENT IN THE VICINITY OF THE ANCHORAGE.
4. USING THE RESULTS OF THE GPR, DETERMINE THE PRECISE LOCATION OF ANCHORAGES THAT WILL BE DRILLED INTO THE EXISTING STRUCTURE. CONTRACTOR MAY PROPOSE TO ADJUST THE HORIZONTAL AND VERTICAL ANCHORAGE SPACING TO MISS EXISTING REINFORCEMENT.
5. SUBMIT SHOP DRAWINGS AND ERECTION METHODOLOGY FOR REVIEW BY THE ENGINEER. ALL CONTRACTOR PROPOSED CHANGES TO THE ANCHORAGE SHALL BE SUBMITTED WITH THE SHOP DRAWINGS FOR REVIEW.
6. FOLLOWING REVIEW AND ACCEPTANCE OF THE SHOP DRAWINGS, DRILL HOLES INTO THE BENT USING A SEPARATE METAL TEMPLATE FOR EACH LOCATION. CONTRACTOR SHALL USE A DRILL BIT CAPABLE OF PENETRATING CONCRETE THAT IS NOT CAPABLE OF PENETRATING REINFORCING STEEL. CONTRACTOR SHALL CLEARLY MARK THE LOCATION AND ORIENTATION OF EACH TEMPLATE TO ENSURE THE HOLES WILL BE PROPERLY DRILLED FOR EACH ANCHORAGE. IF REINFORCEMENT IS ENCOUNTERED, STOP WORK AND REPORT TO THE ENGINEER.
7. INSTALL ALL ADHESIVE ANCHORS FOR THE ANCHORAGE.
8. USING A HYDRAULIC TEST JACK, PROOF LOAD EACH ADHESIVE ANCHOR TO 10 KIPS OF TENSION.
9. FOLLOWING THE COMPLETION OF DRILLING, INSTALLATION, AND PROOF LOADING OF ALL ADHESIVE ANCHORS, FABRICATE THE SOLE PLATES, CORBELS, JACK BEARINGS, AND POST-TENSIONING BARS. ANCHORAGE HOLES IN SOLE PLATES AND CORBELS SHALL BE SHOP DRILLED USING THE TEMPLATE THAT WAS USED TO DRILL THE HOLES IN THE BENT CAP.
10. INTENTIONALLY ROUGHEN THE CONCRETE SUBSTRATE OF THE BENT CAP AT THE LOCATION OF THE GROUT PAD TO AN AMPLITUDE OF 1/4".
11. PLACE A 1/4" THICK EXPANDED POLYSTYRENE SLEEVE AROUND THE ADHESIVE ANCHORS AT THE LOCATION OF THE GROUT PAD TO PREVENT BOND WITH GROUT DURING INSTALLATION.
12. PLACE THE ANCHORAGE AGAINST THE BENT CAP IN A LEVEL POSITION, SQUARE TO THE CAP. SET THE ANCHORAGE AT THE SPECIFIED DISTANCE AWAY FROM THE BENT TO ENSURE THE CORRECT GROUT PAD THICKNESS USING ADJUSTABLE SHIMS OR LUGS ON THE FACE OF THE ANCHORAGE. PLACEMENT AND SPACING METHODOLOGY SHALL BE SHOWN IN SHOP AND ERECTION DRAWINGS. LOCATE LUGS OR SHIMS TO PREVENT OVERSTRESS IN THE ANCHORAGE AND BENT CAP CONCRETE DURING THE STRESSING OF ADHESIVE ANCHORS PRIOR TO THE PLACEMENT OF THE GROUT PAD.
13. USING A HYDRAULIC JACK, PRETENSION AND LOCK OFF EACH ADHESIVE ANCHOR AT A TENSION OF 1 KIP. CONTRACTOR MAY PROPOSE STRESSING A SPECIFIC NUMBER OF ADHESIVE ANCHORS RATHER THAN ALL OF THE ANCHORS. STRESSING OF ADHESIVE ANCHORS SHALL BE SUFFICIENT TO FIX THE ANCHORAGE IN PLACE DURING INSTALLATION OF THE GROUT PAD BETWEEN THE ANCHORAGE AND THE BENT CAP, WITHOUT THE AID OF ANY EXTERNAL SUPPORTS.
14. INSTALL THE GROUT PAD BETWEEN THE ANCHORAGE AND THE BENT. PUMP THE GROUT FROM THE BOTTOM OF THE ANCHORAGE, AND ENSURE ADEQUATE PLACEMENT AND CONSOLIDATION OF THE GROUT USING WEEP HOLES AT THE TOP OF THE ANCHORAGE. CLOSE THE WEEP HOLES AFTER THE GROUT IS ALLOWED TO FLOW THROUGH THE HOLE.
15. ENSURE ADEQUATE CURE TIME FOR THE GROUT PAD TO REACH SPECIFIED STRENGTH BASED ON THE GROUT MANUFACTURER'S PUBLISHED CURE TIMES.
16. INSTALL THE 4-1¾" Ø POST-TENSIONING BARS, INCLUDING NUTS AND ANCHOR PLATES. TIGHTEN ALL NUTS TO HAND TIGHT CONDITION.
17. STRESS THE POST-TENSIONING BARS IN THE ORDER SHOWN IN THE "POST-TENSIONING STRESSING ORDER" DETAIL.
    a. INITIALLY STRESS ALL BARS TO A TENSION OF 5 KIPS.
    b. STRESSING THEN SHALL PROCEED IN INCREMENTS OF 25 KIPS UP TO THE FINAL TENSION IN THE BARS, 235 KIPS PER BAR AFTER LOCK OFF.
    c. NO BAR SHALL HAVE A LOAD THAT IS 25 KIPS GREATER OR LESS THAN THE LOADING IN ANY OTHER POST-TENSIONING BARS.
    d. CONTRACTOR SHALL OBSERVE THE BENTS AND THE ANCHORAGES CONTINUOUSLY DURING STRESSING OPERATIONS. IF ANY DISTRESS IN THE BENT OR ANCHORAGE IS OBSERVED DURING STRESSING OPERATIONS, CONTRACTOR SHALL CEASE STRESSING OPERATIONS AND REPORT TO THE ENGINEER.
18. USING A HYDRAULIC JACK, PRETENSION AND LOCK OFF EACH ADHESIVE ANCHOR AT A SERVICE TENSION OF 1 KIP.
19. INSTALL SILICONE SEALANT AROUND THE EDGES OF THE ANCHORAGE THAT FACE THE BENT CAP.
20. INSTALL COVER ON TOP OF THE ANCHORAGE TO PREVENT WATER INTRUSION.

BENT COLUMN CONCRETE EVALUATION SEQUENCE

IN PARALLEL WITH THE INSTALLATION OF THE POST-TENSIONING SYSTEM AT THE BENT CAPS, THE CONTRACTOR AND THE ENGINEER SHALL EVALUATE THE CONCRETE IN THE COLUMNS. THE CONTRACTOR SHALL DRILL TWO 2" DIAMETER HOLES THRU THE STAY-IN-PLACE FORMWORK IN EACH COLUMN. ONE HOLE SHALL BE LOCATED AT A DISTANCE OF APPROXIMATELY 5'-0" BELOW THE SOFFIT OF THE CAP AND THE SECOND HOLE SHALL BE LOCATED APPROXIMATELY 5'-0" ABOVE THE GROUND SURFACE. USE THE FOLLOWING SEQUENCE TO DRILL THE HOLES AND PERFORM THE INSPECTION:

1. THE ENGINEER SHALL SOUND THE FORMS AND CHOOSE THE LOCATION OF THE HOLE. THE HOLE LOCATIONS SHALL BE CHOSEN AT A POINT WHERE THE FORMWORK SOUNDS TO BE DELAMINATED FROM THE CONCRETE SUBSTRATE.
2. THE CONTRACTOR SHALL DRILL THE HOLE THRU THE STAY-IN-PLACE FORM WITHOUT DAMAGING THE CONCRETE SUBSTRATE.
3. THE ENGINEER SHALL INSPECT THE CONCRETE SUBSTRATE ONCE THE HOLE HAS BEEN DRILLED. THE CONTRACTOR SHALL PHOTOGRAPH THE HOLE AND CONCRETE SUBSTRATE AND DOCUMENT THE CONDITION OF THE CONCRETE.
4. THE CONTRACTOR SHALL SUBMIT THE PHOTOGRAPHS AND CONDITION REPORT TO THE ENGINEER FOLLOWING THE EVALUATION.
5. UPON ACCEPTANCE OF THE SUBSTRATE BY THE ENGINEER, THE CONTRACTOR SHALL SEAL WELD A 3" DIAMETER X 1/2" THICK STEEL PLATE AROUND THE 2" DIAMETER HOLE.
6. COMPLETE THIS SEQUENCE IN PARALLEL WITH THE REMOVAL OF THE CAP STAY-IN-PLACE FORMWORK. NO SEPARATE PAYMENT SHALL BE MADE FOR THIS SEQUENCE, BUT PAYMENT SHALL BE INCLUDED IN THE POST-TENSIONING ANCHORAGE PAY ITEM.

POST-TENSIONING GENERAL NOTES

FOR FURTHER DETAILS, SEE POST-TENSIONING SYSTEM SPECIAL PROVISIONS.

PT = POST-TENSIONING

EDGES OF STEEL PLATES IN THE PT ANCHORAGE THAT BEAR AGAINST THE SURFACES OF OTHER PLATES SHALL BE TIGHT FIT WITH AN ANSI ROUGHNESS HEIGHT VALUE NOT GREATER THAN 500.

USE ASTM A193 316 B8M CLASS II ADHESIVE ANCHORS.

PLACE A CUSTOM COVERING OVER THE PT ANCHORAGE TO PREVENT WATER FROM COLLECTING ON THE ANCHORAGE.

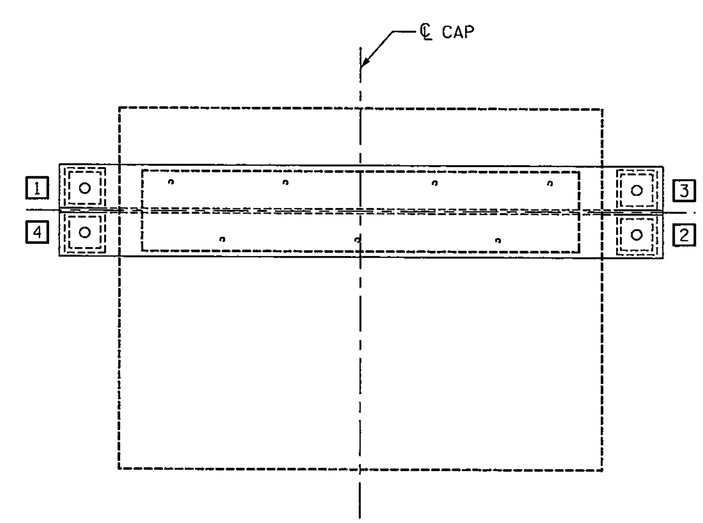
POST-TENSIONING BARS SHALL BE STAINLESS STEEL, ASTM A564, ALLOY S17400, TYPE 630 CONDITION H1025. ALL OTHER MECHANICAL PROPERTIES FOR THE BARS SHALL BE IN ACCORDANCE WITH ASTM A722, TYPE II. FOR FURTHER DETAILS, SEE SPECIAL PROVISIONS.

ALL PHOTOGRAPHS OF THE CONCRETE SUBSTRATE SHALL BE SUBMITTED IN JPEG FORMAT.

WHERE STAINLESS STEEL PLATES CONTACT WEATHERING STEEL PLATES, SHOP COAT BOTH SURFACES WITH NCDOT PAINT SYSTEM 4.

BILL OF MATERIAL

PAY ITEMS	PAY UNIT	STEEL WEIGHT
PT BARS	LUMP SUM	11,654 LBS.
PT BAR ANCHORAGE STRUCTURAL STEEL	LUMP SUM	58,479 LBS.



POST-TENSION STRESSING ORDER

PROJECT NO. 15BPR.20

HENDERSON COUNTY

STATION: 35+30.22 -L-

SHEET 1 OF 7

AECOM

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AECOM License No. F-0342

NORTH CAROLINA PROFESSIONAL SEAL 035062 ENGINEER JOHN E. SLOAN
3/2/2021

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

SUBSTRUCTURE

BENTS 1-4
POST-TENSIONING
SYSTEM

REVISIONS					
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SHEET NO. S-117

TOTAL SHEETS 129

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DRAWN BY : M.K. TOM DATE : 2/2019
CHECKED BY : J.E. SLOAN DATE : 2/2019
DESIGNED BY : J.E. SLOAN DATE : 2/2019
DESIGN CHECKED BY : D. TUTTLE DATE : 2/2019

USER: muenchk
DGN: R:\Structures\04 Drawings\401_219_15BPR20_SMU_B1.dgn

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