

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

PROPOSAL

INCLUDES ADDENDUM No.1 DATED 04-11-2019

DATE AND TIME OF BID OPENING: **APRIL 16, 2019 AT 2:00 PM**

CONTRACT ID C204211
WBS 45982.3.1

FEDERAL-AID NO. STBG-0505(084)
COUNTY DURHAM
T.I.P. NO. U-5968
MILES 0.163
ROUTE NO.
LOCATION CITY OF DURHAM.

TYPE OF WORK ITS AND SIGNAL SYSTEM UPGRADE.

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 SIGNAL PROPOSAL

5% BID BOND OR BID DEPOSIT REQUIRED

**PROPOSAL FOR THE CONSTRUCTION OF
CONTRACT No. C204211 IN DURHAM COUNTY, NORTH CAROLINA**

Date _____ 20 _____

**DEPARTMENT OF TRANSPORTATION,
RALEIGH, NORTH CAROLINA**

The Bidder has carefully examined the location of the proposed work to be known as Contract No. C204211 has carefully examined the plans and specifications, which are acknowledged to be part of the proposal, the special provisions, the proposal, the form of contract, and the forms of contract payment bond and contract performance bond; and thoroughly understands the stipulations, requirements and provisions. The undersigned bidder agrees to bound upon his execution of the bid and subsequent award to him by the Board of Transportation in accordance with this proposal to provide the necessary contract payment bond and contract performance bond within fourteen days after the written notice of award is received by him. The undersigned Bidder further agrees to provide all necessary machinery, tools, labor, and other means of construction; and to do all the work and to furnish all materials, except as otherwise noted, necessary to perform and complete the said contract in accordance with *the 2018 Standard Specifications for Roads and Structures* by the dates(s) specified in the Project Special Provisions and in accordance with the requirements of the Engineer, and at the unit or lump sum prices, as the case may be, for the various items given on the sheets contained herein.

The Bidder shall provide and furnish all the materials, machinery, implements, appliances and tools, and perform the work and required labor to construct and complete State Highway Contract No. C204211 in Durham County, for the unit or lump sum prices, as the case may be, bid by the Bidder in his bid and according to the proposal, plans, and specifications prepared by said Department, which proposal, plans, and specifications show the details covering this project, and hereby become a part of this contract.

The published volume entitled *North Carolina Department of Transportation, Raleigh, Standard Specifications for Roads and Structures, January 2018* with all amendments and supplements thereto, is by reference incorporated into and made a part of this contract; that, except as herein modified, all the construction and work included in this contract is to be done in accordance with the specifications contained in said volume, and amendments and supplements thereto, under the direction of the Engineer.

If the proposal is accepted and the award is made, the contract is valid only when signed either by the Contract Officer or such other person as may be designated by the Secretary to sign for the Department of Transportation. The conditions and provisions herein cannot be changed except over the signature of the said Contract Officer.

The quantities shown in the itemized proposal for the project are considered to be approximate only and are given as the basis for comparison of bids. The Department of Transportation may increase or decrease the quantity of any item or portion of the work as may be deemed necessary or expedient.

An increase or decrease in the quantity of an item will not be regarded as sufficient ground for an increase or decrease in the unit prices, nor in the time allowed for the completion of the work, except as provided for the contract.

Accompanying this bid is a bid bond secured by a corporate surety, or certified check payable to the order of the Department of Transportation, for five percent of the total bid price, which deposit is to be forfeited as liquidated damages in case this bid is accepted and the Bidder shall fail to provide the required payment and performance bonds with the Department of Transportation, under the condition of this proposal, within 14 calendar days after the written notice of award is received by him, as provided in the *Standard Specifications*; otherwise said deposit will be returned to the Bidder.



State Contract Officer

DocuSigned by:

Ronald E. Davenport, Jr.

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4/11/2019

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PROJECT SPECIAL PROVISIONS**GENERAL****CONTRACT TIME AND LIQUIDATED DAMAGES:**

(7-1-95) (Rev. 12-18-07)

108

SP1 G10 B

The date of availability for this contract is **May 28, 2019**.

The completion date for this contract is **August 1, 2024**.

The liquidated damages for this contract are **Two Thousand Dollars (\$ 2,000.00)** per calendar day.

INTERMEDIATE CONTRACT TIME NUMBER 1 AND LIQUIDATED DAMAGES:

(2-20-07)

108

SP1 G14 A

The Contractor shall complete the required work of installing, maintaining, and removing the traffic control devices for lane closures and restoring traffic to the existing traffic pattern. The Contractor shall not close or narrow a lane of traffic on **I-85, I-40, NC-147, US-15/501, US-501, US-70** during the following time restrictions:

DAY AND TIME RESTRICTIONS

**Monday thru Friday
6:00 AM to 8:00 PM**

**Saturday and Sunday
10:00 AM to 8:00 PM**

In addition, the Contractor shall not close or narrow a lane of traffic on **I-85, I-40, NC-147, US-15/501, US-501, US-70**, detain and/or alter the traffic flow on or during holidays, holiday weekends, special events, or any other time when traffic is unusually heavy, including the following schedules:

HOLIDAY AND HOLIDAY WEEKEND LANE CLOSURE RESTRICTIONS

1. For **unexpected occurrence** that creates unusually high traffic volumes, as directed by the Engineer.
2. For **New Year's Day**, between the hours of **6:00 AM** December 31st and **8:00 PM** January 2nd. If New Year's Day is on a Friday, Saturday, Sunday or Monday, then until **8:00 PM** the following Tuesday.
3. For **Easter**, between the hours of **6:00 AM** Thursday and **8:00 PM** Monday.
4. For **Memorial Day**, between the hours of **6:00 AM** Friday and **8:00 PM** Tuesday.

5. For **Independence Day**, between the hours of **6:00 AM** the day before Independence Day and **8:00 PM** the day after Independence Day.

If **Independence Day** is on a Friday, Saturday, Sunday or Monday, then between the hours of **6:00 AM** the Thursday before Independence Day and **8:00 PM** the Tuesday after Independence Day.

6. For **Labor Day**, between the hours of **6:00 AM** Friday and **8:00 PM** Tuesday.
7. For **Thanksgiving**, between the hours of **6:00 AM** Tuesday and **8:00 PM** Monday.
8. For **Christmas**, between the hours of **6:00 AM** the Friday before the week of Christmas Day and **8:00 PM** the following Tuesday after the week of Christmas Day.
9. For **events occurring at the following venues**, between **two (2) hours before** the start of the event and **two (2) hours after** the end of the event.

- Durham Bulls Athletic Park
- Durham Performing Arts Center
- Duke University (limited to events related to Graduation, Football games, and Men's and Women's Basketball games)
- North Carolina Central University (limited to events related to Graduation, Football games, and Men's and Women's Basketball games)

Holidays and holiday weekends shall include New Year's, Easter, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas. The Contractor shall schedule his work so that lane closures will not be required during these periods, unless otherwise directed by the Engineer.

The time of availability for this intermediate contract work shall be the time the Contractor begins to install all traffic control devices for lane closures according to the time restrictions listed herein.

The completion time for this intermediate contract work shall be the time the Contractor is required to complete the removal of all traffic control devices for lane closures according to the time restrictions stated above and place traffic in the existing traffic pattern.

The liquidated damages are **One Thousand Two Hundred Fifty Dollars (\$ 1,250.00)** per fifteen **(15)** minute time period.

INTERMEDIATE CONTRACT TIME NUMBER 2 AND LIQUIDATED DAMAGES:

(2-20-07)

108

SP1 G14 A

The Contractor shall complete the required work of installing, maintaining, and removing the traffic control devices for lane closures and restoring traffic to the existing traffic pattern. The Contractor shall not close or narrow a lane of traffic on **NC-54, NC-55, NC-98, NC-751, any Business US Routes, Downtown Loop (Ramseur St., Roxboro St., Morgan St.), any road inside the Downtown Loop** during the following time restrictions:

DAY AND TIME RESTRICTIONS

**Monday thru Friday
7:00 AM to 9:00 AM
4:00 PM to 7:00 PM**

In addition, the Contractor shall not close or narrow a lane of traffic on **NC-54, NC-55, NC-98, NC-751, any Business US Routes, Downtown Loop (Ramseur St., Roxboro St., Morgan St.), any road inside the Downtown Loop**, detain and/or alter the traffic flow on or during holidays, holiday weekends, special events, or any other time when traffic is unusually heavy, including the following schedules:

HOLIDAY AND HOLIDAY WEEKEND LANE CLOSURE RESTRICTIONS

1. For **unexpected occurrence** that creates unusually high traffic volumes, as directed by the Engineer.
2. For **New Year's Day**, between the hours of **7:00 AM** December 31st and **7:00 PM** January 2nd. If New Year's Day is on a Friday, Saturday, Sunday or Monday, then until **7:00 PM** the following Tuesday.
3. For **Easter**, between the hours of **7:00 AM** Thursday and **7:00 PM** Monday.
4. For **Memorial Day**, between the hours of **7:00 AM** Friday and **7:00 PM** Tuesday.
5. For **Independence Day**, between the hours of **7:00 AM** the day before Independence Day and **7:00 PM** the day after Independence Day.

If **Independence Day** is on a Friday, Saturday, Sunday or Monday, then between the hours of **7:00 AM** the Thursday before Independence Day and **7:00 PM** the Tuesday after Independence Day.
6. For **Labor Day**, between the hours of **7:00 AM** Friday and **7:00 PM** Tuesday.
7. For **Thanksgiving**, between the hours of **7:00 AM** Tuesday and **7:00 PM** Monday.
8. For **Christmas**, between the hours of **7:00 AM** the Friday before the week of Christmas Day and **7:00 PM** the following Tuesday after the week of Christmas Day.

9. For events occurring at the following venues, between **two (2) hours before** the start of the event and **two (2) hours after** the end of the event.

- Durham Bulls Athletic Park
- Durham Performing Arts Center
- Duke University (limited to events related to Graduation, Football games, and Men's and Women's Basketball games)
- North Carolina Central University (limited to events related to Graduation, Football games, and Men's and Women's Basketball games)

Holidays and holiday weekends shall include New Year's, Easter, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas. The Contractor shall schedule his work so that lane closures will not be required during these periods, unless otherwise directed by the Engineer.

The time of availability for this intermediate contract work shall be the time the Contractor begins to install all traffic control devices for lane closures according to the time restrictions listed herein.

The completion time for this intermediate contract work shall be the time the Contractor is required to complete the removal of all traffic control devices for lane closures according to the time restrictions stated above and place traffic in the existing traffic pattern.

The liquidated damages are **One Thousand Dollars (\$ 1,000.00)** per hour.

INTERMEDIATE CONTRACT TIME NUMBER 3 AND LIQUIDATED DAMAGES:

The Contractor shall complete the work required to install the new signal system fiber optic cable communications network with minimal disruption to the existing signal system fiber optic cable communications network. If the Contractor unintentionally breaks, cuts, or damages the existing fiber optic cables all repairs shall be made within seventy-two (72) hours. If the Contractor is required to intentionally break or cut existing fiber optic cables to facilitate the installation of new fiber optic cables, approval is required by the Engineer and all repairs shall be made within seventy-two (72) hours.

The time of availability for this intermediate contract work shall be the **time** when the Contractor intentionally or unintentionally disrupts the existing fiber optic cable.

The completion time for this intermediate contract time shall be the **time which is seventy-two (72) consecutive hours after and including the time of availability.**

The liquidated damages are **Two Hundred Fifty Dollars (\$ 250.00)** per hour.

MAJOR CONTRACT ITEMS:

(2-19-02)

104

SP1 G28

The following listed items are the major contract items for this contract (see Article 104-5 of the *2018 Standard Specifications*):

| Line # | Description |
|---------------|--|
| 51 — | Splice Enclosure |
| 74 — | Controller With Cabinet & Aux File (2070LX 332 Base Mounted) |

NO SPECIALTY ITEMS:

(7-1-95)

108-6

SP1 G34

None of the items included in this contract will be specialty items (see Article 108-6 of the *2018 Standard Specifications*).

SCHEDULE OF ESTIMATED COMPLETION PROGRESS:

(7-15-08) (Rev. 6-19-18)

108-2

SP1 G58

The Contractor's attention is directed to the Standard Special Provision entitled *Availability of Funds Termination of Contracts* included elsewhere in this proposal. The Department of Transportation's schedule of estimated completion progress for this project as required by that Standard Special Provision is as follows:

| | <u>Fiscal Year</u> | <u>Progress (% of Dollar Value)</u> |
|------|---------------------------|--|
| 2019 | (7/01/18 - 6/30/19) | 2% of Total Amount Bid |
| 2020 | (7/01/19 - 6/30/20) | 28% of Total Amount Bid |
| 2021 | (7/01/20 - 6/30/21) | 24% of Total Amount Bid |
| 2022 | (7/01/21 - 6/30/22) | 19% of Total Amount Bid |
| 2023 | (7/01/22 – 6/30/23) | 16% of Total Amount Bid |
| 2024 | (7/01/23 – 6/30/24) | 10% of Total Amount Bid |
| 2025 | (7/01/24 – 6/30/25) | 1% of Total Amount Bid |

The Contractor shall also furnish his own progress schedule in accordance with Article 108-2 of the *2018 Standard Specifications*. Any acceleration of the progress as shown by the Contractor's progress schedule over the progress as shown above shall be subject to the approval of the Engineer.

DISADVANTAGED BUSINESS ENTERPRISE:

(10-16-07)(Rev. 2-19-19)

102-15(J)

SP1 G61

Description

The purpose of this Special Provision is to carry out the U.S. Department of Transportation's policy of ensuring nondiscrimination in the award and administration of contracts financed in whole or in part with Federal funds. This provision is guided by 49 CFR Part 26.

Definitions

Additional DBE Subcontractors - Any DBE submitted at the time of bid that will not be used to meet the DBE goal. No submittal of a Letter of Intent is required.

Committed DBE Subcontractor - Any DBE submitted at the time of bid that is being used to meet the DBE goal by submission of a Letter of Intent. Or any DBE used as a replacement for a previously committed DBE firm.

Contract Goal Requirement - The approved DBE participation at time of award, but not greater than the advertised contract goal.

DBE Goal - A portion of the total contract, expressed as a percentage, that is to be performed by committed DBE subcontractor(s).

Disadvantaged Business Enterprise (DBE) - A firm certified as a Disadvantaged Business Enterprise through the North Carolina Unified Certification Program.

Goal Confirmation Letter - Written documentation from the Department to the bidder confirming the Contractor's approved, committed DBE participation along with a listing of the committed DBE firms.

Manufacturer - A firm that operates or maintains a factory or establishment that produces on the premises, the materials or supplies obtained by the Contractor.

Regular Dealer - A firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials or supplies required for the performance of the contract are bought, kept in stock, and regularly sold to the public in the usual course of business. A regular dealer engages in, as its principal business and in its own name, the purchase and sale or lease of the products in question. A regular dealer in such bulk items as steel, cement, gravel, stone, and petroleum products need not keep such products in stock, if it owns and operates distribution equipment for the products. Brokers and packagers are not regarded as manufacturers or regular dealers within the meaning of this section.

Replacement / Substitution – A full or partial reduction in the amount of work subcontracted to a committed (or an approved substitute) DBE firm.

North Carolina Unified Certification Program (NCUCP) - A program that provides comprehensive services and information to applicants for DBE certification, such that an applicant is required to apply only once for a DBE certification that will be honored by all recipients of USDOT funds in the state and not limited to the Department of Transportation only. The Certification Program is in accordance with 49 CFR Part 26.

United States Department of Transportation (USDOT) - Federal agency responsible for issuing regulations (49 CFR Part 26) and official guidance for the DBE program.

Forms and Websites Referenced in this Provision

DBE Payment Tracking System - On-line system in which the Contractor enters the payments made to DBE subcontractors who have performed work on the project.
<https://apps.dot.state.nc.us/Vendor/PaymentTracking/>

DBE-IS Subcontractor Payment Information - Form for reporting the payments made to all DBE firms working on the project. This form is for paper bid projects only.
<https://connect.ncdot.gov/business/Turnpike/Documents/Form%20DBE-IS%20Subcontractor%20Payment%20Information.pdf>

RF-1 DBE Replacement Request Form - Form for replacing a committed DBE.
<http://connect.ncdot.gov/projects/construction/Construction%20Forms/DBE%20MBE%20WBE%20Replacement%20Request%20Form.pdf>

SAF Subcontract Approval Form - Form required for approval to sublet the contract.
<http://connect.ncdot.gov/projects/construction/Construction%20Forms/Subcontract%20Approval%20Form%20Rev.%202012.zip>

JC-1 Joint Check Notification Form - Form and procedures for joint check notification. The form acts as a written joint check agreement among the parties providing full and prompt disclosure of the expected use of joint checks.
<http://connect.ncdot.gov/projects/construction/Construction%20Forms/Joint%20Check%20Notification%20Form.pdf>

Letter of Intent - Form signed by the Contractor and the DBE subcontractor, manufacturer or regular dealer that affirms that a portion of said contract is going to be performed by the signed DBE for the estimated amount (based on quantities and unit prices) listed at the time of bid.
<http://connect.ncdot.gov/letting/LetCentral/Letter%20of%20Intent%20to%20Perform%20as%20a%20Subcontractor.pdf>

Listing of DBE Subcontractors Form - Form for entering DBE subcontractors on a project that will meet this DBE goal. This form is for paper bids only.
[http://connect.ncdot.gov/municipalities/Bid%20Proposals%20for%20LGA%20Content/08%20DBE%20Subcontractors%20\(Federal\).docx](http://connect.ncdot.gov/municipalities/Bid%20Proposals%20for%20LGA%20Content/08%20DBE%20Subcontractors%20(Federal).docx)

Subcontractor Quote Comparison Sheet - Spreadsheet for showing all subcontractor quotes in the work areas where DBEs quoted on the project. This sheet is submitted with good faith effort packages.
<http://connect.ncdot.gov/business/SmallBusiness/Documents/DBE%20Subcontractor%20Quote%20Comparison%20Example.xls>

DBE Goal

The following DBE goal for participation by Disadvantaged Business Enterprises is established for this contract:

Disadvantaged Business Enterprises **0.0** %

- (A) *If the DBE goal is more than zero*, the Contractor shall exercise all necessary and reasonable steps to ensure that DBEs participate in at least the percent of the contract as set forth above as the DBE goal.

- (B) *If the DBE goal is zero*, the Contractor shall make an effort to recruit and use DBEs during the performance of the contract. Any DBE participation obtained shall be reported to the Department.

Directory of Transportation Firms (Directory)

Real-time information is available about firms doing business with the Department and firms that are certified through NCUCP in the Directory of Transportation Firms. Only firms identified in the Directory as DBE certified shall be used to meet the DBE goal. The Directory can be found at the following link. [https:// www.ebs.nc.gov/VendorDirectory/default.html](https://www.ebs.nc.gov/VendorDirectory/default.html)

The listing of an individual firm in the directory shall not be construed as an endorsement of the firm's capability to perform certain work.

Listing of DBE Subcontractors

At the time of bid, bidders shall submit all DBE participation that they anticipate to use during the life of the contract. Only those identified to meet the DBE goal will be considered committed, even though the listing shall include both committed DBE subcontractors and additional DBE subcontractors. Additional DBE subcontractor participation submitted at the time of bid will be used toward the Department's overall race-neutral goal. Only those firms with current DBE certification at the time of bid opening will be acceptable for listing in the bidder's submittal of DBE participation. The Contractor shall indicate the following required information:

(A) **Electronic Bids**

Bidders shall submit a listing of DBE participation in the appropriate section of the electronic submittal file.

- (1) Submit the names and addresses of DBE firms identified to participate in the contract. If the bidder uses the updated listing of DBE firms shown in the electronic submittal file, the bidder may use the dropdown menu to access the name and address of the DBE firm.
- (2) Submit the contract line numbers of work to be performed by each DBE firm. When no figures or firms are entered, the bidder will be considered to have no DBE participation.
- (3) The bidder shall be responsible for ensuring that the DBE is certified at the time of bid by checking the Directory of Transportation Firms. If the firm is not certified at the time of the bid-letting, that DBE's participation will not count towards achieving the DBE goal.

(B) Paper Bids

- (1) *If the DBE goal is more than zero,*
 - (a) Bidders, at the time the bid proposal is submitted, shall submit a listing of *DBE* participation, including the names and addresses on *Listing of DBE Subcontractors* contained elsewhere in the contract documents in order for the bid to be considered responsive. Bidders shall indicate the total dollar value of the DBE participation for the contract.
 - (b) If bidders have no DBE participation, they shall indicate this on the *Listing of DBE Subcontractors* by entering the word “None” or the number “0.” This form shall be completed in its entirety. **Blank forms will not be deemed to represent zero participation.** Bids submitted that do not have DBE participation indicated on the appropriate form will not be read publicly during the opening of bids. The Department will not consider these bids for award and the proposal will be rejected.
 - (c) The bidder shall be responsible for ensuring that the DBE is certified at the time of bid by checking the Directory of Transportation Firms. If the firm is not certified at the time of the bid-letting, that DBE’s participation will not count towards achieving the corresponding goal.
- (2) *If the DBE goal is zero,* entries on the *Listing of DBE Subcontractors* are not required for the zero goal, however any DBE participation that is achieved during the project shall be reported in accordance with requirements contained elsewhere in the special provision.

DBE Prime Contractor

When a certified DBE firm bids on a contract that contains a DBE goal, the DBE firm is responsible for meeting the goal or making good faith efforts to meet the goal, just like any other bidder. In most cases, a DBE bidder on a contract will meet the DBE goal by virtue of the work it performs on the contract with its own forces. However, all the work that is performed by the DBE bidder and any other DBE subcontractors will count toward the DBE goal. The DBE bidder shall list itself along with any DBE subcontractors, if any, in order to receive credit toward the DBE goal.

For example, if the DBE goal is 45% and the DBE bidder will only perform 40% of the contract work, the prime will list itself at 40%, and the additional 5% shall be obtained through additional DBE participation with DBE subcontractors or documented through a good faith effort.

DBE prime contractors shall also follow Sections A and B listed under *Listing of DBE Subcontractor* just as a non-DBE bidder would.

Written Documentation – Letter of Intent

The bidder shall submit written documentation for each DBE that will be used to meet the DBE goal of the contract, indicating the bidder's commitment to use the DBE in the contract. This documentation shall be submitted on the Department's form titled *Letter of Intent*.

The documentation shall be received in the office of the State Contractor Utilization Engineer or at DBE@ncdot.gov no later than 10:00 a.m. of the sixth calendar day following opening of bids, unless the sixth day falls on an official state holiday. In that situation, it is due in the office of the State Contractor Utilization Engineer no later than 10:00 a.m. on the next official state business day.

If the bidder fails to submit the Letter of Intent from each committed DBE to be used toward the DBE goal, or if the form is incomplete (i.e. both signatures are not present), the DBE participation will not count toward meeting the DBE goal. If the lack of this participation drops the commitment below the DBE goal, the Contractor shall submit evidence of good faith efforts, completed in its entirety, to the State Contractor Utilization Engineer or DBE@ncdot.gov no later than 10:00 a.m. on the eighth calendar day following opening of bids, unless the eighth day falls on an official state holiday. In that situation, it is due in the office of the State Contractor Utilization Engineer no later than 10:00 a.m. on the next official state business day.

Submission of Good Faith Effort

If the bidder fails to meet or exceed the DBE goal, the apparent lowest responsive bidder shall submit to the Department documentation of adequate good faith efforts made to reach the DBE goal.

A hard copy and an electronic copy of this information shall be received in the office of the State Contractor Utilization Engineer or at DBE@ncdot.gov no later than 10:00 a.m. on the sixth calendar day following opening of bids unless the sixth day falls on an official state holiday. In that situation, it is due in the office of the State Contractor Utilization Engineer no later than 10:00 a.m. on the next official state business day. If the contractor cannot send the information electronically, then one complete set and 5 copies of this information shall be received under the same time constraints above.

Note: Where the information submitted includes repetitious solicitation letters, it will be acceptable to submit a representative letter along with a distribution list of the firms that were solicited. Documentation of DBE quotations shall be a part of the good faith effort submittal. This documentation may include written subcontractor quotations, telephone log notations of verbal quotations, or other types of quotation documentation.

Consideration of Good Faith Effort for Projects with DBE Goals More Than Zero

Adequate good faith efforts mean that the bidder took all necessary and reasonable steps to achieve the goal which, by their scope, intensity, and appropriateness, could reasonably be expected to obtain sufficient DBE participation. Adequate good faith efforts also mean that the bidder actively and aggressively sought DBE participation. Mere *pro forma* efforts are not considered good faith efforts.

The Department will consider the quality, quantity, and intensity of the different kinds of efforts a bidder has made. Listed below are examples of the types of actions a bidder will take in making a good faith effort to meet the goal and are not intended to be exclusive or exhaustive, nor is it intended to be a mandatory checklist.

- (A) Soliciting through all reasonable and available means (e.g. attendance at pre-bid meetings, advertising, written notices, use of verifiable electronic means through the use of the NCDOT Directory of Transportation Firms) the interest of all certified DBEs who have the capability to perform the work of the contract. The bidder must solicit this interest within at least 10 days prior to bid opening to allow the DBEs to respond to the solicitation. Solicitation shall provide the opportunity to DBEs within the Division and surrounding Divisions where the project is located. The bidder must determine with certainty if the DBEs are interested by taking appropriate steps to follow up initial solicitations.
- (B) Selecting portions of the work to be performed by DBEs in order to increase the likelihood that the DBE goals will be achieved.
 - (1) Where appropriate, break out contract work items into economically feasible units to facilitate DBE participation, even when the prime contractor might otherwise prefer to perform these work items with its own forces.
 - (2) Negotiate with subcontractors to assume part of the responsibility to meet the contract DBE goal when the work to be sublet includes potential for DBE participation (2nd and 3rd tier subcontractors).
- (C) Providing interested DBEs with adequate information about the plans, specifications, and requirements of the contract in a timely manner to assist them in responding to a solicitation.
- (D)
 - (1) Negotiating in good faith with interested DBEs. It is the bidder's responsibility to make a portion of the work available to DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available DBE subcontractors and suppliers, to facilitate DBE participation. Evidence of such negotiation includes the names, addresses, and telephone numbers of DBEs that were considered; a description of the information provided regarding the plans and specifications for the work selected for subcontracting; and evidence as to why additional agreements could not be reached for DBEs to perform the work.
 - (2) A bidder using good business judgment would consider a number of factors in negotiating with subcontractors, including DBE subcontractors, and would take a firm's price and capabilities as well as contract goals into consideration. However, the fact that there may be some additional costs involved in finding and using DBEs is not in itself sufficient reason for a bidder's failure to meet the contract DBE goal, as long as such costs are reasonable. Also, the ability or desire of a prime contractor to perform the work of a contract with its own organization does not relieve the bidder of the responsibility to make good faith efforts. Bidding

contractors are not, however, required to accept higher quotes from DBEs if the price difference is excessive or unreasonable.

- (E) Not rejecting DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities. The bidder's standing within its industry, membership in specific groups, organizations, or associates and political or social affiliations (for example, union vs. non-union employee status) are not legitimate causes for the rejection or non-solicitation of bids in the bidder's efforts to meet the project goal.
- (F) Making efforts to assist interested DBEs in obtaining bonding, lines of credit, or insurance as required by the recipient or bidder.
- (G) Making efforts to assist interested DBEs in obtaining necessary equipment, supplies, materials, or related assistance or services.
- (H) Effectively using the services of available minority/women community organizations; minority/women contractors' groups; Federal, State, and local minority/women business assistance offices; and other organizations as allowed on a case-by-case basis to provide assistance in the recruitment and placement of DBEs. Contact within 7 days from the bid opening the Business Opportunity and Work Force Development Unit at BOWD@ncdot.gov to give notification of the bidder's inability to get DBE quotes.
- (I) Any other evidence that the bidder submits which shows that the bidder has made reasonable good faith efforts to meet the DBE goal.

In addition, the Department may take into account the following:

- (1) Whether the bidder's documentation reflects a clear and realistic plan for achieving the DBE goal.
- (2) The bidders' past performance in meeting the DBE goals.
- (3) The performance of other bidders in meeting the DBE goal. For example, when the apparent successful bidder fails to meet the DBE goal, but others meet it, you may reasonably raise the question of whether, with additional reasonable efforts the apparent successful bidder could have met the goal. If the apparent successful bidder fails to meet the DBE goal, but meets or exceeds the average DBE participation obtained by other bidders, the Department may view this, in conjunction with other factors, as evidence of the apparent successful bidder having made a good faith effort.

If the Department does not award the contract to the apparent lowest responsive bidder, the Department reserves the right to award the contract to the next lowest responsive bidder that can satisfy to the Department that the DBE goal can be met or that an adequate good faith effort has been made to meet the DBE goal.

Non-Good Faith Appeal

The State Contractual Services Engineer will notify the contractor verbally and in writing of non-good faith. A contractor may appeal a determination of non-good faith made by the Goal Compliance Committee. If a contractor wishes to appeal the determination made by the Committee, they shall provide written notification to the State Contractual Services Engineer or at DBE@ncdot.gov. The appeal shall be made within 2 business days of notification of the determination of non-good faith.

Counting DBE Participation Toward Meeting DBE Goal**(A) Participation**

The total dollar value of the participation by a committed DBE will be counted toward the contract goal requirement. The total dollar value of participation by a committed DBE will be based upon the value of work actually performed by the DBE and the actual payments to DBE firms by the Contractor.

(B) Joint Checks

Prior notification of joint check use shall be required when counting DBE participation for services or purchases that involves the use of a joint check. Notification shall be through submission of Form JC-1 (*Joint Check Notification Form*) and the use of joint checks shall be in accordance with the Department's Joint Check Procedures.

(C) Subcontracts (Non-Trucking)

A DBE may enter into subcontracts. Work that a DBE subcontracts to another DBE firm may be counted toward the contract goal requirement. Work that a DBE subcontracts to a non-DBE firm does not count toward the contract goal requirement. If a DBE contractor or subcontractor subcontracts a significantly greater portion of the work of the contract than would be expected on the basis of standard industry practices, it shall be presumed that the DBE is not performing a commercially useful function. The DBE may present evidence to rebut this presumption to the Department. The Department's decision on the rebuttal of this presumption is subject to review by the Federal Highway Administration but is not administratively appealable to USDOT.

(D) Joint Venture

When a DBE performs as a participant in a joint venture, the Contractor may count toward its contract goal requirement a portion of the total value of participation with the DBE in the joint venture, that portion of the total dollar value being a distinct clearly defined portion of work that the DBE performs with its forces.

(E) Suppliers

A contractor may count toward its DBE requirement 60 percent of its expenditures for materials and supplies required to complete the contract and obtained from a DBE regular dealer and 100 percent of such expenditures from a DBE manufacturer.

(F) Manufacturers and Regular Dealers

A contractor may count toward its DBE requirement the following expenditures to DBE firms that are not manufacturers or regular dealers:

- (1) The fees or commissions charged by a DBE firm for providing a *bona fide* service, such as professional, technical, consultant, or managerial services, or for providing bonds or insurance specifically required for the performance of a DOT-assisted contract, provided the fees or commissions are determined to be reasonable and not excessive as compared with fees and commissions customarily allowed for similar services.
- (2) With respect to materials or supplies purchased from a DBE, which is neither a manufacturer nor a regular dealer, count the entire amount of fees or commissions charged for assistance in the procurement of the materials and supplies, or fees or transportation charges for the delivery of materials or supplies required on a job site (but not the cost of the materials and supplies themselves), provided the fees are determined to be reasonable and not excessive as compared with fees customarily allowed for similar services.

Commercially Useful Function

(A) DBE Utilization

The Contractor may count toward its contract goal requirement only expenditures to DBEs that perform a commercially useful function in the work of a contract. A DBE performs a commercially useful function when it is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. To perform a commercially useful function, the DBE shall also be responsible with respect to materials and supplies used on the contract, for negotiating price, determining quality and quantity, ordering the material and installing (where applicable) and paying for the material itself. To determine whether a DBE is performing a commercially useful function, the Department will evaluate the amount of work subcontracted, industry practices, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the DBE credit claimed for its performance of the work, and any other relevant factors.

(B) DBE Utilization in Trucking

The following factors will be used to determine if a DBE trucking firm is performing a commercially useful function:

- (1) The DBE shall be responsible for the management and supervision of the entire trucking operation for which it is responsible on a particular contract, and there shall not be a contrived arrangement for the purpose of meeting DBE goals.
- (2) The DBE shall itself own and operate at least one fully licensed, insured, and operational truck used on the contract.
- (3) The DBE receives credit for the total value of the transportation services it provides on the contract using trucks it owns, insures, and operates using drivers it employs.
- (4) The DBE may subcontract the work to another DBE firm, including an owner-operator who is certified as a DBE. The DBE who subcontracts work to another DBE receives credit for the total value of the transportation services the subcontracted DBE provides on the contract.
- (5) The DBE may also subcontract the work to a non-DBE firm, including from an owner-operator. The DBE who subcontracts the work to a non-DBE is entitled to credit for the total value of transportation services provided by the non-DBE subcontractor not to exceed the value of transportation services provided by DBE-owned trucks on the contract. Additional participation by non-DBE subcontractors receives credit only for the fee or commission it receives as a result of the subcontract arrangement. The value of services performed under subcontract agreements between the DBE and the Contractor will not count towards the DBE contract requirement.
- (6) A DBE may lease truck(s) from an established equipment leasing business open to the general public. The lease must indicate that the DBE has exclusive use of and control over the truck. This requirement does not preclude the leased truck from working for others during the term of the lease with the consent of the DBE, so long as the lease gives the DBE absolute priority for use of the leased truck. This type of lease may count toward the DBE's credit as long as the driver is under the DBE's payroll.
- (7) Subcontracted/leased trucks shall display clearly on the dashboard the name of the DBE that they are subcontracted/leased to and their own company name if it is not identified on the truck itself. Magnetic door signs are not permitted.

DBE Replacement

When a Contractor has relied on a commitment to a DBE subcontractor (or an approved substitute DBE subcontractor) to meet all or part of a contract goal requirement, the contractor shall not terminate the DBE subcontractor for convenience. This includes, but is not limited to, instances in which the Contractor seeks to perform the work of the terminated subcontractor with another

DBE subcontractor, a non-DBE subcontractor, or with the Contractor's own forces or those of an affiliate.

The Contractor must give notice in writing both by certified mail and email to the DBE subcontractor, with a copy to the Engineer of its intent to request to terminate and/or substitute, and the reason for the request. The Contractor must give the DBE subcontractor five (5) business days to respond to the Contractor's Notice of Intent to Request Termination and/or Substitution. If the DBE subcontractor objects to the intended termination/substitution, the DBE, within five (5) business days must advise the Contractor and the Department of the reasons why the action should not be approved. The five-day notice period shall begin on the next business day after written notice is provided to the DBE subcontractor.

A committed DBE subcontractor may only be terminated after receiving the Department's written approval based upon a finding of good cause for the proposed termination and/or substitution. For purposes of this section, good cause shall include the following circumstances:

- (a) The listed DBE subcontractor fails or refuses to execute a written contract;
- (b) The listed DBE subcontractor fails or refuses to perform the work of its subcontract in a way consistent with normal industry standards. Provided, however, that good cause does not exist if the failure or refusal of the DBE subcontractor to perform its work on the subcontract results from the bad faith or discriminatory action of the prime contractor;
- (c) The listed DBE subcontractor fails or refuses to meet the prime contractor's reasonable, nondiscriminatory bond requirements;
- (d) The listed DBE subcontractor becomes bankrupt, insolvent, or exhibits credit unworthiness;
- (e) The listed DBE subcontractor is ineligible to work on public works projects because of suspension and debarment proceedings pursuant to 2 CFR Parts 180, 215 and 1,200 or applicable state law;
- (f) The listed DBE subcontractor is not a responsible contractor;
- (g) The listed DBE voluntarily withdraws from the project and provides written notice of withdrawal;
- (h) The listed DBE is ineligible to receive DBE credit for the type of work required;
- (i) A DBE owner dies or becomes disabled with the result that the listed DBE contractor is unable to complete its work on the contract;
- (j) Other documented good cause that compels the termination of the DBE subcontractor. Provided, that good cause does not exist if the prime contractor seeks to terminate a DBE it relied upon to obtain the contract so that the prime contractor can self-perform the work for which the DBE contractor was engaged or so that the prime contractor can substitute another DBE or non-DBE contractor after contract award.

The Contractor shall comply with the following for replacement of a committed DBE:

(A) Performance Related Replacement

When a committed DBE is terminated for good cause as stated above, an additional DBE that was submitted at the time of bid may be used to fulfill the DBE commitment. A good faith effort will only be required for removing a committed DBE if there were no additional

DBEs submitted at the time of bid to cover the same amount of work as the DBE that was terminated.

If a replacement DBE is not found that can perform at least the same amount of work as the terminated DBE, the Contractor shall submit a good faith effort documenting the steps taken. Such documentation shall include, but not be limited to, the following:

- (1) Copies of written notification to DBEs that their interest is solicited in contracting the work defaulted by the previous DBE or in subcontracting other items of work in the contract.
 - (2) Efforts to negotiate with DBEs for specific subbids including, at a minimum:
 - (a) The names, addresses, and telephone numbers of DBEs who were contacted.
 - (b) A description of the information provided to DBEs regarding the plans and specifications for portions of the work to be performed.
 - (3) A list of reasons why DBE quotes were not accepted.
 - (4) Efforts made to assist the DBEs contacted, if needed, in obtaining bonding or insurance required by the Contractor.
- (B) Decertification Replacement
- (1) When a committed DBE is decertified by the Department after the SAF (*Subcontract Approval Form*) has been received by the Department, the Department will not require the Contractor to solicit replacement DBE participation equal to the remaining work to be performed by the decertified firm. The participation equal to the remaining work performed by the decertified firm will count toward the contract goal requirement.
 - (2) When a committed DBE is decertified prior to the Department receiving the SAF (*Subcontract Approval Form*) for the named DBE firm, the Contractor shall take all necessary and reasonable steps to replace the DBE subcontractor with another DBE subcontractor to perform at least the same amount of work to meet the DBE goal requirement. If a DBE firm is not found to do the same amount of work, a good faith effort must be submitted to NCDOT (see A herein for required documentation).

All requests for replacement of a committed DBE firm shall be submitted to the Engineer for approval on Form RF-1 (*DBE Replacement Request*). If the Contractor fails to follow this procedure, the Contractor may be disqualified from further bidding for a period of up to 6 months.

Changes in the Work

When the Engineer makes changes that result in the reduction or elimination of work to be performed by a committed DBE, the Contractor will not be required to seek additional

participation. When the Engineer makes changes that result in additional work to be performed by a DBE based upon the Contractor's commitment, the DBE shall participate in additional work to the same extent as the DBE participated in the original contract work.

When the Engineer makes changes that result in extra work, which has more than a minimal impact on the contract amount, the Contractor shall seek additional participation by DBEs unless otherwise approved by the Engineer.

When the Engineer makes changes that result in an alteration of plans or details of construction, and a portion or all of the work had been expected to be performed by a committed DBE, the Contractor shall seek participation by DBEs unless otherwise approved by the Engineer.

When the Contractor requests changes in the work that result in the reduction or elimination of work that the Contractor committed to be performed by a DBE, the Contractor shall seek additional participation by DBEs equal to the reduced DBE participation caused by the changes.

Reports and Documentation

A SAF (*Subcontract Approval Form*) shall be submitted for all work which is to be performed by a DBE subcontractor. The Department reserves the right to require copies of actual subcontract agreements involving DBE subcontractors.

When using transportation services to meet the contract commitment, the Contractor shall submit a proposed trucking plan in addition to the SAF. The plan shall be submitted prior to beginning construction on the project. The plan shall include the names of all trucking firms proposed for use, their certification type(s), the number of trucks owned by the firm, as well as the individual truck identification numbers, and the line item(s) being performed.

Within 30 calendar days of entering into an agreement with a DBE for materials, supplies or services, not otherwise documented by the SAF as specified above, the Contractor shall furnish the Engineer a copy of the agreement. The documentation shall also indicate the percentage (60% or 100%) of expenditures claimed for DBE credit.

Reporting Disadvantaged Business Enterprise Participation

The Contractor shall provide the Engineer with an accounting of payments made to all DBE firms, including material suppliers and contractors at all levels (prime, subcontractor, or second tier subcontractor). This accounting shall be furnished to the Engineer for any given month by the end of the following month. Failure to submit this information accordingly may result in the following action:

- (A) Withholding of money due in the next partial pay estimate; or
- (B) Removal of an approved contractor from the prequalified bidders' list or the removal of other entities from the approved subcontractors list.

While each contractor (prime, subcontractor, 2nd tier subcontractor) is responsible for accurate accounting of payments to DBEs, it shall be the prime contractor's responsibility to report all monthly and final payment information in the correct reporting manner.

Failure on the part of the Contractor to submit the required information in the time frame specified may result in the disqualification of that contractor and any affiliate companies from further bidding until the required information is submitted.

Failure on the part of any subcontractor to submit the required information in the time frame specified may result in the disqualification of that contractor and any affiliate companies from being approved for work on future DOT projects until the required information is submitted.

Contractors reporting transportation services provided by non-DBE lessees shall evaluate the value of services provided during the month of the reporting period only.

At any time, the Engineer can request written verification of subcontractor payments.

The Contractor shall report the accounting of payments through the Department's DBE Payment Tracking System.

Failure to Meet Contract Requirements

Failure to meet contract requirements in accordance with Subarticle 102-15(J) of the *2018 Standard Specifications* may be cause to disqualify the Contractor.

CERTIFICATION FOR FEDERAL-AID CONTRACTS:

(3-21-90)

SP1 G85

The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:

- (A) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (B) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, *Disclosure Form to Report Lobbying*, in accordance with its instructions.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by *Section 1352, Title 31, U.S. Code*. Any person who

fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

The prospective participant also agrees by submitting his or her bid or proposal that he or she shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such subrecipients shall certify and disclose accordingly.

CONTRACTOR'S LICENSE REQUIREMENTS:

(7-1-95)

102-14

SP1 G88

If the successful bidder does not hold the proper license to perform any plumbing, heating, air conditioning, or electrical work in this contract, he will be required to sublet such work to a contractor properly licensed in accordance with *Article 2 of Chapter 87 of the General Statutes* (licensing of heating, plumbing, and air conditioning contractors) and *Article 4 of Chapter 87 of the General Statutes* (licensing of electrical contractors).

U.S. DEPARTMENT OF TRANSPORTATION HOTLINE:

(11-22-94)

108-5

SP1 G100

To report bid rigging activities call: **1-800-424-9071**

The U.S. Department of Transportation (DOT) operates the above toll-free hotline Monday through Friday, 8:00 a.m. to 5:00 p.m. eastern time. Anyone with knowledge of possible bid rigging, bidder collusion, or other fraudulent activities should use the hotline to report such activities.

The hotline is part of the DOT's continuing effort to identify and investigate highway construction contract fraud and abuse is operated under the direction of the DOT Inspector General. All information will be treated confidentially and caller anonymity will be respected.

CARGO PREFERENCE ACT:

(2-16-16)

Privately owned United States-flag commercial vessels transporting cargoes are subject to the Cargo Preference Act (CPA) of 1954 requirements and regulations found in 46 CFR 381.7. Contractors are directed to clause (b) of 46 CFR 381.7 as follows:

(b) Contractor and Subcontractor Clauses. "Use of United States-flag vessels: The contractor agrees-

" (1) To utilize privately owned United States-flag commercial vessels to ship at least 50 percent of the gross tonnage (computed separately for dry bulk carriers, dry cargo liners, and tankers) involved, whenever shipping any equipment, material, or commodities pursuant to this contract, to the extent such vessels are available at fair and reasonable rates for United States-flag commercial vessels.

(2) To furnish within 20 days following the date of loading for shipments originating within the United States or within 30 working days following the date of loading for shipments originating outside the United States a legible copy of a rated, 'on-board' commercial ocean bill-of-lading in English for each shipment of cargo described in paragraph (b) (1) of this section to both the Contracting Officer (through the prime contractor in the case of

subcontractor bills-of-lading) and to the Division of National Cargo, Office of Market Development, Maritime Administration, Washington, DC 20590.

(3) To insert the substance of the provisions of this clause in all subcontracts issued pursuant to this contract."

ELECTRONIC BIDDING:

(2-19-19)

101, 102, 103

SP1 G140

Revise the *2018 Standard Specifications* as follows:

Page 1-4, Article 101-3, DEFINITIONS, BID (OR PROPOSAL) *Electronic Bid*, line 1, replace "Bid Express®" with "the approved electronic bidding provider".

Page 1-15, Subarticle 102-8(B), Electronic Bids, lines 39-40, replace "to Bid Express®" with "via the approved electronic bidding provider".

Page 1-15, Subarticle 102-8(B)(1), Electronic Bids, line 41, delete "from Bid Express®"

Page 1-17, Subarticle 102-9(C)(2), Electronic Bids, line 21, replace "Bid Express® miscellaneous folder within the .ebs" with "electronic submittal".

Page 1-29, Subarticle 103-4(C)(2), Electronic Bids, line 32, replace ".ebs miscellaneous data file of Expedite" with "electronic submittal file"

STANDARD SPECIAL PROVISION
AVAILABILITY OF FUNDS – TERMINATION OF CONTRACTS

(5-20-08)

Z-2

General Statute 143C-6-11. (h) Highway Appropriation is hereby incorporated verbatim in this contract as follows:

(h) Amounts Encumbered. – Transportation project appropriations may be encumbered in the amount of allotments made to the Department of Transportation by the Director for the estimated payments for transportation project contract work to be performed in the appropriation fiscal year. The allotments shall be multiyear allotments and shall be based on estimated revenues and shall be subject to the maximum contract authority contained in *General Statute 143C-6-11(c)*. Payment for transportation project work performed pursuant to contract in any fiscal year other than the current fiscal year is subject to appropriations by the General Assembly. Transportation project contracts shall contain a schedule of estimated completion progress, and any acceleration of this progress shall be subject to the approval of the Department of Transportation provided funds are available. The State reserves the right to terminate or suspend any transportation project contract, and any transportation project contract shall be so terminated or suspended if funds will not be available for payment of the work to be performed during that fiscal year pursuant to the contract. In the event of termination of any contract, the contractor shall be given a written notice of termination at least 60 days before completion of scheduled work for which funds are available. In the event of termination, the contractor shall be paid for the work already performed in accordance with the contract specifications.

Payment will be made on any contract terminated pursuant to the special provision in accordance with Subarticle 108-13(D) of the *2018 Standard Specifications*.

STANDARD SPECIAL PROVISION**ERRATA**

(10-16-18) (Rev.1-15-19)

Z-4

Revise the *2018 Standard Specifications* as follows:

Division 6

Page 6-7, Article 609-1 DESCRIPTION, line 29, replace article number “609-10” with “609-9”.

Division 7

Page 7-27, Article 725-1 MEASUREMENT AND PAYMENT, line 4, replace article number “725-1” with “724-4”.

Page 7-28, Article 725-1 MEASUREMENT AND PAYMENT, line 10, replace article number “725-1” with “725-3”.

Division 10

Page 10-78, Article 1056-4 GEOTEXTILES, TABLE 1056-1, Permittivity, Type 2, replace “Table 6^D” with “Table 7^D” and **Permittivity, Type 3^B**, replace “Table 7^D” with “Table 8^D”.

Page 10-162, Article 1080-50 PAINT FOR VERTICAL MARKERS, line 1, replace article number “1080-50” with “1080-10”.

Page 10-162, Article 1080-61 EPOXY RESIN FOR REINFORCING STEEL, line 5, replace article number “1080-61” with “1080-11”.

Page 10-162, Article 1080-72 ABRASIVE MATERIALS FOR BLAST CLEANING STEEL, line 22, replace article number “1080-72” with “1080-12”.

Page 10-163, Article 1080-83 FIELD PERFORMANCE AND SERVICES, line 25, replace article number “1080-83” with “1080-13”.

Division 17

Page 17-15, Article 1715-4 MEASUREMENT AND PAYMENT, lines 42-44, replace the second sentence with the following:

An example is an installation of a single 1.25 inch HDPE conduit would be paid as:

Directional Drill (1)(1.25”) Linear Foot

STANDARD SPECIAL PROVISION**PLANT AND PEST QUARANTINES****(Imported Fire Ant, Gypsy Moth, Witchweed, Emerald Ash Borer, And Other Noxious Weeds)**

(3-18-03) (Rev. 12-20-16)

Z-04a

Within Quarantined Area

This project may be within a county regulated for plant and/or pests. If the project or any part of the Contractor's operations is located within a quarantined area, thoroughly clean all equipment prior to moving out of the quarantined area. Comply with federal/state regulations by obtaining a certificate or limited permit for any regulated article moving from the quarantined area.

Originating in a Quarantined County

Obtain a certificate or limited permit issued by the N.C. Department of Agriculture/United States Department of Agriculture. Have the certificate or limited permit accompany the article when it arrives at the project site.

Contact

Contact the N.C. Department of Agriculture/United States Department of Agriculture at 1-800-206-9333, 919-707-3730, or <http://www.ncagr.gov/plantindustry/> to determine those specific project sites located in the quarantined area or for any regulated article used on this project originating in a quarantined county.

Regulated Articles Include

1. Soil, sand, gravel, compost, peat, humus, muck, and decomposed manure, separately or with other articles. This includes movement of articles listed above that may be associated with cut/waste, ditch pulling, and shoulder cutting.
2. Plants with roots including grass sod.
3. Plant crowns and roots.
4. Bulbs, corms, rhizomes, and tubers of ornamental plants.
5. Hay, straw, fodder, and plant litter of any kind.
6. Clearing and grubbing debris.
7. Used agricultural cultivating and harvesting equipment.
8. Used earth-moving equipment.
9. Any other products, articles, or means of conveyance, of any character, if determined by an inspector to present a hazard of spreading imported fire ant, gypsy moth, witchweed, emerald ash borer, or other noxious weeds.

STANDARD SPECIAL PROVISION**TITLE VI AND NONDISCRIMINATION:**

(6-28-77)(Rev 6/19/2018)

Z-6

Revise the *2018 Standard Specifications* as follows:

Replace Article 103-4(B) with the following:

The North Carolina Department of Transportation is committed to carrying out the U.S. Department of Transportation's policy of ensuring nondiscrimination in the award and administration of contracts.

The provisions of this section related to United States Department of Transportation (US DOT) Order 1050.2A, Title 49 Code of Federal Regulations (CFR) part 21, 23 United States Code (U.S.C.) 140 and 23 CFR part 200 (or 49 CFR 303, 49 U.S.C. 5332 or 49 U.S.C. 47123) are applicable to all North Carolina Department of Transportation (NCDOT) contracts and to all related subcontracts, material supply, engineering, architectural and other service contracts, regardless of dollar amount. Any Federal provision that is specifically required not specifically set forth is hereby incorporated by reference.

(1) **Title VI Assurances (USDOT Order 1050.2A, Appendix A)**

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

(a) Compliance with Regulations

The contractor (hereinafter includes consultants) shall comply with the Acts and the Regulations relative to Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

(b) Nondiscrimination

The contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor shall not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 CFR Part 21.

(c) Solicitations for Subcontractors, Including Procurements of Materials and Equipment

In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Nondiscrimination on the grounds of race, color, or national origin.

(d) Information and Reports

The contractor shall provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and shall permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the FHWA to be pertinent to ascertain compliance with such Acts,

Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor shall so certify to the Recipient or the FHWA, as appropriate, and shall set forth what efforts it has made to obtain the information.

(e) Sanctions for Noncompliance:

In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it and/or the FHWA may determine to be appropriate, including, but not limited to:

- (i) Withholding payments to the contractor under the contract until the contractor complies; and/or
- (ii) Cancelling, terminating, or suspending a contract, in whole or in part.

(f) Incorporation of Provisions

The contractor shall include the provisions of paragraphs (a) through (f) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor shall take action with respect to any subcontract or procurement as the Recipient or the FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance. Provided, that if the contractor becomes involved in, or is threatened with litigation by a subcontractor, or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

(2) **Title VI Nondiscrimination Program (23 CFR 200.5(p))**

The North Carolina Department of Transportation (NCDOT) has assured the USDOT that, as a condition to receiving federal financial assistance, NCDOT will comply with Title VI of the Civil Rights Act of 1964 and all requirements imposed by Title 49 CFR part 21 and related nondiscrimination authorities to ensure that no person shall, on the ground of race, color, national origin, limited English proficiency, sex, age, or disability (including religion/creed or income-level, where applicable), be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any programs, activities, or services conducted or funded by NCDOT. Contractors and other organizations under contract or agreement with NCDOT must also comply with Title VI and related authorities, therefore:

(a) During the performance of this contract or agreement, contractors (e.g., subcontractors, consultants, vendors, prime contractors) are responsible for complying with NCDOT's Title VI Program. Contractors are not required to prepare or submit Title VI Programs. To comply with this section, the prime contractor shall:

1. Post NCDOT's Notice of Nondiscrimination and the Contractor's own Equal Employment Opportunity (EEO) Policy in conspicuous locations accessible to all employees, applicants and subcontractors on the jobsite.
2. Physically incorporate the required Title VI clauses into all subcontracts on federally-assisted and state-funded NCDOT projects, and ensure inclusion by subcontractors into all lower-tier subcontracts.
3. Required Solicitation Language. The Contractor shall include the following notification in all solicitations for bids and requests for work or material, regardless of funding source:

“The North Carolina Department of Transportation, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§

2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award. In accordance with other related nondiscrimination authorities, bidders and contractors will also not be discriminated against on the grounds of sex, age, disability, low-income level, creed/religion, or limited English proficiency in consideration for an award.”

4. Physically incorporate the FHWA-1273, in its entirety, into all subcontracts and subsequent lower tier subcontracts on Federal-aid highway construction contracts only.
 5. Provide language assistance services (i.e., written translation and oral interpretation), free of charge, to LEP employees and applicants. Contact NCDOT OCR for further assistance, if needed.
 6. For assistance with these Title VI requirements, contact the NCDOT Title VI Nondiscrimination Program at 1-800-522-0453.
- (b) Subrecipients (e.g. cities, counties, LGAs, planning organizations) may be required to prepare and submit a Title VI Plan to NCDOT, including Title VI Assurances and/or agreements. Subrecipients must also ensure compliance by their contractors and subrecipients with Title VI. (23 CFR 200.9(b)(7))
- (c) If reviewed or investigated by NCDOT, the contractor or subrecipient agrees to take affirmative action to correct any deficiencies found within a reasonable time period, not to exceed 90 calendar days, unless additional time is granted by NCDOT. (23 CFR 200.9(b)(15))
- (d) The Contractor is responsible for notifying subcontractors of NCDOT’s External Discrimination Complaints Process.
1. Applicability
Title VI and related laws protect participants and beneficiaries (e.g., members of the public and contractors) from discrimination by NCDOT employees, subrecipients and contractors, regardless of funding source.
 2. Eligibility
Any person—or class of persons—who believes he/she has been subjected to discrimination based on race, color, national origin, Limited English Proficiency (LEP), sex, age, or disability (and religion in the context of employment, aviation, or transit) may file a written complaint. The law also prohibits intimidation or retaliation of any sort.
 3. Time Limits and Filing Options
Complaints may be filed by the affected individual(s) or a representative and must be filed no later than 180 calendar days after the following:
 - (i) The date of the alleged act of discrimination; or
 - (ii) The date when the person(s) became aware of the alleged discrimination; or
 - (iii) Where there has been a continuing course of conduct, the date on which that conduct was discontinued or the latest instance of the conduct.Title VI and related discrimination complaints may be submitted to the following entities:

- North Carolina Department of Transportation, Office of Civil Rights, Title VI Program, 1511 Mail Service Center, Raleigh, NC 27699-1511; toll free 1-800-522-0453
 - Federal Highway Administration, North Carolina Division Office, 310 New Bern Avenue, Suite 410, Raleigh, NC 27601, 919-747-7010
 - US Department of Transportation, Departmental Office of Civil Rights, External Civil Rights Programs Division, 1200 New Jersey Avenue, SE, Washington, DC 20590; 202-366-4070
4. Format for Complaints
Complaints must be in writing and signed by the complainant(s) or a representative, and include the complainant's name, address, and telephone number. Complaints received by fax or e-mail will be acknowledged and processed. Allegations received by telephone will be reduced to writing and provided to the complainant for confirmation or revision before processing. Complaints will be accepted in other languages, including Braille.
5. Discrimination Complaint Form
Contact NCDOT Civil Rights to receive a full copy of the Discrimination Complaint Form and procedures.
6. Complaint Basis
Allegations must be based on issues involving race, color, national origin (LEP), sex, age, disability, or religion (in the context of employment, aviation or transit). "Basis" refers to the complainant's membership in a protected group category.

**TABLE 103-1
COMPLAINT BASIS**

| Protected Categories | Definition | Examples | Applicable Nondiscrimination Authorities |
|--|--|--|--|
| Race and Ethnicity | An individual belonging to one of the accepted racial groups; or the perception, based usually on physical characteristics that a person is a member of a racial group | Black/African American, Hispanic/Latino, Asian, American Indian/Alaska Native, Native Hawaiian/Pacific Islander, White | Title VI of the Civil Rights Act of 1964; 49 CFR Part 21; 23 CFR 200; 49 U.S.C. 5332(b); 49 U.S.C. 47123. (<i>Executive Order 13166</i>) |
| Color | Color of skin, including shade of skin within a racial group | Black, White, brown, yellow, etc. | |
| National Origin (<i>Limited English Proficiency</i>) | Place of birth. Citizenship is not a factor. (<i>Discrimination based on language or a person's accent is also covered</i>) | Mexican, Cuban, Japanese, Vietnamese, Chinese | |
| Sex | Gender. The sex of an individual. <i>Note: Sex under this program does not include sexual orientation.</i> | Women and Men | 1973 Federal-Aid Highway Act; 49 U.S.C. 5332(b); 49 U.S.C. 47123. |
| Age | Persons of any age | 21-year-old person | Age Discrimination Act of 1975 49 U.S.C. 5332(b); 49 U.S.C. 47123. |
| Disability | Physical or mental impairment, permanent or temporary, or perceived. | Blind, alcoholic, para-amputee, epileptic, diabetic, arthritic | Section 504 of the Rehabilitation Act of 1973; Americans with Disabilities Act of 1990 |

| | | | |
|--|---|---|--|
| <p>Religion (in the context of employment) <i>(Religion/ Creed in all aspects of any aviation or transit-related construction)</i></p> | <p>An individual belonging to a religious group; or the perception, based on distinguishable characteristics that a person is a member of a religious group. In practice, actions taken as a result of the moral and ethical beliefs as to what is right and wrong, which are sincerely held with the strength of traditional religious views. Note: Does not have to be associated with a recognized religious group or church; if an individual sincerely holds to the belief, it is a protected religious practice.</p> | <p>Muslim, Christian, Sikh, Hindu, etc.</p> | <p>Title VII of the Civil Rights Act of 1964; 23 CFR 230; FHWA-1273 Required Contract Provisions. (49 U.S.C. 5332(b); 49 U.S.C. 47123)</p> |
|--|---|---|--|

(3) Pertinent Nondiscrimination Authorities

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest agrees to comply with the following non-discrimination statutes and authorities, including, but not limited to:

- (a) Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 CFR Part 21.
- (b) The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
- (c) Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
- (d) Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability) and 49 CFR Part 27;
- (e) The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
- (f) Airport and Airway Improvement Act of 1982, (49 USC § 471, Section 47123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
- (g) The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, sub-recipients and contractors, whether such programs or activities are Federally funded or not);
- (h) Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
- (i) The Federal Aviation Administration's Nondiscrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- (j) Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures Nondiscrimination against minority populations by discouraging programs, policies, and activities with

disproportionately high and adverse human health or environmental effects on minority and low-income populations;

- (k) Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of Limited English proficiency (LEP). To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
- (l) Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).
- (m) Title VII of the Civil Rights Act of 1964 (42 U.S.C. § 2000e et seq., Pub. L. 88-352), (prohibits employment discrimination on the basis of race, color, religion, sex, or national origin).

(4) Additional Title VI Assurances

***The following Title VI Assurances (Appendices B, C and D) shall apply, as applicable*

(a) Clauses for Deeds Transferring United States Property (1050.2A, Appendix B)

The following clauses will be included in deeds effecting or recording the transfer of real property, structures, or improvements thereon, or granting interest therein from the United States pursuant to the provisions of Assurance 4.

NOW, THEREFORE, the U.S. Department of Transportation as authorized by law and upon the condition that the North Carolina Department of Transportation (NCDOT) will accept title to the lands and maintain the project constructed thereon in accordance with the North Carolina General Assembly, the Regulations for the Administration of the Federal-Aid Highway Program, and the policies and procedures prescribed by the Federal Highway Administration of the U.S. Department of Transportation in accordance and in compliance with all requirements imposed by Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation pertaining to and effectuating the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252; 42 U.S.C. § 2000d to 2000d-4), does hereby remise, release, quitclaim and convey unto the NCDOT all the right, title and interest of the U.S. Department of Transportation in and to said lands described in Exhibit A attached hereto and made a part hereof.

(HABENDUM CLAUSE)

TO HAVE AND TO HOLD said lands and interests therein unto the North Carolina Department of Transportation (NCDOT) and its successors forever, subject, however, to the covenants, conditions, restrictions and reservations herein contained as follows, which will remain in effect for the period during which the real property or structures are used for a purpose for which Federal financial assistance is extended or for another purpose involving the provision of similar services or benefits and will be binding on the NCDOT, its successors and assigns.

The NCDOT, in consideration of the conveyance of said lands and interests in lands, does hereby covenant and agree as a covenant running with the land for itself, its successors and assigns, that (1) no person will on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination with regard to any facility located wholly or in part on, over, or under such lands hereby conveyed [,] [and]* (2) that the NCDOT will use the lands and interests in lands and interests in lands so conveyed, in compliance with all requirements imposed by or pursuant to Title 49, Code of Federal Regulations, U.S. Department of Transportation, Subtitle A, Office of the Secretary, Part 21, Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Effectuation of Title VI of the Civil Rights Act of 1964, and as said Regulations and Acts may be amended [, and (3) that in the event of breach of any of the above-mentioned nondiscrimination conditions, the Department will have a right to enter or re-enter said lands and facilities on said land, and that above described land and facilities will thereon revert to and vest in and become the absolute property of the U.S. Department of Transportation and its assigns as such interest existed prior to this instruction].*

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary in order to make clear the purpose of Title VI.)

(b) Clauses for Transfer of Real Property Acquired or Improved Under the Activity, Facility, or Program (1050.2A, Appendix C)

The following clauses will be included in deeds, licenses, leases, permits, or similar instruments entered into by the North Carolina Department of Transportation (NCDOT) pursuant to the provisions of Assurance 7(a):

1. The (grantee, lessee, permittee, etc. as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree [in the case of deeds and leases add "as a covenant running with the land"] that:
 - (i.) In the event facilities are constructed, maintained, or otherwise operated on the property described in this (deed, license, lease, permit, etc.) for a purpose for which a U.S. Department of Transportation activity, facility, or program is extended or for another purpose involving the provision of similar services or benefits, the (grantee, licensee, lessee, permittee, etc.) will maintain and operate such facilities and services in compliance with all requirements imposed by the Acts and Regulations (as may be amended) such that no person on the grounds of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities.
2. With respect to licenses, leases, permits, etc., in the event of breach of any of the above Nondiscrimination covenants, the NCDOT will have the right to terminate the (lease, license, permit, etc.) and to enter, re-enter, and repossess said lands and facilities thereon, and hold the same as if the (lease, license, permit, etc.) had never been made or issued. *
3. With respect to a deed, in the event of breach of any of the above Nondiscrimination covenants, the NCDOT will have the right to enter or re-enter the lands and facilities thereon, and the above described lands and facilities will there upon revert to and vest in and become the absolute property of the NCDOT and its assigns. *

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

(c) Clauses for Construction/Use/Access to Real Property Acquired Under the Activity, Facility or Program (1050.2A, Appendix D)

The following clauses will be included in deeds, licenses, permits, or similar instruments/ agreements entered into by the North Carolina Department of Transportation (NCDOT) pursuant to the provisions of Assurance 7(b):

1. The (grantee, licensee, permittee, etc., as appropriate) for himself/herself, his/her heirs, personal representatives, successors in interest, and assigns, as a part of the consideration hereof, does hereby covenant and agree (in the case of deeds and leases add, "as a covenant running with the land") that (1) no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or be otherwise subjected to discrimination in the use of said facilities, (2) that in the construction of any improvements on, over, or under such land, and the furnishing of services thereon, no person on the ground of race, color, or national origin, will be excluded from participation in, denied the benefits of, or otherwise be subjected to discrimination, (3) that the (grantee, licensee, lessee, permittee, etc.) will use the premises in compliance with all other requirements imposed by or pursuant to the Acts and Regulations, as amended, set forth in this Assurance.
2. With respect to (licenses, leases, permits, etc.), in the event of breach of any of the above Non-discrimination covenants, the NCDOT will have the right to terminate the (license, permit, etc., as appropriate) and to enter or re-enter and repossess said land and the facilities thereon, and hold the same as if said (license, permit, etc., as appropriate) had never been made or issued. *
3. With respect to deeds, in the event of breach of any of the above Nondiscrimination covenants, the NCDOT will there upon revert to and vest in and become the absolute property of the NCDOT and its assigns. *

(*Reverter clause and related language to be used only when it is determined that such a clause is necessary to make clear the purpose of Title VI.)

STANDARD SPECIAL PROVISION**MINORITY AND FEMALE EMPLOYMENT REQUIREMENTS**

Z-7

NOTICE OF REQUIREMENTS FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY (*EXECUTIVE NUMBER 11246*)

1. The goals and timetables for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, see as shown on the attached sheet entitled "Employment Goals for Minority and Female participation".

These goals are applicable to all the Contractor's construction work (whether or not it is Federal or federally assisted) performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, it shall apply the goals established for such geographical area where the work is actually performed. With regard to this second area, the Contractor also is subject to the goals for both its federally involved and nonfederally involved construction.

The Contractor's compliance with the Executive Order and the regulations in *41 CFR Part 60-4* shall be based on its implementation of the Equal Opportunity Clause, specific affirmative action obligations required by the specifications set forth in *41 CFR 60-4.3(a)*, and its effort to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade and the Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor or from project to project for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, the executive Order and the regulations in *41 CFR Part 60-4*. Compliance with the goals will be measured against the total work hours performed.

2. As used in this Notice and in the contract resulting from this solicitation, the "covered area" is the county or counties shown on the cover sheet of the proposal form and contract.

**EMPLOYMENT GOALS FOR MINORITY
AND FEMALE PARTICIPATION**

Economic Areas

Area 023 29.7%

Bertie County
Camden County
Chowan County
Gates County
Hertford County
Pasquotank County
Perquimans County

Area 024 31.7%

Beaufort County
Carteret County
Craven County
Dare County
Edgecombe County
Green County
Halifax County
Hyde County
Jones County
Lenoir County
Martin County
Nash County
Northampton County
Pamlico County
Pitt County
Tyrrell County
Washington County
Wayne County
Wilson County

Area 025 23.5%

Columbus County
Duplin County
Onslow County
Pender County

Area 026 33.5%

Bladen County
Hoke County
Richmond County
Robeson County
Sampson County
Scotland County

Area 027 24.7%

Chatham County
Franklin County
Granville County
Harnett County
Johnston County
Lee County
Person County
Vance County
Warren County

Area 028 15.5%

Alleghany County
Ashe County
Caswell County
Davie County
Montgomery County
Moore County
Rockingham County
Surry County
Watauga County
Wilkes County

Area 029 15.7%

Alexander County
Anson County
Burke County
Cabarrus County
Caldwell County
Catawba County
Cleveland County
Iredell County
Lincoln County
Polk County
Rowan County
Rutherford County
Stanly County

Area 0480 8.5%

Buncombe County
Madison County

Area 030 6.3%

Avery County
Cherokee County
Clay County
Graham County
Haywood County
Henderson County
Jackson County
McDowell County
Macon County
Mitchell County
Swain County
Transylvania County
Yancey County

SMSA Areas

Area 5720 26.6%

Currituck County

Area 9200 20.7%

Brunswick County

New Hanover County

Area 2560 24.2%

Cumberland County

Area 6640 22.8%

Durham County

Orange County

Wake County

Area 1300 16.2%

Alamance County

Area 3120 16.4%

Davidson County

Forsyth County

Guilford County

Randolph County

Stokes County

Yadkin County

Area 1520 18.3%

Gaston County

Mecklenburg County

Union County

Goals for Female

Participation in Each Trade

(Statewide) 6.9%

STANDARD SPECIAL PROVISION**REQUIRED CONTRACT PROVISIONS FEDERAL - AID CONSTRUCTION CONTRACTS**

FHWA - 1273 Electronic Version - May 1, 2012

Z-8

- I. General
- II. Nondiscrimination
- III. Nonsegregated Facilities
- IV. Davis-Bacon and Related Act Provisions
- V. Contract Work Hours and Safety Standards Act Provisions
- VI. Subletting or Assigning the Contract
- VII. Safety: Accident Prevention
- VIII. False Statements Concerning Highway Projects
- IX. Implementation of Clean Air Act and Federal Water Pollution Control Act
- X. Compliance with Governmentwide Suspension and Debarment Requirements
- XI. Certification Regarding Use of Contract Funds for Lobbying

ATTACHMENTS

- A. Employment and Materials Preference for Appalachian Development Highway System or Appalachian Local Access Road Contracts (included in Appalachian contracts only)

I. GENERAL

1. Form FHWA-1273 must be physically incorporated in each construction contract funded under Title 23 (excluding emergency contracts solely intended for debris removal). The contractor (or subcontractor) must insert this form in each subcontract and further require its inclusion in all lower tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services).
The applicable requirements of Form FHWA-1273 are incorporated by reference for work done under any purchase order, rental agreement or agreement for other services. The prime contractor shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.
Form FHWA-1273 must be included in all Federal-aid design-build contracts, in all subcontracts and in lower tier subcontracts (excluding subcontracts for design services, purchase orders, rental agreements and other agreements for supplies or services). The design-builder shall be responsible for compliance by any subcontractor, lower-tier subcontractor or service provider.
Contracting agencies may reference Form FHWA-1273 in bid proposal or request for proposal documents, however, the Form FHWA-1273 must be physically incorporated (not referenced) in all contracts, subcontracts and lower-tier subcontracts (excluding purchase orders, rental agreements and other agreements for supplies or services related to a construction contract).
2. Subject to the applicability criteria noted in the following sections, these contract provisions shall apply to all work performed on the contract by the contractor's own organization and with the assistance of workers under the contractor's immediate superintendence and to all work performed on the contract by piecework, station work, or by subcontract.
3. A breach of any of the stipulations contained in these Required Contract Provisions may be sufficient grounds for withholding of progress payments, withholding of final payment, termination of the contract, suspension / debarment or any other action determined to be appropriate by the contracting agency and FHWA.
4. Selection of Labor: During the performance of this contract, the contractor shall not use convict labor for any purpose within the limits of a construction project on a Federal-aid highway unless it is labor performed by convicts who are on parole, supervised release, or probation. The term Federal-aid highway does not include roadways functionally classified as local roads or rural minor collectors.

II. NONDISCRIMINATION

The provisions of this section related to 23 CFR Part 230 are applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more. The provisions of 23 CFR Part 230 are not applicable to material supply, engineering, or architectural service contracts.

In addition, the contractor and all subcontractors must comply with the following policies: Executive Order 11246, 41 CFR 60, 29 CFR 1625-1627, Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The contractor and all subcontractors must comply with: the requirements of the Equal Opportunity Clause in 41 CFR 60-1.4(b) and, for all construction contracts exceeding \$10,000, the Standard Federal Equal Employment Opportunity Construction Contract Specifications in 41 CFR 60-4.3.

Note: The U.S. Department of Labor has exclusive authority to determine compliance with Executive Order 11246 and the policies of the Secretary of Labor including 41 CFR 60, and 29 CFR 1625-1627. The contracting agency and the FHWA have the authority and the responsibility to ensure compliance with Title 23 USC Section 140, the Rehabilitation Act of 1973, as amended (29 USC 794), and Title VI of the Civil Rights Act of 1964, as amended, and related regulations including 49 CFR Parts 21, 26 and 27; and 23 CFR Parts 200, 230, and 633.

The following provision is adopted from 23 CFR 230, Appendix A, with appropriate revisions to conform to the U.S. Department of Labor (US DOL) and FHWA requirements.

1. **Equal Employment Opportunity:** Equal employment opportunity (EEO) requirements not to discriminate and to take affirmative action to assure equal opportunity as set forth under laws, executive orders, rules, regulations (28 CFR 35, 29 CFR 1630, 29 CFR 1625-1627, 41 CFR 60 and 49 CFR 27) and orders of the Secretary of Labor as modified by the provisions prescribed herein, and imposed pursuant to 23 U.S.C. 140 shall constitute the EEO and specific affirmative action standards for the contractor's project activities under this contract. The provisions of the Americans with Disabilities Act of 1990 (42 U.S.C. 12101 et seq.) set forth under 28 CFR 35 and 29 CFR 1630 are incorporated by reference in this contract. In the execution of this contract, the contractor agrees to comply with the following minimum specific requirement activities of EEO:
 - a. The contractor will work with the contracting agency and the Federal Government to ensure that it has made every good faith effort to provide equal opportunity with respect to all of its terms and conditions of employment and in their review of activities under the contract.
 - b. The contractor will accept as its operating policy the following statement:

"It is the policy of this Company to assure that applicants are employed, and that employees are treated during employment, without regard to their race, religion, sex, color, national origin, age or disability. Such action shall include: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship, pre-apprenticeship, and/or on-the-job training."

2. **EEO Officer:** The contractor will designate and make known to the contracting officers an EEO Officer who will have the responsibility for and must be capable of effectively administering and promoting an active EEO program and who must be assigned adequate authority and responsibility to do so.
3. **Dissemination of Policy:** All members of the contractor's staff who are authorized to hire, supervise, promote, and discharge employees, or who recommend such action, or who are substantially involved in such action, will be made fully cognizant of, and will implement, the contractor's EEO policy and contractual responsibilities to provide EEO in each grade and classification of employment. To ensure that the above agreement will be met, the following actions will be taken as a minimum:
 - a. Periodic meetings of supervisory and personnel office employees will be conducted before the start of work and then not less often than once every six months, at which time the contractor's EEO policy and its implementation will be reviewed and explained. The meetings will be conducted by the EEO Officer.
 - b. All new supervisory or personnel office employees will be given a thorough indoctrination by the EEO Officer, covering all major aspects of the contractor's EEO obligations within thirty days following their reporting for duty with the contractor.
 - c. All personnel who are engaged in direct recruitment for the project will be instructed by the EEO Officer in the contractor's procedures for locating and hiring minorities and women.
 - d. Notices and posters setting forth the contractor's EEO policy will be placed in areas readily accessible to employees, applicants for employment and potential employees.
 - e. The contractor's EEO policy and the procedures to implement such policy will be brought to the attention of employees by means of meetings, employee handbooks, or other appropriate means.
4. **Recruitment:** When advertising for employees, the contractor will include in all advertisements for employees the notation: "An Equal Opportunity Employer." All such advertisements will be placed in publications having a large circulation among minorities and women in the area from which the project work force would normally be derived.
 - a. The contractor will, unless precluded by a valid bargaining agreement, conduct systematic and direct recruitment through public and private employee referral sources likely to yield qualified minorities and women. To meet this requirement, the contractor will identify sources of potential minority group employees, and establish with such identified sources procedures whereby minority and women applicants may be referred to the contractor for employment consideration.
 - b. In the event the contractor has a valid bargaining agreement providing for exclusive hiring hall referrals, the contractor is expected to observe the provisions of that agreement to the extent that the system meets the contractor's compliance with EEO contract provisions. Where implementation of such an agreement has the effect of discriminating against minorities or women, or obligates the contractor to do the same, such implementation violates Federal nondiscrimination provisions.
 - c. The contractor will encourage its present employees to refer minorities and women as applicants for employment. Information and procedures with regard to referring such applicants will be discussed with employees.
5. **Personnel Actions:** Wages, working conditions, and employee benefits shall be established and administered, and personnel actions of every type, including hiring, upgrading, promotion, transfer, demotion, layoff, and termination, shall be taken without regard to race, color, religion, sex, national origin, age or disability. The following procedures shall be followed:
 - a. The contractor will conduct periodic inspections of project sites to insure that working conditions and employee facilities do not indicate discriminatory treatment of project site personnel.
 - b. The contractor will periodically evaluate the spread of wages paid within each classification to determine any evidence of discriminatory wage practices.
 - c. The contractor will periodically review selected personnel actions in depth to determine whether there is evidence of discrimination. Where evidence is found, the contractor will promptly take corrective action. If the review indicates that the discrimination may extend beyond the actions reviewed, such corrective action shall include all affected persons.
 - d. The contractor will promptly investigate all complaints of alleged discrimination made to the contractor in connection with its obligations under this contract, will attempt to resolve such complaints, and will take appropriate corrective action within a reasonable time. If the investigation indicates that the discrimination may affect persons other than the complainant, such corrective action shall include such other persons. Upon completion of each investigation, the contractor will inform every complainant of all of their avenues of appeal.
6. **Training and Promotion:**
 - a. The contractor will assist in locating, qualifying, and increasing the skills of minorities and women who are applicants for employment or current employees. Such efforts should be aimed at developing full journey level status employees in the type of trade or job classification involved.
 - b. Consistent with the contractor's work force requirements and as permissible under Federal and State regulations, the contractor shall make full use of training programs, i.e., apprenticeship, and on-the-job training programs for the geographical area of contract performance. In the event a special provision for training is provided under this contract, this subparagraph will be superseded as indicated in the special provision. The contracting agency may reserve training positions for persons who receive welfare assistance in accordance with 23 U.S.C. 140(a).
 - c. The contractor will advise employees and applicants for employment of available training programs and entrance requirements for each.
 - d. The contractor will periodically review the training and promotion potential of employees who are minorities and women and will encourage eligible employees to apply for such training and promotion.
7. **Unions:** If the contractor relies in whole or in part upon unions as a source of employees, the contractor will use good faith efforts to obtain the cooperation of such unions to increase opportunities for minorities and women. Actions by the contractor, either directly or through a contractor's association acting as agent, will include the procedures set forth below:
 - a. The contractor will use good faith efforts to develop, in cooperation with the unions, joint training programs aimed toward qualifying more minorities and women for membership in the unions and increasing the skills of minorities and women so that they may qualify for higher paying employment.
 - b. The contractor will use good faith efforts to incorporate an EEO clause into each union agreement to the end that such union will be contractually bound to refer applicants without regard to their race, color, religion, sex, national origin, age or disability.
 - c. The contractor is to obtain information as to the referral practices and policies of the labor union except that to the extent such information is within the exclusive possession of the labor union and such labor union refuses to furnish such information to the contractor, the contractor shall so certify to the contracting agency and shall set forth what efforts have been made to obtain such information.

- d. In the event the union is unable to provide the contractor with a reasonable flow of referrals within the time limit set forth in the collective bargaining agreement, the contractor will, through independent recruitment efforts, fill the employment vacancies without regard to race, color, religion, sex, national origin, age or disability; making full efforts to obtain qualified and/or qualifiable minorities and women. The failure of a union to provide sufficient referrals (even though it is obligated to provide exclusive referrals under the terms of a collective bargaining agreement) does not relieve the contractor from the requirements of this paragraph. In the event the union referral practice prevents the contractor from meeting the obligations pursuant to Executive Order 11246, as amended, and these special provisions, such contractor shall immediately notify the contracting agency.
8. **Reasonable Accommodation for Applicants / Employees with Disabilities:** The contractor must be familiar with the requirements for and comply with the Americans with Disabilities Act and all rules and regulations established there under. Employers must provide reasonable accommodation in all employment activities unless to do so would cause an undue hardship.
9. **Selection of Subcontractors, Procurement of Materials and Leasing of Equipment:** The contractor shall not discriminate on the grounds of race, color, religion, sex, national origin, age or disability in the selection and retention of subcontractors, including procurement of materials and leases of equipment. The contractor shall take all necessary and reasonable steps to ensure nondiscrimination in the administration of this contract.
- The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.
 - The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.
10. **Assurance Required by 49 CFR 26.13(b):**
- The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.
 - The contractor or subcontractor shall not discriminate on the basis of race, color, national origin, or sex in the performance of this contract. The contractor shall carry out applicable requirements of 49 CFR Part 26 in the award and administration of DOT-assisted contracts. Failure by the contractor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy as the contracting agency deems appropriate.
11. **Records and Reports:** The contractor shall keep such records as necessary to document compliance with the EEO requirements. Such records shall be retained for a period of three years following the date of the final payment to the contractor for all contract work and shall be available at reasonable times and places for inspection by authorized representatives of the contracting agency and the FHWA.
- The records kept by the contractor shall document the following:
 - The number and work hours of minority and non-minority group members and women employed in each work classification on the project;
 - The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and
 - The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;
 - The contractors and subcontractors will submit an annual report to the contracting agency each July for the duration of the project, indicating the number of minority, women, and non-minority group employees currently engaged in each work classification required by the contract work. This information is to be reported on Form FHWA-1391. The staffing data should represent the project work force on board in all or any part of the last payroll period preceding the end of July. If on-the-job training is being required by special provision, the contractor will be required to collect and report training data. The employment data should reflect the work force on board during all or any part of the last payroll period preceding the end of July.

III. NONSEGREGATED FACILITIES

This provision is applicable to all Federal-aid construction contracts and to all related construction subcontracts of \$10,000 or more.

The contractor must ensure that facilities provided for employees are provided in such a manner that segregation on the basis of race, color, religion, sex, or national origin cannot result. The contractor may neither require such segregated use by written or oral policies nor tolerate such use by employee custom. The contractor's obligation extends further to ensure that its employees are not assigned to perform their services at any location, under the contractor's control, where the facilities are segregated. The term "facilities" includes waiting rooms, work areas, restaurants and other eating areas, time clocks, restrooms, washrooms, locker rooms, and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing provided for employees. The contractor shall provide separate or single-user restrooms and necessary dressing or sleeping areas to assure privacy between sexes.

IV. DAVIS-BACON AND RELATED ACT PROVISIONS

This section is applicable to all Federal-aid construction projects exceeding \$2,000 and to all related subcontracts and lower-tier subcontracts (regardless of subcontract size). The requirements apply to all projects located within the right-of-way of a roadway that is functionally classified as Federal-aid highway. This excludes roadways functionally classified as local roads or rural minor collectors, which are exempt. Contracting agencies may elect to apply these requirements to other projects.

The following provisions are from the U.S. Department of Labor regulations in 29 CFR 5.5 "Contract provisions and related matters" with minor revisions to conform to the FHWA-1273 format and FHWA program requirements.

1. Minimum wages

- All laborers and mechanics employed or working upon the site of the work, will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics.

Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph 1.d. of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph 1.b. of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

- b. (1) The contracting officer shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The contracting officer shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:
 - (i) The work to be performed by the classification requested is not performed by a classification in the wage determination; and
 - (ii) The classification is utilized in the area by the construction industry; and
 - (iii) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (2) If the contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the contracting officer agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by the contracting officer to the Administrator of the Wage and Hour Division, Employment Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (3) In the event the contractor, the laborers or mechanics to be employed in the classification or their representatives, and the contracting officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the contracting officer shall refer the questions, including the views of all interested parties and the recommendation of the contracting officer, to the Wage and Hour Administrator for determination. The Wage and Hour Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the contracting officer or will notify the contracting officer within the 30-day period that additional time is necessary.
- (4) The wage rate (including fringe benefits where appropriate) determined pursuant to paragraphs 1.b.(2) or 1.b.(3) of this section, shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.
- c. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- d. If the contractor does not make payments to a trustee or other third person, the contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program. Provided, That the Secretary of Labor has found, upon the written request of the contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.
2. **Withholding.** The contracting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the contractor under this contract, or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the contracting agency may, after written notice to the contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.
3. **Payrolls and basic records**
 - a. Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.
 - b. (1) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the contracting agency. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g. , the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at <http://www.dol.gov/esa/whd/forms/wh347instr.htm> or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the contracting agency for transmission to the State DOT, the FHWA or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the contracting agency.
 - (2) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:
 - (i) That the payroll for the payroll period contains the information required to be provided under §5.5 (a)(3)(ii) of Regulations, 29 CFR part 5, the appropriate information is being maintained under §5.5 (a)(3)(i) of Regulations, 29 CFR part 5, and that such information is correct and complete;
 - (ii) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 CFR part 3;
 - (iii) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

- (3) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph 3.b.(2) of this section.
- (4) The falsification of any of the above certifications may subject the contractor or subcontractor to civil or criminal prosecution under section 1001 of title 18 and section 231 of title 31 of the United States Code.
- c. The contractor or subcontractor shall make the records required under paragraph 3.a. of this section available for inspection, copying, or transcription by authorized representatives of the contracting agency, the State DOT, the FHWA, or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the contractor or subcontractor fails to submit the required records or to make them available, the FHWA may, after written notice to the contractor, the contracting agency or the State DOT, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.
4. **Apprentices and trainees**
- a. Apprentices (programs of the USDOL). Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.
- The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the contractor's or subcontractor's registered program shall be observed.
- Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.
- In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, the contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- b. Trainees (programs of the USDOL). Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration.
- The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration.
- Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.
- In the event the Employment and Training Administration withdraws approval of a training program, the contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR part 30.
- d. Apprentices and Trainees (programs of the U.S. DOT). Apprentices and trainees working under apprenticeship and skill training programs which have been certified by the Secretary of Transportation as promoting EEO in connection with Federal-aid highway construction programs are not subject to the requirements of paragraph 4 of this Section IV. The straight time hourly wage rates for apprentices and trainees under such programs will be established by the particular programs. The ratio of apprentices and trainees to journeymen shall not be greater than permitted by the terms of the particular program.
5. **Compliance with Copeland Act requirements.** The contractor shall comply with the requirements of 29 CFR part 3, which are incorporated by reference in this contract.
6. **Subcontracts.** The contractor or subcontractor shall insert Form FHWA-1273 in any subcontracts and also require the subcontractors to include Form FHWA-1273 in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 CFR 5.5.
7. **Contract termination:** debarment. A breach of the arising contract clauses in 29 CFR 5.5 may be grounds for termination of the contract, and for debarment as a contractor and a subcontractor as provided in 29 CFR 5.12.
8. **Compliance with Davis-Bacon and Related Act requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are herein incorporated by reference in this contract.
9. **Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this contract shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.
10. **Certification of eligibility.**
- a. By entering into this contract, the contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

- b. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001.

V. CONTRACT WORK HOURS AND SAFETY STANDARDS ACT

The following clauses apply to any Federal-aid construction contract in an amount in excess of \$100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by 29 CFR 5.5(a) or 29 CFR 4.6. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

1. **Overtime requirements.** No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty hours in such workweek.
2. **Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the clause set forth in paragraph (1.) of this section, the contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (1.) of this section, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (1.) of this section.
3. **Withholding for unpaid wages and liquidated damages.** The FHWA or the contacting agency shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (2.) of this section.
4. **Subcontracts.** The contractor or subcontractor shall insert in any subcontracts the clauses set forth in paragraph (1.) through (4.) of this section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in paragraphs (1.) through (4.) of this section.

VI. SUBLETTING OR ASSIGNING THE CONTRACT

This provision is applicable to all Federal-aid construction contracts on the National Highway System.

1. The contractor shall perform with its own organization contract work amounting to not less than 30 percent (or a greater percentage if specified elsewhere in the contract) of the total original contract price, excluding any specialty items designated by the contracting agency. Specialty items may be performed by subcontract and the amount of any such specialty items performed may be deducted from the total original contract price before computing the amount of work required to be performed by the contractor's own organization (23 CFR 635.116).
 - a. The term "perform work with its own organization" refers to workers employed or leased by the prime contractor, and equipment owned or rented by the prime contractor, with or without operators. Such term does not include employees or equipment of a subcontractor or lower tier subcontractor, agents of the prime contractor, or any other assignees. The term may include payments for the costs of hiring leased employees

from an employee leasing firm meeting all relevant Federal and State regulatory requirements. Leased employees may only be included in this term if the prime contractor meets all of the following conditions:

- (1) the prime contractor maintains control over the supervision of the day-to-day activities of the leased employees;
 - (2) the prime contractor remains responsible for the quality of the work of the leased employees;
 - (3) the prime contractor retains all power to accept or exclude individual employees from work on the project; and
 - (4) the prime contractor remains ultimately responsible for the payment of predetermined minimum wages, the submission of payrolls, statements of compliance and all other Federal regulatory requirements.
- b. "Specialty Items" shall be construed to be limited to work that requires highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organizations qualified and expected to bid or propose on the contract as a whole and in general are to be limited to minor components of the overall contract.
2. The contract amount upon which the requirements set forth in paragraph (1) of Section VI is computed includes the cost of material and manufactured products which are to be purchased or produced by the contractor under the contract provisions.
 3. The contractor shall furnish (a) a competent superintendent or supervisor who is employed by the firm, has full authority to direct performance of the work in accordance with the contract requirements, and is in charge of all construction operations (regardless of who performs the work) and (b) such other of its own organizational resources (supervision, management, and engineering services) as the contracting officer determines is necessary to assure the performance of the contract.
 4. No portion of the contract shall be sublet, assigned or otherwise disposed of except with the written consent of the contracting officer, or authorized representative, and such consent when given shall not be construed to relieve the contractor of any responsibility for the fulfillment of the contract. Written consent will be given only after the contracting agency has assured that each subcontract is evidenced in writing and that it contains all pertinent provisions and requirements of the prime contract.
 5. The 30% self-performance requirement of paragraph (1) is not applicable to design-build contracts; however, contracting agencies may establish their own self-performance requirements.

VII. SAFETY: ACCIDENT PREVENTION

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

1. In the performance of this contract the contractor shall comply with all applicable Federal, State, and local laws governing safety, health, and sanitation (23 CFR 635). The contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions as it determines, or as the contracting officer may determine, to be reasonably necessary to protect the life and health of employees on the job and the safety of the public and to protect property in connection with the performance of the work covered by the contract.
2. It is a condition of this contract, and shall be made a condition of each subcontract, which the contractor enters into pursuant to this contract, that the contractor and any subcontractor shall not permit any employee, in performance of the contract, to work in surroundings or under conditions which are unsanitary, hazardous or dangerous to his/her health or safety, as determined under construction safety and health standards (29 CFR 1926) promulgated by the Secretary of Labor, in accordance with Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 3704).
3. Pursuant to 29 CFR 1926.3, it is a condition of this contract that the Secretary of Labor or authorized representative thereof, shall have right of entry to any site of contract performance to inspect or investigate the matter of compliance with the construction safety and health standards and to carry out the duties of the Secretary under Section 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C.3704).

VIII. FALSE STATEMENTS CONCERNING HIGHWAY PROJECTS

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

In order to assure high quality and durable construction in conformity with approved plans and specifications and a high degree of reliability on statements and representations made by engineers, contractors, suppliers, and workers on Federal-aid highway projects, it is essential that all persons concerned with the project perform their functions as carefully, thoroughly, and honestly as possible. Willful falsification, distortion, or misrepresentation with respect to any facts related to the project is a violation of Federal law. To prevent any misunderstanding regarding the seriousness of these and similar acts, Form FHWA-1022 shall be posted on each Federal-aid highway project (23 CFR 635) in one or more places where it is readily available to all persons concerned with the project:

18 U.S.C. 1020 reads as follows:

"Whoever, being an officer, agent, or employee of the United States, or of any State or Territory, or whoever, whether a person, association, firm, or corporation, knowingly makes any false statement, false representation, or false report as to the character, quality, quantity, or cost of the material used or to be used, or the quantity or quality of the work performed or to be performed, or the cost thereof in connection with the submission of plans, maps, specifications, contracts, or costs of construction on any highway or related project submitted for approval to the Secretary of Transportation; or

Whoever knowingly makes any false statement, false representation, false report or false claim with respect to the character, quality, quantity, or cost of any work performed or to be performed, or materials furnished or to be furnished, in connection with the construction of any highway or related project approved by the Secretary of Transportation; or

Whoever knowingly makes any false statement or false representation as to material fact in any statement, certificate, or report submitted pursuant to provisions of the Federal-aid Roads Act approved July 1, 1916, (39 Stat. 355), as amended and supplemented;

Shall be fined under this title or imprisoned not more than 5 years or both."

IX. IMPLEMENTATION OF CLEAN AIR ACT AND FEDERAL WATER POLLUTION CONTROL ACT

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts.

By submission of this bid/proposal or the execution of this contract, or subcontract, as appropriate, the bidder, proposer, Federal-aid construction contractor, or subcontractor, as appropriate, will be deemed to have stipulated as follows:

1. That any person who is or will be utilized in the performance of this contract is not prohibited from receiving an award due to a violation of Section 508 of the Clean Water Act or Section 306 of the Clean Air Act.
2. That the contractor agrees to include or cause to be included the requirements of paragraph (1) of this Section X in every subcontract, and further agrees to take such action as the contracting agency may direct as a means of enforcing such requirements.

X. CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION

This provision is applicable to all Federal-aid construction contracts, design-build contracts, subcontracts, lower-tier subcontracts, purchase orders, lease agreements, consultant contracts or any other covered transaction requiring FHWA approval or that is estimated to cost \$25,000 or more – as defined in 2 CFR Parts 180 and 1200.

1. Instructions for Certification – First Tier Participants:

- a. By signing and submitting this proposal, the prospective first tier participant is providing the certification set out below.
- b. The inability of a person to provide the certification set out below will not necessarily result in denial of participation in this covered transaction. The prospective first tier participant shall submit an explanation of why it cannot provide the certification set out below. The certification or explanation will be considered in connection with the department or agency's determination whether to enter into this transaction. However, failure of the prospective first tier participant to furnish a certification or an explanation shall disqualify such a person from participation in this transaction.
- c. The certification in this clause is a material representation of fact upon which reliance was placed when the contracting agency determined to enter into this transaction. If it is later determined that the prospective participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the contracting agency may terminate this transaction for cause of default.
- d. The prospective first tier participant shall provide immediate written notice to the contracting agency to whom this proposal is submitted if any time the prospective first tier participant learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- e. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).
- f. The prospective first tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency entering into this transaction.
- g. The prospective first tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transactions," provided by the department or contracting agency, entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.
- h. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.
- i. Nothing contained in the foregoing shall be construed to require the establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of the prospective participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- j. Except for transactions authorized under paragraph (f) of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency may terminate this transaction for cause or default.

* * * * *

2. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – First Tier Participants:

- a. The prospective first tier participant certifies to the best of its knowledge and belief, that it and its principals:
 - (1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency;
 - (2) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - (3) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (a)(2) of this certification; and
 - (4) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- b. Where the prospective participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Instructions for Certification - Lower Tier Participants:

(Applicable to all subcontracts, purchase orders and other lower tier transactions requiring prior FHWA approval or estimated to cost \$25,000 or more - 2 CFR Parts 180 and 1200)

- a. By signing and submitting this proposal, the prospective lower tier is providing the certification set out below.
- b. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department, or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.
- c. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous by reason of changed circumstances.
- d. The terms "covered transaction," "debarred," "suspended," "ineligible," "participant," "person," "principal," and "voluntarily excluded," as used in this clause, are defined in 2 CFR Parts 180 and 1200. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations. "First Tier Covered Transactions" refers to any covered transaction between a grantee or subgrantee of

Federal funds and a participant (such as the prime or general contract). "Lower Tier Covered Transactions" refers to any covered transaction under a First Tier Covered Transaction (such as subcontracts). "First Tier Participant" refers to the participant who has entered into a covered transaction with a grantee or subgrantee of Federal funds (such as the prime or general contractor). "Lower Tier Participant" refers to any participant who has entered into a covered transaction with a First Tier Participant or other Lower Tier Participants (such as subcontractors and suppliers).

- e. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transaction with a person who is debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.
- f. The prospective lower tier participant further agrees by submitting this proposal that it will include this clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion-Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions exceeding the \$25,000 threshold.
- g. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that is not debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant is responsible for ensuring that its principals are not suspended, debarred, or otherwise ineligible to participate in covered transactions. To verify the eligibility of its principals, as well as the eligibility of any lower tier prospective participants, each participant may, but is not required to, check the Excluded Parties List System website (<https://www.epls.gov/>), which is compiled by the General Services Administration.
- h. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- i. Except for transactions authorized under paragraph e of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is suspended, debarred, ineligible, or voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

* * * * *

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion--Lower Tier Participants:

1. The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any Federal department or agency.
2. Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

* * * * *

XI. CERTIFICATION REGARDING USE OF CONTRACT FUNDS FOR LOBBYING

This provision is applicable to all Federal-aid construction contracts and to all related subcontracts which exceed \$100,000 (49 CFR 20).

1. The prospective participant certifies, by signing and submitting this bid or proposal, to the best of his or her knowledge and belief, that:
 - a. No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
 - b. If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
2. This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.
3. The prospective participant also agrees by submitting its bid or proposal that the participant shall require that the language of this certification be included in all lower tier subcontracts, which exceed \$100,000 and that all such recipients shall certify and disclose accordingly.

STANDARD SPECIAL PROVISION**ON-THE-JOB TRAINING**

(10-16-07) (Rev. 4-21-15)

Z-10

Description

The North Carolina Department of Transportation will administer a custom version of the Federal On-the-Job Training (OJT) Program, commonly referred to as the Alternate OJT Program. All contractors (existing and newcomers) will be automatically placed in the Alternate Program. Standard OJT requirements typically associated with individual projects will no longer be applied at the project level. Instead, these requirements will be applicable on an annual basis for each contractor administered by the OJT Program Manager.

On the Job Training shall meet the requirements of 23 CFR 230.107 (b), 23 USC – Section 140, this provision and the On-the-Job Training Program Manual.

The Alternate OJT Program will allow a contractor to train employees on Federal, State and privately funded projects located in North Carolina. However, priority shall be given to training employees on NCDOT Federal-Aid funded projects.

Minorities and Women

Developing, training and upgrading of minorities and women toward journeyman level status is a primary objective of this special training provision. Accordingly, the Contractor shall make every effort to enroll minority and women as trainees to the extent that such persons are available within a reasonable area of recruitment. This training commitment is not intended, and shall not be used, to discriminate against any applicant for training, whether a member of a minority group or not.

Assigning Training Goals

The Department, through the OJT Program Manager, will assign training goals for a calendar year based on the contractors' past three years' activity and the contractors' anticipated upcoming year's activity with the Department. At the beginning of each year, all contractors eligible will be contacted by the Department to determine the number of trainees that will be assigned for the upcoming calendar year. At that time the Contractor shall enter into an agreement with the Department to provide a self-imposed on-the-job training program for the calendar year. This agreement will include a specific number of annual training goals agreed to by both parties. The number of training assignments may range from 1 to 15 per contractor per calendar year. The Contractor shall sign an agreement to fulfill their annual goal for the year.\

Training Classifications

The Contractor shall provide on-the-job training aimed at developing full journeyman level workers in the construction craft/operator positions. Preference shall be given to providing training in the following skilled work classifications:

| | |
|---------------------|----------------------------------|
| Equipment Operators | Office Engineers |
| Truck Drivers | Estimators |
| Carpenters | Iron / Reinforcing Steel Workers |
| Concrete Finishers | Mechanics |
| Pipe Layers | Welders |

The Department has established common training classifications and their respective training requirements that may be used by the contractors. However, the classifications established are not all-inclusive. Where the training is oriented toward construction applications, training will be allowed in lower-level management positions such as office engineers and estimators. Contractors shall submit new classifications for specific job functions that their employees are performing. The Department will review and recommend for acceptance to FHWA the new classifications proposed by contractors, if applicable. New classifications shall meet the following requirements:

Proposed training classifications are reasonable and realistic based on the job skill classification needs, and

The number of training hours specified in the training classification is consistent with common practices and provides enough time for the trainee to obtain journeyman level status.

The Contractor may allow trainees to be trained by a subcontractor provided that the Contractor retains primary responsibility for meeting the training and this provision is made applicable to the subcontract. However, only the Contractor will receive credit towards the annual goal for the trainee.

Where feasible, 25 percent of apprentices or trainees in each occupation shall be in their first year of apprenticeship or training. The number of trainees shall be distributed among the work classifications on the basis of the contractor's needs and the availability of journeymen in the various classifications within a reasonable area of recruitment.

No employee shall be employed as a trainee in any classification in which they have successfully completed a training course leading to journeyman level status or in which they have been employed as a journeyman.

Records and Reports

The Contractor shall maintain enrollment, monthly and completion reports documenting company compliance under these contract documents. These documents and any other information as requested shall be submitted to the OJT Program Manager.

Upon completion and graduation of the program, the Contractor shall provide each trainee with a certification Certificate showing the type and length of training satisfactorily completed.

Trainee Interviews

All trainees enrolled in the program will receive an initial and Trainee/Post graduate interview conducted by the OJT program staff.

Trainee Wages

Contractors shall compensate trainees on a graduating pay scale based upon a percentage of the prevailing minimum journeyman wages (Davis-Bacon Act). Minimum pay shall be as follows:

| | |
|------------|---|
| 60 percent | of the journeyman wage for the first half of the training period |
| 75 percent | of the journeyman wage for the third quarter of the training period |
| 90 percent | of the journeyman wage for the last quarter of the training period |

In no instance shall a trainee be paid less than the local minimum wage. The Contractor shall adhere to the minimum hourly wage rate that will satisfy both the NC Department of Labor (NCDOL) and the Department.

Achieving or Failing to Meet Training Goals

The Contractor will be credited for each trainee employed by him on the contract work who is currently enrolled or becomes enrolled in an approved program and who receives training for at least 50 percent of the specific program requirement. Trainees will be allowed to be transferred between projects if required by the Contractor's scheduled workload to meet training goals.

If a contractor fails to attain their training assignments for the calendar year, they may be taken off the NCDOT's Bidders List.

Measurement and Payment

No compensation will be made for providing required training in accordance with these contract documents.

STANDARD SPECIAL PROVISION
MINIMUM WAGES
GENERAL DECISION NC190088 01/04/2019 NC88

Z-088

Date: January 4, 2019

General Decision Number: NC190088 01/04/2019 NC88

Superseded General Decision Numbers: NC20180101

State: North Carolina

Construction Type: HIGHWAY

COUNTIES:

| | | |
|----------|-------------|------------|
| Alamance | Forsyth | Randolph |
| Anson | Gaston | Rockingham |
| Cabarrus | Guilford | Stokes |
| Chatham | Mecklenburg | Union |
| Davie | Orange | Yadkin |
| Durham | Person | |

HIGHWAY CONSTRUCTION PROJECTS (excluding tunnels, building structures in rest area projects & railroad construction; bascule, suspension & spandrel arch bridges designed for commercial navigation, bridges involving marine construction; and other major bridges).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract for calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR.5.5(a)(1)(ii) (or the EO minimum wage rate, if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2) – (60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number

0

Publication Date

01/04/2019

SUNC2014-003 11/14/2014

| | Rates | Fringes |
|--------------------------------|-------|---------|
| BLASTER | 18.64 | |
| CARPENTER | 13.68 | .05 |
| CEMENT MASON/CONCRETE FINISHER | 13.93 | |
| ELECTRICIAN | | |
| Electrician | 18.79 | 2.72 |

| | Rates | Fringes |
|---|-------|---------|
| Telecommunications Technician | 15.19 | 1.25 |
| IRONWORKER | 13.30 | |
| LABORER | | |
| Asphalt Raker and Spreader | 12.78 | |
| Asphalt Screed/Jackman | 14.50 | |
| Carpenter Tender | 12.51 | .27 |
| Cement Mason/Concrete Finisher Tender | 11.04 | |
| Common or General | 10.40 | .01 |
| Guardrail/Fence Installer | 13.22 | |
| Pipelayer | 12.43 | |
| Traffic Signal/Lighting Installer | 15.65 | .24 |
| PAINTER | | |
| Bridge | 23.77 | |
| POWER EQUIPMENT OPERATORS | | |
| Asphalt Broom Tractor | 10.00 | |
| Bulldozer Fine | 16.13 | |
| Bulldozer Rough | 14.36 | |
| Concrete Grinder/Groover | 17.92 | |
| Crane Boom Trucks | 18.19 | |
| Crane Other | 19.83 | |
| Crane Rough/All-Terrain | 19.10 | |
| Drill Operator Rock | 14.28 | |
| Drill Operator Structure | 20.89 | |
| Excavator Fine | 16.95 | |
| Excavator Rough | 13.63 | |
| Grader/Blade Fine | 19.84 | |
| Grader/Blade Rough | 15.47 | |
| Loader 2 Cubic Yards or Less | 13.31 | |
| Loader Greater Than 2 Cubic Yards | 16.19 | |
| Material Transfer Vehicle (Shuttle Buggy) | 15.44 | |
| Mechanic | 17.51 | |
| Milling Machine | 15.22 | |
| Off-Road Hauler/Water Tanker | 11.83 | |
| Oiler/Greaser | 14.16 | |
| Pavement Marking Equipment | 12.05 | |
| Paver Asphalt | 15.97 | |
| Paver Concrete | 18.20 | |
| Roller Asphalt Breakdown | 12.79 | |
| Roller Asphalt Finish | 13.76 | |
| Roller Other | 12.08 | |
| Scraper Finish | 12.65 | |
| Scraper Rough | 11.50 | |
| Slip Form Machine | 19.60 | |
| Tack Truck/Distributor Operator | 14.82 | |
| TRUCK DRIVER | | |
| GVWR of 26,000 Lbs or Less | 11.45 | |
| GVWR of 26,000 Lbs or Greater | 13.57 | .03 |

Welders – Receive rate prescribed for craft performing operation to which welding is incidental.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any

solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U. S. Department of Labor
200 Constitution Avenue, N.W.
Washington, D.C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, D.C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.

Washington, D.C. 20210

4.) All decisions by the Administrative Review Board are final.

END OF GENERAL DECISION

TC-1

U-5968

Durham County

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| ADA Compliant Pedestrian Traffic Control Devices | TC-5 |



DocuSigned by:
Kevin Smith 1/2/2019
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TC-2

U-5968

Durham County

TEMPORARY TRAFFIC CONTROL:

(12/20/2018)

GENERAL REQUIREMENTS

The Contractor shall maintain traffic on all roads during construction and shall furnish, install, relocate, maintain, and remove traffic control devices as shown in the *Roadway Standard Drawings* or as directed by the Engineer.

Maintain traffic in accordance with Divisions 10, 11 and 12 of the *2018 Standard Specifications* and the following provisions:

Install Work Zone Advance Warning Signs in accordance with Standard Drawing No. 1101.01 of the *2018 Roadway Standard Drawings* prior to beginning any other work.

Remove lane closure devices from the lane when work is not being performed behind the lane closure or when a lane closure is no longer needed or as directed by the Engineer.

When Personnel and/or equipment are working within 15 ft. of an open travel lane, close the nearest open shoulder using Roadway Standard Drawing No. 1101.04 unless the work area is protected by barrier or guardrail or a lane closure is installed.

When personnel and/or equipment are working on the shoulder adjacent to an undivided facility and within 5 ft. of an open travel lane, close the nearest open travel lane using Roadway Standard Drawing No. 1101.02 of the *2018 Roadway Standard Drawings* unless the work area is protected by barrier or guardrail.

When personnel and/or equipment are working on the shoulder adjacent to a divided facility and within 10 ft. of an open travel lane, close the nearest open travel lane using Roadway Standard Drawing No. 1101.02 of the *2018 Roadway Standard Drawing*, unless the work area is protected by barrier or guardrail.

When personnel and/or equipment are working within a lane of travel of an undivided or divided facility, close the lane using Roadway Standard Drawing No. 1101.02 of the *2018 Roadway Standard Drawings* or as directed by the Engineer. Conduct the work so that all personnel and/or equipment remain within the closed travel lane. Perform work only when weather and visibility conditions allow safe operations as directed by the Engineer.

Do not work simultaneously within 15 ft. on both sides of an open travelway, ramp, or loop within the same location, unless protected with guardrail or barrier.

Notify the Engineer (30) calendar days prior to any traffic pattern alteration.

Ensure all necessary signing is in place prior to altering any traffic pattern.

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Law Enforcement shall be used to maintain traffic through the work area and/or intersections as directed by the Engineer.

Contractor shall maintain sidewalk access at all times. Contractor shall be responsible to provide temporary sidewalks (concrete, asphalt, or other suitable material as approved by the engineer) at all locations where the open pedestrian travelway has been closed/removed for construction operations. ADA compliant pedestrian barricades/channelizing devices shall be used to close sidewalks and redirect pedestrians along the temporary sidewalk, as directed by the Engineer. Mount appropriate sidewalk closure and pedestrian detour signs to these barricades/channelizing devices to inform pedestrians of the closure and pedestrian detour. See Special Provision (ADA Compliant Pedestrian Traffic Control Devices).

When lane closures are not in effect, space channelizing devices in work areas no greater in feet than twice the posted speed limit (MHP), except 10 ft. on-center in radii, and 3 ft. off the edge of an open travelway. Refer to *2018 Standard Specifications* Sections 1130 (Drums), 1135 (Cones), and 1180 (Skinny Drums) for additional requirements.

Place additional sets of three channelizing devices (Drums, Cones, or Skinny Drums) perpendicular to the edge of travelway on 100 to 500 ft. centers (as directed by the Engineer) when unopened lanes are closed to traffic.

Time Restrictions for Lane Closure and Road Closure Activities

All lane closure and road closure activities shall be performed in compliance with the Day and Time restrictions listed and defined in this Contract.

Any activities performed outside of these requirements will be subject to the Liquidated Damages unless approved by the Engineer prior to beginning the activity.

The Contractor may place/pre-stage all required signs and traffic control devices necessary for lane closures prior to the closure time as approved by the Engineer. The travel lane(s) are to be closed at the prescribed times defined in this Contract.

For removal, the lane(s) must be reopened in compliance with the times defined in this Contract. It is acceptable to remove the signs and traffic control devices from the shoulder/staging area after the lane(s) are reopened to traffic.

TEMPORARY TRAFFIC CONTROL (TTC)

Refer to Standard Drawing No. 1101.01, 1101.02, 1101.04, 1101.11, 1110.01, 1110.02, 1115.01, 1130.01, 1135.01, 1145.01, 1150.01, 1165.01, and 1180.01 of the *2018 Roadway Standard Drawings* when closing a lane of travel in the work zone.

Drums are recommended for all lane closure operations occurring at night. If the contractor elects to use skinny drums at night, the contractor shall space skinny drums no greater than 20 ft. apart in the tangent sections of the lane closure. Skinny drums shall not be used for tapers.

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When covering work zone signs, use an opaque material that prevents reading of the sign at night by a driver using high beam headlights. Use material which does not damage the sign sheeting. Tape shall not be affixed to the sign sheeting at any time.

TRAFFIC OPERATIONS

1. Project Requirements:

The Contractor shall comply with the following requirements. Non-compliance will result in a suspension of all work operations:

- A. Submit a written construction sequence for traffic control and construction lighting to the Engineer prior to the first pre-construction meeting. The sequence must be approved before beginning work or closing a lane of traffic. The Contractor and Engineer will coordinate with the State Work Zone Engineer at 919-814-4937 for additional traffic control guidance, as necessary.
- B. Obtain written approval of the Engineer before working in more than one location or setting up additional lane closures.
- C. The Contractor on this and any adjacent projects, or subcontractors working within this project shall coordinate lane closure location, type, and direction with the Engineer to best maintain lane continuity through the limits of this and adjacent projects.
- D. Operate equipment and conduct operations in the same direction as the flow of traffic unless the operation is protected by barrier or guardrail or as directed by the Engineer. Maintain vehicular access in accordance with Section 1101-05 of the *2018 Standard Specifications*.
- E. Provide appropriate construction lighting in accordance with Section 1413 of the *2018 Standard Specifications*.

2. Work Zone Signing:

A. Description

Install and maintain signing in accordance with the Divisions 10 and 11 of the *2018 Standard Specifications*.

B. Installation

All stationary Advance/General warning work zone signs require notification to existing Utility owners per Article 105-8 of the *2018 Standard Specifications* within 3 to 12 full working days prior to installation.

Install all Advance/General warning work zone signs before beginning work. If signs are installed more than three (3) calendar days prior to the beginning of work, cover the signs

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until the work begins. Install each work zone Advance/General warning sign separately and not on the same post or stand with any other sign except where an advisory speed plate or directional arrow is used.

All sign locations to be verified by the Engineer prior to installation.

If there is a period of construction inactivity longer than fourteen (14) calendar days, remove or cover advance/general warning work zone signs. Uncover advance/general warning work zone signs no more than three (3) calendar days before work resumes.

All other operations may be suspended upon failure to comply with the above requirements. Such suspended operations would not be resumed until the above requirements are fulfilled.

C. Sign Removal

Once the Project is substantially completed, the Contractor shall remove the Stationary Work Zone Signs. Any remaining punch list items requiring traffic control are to be completed with portable work zone signing.

MEASUREMENT AND PAYMENT

Payment at the contract unit prices for the various traffic control items in the contract will be measured and paid in accordance with the item's specific Section in the *2018 Standard Specifications*, Section 1105 of the *2018 Standard Specifications*, or the item's Special Provision, as determined by the Engineer.

ADA COMPLIANT PEDESTRIAN TRAFFIC CONTROL DEVICES:

(01/02/2019)

Description

Furnish, install, and maintain all ADA compliant pedestrian traffic control devices that includes Pedestrian Channelizing Devices for existing sidewalks that are disrupted, closed, or relocated by planned work activities.

Construction Methods

The ADA compliant pedestrian traffic control devices involved in the closing or redirecting of pedestrians as designated on the Transportation Management Plan (TMP) shall be manufactured and assembled in accordance with the requirements of the Americans with Disabilities Act (ADA) and be on the NCDOT approved products list.

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Pedestrian Channelizing Devices shall be manufactured and assembled to be connected as to eliminate any gaps that allow pedestrians to stray from the channelizing path. Any Pedestrian Channelizing Devices used to close or block a sidewalk shall have a "SIDEWALK CLOSED" sign affixed to it.

Measurement and Payment

The measurement and payment for the Pedestrian Channelizing Devices will be by the linear foot.

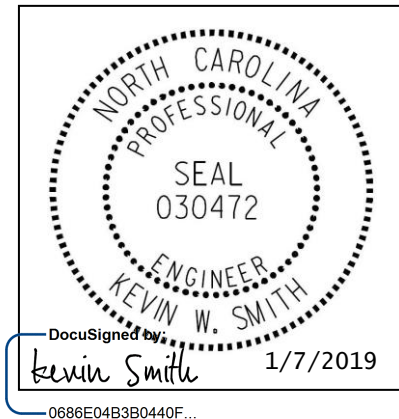
Payment is dependent upon satisfactory installation and acceptance by the Engineer. The unit prices include any costs associated with installation, maintenance and removal of the devices from the project.

Payment will be made under:

Pay Item

Pay Unit

Pedestrian Channelizing Devices.....Linear Foot



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INTELLIGENT TRANSPORTATION SYSTEMS
TRAFFIC SIGNAL SYSTEM
UPGRADE AND EXPANSION

PROJECT SPECIAL PROVISIONS

Not Valid Unless Signed

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1. GENERAL REQUIREMENTS

1.1.DESCRPTION

A. General

Conform to these Project Special Provisions, Project Plans, the Signals and ITS Project Special Provisions (current version 18.1), and the *2018 Standard Specifications for Roads and Structures* (also referred to hereinafter as the “Standard Specifications”). The current edition of these specifications and publications in effect on the date of advertisement will apply.

In the event of a conflict between these Project Special Provisions and the Standard Specifications or the Signals and ITS Project Special Provisions, these Project Special Provisions govern.

In the event of a conflict between the Signals and ITS Project Special Provisions and the Standard Specifications, the Signals and ITS Project Special Provisions govern.

B. Scope

Furnish, install, and fully integrate new and existing traffic signal controllers and cabinets, new and existing fiber optic communications cable, new and existing wireless radio communications links, new and existing closed-circuit television camera units, and new and existing central hardware and software for the upgrade and expansion of the existing central distributed processing traffic signal system for the City of Durham in North Carolina.

Furnish, install, and fully integrate approximately 425 new 2070LX traffic signal controllers in new model 332 and 336 style cabinets to replace existing controllers and cabinets at locations shown in the Plans.

Furnish, install, and fully integrate a new GPS-based emergency vehicle preemptions (EVP) system at locations shown in the Plans.

Furnish, install, and fully integrate approximately 125 new digital IP closed circuit television (CCTV) cameras. Establish new installations or replace existing analog CCTV cameras at locations shown in the Plans.

Furnish and install approximately 160 miles of new fiber optic cables in new underground conduit, existing underground conduit, or attached to existing joint-use utility poles as shown in the Plans. Integrate new fiber optic communications with the existing signal system communications network as shown in the Plans.

Furnish, install, and fully integrate a new local area network (LAN) utilizing Ethernet communications over fiber optic cables to connect field ethernet switches at signal cabinets, three hub ethernet switches, and two core ethernet switches.

Furnish, install, and fully integrate approximately 15 new wireless Ethernet radio systems to replace existing serial radio systems at locations shown in the Plans.

Furnish, install, and fully integrate approximately 7 new dial-up cellular modems at locations shown in the Plans.

Furnish, install, and fully integrate a connected vehicle test bed encompassing 18 signals along NC-55. This includes the installation and integration of road side units (RSU), on board units (OBU), and human machine interfaces (HMI).

Furnish, install, and fully integrate new head-end terminations of the communications network at the City of Durham City Hall (“City Hall”) located at 101 City Hall Plaza and at the City of Durham Transportation Department Sign and Signal Shop (“Signal Shop”) located at 320 Muldee Street.

Furnish, install, and fully integrate an upgraded traffic control center (“TCC”) located on the 4th floor of City Hall.

Furnish, install, and fully integrate remote connections for viewing CCTV video feeds at Durham Television Network (“DTV8”) located in the First Floor of City Hall, City of Durham Police Headquarters (“Police HQ”) located at 602 E. Main Street, Durham County Courthouse (“County Courthouse”) located at 512 S. Dillard Street, and City of Durham Emergency Operations Center (“EOC”) located at 2422 Broad Street. Install remote connections to be integrated by others at the NCDOT Division 5 Office (“Division 5 Office”) located at 2612 N. Duke Street and NCDOT Statewide Transportation Operations Center (“STOC”) located at 1636 Gold Star Drive in Raleigh. Install communications cable for future remote connections to NCDOT Division 5 Maintenance (“Division 5 Maintenance”) located at 1069 Prison Camp Road.

1.2.MATERIAL

A. General

Comply with Section 1098-1 of the Standard Specifications in addition to the following special provisions.

B. Observation Period

Prior to final acceptance, all Contractor-furnished equipment and software shall successfully complete a 60-day Observation Period.

The 60-day Observation Period is considered to be part of the work included in the total contract time and must be completed prior to final acceptance of the project.

Final acceptance will occur following the successful completion of the 60-day Observation Period and after all documentation requirements have been fully satisfied.

Refer to the Testing and Acceptance section of these Project Special Provisions for additional requirements.

C. Performance of Warranty Repair and Maintenance

Provide authorization to the City of Durham and the North Carolina Department of Transportation to perform all warranty repairs after project acceptance. The decision to perform warranty work at a City or Department facility by City or Department technicians or to have warranty work performed by the vendor shall be at the discretion of the City of Durham or the North Carolina Department of Transportation. Provide any training required by the manufacturer to authorize the City of Durham and the North Carolina Department of Transportation to perform warranty work and ensure manufacturer will furnish parts to the City of Durham and the North Carolina Department of Transportation for all warranty repairs at no cost to the City or Department. In addition, ensure the manufacturer agrees to provide prompt technical support to the City of Durham and the North Carolina Department of Transportation technicians for a period of one year

after the end of the warranty period at no cost to the City or Department. Defective parts replaced under warranty by the City of Durham and the North Carolina Department of Transportation will be returned to the vendor at the vendor's request. Provide schematics, part lists, and other documentation to perform bench repair to the City of Durham or the North Carolina Department of Transportation within 2 weeks upon request. The City and Department agree not to divulge any proprietary information in the schematics, part lists and other documentation upon request from the vendor. After project acceptance and at the request of the City or Department, manufacturer shall perform warranty repairs to equipment which fails during the warranty period at no cost to the City or Department including freight costs to ship repaired equipment back to Durham. Ensure all equipment is repaired and returned to the City of Durham or the North Carolina Department of Transportation within 21 calendar days of receipt by the manufacturer.

1.3.CONSTRUCTION METHODS

A. General

Comply with Section 1700-3 of the Standard Specifications in addition to the following special provisions.

Article 1700-3(K) of the Standard Specifications are revised as follows:

Page 17-4, revise sentence starting on line 14 to read "Modify existing electrical services, as necessary, to meet the grounding requirements of the NEC, these Standard Specifications, Standard Drawings, and the project plans."

Page 17-4, revise sentence beginning on line 21 to read "Furnish and install additional ground rods to grounding electrode system as necessary to meet the Standard Specifications, Standard Drawings, and test requirements."

B. Requirements for Working Within City of Durham

There are no permitting fees associated with the construction of traffic signal system infrastructure within City of Durham right-of-way.

The Contractor shall be responsible for clearly identifying their contractors/subcontractors on their work vehicles and equipment (e.g. Company name/logo and a phone number) in an effort to clearly identify work crews in a timely manner.

The Contractor shall issue weekly notification e-mails to the City throughout the project duration that documents their current and planned construction activities. The City will maintain and update an electronic distribution list on behalf of the Contractor.

The Contractor shall not perform any construction activities within City Hall on business days between the hours of 8:00am to 5:00pm, unless otherwise approved by the Engineer and two-day advance notice given to the City. The Contractor may perform integration and computer software activities during these hours as needed, but only during weekday off-hours (5:00pm to 8:00am) and weekends with approval of the Engineer.

C. Removal of Existing Equipment and Material

Remove all Department-owned signals and communications related equipment and material that will not be used. Assume ownership of removed poles, messenger cable, interconnect cable, communications cable and supporting hardware. Return all other equipment and material between

8:00 a.m. and 12:00 p.m., Monday through Thursday, to the Division 5 Traffic Services Office located at 1076 Prison Camp Road in Durham.

Remove all City of Durham owned signals and communications related equipment and material that will not be used. Return all McCain 2070E controllers between 8:00 a.m. and 12:00 p.m., Monday through Thursday, to the City Signal Shop located at 320 Muldee Street in Durham. Assume ownership of all other equipment and material.

All existing communications cable and supporting splicing and communications equipment that is not being reused or removed shall be abandoned in place.

D. Requirements for Historic Areas

As shown in the Plans, some work will be conducted within areas determined to contain properties with documented historic significance. If it is necessary to deviate from the Plans in these areas, alert the Engineer to contact Project Development And Environmental Analysis Branch-Historic Architecture Group of the North Carolina Department of Transportation for an effects determination before proceeding.

Avoid damaging or removing sidewalks and curbs within designated historic districts whenever possible. Do not damage, disturb, or remove any existing granite curbs. Where granite curbs conflict with the installation of underground conduit and cable, bore (drill) conduit underneath granite curb. Do not bore through granite curbs. Replace any granite curb damaged due to construction of this project at no cost to the Department.

Where removal and replacement of concrete sidewalk and concrete curb is unavoidable, replace them with concrete materials that match the finish, appearance, and color of the adjacent existing sidewalk as close as technically feasible as determined by the Engineer. Finishes may include, but are not limited to, water-washed, broom, and trowel. The dimensions and the profile (i.e. shape) of the new curbing shall match that of the adjacent existing curbing.

Where removal and replacement of sidewalk constructed of materials other than concrete is unavoidable, replace the sidewalk with in-kind materials that match the finish, appearance, and color of the adjacent existing sidewalk as close as technically feasible as determined by the Engineer. If the sidewalk is constructed of materials such as brick, stone, or pavers, carefully remove and subsequently reinstall the bricks, stones, or pavers using methods approved by the Engineer. Take photographs and make sketches to record the pattern of the existing materials prior to removal. Replace any bricks, stones, or pavers damages due to construction on this project with approved in-kind, matching materials.

Repair and replacement of existing sidewalk will be measured and paid for in accordance with the Signal Cabinet Foundations section of these Project Special Provisions.

Complete all repairs with in-kind materials to all sidewalks removed for construction and reopen the repaired and restored sidewalk to pedestrian traffic within five consecutive calendar days following initial removal. If the Contractor fails to repair and reopen a sidewalk in accordance with these Project Special provisions within the time frame specified, the Department reserves the right to make the necessary repairs, and all expenses incurred by the Department in making the repairs and restoring the sidewalk will be deducted from payment due the Contractor, plus \$500 liquidated damage per occasion, per day, or any portion thereof, until corrected.

Do not trim, remove, or damage tree limbs within historic districts. Hand-lashing of aerial cables to messenger cable may be required in some areas due to overhanging and protruding tree limbs

along the cable route. When required, hand-lashing will be performed at no additional cost to the Department.

E. Related Projects

Current roadway and transportation projects within the project area may impact traffic signal operations and communications. Coordinate with the Engineer on how to proceed if those projects have not been completed and construction in these areas is on the critical path of the project schedule.

The City and Department have general maintenance backlog work for public safety that will need to be continued throughout the duration of this project. Coordinate with Engineer for actions to be taken if any maintenance construction prohibits the availability of the traffic signal for construction.

F. Sequence of Construction

Perform construction of the project in the sequence called for in these Project Special Provisions. All work not performed in accord with the sequence of construction must be approved by the Engineer. Adherence to the sequence of construction must be reflected in the Contractor's project schedule and all updates to the project schedule. Construction shall have minimal disruption to the existing signal operations.

As new intersections are installed but are not under monitoring and supervision of the central system, maintain existing signal coordination and common controller clock time. All clocks that are updated shall be updated from a single clock source. Review each intersection that has been installed but is not online on a regular basis (no less than three times a week) in the form of a field visit and review the controller clock for drift against the common time source. Reset clock to common time source if it has drifted. Document the field visit and any actions taken in the cabinet's maintenance diary. Record time and date of each visit, activity performed, and person performing visit. Maintain records of clock maintenance activities in a single document and furnish to the Engineer for review upon request. Failure to visit each intersection that is not online to check and update clocks will result in a liquidated damage of \$1,500 per visit not performed.

For the Sequence of Construction, the Contractor shall perform the work per the following phasing.

Phase 1 – This phase shall consist of installing new infrastructure for the fiber optic communications and includes:

- Installing new messenger cable and guy assemblies throughout the project area. Also, installing communications cable ID markers on messenger cable to identify and reserve fiber optic cable attachment locations on existing utility poles.
- Installing new junction boxes, underground conduit, and pole risers throughout the project area.
- Installing the hub cabinets and foundations in the field and establishing electrical service.
- Not disturbing the existing signal cabinets/controller or the existing signal system communications network.

Phase 2 – This phase shall consist of installing new fiber optic communications cables and equipment and includes:

- Installing new fiber optic cables throughout the project area by lashing to aerial messenger cable and/or existing communications cables or pulling through underground conduit.
- Installing new fiber optic splice enclosures and performing splicing where new fiber optic cables connect. No splicing involving existing fiber optic cables shall be performed during this phase.
- Installing interconnect centers in the hub cabinets and terminating the fiber optic cables entering the cabinet.
- Not disturbing the existing signal cabinets/controller or the existing signal system communications network.

Phase 3 – This phase shall consist of preparing the signal system at the Signal Shop and includes:

- Routing the 144-SMFO and 288-SMFO cables that enter the building to the Server Room using existing building entrances and raceways.
- Installing the new fiber optic interconnect center in the Server Room rack cabinet and terminating the 144-SMFO and 288-SMFO cables.
- Installing the core Ethernet switch and application servers in the rack cabinets.
- Configuring and integrating the application servers to establish the new central signal system.
- Configuring and integrating the application server to establish the upgraded CCTV video management software.
- Installing the new computer workstation at the Signal Shop and installing the signal system and CCTV video management client software.

Phase 4 – This phase shall consist of preparing the hub ethernet switches and includes:

- Installing the hub Ethernet switches in the hub cabinets and integrating them with the fiber optic cable terminations.
- Establishing ethernet communications between all the hub switches and the core switch at the Signal Shop.

Phase 5 – This phase shall consist of integrating the Ethernet groups and includes:

- Performing one session of the cabinet and controller training for City and Department technicians (as detailed in these Project Special Provisions) prior to installing any new cabinets and controllers in the field.
- Integrating groups (one group at a time) in this order:
 - **Phase 5A (Ring A)** – all channels that terminate at hub A
 - **Phase 5B (Ring B)** – all channels that terminate at hub B
 - **Phase 5C (Ring C)** – all channels that terminate at hub C

- The Contractor shall complete all work for a given group and verify it is fully functional before starting work in a different group. After taking down an existing communication channel, the contractor must complete all construction for traffic signals in that channel in a time period no greater than two (2) days per traffic signal in that channel. Establish time-based coordination within the limits of the prior closed loop system and maintain controller clocks.
 - During Phase 5C, there are four signals (05-0789, 05-0958, 05-0959, and 05-2308) within channel C34 that are currently integrated with the Town of Chapel Hill traffic signal system. For these signals, the Contractor shall not disturb the existing communications prior to the cabinet and controller replacement. Coordinate with the Engineer and all impacted agencies to schedule signal and fiber work. The Town of Chapel Hill will perform all splicing work needed for the Chapel Hill signal system after the signals are transitioned to the Durham signal system.
- Verifying that all existing traffic signal communication channels are still fully functional at the TCC.
- Performing signal work (cabinet and controller replacement) for traffic signals within the group.
- Performing CCTV work (camera installation and replacement) for proposed and existing CCTV cameras within the group.
- Performing communications work (field Ethernet switch installation and wireless radio upgrade) within the group.
- Integrating the field Ethernet switches within the group with the fiber optic communications network, the corresponding hub ethernet switch, and the core Ethernet switch at the Signal Shop.
- Integrating the Ethernet group with the signal system software at the Signal Shop to establish communications with the traffic signals.
- Integrating the Ethernet group with the CCTV control software at the Signal Shop to establish communications with the CCTV cameras along with viewing video and controlling PTZ functions.

Phase 6 – This phase shall consist of preparing the remove CCTV video connections for County Courthouse, EOC, and STOC. This phase is to be initiated once all existing analog CCTV cameras have been replaced with online and fully functioning digital IP CCTV cameras, and thus may begin prior to completing Phase 5. This phase includes:

- For County Courthouse, transition the existing fiber optic cable connection along Roxboro Street to be integrated with the new signal system network. Remove existing analog video equipment at County Courthouse. Install the new network switch, new video display appliance, and new workstation loaded with the video management software. Integrate the video display appliance with the existing video monitor. Configure the software to integrate with the video management server to display all CCTV video feeds. Integrate the video display appliance with the existing video monitor.

- For EOC, transition the existing fiber optic cable connection along Stadium Drive to be integrated with the new signal system network. Remove existing analog video equipment at EOC. Install the new network switch, new video display appliance, and new workstation loaded with the video management software. Integrate the video display appliance with the existing video monitor. Configure the software to integrate with the video management server to display all CCTV video feeds. Integrate the video display appliance with the existing video monitors.
- For STOC, transition the existing fiber optic cable connection along NC-147 to be integrated with the new signal system network. Install the new network switch at the STOC to be integrated by others in the future.

Phase 7 – This phase shall consist of preparing the signal system at the Durham TCC and includes:

- Routing the 144-SMFO and 288-SMFO cables that enter the building to the Server Room using existing building entrances and raceways.
- Installing the new fiber optic interconnect center in the Server Room rack cabinet and terminating the 144-SMFO and 288-SMFO cables.
- Installing the core Ethernet switch in the rack cabinets.
- Configuring and integrating the core switch with the core switch at the Signal Shop to establish the new central signal system and CCTV video management software.
- Installing the new computer workstation at the TCC and installing the signal system and CCTV video management client software.

Phase 8 – This phase shall consist of preparing the remove CCTV video connections for DTV8 and Police HQ. This phase includes:

- For DTV8, install the new network switch and new workstation loaded with the video management software. Configure the software to integrate with the video management server to display all CCTV video feeds.
- For Police HQ, transition the existing fiber optic cable connection in City Hall to be integrated with the new signal system network. Remove existing analog video equipment at Police HQ. Install the new network switch. At each of the six operator consoles, install a new video display appliance and new workstation that is integrated with the network switch. Integrate the video display appliance with the existing video monitor. Configure the workstation software to integrate with the video management server to display all CCTV video feed.

Phase 9 – This phase shall consist of all testing and training required in these Project Special Provisions prior to System Acceptance.

1.4.REQUIREMENTS FOR CABLES CROSSING RAILROADS

A. Railroad Crossings

Application has been made with Norfolk Southern Corporation (NS), CSX Transportation (CSX), and North Carolina Railroad Company (NCR) herein called the Railroad Company(ies), for the encroachment agreements necessary under this Contract. Do not commence cable routings over

or under railroad-owned facilities until notification and coordination with Engineer and the appropriate Railroad Company has occurred. Install fiber-optic communications cable as shown on the Plans. All work associated with the crossing is to conform to the Railroad Company's specifications.

B. Insurance Requirements

The Department has provided Railroad Protective Liability Insurance to the railroad companies as part of the Department's encroachment agreements with the railroad companies for each of location listed in the table above.

If required by the railroad, pay for railroad personnel to be present when work is performed.

In addition to any other forms of insurance or bonds required under the terms of the Contract and the Standard Specifications, take out and keep in force from the commencement of all construction on railroad right-of-way until the final inspection and acceptance of the project by the Engineer, insurance of the following kinds and amount. It is understood that the amounts specified are minimum amounts and that larger amounts may be carried if so desired. Any insurance taken out due to these requirements shall be subject to the approval of the Engineer, and the Railroad Companies as to form and amount. Furnish satisfactory policies prior to beginning of the work on railroad right-of-way.

Refer to the following web links for more specific insurance requirements and requirements for working on the rights-of-way of each railroad company. In the event of a conflict between the requirements of one or more railroad companies and the requirements contained in the Plans or these Project Special Provisions, the requirements of the railroad company shall govern.

1. Commercial General Liability Insurance

Furnish evidence to the Engineer of Contractor's commercial General Liability Insurance coverage with a combined single limit of not less than \$5,000,000 for each occurrence for operations performed on the railroad right-of-way. The Contractor's policy shall name the railroad company(ies) as an additional insured. If any part of the work is sublet, similar insurance in the same amounts and evidence thereof as required of the Prime Contractor shall be provided by or on behalf of the Subcontractor to cover Subcontractor's operations on the railroad right-of-way.

Keep such insurance in force until final inspection of the project, or that portion or portions within the railroad right-of-way, by the Engineer or, in the case of Subcontractors, until the Contractor furnishes a letter to the Engineer stating that the Subcontractor has completed his/her subcontracted work within the railroad right-of-way to Contractor's satisfaction, and that the Contractor will accomplish any additional work necessary on the railroad right-of-way with the Contractor's own forces.

2. Termination of Insurance and Policies to be Submitted

Any insurance policies given hereunder shall cover all Contractor-performed work the Contractor in connection with the work in the introductory paragraph within railroad right-of-way but shall not be liable for accidents occurring after acceptance of the completed project by the Department. Such policies shall contain a clause requiring 30 days written notice be given to the Engineer and to the appropriate Railroad Company, prior to cancellation or change.

Submit to the Engineer the original and one copy of the Commercial General Liability Policy, one certified duplicate copy of all other policies, and certificates of insurance in an original and two copies as required by these Project Special Provisions.

No extra allowance will be made for the insurance required hereunder. The entire cost shall be included in the contract unit price bids for other pay items.

The named insured under the commercial General Liability Insurance Policy is the respective Railroad Company, and the designation of the job site description of work is as follows: All construction on the <<RAILROAD COMPANY>> right-of-way on NCDOT Project No. U-5968 in the City of Durham and Durham County, North Carolina.

C. Flagging Protection or Watchman Service

Provide 72 hours advance notice to NS in order that flagging service can be arranged and provided. Do not undertake any work within the NS right-of-way until the flagman is at the job site.

Provide a minimum of 10 working days advanced written notice to NCRP in order that flagging service can be arranged and provided. Do not undertake any work within the NCRP right-of-way until the flagman is at the job site.

D. Delays Caused by Operations of Others

Neither the Department nor the Railroad Company assumes any responsibility for any work performed by others in connection with the construction of the project, and the Contractor shall have no claim whatsoever against the Department or the Railroad Company for any inconvenience, delay, or additional cost incurred by the Contractor on account of such operations by others.

E. Time Extensions

No time extensions related to railroad encroachments will be allowed until the related work becomes the controlling factor relative to overall project completion.

F. Cooperation with Others

Cooperate with others participating in the construction of the project to the end that all work may be carried on to the best advantage.

G. Authority of Railroad Engineer

The authorized representative of the Railroad Company, hereinafter referred to as the Railroad Engineer, will have the final authority in all matters affecting the safe maintenance of railroad traffic of his company.

H. Interference with Railroad Operations

Arrange and conduct work so that there will be no interference with railroad operations, including train, signal, telephone and telegraphic services, or damage to the property of the Railroad Company or to the poles, wire, and other facilities of tenants on the rights-of-way of the Railroad Company. Wherever work is liable to affect the operations or safety of trains, first submit the method of doing such work to the Railroad Engineer for approval. However, such approval will not relieve the Contractor from liability.

Should conditions arising from or in connection with the work, require that immediate and unusual provisions be made to protect train operations and property of the Railroad Company, it shall be a part of the required services by the Contractor to make such provisions and if, in the judgment of the Railroad Engineer such provisions are insufficient, the Railroad Engineer or the Department may, at the expense of the Contractor, require or provide such provisions as may be deemed necessary.

I. Storage of Materials

Do not store materials and equipment where they will interfere with railroad operations, nor on the rights-of-way of the Railroad Company without first having obtained permission from the Railroad Engineer. Such permission will be with the understanding that the Railroad Company will not be liable or damage to such material and equipment from any cause, and that the Railroad Engineer may move or require the Contractor to move, at the Contractor's expense, such material and equipment.

J. Completion and Acceptance of Work

Upon completion of the work, remove from within the limits of the railroad right-of-way all machinery, equipment, surplus materials, or rubbish and leave said rights-of-way in a neat and orderly condition. Acceptance of the work will be contingent upon final inspection by the Department and by the Railroad Company (if required by the Railroad Company) to determine if the work was completed satisfactorily in a manner acceptable to the Department and the Railroad Company.

1.5.MEASUREMENT AND PAYMENT

There will be no direct payment for work covered in this section. Payment at the contract unit prices for the various items in the contract will be full compensation for all work covered by this section.

Repair, removal and replacement of damaged or unacceptable equipment or work under this section will be at no additional cost to the Department. The Department will deduct the cost of Department-owned equipment damaged by the Contractor from money due to the Contractor.

If the Department or City of Durham performs maintenance and emergency service necessary to ensure continuous traffic signal operation, all expenses incurred by the Department or City in implementing this option will be deducted from payment due the Contractor, plus \$2,500 liquidated damage per occasion, per day or any portion thereof, until corrected.

2. MOBILIZATION

2.1.Description

This work consists of preparatory work and operations, including but not limited to the movement of personnel, equipment, supplies, and incidentals to the project site, for the establishment of offices, buildings, and other facilities necessary for work on the project; the removal and disbandment of those personnel, equipment, supplies, incidentals, or other facilities that were established for the prosecution of work on the project; and for all other work and operations which must be performed for costs incurred prior to beginning work on the various items on the project site.

2.2.Measurement and Payment

Mobilization will be measured and paid for at the contract lump sum price.

Partial payments for Mobilization will be made with the first and second partial pay estimates paid on the contract and will be made at the rate of 50% lump sum price on each of these partial pay estimates, provided the amount bid for Mobilization does not exceed 5% of the total amount bid for the contract. Where the amount bid for Mobilization exceeds 5% of the total amount bid for the contract, 2.5% of the total amount bid will be paid on each of the first 2 partial pay estimates. That portion exceeding 5% will be paid on the last partial pay estimate.

Such price and payment includes, but is not limited to, the movement of personnel, equipment, supplies and incidentals to the project site, for the establishment of offices, buildings and other facilities necessary for work on the project; the removal and disbandment of those personnel, equipment, supplies, incidentals or other facilities that were established for the prosecution of work on the project; and for all other work and operations that shall be performed for costs incurred before beginning work on the various items on the project site.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------|-----------------|
| Mobilization..... | Lump Sum |

3. SIGNAL HEADS

3.1.DESCRPTION

Furnish and install vehicle LED signal heads, visors, interconnecting brackets, wire entrance fittings, mounting assemblies, signal cable, lashing wire, grounding systems and all necessary hardware.

3.2.MATERIAL

A. General:

Fabricate vehicle signal head housings and end caps from die-cast aluminum. Fabricate 12-inch and 16-inch pedestrian signal head housings and end caps from die-cast aluminum. Fabricate 9-inch pedestrian signal head housings, end caps, and visors from virgin polycarbonate material. Provide visor mounting screws, door latches, and hinge pins fabricated from stainless steel. Provide interior screws, fasteners, and metal parts fabricated from stainless steel.

Fabricate tunnel and traditional visors from sheet aluminum.

Paint all surfaces inside and outside of signal housings and doors. Paint outside surfaces of tunnel and traditional visors, wire outlet bodies, wire entrance fitting brackets and end caps when supplied as components of messenger cable mounting assemblies, pole and pedestal mounting assemblies, and pedestrian pushbutton housings. Have electrostatically-applied, fused-polyester paint in highway yellow (Federal Standard 595C, Color Chip Number 13538) a minimum of 2.5 to 3.5 mils thick. Do not apply paint to the latching hardware, rigid vehicle signal head mounting brackets for mast-arm attachments, messenger cable hanger components or balance adjuster components.

Have the interior surfaces of tunnel and traditional visors painted an alkyd urea black synthetic baking enamel with a minimum gloss reflectance and meeting the requirements of MIL-E-10169, "Enamel Heat Resisting, Instrument Black."

Where required, provide polycarbonate signal heads and visors that comply with the provisions pertaining to the aluminum signal heads listed on the QPL with the following exceptions:

Fabricate signal head housings, end caps, and visors from virgin polycarbonate material. Provide UV stabilized polycarbonate plastic with a minimum thickness of 0.1 ± 0.01 inches that is highway yellow (Federal Standard 595C, Color Chip 13538). Ensure the color is incorporated into the plastic material before molding the signal head housings and end caps. Ensure the plastic formulation provides the following physical properties in the assembly (tests may be performed on separately molded specimens):

| Test | Required | Method |
|--|--------------------|------------|
| Specific Gravity | 1.17 minimum | ASTM D 792 |
| Flammability | Self-extinguishing | ASTM D 635 |
| Tensile Strength, yield, PSI | 8500 minimum | ASTM D 638 |
| Izod impact strength, ft-lb/in [notched, 1/8 inch] | 12 minimum | ASTM D 256 |

For pole mounting, provide side of pole mounting assemblies with framework and all other hardware necessary to make complete, watertight connections of the signal heads to the poles and pedestals. Fabricate the mounting assemblies and frames from aluminum with all necessary

hardware, screws, washers, etc. to be stainless steel. Provide mounting fittings that match the positive locking device on the signal head with the serrations integrally cast into the brackets. Provide upper and lower pole plates that have 1 ¼-inch vertical conduit entrance hubs with the hubs capped on the lower plate and 1 ½-inch horizontal hubs. Ensure that the assemblies provide rigid attachments to poles and pedestals so as to allow no twisting or swaying of the signal heads. Ensure that all raceways are free of sharp edges and protrusions and can accommodate a minimum of ten Number 14 AWG conductors.

For pedestal mounting, provide a post-top slipfitter mounting assembly that matches the positive locking device on the signal head with serrations integrally cast into the slipfitter. Provide stainless steel hardware, screws, washers, etc. Provide a minimum of six 3/8 X 3/4-inch long square head bolts for attachment to pedestal. Provide a center post for multi-way slipfitters.

For light emitting diode (LED) traffic signal modules, provide the following requirements for inclusion on the Department's Qualified Products List for traffic signal equipment.

1. Sample submittal,
2. Third-party independent laboratory testing results for each submitted module with evidence of testing and conformance with all of the Design Qualification Testing specified in section 6.4 of each of the following Institute of Transportation Engineers (ITE) specifications:
 - Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement
 - Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement
 - Pedestrian Traffic Control Signal Indications –Light Emitting Diode (LED) Signal Modules.

(Note: The Department currently recognizes two approved independent testing laboratories. They are Intertek ETL Semko and Light Metrics, Incorporated with Garwood Laboratories. Independent laboratory tests from other laboratories may be considered as part of the QPL submittal at the discretion of the Department,

3. Evidence of conformance with the requirements of these specifications,
4. A manufacturer's warranty statement in accordance with the required warranty, and
5. Submittal of manufacturer's design and production documentation for the model, including but not limited to, electrical schematics, electronic component values, proprietary part numbers, bill of materials, and production electrical and photometric test parameters.
6. Evidence of approval of the product to bear the Intertek ETL Verified product label for LED traffic signal modules.

In addition to meeting the performance requirements for the minimum period of 60 months, provide a written warranty against defects in materials and workmanship for the modules for a period of 60 months after installation of the modules. During the warranty period, the manufacturer must provide new replacement modules within 45 days of receipt of modules that have failed at no cost to the State. Repaired or refurbished modules may not be used to fulfill the manufacturer's warranty obligations. Provide manufacturer's warranty documentation to the Department during evaluation of product for inclusion on Qualified Products List (QPL).

B. Vehicle Signal Heads:

Comply with the ITE standard "Vehicle Traffic Control Signal Heads". Provide housings with provisions for attaching backplates.

Provide visors that are 8 inches in length for 8-inch vehicle signal head sections. Provide visors that are 10 inches in length for 12-inch vehicle signal heads.

Provide a termination block with one empty terminal for field wiring for each indication plus one empty terminal for the neutral conductor. Have all signal sections wired to the termination block. Provide barriers between the terminals that have terminal screws with a minimum Number 8 thread size and that will accommodate and secure spade lugs sized for a Number 10 terminal screw.

Mount termination blocks in the yellow signal head sections on all in-line vehicle signal heads. Mount the termination block in the red section on five-section vehicle signal heads.

Furnish vehicle signal head interconnecting brackets. Provide one-piece aluminum brackets less than 4.5 inches in height and with no threaded pipe connections. Provide hand holes on the bottom of the brackets to aid in installing wires to the signal heads. Lower brackets that carry no wires and are used only for connecting the bottom signal sections together may be flat in construction.

For messenger cable mounting, provide messenger cable hangers, wire outlet bodies, balance adjusters, bottom caps, wire entrance fitting brackets, and all other hardware necessary to make complete, watertight connections of the vehicle signal heads to the messenger cable. Fabricate messenger cable hanger components, wire outlet bodies and balance adjuster components from stainless steel or malleable iron galvanized in accordance with ASTM A153 (Class A) or ASTM A123. Provide serrated rings made of aluminum. Provide messenger cable hangers with U-bolt clamps. Fabricate washers, screws, hex-head bolts and associated nuts, clevis pins, cotter pins, U-bolt clamps and nuts from stainless steel.

For mast-arm mounting, provide rigid vehicle signal head mounting brackets and all other hardware necessary to make complete, watertight connections of the vehicle signal heads to the mast arms and to provide a means for vertically adjusting the vehicle signal heads to proper alignment. Fabricate the mounting assemblies from aluminum, and provide serrated rings made of aluminum. Provide stainless steel cable attachment assemblies to secure the brackets to the mast arms. Ensure all fastening hardware and fasteners are fabricated from stainless steel.

Provide LED vehicular traffic signal modules (hereafter referred to as modules) that consist of an assembly that uses LEDs as the light source in lieu of an incandescent lamp for use in traffic signal sections. Use LEDs that are aluminum indium gallium phosphorus (AlInGaP) technology for red and yellow indications and indium gallium nitride (InGaN) for green indications. Install the ultra-bright type LEDs that are rated for 100,000 hours of continuous operation from -40°F to +165°F. Design modules to have a minimum useful life of 60 months and to meet all parameters of this specification during this period of useful life.

For the modules, provide spade terminals crimped to the lead wires and sized for a #10 screw connection to the existing terminal block in a standard signal head. Do not provide other types of crimped terminals with a spade adapter.

Ensure the power supply is integral to the module assembly. On the back of the module, permanently mark the date of manufacture (month & year) or some other method of identifying date of manufacture.

Tint the red, yellow and green lenses to correspond with the wavelength (chromaticity) of the LED. Transparent tinting films are unacceptable. Provide a lens that is integral to the unit with a smooth outer surface.

1. LED Circular Signal Modules:

Provide modules in the following configurations: 12-inch circular sections, and 8-inch circular sections. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2018 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications*, that each module meets or exceeds the ITE "Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement" dated June 27, 2005 (hereafter referred to as VTCSH Circular Supplement) and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Circular Supplement:

| <i>Module Type</i> | <i>Max. Wattage at 165° F</i> | <i>Nominal Wattage at 77° F</i> |
|------------------------|-------------------------------|---------------------------------|
| 12-inch red circular | 17 | 11 |
| 8-inch red circular | 13 | 8 |
| 12-inch green circular | 15 | 15 |
| 8-inch green circular | 12 | 12 |

For yellow circular signal modules, provide modules tested under the procedures outlined in the VTCSH Circular Supplement to ensure power required at 77° F is 22 Watts or less for the 12-inch circular module and 13 Watts or less for the 8-inch circular module.

Note: Use a wattmeter having an accuracy of $\pm 1\%$ to measure the nominal wattage and maximum wattage of a circular traffic signal module. Power may also be derived from voltage, current and power factor measurements.

2. LED Arrow Signal Modules

Provide 12-inch omnidirectional arrow signal modules. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2018 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications*, that each module meets or exceeds the requirements for 12-inch omnidirectional modules specified in the ITE "Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Vehicle Arrow Traffic Signal Supplement" dated July 1, 2007 (hereafter referred to as VTCSH Arrow Supplement) and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Arrow Supplement:

| <i>Module Type</i> | <i>Max. Wattage at 165° F</i> | <i>Nominal Wattage at 77° F</i> |
|---------------------|-------------------------------|---------------------------------|
| 12-inch red arrow | 12 | 9 |
| 12-inch green arrow | 11 | 11 |

For yellow arrow signal modules, provide modules tested under the procedures outlined in the VTCSH Arrow Supplement to ensure power required at 77° F is 12 Watts or less.

Note: Use a wattmeter having an accuracy of $\pm 1\%$ to measure the nominal wattage and maximum wattage of an arrow traffic signal module. Power may also be derived from voltage, current and power factor measurements.

3. LED U-Turn Arrow Signal Modules:

Provide modules in the following configurations: 12-inch left U-turn arrow signal modules and 12-inch right U-turn arrow signal modules.

Modules are not required to be listed on the ITS and Signals Qualified Products List. Provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications*, that each module meets or exceeds the ITE "Vehicle Traffic Control Signal Heads – Light Emitting Diode (LED) Circular Signal Supplement" dated June 27, 2005 (hereafter referred to as VTCSH Circular Supplement) and other requirements stated in this specification.

Provide modules that have minimum maintained luminous intensity values that are not less than 16% of the values calculated using the method described in section 4.1 of the VTCSH Circular Supplement.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Circular Supplement:

| <i>Module Type</i> | <i>Max. Wattage at 165° F</i> | <i>Nominal Wattage at 77° F</i> |
|----------------------------|-------------------------------|---------------------------------|
| 12-inch red U-turn arrow | 17 | 11 |
| 12-inch green U-turn arrow | 15 | 15 |

For yellow U-turn arrow signal modules, provide modules tested under the procedures outlined in the VTCSH Circular Supplement to ensure power required at 77° F is 22 Watts or less.

Note: Use a wattmeter having an accuracy of $\pm 1\%$ to measure the nominal wattage and maximum wattage of a circular traffic signal module. Power may also be derived from voltage, current and power factor measurements.

4. LED Bi-Modal Green-Yellow Arrow Signal Modules

Provide 12-inch omnidirectional bi-modal arrow signal modules. Ensure both green and yellow arrow indications are in each module with a clear lens that is integral to the unit. Ensure both indications display an incandescent style look.

Modules are not required to be listed on the ITS and Signals QPL. Ensure that both indications along with the module meet or exceed the requirements in sections 1, 2, 3, 4, and 5 of the VTCSH Arrow Supplement and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the VTCSH Arrow Supplement:

| Arrow Type | Nominal Wattage at 77° F |
|----------------------|--------------------------|
| 12-inch yellow arrow | 12 |
| 12-inch green arrow | 11 |

Note: Use a wattmeter having an accuracy of $\pm 1\%$ to measure the nominal wattage and maximum wattage of a circular traffic signal module. Power may also be derived from voltage, current, and power factor measurements.

C. Pedestrian Signal Heads:

Provide pedestrian signal heads with international symbols that meet the MUTCD. Do not provide letter indications.

Comply with the ITE standard for “Pedestrian Traffic Control Signal Indications” and the following sections of the ITE standard for “Vehicle Traffic Control Signal Heads” in effect on the date of advertisement:

- Section 3.00 - “Physical and Mechanical Requirements”
- Section 4.01 - “Housing, Door, and Visor: General”
- Section 4.04 - “Housing, Door, and Visor: Materials and Fabrication”
- Section 7.00 - “Exterior Finish”

Provide a double-row termination block with three empty terminals and number 10 screws for field wiring. Provide barriers between the terminals that accommodate a spade lug sized for number 10 terminal screws. Mount the termination block in the hand section. Wire all signal sections to the terminal block.

Where required by the plans, provide 16-inch pedestrian signal heads with traditional three-sided, rectangular visors, 6 inches long. Where required by the plans, provide 12-inch pedestrian signal heads with traditional three-sided, rectangular visors, 8 inches long.

Provide 2-inch diameter pedestrian push-buttons with weather-tight housings fabricated from die-cast aluminum and threading in compliance with the NEC for rigid metal conduit. Provide a weep hole in the housing bottom and ensure that the unit is vandal resistant.

Provide push-button housings that are suitable for mounting on flat or curved surfaces and that will accept 1/2-inch conduit installed in the top. Provide units that have a heavy duty push-button assembly with a sturdy, momentary, normally-open switch. Have contacts that are electrically insulated from the housing and push-button. Ensure that the push-buttons are rated for a minimum of 5 mA at 24 volts DC and 250 mA at 12 volts AC.

Provide standard R10-3 signs with mounting hardware that comply with the MUTCD in effect on the date of advertisement. Provide R10-3E signs for countdown pedestrian heads and R10-3B for non-countdown pedestrian heads.

Design the LED pedestrian traffic signal modules (hereafter referred to as modules) for installation into standard pedestrian traffic signal sections that do not contain the incandescent signal section reflector, lens, eggcrate visor, gasket, or socket. Provide modules that consist of an assembly that uses LEDs as the light source in lieu of an incandescent lamp. Use LEDs that are of the latest aluminum indium gallium phosphorus (AlInGaP) technology for the Portland Orange hand and

countdown displays. Use LEDs that are of the latest indium gallium nitride (InGaN) technology for the Lunar White walking man displays. Install the ultra-bright type LEDs that are rated for 100,000 hours of continuous operation from -40°F to +165°F. Design modules to have a minimum useful life of 60 months and to meet all parameters of this specification during this period of useful life.

Design all modules to operate using a standard 3 - wire field installation. Provide spade terminals crimped to the lead wires and sized for a #10 screw connection to the existing terminal block in a standard pedestrian signal housing. Do not provide other types of crimped terminals with a spade adapter.

Ensure the power supply is integral to the module assembly. On the back of the module, permanently mark the date of manufacture (month & year) or some other method of identifying date of manufacture.

Provide modules in the following configuration: 16-inch displays which have the solid hand/walking man overlay on the left and the countdown on the right, and 12-inch displays which have the solid hand/walking man module as an overlay. All makes and models of LED modules purchased for use on the State Highway System shall appear on the current NCDOT Traffic Signal Qualified Products List (QPL).

Provide the manufacturer's model number and the product number (assigned by the Department) for each module that appears on the 2018 or most recent Qualified Products List. In addition, provide manufacturer's certification in accordance with Article 106-3 of the *Standard Specifications*, that each module meets or exceeds the ITE "Pedestrian Traffic Control Signal Indicators - Light Emitting Diode (LED) Signal Modules" dated August 04, 2010 (hereafter referred to as PTCSI Pedestrian Standard) and other requirements stated in this specification.

Provide modules that meet the following requirements when tested under the procedures outlined in the PTCSI Pedestrian Standard:

| Module Type | Max. Wattage at 165° F | Nominal Wattage at 77° F |
|------------------------|------------------------|--------------------------|
| Hand Indication | 16 | 13 |
| Walking Man Indication | 12 | 9 |
| Countdown Indication | 16 | 13 |

Note: Use a wattmeter having an accuracy of $\pm 1\%$ to measure the nominal wattage and maximum wattage of a circular traffic signal module. Power may also be derived from voltage, current and power factor measurements.

Provide module lens that is hard coated or otherwise made to comply with the material exposure and weathering effects requirements of the Society of Automotive Engineers (SAE) J576. Ensure all exposed components of the module are suitable for prolonged exposure to the environment, without appreciable degradation that would interfere with function or appearance.

Ensure the countdown display continuously monitors the traffic controller to automatically learn the pedestrian phase time and update for subsequent changes to the pedestrian phase time.

Ensure the countdown display begins normal operation upon the completion of the preemption sequence and no more than one pedestrian clearance cycle.

D. Signal Cable:

Furnish 16-4 and 16-7 signal cable that complies with IMSA specification 20-1 except provide the following conductor insulation colors:

- For 16-4 cable: white, yellow, red, and green
- For 16-7 cable: white, yellow, red, green, yellow with black stripe tracer, red with black stripe tracer, and green with black stripe tracer. Apply continuous stripe tracer on conductor insulation with a longitudinal or spiral pattern.

Provide a ripcord to allow the cable jacket to be opened without using a cutter. IMSA specification 19-1 will not be acceptable. Provide a cable jacket labeled with the IMSA specification number and provide conductors constructed of stranded copper.

E. Optically-Programmed Vehicle Signal Sections:

Material, equipment, and hardware furnished under this section must be pre-approved on the Department's QPL by the date of installation.

Design the programmable signal sections to tilt in two-degree increments for a maximum of ten degrees above and ten degrees below horizontal, while still maintaining a common vertical axis.

Design the programmable signal sections to mount to standard signal sections to form a signal head. Ensure that the programmable signal sections have a mounting system compatible with the standard 1 ½-inch traffic signal fittings.

Provide an optical system consisting of a lamp, a diffuser, an optical limiter, and an objective lens. Ensure that all programming is accomplished optically with no hoods or louvers necessary to accomplish the programming. Provide optical masking tape with each section.

Provide a 150-Watt, 115 VAC lamp with integral reflector and rated output of 1750 lumens. Ensure that the average rated life is at least 6000 hours.

Provide a high resolution, annular, incremental lens. Ensure that the lens and door are sealed to provide a moisture and dust proof seal. Provide a red, yellow, or green ball or arrow indication as specified by the bid list, plans, or purchase order.

F. Louvers:

Material, equipment, and hardware furnished under this section must be pre-approved on the Department's QPL by the date of installation.

Provide louvers made from sheet aluminum. Paint the louvers alkyd urea black synthetic baked enamel with a minimum gloss reflectance and meeting the requirements of MIL-E-10169, "Enamel Heat Resisting, Instrument Black."

Ensure that the louvers have a 0-degree horizontal viewing angle. Provide a minimum of 5 vanes.

3.3.CONSTRUCTION METHODS

Comply with Section 1705-3 of the Standard Specifications.

3.4.MEASUREMENT AND PAYMENT

Vehicle Signal Head (____) and *Pedestrian Signal Head* (____) will be measured and paid as the actual number of signal heads of each type, size and number of sections furnished, installed, and accepted.

Louver will be measured and paid as the actual number of signal sections for which louvers have been furnished, installed and accepted.

Modify Existing Vehicle Signal Head will be measured and paid as the actual number of existing vehicle heads modified and accepted.

Relocate Existing Vehicle Signal Head will be measured and paid as the actual number of existing vehicle heads relocated and accepted.

Signal Cable will be measured and paid as actual linear feet of signal cable furnished, installed and accepted. Measurement will be point to point with no allowance for sag. Twenty-five feet will be allowed for vertical segments up or down poles.

No measurement will be made of visors, wire entrance fittings, interconnecting brackets, mounting assemblies, pedestrian pushbuttons, pedestrian signal signs and signal head shifts as these are incidental to furnishing and installing signal heads. No measurement will be made for drip loops, coiled sections or lashing wire as these are incidental to furnishing and installing signal cable.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Vehicle Signal Head (12", 3 Section)..... | Each |
| Vehicle Signal Head (12", 4 Section)..... | Each |
| Vehicle Signal Head (12", 5 Section)..... | Each |
| Pedestrian Signal Head (16" 1 Section with Countdown)..... | Each |
| Louver..... | Each |
| Modify Existing Vehicle Signal Head..... | Each |
| Relocate Existing Vehicle Signal Head..... | Each |
| Signal Cable..... | Linear Foot |

4. BACKPLATES

4.1.DESCRPTION

Furnish and install backplates for vehicle signal heads with all necessary hardware.

4.2.MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to 1098-2 (Backplates) of the Standard Specifications.

4.3.CONSTRUCTION METHODS

Comply with Section 1706-3 of the Standard Specifications.

4.4.MEASUREMENT AND PAYMENT

Backplate will be measured and paid in units of each, furnished, installed and accepted. No measurement will be made for different sizes, type or reflective taping of backplates.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Backplate..... | Each |

5. MESSENGER CABLE

5.1.DESCRPTION

Furnish and install messenger cable (spanwire) with cable clamps, machine bolts, eye bolts, 3-bolt clamps, eye nuts, split-bolt connectors and all necessary hardware.

5.2.MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to 1091-2 (Wire), 1091-6 (Grounding Electrode), 1098-3 (Messenger Cable), and 1098-6 (Pole Line Hardware) of the Standard Specifications.

5.3.CONSTRUCTION METHODS

Comply with Section 1710-3 of the Standard Specifications.

5.4.MEASUREMENT AND PAYMENT

Messenger Cable (____) will be measured and paid as actual horizontal linear feet of messenger cable furnished, installed, and accepted. Measurement will be point to point with no allowance for sag.

No measurement will be made of cable clamps, machine bolts, eye bolts, 3-bolt assemblies, eye nuts, split bolt connectors and pole grounding systems as these will be incidental to furnishing and installing messenger cable.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------|-----------------|
| Messenger Cable (3/8") | Linear Foot |
| Messenger Cable (1/4") | Linear Foot |

6. UNDERGROUND CABLE INSTALLATION

6.1.DESCRPTION

Furnish and install conduit for underground installation with miscellaneous fittings, all necessary hardware, marker tape, backfill, graded stone, paving materials, and seeding and mulching in accordance with Section 1715 of the Standard Specifications

6.2.MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to Articles 1091-3 (Conduit), 1091-4 (Duct and Conduit Sealer), 1018-2 (Backfill), and 545-2 and 545-3 (Graded Stone) of the Standard Specifications.

Furnish underground HDPE conduits as shown in the Plans. All vertical conduits (entrance to electrical service and equipment disconnect and pole mounted cabinet) must be rigid galvanized steel.

6.3.CONSTRUCTION METHODS

Install underground conduit in compliance with all requirements of Section 1715-3 of the Standard Specifications and the Plans.

Contractor shall avoid installing underground conduit in locations that will disturb existing brick pavers. If potential impacts are possible, notify the Engineer prior to perform the installation.

6.4.MEASUREMENT AND PAYMENT

Tracer Wire will be measured along the horizontal linear feet of tracer wire furnished, installed and accepted. Measurement will be along the approximate centerline of the conduit system. Payment will be made in linear feet. No payment will be made for excess tracer wire in junction boxes and/or cabinets

Unpaved Trenching (qty) (size) will be measured horizontal linear feet of trenching for underground conduit installation of each type furnished, installed, and accepted. Measurement will be along the approximate centerline of the conduit system. Payment will be in linear feet.

Paved Trenching (qty)(size) will be measured horizontal linear feet of trenching for underground conduit installation of each type furnished, installed and accepted. Measurement will be along the approximate centerline of the conduit system. Payment will be in linear feet

Directional Drill (qty) (size) will be measured horizontal linear feet of directional drill for underground conduit installation furnished, installed, and accepted. Measurement will be along the approximate centerline of the conduit system. Payment will be in linear feet.

No measurement will be made of vertical segments, non-metallic conduit, metallic conduit, conduit sealing material, backfill, graded stone, paved materials, brick pavers, miscellaneous fittings, non-detectable marker tape, pull lines, seeding and mulching as these will be considered incidental to conduit installation.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Tracer Wire | Linear Foot |
| Unpaved Trenching (1) (2")..... | Linear Foot |
| Unpaved Trenching (2) (2")..... | Linear Foot |
| Paved Trenching (1) (2") | Linear Foot |
| Paved Trenching (2) (2") | Linear Foot |
| Directional Drill (1) (2") | Linear Foot |
| Directional Drill (2) (2") | Linear Foot |
| Directional Drill (1) (5") & (2) (2") | Linear Foot |
| Directional Drill (1) (6") & (3) (2") | Linear Foot |

7. JUNCTION BOXES

7.1.DESCRPTION

Furnish and install junction boxes (pull boxes) with covers, graded stone, grounding systems, and all necessary hardware. Comply with Section 1716 of the Standard Specifications.

7.2.MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department’s QPL.

Refer to Section 1005 (#57 or #67 Washed Stone) and Article 1098-5 (Junction Boxes) of the Standard Specifications.

Provide covers engraved with “NCDOT FIBER OPTIC CABLE” on the top face.

Install special oversized heavy-duty junction boxes with minimum inside dimensions of 36” x 36” (length x width) for storage of fiber optic splice enclosures and communications cables.

7.3.CONSTRUCTION METHODS

Install junction boxes in compliance with all requirements of Section 1716-3 of the Standard Specifications.

Contractor shall provide real-world coordinates according to Section 1716-3 for all new junction boxes installed as well as all existing junction boxes that are reused.

At locations where an existing junction box is removed and replaced by a new junction box, the Contractor shall remove the junction box with minimal disruption to the surface of the surrounding area. The junction box should be disposed of by the Contractor in a manner approved by the Engineer.

7.4.MEASUREMENT AND PAYMENT

Junction Box (_____) will be measured and paid in actual number of junction boxes of each size and type furnished, installed, and accepted.

Remove Existing Junction Box will be measured and paid in actual number of junction boxes removed and disposed.

No measurement will be made of covers, graded stone, and grounding systems as these will be considered incidental to furnishing and installing junction boxes. Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Junction Box (Standard Size)..... | Each |
| Junction Box (Oversized, Heavy Duty) | Each |
| Junction Box (Special Oversized, Heavy Duty) | Each |
| Remove Existing Junction Box..... | Each |

8. WOOD POLES

8.1.DESCRPTION

Furnish and install wood poles with grounding systems and all necessary hardware in accordance with Section 1720 of the Standard Specifications.

8.2.MATERIAL

A. General

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to Section 1082 (Wood Poles and Inspection Requirements) and Articles 1091-2 (Wire) and 1091-6 (Grounding Electrodes) of the Standard Specifications.

B. Wood Pole

Furnish Class III or better wood poles for communication cable attachments that have a minimum length of 40 feet and are of a sufficient length to maintain the minimum required clearances above the roadway and obstructions.

C. CCTV Wood Pole

Furnish Class II or better wood poles to mount CCTV cameras and cabinets that are a minimum length of 60 feet and are of a sufficient length to permit the CCTV camera to be mounted 45 feet above the ground at the pole.

D. Remove and Replace Existing Traffic Signal Span Pole

At locations shown in the Plans, the existing traffic signal span pole is to be removed and replaced with a new Class II, 60 ft. traffic signal span pole in the same location and meeting the specifications above.

The Contractor shall stabilize all existing cables that attach to the signal pole prior to removal. This may include, but not be limited to, messenger cable, signal cable, lead-in cable, communications cable, and guy wires. Any cables that need to be disconnected to perform the work shall be documented for correct operation and labeled prior to disconnecting.

After installing the Class II, 60 ft. traffic signal span pole, the Contractor shall attach all existing cables and guy wires in compliance with these Project Special Provisions and the Standard Specifications. Existing pole attachment hardware shall be replaced with new hardware that meets the Project Special Provisions and Standard Specifications. This includes but is not limited to angle eye bolts, oval eye bolts, nuts, washers, and strandvises.

All work at a location shall be completed in one working day. Existing spans, cables and risers shall all be attached to the new Class II, 60 ft. wood pole prior to leaving the work site. All cables disconnected to perform the work shall be verified to be re-connected and operational.

8.3.CONSTRUCTION METHOD

Install wood poles in compliance with all requirements of Section 1720-3 of the Standard Specifications.

Section 1720-3 of the 2018 Standard Specifications are revised as follows:

Page 17-18, revise sentence starting on line 13 to read “On new Department-owned poles, install a grounding system consisting of #6 AWG solid bare copper wire that is mechanically crimped using an irreversible compression tool with die to a single ground rod installed at base of pole or to the electrical service grounding electrode system located within 10 feet of the pole.”

8.4.MEASUREMENT AND PAYMENT

Wood Pole will be measured and paid as the actual number of wood poles for communication cable attachments furnished, installed, and accepted.

CCTV Wood Pole will be measured and paid as the actual number of wood poles for CCTV camera attachments furnished, installed, and accepted.

Remove and Replace Traffic Signal Span Pole will be measured and paid as the actual number of existing traffic signal span poles removed, replaced with a new 60 ft. Class II wood pole, and accepted. No separate pay item will be made for permits, labor, equipment, or materials required while disconnecting and reattaching electrical services, cables and wires or for any temporary relocations made before acceptance. Removal and disposal of any items not re-used will be considered incidental to this pay item. Any cables damaged during the work required for this item shall be replaced at no cost to the City or Department.

No measurement will be made for installing grounding systems as these will be incidental to furnishing and installing poles.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Wood Pole..... | Each |
| CCTV Wood Pole..... | Each |
| Remove and Replace Traffic Signal Span Pole | Each |

9. GUY ASSEMBLIES

9.1.DESCRPTION

Furnish and install guy assemblies with all necessary hardware.

9.2.MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to 1098-6 (Pole Line Hardware) and 1098-7 (Guy Assembly) of the Standard Specifications.

9.3.CONSTRUCTION METHODS

When installing messenger cable for supporting only communications cable, use approved one-bolt attachment method for attaching messenger cable and guy assembly.

Bond guy assembly to existing pole ground using parallel groove clamp or equivalent. If existing poles do not have a grounding system, install new grounding system for bonding guy assembly that complies with Article 1720-3.

Do not attach to existing guy assemblies unless specifically approved by owner.

9.4.MEASUREMENT AND PAYMENT

Guy Assembly will be measured and paid as the actual number of guy assemblies furnished, installed and accepted.

No measurement will be made of guy cable, guy guards, anchors, clamps, grounding systems or fittings as these will be incidental to furnishing and installing guy assemblies.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------|-----------------|
| Guy Assembly..... | Each |

10. RISER ASSEMBLIES

10.1. DESCRIPTION

Furnish and install riser assemblies with clamp-on, aluminum weatherheads or heat shrink tubing, galvanized pole attachment fittings and all necessary hardware.

10.2. MATERIAL

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

Refer to 1091-2 (Wire), 1091-3 (Rigid Metallic Conduit), 1091-6 (Grounding Electrodes), 1098-4 (Riser Sealing Devices), and 1098-6 (Pole Line Hardware) of the Standard Specifications.

10.3. CONSTRUCTION METHOD

Install riser assemblies in compliance with all requirements of Section 1722-3 of the Standard Specifications.

10.4. MEASUREMENT AND PAYMENT

___" Riser with ___ will be measured and paid as the actual number of risers of each type and size furnished, installed and accepted. No measurement will be made of weatherheads, heat shrink tubing or pole attachment fittings as these will be incidental to furnishing and installing risers.

Heat Shrink Tubing Retrofit Kit will be measured and paid as the actual number of heat shrink tubing retrofit kits furnished, installed and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| 1/2" Riser with Weatherhead | Each |
| 1" Riser with Weatherhead | Each |
| 2" Riser with Weatherhead | Each |
| 2" Riser with Heat Shrink Tubing | Each |
| Heat Shrink Tubing Retrofit Kit | Each |

11. TERMINAL SPLICE BOX

11.1. DESCRIPTION

Furnish, install, and integrate new terminal splice boxes at locations where existing pole-mounted signal cabinets are replaced with new base-mounted signal cabinets in the same quadrant as shown in the Plans. Provide materials and perform work to splice and extend signal conductors and loop lead-in cables where present.

11.2. MATERIAL

Furnish terminal splice box that is fabricated of steel or aluminum and satisfies the requirements of environmentally sealed NEMA Type 4X enclosures. Furnish terminal splice boxes with a minimum size of 12 inches wide by 20 inches high by 8 inches deep with a hinged cover which shall open to the side. Each terminal splice box shall have a terminal block having at least twenty (20) terminals with each terminal having two (2) terminal screws. The terminal screws shall be nickel-plated brass screws and have a minimum outside diameter of 4.3 mm. A removable sorting bar shall be provided between the screws of each terminal. The terminal block shall be of electrical grade thermoplastic or thermosetting plastic and shall have the terminals recessed between molded barriers. The terminal block shall be mounted on the back wall of the terminal splice box in such a manner that no mounting screws, nuts, etc. protrude through the box. The terminal block shall be centered on the back wall in line with the long dimension of the box. Install additional terminal blocks as necessary.

The terminal splice box shall have the following holes in the bottom. The box shall be furnished with weatherproof caps for all holes

- One (1) hole suitable for a 2-inch conduit, at the rear and centered.
- Two (2) holes which will accommodate 2-inch rigid metal conduits, one on either side of the hole described above. Each of these holes shall be provided with suitable cable entrance fittings which will both clamp the entering cables in place and protect their insulation from damage. These holes and their fittings shall be located so that the conduit hole between them can be fitted with a conduit hub without difficulty.

Furnish binder type terminal strips. Separate binder strips shall be furnished for signal wiring and loop lead-in.

11.3. CONSTRUCTION METHODS

Furnish terminal splice box with brackets suitable for attaching the box to wood poles banded attachments and screws and other attachment hardware as approved by the Engineer. The brackets shall facilitate a firm attachment to the pole. The design of the brackets shall be such that the conduit hubs and cable fittings shall not make mounting of the box difficult. At locations where the terminal splice box is to be attached externally to a metal strain pole, use banding method approved by the Engineer.

Bond terminal splice box to equipment ground in cabinet using a 14 AWG stranded THHN. Do not put loop grounds and other grounds with neutral conductors.

Additional signal conductors and loop lead-in cable shall be of the same size and type of the existing wires and cables. Provide permanent labels prior to construction on all incoming and outgoing conductors using a naming convention such as Phase One Green, Phase Two Yellow, Loops 2A, etc.

11.4. MEASUREMENT AND PAYMENT

Terminal Splice Box will be measured and paid as the actual number of terminal splice boxes furnished, installed, and accepted.

No measurement will be made of riser assemblies, underground and pole conduit, additional signal conductors, and loop lead-in, as the splicing of all existing signal conductor and loop lead-ins in the splice box, extending them through new risers and conduits, and connecting them to the new controller cabinet shall be incidental to furnishing and installing terminal splice boxes.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| Terminal Splice Box | Each |

12. INDUCTIVE DETECTION LOOPS

12.1. DESCRIPTION

Furnish and install inductive detection loops with loop slot sealant, loop wire, conduit with fittings and all necessary hardware.

12.2. MATERIAL

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

Provide the Engineer a Type 3 material certification and MSDS for the sealant in accordance with Article 106-3.

Refer to 1098-8 (Inductive Detection Loops) of the Standard Specifications.

12.3. CONSTRUCTION METHOD

Install inductive detection loops in compliance with all requirements of Section 1725-3 of the Standard Specifications.

12.4. MEASUREMENT AND PAYMENT

Inductive Loop Sawcut will be measured and paid as the actual linear feet of inductive loop sawcut furnished, installed, and accepted.

No measurement will be made of core drilling, loop slot sealant, loop wire, conduit and conduit fittings as these will be incidental to furnishing and installing inductive detection loops.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------------------|-----------------|
| Inductive Loop Sawcut | Linear Foot |

13. LEAD-IN CABLE

13.1. DESCRIPTION

Furnish and install lead-in cable with all necessary hardware to be used in conjunction with inductive detection loops.

13.2. MATERIAL

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

Refer to 1098-6 (Lashing Wire and Hardware), 1098-6 (Wrapping Tape), and 1098-9 (Lead-In Cable) of the Standard Specifications.

13.3. CONSTRUCTION METHOD

Install lead-in cable in compliance with all requirements of Section 1726-3 of the Standard Specifications.

13.4. MEASUREMENT AND PAYMENT

Lead-in Cable (____) will be measured and paid as the actual linear feet of lead-in cable furnished, installed, and accepted. Measurement will be made by calculating the difference in length markings located on outer jacket from start of run to end of run for each run. Terminate all cables before determining length of cable run.

If markings are not visible, measurement will be point to point with no allowance for sag. Twenty-five feet will be allowed for vertical segments up or down poles.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| Lead-In Cable (14-2)..... | Linear Foot |

14. FIBER OPTIC CABLE

14.1. DESCRIPTION

Furnish and install single mode fiber-optic (SMFO) communications cable and drop cable assemblies with grounding systems, fiber-optic cable storage racks (snow shoes), communications cable identification markers, lashing wire, and all necessary hardware.

14.2. MATERIAL

Furnish material, equipment, and hardware under this section that is pre-approved on the Department's QPL.

Refer to Articles 1098-10(A) (SMFO Communications Cable), 1098-10(C) (Communications Cable Identification Markers), 1098-10(D) (Fiber-Optic Cable Storage Guides), and 1098-6 (Lashing Wire and Hardware) of the Standard Specifications.

Provide communications cable identification markers with 919-560-4377 as the contact telephone number.

At locations shown in the Plans, furnish and install fiber optic cable with single armored construction to protect against rodents. The armor shall be made of corrugated steel and be easily stripped using an integrated ripcord. The armored cable shall also meet all specifications in these Project Special Provisions and the applicable Standard Specifications.

14.3. CONSTRUCTION METHODS

A. General

Install fiber-optic cable in compliance with all requirements of Section 1730-3 of the Standard Specifications.

Do not install any communications cables in the same conduit or junction box as power cables.

Store 30 feet of each fiber optic cable entering a junction box or field equipment. Store 100 feet of each fiber optic cable being spliced in an underground splice enclosure located in a junction box. Coil all stored cable in the bottom of the junction box and in a manner that does not violate the maximum bending radius of the cable.

B. Underground Installation

Install fiber-optic cable in underground conduit in compliance with Article 1730-3(C) of the Standard Specifications.

When installing new fiber optic cables in existing conduit that was not installed under this Project, use pull lines when available and other methods approved by the Engineer. Use care not to damage existing fiber optic cables in the conduit system when installing new fiber optic cables. In the event of damage to existing cables, the Contractor shall make all required repairs and/or remediations within three calendar days of the damage being done.

In some situations, the Contractor may need to remove an existing signal system fiber optic trunk cable to assist in the installation of a new fiber optic trunk cable. Upon approval by the Engineer and City of Durham, the Contractor may remove the existing cable between existing splice points and pull in the new cable(s) and re-splice the existing cable within three calendar days of the removal.

14.4. MEASUREMENT AND PAYMENT

Communications cable (____-fiber) will be measured and paid as the actual linear feet of fiber-optic cable of each fiber count furnished, installed, and accepted. Measurement will be made by calculating the difference in length markings located on outer jacket from start of run to end of run for each run. Terminate all fibers before determining length of cable run.

Communications cable (armored ____-fiber) will be measured and paid as the actual linear feet of armored fiber-optic cable of each fiber count furnished, installed, and accepted. Measurement will be made by calculating the difference in length markings located on outer jacket from start of run to end of run for each run. Terminate all fibers before determining length of cable run.

Drop Cable will be measured and paid as linear feet of fiber-optic drop cable (12-fiber) assemblies furnished, installed and accepted. Sag and vertical segments will not be paid as these distances are incidental to the installation of drop cable assemblies.

No measurement will be made for terminating, splicing and testing fiber-optic cable, communications cable identification markers, fiber-optic cable storage racks or lashing wire and all necessary hardware as these will be incidental to the installation of fiber-optic cable.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Communications Cable (24-Fiber) | Linear Foot |
| Communications Cable (36-Fiber) | Linear Foot |
| Communications Cable (72-Fiber) | Linear Foot |
| Communications Cable (144-Fiber) | Linear Foot |
| Communications Cable (288-Fiber) | Linear Foot |
| Communications Cable (Armored 12-Fiber) | Linear Foot |
| Communications Cable (Armored 72-Fiber) | Linear Foot |
| Drop Cable | Linear Foot |

15. FIBER OPTIC SPLICE CENTERS

15.1. DESCRIPTION

Furnish and install fiber-optic interconnect centers, fiber-optic splice enclosures, and all necessary hardware.

Modify existing fiber optic interconnect centers and/or splice enclosures as shown in the plans. Refer to manufacturer's recommendations for opening, modifying and re-sealing the existing fiber optic interconnect center and/or fiber optic splice enclosures.

15.2. MATERIALS

Comply with Article 1098-11 (Fiber-Optic Splice Centers) of the Standard Specifications with the following exceptions:

Furnish splice enclosures that utilize compressed gel to seal the cable entry ports. The sealing shall be re-useable and not require the use of heat shrink materials.

For terminating cables inside signal cabinets and CCTV cabinets, furnish standard sized interconnect centers to accommodate a minimum of 12 fibers entering the cabinet.

For terminating cables inside hub cabinets, furnish oversized interconnect centers to accommodate a minimum of 144 fibers entering the cabinet.

15.3. CONSTRUCTION METHODS

Install fiber-optic splice centers, perform termination and splicing, and test in compliance with all requirements of Section 1731-3 of the Standard Specifications.

When splicing armored cable, Contractor shall properly connect the exposed armor to the grounding nut in the splice enclosure and properly connect the enclosure to the pole ground.

Contractor is responsible for field verifying existing splicing. The Contractor shall coordinate with the Engineer where existing splicing is not as expected with regards to the number and size of existing cables shown on the Splice Details or the existing connections between cables shown on the Splice Details.

15.4. MEASUREMENT AND PAYMENT

Interconnect center will be measured and paid as the actual number of fiber-optic interconnect centers of each type furnished, installed, and accepted.

Splice enclosure will be measured and paid as the actual number of fiber-optic splice enclosures furnished, installed, and accepted. No measurement will be made between aerial, underground, manhole, or junction box installation of the fiber-optic splice enclosure.

Modifying splice enclosure will be measured and paid as the actual number of fiber-optic splice enclosures modified and accepted. No measurement will be made between aerial, underground, splice cabinet, manhole, or junction box installation of the fiber-optic splice enclosure.

No measurement will be made of splice trays, pigtails, jumpers, connector panels, testing and any corrective actions, repairs and replacements needed for exceeding maximum allowable

attenuation or other defects, as these will be considered incidental to furnishing and installing fiber-optic interconnect centers and splice enclosures and modifying splice enclosures.

No measurement will be made for the removal of existing interconnect centers as part of signal cabinet or CCTV cabinet replacements.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------------------------|-----------------|
| Interconnect Center (Standard)..... | Each |
| Interconnect Center (Oversized)..... | Each |
| Splice Enclosure..... | Each |
| Modify Splice Enclosure..... | Each |

16. DELINEATOR MARKERS

16.1. DESCRIPTION

Furnish and install delineator markers with all necessary hardware.

16.2. MATERIALS

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department’s QPL. Refer to Article 1098-13 (Delineator Markers) of the Standard Specifications.

Provide delineator markers with 919-560-4377 as the contact telephone number.

16.3. CONSTRUCTION METHODS

Install delineator markers in compliance with all requirements of Section 1733-3 of the Standard Specifications.

16.4. MEASUREMENT AND PAYMENT

Delineator marker will be paid for by the actual number furnished, installed, and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------------|-----------------|
| Delineator Marker | Each |

17. POWER OVER ETHERNET (POE) CABLE

17.1. DESCRIPTION

Furnish and install Power Over Ethernet (PoE) cable to serve as interconnect between Ethernet switches and Digital CCTV cameras.

17.2. MATERIAL

Furnish CAT6A PoE cable that is suitable for outdoor installation that and meets or exceeds the following standards:

- 4-pair shielded twisted pair cable
- 23 AWG (minimum) solid bare copper conductor
- Meets or exceeds CAT6A specifications
- High-density polyethylene insulation, PVC jacket
- Ascending / Descending Sequential Foot Markings
- Compliant with EIA/TIA standards
- UL/CSA listed
- UV Stabilized PE Jacket
- Gel Filled
- Meets TIA/EIA 568B.2 Networking Standard
- Supports 10/100/1000/10,000Mbps
- Mean Power Sum for Equal Level Far End Crosstalk (ELFEXT): 45dB/kft (minimum) at 772kHz
- Worst Pair Power Sum for ELFEXT: 40dB/kft (minimum) at 772kHz
- Mean Power Sum for Near-end Crosstalk (NEXT): 42dB/kft (minimum) at 772 kHz
- Operating Temperature: Rated from -10 to +60 Celsius
- Average mutual capacitance: 90nf/mile (maximum)

The PoE cable must be factory tested on reels for each pair's mutual capacitance, crosstalk loss, insulation resistance, and conductor resistance. Furnish the Engineer with a certified factory report for each reel showing compliance with these Project Special Provisions, the factory test results, and the manufactured date of the cable. The contractor shall not use Ethernet cable manufactured more than one year before the date of installation.

Provide RJ-45 connectors with gold conductors and terminate according EIA/TIA 568 A/568-B standards. Provide connectors with eight contacts. Furnish connectors appropriately rated for the cable being installed.

17.3. CONSTRUCTION METHODS

Install PoE cable in conduits, risers, and on aerial messenger cable at locations shown in the Plans. Allow a minimum of 5 feet of cable slack in each cabinet.

PoE cables shall not be spliced. All PoE cables shall be labeled with water proof, smear resistant labels that denote the equipment cabinets or housing they are run from and the device and identifier for that device they are connected.

The contractor shall not exceed 80 percent of the manufacturer's maximum pulling tension when installing underground PoE cable. Use a clutch device (dynamometer) so as not to exceed the allowable pulling tension if the cable is pulled by mechanical means. Do not use a motorized vehicle to generate cable-pulling forces.

Keep tension on the cable reel and the pulling line at the start of each pull. Do not release the tension in the cable if the pulling operation is halted. Restart the pulling operation by gradually increasing the tension until the cable is in motion.

17.4. MEASUREMENT AND PAYMENT

PoE cable will be measured and paid as linear feet of outdoor rated PoE cable furnished, installed, and accepted. Lengths of PoE cable installed will be determine using the sequential foot markings for each segment of cable installed and terminated.

No measurement will be made for terminating and testing of the cable, connectors, cable and identification markers, as these will be considered incidental to the installation of the PoE cable.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| PoE Cable..... | Linear Feet |

18. REMOVE EXISTING COMMUNICATIONS CABLE

18.1. DESCRIPTION

Remove existing communications cable as shown in the Plans.

18.2. CONSTRUCTION METHODS

Remove existing communications cable in compliance with all requirements of Section 1734-2 of the Standard Specifications.

Contractor shall only remove existing drop cables to facilitate the installation of new drop cables to a signal cabinet or CCTV cabinet. Under no circumstances should an existing trunk cable be removed or disturbed.

If the existing drop cable is being removed up to the existing splice enclosure, do not open or disturb the splice enclosure. Contractor shall cut the existing drop cable outside of the splice enclosure.

18.3. MEASUREMENT AND PAYMENT

Remove Existing Communications Cable will be measured in horizontal linear feet of existing communications cable removed and accepted. Payment will be in linear feet. Sag, vertical segments or spare segments of communications cable will not be paid as these distances will be incidental to the removal of existing communications cable.

No additional measurement will be made for multiple cables being removed from the same conduit or same pole. Where multiple adjacent conduits exist (each containing multiple cables), each conduit will be measured and paid separately. No payment will be made for cable that cannot be removed and is abandoned in place.

No measurement will be made of the removal of messenger cable and pole attachment hardware, as these will be incidental to removing existing communications hardware.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Remove Existing Communications Cable | Linear Foot |

19. CABLE TRANSFERS

19.1. DESCRIPTION

Remove and reinstall existing communications cable for pole relocations.

19.2. CONSTRUCTION METHODS

Transfers of existing communications cable to new poles may be required during this project. Perform transfers as directed by the Engineer. Remove existing communications cables from pole to be removed and reinstall these communications cables and any existing attachment hardware on new pole. Remove all communications hardware from existing pole. Furnish and install any new attachment hardware as required.

19.3. MEASUREMENT AND PAYMENT

Cable Transfer will be measured and paid as the actual number of cable transfers with attachment hardware to new poles furnished, installed and accepted.

The transfer of signal cables from an existing signal pole to a new CCTV pole will be measured and paid for according to the "Remove and Replace Existing Wood Signal Pole" pay item in these Project Special Provisions.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------|-----------------|
| Cable Transfer..... | Each |

20. WIRELESS ETHERNET RADIO SYSTEM

20.1. DESCRIPTION

Furnish and install a spread spectrum wireless Ethernet radio system with all necessary hardware and signage in accordance with the Plans and Project Special Provisions to provide a data link between field devices. Provide a radio system with a bi-directional, full duplex communications channel between multiple “line-of-sight” antennas to the fiber optic network using license free, spread spectrum technology. Radio systems for transmission of compressed digital video shall operate at the 2.4 or 5.8 GHz frequency.

Furnish material and workmanship conforming to the *National Electrical Code* (NEC), the *National Electrical Safety Code* (NESC), Underwriter’s Laboratories (UL) or a third-party listing agency accredited by the North Carolina Department of Insurance, and all local safety codes in effect on the date of advertisement.

20.2. MATERIALS

A. Field Set-up Software

The Field Set-up Software shall be a Window-based software program that uses a GUI (Graphical User Interface) to provide the following features at a minimum:

- Remote programming
- Remote radio configuration
- Remote maintenance
- Remote diagnostics
- Spectrum analyzer

Furnish software supplied with drivers to allow easy set-up with all industry standard traffic signal controllers, including 2070L/2070LX controllers containing custom software written specifically for the North Carolina Department of Transportation. Manufacturer is required to develop additional drivers (at no charge) for other equipment not supported by their existing pre-written Driver Package when needed.

B. Central Management Software

The Central Management Software shall provide the following minimum features:

- Window-based software program that uses a GUI (Graphical User Interface)
- Network mapping: online/offline status, Auto Discovery
- Wireless diagnostics: Wireless link status, Signal level, Spectrum Analyzer, Antenna Alignment
- Network Diagnostics: Bandwidth testing, Network traffic monitoring, Ping test capabilities
- Event logs
- System configuration utility: Security, RF channels, VLAN, configuration system backup

- Email alert capabilities
- GPS identification

C. 2.4 GHz Broadband (Ethernet) Dual Radio (Integrated Panel)

Furnish a 2.4 GHz Broadband Ethernet Dual Radio Transceiver with a RJ-45 Ethernet 10/100 Base T connector (auto crossover) with an integrated 20 dBi gain panel antenna and Field Set-up Software. Ensure the dual radio design is designed to support a second antenna configuration (yagi/single panel) through one additional (1) N-Type-Female coaxial port.

D. 5.8 GHz Broadband (Ethernet) Dual Radio (Integrated Panel)

Furnish a 5.8 GHz Broadband Ethernet Dual Radio Transceiver with a RJ-45 Ethernet 10/100 Base T connector (auto crossover) with an integrated 23 dBi gain panel antenna and Field Set-up Software. Ensure the dual radio design is designed to support a second antenna configuration (yagi/single panel) through one additional (1) N-Type-Female coaxial port. Provide Field Set-up Software with each radio.

E. Antenna Mounting Hardware Kit

Furnish an antenna mounting kit to support the antenna when attached to a metal pole, mast arm, or wood pole.

Ensure the Antenna Mounting Hardware Kit includes the following:

- 96" galvanized cable with stainless steel bolt with a nut and lock washer assembly on each end.
- Pole base plate accepts a 1 ½" NPT aluminum pipe and provides a surface that is a minimum of 6 ¾ inch long by 4 ¼" to provide contact with the surface of the pole. Ensure the pole base plate is designed to allow both ends of the 96" galvanized cable to be secured and tightened to the base plate. Furnish a stainless-steel set screw to secure the 1 ½" NPT aluminum pipe to the base plate.
- A 90 degree, die cast elbow with internal treads on both ends to accommodate 1 ½" NPT aluminum pipes. Furnish the elbow with a minimum of 1 stainless steel set screw on each end of the elbow for securing the threaded nipple and support pipes.
- Nipple Pipe: 1 ½" * 18" NPT long aluminum pipe, threaded on both ends.
- Support Pipe: 1 ½" * 24" NPT long aluminum pipe, threaded on 1 end with an end cap.

20.3. CONSTRUCTION METHODS

Perform a radio path Site Survey test before installing any equipment. All radio path site surveys shall be completed during full foliage conditions. Ensure the test evaluates the Signal Strength (dBm), Fade Margin (dB), Signal-to-Noise Ratio, Data Integrity (poll test), and a complete frequency spectrum scan. Ensure the radio path site survey test is performed using the supplied brand of radio equipment to be deployed. During the initial radio path signal strength test it may be determined that a repeater station may be necessary to complete the intended link. Provide the test results to the Engineer for review and approval. Submit copies of the test results and colored copies of the frequency spectrum scan along with an electronic copy of this information. The Engineer will

approve final locations of antennas and any necessary repeater stations. Install a coaxial cable – jumper with N-type connectors and additional antenna at locations where it is determined that a dual antenna configuration is necessary to accommodate communications in multiple directions.

Install the antenna in such a manner that avoids conflicts with other utilities (separation distances in accordance with the guidelines of the NESC) and as specified in the antenna manufacturer’s recommendations. Secure the antenna mounting hardware to the pole and route the coaxial cable such that no strain is placed on the N-Type Male coaxial connectors. On wood pole installations, bond the antenna mounting hardware to the pole ground using # 6 AWG bare copper wire using split bolt or compression type fitting.

Do not exceed the 1-inch bend radius of the coaxial cable as it traverses from the dual radio to the standalone antenna assembly. Properly ground and secure the arrestor in the cabinet. Permanently label all cables entering the cabinet. Ensure the POE injector for the radio system is **NOT** connected to the GFCI receptacle circuit located in the cabinet. Place a copy of all manufacturer equipment specifications and instruction and maintenance manuals in the equipment cabinet.

At certain locations it may be necessary to integrate the radio system with a fiber optic system. Follow the details shown in the fiber optic splice plans.

20.4. MEASUREMENT AND PAYMENT

Wireless Ethernet Radio System will be measured and paid for as the actual number of wireless radio systems furnished, installed and accepted.

This item includes the appropriate sized antennas, radios, power supplies and injectors, disconnect/snap switches, signs, decals, interface cabling, coaxial cabling, coaxial cable connectors, and labeling. Any integration between the wireless radio system and a fiber optic network, installation materials and configuration software necessary to complete this work, including the radio path Site Survey test and warranties, will be incidental.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------------------------|-----------------|
| Wireless Ethernet Radio System..... | Each |

21. SIGNS INSTALLED FOR SIGNALS

21.1. DESCRIPTION

Furnish and install signs for signals with cable hangers, rigid sign mounting brackets, U-channel posts and all necessary hardware.

21.2. MATERIAL

Provide signs according to Section 1745-2 of the Standard Specifications.

Refer to Articles 1092-1 (Signs and Hardware) and 1092-2 (Retroreflective Sheeting) of the Standard Specifications.

21.3. CONSTRUCTION METHODS

Install signs in compliance with all requirements of Section 1745-3 of the Standard Specifications.

21.4. MEASUREMENT AND PAYMENT

Sign for Signals will be measured and paid as the actual number of signs for signals, regardless of mounting method, furnished, installed and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------------|-----------------|
| Sign for Signals..... | Each |

22. RELOCATE EXISTING SIGN

22.1. DESCRIPTION

Relocate existing signs.

22.2. CONSTRUCTION METHODS

As directed by the plans, relocate existing signs. Comply with Article 1745-3 of the Standard Specifications.

22.3. MEASUREMENT AND PAYMENT

Relocate Existing Sign will be measured and paid as the actual number of existing signs, regardless of mounting method, relocated and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------|-----------------|
| Relocate Existing Sign | Each |

23. SIGNAL CABINET FOUNDATIONS

23.1. DESCRIPTION

Furnish and install signal cabinet foundations and all necessary hardware.

Furnish either poured concrete foundations or preformed cabinet pad foundations and all necessary hardware. Obtain approval of foundation type.

23.2. MATERIAL

Furnish preformed cabinet pad foundation material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

Refer to Articles 100-4 (Portland Cement Concrete) and 1098-15 (Signal Cabinet Foundation) of the Standard Specifications.

23.3. CONSTRUCTION METHODS

Install signal cabinet foundations in compliance with all requirements of Section 1750-3 of the Standard Specifications.

23.4. MEASUREMENT AND PAYMENT

Signal Cabinet Foundation will be measured and paid as the actual number furnished, installed and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------------------|-----------------|
| Signal Cabinet Foundation..... | Each |

24. CONTROLLERS WITH CABINETS

24.1. DESCRIPTION

Furnish and install controllers with cabinets and all necessary hardware. Furnish all pole or foundation mounting hardware, detector sensor cards, external electrical service disconnects, one Corbin Number 2 cabinet key, one police panel key, conflict monitors, surge protection, grounding systems, AC/DC isolator cards and all necessary hardware.

24.2. MATERIAL

A. General

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

B. Type 2070LX Controllers

Furnish model 2070LX controller units that conform to CALTRANS *Transportation Electrical Equipment Specifications* (TEES) (dated March 12, 2009, plus Errata 1 dated January 21, 2010 and Errata 2 dated December 5, 2014) except as required herein.

The Department will provide software at the beginning of the burning-in period. Contractor shall give 5 working days' notice before needing software. Program software provided by the Department.

Provide model 2070LX controllers with Linux kernel 2.6.18 or higher and device drivers, composed of the unit chassis and at a minimum the following modules and assemblies:

- MODEL 2070-1C, CPU Module, Single Board, with 8Mb Datakey (blue in color)
- MODEL 2070-2E+, Field I/O Module (FI/O)
- Note: Configure the Field I/O Module to disable both the External WDT Shunt/Toggle Switch and SP3 (SP3 active indicator is "off")
- MODEL 2070-3B, Front Panel Module (FP), Display B (8x40)
- MODEL 2070-4A, Power Supply Module, 10 AMP

Provide a Board Support Package (BSP) to the state and to any specified applications software manufacturer when requested by the state to facilitate the porting of application software.

C. General Cabinets

Provide a moisture resistant coating on all circuit boards.

Provide one 20 mm diameter radial lead UL-recognized metal oxide varistor (MOV) between each load switch field terminal and equipment ground. Electrical performance is outlined below.

| PROPERTIES OF MOV SURGE PROTECTOR | |
|--|--------------------------|
| Maximum Continuous Applied Voltage at 185° F | 150 VAC (RMS) 200 VDC |
| Maximum Peak 8x20µs Current at 185° F | 6500 A |
| Maximum Energy Rating at 185° F | 80 J |
| Voltage Range 1 mA DC Test at 77° F | 212-268 V |
| Max. Clamping Voltage 8x20µs, 100A at 77° F | 395 V |
| Typical Capacitance (1 MHz) at 77° F | 1600 pF |

Provide a power line surge protector that is a two-stage device that will allow connection of the radio frequency interference filter between the stages of the device. Ensure that a maximum continuous current is at least 10A at 120V. Ensure that the device can withstand a minimum of 20 peak surge current occurrences at 20,000A for an 8x20 microsecond waveform. Provide a maximum clamp voltage of 395V at 20,000A with a nominal series inductance of 200µh. Ensure that the voltage does not exceed 395V. Provide devices that comply with the following:

| Frequency (Hz) | Minimum Insertion Loss (dB) |
|-----------------------|------------------------------------|
| 60 | 0 |
| 10,000 | 30 |
| 50,000 | 55 |
| 100,000 | 50 |
| 500,000 | 50 |
| 2,000,000 | 60 |
| 5,000,000 | 40 |
| 10,000,000 | 20 |
| 20,000,000 | 25 |

D. Type 170E Cabinets

1. Type 170 E Cabinets General:

Conform to the city of Los Angeles' Specification No. 54-053-08, *Traffic Signal Cabinet Assembly Specification* (dated July 2008), except as required herein.

Furnish model 336S pole mounted cabinets configured for 8 vehicle phases, 4 pedestrian phases, and 6 overlaps. Do not reassign load switches to accommodate overlaps unless shown on electrical

details. Provide 336S pole mounted cabinets that are 46” high with 40” high internal rack assemblies.

Furnish model 332 base mounted cabinets configured for 8 vehicle phases, 4 pedestrian phases, and 6 overlaps. When overlaps are required, provide auxiliary output files for the overlaps. Do not reassign load switches to accommodate overlaps unless shown on electrical details.

Provide model 200 load switches, model 222 loop detector sensors, model 252 AC isolators, and model 242 DC isolators according to the electrical details. As a minimum, provide one (1) model 2018 conflict monitor, one (1) model 206L power supply unit, two (2) model 204 flashers, one (1) DC isolator (located in slot I14), and four (4) model 430 flash transfer relays (provide seven (7) model 430 flash transfer relays if auxiliary output file is installed) with each cabinet.

2. Type 170 E Cabinet Electrical Requirements:

Provide a cabinet assembly designed to ensure that upon leaving any cabinet switch or conflict monitor initiated flashing operation, the controller starts up in the programmed start up phases and start up interval.

Furnish two sets of non-fading cabinet wiring diagrams and schematics in a paper envelope or container and placed in the cabinet drawer.

All AC+ power is subject to radio frequency signal suppression.

Provide surge suppression in the cabinet for each type of cabinet device. Provide surge protection for the full capacity of the cabinet input file. Provide surge suppression devices that operate properly over a temperature range of -40° F to +185° F. Ensure the surge suppression devices provide both common and differential modes of protection.

Provide a pluggable power line surge protector that is installed on the back of the PDA (power distribution assembly) chassis to filter and absorb power line noise and switching transients. Ensure the device incorporates LEDs for failure indication and provides a dry relay contact closure for the purpose of remote sensing. Ensure the device meets the following specifications:

| | |
|--|----------------------|
| Peak Surge Current (Single pulse, 8x20µs)..... | 20,000A |
| Occurrences (8x20µs waveform)..... | 10 minimum @ 20,000A |
| Maximum Clamp Voltage..... | 395VAC |
| Operating Current..... | 15 amps |
| Response Time..... | < 5 nanoseconds |

Provide a loop surge suppressor for each set of loop terminals in the cabinet. Ensure the device meets the following specifications:

| | |
|--------------------------------------|--------|
| Peak Surge Current (6 times, 8x20µs) | |
| (Differential Mode)..... | 400A |
| (Common Mode)..... | 1,000A |

| | |
|--|-----------------|
| Occurrences (8x20 μ s waveform)..... | 500 min @ 200A |
| Maximum Clamp Voltage | |
| (Differential Mode @400A)..... | 35V |
| (Common Mode @1,000A)..... | 35V |
| Response Time..... | < 5 nanoseconds |
| Maximum Capacitance..... | 35 pF |

Provide a data communications surge suppressor for each communications line entering or leaving the cabinet. Ensure the device meets the following specifications:

| | |
|--|-------------------------------|
| Peak Surge Current (Single pulse, 8x20 μ s)..... | 10,000A |
| Occurrences (8x20 μ s waveform)..... | 100 min @ 2,000A |
| Maximum Clamp Voltage..... | Rated for equipment protected |
| Response Time..... | < 1 nanosecond |
| Maximum Capacitance..... | 1,500 pF |
| Maximum Series Resistance..... | 15 Ω |

Provide a DC signal surge suppressor for each DC input channel in the cabinet. Ensure the device meets the following specifications:

| | |
|--|----------------|
| Peak Surge Current (Single pulse, 8x20 μ s)..... | 10,000A |
| Occurrences (8x20 μ s waveform)..... | 100 @ 2,000A |
| Maximum Clamp Voltage..... | 30V |
| Response Time..... | < 1 nanosecond |

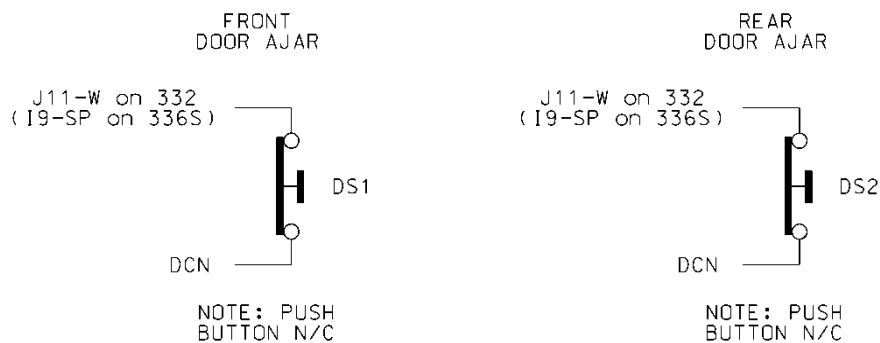
Provide a 120 VAC signal surge suppressor for each AC+ interconnect signal input. Ensure the device meets the following specifications:

| | |
|--|-----------------------|
| Peak Surge Current (Single pulse, 8x20 μ s)..... | 20,000A |
| Maximum Clamp Voltage..... | 350VAC |
| Response Time..... | < 200 nanoseconds |
| Discharge Voltage..... | <200 Volts @ 1,000A |
| Insulation Resistance..... | \geq 100 M Ω |

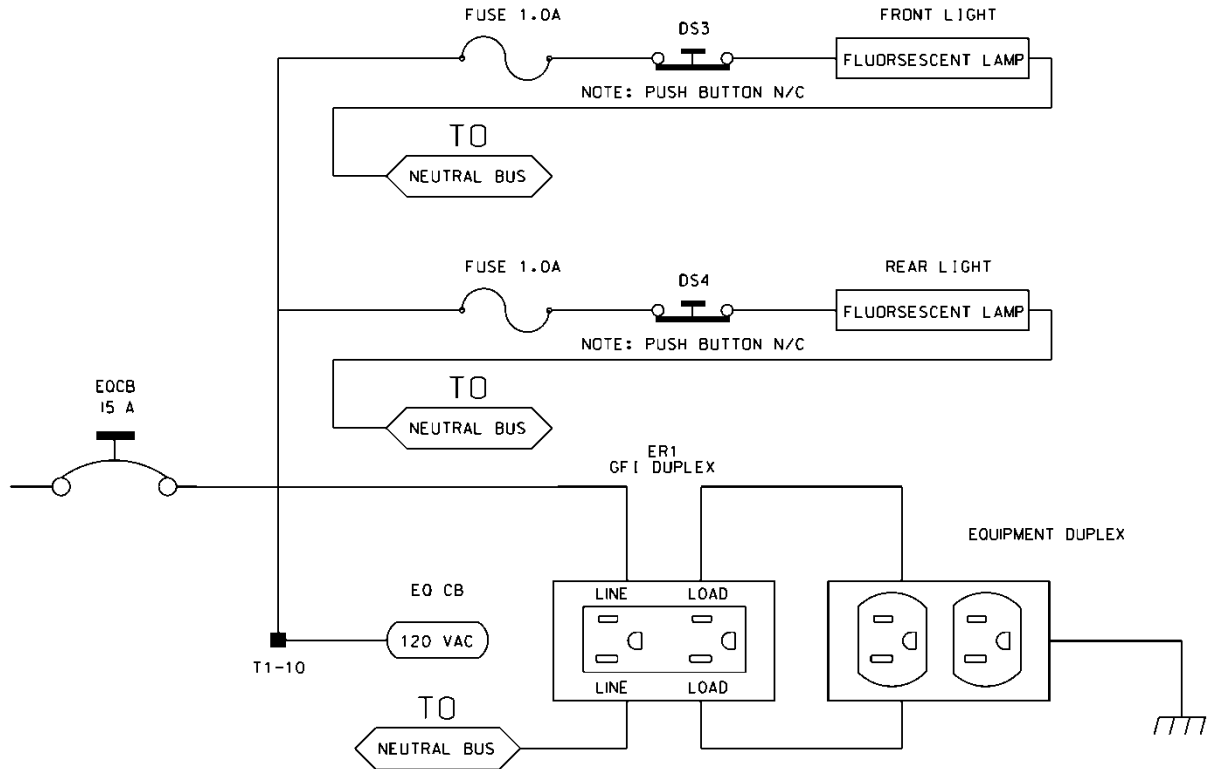
Provide conductors for surge protection wiring that are of sufficient size (ampacity) to withstand maximum overcurrents which could occur before protective device thresholds are attained and current flow is interrupted.

If additional surge protected power outlets are needed to accommodate fiber transceivers, modems, etc., install a UL listed, industrial, heavy-duty type power outlet strip with a minimum rating of 15 A / 125 VAC, 60 Hz. Provide a strip that has a minimum of 3 grounded outlets. Ensure the power outlet strip plugs into one of the controller unit receptacles located on the rear of the PDA. Ensure power outlet strip is mounted securely; provide strain relief if necessary.

Provide a door switch in the front and a door switch in the rear of the cabinet that will provide the controller unit with a Door Ajar alarm when either the front or the rear door is open. Ensure the door switches apply DC ground to the Input File when either the front door or the rear door is open.



Furnish a fluorescent fixture in the rear across the top of the cabinet and another fluorescent fixture in the front across the top of the cabinet at a minimum. Ensure that the fixtures provide sufficient light to illuminate all terminals, labels, switches, and devices in the cabinet. Conveniently locate the fixtures so as not to interfere with a technician's ability to perform work on any devices or terminals in the cabinet. Provide a protective diffuser to cover exposed bulbs. Install 16-watt T-4 lamps in the fluorescent fixtures. Provide a door switch to provide power to each fixture when the respective door is open. Wire the fluorescent fixtures to the 15-amp ECB (equipment circuit breaker).



Furnish a police panel with a police panel door. For model 336S cabinets, mount the police panel on the rear door. Ensure that the police panel door permits access to the police panel when the main door is closed. Ensure that no rainwater can enter the cabinet even with the police panel door open. Provide a police panel door hinged on the right side as viewed from the front. Provide a police panel door lock that is keyed to a standard police/fire call box key. In addition to the requirements of LA Specification No. 54-053-08, provide the police panel with a toggle switch connected to switch the intersection operation between normal stop-and-go operation (AUTO) and manual operation (MANUAL). Ensure that manual control can be implemented using inputs and software such that the controller provides full programmed clearance times for the yellow clearance and red clearance for each phase while under manual control.

Provide a 1/4-inch locking phone jack in the police panel for a hand control to manually control the intersection. Provide sufficient room in the police panel for storage of a hand control and cord.

Ensure the 336S cabinet Input File is wired as follows:

| 336S Cabinet | | | | | | | | | | | | | | |
|-----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Port-Bit/C-1 Pin Assignment | | | | | | | | | | | | | | |
| Slot # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| C-1 (Spares) | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 75 | 76 | 77 | 78 | 79 | 80 |
| Port | 3-2 | 1-1 | 3-4 | 1-3 | 3-1 | 1-2 | 3-3 | 1-4 | 2-5 | 5-5 | 5-6 | 5-1 | 5-2 | 6-7 |
| C-1 | 56 | 39 | 58 | 41 | 55 | 40 | 57 | 42 | 51 | 71 | 72 | 67 | 68 | 81 |
| Port | 2-1 | 1-5 | 2-3 | 1-7 | 2-2 | 1-6 | 2-4 | 1-8 | 2-6 | 5-7 | 5-8 | 5-3 | 5-4 | 6-8 |
| C-1 | 47 | 43 | 49 | 45 | 48 | 44 | 50 | 46 | 52 | 73 | 74 | 69 | 70 | 82 |

For model 332 base mounted cabinets, ensure terminals J14-E and J14-K are wired together on the rear of the Input File. Connect TB9-12 (J14 Common) on the Input Panel to T1-2 (AC-) on the rear of the PDA.

Provide detector test switches mounted at the top of the cabinet rack or other convenient location which may be used to place a call on each of eight phases based on the chart below. Provide three positions for each switch: On (place call), Off (normal detector operation), and Momentary On (place momentary call and return to normal detector operation after switch is released). Ensure that the switches are located such that the technician can read the controller display and observe the intersection.

Connect detector test switches for cabinets as follows:

| 336S Cabinet | | 332 Cabinet | |
|------------------------|-----------|------------------------|-----------|
| Detector Call Switches | Terminals | Detector Call Switches | Terminals |
| Phase 1 | I1-F | Phase 1 | I1-W |
| Phase 2 | I2-F | Phase 2 | I4-W |
| Phase 3 | I3-F | Phase 3 | I5-W |
| Phase 4 | I4-F | Phase 4 | I8-W |
| Phase 5 | I5-F | Phase 5 | J1-W |
| Phase 6 | I6-F | Phase 6 | J4-W |
| Phase 7 | I7-F | Phase 7 | J5-W |
| Phase 8 | I8-F | Phase 8 | J8-W |

Provide the PCB 28/56 connector for the conflict monitor unit (CMU) with 28 independent contacts per side, dual-sided with 0.156-inch contact centers. Provide the PCB 28/56 connector contacts with solder eyelet terminations. Ensure all connections to the PCB 28/56 connector are soldered to the solder eyelet terminations.

Ensure that all cabinets have the CMU connector wired according to the 332 cabinet connector pin assignments (include all wires for auxiliary output file connection). Wire pins 13, 16, R, and U of the CMU connector to a separate 4 pin plug, P1, as shown below. Provide a second plug, P2, which will mate with P1 and is wired to the auxiliary output file as shown below. Provide an additional plug, P3, which will mate with P1 and is wired to the pedestrian yellow circuits as shown below. When no auxiliary output file is installed in the cabinet, provide wires for the green and yellow inputs for channels 11, 12, 17, and 18, the red inputs for channels 17 and 18, and the wires for the P2 plug. Terminate the two-foot wires with ring type lugs, insulated, and bundled for optional use.

| PIN | P1 | | P2 | | P3 | |
|-----|----------|---------|----------|---------|----------|---------|
| | FUNCTION | CONN TO | FUNCTION | CONN TO | FUNCTION | CONN TO |
| 1 | CH-9G | CMU-13 | OLA-GRN | A123 | 2P-YEL | 114 |
| 2 | CH-9Y | CMU-16 | OLA-YEL | A122 | 4P-YEL | 105 |
| 3 | CH-10G | CMU-R | OLB-GRN | A126 | 6P-YEL | 120 |
| 4 | CH-10Y | CMU-U | OLB-YEL | A125 | 8P-YEL | 111 |

Do not provide the P20 terminal assembly (red monitor board) or red interface ribbon cable as specified in LA Specification No. 54-053-08.

Provide a P20 connector that mates with and is compatible with the red interface connector mounted on the front of the conflict monitor. Ensure that the P20 connector and the red interface connector on the conflict monitor are center polarized to ensure proper connection. Ensure that removal of the P20 connector will cause the conflict monitor to recognize a latching fault condition and place the cabinet into flashing operation.

Wire the P20 connector to the output file and auxiliary output file using 22 AWG stranded wires. Ensure the length of these wires is a minimum of 42 inches in length. Provide a durable braided sleeve around the wires to organize and protect the wires.

Wire the P20 connector to the traffic signal red displays to provide inputs to the conflict monitor as shown below. Ensure the pedestrian Don't Walk circuits are wired to channels 13 through 16 of the P20 connector. When no auxiliary output file is installed in the cabinet, provide wires for channels 9 through 12 reds. Provide a wire for special function 1. Terminate the unused wires with ring type lugs, insulated, and bundled for optional use.

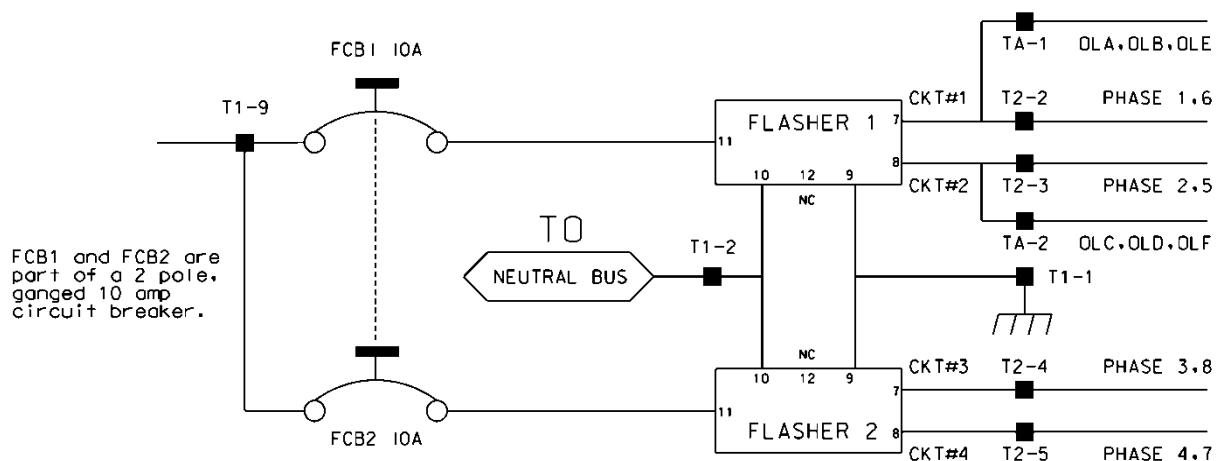
| P20 Connector | | | | | |
|---------------|----------------|---------|-----|-----------------|---------|
| PIN | FUNCTION | CONN TO | PIN | FUNCTION | CONN TO |
| 1 | Channel 15 Red | 119 | 2 | Channel 16 Red | 110 |
| 3 | Channel 14 Red | 104 | 4 | Chassis GND | 01-9 |
| 5 | Channel 13 Red | 113 | 6 | N/C | |
| 7 | Channel 12 Red | AUX 101 | 8 | Spec Function 1 | |
| 9 | Channel 10 Red | AUX 124 | 10 | Channel 11 Red | AUX 114 |
| 11 | Channel 9 Red | AUX 121 | 12 | Channel 8 Red | 107 |
| 13 | Channel 7 Red | 122 | 14 | Channel 6 Red | 134 |
| 15 | Channel 5 Red | 131 | 16 | Channel 4 Red | 101 |
| 17 | Channel 3 Red | 116 | 18 | Channel 2 Red | 128 |
| 19 | Channel 1 Red | 125 | 20 | Red Enable | 01-14 |

Ensure the controller unit outputs to the auxiliary output file are pre-wired to the C5 connector. When no auxiliary output file is installed in the cabinet, connect the C5 connector to a storage socket located on the Input Panel or on the rear of the PDA.

Do not wire pin 12 of the load switch sockets.

In addition to the requirements of LA Specification No. 54-053-08, ensure relay K1 on the Power Distribution Assembly (PDA) is a four-pole relay and K2 on the PDA is a two-pole relay.

Provide a two pole, ganged circuit breaker for the flash bus circuit. Ensure the flash bus circuit breaker is an inverse time circuit breaker rated for 10 amps at 120 VAC with a minimum of 10,000 RMS symmetrical amperes short circuit current rating. Do not provide the auxiliary switch feature on the flash bus circuit breaker. Ensure the ganged flash bus circuit breaker is certified by the circuit breaker manufacturer to provide gang tripping operation.



Ensure auxiliary output files are wired as follows:

| AUXILIARY OUTPUT FILE TERMINAL BLOCK TA ASSIGNMENTS | |
|--|---|
| POSITION | FUNCTION |
| 1 | Flasher Unit #1, Circuit 1/FTR1 (OLA, OLB)/FTR3 (OLE) |
| 2 | Flasher Unit #1, Circuit 2/FTR2 (OLC, OLD)/FTR3 (OLF) |
| 3 | Flash Transfer Relay Coils |
| 4 | AC - |
| 5 | Power Circuit 5 |
| 6 | Power Circuit 5 |
| 7 | Equipment Ground Bus |
| 8 | NC |

Provide four spare load resistors mounted in each cabinet. Ensure each load resistor is rated as shown in the table below. Wire one side of each load resistor to AC-. Connect the other side of each resistor to a separate terminal on a four (4) position terminal block. Mount the load resistors and terminal block either inside the back of Output File No. 1 or on the upper area of the Service Panel.

| ACCEPTABLE LOAD RESISTOR VALUES | |
|--|----------------|
| VALUE (ohms) | WATTAGE |
| 1.5K – 1.9 K | 25W (min) |
| 2.0K – 3.0K | 10W (min) |

Provide Model 200 load switches, Model 204 flashers, Model 242 DC isolators, Model 252 AC isolators, and Model 206L power supply units that conform to CALTRANS' "Transportation Electrical Equipment Specifications" dated March 12, 2009 with Erratum 1.

3. Type 170 E Cabinet Physical Requirements:

Do not mold, cast, or scribe the name "City of Los Angeles" on the outside of the cabinet door as specified in LA Specification No. 54-053-08. Do not provide a Communications Terminal Panel as specified in LA Specification No. 54-053-08. Do not provide terminal block TBB on the Service

Panel. Do not provide Cabinet Verification Test Program software or associated test jigs as specified in LA Specification No. 54-053-08.

Furnish unpainted, natural, aluminum cabinet shells. Ensure that all non-aluminum hardware on the cabinet is stainless steel or a Department approved non-corrosive alternate.

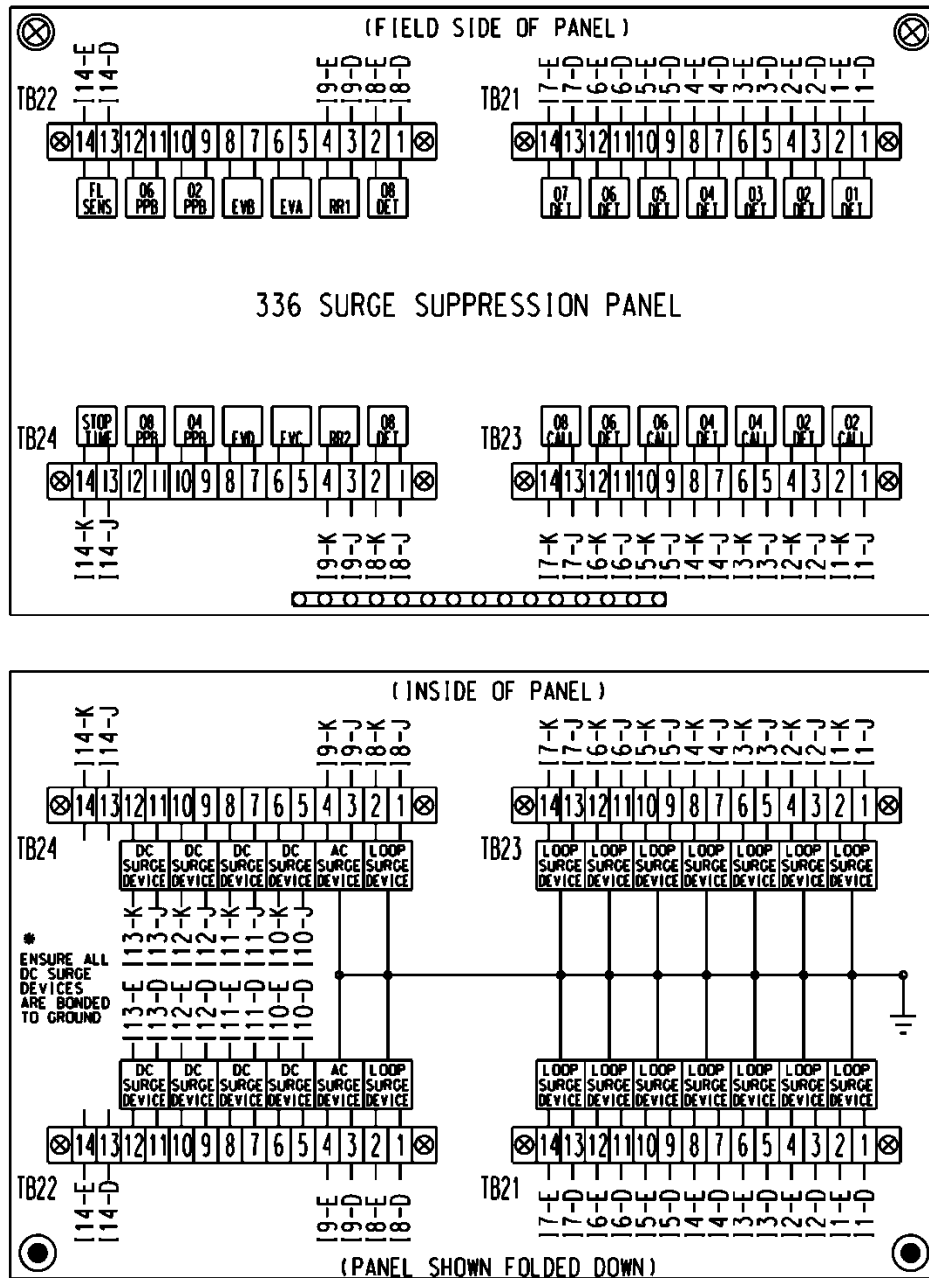
Ensure the lifting eyes, gasket channels, police panel, and all supports welded to the enclosure and doors are fabricated from 0.125-inch minimum thickness aluminum sheet and meet the same standards as the cabinet and doors.

Provide front and rear doors with latching handles that allow padlocking in the closed position. Furnish 0.75-inch minimum diameter stainless steel handles with a minimum 0.5-inch shank. Place the padlocking attachment at 4.0 inches from the handle shank center to clear the lock and key. Provide an additional 4.0 inches minimum gripping length.

Provide Corbin #2 locks on the front and rear doors. Provide one (1) Corbin #2 and one (1) police master key with each cabinet. Ensure main door locks allow removal of keys in the locked position only.

Provide a surge protection panel with 16 loop surge protection devices and designed to allow sufficient free space for wire connection/disconnection and surge protection device replacement. For model 332 cabinets, provide an additional 20 loop surge protection devices. Provide an additional two AC+ interconnect surge devices to protect one slot and eight DC surge protection devices to protect four slots. Provide no protection devices on slot I14.

For pole mounted cabinets, mount surge protection devices for the AC+ interconnect inputs, inductive loop detector inputs, and low voltage DC inputs on a swing down panel assembly fabricated from sturdy aluminum. Attach the swing down panel to the bottom rear cabinet rack assembly using thumb screws. Ensure the swing down panel allows for easy removal of the input file without removing the surge protection panel assembly or its parts. Have the surge protection devices mounted horizontally on the panel and soldered to the feed through terminals of four 14 position terminal blocks with #8 screws mounted on the other side. Ensure the top row of terminals is connected to the upper slots and the bottom row of terminals is connected to the bottom slots. Provide a 15-position copper equipment ground bus attached to the field terminal side (outside) of the swing down panel for termination of loop lead-in shield grounds. Ensure that a Number 4 AWG green wire connects the surge protection panel assembly ground bus to the main cabinet equipment ground.



For base mounted cabinets, mount surge protection panels on the left side of the cabinet as viewed from the rear. Attach each panel to the cabinet rack assembly using bolts and make it easily removable. Mount the surge protection devices in vertical rows on each panel and connect the devices to one side of 12 position, double row terminal blocks with #8 screws. For each surge protection panel, terminate all grounds from the surge protection devices on a copper equipment ground bus attached to the surge protection panel. Wire the terminals to the rear of a standard input file using spade lugs for input file protection.

Provide permanent labels that indicate the slot and the pins connected to each terminal that may be viewed from the rear cabinet door. Label and orient terminals so that each pair of inputs is next to each other. Indicate on the labeling the input file (I or J), the slot number (1-14) and the terminal pins of the input slots (either D & E for upper or J & K for lower).

Provide a minimum 14 x 16 inch pull out, hinged top shelf located immediately below controller mounting section of the cabinet. Ensure the shelf is designed to fully expose the table surface outside the controller at a height approximately even with the bottom of the controller. Ensure the shelf has a storage bin interior which is a minimum of 1 inch deep and approximately the same dimensions as the shelf. Provide an access to the storage area by lifting the hinged top of the shelf. Fabricate the shelf and slide from aluminum or stainless steel and ensure the assembly can support the 2070L controller plus 15 pounds of additional weight. Ensure shelf has a locking mechanism to secure it in the fully extended position and does not inhibit the removal of the 2070L controller or removal of cards inside the controller when fully extended. Provide a locking mechanism that is easily released when the shelf is to be returned to its non-use position directly under the controller.

4. Model 2018 Enhanced Conflict Monitor:

Furnish Model 2018 Enhanced Conflict Monitors that provide monitoring of 18 channels. Ensure each channel consists of a green, yellow, and red field signal input. Ensure that the conflict monitor meets or exceeds CALTRANS' Transportation Electrical Equipment Specifications dated March 12, 2009, with Erratum 1 (hereafter referred to as CALTRANS' 2009 TEES) for a model 210 monitor unit and other requirements stated in this specification.

Ensure the conflict monitor is provided with an 18-channel conflict programming card. Pin EE and Pin T of the conflict programming card shall be connected together. Pin 16 of the conflict programming card shall be floating. Ensure that the absence of the conflict programming card will cause the conflict monitor to trigger (enter into fault mode) and remain in the triggered state until the programming card is properly inserted and the conflict monitor is reset.

Provide a conflict monitor that incorporates LED indicators into the front panel to dynamically display the status of the monitor under normal conditions and to provide a comprehensive review of field inputs with monitor status under fault conditions. Ensure that the monitor indicates the channels that were active during a conflict condition and the channels that experienced a failure for all other per channel fault conditions detected. Ensure that these indications and the status of each channel are retained until the Conflict Monitor is reset. Furnish LED indicators for the following:

- AC Power (Green LED indicator)
- VDC Failed (Red LED indicator)
- WDT Error (Red LED indicator)
- Conflict (Red LED indicator)
- Red Fail (Red LED indicator)
- Dual Indication (Red LED indicator)
- Yellow/Clearance Failure (Red LED indicator)
- PCA/PC Ajar (Red LED indicator)

- Monitor Fail/Diagnostic Failure (Red LED indicator)
- 54 Channel Status Indicators (1 Red, 1 Yellow, and 1 Green LED indicator for each of the 18 channels)

Provide a switch to set the Red Fail fault timing. Ensure that when the switch is in the ON position the Red Fail fault timing value is set to 1350 +/- 150 ms (2018 mode). Ensure that when the switch is in the OFF position the Red Fail fault timing value is set to 850 +/- 150 ms (210 mode).

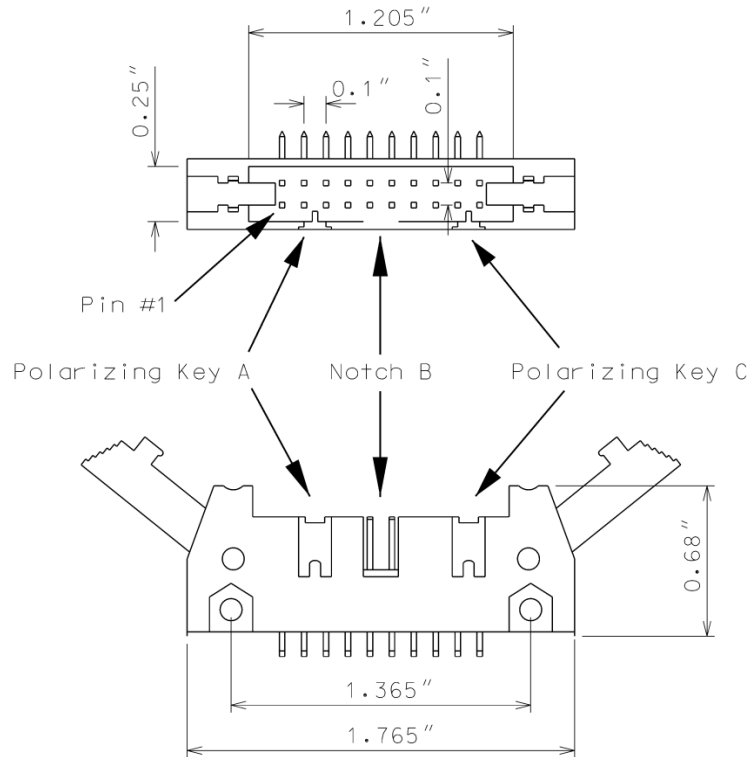
Provide a switch to set the Watchdog fault timing. Ensure that when the switch is in the ON position the Watchdog fault timing value is set to 1.0 +/- 0.1 s (2018 mode). Ensure that when the switch is in the OFF position the Watchdog fault timing value is set to 1.5 +/- 0.1 s (210 mode).

Provide a jumper or switch to set the AC line brown-out levels. Ensure that when the jumper is present or the switch is in the ON position the AC line dropout voltage threshold is 98 +/- 2 Vrms, the AC line restore voltage threshold is 103 +/- 2 Vrms, and the AC line brown-out timing value is set to 400 +/- 50ms (2018 mode). Ensure that when the jumper is not present or the switch is in the OFF position the AC line dropout voltage threshold is 92 +/- 2 Vrms, the AC line restore voltage threshold is 98 +/- 2 Vrms, and the AC line brown-out timing value is set to 80 +/- 17 ms (210 mode).

Provide a jumper or switch that will enable and disable the Watchdog Latch function. Ensure that when the jumper is not present or the switch is in the OFF position the Watchdog Latch function is disabled. In this mode of operation, a Watchdog fault will be reset following a power loss, brownout, or power interruption. Ensure that when the jumper is present or the switch is in the ON position the Watchdog Latch function is enabled. In this mode of operation, a Watchdog fault will be retained until a Reset command is issued.

Provide a jumper that will reverse the active polarity for pin #EE (output relay common). Ensure that when the jumper is not present pin #EE (output relay common) will be considered 'Active' at a voltage greater than 70 Vrms and 'Not Active' at a voltage less than 50 Vrms (Caltrans mode). Ensure that when the jumper is present pin #EE (output relay common) will be considered 'Active' at a voltage less than 50 Vrms and 'Not Active' at a voltage greater than 70 Vrms (Failsafe mode).

In addition to the connectors required by CALTRANS' 2009 TEES, provide the conflict monitor with a red interface connector mounted on the front of the monitor. Ensure the connector is a 20 pin, right angle, center polarized, male connector with latching clip locks and polarizing keys. Ensure the right angle solder tails are designed for a 0.062" thick printed circuit board. Keying of the connector shall be between pins 3 and 5, and between 17 and 19. Ensure the connector has two rows of pins with the odd numbered pins on one row and the even pins on the other row. Ensure the connector pin row spacing is 0.10" and pitch is 0.10". Ensure the mating length of the connector pins is 0.24". Ensure the pins are finished with gold plating 30μ" thick.



Ensure the red interface connector pins on the monitor have the following functions:

| Pin # | Function | Pin # | Function |
|--------------|-----------------|--------------|--------------------|
| 1 | Channel 15 Red | 2 | Channel 16 Red |
| 3 | Channel 14 Red | 4 | Chassis Ground |
| 5 | Channel 13 Red | 6 | Special Function 2 |
| 7 | Channel 12 Red | 8 | Special Function 1 |
| 9 | Channel 10 Red | 10 | Channel 11 Red |
| 11 | Channel 9 Red | 12 | Channel 8 Red |
| 13 | Channel 7 Red | 14 | Channel 6 Red |
| 15 | Channel 5 Red | 16 | Channel 4 Red |
| 17 | Channel 3 Red | 18 | Channel 2 Red |
| 19 | Channel 1 Red | 20 | Red Enable |

Ensure that removal of the P20 cable connector will cause the conflict monitor to recognize a latching fault condition and place the cabinet into flashing operation.

Provide Special Function 1 and Special Function 2 inputs to the unit which shall disable only Red Fail Monitoring when either input is sensed active. A Special Function input shall be sensed active when the input voltage exceeds 70 Vrms with a minimum duration of 550 ms. A Special Function input shall be sensed not active when the input voltage is less than 50 Vrms or the duration is less than 250 ms. A Special Function input is undefined by these specifications and may or may not be sensed active when the input voltage is between 50 Vrms and 70 Vrms or the duration is between 250 ms and 550 ms.

Ensure the conflict monitor recognizes field signal inputs for each channel that meet the following requirements:

- consider a Red input greater than 70 Vrms and with a duration of at least 500 ms as an “on” condition;
- consider a Red input less than 50 Vrms or with a duration of less than 200 ms as an “off” condition (no valid signal);
- consider a Red input between 50 Vrms and 70 Vrms or with a duration between 200 ms and 500 ms to be undefined by these specifications;
- consider a Green or Yellow input greater than 25 Vrms and with a duration of at least 500 ms as an “on” condition;
- consider a Green or Yellow input less than 15 Vrms or with a duration of less than 200 ms as an “off” condition; and
- consider a Green or Yellow input between 15 Vrms and 25 Vrms or with a duration between 200 ms and 500 ms to be undefined by these specifications.

Provide a conflict monitor that recognizes the faults specified by CALTRANS’ 2009 TEES and the following additional faults. Ensure the conflict monitor will trigger upon detection of a fault and will remain in the triggered (in fault mode) state until the unit is reset at the front panel or through the external remote reset input for the following failures:

1. **Red Monitoring or Absence of Any Indication (Red Failure):** A condition in which no “on” voltage signal is detected on any of the green, yellow, or red inputs to a given monitor channel. If a signal is not detected on at least one input (R, Y, or G) of a conflict monitor channel for a period greater than 1000 ms when used with a 170 controller and 1500 ms when used with a 2070 controller, ensure monitor will trigger and put the intersection into flash. If the absence of any indication condition lasts less than 700 ms when used with a 170 controller and 1200 ms when used with a 2070 controller, ensure conflict monitor will not trigger. Red fail monitoring shall be enabled on a per channel basis by the use of switches located on the conflict monitor. Have red monitoring occur when all of the following input conditions are in effect:
 - a) Red Enable input to monitor is active (Red Enable voltages are “on” at greater than 70 Vrms, off at less than 50 Vrms, undefined between 50 and 70 Vrms), and
 - b) Neither Special Function 1 nor Special Function 2 inputs are active.

- c) Pin #EE (output relay common) is not active
2. **Short/Missing Yellow Indication Fault (Clearance Error):** Yellow indication following a green is missing or shorter than 2.7 seconds (with ± 0.1 -second accuracy). If a channel fails to detect an “on” signal at the Yellow input for a minimum of 2.7 seconds (± 0.1 second) following the detection of an “on” signal at a Green input for that channel, ensure that the monitor triggers and generates a clearance/short yellow error fault indication. Short/missing yellow (clearance) monitoring shall be enabled on a per channel basis by the use of switches located on the conflict monitor. This fault shall not occur when the channel is programmed for Yellow Inhibit, when the Red Enable signal is inactive or pin #EE (output relay common) is active.
 3. **Dual Indications on the Same Channel:** In this condition, more than one indication (R,Y,G) is detected as “on” at the same time on the same channel. If dual indications are detected for a period greater than 500 ms, ensure that the conflict monitor triggers and displays the proper failure indication (Dual Ind fault). If this condition is detected for less than 200 ms, ensure that the monitor does not trigger. G-Y-R dual indication monitoring shall be enabled on a per channel basis by the use of switches located on the conflict monitor. G-Y dual indication monitoring shall be enabled for all channels by use of a switch located on the conflict monitor. This fault shall not occur when the Red Enable signal is inactive or pin #EE (output relay common) is active.
 4. **Configuration Settings Change:** The configuration settings are comprised of (as a minimum) the permissive diode matrix, dual indication switches, yellow disable jumpers, any option switches, any option jumpers, and the Watchdog Enable switch. Ensure the conflict monitor compares the current configuration settings with the previous stored configuration settings on power-up, on reset, and periodically during operation. If any of the configuration settings are changed, ensure that the conflict monitor triggers and causes the program card indicator to flash. Ensure that configuration change faults are only reset by depressing and holding the front panel reset button for a minimum of three seconds. Ensure the external remote reset input does not reset configuration change faults.

Ensure the conflict monitor will trigger and the AC Power indicator will flash at a rate of 2 Hz \pm 20% with a 50% duty cycle when the AC Line voltage falls below the “drop-out” level. Ensure the conflict monitor will resume normal operation when the AC Line voltage returns above the “restore” level. Ensure the AC Power indicator will remain illuminated when the AC voltage returns above the “restore” level. Should an AC Line power interruption occur while the monitor is in the fault mode, then upon restoration of AC Line power, the monitor will remain in the fault mode and the correct fault and channel indicators will be displayed.

Provide a flash interval of at least 6 seconds and at most 10 seconds in duration following a power-up, an AC Line interruption, or a brownout restore. Ensure the conflict monitor will suspend all fault monitoring functions, close the Output relay contacts, and flash the AC indicator at a rate of 4 Hz \pm 20% with a 50% duty cycle during this interval. Ensure the termination of the flash interval after at least 6 seconds if the Watchdog input has made 5 transitions between the True and False state and the AC Line voltage is greater than the “restore” level. If the watchdog input has not made

5 transitions between the True and False state within 10 ± 0.5 seconds, the monitor shall enter a WDT error fault condition.

Ensure the conflict monitor will monitor an intersection with a minimum of four approaches using the four-section Flashing Yellow Arrow (FYA) vehicle traffic signal as outlined by the NCHRP 3-54 research project for protected-permissive left turn signal displays. Ensure the conflict monitor will operate in the FYA mode and FYAc (Compact) mode as specified below to monitor each channel pair for the following fault conditions: Conflict, Flash Rate Detection, Red Fail, Dual Indication, and Clearance. Provide a switch to select between the FYA mode and FYAc mode. Provide a switch to select each FYA phase movement for monitoring.

FYA mode

| FYA Signal Head | Phase 1 | Phase 3 | Phase 5 | Phase 7 |
|-----------------------|------------------|-------------------|-------------------|-------------------|
| Red Arrow | Channel 9 Red | Channel 10 Red | Channel 11 Red | Channel 12 Red |
| Yellow Arrow | Channel 9 Yellow | Channel 10 Yellow | Channel 11 Yellow | Channel 12 Yellow |
| Flashing Yellow Arrow | Channel 9 Green | Channel 10 Green | Channel 11 Green | Channel 12 Green |
| Green Arrow | Channel 1 Green | Channel 3 Green | Channel 5 Green | Channel 7 Green |

FYAc mode

| FYA Signal Head | Phase 1 | Phase 3 | Phase 5 | Phase 7 |
|-----------------------|------------------|------------------|------------------|-------------------|
| Red Arrow | Channel 1 Red | Channel 3 Red | Channel 5 Red | Channel 7 Red |
| Yellow Arrow | Channel 1 Yellow | Channel 3 Yellow | Channel 5 Yellow | Channel 7 Yellow |
| Flashing Yellow Arrow | Channel 1 Green | Channel 3 Green | Channel 5 Green | Channel 7 Green |
| Green Arrow | Channel 9 Green | Channel 9 Yellow | Channel 10 Green | Channel 10 Yellow |

If a FYA channel pair is enabled for FYA operation, the conflict monitor will monitor the FYA logical channel pair for the additional following conditions:

1. **Conflict:** Channel conflicts are detected based on the permissive programming jumpers on the program card. This operation remains unchanged from normal operation except for the solid Yellow arrow (FYA clearance) signal.
2. **Yellow Change Interval Conflict:** During the Yellow change interval of the Permissive Turn channel (flashing Yellow arrow) the conflict monitor shall verify that no conflicting channels to the solid Yellow arrow channel (clearance) are active. These conflicting channels shall be determined by the program card compatibility programming of the Permissive Turn channel (flashing Yellow arrow). During the Yellow change interval of the Protected Turn channel (solid Green arrow) the conflict monitor shall verify that no conflicting channels to the solid Yellow arrow channel (clearance) are active as determined by the program card compatibility programming of the Protected Turn channel (solid Green arrow).
3. **Flash Rate Detection:** The conflict monitor unit shall monitor for the absence of a valid flash rate for the Permissive turn channel (flashing Yellow arrow). If the Permissive turn channel (flashing Yellow arrow) is active for a period greater than 1600 milliseconds, ensure the conflict monitor triggers and puts the intersection into flash. If the Permissive turn channel (flashing Yellow arrow) is active for a period less than 1400 milliseconds, ensure the conflict monitor does not trigger. Ensure the conflict monitor will remain in the triggered (in fault mode) state until the unit is reset at the front panel or through the external remote reset input. Provide a jumper or switch that will enable and disable the Flash Rate Detection function. Ensure that when the jumper is not present or the switch is in the OFF position the Flash Rate Detection function is enabled. Ensure that when the jumper is present or the switch is in the ON position the Flash Rate Detection function is disabled.
4. **Red Monitoring or Absence of Any Indication (Red Failure):** The conflict monitor unit shall detect a red failure if there is an absence of voltage on all four of the inputs of a FYA channel pair (RA, YA, FYA, GA).
5. **Dual Indications on the Same Channel:** The conflict monitor unit shall detect a dual indication if two or more inputs of a FYA channel pair (RA, YA, FYA, GA) are “on” at the same time.
6. **Short/Missing Yellow Indication Fault (Clearance Error):** The conflict monitor unit shall monitor the solid Yellow arrow for a clearance fault when terminating both the Protected Turn channel (solid Green arrow) interval and the Permissive Turn channel (flashing Yellow arrow) interval.

Ensure that the conflict monitor will log at least nine of the most recent events detected by the monitor in non-volatile EEPROM memory (or equivalent). For each event, record at a minimum the time, date, type of event, status of each field signal indication with RMS voltage, and specific channels involved with the event. Ensure the conflict monitor will log the following events: monitor reset, configuration, previous fault, and AC line. Furnish the signal sequence log that shows all channel states (Greens, Yellows, and Reds) and the Red Enable State for a minimum of 2 seconds prior to the current fault trigger point. Ensure the display resolution of the inputs for the signal sequence log is not greater than 50 ms.

For conflict monitors used within an Ethernet communications system, provide a conflict monitor with an Ethernet 10/100 Mbps, RJ-45 port for data communication access to the monitor by a local notebook computer and remotely via a workstation or notebook computer device connected to the signal system local area network. The Ethernet port shall be electrically isolated from the conflict monitor's electronics and shall provide a minimum of 1500 Vrms isolation. Integrate monitor with Ethernet network in cabinet. Provide software to retrieve the time and date from a network server in order to synchronize the on-board times between the conflict monitor and the controller. Furnish and install the following Windows based, graphic user interface software on workstations and notebook computers where the signal system client software is installed: 1) software to view and retrieve all event log information, 2) software that will search and display a list of conflict monitor IP addresses and IDs on the network, and 3) software to change the conflict monitor's network parameters such as IP address and subnet mask.

For non-Ethernet connected monitors, provide a RS-232C/D compliant port (DB-9 female connector) on the front panel of the conflict monitor in order to provide communications from the conflict monitor to the 170/2070 controller or to a Department-furnished laptop computer. Electrically isolate the port interface electronics from all monitor electronics, excluding Chassis Ground. Ensure that the controller can receive all event log information through a controller Asynchronous Communications Interface Adapter (Type 170E) or Async Serial Comm Module (2070). Furnish and connect a serial cable from the conflict monitor's DB-9 connector to Comm Port 1 of the 2070 controller. Ensure conflict monitor communicates with the controller. Provide a Windows based graphic user interface software to communicate directly through the same monitor RS-232C/D compliant port to retrieve and view all event log information to a Department-furnished laptop computer. The RS-232C/D compliant port on the monitor shall allow the monitor to function as a DCE device with pin connections as follows:

| Conflict Monitor RS-232C/D (DB-9 Female) Pinout | | |
|--|-----------------|------------|
| Pin Number | Function | I/O |
| 1 | DCD | O |
| 2 | TX Data | O |
| 3 | RX Data | I |
| 4 | DTR | I |
| 5 | Ground | - |
| 6 | DSR | O |
| 7 | CTS | I |
| 8 | RTS | O |
| 9 | NC | - |

MONITOR BOARD EDGE CONNECTOR

| Pin # | Function (Back Side) | Pin # | Function (Component Side) |
|--------------|-----------------------------|--------------|----------------------------------|
| 1 | Channel 2 Green | A | Channel 2 Yellow |
| 2 | Channel 13 Green | B | Channel 6 Green |
| 3 | Channel 6 Yellow | C | Channel 15 Green |
| 4 | Channel 4 Green | D | Channel 4 Yellow |
| 5 | Channel 14 Green | E | Channel 8 Green |
| 6 | Channel 8 Yellow | F | Channel 16 Green |
| 7 | Channel 5 Green | H | Channel 5 Yellow |
| 8 | Channel 13 Yellow | J | Channel 1 Green |
| 9 | Channel 1 Yellow | K | Channel 15 Yellow |
| 10 | Channel 7 Green | L | Channel 7 Yellow |
| 11 | Channel 14 Yellow | M | Channel 3 Green |
| 12 | Channel 3 Yellow | N | Channel 16 Yellow |
| 13 | Channel 9 Green | P | Channel 17 Yellow |
| 14 | Channel 17 Green | R | Channel 10 Green |
| 15 | Channel 11 Yellow | S | Channel 11 Green |
| 16 | Channel 9 Yellow | T | Channel 18 Yellow |
| 17 | Channel 18 Green | U | Channel 10 Yellow |
| -- | | -- | |
| 18 | Channel 12 Yellow | V | Channel 12 Green |
| 19 | Channel 17 Red | W | Channel 18 Red |
| 20 | Chassis Ground | X | Not Assigned |
| 21 | AC- | Y | DC Common |
| 22 | Watchdog Timer | Z | External Test Reset |
| 23 | +24VDC | AA | +24VDC |
| 24 | Tied to Pin 25 | BB | Stop Time (Output) |
| 25 | Tied to Pin 24 | CC | Not Assigned |
| 26 | Not Assigned | DD | Not Assigned |
| 27 | Relay Output, Side #3, N.O. | EE | Relay Output, Side #2, Common |
| 28 | Relay Output, Side #1, N.C. | FF | AC+ |

-- Slotted for keying between Pins 17/U and 18/V

CONFLICT PROGRAM CARD PIN ASSIGNMENTS

| Pin # | Function (Back Side) | Pin # | Function (Component Side) |
|--------------|-----------------------------|--------------|----------------------------------|
| 1 | Channel 2 Green | A | Channel 1 Green |
| 2 | Channel 3 Green | B | Channel 2 Green |
| 3 | Channel 4 Green | C | Channel 3 Green |
| 4 | Channel 5 Green | D | Channel 4 Green |
| 5 | Channel 6 Green | E | Channel 5 Green |
| 6 | Channel 7 Green | F | Channel 6 Green |
| 7 | Channel 8 Green | H | Channel 7 Green |
| 8 | Channel 9 Green | J | Channel 8 Green |
| 9 | Channel 10 Green | K | Channel 9 Green |
| 10 | Channel 11 Green | L | Channel 10 Green |
| 11 | Channel 12 Green | M | Channel 11 Green |
| 12 | Channel 13 Green | N | Channel 12 Green |
| 13 | Channel 14 Green | P | Channel 13 Green |
| 14 | Channel 15 Green | R | Channel 14 Green |
| 15 | Channel 16 Green | S | Channel 15 Green |
| 16 | N/C | T | PC AJAR |
| 17 | Channel 1 Yellow | U | Channel 9 Yellow |
| 18 | Channel 2 Yellow | V | Channel 10 Yellow |
| 19 | Channel 3 Yellow | W | Channel 11 Yellow |
| 20 | Channel 4 Yellow | X | Channel 12 Yellow |
| 21 | Channel 5 Yellow | Y | Channel 13 Yellow |
| 22 | Channel 6 Yellow | Z | Channel 14 Yellow |
| 23 | Channel 7 Yellow | AA | Channel 15 Yellow |
| 24 | Channel 8 Yellow | BB | Channel 16 Yellow |
| -- | | -- | |
| 25 | Channel 17 Green | CC | Channel 17 Yellow |
| 26 | Channel 18 Green | DD | Channel 18 Yellow |
| 27 | Channel 16 Green | EE | PC AJAR (Program Card) |
| 28 | Yellow Inhibit Common | FF | Channel 17 Green |

-- Slotted for keying between Pins 24/BB and 25/CC

characteristics as shown in the wiring detail in Figure 1. Provide 4 terminal screws with saddle clamps.

Provide fuses F1 and F2 as a UL Listed ¼" x 1-1/4" glass tube rated at 250 volts with a 10kA interrupting rating. Ensure F1 non-delay (fast-acting) and F2 slow-blow (time-delay) fuses have a maximum opening times of 60 minutes and 120 seconds for currents of 135 and 200 percent of the ampere rating, respectively. Ensure F2 slow-blow (time-delay) fuses have a minimum opening times of 12 seconds at 200 percent of the ampere rating. Provide fuse holders that are UL Recognized panel-mounted holders rated 250V, 15 ampere minimum with bayonet-type knobs which accept ¼" x 1-1/4" glass tube fuses.

Provide terminal blocks that are rated for 300V and are made of electrical grade thermoplastic or thermosetting plastic. Ensure each terminal block is of closed back design and has recessed-screw terminals with molded barriers between terminals. Ensure each terminal block is labeled with a block designation. Ensure each terminal is labeled with the function and a number.

Provide 3/4-inch diameter radial lead UL-recognized metal oxide varistors (MOVs) that have electrical performance as outlined below.

| PROPERTIES OF MOV SURGE PROTECTOR | |
|--|--------------------------|
| Maximum Continuous Applied Voltage at 185° F | 150 VAC (RMS) 200 VDC |
| Maximum Peak 8x20µs Current at 185° F | 6500 A |
| Maximum Energy Rating at 185° F | 80 J |
| Voltage Range 1 mA DC Test at 77° F | 212-268 V |
| Max. Clamping Voltage 8x20µs, 100A at 77° F | 395 V |
| Typical Capacitance (1 MHz) at 77° F | 1600 pF |

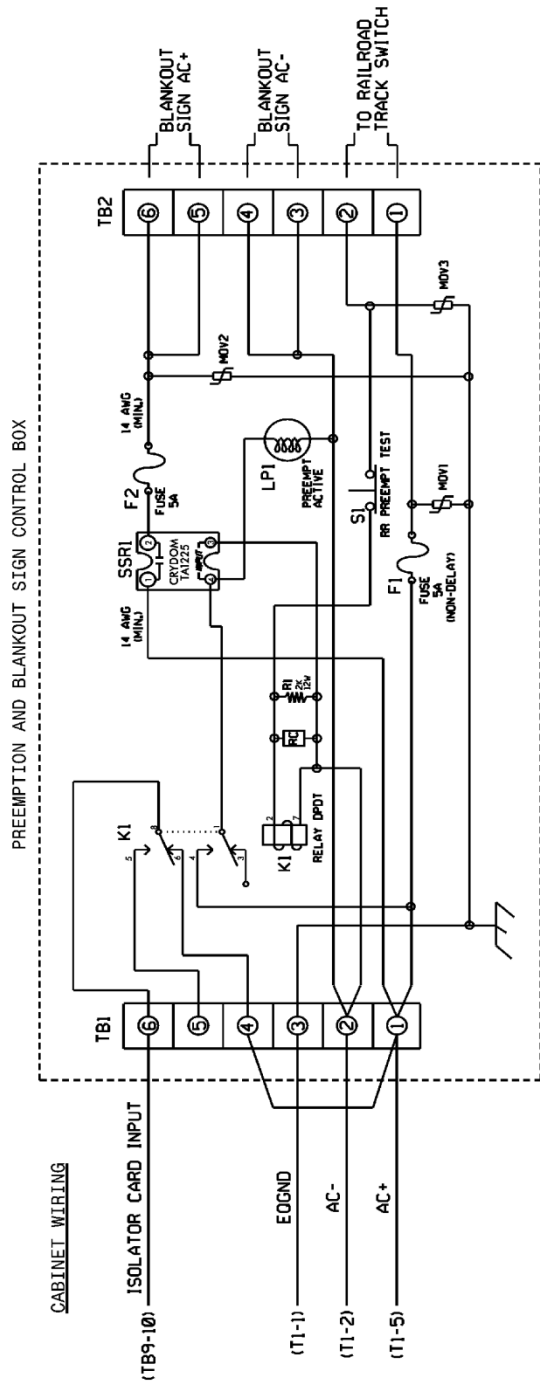
Provide resistor R1 as a 2K ohm, 12 watt, wirewound resistor with tinned terminals and attaching leads. Ensure the resistor is spaced apart from surrounding wires.

Provide a LED or incandescent lamp that has a voltage rating of 120 VAC with a minimum life rating at 50,000 hours.

Wire the preemption and sign control box as shown in Figure 1.

RAILROAD PREEMPTION WIRING DETAIL

(wire as shown below)



NOTES

1. RELAY K1 IS SHOWN IN THE ENERGIZED (PREEMPT NOI ACTIVE) NORMAL OPERATION STATE.
2. AC ISOLATOR CARD SHALL ACTIVATE PREEMPTION UPON REMOVAL OF AC+ FROM INPUT (AS SHOWN ABOVE). THIS IS ACCOMPLISHED BY SETTING TYPE 252 AC ISOLATOR CARD TO INVERTED OPERATION.

FRONT VIEW

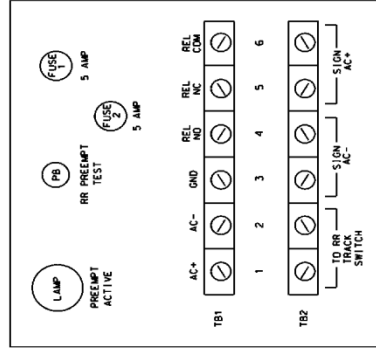


Figure 1

E. Type 170 Detector Sensor Units

Furnish detector sensor units that comply with Chapter 5 Section 1, "General Requirements," and Chapter 5 Section 2, "Model 222 & 224 Loop Detector Sensor Unit Requirements," of the CALTRANS "Transportation Electrical Equipment Specifications" dated March 12, 2009 with Erratum 1.

24.3. CONSTRUCTION METHODS

A. General

Remove existing controllers and cabinets where required. Remove maintenance diary from cabinet and place in new cabinet. Take existing equipment out of service only at the time directed.

Locate new cabinets so as not to obstruct sight distance of vehicles turning on red.

Install controllers, cabinets, detector sensor units and hardware that provide required phasing, color sequence, flash sequence, interconnection, railroad clearance and preemption and emergency vehicle clearance and preemption.

Stencil signal inventory number on cabinet side facing roadway. Use 3" black characters.

Provide external electrical service disconnect at all new and existing cabinet locations unless otherwise specified.

Do not program controller for late night flashing operation at railroad preemption installations. For all other installations, do not program controller for late night flashing operation unless otherwise directed. Ensure all signal heads for same approach flash concurrently during flashing operation.

Provide serial number and cabinet model number for each new controller and controller cabinet installed.

Install pole mounted cabinets so height to cabinet middle is 4 ft.

Activate controllers with proposed phasing and timing.

B. Workshop

Provide enclosed workshop to set up and test new controllers and cabinets before installation. Locate workshop within Division responsible for project administration. Ensure workshop provides protection from weather and sufficient space to house 2 test observers, all necessary test equipment and material, controllers and cabinets.

Configure and test each controller and cabinet to match the proposed signal design. Ensure all equipment furnished and installed or modified by the Contractor at each location operates in full compliance with the plans and project special provisions. Test each controller and cabinet for proper color sequence, flashing operation, phase timings, preemption, coordination and conflict monitor programming or malfunction management unit programming. Ensure that simultaneous conflicting phase outputs will cause the cabinet to revert to flashing operation. For intersections with any type of preemption, submit a completed Preemption Test Procedure Checklist. The checklist is located on the Department's website at <https://connect.ncdot.gov/resources/safety/Pages/ITS-and-Signals.aspx>.

Test the cabinet and controller for eight hours minimum. Following this test and before installation, the Engineer will inspect the equipment in operation. The Engineer may require other tests to ensure proper operation. These tests shall be at no additional cost to the Department.

C. Railroad Preemption

Where railroad preemption is required, coordinate all work with the railroad company. Do not place signals into operation until signal equipment has been interconnected with required railroad-highway crossing devices and railroad preemption is working properly. Ensure preemption sequences begin immediately after activation of train detection.

Contact and coordinate with the railroad company to schedule interconnection of the signal to the railroad controller cabinet. Install lead-in cable from the signal controller cabinet to a railroad company furnished and installed lockable junction box. Interconnection will be made by the railroad company.

Provide fail-safe operation such that removal of voltage from the railroad side of the isolation relay will initiate the railroad preemption sequence.

D. Vehicle Detection

Where required, preserve the existing video and/or microwave radar vehicle detection systems functionality during signal cabinet change-outs or other cabinet modifications by reusing and/or providing all necessary equipment and hardware. This work shall be considered incidental to the installation of new signal cabinets.

E. Audible Pedestrian Signals

Where required, preserve the existing audible pedestrian signal functionality during signal cabinet change-outs or other cabinet modifications by reusing and/or providing all necessary equipment and hardware. This work shall be considered incidental to the installation of new signal cabinets.

F. Cabinet Artwork

The City of Durham currently maintains some existing signal cabinets that have exterior artwork that was installed under the direction of the City of Durham Office of Economic and Workforce Development. These existing signal cabinets shall be carefully removed in such a manner that the cabinet and artwork are not damaged. The City will be onsite to immediately take possession of the cabinet to be re-purposed as a City art exhibit. The Contractor shall provide the City with at least 2 days' notice prior to removing the cabinet.

24.4. MEASUREMENT AND PAYMENT

Controllers with Cabinet (____) will be measured and paid as the actual number of each type of controllers with cabinets furnished, installed, and accepted.

Detector Card (____) will be measured and paid as the actual number furnished, installed, and accepted.

No measurement will be made of conflict monitors, external electrical service disconnect, grounding systems, meter bases and workshop as these will be incidental to furnishing and installing controllers with cabinets.

No measurement will be made for the removal of existing signal cabinets or removal of existing signal controllers as this will be incidental to the installation of the new signal cabinet.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Controller with Cabinet (2070LX, 332 Base Mounted) | Each |
| Controller with Cabinet (2070LX, 336S Pole Mounted)..... | Each |
| Controller with Cabinet (2070LX, 336S Base Mounted)..... | Each |
| Controller with Cabinet and Aux File (2070LX, 332 Base Mounted) | Each |
| Controller with Cabinet and Aux File (2070LX, 336S Pole Mounted)..... | Each |
| Controller with Cabinet and Aux File (2070LX, 336S Base Mounted) | Each |
| Detector Card (2070L)..... | Each |

25. PUSH BUTTON INTEGRATED ACCESSIBLE PEDESTRIAN SIGNAL (APS)

25.1. DESCRIPTION

Furnish and install push button integrated accessible pedestrian signals that include pedestrian push button, push button locator tone, raised tactile arrow, audio and vibro-tactile walk indications, automatic volume adjustment, pedestrian information sign, and all necessary hardware. Furnish the R10-3e with appropriate arrow direction for the pedestrian information sign.

25.2. MATERIALS

Furnish material, equipment, and hardware under this section that is pre-approved on the ITS and Signals QPL.

Provide the accessible pedestrian signals with a 2-inch diameter pedestrian push button that contains a tactile arrow whose direction can be easily adjusted in the field. Ensure each push button actuates a sturdy, momentary, normally-open switch with a minimum rating of 20 million actuations. Include on the button, a raised tactile arrow having a high visual contrast with the remainder of the button face. Ensure the housing is weather-tight and fabricated from aluminum. Ensure the housing is suitable for mounting on wood and metal poles. Paint surfaces of the pedestrian push button housing in highway yellow, unless otherwise specified, with an electrostatically-applied, fused-polyester paint method. Ensure the thickness of the paint is a minimum of 2.5 mils. Provide the pedestrian information sign that is integral to the housing.

Ensure the accessible pedestrian signals can provide tones, sounds, and speech messages that are synchronized at an intersection. Provide a means for adjusting the base sound level for the tones, sounds, and speech messages. Ensure the tones, sounds, and speech messages will adjust automatically to the ambient noise level up to a maximum of 100 dBA. Provide the custom speech messages in both English and Spanish languages. Ensure you can program the accessible pedestrian signal by a means not readily accessible by unauthorized persons.

Ensure each push button provides a standard locator tone that is deactivated when the traffic signal is operating in the flash mode. Provide a user-programmable audible beaconing feature that is initiated by an extended push button press of one second or more. Ensure the audible beaconing feature increases the volume of the push button locator tone during the pedestrian change interval of the called pedestrian phase and operates in one of the following ways:

- A. The louder audible walk indication and louder locator tone comes from the far end of the crosswalk, as pedestrians cross the street,
- B. The louder locator tone comes from both ends of the crosswalk, or
- C. The louder locator tone comes from an additional speaker that is aimed at the center of the crosswalk and that is mounted on a pedestrian signal head.

Provide confirmation of the push button activation by an LED pilot light. Ensure the pilot light remains illuminated until the pedestrian's green or WALKING PERSON (symbolizing WALK) signal indication is displayed. Ensure each press of the pushbutton initiates a "wait" speech message during all intervals except the Walk interval.

Ensure you can select a percussive tone and custom speech message to sound during the "Walk" interval. Provide a push button that vibrates during the "Walk" interval. Ensure the "Walk" indications have the same duration as the illuminated pedestrian signals except when the signal is programmed to rest in the walk interval. When the pedestrian signal is programmed to rest in walk,

ensure the “Walk” indication is limited to the first 7 seconds of the walk interval. The “Walk” indication shall be recalled by a button press during the walk interval provided that the crossing time remaining is greater than the pedestrian change interval. Ensure the “Walk” indications are deactivated when the traffic control signal is operating in a flashing mode. When audible “Walk” indications are selected as a percussive tone, ensure the tone repeats at 8 to 10 ticks per second and consists of multiple frequencies with a dominant component at 880 Hz.

Ensure the accessible pedestrian signals are weatherproof and suitable for operation in wet locations. Ensure proper operation over a temperature range of -30°F (-34°C) to 165°F (+74°C). Ensure all circuit boards have a moisture resistant coating. Ensure the equipment interfaces and operates properly in a Type-170E cabinet.

25.3. CONSTRUCTION METHODS

Comply with the requirements of Section 1705 of the *Standard Specifications*. Install in accordance with the manufacturer’s recommendations.

Mount push button integrated accessible pedestrian signals in a tamperproof manner on wood and metal poles, signal pedestals, or pushbutton posts as indicated in the signal plans.

Install each pushbutton so that the tactile arrow is pointed in the direction of travel and is aligned parallel to the direction of travel on the associated crosswalk.

Ensure pushbuttons are separated by a distance of at least 10 feet such that they clearly indicate which crosswalk has the WALK indication. Where there are constraints on a particular corner that make it impractical to provide the 10 feet of separation between the two pushbuttons, the pushbuttons may be placed closer together or on the same pole, with approval by the Engineer. If two pushbuttons are placed on the same pole or with less than 10 feet separation, provide a speech walk message for the WALK indication and a speech pushbutton information message.

Adjust the intensity of the pushbutton locator tones so they are audible 6 feet to 12 feet from the pushbutton, or to the building line, whichever is less. Ensure the pushbutton locator tones are no more than 5 dBA louder than ambient sound. Configure audible “Walk” indication to be audible at the nearest end of the associated crosswalk.

If speech messages are used, have each recorded custom speech message approved by the Engineer in advance.

25.4. MEASUREMENT AND PAYMENT

Actual number of push button integrated accessible pedestrian signal detector stations furnished, installed, and accepted.

Actual number of central control units for APS detector stations furnished, installed, and accepted.

No measurement will be made of cables or hardware, as these will be considered incidental to furnishing and installing push button integrated accessible pedestrian signals.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| APS Detector Stations..... | Each |
| Central Control Units For APS Detector Stations | Each |

26. VEHICLE PREEMPTION SYSTEM

26.1. DESCRIPTION

At locations shown in the Signal Plans the Contractor shall furnish, install, and implement GPS-based vehicle preemption systems.

Coordinate vehicle preemption work with the Engineer and proper operating authority.

26.2. MATERIAL

A. General

Material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

B. System Functionality

The vehicle preemption system shall provide the following features and functionality:

- The system shall be GPS-based and provide vehicle-to-intersection communications using 2.4 GHz spread spectrum radio transceivers with a minimum range of 2,000 feet. No infrared or cellular communications shall be used.
- The system shall provide for high and low levels of priority.
- The system shall allow each vehicle to have a unique identification code.

C. Intersection Equipment

Furnish a GPS radio for the vehicle preemption system that is an integrated stand-alone unit consisting of a GPS receiver with antenna and 2.4 GHz spread spectrum transceiver with antenna. The transceiver shall receive and process data being transmitted by equipped vehicle within radio range. This data shall include vehicle location, heading, and speed.

Furnish a phase selector for the vehicle preemption system that is card-based and can be installed directly in the input file of the traffic signal cabinet. The phase selector shall be Ethernet-enabled for integration with the signal system communications network

Furnish cabling to connect the GPS radio and phase selector per the manufacturer's recommendation. All cabling shall be outdoor rated and suitable for lashing to existing signal cable or installed in existing underground conduit, vertical risers, or metal pole raceways.

D. Test Vehicle Equipment

Furnish a test vehicle equipment that consists of a GPS receiver with antenna and 2.4 GHz spread spectrum transceiver with antenna. The test equipment shall be fully compatible with the intersection equipment and central management software being installed.

E. Software

Furnish central management software that monitors the status of the vehicle preemption system in real-time. The software shall archive preempt data and generate activity logs and user-defined reports. The software shall also allow for the remote configuration and diagnostics of the intersection equipment.

26.3. CONSTRUCTION METHODS

A. General

Install and integrate all vehicle preemption system equipment according to manufacturer’s recommendations.

Vehicle equipment for the system will be furnished and installed by others following acceptance of the intersection equipment.

B. Intersection Equipment

Install the GPS radio on the exterior of the traffic signal cabinet and routing cabling to the phase selector using a method approved by the Engineer.

Integrate and program the phase selector according to the Signal Plans.

The Contractor shall be responsible for approach mapping at the intersection level.

C. Test Vehicle Equipment

Provide test vehicle equipment to the Engineer.

D. Software

Install the central management software on workstations in the TCC and Signal Shop as shown on the block diagram in the Plans. Integrate the software clients with the signal system communications network to monitor all intersection preemption equipment installed under this Project.

26.4. MEASUREMENT AND PAYMENT

Vehicle Preemption System Intersection Equipment will be measured and paid as the actual number of intersections where GPS radios and phase selectors are furnished, installed and accepted.

Vehicle Preemption System Software will be paid at the contract lump sum price. This shall include furnishing, installing, configuring, and testing the software.

No measurement will be made for cabling, integration, programming, radio surveys, testing, test vehicle equipment, or any other activities required to establish a fully functioning vehicle preemption system as this will be considered incidental to the intersection equipment and software.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Vehicle Preemption System Intersection Equipment | Each |
| Vehicle Preemption System Software | Lump Sum |

27. MODIFY CABINET FOUNDATIONS

27.1. DESCRIPTION

Where approved by the Engineer, install conduit entrances into existing foundations in accordance with the plans and specifications. Modify existing foundations in accordance with the plans and specifications.

27.2. MATERIAL

Material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

Refer to Articles 100-4 (Portland Cement Concrete) and 1098-15 (Signal Cabinet Foundation) of the Standard Specifications.

27.3. CONSTRUCTION METHODS

Modify signal cabinet foundations in compliance with all requirements of Section 1752-3 of the Standard Specifications.

27.4. MEASUREMENT AND PAYMENT

Conduit Entrance into Existing Foundation will be measured and paid as the actual number of conduit entrances drilled into existing cabinet foundations furnished, installed and accepted.

Modify Foundation for Controller Cabinet will be measured and paid as the actual number of existing cabinet foundations modified and accepted.

No measurement or payment will be made for rotating the signal cabinet foundation on an existing cabinet foundation that is not being modified.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Conduit Entrance into Existing Foundation..... | Each |
| Modify Foundation for Controller Cabinet..... | Each |

28. CABINET BASE ADAPTER/EXTENDER

28.1. DESCRIPTION

Furnish and install cabinet base adapters and extenders with all necessary hardware for Type 170 cabinets.

28.2. MATERIAL

A. General

Furnish material, equipment and hardware under this section that is pre-approved on the ITS and Signals QPL.

Refer to Article 1098-16 (Cabinet Base Adapter or Extender) of the Standard Specifications.

B. Integrated Base Adapter

Furnish cabinet base adapters with an integrated electrical service meter and disconnect. The integrated unit shall provide physical separation and protection between electrical service equipment and cabling and signal cabinet equipment and cabling.

The integrated unit shall meet all requirements for Cabinet Base Adapter and Electrical Service in these Project Special Provisions.

28.3. CONSTRUCTION METHODS

Install cabinet base adapters and extenders in compliance with all requirements of Section 1753-3 of the Standard Specifications.

Coordinate with the City of Durham and Duke Energy prior to and during the installation of integrated cabinet base adapters.

28.4. MEASUREMENT AND PAYMENT

Cabinet Base Adapters will be measured and paid as the actual number furnished, installed and accepted.

Integrated Cabinet Base Adapters will be measured and paid as the actual number furnished, installed and accepted.

Cabinet Base Extenders will be measured and paid as the actual number furnished, installed and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------------------|-----------------|
| Cabinet Base Adapter | Each |
| Integrated Cabinet Base Adapter | Each |
| Cabinet Base Extender | Each |

29. ELECTRICAL SERVICE

29.1. DESCRIPTION

Install new electrical service equipment as shown in the Plans. The first item of work on this project is the installation of all electrical service poles and meter base/disconnect combination panels to expedite the power service connections. Comply with the National Electrical Code (NEC), the National Electrical Safety Code (NESC), the Standard Specifications, the Project Special Provisions, and all local ordinances.

All work involving electrical service shall be coordinated with the appropriate utility company and the Signal Supervisor from NCDOT Division 5 Traffic Services.

29.2. MATERIAL

A. Meter Base/Disconnect Combination Panel

Furnish and install new meter base/disconnect combination panels as shown in the Plans. Provide meter base/disconnect combination panels that have a minimum of four (4) spaces in the disconnect. Furnish a single pole 15A circuit breaker with a minimum of 10,000 RMS symmetrical amperes short circuit current rating in a lockable NEMA 3R enclosure. Ensure meter base/ disconnect combination panel is listed as meeting UL Standard UL-67 and marked as being suitable for use as service equipment. Ensure circuit breakers are listed as meeting UL-489. Fabricate enclosure from galvanized steel and electrostatically apply dry powder paint finish, light gray in color, to yield a minimum thickness of 2.4 mils. All exterior surfaces must be powder coated steel. Provide ground bus and neutral bus with a minimum of four terminals and a minimum wire capacity range of number 12 through number 3 AWG.

All new electrical breakers shall be labeled with the maximum available fault current. The Department will obtain this information from the utility company and the Contractor shall request it from the Engineer.

Furnish NEMA Type 3R combinational panel rated 200 Ampere minimum that meets the requirements of the local utility. Provide meter base with sockets' ampere rating based on sockets being wired with a minimum of 167 degrees F insulated wire. Furnish 4 terminal, 600-volt, single phase, 3-wire meter bases that comply with the following:

- Line, Load, and Neutral Terminals accept 4/0 AWG and smaller Copper/Aluminum wire
- With or without horn bypass
- Made of galvanized steel
- Listed as meeting UL Standard US-414
- Overhead or underground service entrance specified.

Furnish 1.25" watertight hub for threaded rigid conduit with meter base.

At the main service disconnect, furnish and install UL-approved lightning arrestors that meet the following requirements:

| | |
|--|------------------------------|
| Type of design | Silicon Oxide Varistor |
| Voltage | 120/240 Single Phase, 3 wire |
| Maximum current | 100,000 amps |
| Maximum energy | 3000 joules per pole |
| Maximum number of surges | Unlimited |
| Response time one milliamp test | 5 nanoseconds |
| Response time to clamp 10,000 amps | 10 nanoseconds |
| Response time to clamp 50,000 amps | 25 nanoseconds |
| Leak current at double the rated voltage | None |
| Ground wire | Separate |

B. Equipment Cabinet Disconnect

Provide new equipment cabinet disconnects when the meter base/disconnect combination panel is not adjacent or in the same intersection quadrant as the equipment cabinet. Furnish single pole 15A circuit breaker. Furnish panels that have a minimum of four (4) spaces in the disconnect. Furnish circuit breakers with a minimum of 10,000 RMS symmetrical amperes short circuit current rating in a lockable NEMA 3R enclosure. Ensure meter base/ disconnect combination panel is listed as meeting UL Standard UL-67 and marked as being suitable for use as service equipment. Ensure circuit breakers are listed as meeting UL-489. Fabricate enclosure from galvanized steel and electrostatically apply dry powder paint finish, light gray in color, to yield a minimum thickness of 2.4 mils. All exterior surfaces must be powder coated steel. Provide ground bus and neutral bus with a minimum of four terminals and a minimum wire capacity range of number 12 through number 3 AWG.

C. 3-Wire Copper Service Entrance Conductors

Furnish 3-wire stranded copper service entrance conductors with THWN rating. Provide conductors with black, red, and white insulation that are intended for power circuits at 600 Volts or less and comply with the following:

- Listed as meeting UL Standard UL-83
- Meets ASTM B-3 and B-8 or B-787 standards.

See the Plans for wire sizes and quantities.

D. 3-Wire Copper Feeder Conductors

Furnish 3-wire stranded copper feeder conductors with THWN rating for supplying power to CCTV field equipment cabinets. Provide conductors with black or red, white, and green insulation that are intended for power circuits at 600 Volts or less and comply with the following:

- Listed as meeting UL Standard UL-83
- Meets ASTM B-3 and B-8 or B-787 standards.

See the Plans for wire sizes and quantities.

E. Grounding System

Furnish 5/8"x10' copper clad steel grounding electrodes (ground rods), #4 AWG solid bare copper conductors, and exothermic welding kits for grounding system installations. Comply with the NEC, Standard Specifications, these Project Special Provisions, and the Plans.

29.3. CONSTRUCTION METHODS

A. General

Coordinate with the Engineer and the utility company to de-energize the existing service temporarily prior to starting any modifications.

Permanently label cables at all access points using nylon tags labeled with permanent ink. Ensure each cable has a unique identifier. Label cables immediately upon installation. Use component name and labeling scheme approved by the Engineer.

B. Meter Base/Disconnect Combination Panel

Install meter base/disconnect combination panels with lightning arrestors as called for in the Plans. Route the feeder conductors from the meter base/disconnect to the equipment cabinet in conduit. Provide rigid galvanized conduit for above ground and PVC for below ground installations.

C. Electrical Service Disconnect

Install equipment cabinet disconnects and circuit breakers as needed. Install THWN stranded copper feeder conductors as shown in Plans between the electrical service disconnect and the equipment cabinet disconnect. Route the conductors from the equipment cabinet disconnect to the equipment cabinet in rigid galvanized steel conduit. Bond the equipment cabinet disconnect in accordance with the NEC. Ensure that the grounding system complies with the grounding requirements of these Project Special Provisions, the Standard Specifications and the Plans.

D. 3-Wire Copper Service Entrance Conductors

Furnish and install 3-wire THWN stranded copper service entrance conductors in 1.25-inch rigid galvanized risers as shown in the plans. Install a waterproof hub on top of the electrical service disconnect for riser entrance/exit. Size the conductors as required by the load and distance. Comply with the Standard Specifications and Standard Drawings and all applicable electrical codes.

E. 3-Wire Copper Feeder Conductors

Install 3-wire THWN stranded copper feeder conductors to supply 120 VAC to the CCTV field equipment cabinets. Size the conductors as required by the load and distance. Comply with the Standard Specifications and Standard Drawings and all applicable electrical codes.

F. Grounding System

Install ground rods as indicated in the Plans. Connect the #4 AWG grounding conductor to ground rods using an exothermic welding process. Test the system to ensure a ground resistance of 20-ohms or less is achieved. Drive additional ground rods as necessary or as directed by the Engineer to achieve the proper ground resistance.

29.4. MEASUREMENT AND PAYMENT

New Electrical Service will be measured and paid as the actual number of services furnished, installed, and accepted.

Modify Existing Electrical Service will be measured and paid as the actual number of existing services modified and accepted.

No measurement will be made of riser assemblies, meter bases, service disconnects, underground and exposed conduit runs to the cabinet, acquisition of service fees, electrical service conductors, ground rod, ground wire and any remaining hardware and conduit to connect the electrical service to the cabinet as these are incidental to modifying existing or installing new electrical service.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| New Electrical Service..... | Each |
| Modify Existing Electrical Service | Each |

30. DIGITAL CCTV EQUIPMENT

30.1. DESCRIPTION

Furnish and install digital CCTV equipment described in these Project Special Provisions. All new CCTV cameras shall be fully compatible with the video management software that is being integrated under this Project.

Contact the Engineer to confirm all CCTV locations prior to beginning construction.

30.2. MATERIAL

A. General

Furnish and install new CCTV camera assemblies at the locations shown on the Plans. Each assembly consists of the following:

- One dome CCTV color digital signal processing camera unit with zoom lens, filter, control circuit, and accessories in a single enclosed unit
- Built-in video encoder capable of H.264/MPEG-4 compression for video-over IP transmission
- Motorized pan, tilt, and zoom
- Pole-mount camera attachment assembly
- All necessary cable, connectors and incidental hardware to make a complete and operable system
- A lightning arrestor installed in-line between the CCTV camera and the equipment cabinet components.
- A NEMA-rated enclosure constructed of aluminum with a clear acrylic dome or approved equal Camera Unit housing.

B. Camera and Lens

1. Cameras

Furnish new 1/3-inch charged-coupled device (CCD) color cameras. The sensors shall use Complementary Metal-Oxide-Semiconductor (CMOS) technology. The camera must meet the following minimum requirements:

- Sensor size: 2 megapixels
- Video Resolution: 1920x1080 (HDTV 1080p)
- Aspect Ratio: 16:9
- Overexposure protection: The camera shall have built-in circuitry or a protection device to prevent any damage to the camera when pointed at strong light sources, including the sun
- Low light condition imaging
- Wide dynamic range (WDR) operation
- Electronic image stabilization
- Automatic focus with manual override

2. Zoom Lens

Furnish each camera with a motorized zoom lens that is high performance integrated dome system or approved equivalent with automatic iris control with manual override and neutral density spot filter. Furnish lenses that meet the following optical specifications:

- 30X optical zoom, and 12X electronic zoom
- Preset positioning: 64 Presets

The lens must be capable of both automatic and remote manual control iris and focus override operation. The lens must be equipped for remote control of zoom and focus, including automatic movement to any of the preset zoom and focus positions. Mechanical or electrical means must be provided to protect the motors from overrunning in extreme positions. The operating voltages of the lens must be compatible with the outputs of the camera control.

3. Communication Standards:

The CCTV camera shall support the appropriate NTCIP 1205 communication protocol (version 1.08 or higher), ONVIF, or approved equal.

4. Networking Standards:

- Network Connection: 10/100 Mbps auto-negotiate
- Frame Rate: 30 to 60 fps
- Data Rate: scalable
- Built-in Web Server
- Unicast & multicast support
- Two simultaneous video streams (Dual H.264 and MJPEG):
 - Video 1: H.264 (Main Profile, at minimum)
 - Video 2: H.264 or MJPEG
- Supported Protocols: DNS, IGMPv2, NTP, RTSP, RTP, TCP, UDP, DHCP, HTTP, IPv4

The video camera shall allow for the simultaneous encoding and transmission of the two digital video streams, one in H.264 format (high-resolution) and one in H.264 or MJPEG format (low-resolution).

Initially use UDP/IP for video transport and TCP/IP for camera control transport unless otherwise approved by the Engineer.

The 10/100BaseTX port shall support half-duplex or full-duplex and provide auto negotiation and shall be initially configured for full-duplex.

The camera unit shall be remotely manageable using standard network applications via web browser interface administration. Telnet or SNMP monitors shall be provided.

C. Camera Housing

Furnish new dome style enclosure for the CCTV assemblies. Equip each housing with mounting assembly for attachment to the CCTV camera pole. The enclosures must be equipped with a sunshield and be fabricated from corrosion resistant aluminum and finished in a neutral color of weather resistant enamel. The enclosure must meet or exceed NEMA 4X ratings. The viewing area of the enclosure must be tempered glass.

D. Pan and Tilt Unit

Equip each new dome style assembly with a pan and tilt unit. The pan and tilt unit must be integral to the high performance integrated dome system. The pan and tilt unit must be rated for outdoor operation, provide dynamic braking for instantaneous stopping, prevent drift, and have minimum backlash. The pan and tilt units must meet or exceed the following specifications:

- Pan: continuous 360 Degrees
- Tilt: up/down +2 to -90 degrees minimum
- Motors: Two-phase induction type, continuous duty, instantaneous reversing
- Preset Positioning: 64 PTZ presets per camera

E. Control Receiver/Driver

Provide each new camera unit with a control receiver/driver that is integral to the CCTV dome assembly. The control receiver/driver will receive serial asynchronous data initiated from a camera control unit, decode the command data, perform error checking, and drive the pan/tilt unit, camera controls, and motorized lens. As a minimum, the control receiver/drivers must provide the following functions:

- Zoom in/out
- Automatic focus with manual override
- Tilt up/down
- Automatic iris with manual override
- Pan right/left
- Minimum 64 preset positions for pan, tilt, and zoom

In addition, each control receiver/driver must accept status information from the pan/tilt unit and motorized lens for preset positioning of those components. The control receiver/driver will relay pan, tilt, zoom, and focus positions from the field to the remote camera control unit. The control receiver/driver must accept “goto” preset commands from the camera control unit, decode the command data, perform error checking, and drive the pan/tilt and motorized zoom lens to the correct preset position. The preset commands from the camera control unit will consist of unique values for the desired pan, tilt, zoom, and focus positions.

F. Electrical

The camera assembly shall support power-over-Ethernet (PoE) in compliance with IEEE 802.3af. Provide any external power injector that is required for PoE with each assembly.

G. CCTV Camera Attachment to Pole

Furnish and install an attachment assembly for the CCTV camera unit. Use stainless steel banding approved by the Engineer.

Furnish CCTV attachments that allow for the removal and replacement of the CCTV enclosure as well as providing a weatherproof, weather tight, seal that does not allow moisture to enter the enclosure.

Furnish a CCTV Camera Attachment Assembly that can withstand wind loading at the maximum wind speed and gust factor called for in these Special Provisions and can support a minimum camera unit dead load of 45 pounds (20.4 kg).

H. Surge Suppression

Protect all equipment with metal oxide varistors connecting each power conductor to ground.

Protect the electrical and Ethernet cables from the CCTV unit entering the equipment cabinet with surge protection. Provide an integrated unit that accepts unprotected electrical and Ethernet connections and outputs protected electrical and Ethernet connections. Ethernet connections shall be RJ45 with full gigabit Ethernet transmission speeds and electrical connections shall be #22-#14 AWG screw terminals. The surge protection unit shall comply with EIA/TIA568A and EIA/TIA568B standards for data transmission and automatically reset.

I. Video Management Software

Provide video management software to setup, configure and operate the cameras in the field. This software shall include features to set communications IP addresses and protocols, define camera ID, lens control, digital signal processing (DSP) settings, azimuth configuration, presets, streaming profiles, and privacy zones. The software shall permit the user to copy configuration settings to multiple cameras.

The software shall enable the user to control all functions of the camera locally from the CCTV cabinet and/or traffic signal cabinet with an Ethernet connection.

30.3. CONSTRUCTION METHODS

A. General

Mount CCTV camera units at heights as shown in the Plans and positioned to adequately see traffic in all directions. The maximum attachment height for cameras is 45 feet above ground level.

Obtain approval of the camera locations and orientation from the Engineer prior to installing the CCTV camera assemblies.

Mount CCTV cameras on the side of poles nearest intended field of view. Avoid occluding the view with the pole.

B. Electrical and Mechanical Requirements

Ground all equipment as called for in the Standard Specifications, these Special Provisions, and the Plans.

Install surge protectors on all ungrounded conductors entering the CCTV enclosure. House the protectors in a small, ventilated weatherproof cabinet attached near the CCTV attachment point in a manner approved by the Engineer.

C. Video Management Software

Install the video management configuration software to setup, configure and operate the cameras on each laptop supplied with the project. Install the video management software on each client workstation and the video management server in the Project. Configure user rights and permissions upon coordination and approval by the City of Durham Traffic Engineer.

30.4. MEASUREMENT AND PAYMENT

Digital CCTV Camera Assembly will be measured and paid as the actual number of digital CCTV assemblies furnished, installed, integrated, and accepted. No separate measurement will be made for electrical cabling, connectors, CCTV camera attachment assemblies, conduit, condulets, grounding equipment, surge protectors, or any other equipment or labor required to install the digital CCTV assembly.

Ethernet cable and risers that are required to connect the camera to an Ethernet switch will be paid for separately.

No separate measurement and payment will be made for the Vendor supplied configuration software and video management software as such work will be incidental to furnishing and installing the CCTV cameras.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------------|-----------------|
| Digital CCTV Camera Assembly | Each |

31. REMOVE EXISTING MATERIALS

31.1. DESCRIPTION

This Project includes the removal of existing materials and equipment as part of the replacement and/or installation of new materials and equipment. At locations shown in the Plans, remove existing materials and equipment as detailed in these Project Special Provisions.

31.2. CONSTRUCTION METHODS

A. Remove Existing CCTV Assembly

Remove existing CCTV cameras at locations shown in the Plans. Remove the existing camera, pole attachment hardware, and cabling. Ensure that the existing wood or metal pole is not damaged during the CCTV removal. Deliver removed CCTV equipment to the City of Durham Traffic Signal Shop.

B. Remove Existing CCTV Cabinet

Remove existing CCTV cabinets at locations shown in the Plans. Remove the existing control and communications equipment and cabinet. Deliver removed CCTV equipment cabinet to the City of Durham Traffic Signal Shop.

C. Remove Existing Electrical Service

As shown in the Plans, remove existing electrical services for removed equipment.

For a dedicated electrical service, coordinate with the Engineer to have the electrical service de-energized. Once the service is de-energized, remove the existing conductors and conduit between the cabinet and service. Remove the existing electrical meter and deliver the meter to the Engineer.

For an electrical service that is shared with other signal equipment, the Contractor shall only remove the existing conductors and conduit between the cabinet and disconnect. Any existing breakers removed shall be replaced with appropriate breaker filler plates as needed cover the existing knockouts.

D. Remove Existing Cabinet Foundation

Remove existing cabinet foundations at locations shown in the Plans.

Restore the disturbed ground surrounding the removed cabinet foundation to its original, preconstruction condition as determined and approved by the Engineer.

For paved areas, replace removed or damages pavement with in-kind materials, matching the elevation, color, texture, finish, and general appearance of the surrounding pavement. Refer to Section 1 of these Project Special Provisions for additional requirements concerning sidewalks and curbs in historic districts. Replace concrete sidewalk in whole slabs from joint to joint and comply with Section 848 of the Standard Specifications. Replace sidewalk pavers using pavers of the same color, texture, shape, dimensions, and materials as the damaged or modified items. Place graded stone material to temporarily maintain pedestrian traffic where repairs cannot be performed immediately. Comply with Article 545-4 of the Standard Specifications.

For unpaved areas, backfill excavations with removed material, tamp the backfilled material, and rake smooth the top 1.5 inches. Finish unpaved areas flush with surrounding natural ground and to match the original contour of the ground. Seed with the same type of grass as surrounding area and

mulch the newly seeded area. If unpaved area was not grassed, replace the original ground cover in-kind as directed by the Engineer.

Complete repairs to and restoration of all ground (paved and unpaved) disturbed for construction within ten (10) consecutive calendar days following initial removal. If the Contractor fails to repair and restore the ground in accordance with these Project Special provisions within the time frame specified, the Department reserves the right to make the necessary repairs, and all expenses incurred by the Department in making the repairs and restoring the ground will be deducted from payment due the Contractor, plus \$500 liquidated damage per occasion, per day, or any portion thereof, until corrected.

E. Remove Existing Wireless Radio Systems

At locations shown in the Summary of Work table of the Plans, remove and retain the existing wireless radio and cabling from the signal cabinet. Remove and retain the existing pole-mounted antenna, attachment hardware, risers, cabling, surge protection, splitters, and any other accessories from the pole and cabinet.

The Contractor shall return the radio and antenna from NCDOT-owned signals to the Division 5 Traffic Services Office and from City-owned signals to the City Traffic Services Division. The Contractor shall dispose of all other removed equipment and materials.

31.3. MEASUREMENT AND PAYMENT

Remove Existing ____ will be measured and paid as the actual number of each item type removed and accepted.

No measurement or payment will be made for storage, cost of transportation, tools, materials, all related testing, cost of labor, incidentals and all other equipment necessary for removal as such work will be considered incidental to removing materials and equipment.

No measurement or payment will be made for restoration of the surrounding unpaved ground surfaces in accordance with these Project Special Provisions as such work will be considered incidental to removing cabinet foundations.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Remove Existing CCTV Assembly | Each |
| Remove Existing CCTV Cabinet..... | Each |
| Remove Existing Electrical Service..... | Each |
| Remove Existing Cabinet Foundation | Each |
| Remove Existing Wireless Radio and Antenna | Each |

32. UPGRADE CCTV LIGHTNING PROTECTION

32.1. DESCRIPTION

Remove and replace the existing CCTV pole lightning protection at locations as shown in the Plans. The lightning protection upgrade will include air terminal, rope lay bare copper lightning conductor, copper cable clips, galvanized screws, 2-inch PVC U-Guard, and exothermic weld to the existing main ground rod.

32.2. MATERIAL

Furnish and install the following new items:

- 0.5-inch x 36-inch copper clad steel air terminal (Class II)
- Air terminal pole attachment hardware for wood pole
- Class II 28 strand 15 AWG rope lay bare copper lightning conductor
- Copper cable clips
- 0.25-inch x 1.5-inch hex head galvanized screws
- inch PVC U-Guard
- Exothermic weld to existing main ground rod

32.3. CONSTRUCTION METHODS

Remove the existing lightning protection at existing CCTV wood poles as shown in the plans. Install new lightning protection as described above and as shown on plan sheet SD-100. Retain the existing CCTV ground rods and exothermically weld the new rope lay copper lightning conductor to the main ground rod located next to the CCTV pole.

32.4. MEASUREMENT AND PAYMENT

Upgrade CCTV Lightning Protection will be measured and paid as the actual number furnished, installed, and accepted. All cabling, configuration, and testing or other labor or materials required to upgrade CCTV lightning protection will be considered incidental and not be paid for separately.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Upgrade CCTV Lightning Protection | Each |

33. ETHERNET HUB CABINET

33.1. DESCRIPTION

Furnish 336S base mounted cabinets to house ethernet hub switches and communications equipment.

The cabinets must consist of a cabinet housing, 19-inch EIA mounting cage, and power distribution assembly (PDA #3 as described in the CALTRANS TSCES).

The cabinet housing must conform to sections 6.2.2 (Housing Construction), 6.2.3 (Door Latches and Locks), 6.2.4 (Housing Ventilation), and 6.2.5 (Hinges and Door Catches) of the CALTRANS TSCES. Do not equip the cabinet housings with a police panel.

The cabinet cage must conform to section 6.3 of the CALTRANS TSCES.

Terminal blocks on the PDA #3 Assembly have internal wiring for the Model 200 switch pack sockets. Do not use terminal blocks on PDA #3 as power terminals for cabinet devices. Do not furnish cabinet with "Input Panels" described in section 6.4.7.1 of the TSCES. Do furnish cabinet with "Service Panels" as described in section 6.4.7.1 of the TSCES and as depicted on drawing TSCES-9 in the TSCES. Use service panel #2.

Furnish terminal blocks for power for cabinet CCTV and communications devices as needed to accommodate the number of devices in the cabinet.

Do not furnish cabinets with C1, C5, or C6 harness, input file, output file, monitor units, model 208 unit, model 430 unit, or switch packs.

Furnish all conduits, shelving, mounting adapters, and other equipment as necessary to route cabling, mount equipment, and terminate conduit in equipment cabinet.

33.2. MATERIAL

A. Shelf Drawer

Provide a pull out, hinged-top drawer, having sliding tracks, with lockout and quick disconnect feature, such as a Vent-Rak Retractable Writing Shelf, #D-4090-13 or equivalent in the equipment cabinet. Furnish a pullout drawer that extends a minimum of 14 inches that is capable of being lifted to gain access to the interior of the drawer. Minimum interior dimensions of the drawer are to be 1 inch high, 13 inches deep, and 16 inches wide. Provide drawers capable of supporting a 40-pound device or component when fully extended.

B. Cabinet Light

Each cabinet must include two (2) fluorescent lighting fixtures (one front, one back) mounted horizontally inside the top portion of the cabinet. The fixtures must include a cool white lamp and must be operated by normal power factor UL-listed ballast. A door-actuated switch must be installed to turn on the applicable cabinet light when the front door or back door is opened. The lights must be mounted not to interfere with the upper door stay.

C. Surge Protection for System Equipment

Each cabinet must be provided with devices to protect the CCTV and communications equipment from electrical surges and over voltages as described below.

1. Main AC Power Input

Each cabinet must be provided with a hybrid-type, power line surge protection device mounted inside the power distribution assembly. The protector must be installed between the applied line voltage and earth ground. The surge protector must be capable of reducing the effect of lighting transient voltages applied to the AC line. The protector must be mounted inside the Power Distribution Assembly housing facing the rear of the cabinet. The protector must include the following features and functions:

- Maximum AC line voltage: 140 VAC.
- Twenty pulses of peak current, each of which must rise in 8 microseconds and fall in 20 microseconds to ½ the peak: 20000 Amperes.
- The protector must be provided with the following terminals:
 - Main Line (AC Line first stage terminal).
 - Main Neutral (AC Neutral input terminal).
 - Equipment Line Out (AC line second state output terminal, 19 amps).
 - Equipment Neutral Out (Neutral terminal to protected equipment).
 - GND (Earth connection).
- The Main AC line in and the Equipment Line out terminals must be separated by a 200 Microhenry (minimum) inductor rated to handle 10 AMP AC Service.
- The first stage clamp must be between Main Line and Ground terminals.
- The second stage clamp must be between Equipment Line Out and Equipment Neutral.
- The protector for the first and second stage clamp must have an MOV or similar solid-state device rated at 20 KA and must be of a completely solid-state design (i.e., no gas discharge tubes allowed).
- The Main Neutral and Equipment Neutral Out must be connected together internally and must have an MOV similar solid-state device or gas discharge tube rated at 20 KA between Main Neutral and Ground terminals.
- Peak Clamp Voltage: 350 volts at 20 KA. (Voltage measured between Equipment Line Out and Equipment Neutral Out terminals. Current applied between Main Line and Ground Terminals with Ground and Main Neutral terminals externally tied together).
- Voltage must never exceed 350 volts.
- The Protector must be epoxy-encapsulated in a flame-retardant material.
- Continuous service current: 10 Amps at 120 VAC RMS.
- The Equipment Line Out must provide power to cabinet CCTV and communications equipment and to the 24V power supply.

2. Ground Bus

Provide a neutral bus that is not connected to the earth ground or the logic ground anywhere within the cabinet. Ensure that the earth ground bus and the neutral ground bus each have ten

compression type terminals, each of which can accommodate wires ranging from number 14 through number 4 AWG.

33.3. CONSTRUCTION METHODS

Install base mounted cabinets as shown on the Plans. Refer to Section 1750 - Signal Cabinet Foundations of the Standard Specifications for installation requirements for the foundations.

Install all conduits, condulets, and attachments to equipment cabinets in a manner that preserves the minimum bending radius of cables and creates water proof connections and seals.

33.4. MEASUREMENT AND PAYMENT

Ethernet hub cabinet will be measured and paid as the actual number of cabinets furnished, installed and accepted.

No payment will be made for the cabling, connectors, cabinet attachment assemblies, conduit, condulets, risers, grounding equipment, surge protectors, or any other equipment or labor required to install the field equipment cabinet and integrate the cabinets with the communications equipment.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| Ethernet Hub Cabinet..... | Each |

34. LOCAL AREA NETWORK EQUIPMENT

34.1. DESCRIPTION

Furnish, install, configure, and test a 10 Gigabit Ethernet local area network (LAN). Furnish LAN that interconnects field devices including signal controllers and CCTV cameras with central hardware including computer workstations, server computers, and CCTV central equipment. Furnish LAN connections as shown on the block diagram.

34.2. MATERIAL

A. General

Furnish equipment for the LAN that complies with IEEE standard 802. Furnish Ethernet Switches of all types that are fully compatible and interoperable with the network performance management software and network hardware operating system software.

Furnish Ethernet Switches of all types that comply with the following electrical safety requirements: UL60950 or CSA C22.2 No. 60950 (safety requirements for IT equipment) and FCC Part15 Class A for EMI emissions.

For installations routing cables inside buildings, utilize existing cable raceways, electrical boxes, and metallic conduit where feasible. Where called for in the Plans, install new thin-walled EMT conduit that complies with the NEC and EIA/TIA Standard 569 and commercial building standards for telecommunications pathways.

B. Network Performance Management Software

Furnish network performance management and remote monitoring (RMON) software. Furnish the license(s) and additional copies of the software to allow it to be installed on all workstations (up to 10) designated by the Engineer.

Furnish software capable of monitoring all nodes and utilized ports on the enterprise. Furnish software capable of 50% expansion in the number of nodes and ports managed over the number of nodes and ports present and utilized at the final acceptance of the project.

The software shall use a GUI to configure, manage, and monitor the local network. At a minimum, the software shall provide the following functions and features:

- SNMP based
- Full management of network firewall
- Support SSH
- Utilize a GUI Web/browser style interface
- Provide a schematic display of the entire network enterprise that may be drilled down to the port level or panned out to the System level
- Provide Inventory tracking
- Provide bandwidth monitoring

- Provide SMTP support
- Provide auto alerting
- Monitor QOS
- Support management VOIP
- Support NETFLOW
- Support Wireless network management
- Receive SYSlog messages
- Generate usage/error reports
- Be capable of “pushing” upgrades to network gear via TFTP
- Detect switch failures
- Detect router failures
- Detect cable failures
- Provide network performance information
- Support the monitoring of cabinet and equipment temperature alarms via use of SNMP traps.
- Provide switch configuration backup capabilities via TFTP
- Provide configuration change tracking capabilities

C. SFP Modules

All SFP modules for Ethernet equipment furnished under this Project shall be rated to transmit and receive Ethernet data for the distance required and shall be compatible with the corresponding SFP module it is mated with.

The Contractor shall be responsible for verifying the distance between mated SFP modules and providing the correct type. Based on calculations from the proposed fiber optic network design, LX type modules may be acceptable for most links except for the following that may require ZX type modules:

- 05-1212 to TCC
- 05-0254 to TCC
- 05-1008 to Hub A
- 05-0108 to Signal Shop
- 05-1117 to Signal Shop
- 05-1379 to TCC
- 05-1083 to TCC
- 05-0998 to Hub B
- 05-0402 to Hub C

- 05-0456 to Signal Shop
- 05-1374 to Signal Shop
- 05-0853 to TCC
- D-0982 to Signal Shop
- D-0253 to Hub C
- 05-0346 to Hub C
- 05-1162 to Hub C
- Hub A to TCC
- Hub B to TCC
- Hub C to TCC
- Hub A to Signal Shop
- Hub B to Signal Shop
- Hub C to Signal Shop
- Signal Shop to TCC
- Signal Shop to STOC
- TCC to STOC
- TCC to EOC

D. Field Ethernet Switch

Furnish Field Ethernet switches fabricated for use in field equipment cabinets that are ruggedized to meet or exceed NEMA TS-2 requirements for temperature, shock, humidity, and vibration.

Furnish Field Ethernet Switches that are DIN rail mounted and come equipped with hardware to permit mounting in an EIA 19" equipment rack.

Furnish Field Ethernet Switches that weigh no more than 15 lbs. and are no more than 250 cubic inches in volume.

Furnish Field Ethernet Switches with the following minimum characteristics and features:

- Eight (8) 10BASE-T/100BASE-TX ports:
- Minimum of two (2) 1000 BaseX Optical uplink ports that utilize small form-factor pluggable (SFP) connectors.
- Furnish SFP modules that are rated to transmit and receive Ethernet data for the distance required. Use SFP modules that are compatible with the SFP module it is mated with.
- Furnish SFP modules rated for use with the new optical cable installed under this project.
- Furnish SFP modules with LC connectors.
- SFP modules shall be considered incidental to the field Ethernet switch.
- Management console port

Furnish Field Ethernet switches with the following features:

- 10/100BaseTX ports:
 - RJ45 connectors
 - Cable type: Category 5e, unshielded twisted pair

- Segment Length: 100m
- Auto-negotiation support (10/100Mbps)
- Auto MDIX crossover capability
- Full Duplex operation (IEEE 802.3x)
- TVS (transient voltage suppression) between Line +/-, Line +/-ground, and Line - ground to protect the circuitry

Furnish Field Ethernet switches with the following networking requirements:

- The switch shall support automatic address learning of up to 8192 MAC addresses.
- The switch shall support the following advanced layer 2 functions:
 - IEEE 802.1Q VLAN, with support for up to 4096 VLANs
 - IEEE 802.1p priority queuing
 - IEEE 802.1w rapid spanning tree
 - IEEE 802.1s multiple spanning tree
 - IEEE802.1AD link aggregation
 - IEEE 802.3x flow control
 - IGMPv2 with 256 IGMP groups
 - Port Rate Limiting
 - Configuration via test file which can be modified through standard text editor
 - Forwarding/filtering rate shall be 14,880 packets per second (PPS) for 10Mps, 148,800 for 100Mps, 1,488,000 for 1000Mps
 - DHCP Option 82

Furnish Field Ethernet switches with the following network management functionality requirements:

- SNMPv2, SNMPv3
- RMON
- GVRP
- Port Mirroring
- 802.1x port security
- Radius Server
- TACACS+ Server
- SSL – Secure Socket Layer
- SSH – Secure Shell
- TFTP

- Network Time Protocol (NTP)
- Simple Network Time Protocol (SNTP)
- Management via web or Telnet

E. Core Ethernet Switch

Furnish Core Ethernet Switch with the following minimum characteristics and features:

- L3 core modular, high-availability, switch equipped with redundant fans, power supplies, and support for redundant supervisor/route processor engines, or approved equivalent functionality.
- A minimum of four (4) slots for switch/routing processor modules, but at least one spare slot shall remain after configuring required ports/interfaces herein.
- The following minimum connectors:
 - Minimum of twelve (12) 10,000 BASE-X SFP-based ports with LC fiber connectors (single-mode).
 - Minimum of twenty-four (24) 1000 BASE-X SFP-based ports with LC fiber connectors (single-mode).
 - LC fiber connectors (single-mode) as needed to meet distance requirements at Core Switch and to be compatible with matched Hub Switches to support the distances shown in the Plans for switches connected to the Core switches. Attenuators will be furnished if required to service link without saturating receiving optics.
 - Fiber jumper cables with appropriate connectors to connect with switch and adjacent drop cable connectors and/or other switches.
 - Ethernet management port: RJ-45 connectors
 - Management console port: RJ-45-to-DB9 cable for PC connections
 - Minimum of twenty-four (24) 10/100/1000 Base-TX copper RJ-45 connectors
- Dynamic Host Configuration Protocol (DHCP)
- Automatic QoS (AutoQoS)
- Autonegotiation on all ports for auto selection of speed and duplexing modes.
- Link Aggregation Control Protocol (LACP)
- Automatic media-dependent interface crossover (MDIX)
- Switching Capacity per line card 300 Gbps
- 256 MB DRAM or greater
- 128 MB FLASH or greater

- 1000 VLANs
- 4000 VLAN IDs
- 1000 Switched Virtual Interfaces (SVIs)
- 9216 Byte Jumbo Frames or greater
- 100 Mpps Forwarding Rate or greater
- Support 1000 IGMP groups and multicast routes
- Support automatic address learning of up to 12,000 MAC addresses
- Security:
 - DHCP Snooping
 - Dynamic ARP Inspection (DAI)
 - Secure Shell (SSH) Protocol, EAP, and Simple Network Management Protocol Version 3 (SNMPv3), Network Time Protocol Version 3 (NTPv3)
 - Port Mirroring
 - TACACS+ and RADIUS authentication
 - MAC Address Notification
 - Port Security
 - Bridge protocol data unit (BPDU) protection and filtering
 - Root Guard
 - IGMP snooping
 - Dynamic VLAN assignment
- Standards: Supply a L3 Ethernet switch that meets or exceeds the following standards:
 - IEEE 802.1s Multiple Spanning Tree Protocol (64 regions)
 - IEEE 802.1w Rapid Reconfiguration Spanning Tree Protocol
 - IEEE 802.1x
 - IEEE 802.3ad
 - IEEE 802.3af
 - IEEE 802.3x full duplex on 10BASE-T, 100BASE-TX, and 1000BASE-T ports
 - IEEE 802.1D Spanning Tree Protocol
 - IEEE 802.1p CoS Prioritization

- IEEE 802.1Q VLAN
- IEEE 802.3 10BASE-T specification
- IEEE 802.3u 100BASE-TX specification
- IEEE 802.3ab 1000BASE-T specification
- IEEE 802.3z 1000BASE-X specification
- An IP gateway redundancy protocol such as virtual router redundancy protocol (VRRP – RFC 2338), hot-standby router protocol (HSRP - proprietary) or gateway load balancing protocol (GLBP - proprietary), or an approved equal will be used to provide a redundant IP gateway in the event of a primary gateway failure.
- OSPFv2 and v3: RFC 2328 for IPv4 and RFC 5340 for IPv6
- The following Indications:
 - Per-port status LEDs: link integrity, disabled, activity, speed, and full-duplex indications
 - System-status LEDs: system, power supplies, fans, and bandwidth utilization indications
- Environmental Requirements:
 - Operating temperature: 0°C to 40°C minimum range
 - Relative humidity operating: 5 to 90% (non-condensing)
- Mean Time Between Failures of greater than 80,000 hours
- Power Supply
 - Rated to handle input power of 115 VAC/60Hz ($\pm 10\%$), unless otherwise approved by the Engineer
 - Hot-swappable redundant modules
- Physical Requirements
 - EIA standard rack mounting in an IT equipment cabinet
 - No larger than 10 RU
- Safety Requirements
 - FCC Part 15 Class A for EMI emissions

F. Hub Ethernet Switch

Furnish Hub Ethernet Switch that meets the requirements above for the Core Ethernet Switch with the following exceptions:

- Environmentally hardened for use in the hub cabinets without air-conditioning or fans
- The following minimum connectors:
 - Minimum of two (2) 10,000 BASE-X SFP-based ports with LC fiber connectors (single-mode).
 - Minimum of twenty-four (24) 1000 BASE-X SFP-based ports with LC fiber connectors (single-mode).

Furnish Hub Ethernet Switch that is fully compatible with the Core Ethernet Switch and from the same manufacturer.

G. Network Ethernet Switch

Furnish Network Ethernet Switch that meets the requirements above for the Core Ethernet Switch with the following exceptions:

- The following minimum connectors:
 - Minimum of two (2) 10,000 BASE-X SFP-based ports with LC fiber connectors (single-mode).
 - Minimum of twelve (12) 10/100/1000 Base-TX copper RJ-45 connectors

Furnish Network Ethernet Switch that is fully compatible with the Core Ethernet Switch and from the same manufacturer.

H. Wireless Access Point

Furnish a wireless access point for the local area network. The access point shall allow for the laptop computers being furnished under this Project to connect to the network and have all functionality as if a wired connection was present.

Furnish wireless access point from the same manufacturer as the core ethernet switch and that is fully compatible with the core ethernet switch. Access point shall have the following minimum functionality:

- Networking: support for IEEE 802.11a, 802.11b/g, 802.11n, 802.11ac
- Radios: dual 2.4 and 5 GHz with integrated antennas
- Authentication and Security: Advanced Encryption Standard (AES) for Wi-Fi Protected Access 2 (WPA2)
- Network port: one RJ-45 10/100/1000 auto-detection port
- Management port: one RJ-45
- Maximum clients: 200 total for all frequencies
- Power: PoE 802.3af including all required power injectors
- Mounting: wall or ceiling mounting accessories

I. VPN Firewall

Furnish network firewall and virtual private network (VPN) server integrated in a single unit. Furnish unit with the following minimum features:

- Integrated bandwidth management functionality
- Integrated intrusion detection functionality
- Four (4) Fast Ethernet (10/100 Mbps) ports
- One (1) serial com port
- Up to 60 Mbps of firewall throughput
- 3 Mbps of Triple Data Encryption Standard (3DES) VPN throughput
- 4.5 Mbps of Advanced Encryption Standard-128 (AES) VPN throughput
- Diagnostic LEDs on front of unit showing states for power, status, and LAN at a minimum

J. Cable

Furnish coaxial, Category 6 network cable, RS-232, monitor cabling, and all other cabling in the lengths required to interconnect devices as called for in the plans, specifications, and manufacturers requirements. Furnish quality and grade of cable capable of being operable at up to twice the distance installed on this project. Furnish cabling meeting all manufacturers' requirements and all applicable standards for performance and safety.

34.3. CONSTRUCTION METHODS**A. General**

Furnish media access control (MAC) addresses for all equipment utilized as part of this project. Affix MAC Address label to each device utilized. Furnish IP addresses for all equipment utilized as part of this project. Affix final IP address each device utilized. Use labels that do not smear or fade.

In field equipment cabinets, fully integrate new Ethernet switches with the fiber optic interconnect centers. Integrate all field equipment as call for.

Fully integrate LAN to accomplish local device failover and fault tolerance.

Fully integrate LAN equipment to provide virus protection, user authentication, and security functions to prevent unauthorized users and data from entering the LAN.

B. Requirements Definition Document

Prior to commencing work, the Contractor shall request from the Engineer a copy of the "IP/Ethernet Communications Plan Document" (prepared by Kimley-Horn and dated February 2018) as a reference to develop a Requirements Definition Document (RDD) that will form the basis for the overall network architecture and design. The RDD shall include:

- Text describing the proposed implementation of the access, distribution and core layers for the network as described in the Plans and these Project Special Provisions

- Table of IP addresses to be assigned to each device within each node based on the IP scheme in the “IP/Ethernet Communications Plan Document”

The RDD shall be prepared and signed by a qualified networking professional (minimum CCNA or a manufacturer-approved equivalent based on the approved hardware vendor) and will be approved by the Engineer. The Qualified network professional will be present during the installation and testing of the local area network as well as during system testing.

C. LAN Integration

Fully integrate field, core, and network switches to form a complete local area network for communications between the TCC, fiber termination point, and each field device.

Fully integrate switches and firewall with computer and central system hardware to form a complete local area network that allows users from the TCC as shown on the block diagram in the Plans to access applications on application servers. Fully integrate network to allow the notebook computer users to be able to connect to the network via the LAN port on the notebook computer using a network cable.

Fully integrate LAN equipment to provide virus protection, user authentication, and security functions to prevent unauthorized users and data from entering the signal system LAN.

All cables for each piece of hardware installed shall be clearly labeled, using a label convention approved by the Engineer. All cabling shall be manufacturer assembled and without any adapters, unless otherwise approved by the Engineer.

D. Network Performance Management Software

Install and fully integrate the network performance management and remote monitoring software on all workstations being integrated with new Core Ethernet Switches in the Signal Shop and TCC.

E. Field Ethernet Switch

Prior to installation of any field Ethernet switches, the Engineer shall approve the Contractor’s desired mounting method and mounting location of the switch in the signal cabinet or CCTV cabinet. Should the Contractor need to modify the approved mounting method and location at a cabinet, notify the Engineer prior to installation for approval of the alternate mounting method or location.

Install and integrate all field Ethernet switches at field locations as depicted in the diagrams and tables and called for in these Project Special Provisions. Integrate with signal controller, conflict monitor, CCTV camera (if present), and existing fiber optic communications.

Furnish SMFO jumpers that are a minimum of 3 feet in length with the appropriate type of factory assembled connectors on each end. Ensure that SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

Provide inline surge protection for all Ethernet connections in field cabinets.

F. Core Ethernet Switch

Install Core Ethernet Switches in the Signal Shop and TCC. Integrate the core Ethernet switch with the new fiber optic cable terminations, using new jumper cables to establish the communications architecture and topology. Route cables in existing overhead raceways.

Fully configure switch with performance monitoring software and operating system software/firmware. Furnish SMFO jumpers with the appropriate type of factory assembled connectors on each end. Ensure that SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

Configure and test all Ethernet equipment prior to installation.

G. Hub Ethernet Switch

Install Hub Ethernet Switches at locations shown in the Plans. Integrate the Hub Ethernet Switch with the new fiber optic cable terminations, using new jumper cables to establish the communications architecture and topology.

Contractor shall integrate the 10 Gigabit Ethernet ports such that there is one connection to the TCC and one connection to the Signal Shop as shown in the Splice Details.

Fully configure switch with performance monitoring software and operating system software/firmware. Furnish SMFO jumpers with the appropriate type of factory assembled connectors on each end. Ensure that SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

Configure and test all Ethernet equipment prior to installation.

H. Network Ethernet Switch

Install Network Ethernet Switches at locations shown in the Plans. Integrate the Network Ethernet Switch with the new or existing fiber optic cable terminations, using new jumper cables to establish the communications architecture and topology.

Fully configure switch with performance monitoring software and operating system software/firmware. Furnish SMFO jumpers with the appropriate type of factory assembled connectors on each end. Ensure that SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

Configure and test all Ethernet equipment prior to installation.

I. Cellular Modem and Antenna

Install a Department-furnished cellular telephone modem for ethernet communications to remote signal controllers and CCTV cameras at locations shown in the Plans. Install the antenna on the cabinet. Connect the modem power supply to an available receptacle inside the signal cabinet. Connect the modem to the ethernet switch using appropriate cables.

Request cellular telephone modems and antennas from the Regional ITS Engineer a minimum of 8 weeks in advance of need.

J. Wireless Access Point

Install a wireless access point at the Signal Shop as shown in the Plans. Integrate the access point with the Core Ethernet Switch and network performance monitoring software.

K. VPN Firewall

Install one (1) VPN firewall switch at the Signal Shop. Integrate with the core Ethernet switch to allow only authorized remote users to access the signal system LAN. Install VPN software as required on all laptop computers provided under this project.

L. Public Internet Service

Furnish a new public internet connection at the Signal Shop from a local third-party internet provider that identifies the City of Durham as the owner. Coordinate with the Engineer and provider on proper termination point in Signal Shop.

Furnish internet modem that is compatible with the provided connection, VPN Firewall, and remote access server being provided under this project.

Integrate the internet connection to serve as the gateway from the Internet for remote users that are physically separate from the local area network.

34.4. MEASUREMENT AND PAYMENT

(____) *Ethernet Switch* will be measured and paid as the actual number furnished, installed, integrated, and accepted. All SFP modules, optics, cabling, attenuators, configuration, and testing or other labor or materials required to install and integrate the Ethernet Switch will be considered incidental and not be paid for separately.

Install Cellular Modem and Antenna will be measure and paid as the actual number of Department-furnished modems and antennas installed, integrated, and accepted. No separate payment will be made for any required cables or for any hardware and fasteners required to mount the antenna.

Wireless Access Point will be measure and paid as the actual number furnished, installed, integrated, and accepted.

VPN Firewall will be measure and paid as the actual number furnished, installed, integrated, and accepted.

Public Internet Service will be measure and paid as the actual number of service connections furnished, installed, integrated, and accepted.

Network Performance Management Software will be paid at the contract lump sum price. This shall include furnishing, installing, configuring, and testing the software.

LAN Integration will be measured and paid as a lump sum. LAN integration includes configuration and integration of all LAN hardware, firmware, software, and VPN firewall to complete the LAN architecture, and submittal of the RDD. All cabling, hardware, patch panels, accessories, labor, and materials required to make the unit function as part of this project shall be considered incidental and not paid for separately. Partial payments for this item will be made on the following schedule: 20% upon completion and acceptance of the RDD; 20% upon installation, integration and acceptance of LAN equipment, 40% upon installation, integration and acceptance of

LAN equipment at Routing Switch locations, and 20% upon installation, integration and acceptance of the entire project furnishing of and acceptance of network as-built documentation.

No separate payment will be made for cable routing within building as this will be considered incidental to equipment installation and integration.

No measurement will be made for the removal of existing transceivers or communications equipment as part of signal cabinet or CCTV cabinet replacements.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Field Ethernet Switch..... | Each |
| Core Ethernet Switch | Each |
| Hub Ethernet Switch | Each |
| Network Ethernet Switch..... | Each |
| Install Cellular Modem and Antenna..... | Each |
| Wireless Access Point..... | Each |
| VPN Firewall | Each |
| Public Internet Service | Each |
| Network Performance Management Software..... | Lump Sum |
| LAN Integration..... | Lump Sum |

35. SYSTEM SOFTWARE

35.1. DESCRIPTION

Furnish the following new software:

- Enterprise Video Management System Software

Install the following software as furnished by the Engineer.

- Distributed Processing System Software (latest version of NCDOT's state-licensed Econolite Centrac software package).
- Local Controller Software (latest IP version of NCDOT's state-licensed Econolite ASC/3-2070 software package). The Engineer will furnish the latest version of the software at the time of burn-in. Request the software from the Engineer a minimum of five business days prior to burn-in.

The Contractor shall be responsible for the development of and integration of all system graphics (and associated system devices) described in the following specifications.

35.2. MATERIAL

A. General

Provide a perpetual, irrevocable software license to the Department and the City of Durham that gives them the right to copy and use all software furnished or upgraded with this project at any facility within the signal system limits.

Furnish software that may be used at the TCC and Signal Shop, or at any other offices in the State of North Carolina that the City and State, or their authorized agent, may establish for the purpose of traffic signal monitoring and control of the Durham Signal System.

Provide any third-party software licenses to the Department and the City of Durham for software that may be used. Example: report-configuring, diagnostic, or monitoring software.

B. Distributed Processing System Software

1. General

All changes to the system, including adding new controllers, configuring communications, modifying maps and intersection displays, etc., shall be performed through the system graphical user interface or by updating files in the system software folders. The use of initialization files and external editors shall not be required.

2. NTCIP Standards

The software shall use NTCIP Standards 1201 and 1202. The central to field device communications shall utilize NTCIP 1202.

3. Database Preparation

The Department and City will perform all database conversions necessary for the new local controller software. Request each database from the respective signal owner at least seven (7) calendar days prior to installation in the signal controller.

Complete all data entry necessary to implement the operation of the system software.

The Engineer (by way of the City or Division 5 Traffic Services) will furnish intersection timing information and coordination parameters (cycle, split, offset). Any custom intersection displays will also be provided by the Department or City. Otherwise, default intersection timing data and standard intersection maps will be utilized when configuring intersections onto the system. Program all system detectors shown in the plans. Coordinate with the City to provide setup, naming/labeling, logging and any features required for the operation of all system detectors.

TOD/DOW/DOY plans, alarms and other information for the operation of the signal system shall be entered by the contractor.

4. System Graphics

All graphics for system maps, control section maps, and intersection displays shall be submitted to the Engineer for approval before being integrated with the software.

5. Intersection Display

The Contractor shall be responsible for the development of and integration of all system graphics (and associated system devices) described in the following specifications.

The intersection graphics shall display both static and dynamic information. The static information shall include the intersection name, geometrics of the intersection (including a graphic display of the number of lanes and their associated use), adjacent land use, the location of the controller, and a layout of the intersection with the intersections signal locations and number of heads. The dynamic information to be displayed shall include:

- All vehicle signal indications for each active phase, and up to sixteen (16) overlaps with red, yellow, and green indicators as well as flashing yellow indicators
- All pedestrian signal indications, for up to sixteen (16) active phases. WALK, flashing DONT WALK, steady DONT WALK, and countdown shall be shown
- Vehicle and pedestrian detector actuations for each active phase
- Cycle timer (central and local clocks)
- Timing plan in effect (with cycle length and offset)
- Operational status of the intersection shall include the following, but not be limited to:
 - Timing in effect (in coordination, TOD, TR, etc.)
 - Status mode (transition, free operation, flash, pre-emption (railroad, emergency vehicle, or transit)
 - Control mode (manual control, local control, failed, etc.)

The intersection display shall accommodate all phasing of the state-licensed local controller software.

The intersection display shall be capable of being dynamically sized by a workstation user. Resizing the window shall not reduce the amount of data displayed on a workstation monitor.

C. Enterprise Video Management System Software

1. General

Furnish and install new video management system (VMS) software to enable:

- Pan, tilt, and zoom control of all CCTV units in the city of Durham traffic control video enterprise; existing and those installed under this Project.
- The management and assignment of H.264 and MJPEG IP video streams from field CCTV units and remote VMS' to display devices in the City of Durham VMS enterprise
- The ability to scale to a up to 300 input video streams, and 100 output client views with no additional software
- The management of user access rights as assigned by a system administrator. User rights shall be able to be assign view-only; pan, tilt, zoom; on a camera by camera basis. Following, the ability to assign CCTV video streams to video output devices shall also be assignable by device and by user,
- The ability to allow remote users outside of the City of Durham enterprise including NCDOT, and adjacent municipalities to obtain remote view only and full CCTV control as assigned by the video management system administrative as permitted via the network environment.

Furnish VMS software that operates in a client/server environment.

Furnish and install VMS software on workstations in the TCC, Signal Shop, County Courthouse, EOC, DTV8, and Police HQ.

Furnish software that is ONVIF compliant.

Integrate software to maintain ability to share video view and control with the STOC in Raleigh, NC.

Provide VMS software to manage video outputs that provides the following features:

- Windows-based,
- Wall configuration,
- Manage and select display sources (CCTV, workstations, TV tuner, and applications),
- Share content to remote display outside the TCC,
- System management (user rights, database configuration, devices, user authentication),
- Wall control,
- Establish user account,
- Manage user privileges and access rights to devices and content

2. Video Output Display Management

Interface and integrate the following remote video access points that will use existing video monitors:

- Signal Shop – 4 Existing Video Displays
- County Courthouse – 1 Existing Video Display
- EOC – 1 Existing Display
- Police HQ – 6 Existing Displays

- DTV8 – Multiple Outputs for Display and Broadcast

Interface and integrate the following remote video access points that will use new video monitors:

- TCC –New Video Wall System
- 4th Floor City Hall Lobby – 1 New Video Display

The video wall management software shall be compatible with the latest Windows operating system at the time of installation.

3. Security

Comply with Federal Information Processing Standards (FIPS) encryption as follows:

- 160-bit SHA1 has encryption for passwords
- 192-bit TripleDES encryption for communications with devices
- 256-bit encryption with client agent applications
- Strong password protection for database files
- Strong user password enforcement
- Role based security policies
- Real-time logging of user activities

4. System Configuration

Configure the software with the following components:

- System software server (1),
- Video servers (1),
- Video wall monitors,
- Ethernet communications network in the building, and
- Ethernet communications over fiber-optic cable to field devices.

The software shall allow users to create windows and layouts of video wall content. The software shall permit the user to add, resize, move or delete windows. The software shall permit to share content to more than one display.

The software shall allow users with appropriate access rights, to manage content to remote devices.

Provide full KVM control of video wall servers.

The software shall obtain content from:

- IP based HD CCTV cameras (H.264 encoding at 30 frames per second)
- Cable TV tuner
- Workstation screen content
- ITS applications on the network

- Internet based content

The software shall consist of the following components:

- Control Software: Client-based software based by the user to control/manage/ configure the video wall management system
- Client Capture Software: Client workstation, captures content from client workstations, display screens, and application windows for sharing anywhere on the network,
- Display Services: Server software to drive any shared display

35.3. CONSTRUCTION METHODS

A. General

Fully integrate the distributed processing signal system software on the Distributed Processing Signal System Server and Communication Server called for in these Project Special Provisions. Fully integrate the distributed processing signal system software on each workstation in the TCC and Signal Shop.

Fully integrate the CCTV central software on the Video Management System Server called for in these Project Special Provisions. Fully integrate the CCTV software on each workstation in the TCC and Signal Shop

Register all software products furnished with this project with the software supplier. The City of Durham and the NCDOT shall be identified as the registered owner of all software.

B. Local Controller Software

Install NCDOT-furnished local controller software on all new controllers. Use the latest version available at the time of installation as directed by the Engineer. Request local controller software from Engineer a minimum of one (1) week prior to use of software during burn-in period.

The controller firmware Econolite ASC/3 controller shall be compatible on all variants of Safetran 2070-LX configurations as well as the following other controller manufacturers' configurations:

| <u>Component</u> | <u>Manufacturer</u> | |
|--------------------|-------------------------------------|--|
| | <u>McCain</u> | <u>Intelight</u> |
| Field IO | M44021 Rev. B | 2070-2A Rev. H1 |
| Front Panel | M44017 Rev. A | 2070-3B Rev. E1 |
| Power Supply | M34020 Rev. A5 | 2070-4A 300101-0001 |
| 1C Host Card | M52803 Rev B | 2070-1C Rev. D2/D3* |
| 1C Engine Board | M52284 Rev A | 2070-1C Rev. G1 |
| 1C Linux Kernel | 2.6.22 | 3.14 |
| Installed Software | ATC Menu and No Traffic Application | App Manager and No Traffic Application |

The Contractor shall demonstrate porting and functionality of Econolite ASC/3 controller software on the controller vendors listed above. This demonstration will be required on all three configurations of controllers regardless of the manufacturer that is selected for the Project.

All controllers in the final Signal System shall have identical local software.

C. Distributed Processing System Software

Integrate the distributed processing traffic control applications software and all other software with the communications system and local controllers to provide a traffic signal system that provides the functionality required by these Project Special Provisions.

Load all parameters necessary to implement coordinated signal operations. The Engineer will furnish the timing parameters in standard traffic engineering format (cycle, split, and offset) prior to the initiation of the 60-day observation period. Make any modifications to the cycle, split, and offset information furnished by the Engineer that are necessary to implement the timing plans into the system database. The test period may not begin until the timing parameters have been loaded. The Engineer may, at his/her option, observe the loading of the timing plans.

As directed by the Engineer, make modifications to the coordinated signal timing parameters (cycle, split and offset) prior to system acceptance to improve system coordination and efficiency. The Engineer will furnish the parameters to be modified by the Contractor. Make these modifications at no additional cost. No timing plan changes will be required after the successful completion of the system operational test (as approved by the Engineer).

Prepare comprehensive, detailed graphic displays for the system display, for all control section displays, and for all intersection displays. Contractor shall install all displays and fully integrate with system software. **Submit all graphics to the Engineer for approval prior to the System Operational Test and prior to integration in the software.**

D. Enterprise Video Management System Software

1. General

Install new VMS Software on the City's workstations and laptops.

Configure administrative and user VLANs for the VMS servers in the TCC Ethernet core switch to enable video sharing.

The software shall allow remote users to view and control all CCTV cameras connected to the TCC through the Ethernet network and the CCTV Control GUI furnished as part of this software such that a user in the TCC, Signal Shop, County Courthouse, EOC, and Police HQ can switch, view, and control cameras.

The software shall allow remote users to view and switch CCTV cameras connected to the TCC through the Ethernet network and the CCTV Control GUI furnished as part of this software such that a user in the City Hall 4th floor lobby and DTV8 can switch and view cameras.

Install VMS software to display and map the CCTV devices from the network so that the CCTV video can be displayed on the video walls, monitors and workstations.

Interface and integrate the following remote video access points that will use existing video monitors:

- Signal Shop – 4 Existing Video Displays
- County Courthouse – 1 Existing Video Display
- EOC – 1 Existing Display
- Police HQ – 6 Existing Displays
- DTV8 – Multiple Outputs for Display and Broadcast

Interface and integrate the following remote video access points that will use new video monitors:

- TCC – New Video Wall System
- 4th Floor City Hall Lobby – 1 New Video Display

1. Configuration

Work with the City of Durham Traffic Engineer to configure the user rights for each employee authorized to access the video wall system. The user rights will address access to specific source and destination devices, and content.

Configure the client control software on each workstation for the user interfaces. Configure user interface for each user.

Configure the system to automatically backup configuration and database files.

35.4. MEASUREMENT AND PAYMENT

Signal System Software will be paid at the contract lump sum price. This shall include the upgrading, testing, and all materials, 3rd party software for reporting, equipment, labor, tools, storage, shipping, and incidentals necessary to upgrade the existing software, complete system integration, and provide a complete operating system. Partial payment for this item will be made as follows: 50% of the lump sum price upon upgrade and configuration of the software and 50% of the lump sum price upon successful completion of the Observation Period. No payment will be made for providing software license as required in these Project Special Provisions.

Enterprise Video Management System Software shall be measured and paid as a lump sum. This shall include furnishing, installing, and all materials, equipment, labor, tools, storage, shipping, and incidentals necessary to install software on the new video server, workstations, and video wall systems to provide a complete operating system

All other software and hardware otherwise required to accomplish the functionality required by the Project Special Provisions will not be paid for separately but will be considered incidental. No payment will be made for providing software license and source code as required in these Project Special Provisions.

No measurement will be made for the installation of the NCDOT-provided local controller software on new controllers, as this will be considered incidental to Controller with Cabinet pay item.

Testing will not be paid for separately but will be considered incidental to equipment installation.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Signal System Software | Lump Sum |
| Enterprise Video Management System Software | Lump Sum |

36. COMPUTER HARDWARE

36.1. DESCRIPTION

Furnish and install server computers and workstation computers at the Durham City Hall and Durham Signal Shop with all software and hardware to provide fully operational computing platforms and systems to accomplish the operational requirements of the computerized signal system.

Install and integrate all computer hardware as shown in the Block Diagram contained in the Plans.

The Contractor may, at their discretion and if approved by the Engineer and City of Durham, replace the individual servers installed with a virtual machine configuration where the processes of each server are allocated across a single or multiple servers.

36.2. MATERIAL

A. General

Furnish hardware that operates at 115 VAC \pm 10 percent at 60 Hz. Furnish hardware that operates in a +40 to +122 degree Fahrenheit environment at 20 to 80 percent relative humidity.

All workstations and servers shall be from the same manufacturer. Servers and workstations that use proprietary power supplies will not be accepted.

Furnish all software licenses, compact discs, manuals, and documentation for all software installed on computers furnished under this project.

For installations routing cables inside buildings, utilize existing cable raceways, electrical boxes, and metallic conduit where feasible.

B. Distributed Processing Signal System Server

Furnish Distributed Processing Signal System server (herein referred to as the "Signal System Server") to host the signal system central software on a client/server environment over the Durham Signal System LAN.

The server shall have the following minimum features:

- Processor: Dual CPUs, Intel Xeon E5-2640 or equivalent
- Memory: 16 GB
- RAID Configuration: RAID 5 (3-16 HDDs or SSDs), hot swappable
- RAID Controller: 1 GB NV Cache
- Hard Drives: 4 x 300 GB
- Network: Two 10/100/1000 network interface cards
- Optical Drive: Internal DVD+/-RW

- Rack mountable in standard EIA 19” equipment rack with a maximum height of 4 RU

The operating system for the Signal System Server shall be Microsoft Windows Server 2012 or newer. The release used shall be the latest revision available as recommended by the supplier of the system software.

The Signal System Server shall be furnished with all necessary software required to operate the signal system properly, which includes Microsoft® SQL Server 2012 R2 or other version compatible with the signal system software and approved by the Engineer, and all applicable licenses.

C. Distributed Processing Signal System Communications Server

Furnish a Distributed Processing Signal System Communications Server (herein referred to as the “Communications Server”). Furnish Communications Server that is equipped with all hardware and software required to meet all of the data communications requirements, including once-per-second polling of all traffic signal controllers.

The server shall have the following minimum features:

- Processor: Dual CPUs, Intel Xeon E5-2640 or equivalent
- Memory: 8 GB
- RAID Configuration: RAID 1 (two 100 GB HDDs)
- RAID Controller
- Hard Drive: 100 GB
- Network: Two 10/100/1000 network interface cards
- Optical Drive: Internal DVD+/-RW
- Rack mountable in standard EIA 19” equipment rack with a maximum height of 4 RU

The operating system for the Communications Server shall be Microsoft Windows Server 2012 or newer. The release used shall be the latest revision available as recommended by the supplier of the system software.

D. Enterprise Video Management System Server

Furnish Enterprise Video Management System Server (herein referred to as the “Video Management System Server”) to host the CCTV video system central software on a client/server environment over the Durham Signal System LAN.

The server shall have the following minimum features: The server shall have the following minimum features:

- Processor: 4th Generation Intel Core i7 4770 or latest equivalent
- Memory: 8 GB
- 64-bit processor

- 120 GB Solid State Drive
- GBE Network Interface Card
- NVIDIA QUATRO K 620 2GB Video Card
- Rack mountable in standard EIA 19" equipment rack with a maximum height of 4 RU

The operating system for the Signal System Server shall be Microsoft Windows Server 2012 or latest version. The release used shall be the latest revision available as recommended by the supplier of the system software.

E. Vehicle Preemption System Server

Furnish Vehicle Preemptions System server to host the Vehicle Preemption System central software on a client/server environment over the Durham Signal System LAN

Furnish server that has the same features as the Signal System Server.

F. Remote Access Server

Furnish Remote Access Server to host remote access software and allow up to eight simultaneous users to access all services on the LAN via Ethernet connection. Furnish minimum six client licenses of remote access software.

Furnish Remote Access Server with same features as the Signal System Server.

Furnish remote access server with remote access software with the following features:

- Support of up to 8 simultaneous users initially with expansion capability of up to 12 simultaneous users
- Provision of each user with a Windows desktop with access to all applications and services on the TCC LAN at their remote location. When logged into remote access server, upon providing username and password, remote user shall be provided with a Windows desktop on their remote computer.
- Client software that is fully functional on all currently supported versions of MS Windows (version Windows 7 and later)
- Allows remote user to access all drives on servers on the LAN and transfer files between their remote station and server on the LAN through windows file access methods such as Windows Explorer
- Supports remote user automatic reconnection if communication connection is lost
- Supports use of client remote access configuration by means of standard windows, menu driven interface.
- Shall support all services available over the LAN (including printers and servers)
- Shall require no more than 64 Mb of RAM to support each user
- Provide security and user authentication features and functionality

- Utilize Windows Remote Desktop functionality or approved equal.

Furnish server with all required operating system and third-party support software to fully operate remote access server.

G. Video Display Appliances

Furnish Video Display Appliances to enable display of IP video streams on remote video display units available on the network. Furnish Video Display Appliances with the following features:

- Operating System: Windows 10 Pro or latest version as recommended by VMS software vendor
- Processor: Intel Core i7-6700 3.40 GHz or equivalent
- Graphics Card: NVIDIA GeForce GTX 1060
- Display Output Ports: 2x HDMI; 1x Display Port, 1x DVI
- RAM: 8 GB
- Storage: 256 GB Solid State Drive
- Optical Drive: DVD Optical Drive
- Peripherals: 8x USB 3.0, 2x USB 2.0, 2x 3.5 mm Audio out jack, 1x PS/2 keyboard, 1x PS/2 mouse
- Rack mountable in standard EIA 19" equipment rack with a maximum height of 4 RU

H. Backup Storage Server

Furnish Backup Storage server to provide backup and restore functionality of the hard-drive(s) in the Signal System Server.

Furnish Backup Storage Server that has the same features as the Signal System Server.

I. Computer Workstations

Each microcomputer workstation shall be upgradeable and shall meet the following minimum requirements:

- Processor: Intel Xeon E5-1603
- Memory: 8 GB
- Hard Drive: 250 GB
- Network: 1 GB network interface card
- Video: 2.0 GB NVIDIA Quadro NVS 510, or equivalent, that can drive 4 video displays
- Optical Drive: Internal DVD+/-RW
- Provide dual (2) flat screen monitors and required video cables. Minimum monitor size shall be 20", 18.5" viewable with a 1,600 × 1,200 resolution

- Mini-Tower chassis
- Microsoft 2-button/scroll mouse
- Full function, 104 keyboard with separate numeric and cursor control keys
- Speakers
- A minimum of four (4) universal serial bus (USB) ports
- Stand-alone UPS unit, with a minimum
 - Surge protection and filtering
 - Battery capable of providing 6 minutes of backup time at full load
 - Three (3) NEMA 5-15R output connections (with battery backup)
 - Three (3) NEMA 5-15R output connections (with surge protection)

The operating system for the signal system workstation(s) shall be Microsoft Windows 7 Professional or newer. The release used shall be the latest revision available as recommended by the supplier of the system software. Install antivirus software.

The operating system shall provide for true multi-tasking and graphical user interface. It shall be possible for workstation users to run Windows-based programs in one or more windows while the traffic signal system applications software continues in full operation.

J. Laptop Computers

Furnish rugged and environmentally hardened laptop computers. Each laptop shall be upgradeable and shall meet the following minimum requirements:

- Certified for MIL-STD-810G, MIL-STD-461F, and IP65
- Processor clock speed 2.8 GHz,
- 16 GB of RAM,
- 13-inch XGA touchscreen display,
- 256 GB SSD storage,
- one internal 24X CD-RW/DVD-ROM drive,
- one RS-232 serial port, or provided adaptor that replicates an RS-232 serial connection using one of the other data ports
- two USB ports
- AC adapter/charger, and a car cigarette lighter adapter cable,
- fully charged battery capable of a minimum of 8 hours of continuous operation,
- one spare battery,

- sound card with built in speakers,
- full function keyboard,
- pointing device that is integral to the case (clip on devices will not be acceptable),
- one cable 10 feet long for connection to a controller port,
- one cable 10 feet long for connection to network port,
- 10/100/1000 Base TX (100 Mbps/1 Gbps Ethernet) with RJ-45 connector on board,
- IEEE 802.11g wireless network adapter card
- USB to Serial cable adapter
- Compatible docking station
- Stylus pen

The operating system for the laptop computers shall be Microsoft Windows 7 Professional or newer. The release used shall be the latest revision available as recommended by the supplier of the system software. Install antivirus software.

K. Surge Suppression Strips

All computer hardware and peripherals not connected to an Uninterruptible Power Supply (UPS) shall be connected to a surge suppression power strip. Provide surge suppression power strips equipped with an on-off switch, an indicator lamp, isolating filter banks, and a minimum of six (6) 120 VAC, 60 Hz outlets. At a minimum, the filter banks shall attenuate high frequency noise

L. Equipment Rack Cabinet

Furnish equipment cabinets with railings and sockets for mounting of EIA 19" mountable equipment. Furnish units with removable and adjustable shelves and pull out drawers capable of holding 1.5 times the heaviest component required to be placed on shelf or drawer (when fully extended). Furnish Rack cabinets that are modular with removable side panels with open front and back sections. Furnish racks with cable management and raceways to facilitate neat and orderly organization of all cables routed to equipment on the rack. Furnish rack cabinets with accessories to ensure cables are not kinked or pinched and that all minimum bend radii of cables are preserved. Furnish rack cabinet units that may be aggregated into single units of up to four bays wide. Furnish units made of quality, non-corrosive materials and non-peeling paint.

Furnish equipment rack cabinets for installation within buildings as shown in the Plans. Furnish units with ventilation fans audible no more than 46 dba at a distance of 4 feet from the unit. Furnish units with each bay a width of no more than 24" and a minimum of 84" of continuous useable rack space beginning no more than 6" above the floor.

M. Uninterruptible Power Supply

Furnish UPS units that are capable of detecting a power failure and providing back-up power to the listed components within twenty (20) milliseconds. The transition to the UPS source from primary power shall occur without loss of data or damage to the equipment being provided with back-up power.

Furnish UPS units that are sized such that each is capable of providing back-up power for the total load of all equipment connected to the UPS plus an additional load of twenty-five percent of the total load for at least thirty (30) minutes of operation. The UPS units shall be capable of interfacing with the Distributed System Software such that upon sensing a loss of power, a system shutdown can be initiated and completed within the specified UPS span of operation.

The UPS unit shall include:

- Commercial 115 VAC, 60 Hz power interconnection and power loss sensing and alarm report via the Distributed System Software
- Power protection and filtering
- Power conversion for battery charging
- Batteries to support thirty (30) minutes of operation with loss of power
- Battery status sensing and low battery alarm reporting via the System Software
- Battery charging and charge management
- Battery power conversion and filtering as necessary for interface compatibility with installed equipment

UPS units shall be connected to commercial power. The UPS units and power interconnect shall comply with article 645 of the National Electric Code (NEC).

36.3. CONSTRUCTION METHODS

A. General

Furnish and install the central hardware required to support the software functions called for in these Project Special Provisions.

Furnish and install the hardware as shown in the block diagram in the Plans.

Whenever possible, use existing cable raceways, ducts, raised floors, and drop ceilings to route cables.

All computer hardware called for in this section shall be installed, integrated, and in use within sixty (60) days of date of purchase. Provide receipt with purchase date to Engineer during hardware installation. Any hardware older than sixty (60) days may be integrated and put in use at the sole discretion of the Engineer.

All cables for each piece of hardware installed shall be clearly labeled, using a label convention approved by the Engineer. All cabling shall be manufacturer assembled and without any adapters, unless otherwise approved by the Engineer.

B. Distributed Processing Signal Server

Install distributed processing signal system server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch, and rack cabinet power source. Integrate with signal system communications server using direct serial, parallel, USB, or network connection. Fully

configure server to operate distributed system processing software. Integrate with backup storage server to support scheduled and on-demand backup of data.

C. Signal System Communications Server

Install signal system communications server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch, and rack cabinet power source. Fully configure server and ports to facilitate signal system communications.

D. Enterprise Video Management System Server

Install video server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch and rack cabinet power source.

E. Vehicle Preemption System Server

Install server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch and rack cabinet power source.

F. Remote Access Server

Install remote access server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch and rack cabinet power source.

Install and configure software with usernames, passwords, and Remote Access Windows desktop that allows client user gaining access to the LAN via the server, has complete access to all software applications on the LAN, available to a local user. Install all third-party software and drivers required to create fully functional remote access server.

G. Video Display Appliance

Install video display appliances at the following locations in the following quantities:

- County Courthouse – 1 Video Display Appliance
- EOC – 1 Video Display Appliance
- Police HQ – 3 Video Display Appliances
- 4th Floor City Hall Lobby – 1 Video Display Appliance
- DTV8 – 1 Video Display Appliance
- Signal Shop – 2 Video Display Appliances

H. Backup Storage Server

Install backup storage server into new equipment rack cabinet in the Signal Shop. Integrate with core Ethernet switch and rack cabinet power source.

Integrate with distributed processing signal server to support scheduled and on-demand backup of data.

I. Computer Workstations

Install two (2) computer workstations with dual monitors at the Durham TCC as shown in the Plans. Integrate with network Ethernet switch. Fully configure microcomputer workstation with all client software to operate all signal system subsystems including distributed processing signal

system and CCTV subsystem. Integrate one of the video card outputs of each workstation with the new video wall system.

Install two (2) computer workstations at the Signal Shop as shown in the Plans. Integrate with network Ethernet switch. Fully configure microcomputer workstation with all client software to operate all signal system subsystems including distributed processing signal system and CCTV subsystem. Integrate one of the video card outputs with the new LCD video monitor.

Install one (1) computer workstation at the County Courthouse, EOC, DTV8, and six (6) computer workstations at the Police HQ. Fully integrate workstations with the CCTV subsystem.

Configure Windows Remote Desktop on the TCC and Signal Shop workstations so that a user can remotely connect to each application server on the LAN and be presented with the same graphical user interface as if they were locally connected to the server.

J. Laptop Computers

Furnish seven (7) laptop computers for use by signal technicians at the Signal Shop. Integrate the laptops with the wireless access point to establish a connect to the signal system network.

K. Surge Suppression Strips

Furnish and install surge suppression power strips for all computer hardware and peripherals, video subsystem, local area network, and central communications equipment not connected to a UPS.

L. Rack Cabinets

Install new rack cabinets in the City Hall location as shown in the Plans. Install full rack cabinets such that access to both the front and back of cabinet is available. Route cabling in cabinets using raceways. Bolt the cabinets to the floor to prevent any rack from falling over if loaded in a top-heavy manner.

M. Uninterruptible Power Supply

Install uninterruptible power supply (UPS) units in the top of each new equipment rack cabinet to supply uninterrupted power in the event of a failure of primary power to supply 30 minutes of backup power for all devices that will ultimately populate the rack bay under this project. Integrate with equipment in rack bay. Configure UPS unit servicing the signal system server to provide the alarm notifications detailed above.

N. Computer Hardware Integration

Fully integrate computer hardware equipment to form complete and operational systems as called for in these Project Special Provisions and shown on the block diagram in the plans. Install and configure all central computer hardware at City Hall and Signal Shop to accomplish the functionality called for in these Project Special Provisions and hardware functionality required to support the computer software to be installed on to the computing hardware called for under this project. Integrate with LAN equipment and field equipment.

Prior to installing and configuring the computer hardware at each facility, develop a computer hardware architecture and system design document that shows the entire layout of the computer hardware systems and their interconnection. The function, description, and model number of each

computer hardware component will be shown in the document. The report will describe the network topology in text and using graphics.

36.4. MEASUREMENT AND PAYMENT

(____) *Server* will be measured and paid as the actual number furnished, installed, integrated, and accepted. For a virtual machine environment, the measurement and payment will be as the number of server instances integrated and accepted and the physical server(s) shall be incidental.

Computer Workstation will be measured and paid as the actual number furnished, installed, integrated, and accepted.

(____) *Video Display Appliance* will be measured and paid as the actual number furnished, installed, integrated, and accepted.

Rack Cabinet will be measured and paid as the actual number furnished, installed, integrated, and accepted. UPS units shall be considered incidental and shall not be paid for separately.

Computer Hardware Integration will be measured and paid as a lump sum price. This item shall include the installation, testing, and all materials, equipment, labor, tools, storage, shipping, and incidentals necessary to install and make fully operational the computer hardware equipment at the TCC.

All cabling, labeling, sockets, outlets, conduit, cable routing, or other accessories required to configure, integrate, and interconnect computer equipment shall be considered incidental and shall not be paid for separately. This shall include provision of the surge suppression power strips.

No measurement will be made for the removal of existing computer hardware or rack cabinets as needed for the installation and integration of new computer hardware.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Distributed Processing Signal System Server..... | Each |
| Signal System Communications Server..... | Each |
| Video Management System Server..... | Each |
| Vehicle Preemption System Server | Each |
| Remote Access Server | Each |
| Backup Storage Server..... | Each |
| Video Display Appliance | Each |
| Computer Workstation..... | Each |
| Laptop Computer | Each |
| Rack Cabinet..... | Each |
| Computer Hardware Integration | Lump Sum |

37. CCTV VIDEO MONITORS**37.1. DESCRIPTION**

Provide the central video hardware and/or software at the Durham TCC and Signal Shop necessary to control and monitor the closed-circuit television (CCTV) cameras installed at locations shown in the Plans.

37.2. MATERIAL**A. General**

All central video equipment shall operate at 115 VAC (+/- 10 percent) at 60 Hz (+/- 10 percent). The equipment shall operate in a +32 to +120 degree F environment at 20 to 80 percent relative humidity.

B. Video Wall System**1. General**

Furnish a new video wall for the TCC to replace the existing wall monitors. The video wall shall be a fully integrated system of monitors and hardware and/or software. The monitors shall be arranged in a matrix that is two (2) rows high by three (3) columns wide for a total of six (6) monitors.

2. Monitors

The monitors of the video wall shall meet the following minimum requirements:

- Size: 46" monitor/tile
- Active screen area: 40.1 inches by 22.5 inches
- Outer dimensions: 40.24 inches by 22.7 inches by 3.6 inches
- Technology: commercial grade direct view LCD
- Resolution: 1920x1080
- Aspect ratio: 16:9
- Contrast ratio: 3500:1
- Response time (white to black): 8 ms
- Refresh rate: 60 Hz
- Full viewing angle: 178 degrees (vertical and horizontal)
- Luminance: 2 brightness levels available; 500-800 cd/m²

- Backlight technology: LED
- Backlight life: at 1/2 brightness, 50,000 hrs
- Acoustic noise: fanless operation
- Advanced cooling system for 24/7 operations
- Bezel width: max of 5.5mm
- Display control: IR, RS-2332
- Orientation: portrait and landscape
- Automatic color and brightness calibration
- Inputs: HDMI
- Power consumption: 160 watts
- Internal or external power supply

3. Mounting System

Furnish a wall-mounted frame for securing monitors in place and routing cables.

4. Management

The Contractor shall provide a solution to scale video across the entire video wall or any section of the video wall.

The video wall system shall meet the following functionality:

- Creation of customized layouts using drag-and-drop configurations in the graphical user interface
- Ability to display a video feed on a single monitor (full-screen) or across multiple monitors
- Ability to display multiple video feeds on a single monitor, up to a 4x4 grid
- Ability to interface with the CCTV video management system software for selecting layouts and video feeds
- Ability to act as an additional monitor output for any of the workstations in the TCC

5. Video Wall Controller

Furnish a video wall controller that is capable of processing video outputs to the wall monitors. Furnish unit with the following minimum specifications:

- Rack mountable with a maximum height of 6 RU
- Operating system of Microsoft Windows 7, and compatible with operating system of the video server installed under this project
- Intel Core i7 3.4 GHz (or greater) processor

- Minimum of 8 GB of RAM
- Minimum of 16 video display outputs with a resolution of 2560 x 1600 at 60 Hz
- Minimum of 4 video inputs that are HDMI or DVI
- 10/100/1000 MB network interface card

C. Monitors

Furnish, install, and integrate one (1) new 65-inch LED (4K, Ultra HD) video monitor in the 4th floor City Hall lobby. The video monitor shall be a fully integrated with the CCTV hardware and software. The monitor shall be wall mounted. The LED video display panel shall operate from 115 V +/- 10%, 60 Hz +/- 5% VAC input power.

The monitors of the video wall shall meet the following minimum requirements:

- Size: 65 inch
- Technology: 4K Ultra HD TV
- Resolution: 2160p
- Refresh rate: 120 Hz
- Full viewing angle: 178 degrees (vertical and horizontal)
- Acoustic noise: fanless operation
- Advanced cooling system for 24/7 operations
- Display control: IR and manual
- Automatic color and brightness calibration
- Inputs: HDMI
- Internal power supply

Furnish a wall-mounting brackets for securing monitors in place and routing cables.

D. Video Converter Unit

Furnish video converter units that shall be capable of transmitting HDMI video between a source and monitor over Cat5e or Cat6 network cables. The transmitter unit and receiver unit shall be matched and provided by the same manufacturer.

Furnish video converter units with the following minimum specifications:

- HDBaseT video distribution
- Video port: HDMI

- Network port: RJ-45

37.3. CONSTRUCTION METHODS

A. General

Install and test all central video equipment in accordance with the manufacturer's recommendations. Furnish and integrate any manufacturer software not explicitly stated in these Project Special Provisions but required for any central video equipment to provide full the stated functionality. Provide a copy of any installed manufacturer software to the Department.

Route all cabling in ceiling, floor, conduit, or cable raceways unless otherwise approved by the Engineer.

All cables for each piece of hardware installed shall be clearly labeled, using a label convention approved by the Engineer. All cabling shall be manufacturer assembled and without any adapters, unless otherwise approved by the Engineer.

B. Video Wall System

As shown in the Plans, install the video wall system in the TCC. Follow manufacture recommendations. Furnish cable raceways or wire molds of the same color as the wall for the discrete placement of cabling.

Prior to installation of the video displays, develop shop drawings and submit to Engineer for approval prior to commencement of installation of the units.

Integrate the video wall system with the CCTV video management system software.

C. Monitor

Furnish, install, and integrate one (1) new 65-inch LED (4K, Ultra HD) video monitor in the 4th floor City Hall lobby. The video monitor shall be a fully integrated with the CCTV hardware and software. The monitor shall be wall mounted. The LED video display panel shall operate from 115 V +/- 10%, 60 Hz +/- 5% VAC input power.

D. Video Converter Unit

Install video converter units as shown in the Plans. Fully integrate with video display appliance and video monitor.

37.4. MEASUREMENT AND PAYMENT

Video Wall System will be measured and paid as a lump sum price. This item shall include the installation, testing, and all materials, equipment, labor, tools, storage, shipping, and incidentals necessary to install and make fully operational the video wall system at the TCC. No separate

measurement will be made for monitors, power supplies, cables, image processor hardware, configuration software, controllers, framing system, brackets, spacers, mounting hardware, cabling, and other materials required.

65" LED Monitor will be measured and paid as the actual number furnished, installed, integrated, and accepted.

No direct measurement will be made for wall mounting brackets, surge suppression strips, cabling used to interconnect devices within buildings including coaxial cabling, network cabling, serial cabling, and power cabling. These will be considered incidental to the 65" LED Monitor.

Video converter unit will be measured and paid as the actual number furnished, installed, integrated, and accepted.

No direct measurement will be made for surge suppression strips. These will be considered incidental to the devices attached to them.

No direct measurement will be made for cabling used to interconnect devices within buildings including coaxial cabling, network cabling, serial cabling, and power cabling. These items will be considered incidental to the devices they are connected.

No direct measurement will be made for the removal of existing video monitors as part of the installation of new monitors and video equipment.

Configuration and integration of central video components will be considered incidental and shall not be measured separately.

Payment will be made under:

| Pay Item | Pay Unit |
|---------------------------|-----------------|
| Video Wall System | Lump Sum |
| 65" LED Monitor | Each |
| Video Converter Unit..... | Each |

38. EXTENSION OF SPAT CHALLENGE/CONNECTED VEHICLE TEST BED

38.1. DESCRIPTION

Currently, the North Carolina Department of Transportation in partnership with the Town of Cary, North Carolina operates and maintains a connected vehicle test bed on NC 55. The existing test bed consists of:

- Connected Vehicle Dedicated Short Range Communications (DSRC) road side units (RSU) installed at each test bed intersection. Currently the test bed utilizes RSU equipment manufactured by Kapsch and Lear
- An On Board Unit (OBU) for testing RSU communications
- A human machine interface (HMI) to configure the OBU and to observe SPaT message transmission from the RSUs.

The Department is seeking to expand the geographic extent of the existing test bed as well as expand the vendors that will be actively utilized in the test bed. The Department has successfully integrated equipment from vendors, Kapsch and Lear, into the current test bed. The Department seeks to trial RSU equipment from three additional vendors. Through the Department's research, possible vendors include Siemens and Trafficast. The Contractor is not required to utilize these vendors.

For this project, install, integrate, test, and maintain new RSUs at the following intersections:

1. 05-2261 – NC 55 & Hopson Rd
2. 05-1583 – NC 55 & TW Alexander Dr
3. 05-1137 – NC 55 & Sedwick Rd
4. 05-2156 – NC 55 & Allendown Rd
5. 05-0390 – NC 55 & NC 54
6. 05-1070 – NC 55 & I-40 EB Ramp
7. 05-1069 – NC 55 & I-40 WB Ramp
8. 05-1528 – NC 55 & Meridian Pkwy
9. 05-1083 – NC 55 & Carpenter Fletcher Rd
10. 05-1977 – NC 55 & MLK Jr Pkwy
11. 05-0289 – NC 55 & Cornwallis Rd

12. 05-0429 – NC 55 & Riddle Rd
13. 05-0395 – NC 55 & Burlington Av
14. 05-0661 – NC 55 & Cecil St
15. 05-0317 – NC 55 & Lawson St
16. 05-0275 – NC 55 & Linwood Rd.
17. 05-1028 – NC 55 & NC-147 SB Ramp
18. 05-0284 – NC 55 & NC-147 NB Ramp

For the three vendors, provide RSU units in approximately equal quantities (e.g. 6 of vendor A, 6 of vendor B, 6 of Vendor C). Install a single vendor at contiguous locations. Vendor A shall be installed at locations 1-6 in the list above, Vendor B shall be installed at locations 7-12 in the list above, and Vendor C shall be installed at locations 13-18 in the list above.

Provide RSU units compatible with existing OBUs manufactured by Lear and eTrans that are currently operated by the Department and compliant with SAE J2735 standards.

38.2. MATERIALS

A. General

Equipment furnished under this contract including OBUs and RSUs shall provide digitally secure data transmission that verified with Security Credential Management System (SCMS).

B. Road Side Units

RSU must meet/exceed all requirements included in the USDOT “Dedicated Short-Range Communications Roadside Unit Specifications” revision 4.1, version 5 (FHWA-JPO-17-589) or later. Additionally, the RSU unit must meet the following:

- RSU must minimally support SAE J2735 compliant message sets, including but not limited to: Basic Safety Message (BSM), Signal Phase and Timing (SPaT), MAP, Traveler Information Message (TIM), Signal Request Message (SRM), Signal Status Message (SSM), Radio Technical Commission For Maritime Services (RTCM) Messages, and Personal Safety Message (PSM).
- RSU must support the full range of Provider Service Identifiers (PSIDs) as specified in IEEE 1609.12.
- RSU shall include necessary software application capable of accepting traffic controller information from a source IP address (from controllers and local controller software installed under this project) and converting it into SAE J2735 SPaT message for

broadcast over 5.9 GHz DSRC Radio without the need for a separate translation hardware “black box”.

- RSU must include applications supporting the correct and efficient processing of received SRM, while properly interfacing with controllers and local controller software installed under this project to activate relevant priority and preemption requests.
- RSU must be able to interface with controllers and local controller software installed under this project to acquire preemption/priority signal status and translate it into J2735 standard SSM for broadcast over 5.9 GHz DSRC Radio.

RSU must support use of global navigation satellite systems (GNSS) to an accuracy of less than 1 meter. Necessary external antennae, are to be provided at no additional cost.

All necessary mounting equipment and cabling (including cabling ends) for RSU installation is to be provided at no additional cost to the Department.

Minimum of two external antennae mounting ports for DSRC broadcast. External antennae and cabling, if necessary, are to be provided at no additional cost.

RSU must enable local wi-fi hotspot communication.

Vendors must provide technical support for product during project construction through a period of at least 1 year from date of Project Acceptance. Technical support includes, but is not limited to:

- Assist and aid in troubleshooting from related issues
- Provide ongoing no-cost firmware upgrades (to meet/adhere the most recent published SAE, IEEE and USDOT standards/specifications)
- Provide RSU installation how-to/documentation
- Configuration how-to/documentation
- Firmware Release Notes

RSU must be certified through the OMNIAIR V2X connected vehicle certification program, with Test Performance Results provided as proof of certification.

The RSU base unit shall support device network monitoring and management via all SNMP v3 (“Dedicated Short-Range Communications Roadside Unit Specifications” revision 4.1, version 5 (FHWA-JPO-17-589) (or later) – Appendix b) parameters at a minimum from the RSU to one or more SNMP central IPV4/IPV6 destination addresses.

The RSU base unit management software must be free from software defects in both running/operational states and in configuration of the unit (base unit and radio units or it must

otherwise be repaired/fixed upon discovery at the suppliers cost.)

C. On Board Unit

Furnish OBU for use in testing RSU equipment. Furnish one (1) OBU for each of the three vendor's RSUs furnished under this project. Furnish OBU meeting the following requirements:

- OBUs shall broadcast Basic Safety Messages as defined in SAE J2945/1.
- OBUs shall support DSRC applications based on SAE J2735_201603 defined messages including at a minimum, Basic Safety Message (BSM), Signal Phase and Timing (SPaT), MAP or Geometric Intersection Description (GID) and Traveler Information Message (TIM), Signal Request Message (SRM), Signal Status Message (SSM), Radio Technical Commission For Maritime Services (RTCM) Messages, and Personal Safety Message (PSM).
- OBUs shall be compliant with the following IEEE standards: 1609.0-2016 or later; 1609.2-2016 or later 1609.3-2016 or later; 1609.4-2016 or later; 1609.12-2016 or later
- OBUs must be certified through the OMNIAIR V2X connected vehicle certification.
- OBUs shall receive and process WAVE service announcements (WSAs)
- OBUs shall be compatible with RSUs supplied and installed under this project.
- OBUs shall be compatible with existing Kapsch and Lear RSU currently in operation in the existing test bed.
- The Vendor shall supply an OBU software development kit (SDK) with each OBU. Each SDK shall include:
 - Debugging tools
 - V2X Services Libraries
 - V2X Security Libraries
 - V2X Message Libraries
 - V2X Networking Libraries
 - V2X Sensor Libraries
 - Sample Code

D. Human Machine Interface

Furnish HMI with each OBU to allow user to configure OBU. HMI shall

- Be Android operating system -based tablet with minimum 10” diagonal screen

- Have micro-USB connection and minimum 3' connection cable that supports power and data transfer
- Support secure wireless connections including Wi-Fi and Blue Tooth communications protocols
- Support cellular communications
- Have minimum 256 GB of memory
- Furnish brackets for mounting and removal from mounting in vehicle.
- Furnish screen cover protection to resist screen scratches and cracks
- Furnish Table case that can absorb shock from drops.

E. Graphical User Interface

Provide, install, and integrate remote monitoring/configuration/evaluation software with graphical user interface (GUI) to enable interaction and interrogation of RSU. Software shall be a Windows-based GUI that is screen pointer driven with drop down menus. Provide single laptop computer for installation of software. Provide Laptop Computer to same specification as called for in the Computer Hardware section of these Project Special Provision. Furnish software for each RSU make provided.

GUI shall support development of Geometric Intersection Description that includes the creation, display, and modification of the following intersection elements:

- Each intersection approach including:
 - Ingress lanes drawn to 1000' or nearest intersection, whichever is least
 - Number of lanes
 - Type of each lane (through, left-through, left turn, etc.)
 - Pedestrian signals
 - Signal Phase and pedestrian count down (in seconds)
 - Red Light Violation Warning
 - Work Zone
 - Speed Zone

38.3. Construction Methods

A. General

All elements included in this project special provision, including power and communications, must comply with these Project Special Provisions, all standard specifications, and any applicable state and local regulations.

Coordinate with Department to obtain information for existing OBU and RSU. Develop and execute test procedures to demonstrate interoperability of existing RSUs and OBUs with RSUs and OBUs provided under this project prior to installation of new equipment.

B. Installation

Ensure all installation is done in a neat and professional manner. Ensure installed RSU can withstand a three second gust wind speed of 120 miles per hour (mph) from any direction as required by ASCE 7.

Ensure installation of RSU is in conformance with the manufacturer's specifications.

Ensure all cabling from the RSU to switch is labeled on both ends, bundled, and stressed.

Ensure that the mounted RSU cabling is plugged into the correct PoE port according to the Manufacturer installation documentation.

Integrate each RSU into the Signal System communications network. Integrate into VLAN in accordance with the Plans and Project Special Provisions, and network requirements documents to be developed by the Contractor.

Furnish GPS correction services subscription to be utilized by all applicable new devices in the furnished and installed as part of the test bed. Ensure service is compatible with each vendors product provided. Provide correction service from multiple GPS correction service providers if necessary. Provide service(s) through construction and a minimum one year following project acceptance at no cost to the Department.

Grounding and Surge Protection must be provided for each RSU installed.

If RSU mounting brackets/poles are metallic, provide adequate electrical insulation between bracket/pole and signal mast arm. Additionally, bond the metallic bracket/pole to the pole ground.

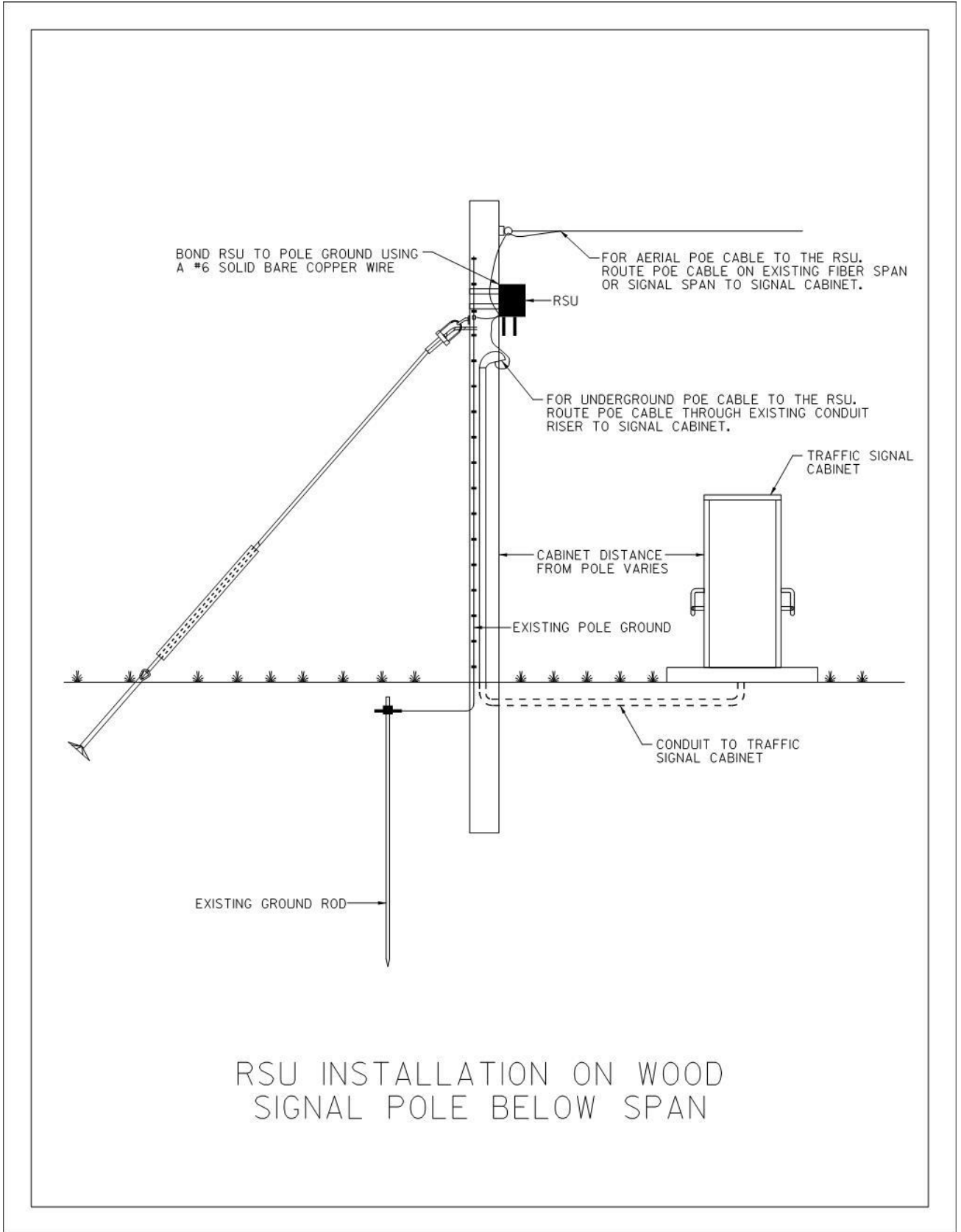
Do not damage any part or equipment during installation. Ensure damaged parts or equipment are replaced at no additional cost to the project or the Department. Repair is not an acceptable means of replacement. Ensure all equipment is replaced with new parts.

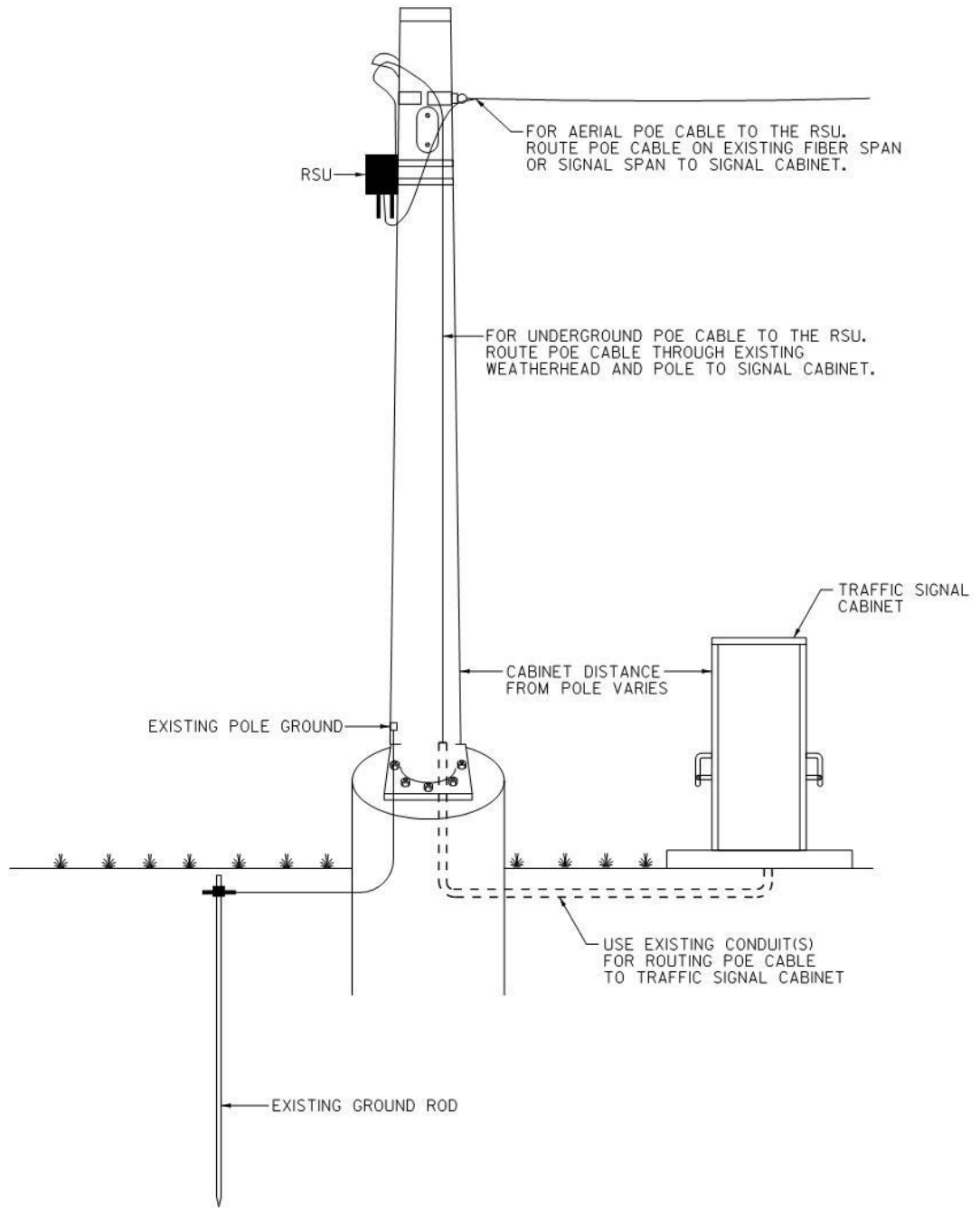
As approved by the Engineer, mount the RSU at a height recommended by the manufacturer in compliance with Federal Communications Commission regulations, and in the context of field

conditions including but not limited to foliage, built structures, and other close proximity radio wave transmitting equipment.

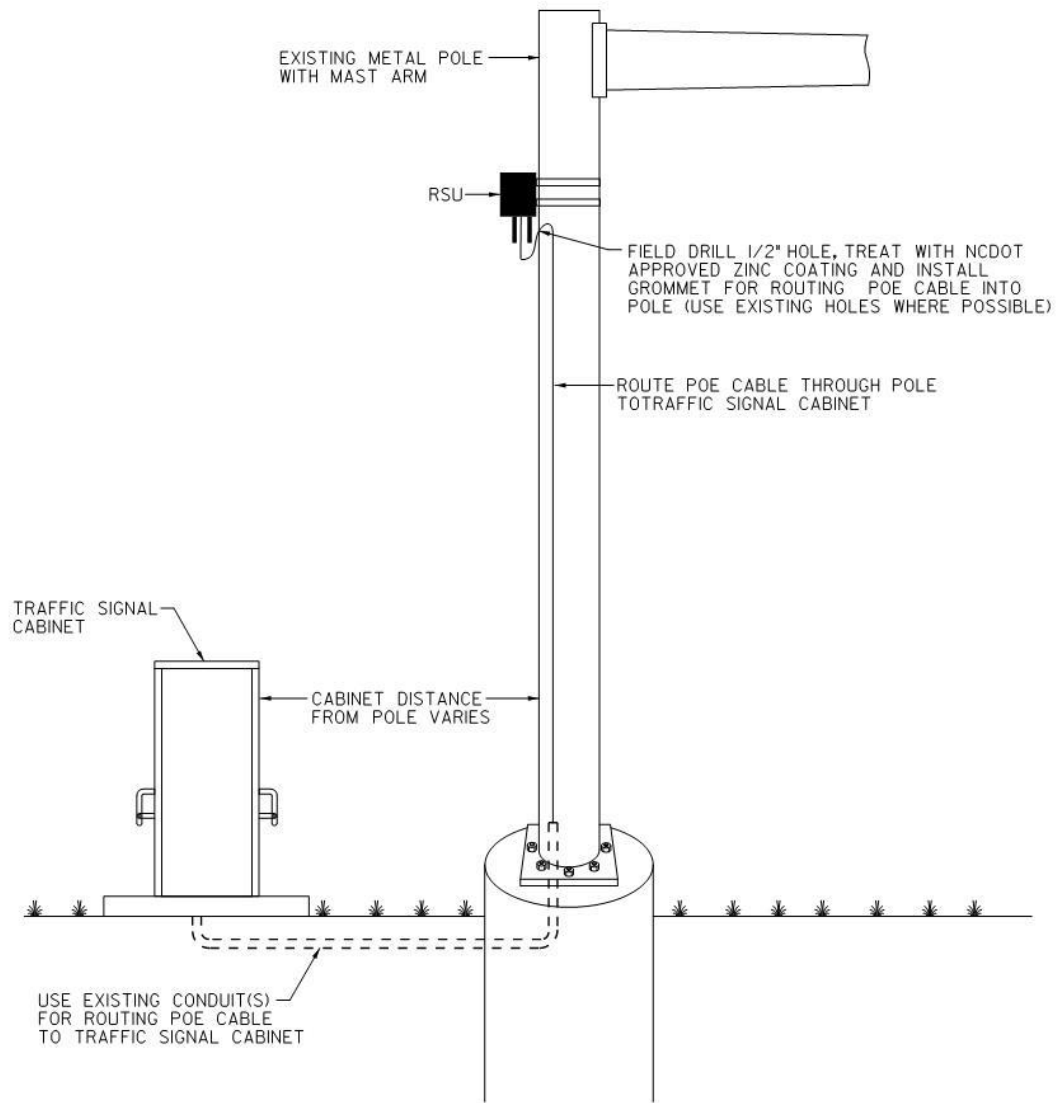
Install all conduits, condulets, and attachments to equipment cabinets in a manner that preserves the minimum bending radius of cables and creates water proof connections and seals.

Refer to the following drawings for installation details of RSU on existing signal poles.





RSU INSTALLATION ON METAL STRAIN POLE BELOW SPAN



RSU INSTALLATION ON MAST ARM UPRIGHT BELOW ARM

Coordinate with the Department to obtain existing RSU DSRC FCC licensure information from the Department. Complete the FCC 601 Schedule M form for each location at no cost to the Department. Complete all forms and submit on behalf of the Department. This collected field data must be provided to the Engineer for registration purposes. Some of the data elements that need to be recorded are shown in the following table:

| | Data Field | Example | Comments |
|-----------------------|---|-------------------------|---|
| Location Information | Site Name (Alphanumeric Only) | 175BLMM0003 | ITS site name with spaces and special characters removed (175MM0046) OR Intersection (US12WDorset) |
| | Latitude (DD MM SS.S) | 42 36'40.44" N | Latitude DMS NAD83 |
| | Longitude (DD MM SS.S) | 83 14'05.56" W | Longitude DMS NAD83 |
| | Municipality | Bloomfield Township, MI | City, Village, Township |
| | Site Elevation (AMSL) (m) | 278.9 | Meters |
| Device Information | Hardware Make/Model | Cohda MK5 | |
| | Serial # | 04E54810154C | |
| | FCC ID # | 2AEGPMK5RSU | |
| | Firmware Version | 3.10.17-rt12 | |
| Mounting Information | Structure Type | Steel Strain Pole | Mounting structure: Steel Strain Pole (RSU only), Steel Strain Pole (RSU only), Spun Concrete Pole, DMS Structure, Etc. |
| | Structure Height (Above Road) (m) | 12.2 | |
| | ... with Appurtenances (Above Road) (m) | 12.9 | Including air terminals and other antennas |
| | Mounting Height (Above Road) (m) | 7.62 | |
| | Elevation Angle (Degrees) | 0 | Elevation angle of the transmitting antenna (rounded to the nearest degree), measured from the horizontal up to the center line of the main beam of the antenna. If the antenna tilts down (depression angle), indicate with a minus sign. See FCC Form 601 Sched M |
| Broadcast Information | Service Channel | 184 | |
| | Antenna Make | Mobile Mark | Make of actual antenna |
| | Antenna Model | EN-60000 | Make of actual antenna |
| | Antenna Gain (dBi) | 5 dBi | |
| | Beamwidth (degrees) | 21 degrees | |
| | Azimuth beamwidth (degrees) | 360 degrees | |
| | Max Power Output (dBm) | 24 dBm | |
| | Max EIRP Power Output (dBm) | 29 dBm | |

C. Configuration and Testing

Develop a SPaT Challenge/Connected Vehicle Test Bed Configuration and Testing Guidance Document. The SPaT Challenge/Connected Vehicle Test Bed Configuration and Testing Guidance Document shall include:

- A listing of each of the 3 RSU make, model, and firmware version to be used under this project and the locations where each unit shall be installed
- A listing of the configuration input software and HMI method (e.g. laptop computer connected via Bluetooth wireless connection) for each RSU type to be deployed under this project
- A schematic diagram for each RSU type showing how the unit will be interconnected with the traffic signal controller cabinet network switch
- A listing of the proposed RSU configuration settings for each intersection that is included in the test bed
- A presentation of methods for utilizing the OBU for testing including connection methods to City of Durham and NCDOT maintenance vehicles
- The presentation of proposed test procedures to test:
 - Basic Safety Message (BSM),
 - Signal Phase and Timing (SPaT),
 - MAP
 - Traveler Information Message (TIM),
 - Signal Request Message (SRM),
 - Signal Status Message (SSM),
 - Radio Technical Commission For Maritime Services (RTCM) Messages
 - Personal Safety Message (PSM)
- Demonstrate message security verification with Security Credential Management System (SCMS). Provide SCMS proof of Concept and Subscription through construction and minimum one (1) year following project acceptance at no additional cost to the Department.

38.4. Training

Provide training for 15-25 students on the configuration, testing, maintenance, troubleshooting, and operations of the RSU, OBU, and HMI. Video Tape session and provide video to Department for future use. This training will include at a minimum but not be limited to:

- RSU output power configuration
- RSU channel configuration

- RSU SPaT message configuration, if any
- RSU MAP configuration
- RSU RTMC message configuration
- RSU message conversion and uploading
- RSU message security validation configuration (interface to SCMS)
- OBU configuration
- Other OBU related training (e.g. connections to vehicle CAN BUS units)
- HMI and Application Training
- GUI training

Provide a comprehensive 5-Day course that cover each manufacture's products as well as the overall theory of operation of the Connected vehicle test bed. Provide detailed course outline for 5-day course. Utilize mix of lecture and hand-on training that incorporates adult learning techniques. Provide printed training material. Provide minimum 5 days of training inclusive of in-class and if applicable, in field training. Provide training facility and make provisions for snacks and lunch.

38.5. Measurement and Payment

Vendor _ RSU will be measured and paid as the actual number furnished, configured, installed, tested, and accepted. All antennae, wiring, cabling, mounting, grounding, conduits, coudulets, PoE surge protectors, cable termination, software configuration, labor, and any other work to provide and install a fully operational RSU will be considered incidental and not be paid for separately.

Vendor _ OBU will be measured and paid as the actual number furnished, configured, installed, tested, and accepted. All cabling, mounting, labor, and any other work to provide and install a fully operational OBU will be considered incidental and not be paid for separately.

Vendor _ HMI will be measured and paid as the actual number furnished, configured, installed, tested, and accepted. All cabling, vehicle mounting brackets, screen coverings, shock cases, and labor will be considered incidental and not be paid for separately.

SPaT GUI Laptop Computer will be measured and paid as the actual number furnished, configured, and accepted. Installation of each GUI software for each RSU onto the single laptop unit will be considered incidental and not paid for separately.

Vendor _ Spare RSU will be measured and paid as the actual number furnished and accepted.

Spare RSU PoE Surge Protector will be measured and paid as the actual number furnished and accepted.

Vendor _ Test Bed Training will be paid for at the contract lump sum price.

Intersection MAP Creation and Installation will be paid for each intersection MAP created and installed for each RSU.

Test Bed Configuration and Testing will be paid for at the contract lump sum price.

Payment will be made under:

| | |
|--|----------|
| Vendor A RSU | Each |
| Vendor B RSU | Each |
| Vendor C RSU | Each |
| Vendor A OBU | Each |
| Vendor B OBU | Each |
| Vendor C OBU | Each |
| Vendor A HMI..... | Each |
| Vendor B HMI | Each |
| Vendor C HMI | Each |
| SPaT GUI Laptop Computer | Each |
| Vendor A Spare RSU..... | Each |
| Vendor B Spare RSU | Each |
| Vendor C Spare RSU | Each |
| Spare RSU PoE Surge Protector..... | Each |
| Vendor A Test Bed Training..... | Lump Sum |
| Vendor B Test Bed Training..... | Lump Sum |
| Vendor C Test Bed Training..... | Lump Sum |
| Intersection MAP Creation and Installation | Lump Sum |
| Test Bed Configuration and Testing..... | Lump Sum |

39. BUILDING MODIFICATIONS AND FIBER OPTIC CABLE TERMINATION

39.1. DESCRIPTION

At locations called for in the Plans such as the Durham City Hall and Durham Signal Shop, route fiber optic cable in new and/or existing conduit and install conduit into buildings as shown. Terminate fiber optic cable into fiber interconnect centers in building as shown in the Plans. Modify rooms and furnish and install cable and cable routing facilities as shown in the Plans.

All construction to reach a building (including up to installing a new junction box at an exterior wall) is paid for using other pay items in these Project Special Provisions. All construction to enter a building (including all work from creating a new entrance or integrating with an existing entrance) and making internal provisions for terminating cables are covered under these building modification pay items.

39.2. MATERIALS

A. General

Use risers and conduit materials as called for in the Standard Specifications or these Project Special Provisions.

Use caulking and sealing materials for sealing entrances into buildings as approved by the Engineer and according to prevailing building codes.

Use new cable raceways, electrical boxes, and metallic conduit as approved by the Engineer. Where called for in the Plans, use thin-walled EMT conduit that complies with the NEC and EIA/TIA Standard 569 and commercial building standards for telecommunications pathways.

The Owner of each facility will be providing any furniture noted in the Plans.

Material, equipment, and hardware furnished under this section shall be pre-approved on the Department's QPL.

B. Central Interconnect Center

There are two central interconnect centers for fiber termination located in the Durham City Hall and the Durham Signal Shop. Both locations have a one 288-fiber cables and one 144-fiber cable enter and terminate inside a cabinet. Both locations shall use modular interconnect centers with sufficient number of modules and furnish them rack mountable.

For the central interconnect center in the Durham City Hall, provide a new rack for all equipment used for fiber termination. Provide splice trays that hold, protect, and organize optical fibers, and secure fibers inside splice tray. Design and size splice trays to be dielectric, to accommodate all fibers entering the splice tray, and to provide sufficient space to prevent microbending of optical

fibers. Provide connector panels with LC-type connectors. For fiber termination and route to enter the Durham City Hall building, see City Hall Building Details. In the details is shown how fiber shall come into the building through existing manholes that connect to the 3rd and 4th floor of the building.

For the central interconnect center in the Durham Signal Shop, use existing rack for fiber termination. Provide splice trays that hold, protect, and organize optical fibers, and secure fibers inside splice tray. Design and size splice trays to be dielectric, to accommodate all fibers entering the splice tray, and to provide sufficient space to prevent microbending of optical fibers. Provide connector panels with LC-type connectors. For fiber termination and route to enter the Durham Signal Shop building, see Signal Shop Building Details. In the details is shown how fiber shall come into the building through aerial fiber optics cable and connect through a riser to an existing handhole that connects to the data room in the building.

Furnish SMFO pigtails with each interconnect center. Provide pigtails that are a maximum of 6 feet in length with a factory assembled LC connector on one end. Ensure that the SMFO pigtails meet the operating characteristics of the SMFO cable with which it is to be coupled.

Furnish SMFO jumpers that are a minimum of 3 feet in length with factory assembled LC connectors on each end. Ensure that SMFO jumpers meet the operating characteristics of the SMFO cable with which it is to be coupled.

39.3. Construction Methods

A. General

Contact Engineer prior to entering any building. Coordinate and obtain approval from Engineer regarding allowable working time in buildings.

Prior to core drilling or otherwise creating new entrance into an existing building, obtain approval of methods and materials from the Engineer. In all cases create entrance that is weatherproof and water tight.

Whenever possible, use existing cable raceways, ducts, raised floors, and drop ceilings to route fiber optic cable.

Perform all work called for in the plans to enter building, install cable conduits and cable raceways, and to route cabling in raised floors, drop ceilings, and new and existing conduits.

Terminate all optical fibers in interconnect centers unless otherwise shown on the Plans.

Install interconnect centers with connector panels, splice trays, storage for slack cable or fibers, mounting and strain relief hardware, and all necessary hardware. As shown in the plans, some

locations call for interconnect centers to be installed in existing rack cabinets. Coordinate with Engineer or Agency representative on exact placement for interconnect center within rack as existing conditions may have changed from that shown in the Plans.

Label all fiber-optic connectors, whether on jumpers, connector panels, or other equipment, to prevent improper connection. Obtain approval of the fiber-optic connector labeling method.

For all fibers designated for termination to connector panel within the interconnect center, fusion splice the fibers to the pigtails.

For all cut fibers designated to pass through interconnect center, fusion splice fibers.

B. Durham City Hall Modifications

Install equipment and route cables into the Durham City Hall as shown in the Plans. Where new cables are to be installed in existing conduit, the Contractor shall blow pull-rope in the conduit prior to installation to ensure conduit can be re-used.

C. Durham Signal Shop Modifications

Install equipment and route cables into the Durham Signal Shop as shown in the Plans. Where new cables are to be installed in existing conduit, the Contractor shall blow pull-rope in the conduit prior to installation to ensure conduit can be re-used.

39.4. Measurement and Payment

Building Modifications will be measured and paid as a lump sum price.

This item shall include all work required to route and terminate the fiber optic cable into the buildings as shown as well as any other work not called for under other items but required to accomplish the building modifications.

No separate payment will be made for rack cabinets, interconnect centers, patch panels, wall sockets and outlets, splicing, conduit, and cable routing within building as this will be considered incidental to building modifications.

No measurement will be made for the removal of existing materials required for completing the work in this section.

Payment will be made under:

| | |
|--|----------|
| Durham City Hall Building Modifications | Lump Sum |
| Durham Signal Shop Building Modifications..... | Lump Sum |

40. SYSTEM SUPPORT EQUIPMENT

40.1. DESCRIPTION

Furnish signal system support equipment with all necessary hardware in accordance with the plans and specifications.

All system support equipment shall be delivered to the City at the start of the Observation Period.

40.2. MATERIAL

A. Signal System Support Equipment

Furnish new, unused signal system support equipment to the Engineer in the quantities shown below:

- Ten (10) 2070LX signal controllers as installed and accepted under this project
- Ten (10) 2070-1C CPU modules as installed and accepted under this project
- Two (2) pole-mounted 336 cabinets as installed and accepted under this project
- Eight (8) base-mounted 332 cabinets as installed and accepted under this project
- Ten (10) DC isolators as installed and accepted under this project
- Ten (10) AC isolators as installed and accepted under this project
- Twenty (20) detector cards as installed and accepted under this project
- Ten (10) conflict monitors as installed and accepted under this project
- Ten (10) model 200 load switches as installed and accepted under this project
- Ten (10) surge protectors as installed and accepted under this project
- Ten (10) flasher modules as installed and accepted under this project
- Ten (10) flash transfer relays as installed and accepted under this project
- One (1) test cabinet and controller as specified below
- One (1) conflict monitor tester with notebook computer as specified below

1. Test Cabinet/Controller

Furnish and install a test cabinet/controller at the Signal Shop as shown in the Plans. The test cabinet shall include a 2070LX controller in a Type 332 cabinet. The test cabinet shall include a full complement of detector amplifiers, switch packs, a conflict monitor, and one fiber optic field Ethernet switch. The test cabinet shall also contain two (2) AC Isolators and two (2) DC Isolators. The test cabinet and panel shall be fully labeled.

Construction

The test cabinet shall have a heavy-duty aluminum dolly base with heavy duty casters. The base shall accommodate a fully equipped base-mounted 332 cabinet/controller. A pole or pedestal shall be attached to the base to support a display panel, which shall be located beside the cabinet convenient

for use by maintenance personnel. The panel shall have all indicators and switches on the front and shall have a suitable aluminum enclosure. The panel shall be fully labeled.

Indicators

The panel shall contain indicators to display the outputs of all the cabinet's traffic signal load switches. Red, yellow, and green indicators shall be used to display the outputs of the traffic signal load switches. In addition, indicators shall be provided for four (4) pedestrian displays and four (4) special functions. The indicators shall use incandescent bulbs or LED's that are user replaceable.

Controls

The panel shall be equipped with controls which are connected to simulate all of the inputs, for test purposes, to the controller which are not already accommodated by switches in the controller cabinet.

Harnesses

The panel shall be connected to the controller cabinet by means of harnesses. The harnesses shall be concealed in the pedestal or pipe supporting the panel and shall enter the cabinet from the bottom.

Connection to System

The test cabinet/controller will be connected to the system on dedicated communication channels. Furnish and install a jumper cable of sufficient length. This jumper cable shall be used to connect the test cabinet's fiber optic Ethernet switch to the communication system.

2. Conflict Monitor Tester with Notebook Computer

Furnish a stand-alone portable signal monitor test unit with notebook computer intended for use on work-bench. The Tester shall use/control a notebook computer of equal requirements to other notebook computers furnished under this project. The Tester shall test Conflict Monitor displays, timing and voltage functions, and input/output combinations of either true or false conflicts. Any software provided with the tester shall be modular, menu driven, and offer a "help" screen. A video "setup/usage" training tape shall be provided with each unit. All input/outputs shall be in plain English. It shall be possible to generate a hardcopy printout, or to store the results to a disk file. A "No Faults Detected" indication shall be displayed as appropriate.

B. Communication System Support Equipment

Furnish new, unused communication system support equipment to the Engineer in the quantities shown below:

- Five Thousand (5,000) feet of 24-fiber communications cable as installed and accepted under this project
- Two Thousand Five Hundred (2,500) feet of 36-fiber communications cable as installed and accepted under this project
- Five Thousand (5,000) feet of 72-fiber communications cable as installed and accepted under this project
- Two Thousand Five Hundred (2,500) feet of 144-fiber communications cable as installed and accepted under this project

- Five Hundred (500) feet of 288-fiber communications cable as installed and accepted under this project
- Two Thousand Five Hundred (2,500) feet of drop cable as installed and accepted under this project
- Ten (10) interconnect centers (standard) as installed and accepted under this project
- One (1) interconnect centers (oversized) as installed and accepted under this project
- Twenty (20) splice enclosures as installed and accepted under this project
- Forty (40) factory connectorized hybrid (ST-LC) jumpers of three-foot length as installed and accepted under this project
- Twenty (20) factory connectorized (ST-type) pigtails of ten-foot length as installed and accepted under this project
- Ten (10) fiber optic field Ethernet switches as installed and accepted under this project

C. CCTV System Support Equipment

Furnish new, unused CCTV system support equipment to the Engineer in the quantities shown below.

- Five (5) CCTV assembly as installed and accepted under this project

40.3. MEASUREMENT AND PAYMENT

Furnish 2070LX Controller will be measured and paid as the actual number furnished and accepted.

Furnish 2070-1C CPU Module will be measured and paid as the actual number furnished and accepted.

Furnish Pole Mount 336 Cabinet will be measured and paid as the actual number furnished and accepted.

Furnish Base Mount 332 Cabinet will be measured and paid as the actual number furnished and accepted.

Furnish DC Isolator Card will be measured and paid as the actual number furnished and accepted.

Furnish AC Isolator Card will be measured and paid as the actual number furnished and accepted.

Furnish Detector Card will be measured and paid as the actual number furnished and accepted.

Furnish Conflict Monitor will be measured and paid as the actual number furnished and accepted.

Furnish Load Switch will be measured and paid as the actual number furnished and accepted.

Furnish Surge Protector will be measured and paid as the actual number furnished and accepted.

Furnish Flasher Module will be measured and paid as the actual number furnished and accepted.

Furnish Flash Transfer Relay will be measured and paid as the actual number furnished and accepted.

Furnish Test Cabinet and Controller will be measured and paid as the actual number furnished and accepted.

Furnish Conflict Monitor Tester will be measured and paid as the actual number furnished and accepted.

Furnish ST-LC Hybrid Jumpers will be measured and paid as the actual number furnished and accepted.

Furnish ST Pigtailed will be measured and paid as the actual number furnished and accepted.

Furnish Field Ethernet Switch will be measured and paid as the actual number furnished and accepted.

Furnish CCTV Assembly will be measured and paid as the actual number furnished and accepted.

Payment will be made under:

| Pay Item | Pay Unit |
|---|-----------------|
| Furnish 2070LX Controller..... | Each |
| Furnish 2070-1C CPU Module..... | Each |
| Furnish Pole Mount 336 Cabinet..... | Each |
| Furnish Base Mount 332 Cabinet..... | Each |
| Furnish DC Isolator Card..... | Each |
| Furnish AC Isolator Card..... | Each |
| Furnish Detector Card..... | Each |
| Furnish Conflict Monitor..... | Each |
| Furnish Load Switch..... | Each |
| Furnish Surge Protector..... | Each |
| Furnish Flasher Module..... | Each |
| Furnish Flash Transfer Relay..... | Each |
| Furnish Test Cabinet and Controller..... | Each |
| Furnish Conflict Monitor Tester..... | Each |
| Furnish Communications Cable (24-Fiber)..... | Linear Feet |
| Furnish Communications Cable (36-Fiber)..... | Linear Feet |
| Furnish Communications Cable (72-Fiber)..... | Linear Feet |
| Furnish Communications Cable (144-Fiber)..... | Linear Feet |
| Furnish Communications Cable (288-Fiber)..... | Linear Feet |

| | |
|--|-------------|
| Furnish Drop Cable..... | Linear Feet |
| Furnish Interconnect Center (Standard)..... | Each |
| Furnish Interconnect Center (Oversized)..... | Each |
| Furnish Splice Enclosure | Each |
| Furnish ST-LC Hybrid Jumpers..... | Each |
| Furnish ST Pigtailed..... | Each |
| Furnish Field Ethernet Switch | Each |
| Furnish CCTV Assembly | Each |

41. TRAINING

41.1. DESCRIPTION

Provide training for the installation, operation and maintenance of the computerized traffic system.

41.2. MATERIAL

A. General

Provide training to properly install, operate, maintain, diagnose and repair each piece of equipment and the software associated with the system. Provide approved manufacturer's representatives or other qualified personnel to conduct training courses. Provide training for a total of fifteen (15) City and Department personnel.

1. Submittal Requirements

At least thirty (30) days prior to commencement of the training course, submit the following to the Engineer for review and approval:

- Schedule of training session dates
- Detailed course curricula
- Draft training manuals and course handouts
- Resumes of all instructors

The Engineer may request modification to the submitted material

For all training programs, a staff of engineers, technicians, and maintenance personnel familiar with traffic signal systems will be the training participants. A "day" of training shall consist of training conducted between the hours of 8:30am and 4:30 pm. For each session, provide all training materials (manuals, notebooks, hand-outs, etc.) as specified in the Documentation Section of these Project Special Provisions.

Qualified instructors shall present all training courses, lectures, and demonstrations in person. The Engineer shall approve all instructors.

Unless otherwise specified, accommodate a minimum of fifteen (15) persons at each session. Limit all hands-on computer exercises to two participants per computer. Contractor shall furnish at no cost to the Department or City additional networked computers (equivalent to those furnished with the project) as necessary to maintain that ratio of two participants per computer.

Conduct all training courses at a location provided by the Contractor within the City of Durham and at a time mutually agreed upon, but not later than the start of system acceptance testing. Provide training material, manuals, and other handouts to serve not only as subject guidance, but also as quick reference for use by the students. Deliver course material in reproducible form at least three (3) days prior to the course.

B. Subject Areas

Provide the training sessions at the required durations as listed in the Table below. A more detailed description of the required content of each training session is provided in the following sections. As part of the Project Implementation Schedule, propose the time of occurrence of each such training schedule.

| Subject | Minimum Duration |
|--|------------------------------|
| System Overview | ½ Day |
| Traffic Control Center Computer Hardware | 1 Day |
| Traffic Control Applications Software | 1 Day |
| Signal Controller and Cabinet Assemblies (for Signal Timing Personnel and Maintenance Personnel) | 2 Occurrences at 2 Days Each |
| Communications Hardware – Fiber Optic Ethernet Switches (Session 1) | 1 Day |
| Communications Hardware – Wireless Radio Systems (Session 2) | 1 Day |
| Central Communications, LAN Equipment, and Software | 3 Days |
| CCTV Central and Field Equipment – System Maintenance (Session 1) | ½ Day |
| CCTV Central and Field Equipment – System Operations (Session 2) | 1 Day |
| Vehicle Preemption System – Field Equipment (Session 1) | ½ Day |
| Vehicle Preemption System – Central Management Software (Session 2) | ½ Day |

C. Required Content and Format

1. Traffic Control System Overview

This training session shall consist of a lecture and discussion on the overall. The purpose of the session is to provide an overview of the traffic control system. This training session shall have a minimum duration of one-half (0.5) day.

2. Traffic Control Center Computer Hardware

The training session shall consist of classroom training and workshops regarding the operation of each of the traffic control system hardware elements and the operator interface. Conduct training by experienced vendor personnel.

The first session shall involve the operation and maintenance procedures for each element of the traffic control system hardware. As part of this session, stress the precautions that must be observed when operating the equipment. As a minimum, cover the following subjects in this segment of the training session:

- Overview of equipment functions and interactions.

- Computer system operation; restart, cold start.
- Functional operation of the servers, Ethernet Control Center LAN and backup system (including maintenance, proper replacement, etc.)
- Workstation operation, maintenance, proper replacement, etc.
- Central communication operation.
- Troubleshooting and problem identification of equipment.
- Operating system, including network operating system
- Operating system commands, including loading and executing programs, and archiving data to the backup system
- Detection of abnormal conditions within the operating system and hardware
- File management and disk organization
- Techniques for creating and editing files, including those used for the traffic control system databases

This training sessions shall have a minimum duration of one (1) day (lectures and/or workshops).

3. Traffic Control Applications Software

These sessions of training for NCDOT and City staff shall include a review of the basic theory and functional application and operation of the traffic control software supplied by the Contractor, including the interface between the application program and the microcomputer operating system. This training system shall include but not be limited to:

- Time-of-day operation and event scheduling
- Traffic responsive pattern selection algorithms
- Reporting capabilities
- Interactive database manipulation
- Theory and application of traffic responsive operation
- Special function features
- Development and modification of screens used in the graphics display
- Creation, placement and operation of the dynamic portions of the graphics display

This session shall include lecture and classroom exercises and shall have a minimum of duration of one (1) day. Course material shall include the software documentation and the system user's manuals.

4. Signal Controller and Cabinet Assemblies

Hold two identical controller training sessions for maintenance personnel. Each of the identical training sessions shall consist of two (2) consecutive days. Conduct one of these training sessions prior to the installation of any new controllers and cabinets on the project.

Training for controllers and cabinets shall be integrated into a single session with training exercises for cabinets and training exercises for controllers running concurrently. Instructors from the controller vendor and instructors from the cabinet vendor shall be in attendance during all days of the session.

Controller-specific instruction during the session shall be taught by experienced vendor personnel who thoroughly understand both the traffic engineering aspects of signal timing and the entry of timing into the controller and internal TBC's. Cabinet-specific instruction during the session shall be taught by a field service specialist(s) employed by the manufacturer.

These three sessions include training for NCDOT and City traffic engineering, signal timing, and maintenance personnel on controller and internal TBC operation and cabinet assemblies.

The signal controller and cabinet assemblies session shall include, but not be limited to, the following:

- Review of the functional operation of the signal cabinet, including a discussion on each individual component of the cabinet that details its function, installation techniques, and normal operation.
- Formal classroom presentation of the functional operation of the 2070LX controller.
- Review of proper cabinet wiring procedures.
- Review on installation of electrical components and surge protection for cabinets.
- Review on operation of signal monitor tester.
- Hands-on workshop on timing data entry for 2070LX controller, including:
 - All local intersection timing parameters
 - All coordination timing parameters
 - All parameters and threshold levels associated with traffic responsive operation
- Formal classroom presentation and hands-on workshop on operation of local controller utility software.
- Review of proper installation, programming, and troubleshooting of conflict monitors.
- Review of proper installation, programming, and troubleshooting of detector cards and lead-in cable.
- Hands-on workshop wherein maintenance personnel will troubleshoot simulated controller and cabinet assembly faults to the component level.

5. Communications Hardware

The training session shall consist of classroom training and workshops regarding the operation of each of the communications system hardware elements and the technician interface. Conduct training by experienced vendor personnel.

The first session shall involve the operation and maintenance procedures for the fiber optic Ethernet switches (field and central models). At a minimum, cover the following subjects in this segment of the training session:

- Overview of equipment functions and interactions.
- Initialization startup and restarting of hardware.
- Setup and configuration of hardware.
- Functional operation of the fiber optic Ethernet switches (including maintenance, proper replacement, etc.)
- Programming required functionality of Ethernet switches
- Troubleshooting and problem identification of equipment.

The second session shall involve the operation and maintenance procedures for the wireless radio systems. At a minimum, the second session shall consist of the following:

- Overview of equipment functions and interactions.
- Overview of setup and operation of any associated software.
- Initialization startup and restarting of hardware.
- Functional operation of the wireless radio systems (including maintenance of fiber optic Ethernet switches and antennas, integration with signal controller and cabinet, etc.)
- Troubleshooting and problem identification of wireless radio equipment.

Each of these two training sessions shall have a minimum duration of one (1) day (lectures and/or workshops).

6. Central Communications, LAN Equipment, and Software

Provide a training session, conducted by experienced vendor personnel and consisting of both operation and maintenance training of the Central Communication and LAN Equipment for the signal system. As a minimum, this session shall include the following subjects:

- Present system topology
- Operational theory of IP/Ethernet communications
- Initial setup and configuration of core Ethernet switch
- Initial setup and configuration of network and field Ethernet switches

- Operational procedures for network performance management software
- Operational procedures for Ethernet switches
- Operational procedures for remote user operation
- Procedures for adding future devices to the network
- Troubleshooting procedures

Provide a workshop session to reinforce the lectures and demonstrate troubleshooting and problem identification of equipment to the component level as well as validation of communications.

This lecture/workshop training session shall have a minimum duration of three (3) days.

7. CCTV Central and Field Equipment

Provide two sessions for the CCTV central and field equipment training.

The first session shall review the maintenance of the CCTV equipment. The training shall address the preventative maintenance and troubleshooting procedures for all the field and central equipment.

This session shall consist of a mixture of lecture and hands-on workshops and shall have a minimum duration of one-half (0.5) days.

The second session shall address the operational theory and procedures of the CCTV system. This training shall be oriented towards users of the system. The training shall address the use of, but not limited to, the following:

- Camera programming
- Video Server
- Camera control software
- Video wall system hardware and software

Include "hands-on" training workshop with a minimum duration of one (1) day as part of this session. The CCTV training sessions shall be presented by field service specialist(s) employed by the suppliers of the CCTV system components.

8. Vehicle Preemption System

Provide two sessions for the vehicle preemption system central and field equipment training.

The first session shall review the installation, configuration, troubleshooting, and maintenance of the intersection equipment. This session shall consist of a mixture of lecture and hands-on workshops and shall have a minimum duration of one-half (0.5) days.

The second session shall address the operations and procedures of the central management software. This training shall be oriented towards users of the system. This session shall consist of a mixture of lecture and hands-on workshops and shall have a minimum duration of one-half (0.5) days.

The vehicle preemption system training sessions shall be presented by field service specialist(s) employed by the suppliers of the vehicle preemption system components.

41.3. MEASUREMENT AND PAYMENT

Training will be paid for at the contract lump sum price.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Training..... | Lump Sum |

42. TESTING AND ACCEPTANCE

42.1. DESCRIPTION

Test all equipment, cable and software furnished and installed under this Contract according to the Standard Specifications. Conduct testing in the presence of the Engineer. **The Department reserves the right to perform any inspections deemed necessary to assure that the equipment conforms to the requirements specified herein.**

Perform factory and field testing (both pre- and post-installation) on the controllers, cabinets, and related hardware.

Cable provided under this contract shall have been pre-tested in accordance with the EIA/TIA Fiber Optic test procedures and as required by Bellcore GR-20-CORE. Supply proof of successful testing, including documentation of test results.

42.2. CABLE TESTS

Prior to installation, provide cable manufacturer's attenuation and Optical Time Domain Reflectometer (OTDR) testing data for each reel of cable upon request.

After installation and splicing is complete, perform cable tests according to the *Fiber Optic Splice Centers* section of these Project Special Provisions.

42.3. EQUIPMENT TESTS

Cabinets and controllers shall be tested according to the *Controllers with Cabinets* section of these Project Special Provisions.

42.4. TRAFFIC SIGNAL SUBSYSTEM

After completion of the integration of traffic signals for each communications group into new signal system software conduct a minimum of a seven-day test of the traffic signal system hardware and that portion of the communications network serving the traffic signal subsystem.

42.5. INTERSECTION OPERATIONAL TESTS

The Department will conduct complete intersection inspections and operational tests for each project intersection. These inspections and tests will determine whether all the field equipment at each location is installed and permanently labeled properly, and that all functions are in conformance with the Contract Documents. The intersection operational tests will be a non-central controlled functional test of the local controller, including the time-base coordination, emergency vehicle preemption and railroad preemption functions, system detectors, and the full operation of the intersection. All work at the intersection except fiber optic cable installation and termination must be completed for the operational test. This work includes the installation of risers, conduit, junction boxes, conduit entrance into the existing foundation, fiber optic interconnect center, and fiber optic field Ethernet switch.

42.6. SYSTEM OPERATIONAL TEST

All equipment and software provided in this project shall be fully installed and operational prior to the start of the system operational test. These test procedures shall demonstrate that all equipment is fully integrated and operational and is properly controlling the system.

Testing of the software and hardware at the TCC and Signal Shop shall include demonstrating proper operation based on these project special provisions. These tests shall also demonstrate the proper function of the CCTV surveillance system, including camera selection, pan/tilt/zoom functions, and remote monitoring of video images. These tests shall also demonstrate the proper operation of the new intersections on the graphics display system, the full functionality of the installed operator workstation, and demonstrating proper reception of video signals on the monitor and control panels.

Submit a System Operational test plan a minimum of sixty (60) days prior to the scheduled start of the test. The test plan will be reviewed by the Engineer, and either approve it or indicate changes that are required for approval. The Contractor shall then submit the revised test plan. This process shall be repeated until the Engineer is able to approve the test plan.

Provide an operational test matrix at least four weeks prior to the scheduled beginning of the system operational test. The test matrix shall include columns for a description of the test, a summary of the test procedures, a column with sufficient space for comments and a status (pass/fail) column.

Repair or replace any component or software module that fails the System Operational Test. Retest repaired or replaced component(s) or software module.

The testing shall include, but not be limited to, the following:

- Demonstration of all key functions of the distributed processing signal system software, including but not limited to:
 - Uploading and downloading of controller data
 - Remote access and paging
 - All monitoring functions
 - Detector logging
 - Signal monitor logging and uploading
 - Traffic responsive operations
 - Event scheduler
 - Security functions
 - Graphic displays
 - Reports

- Power failure recovery, auto re-boot, and start-up of the distributed processing signal system software
- Database access, modification, storage, and retrieval
- Database backup and restoration from archived backup
- Remote access to the signal system software and CCTV software
- Local Area Network operations including monitoring network status and individual field Ethernet switch status
- Demonstrate that all features of the CCTV central software operate as called for with all field equipment

42.7. OBSERVATION PERIOD

A 60-day observation period shall begin upon the successful completion of the tests described in this Section of the Project Special Provisions as well as the correction of all known deficiencies, including minor construction items and punch-list items developed by the Engineer. During the observation period, the City or Department shall observe equipment and software operations to determine that all components of the signal system operate properly and function according to the requirements of the Plans and these Project Special Provisions over an extended length of time.

During the observation period, respond to failures of the Contractor's equipment within two (2) hours and make repairs within eight (8) hours. For items that pose a traffic safety hazard (such as a controller failure), make repairs within four (4) hours. If any failures affect major system components (as defined below) for more than forty-eight (48) hours, the Department shall suspend the observation period beginning when the failure occurred. Resume the observation period after successful repair or replacement of equipment or software. Failures that necessitate a redesign of any component or failures in any of the major system components exceeding a total of three (3) instances of like nature in any thirty (30) day period shall terminate the observation period. Once the redesigned component has been installed and/or the failures corrected, the observation period shall be restarted from zero with the approval of the Engineer.

The major system components are:

- Local controllers and cabinets
- Fiber Optic Communication Network, including field Ethernet switches
- System hardware and software
- CCTV System, including Video wall system
- Wireless Ethernet Radio System
- Local Area Network

A successful 60-day observation period shall consist of continuous operation with no more than a total of five (5) calendar days on non-operation due to mechanical, electrical, or other malfunctions.

The observation period shall be completed by the project completion date and prior to final acceptance of the project. The observation period shall not begin until all testing has been successfully completed and shall not begin without the approval of the Engineer.

42.8. FINAL ACCEPTANCE

Final system acceptance is defined as the time when all work and materials described in the Plans and these Project Special Provisions have been furnished and completely installed by the Contractor; all parts of the work have been approved and accepted by the Engineer; and successful completion of the 60-day observation period.

The project will be ready for final acceptance upon the satisfactory completion of all tests detailed in this Section of the Project Special provisions; the rectification of all punch-list discrepancies; the submittal of all project documentation; and the completion of all required training.

42.9. MEASUREMENT AND PAYMENT

There will be no direct payment for work covered in this Section. Payment at the contract unit prices for the various items in the Contract will be full compensation for all work covered by this Section.

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|----------------------|--------------|-------|--|----------|-----------|--------|
| ROADWAY ITEMS | | | | | | |
| 0001 | 0000100000-N | 800 | MOBILIZATION | Lump Sum | L.S. | |
| 0002 | 4400000000-E | 1110 | WORK ZONE SIGNS (STATIONARY) | 150 | SF | |
| 0003 | 4405000000-E | 1110 | WORK ZONE SIGNS (PORTABLE) | 495 | SF | |
| 0004 | 4410000000-E | 1110 | WORK ZONE SIGNS (BARRICADE MOUNTED) | 250 | SF | |
| 0005 | 4415000000-N | 1115 | FLASHING ARROW BOARD | 4 | EA | |
| 0006 | 4420000000-N | 1120 | PORTABLE CHANGEABLE MESSAGE SIGN | 4 | EA | |
| 0007 | 4430000000-N | 1130 | DRUMS | 90 | EA | |
| 0008 | 4435000000-N | 1135 | CONES | 60 | EA | |
| 0009 | 4445000000-E | 1145 | BARRICADES (TYPE III) | 120 | LF | |
| 0010 | 4455000000-N | 1150 | FLAGGER | 400 | DAY | |
| 0011 | 4480000000-N | 1165 | TMA | 4 | EA | |
| 0012 | 4510000000-N | 1190 | LAW ENFORCEMENT | 6,400 | HR | |
| 0013 | 4516000000-N | 1180 | SKINNY DRUM | 60 | EA | |
| 0014 | 4590000000-E | SP | GENERIC TRAFFIC CONTROL ITEM PEDESTRIAN CHANNELIZING DEVICES | 200 | LF | |
| 0015 | 7048500000-E | 1705 | PEDESTRIAN SIGNAL HEAD (16", 1 SECTION W/COUNTDOWN) | 32 | EA | |
| 0016 | 7060000000-E | 1705 | SIGNAL CABLE | 116,100 | LF | |
| 0017 | 7120000000-E | 1705 | VEHICLE SIGNAL HEAD (12", 3 SECTION) | 494 | EA | |
| 0018 | 7132000000-E | 1705 | VEHICLE SIGNAL HEAD (12", 4 SECTION) | 156 | EA | |
| 0019 | 7144000000-E | 1705 | VEHICLE SIGNAL HEAD (12", 5 SECTION) | 9 | EA | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|---------------|-----------|--------|
| 0020 | 7180000000-N | 1706 | BACKPLATE | 11 EA | | |
| 0021 | 7204000000-N | 1705 | LOUVER | 3 EA | | |
| 0022 | 7216000000-N | 1705 | MODIFY EXISTING VEHICLE SIGNAL HEAD | 5 EA | | |
| 0023 | 7228000000-N | SP | RELOCATE EXISTING VEHICLE SIGNAL HEAD | 3 EA | | |
| 0024 | 7252000000-E | 1710 | MESSENGER CABLE (1/4") | 125,800 LF | | |
| 0025 | 7264000000-E | 1710 | MESSENGER CABLE (3/8") | 150 LF | | |
| 0026 | 7279000000-E | 1715 | TRACER WIRE | 64,200 LF | | |
| 0027 | 7288000000-E | 1715 | PAVED TRENCHING (*****) (1, 2") | 500 LF | | |
| 0028 | 7288000000-E | 1715 | PAVED TRENCHING (*****) (2, 2") | 500 LF | | |
| 0029 | 7300000000-E | 1715 | UNPAVED TRENCHING (*****) (1, 2") | 1,900 LF | | |
| 0030 | 7300000000-E | 1715 | UNPAVED TRENCHING (*****) (2, 2") | 24,400 LF | | |
| 0031 | 7301000000-E | 1715 | DIRECTIONAL DRILL (*****) (1, 2") | 300 LF | | |
| 0032 | 7301000000-E | 1715 | DIRECTIONAL DRILL (*****) (2, 2") | 42,500 LF | | |
| 0033 | 7312000000-N | 1716 | JUNCTION BOX (*****) (SPECIAL OVERSIZED, HEAVY DUTY) | 57 EA | | |
| 0034 | 7324000000-N | 1716 | JUNCTION BOX (STANDARD SIZE) | 53 EA | | |
| 0035 | 7348000000-N | 1716 | JUNCTION BOX (OVER-SIZED, HEAVY DUTY) | 294 EA | | |
| 0036 | 7360000000-N | 1720 | WOOD POLE | 5 EA | | |
| 0037 | 7372000000-N | 1721 | GUY ASSEMBLY | 1,373 EA | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|----------|-----------|--------|
| 0038 | 7396000000-E | 1722 | 1/2" RISER WITH WEATHERHEAD | 4 | EA | |
| 0039 | 7408000000-E | 1722 | 1" RISER WITH WEATHERHEAD | 4 | EA | |
| 0040 | 7420000000-E | 1722 | 2" RISER WITH WEATHERHEAD | 8 | EA | |
| 0041 | 7430000000-N | 1722 | HEAT SHRINK TUBING RETROFIT KIT | 184 | EA | |
| 0042 | 7432000000-E | 1722 | 2" RISER WITH HEAT SHRINK TUBING | 273 | EA | |
| 0043 | 7444000000-E | 1725 | INDUCTIVE LOOP SAWCUT | 22,200 | LF | |
| 0044 | 7456000000-E | 1726 | LEAD-IN CABLE (*****) (14-2) | 101,000 | LF | |
| 0045 | 7516000000-E | 1730 | COMMUNICATIONS CABLE (**FIBER) (144) | 106,600 | LF | |
| 0046 | 7516000000-E | 1730 | COMMUNICATIONS CABLE (**FIBER) (24) | 394,600 | LF | |
| 0047 | 7516000000-E | 1730 | COMMUNICATIONS CABLE (**FIBER) (288) | 5,900 | LF | |
| 0048 | 7516000000-E | 1730 | COMMUNICATIONS CABLE (**FIBER) (36) | 156,300 | LF | |
| 0049 | 7516000000-E | 1730 | COMMUNICATIONS CABLE (**FIBER) (72) | 252,700 | LF | |
| 0050 | 7528000000-E | 1730 | DROP CABLE | 157,100 | LF | |
| 0051 | 7540000000-N | 1731 | SPLICE ENCLOSURE | 400 | EA | |
| 0052 | 7541000000-N | 1731 | MODIFY SPLICE ENCLOSURE | 3 | EA | |
| 0053 | 7566000000-N | 1733 | DELINEATOR MARKER | 213 | EA | |
| 0054 | 7575142200-N | SP | NEW ELECTRICAL SERVICE | 10 | EA | |
| 0055 | 7575160000-E | 1734 | REMOVE EXISTING COMMUNICATIONS CABLE | 52,400 | LF | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|----------|-----------|--------|
| 0056 | 7575180000-N | 1735 | CABLE TRANSFER | 25 | EA | |
| 0057 | 7636000000-N | 1745 | SIGN FOR SIGNALS | 67 | EA | |
| 0058 | 7648000000-N | 1746 | RELOCATE EXISTING SIGN | 2 | EA | |
| 0059 | 7684000000-N | 1750 | SIGNAL CABINET FOUNDATION | 52 | EA | |
| 0060 | 7686000000-N | 1752 | CONDUIT ENTRANCE INTO EXISTING FOUNDATION | 124 | EA | |
| 0061 | 7687000000-N | 1752 | MODIFY FOUNDATION FOR CONTROLLER CABINET | 27 | EA | |
| 0062 | 7696000000-N | 1751 | CONTROLLERS WITH CABINET (***** (2070LX, 332 BASE MOUNTED) | 27 | EA | |
| 0063 | 7696000000-N | 1751 | CONTROLLERS WITH CABINET (***** (2070LX, 336S BASE MOUNTED) | 10 | EA | |
| 0064 | 7696000000-N | 1751 | CONTROLLERS WITH CABINET (***** (2070LX, 336S POLE MOUNTED) | 2 | EA | |
| 0065 | 7780000000-N | 1751 | DETECTOR CARD (TYPE 2070L) | 2,892 | EA | |
| 0066 | 7901000000-N | 1753 | CABINET BASE EXTENDER | 380 | EA | |
| 0067 | 7901010000-N | 1753 | CABINET BASE ADAPTER | 4 | EA | |
| 0068 | 7980000000-N | SP | GENERIC SIGNAL ITEM 65" LED MONITOR | 1 | EA | |
| 0069 | 7980000000-N | SP | GENERIC SIGNAL ITEM APS DETECTOR STATIONS | 8 | EA | |
| 0070 | 7980000000-N | SP | GENERIC SIGNAL ITEM BACKUP STORAGE SERVER | 1 | EA | |
| 0071 | 7980000000-N | SP | GENERIC SIGNAL ITEM CCTV WOOD POLE | 4 | EA | |
| 0072 | 7980000000-N | SP | GENERIC SIGNAL ITEM CENTRAL CONTROL UNITS FOR APS DETECTOR STATIONS | 1 | EA | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|-----------|-----------|--------|
| 0073 | 7980000000-N | SP | GENERIC SIGNAL ITEM COMPUTER WORKSTATION | 13 EA | | |
| 0074 | 7980000000-N | SP | GENERIC SIGNAL ITEM CONTROLLER WITH CABINET & AUX FILE (2070LX 332 BASE MOUNTED) | 330 EA | | |
| 0075 | 7980000000-N | SP | GENERIC SIGNAL ITEM CONTROLLER WITH CABINET & AUX FILE (2070LX, 336S BASE MOUNTED) | 32 EA | | |
| 0076 | 7980000000-N | SP | GENERIC SIGNAL ITEM CONTROLLER WITH CABINET & AUX FILE (2070LX, 336S POLE MOUNTED) | 3 EA | | |
| 0077 | 7980000000-N | SP | GENERIC SIGNAL ITEM CORE ETHERNET SWITCH | 2 EA | | |
| 0078 | 7980000000-N | SP | GENERIC SIGNAL ITEM DIGITAL CCTV CAMERA ASSEMBLY | 124 EA | | |
| 0079 | 7980000000-N | SP | GENERIC SIGNAL ITEM DISTRIBUTED PROCESSING SIGNAL SYSTEM SERVER | 1 EA | | |
| 0080 | 7980000000-N | SP | GENERIC SIGNAL ITEM ETHERNET HUB CABINET | 3 EA | | |
| 0081 | 7980000000-N | SP | GENERIC SIGNAL ITEM FIELD ETHERNET SWITCH | 408 EA | | |
| 0082 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH 2070-1C CPU MODULE | 10 EA | | |
| 0083 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH 2070LX CONTROLLER | 10 EA | | |
| 0084 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH AC ISOLATOR CARD | 10 EA | | |
| 0085 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH BASE MOUNT 332 CABINET | 8 EA | | |
| 0086 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH CCTV ASSEMBLY | 5 EA | | |
| 0087 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH CONFLICT MONITOR | 10 EA | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|----------|-----------|--------|
| 0088 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH CONFLICT MONITOR TESTER | 1 EA | | |
| 0089 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH DC ISOLATOR CARD | 10 EA | | |
| 0090 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH DETECTOR CARD | 20 EA | | |
| 0091 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH FIELD ETHERNET SWITCH | 10 EA | | |
| 0092 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH FLASH TRANSFER RELAY | 10 EA | | |
| 0093 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH FLASHER MODULE | 10 EA | | |
| 0094 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH INTERCONNECT CENTER (OVERSIZED) | 1 EA | | |
| 0095 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH INTERCONNECT CENTER (STANDARD) | 10 EA | | |
| 0096 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH LOAD SWITCH | 10 EA | | |
| 0097 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH POLE MOUNT 336 CABINET | 2 EA | | |
| 0098 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH SPLICE ENCLOSURE | 20 EA | | |
| 0099 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH ST PIGTAILS | 20 EA | | |
| 0100 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH ST-LC HYBRID JUMPERS | 40 EA | | |
| 0101 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH SURGE PROTECTOR | 10 EA | | |
| 0102 | 7980000000-N | SP | GENERIC SIGNAL ITEM FURNISH TEST CABINET & CON- TROLLER | 1 EA | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|-----------|-----------|--------|
| 0103 | 7980000000-N | SP | GENERIC SIGNAL ITEM HUB ETHERNET SWITCH | 3 EA | | |
| 0104 | 7980000000-N | SP | GENERIC SIGNAL ITEM INSTALL CELLULAR MODEM & AN- TENNA | 6 EA | | |
| 0105 | 7980000000-N | SP | GENERIC SIGNAL ITEM INTEGRATED CABINET BASE ADAPTER | 2 EA | | |
| 0106 | 7980000000-N | SP | GENERIC SIGNAL ITEM INTERCONNECT CENTER (OVER- SIZED) | 3 EA | | |
| 0107 | 7980000000-N | SP | GENERIC SIGNAL ITEM INTERCONNECT CENTER (STANDARD) | 399 EA | | |
| 0108 | 7980000000-N | SP | GENERIC SIGNAL ITEM LAPTOP COMPUTER | 7 EA | | |
| 0109 | 7980000000-N | SP | GENERIC SIGNAL ITEM MODIFY EXISTING ELECTRICAL SERVICE | 2 EA | | |
| 0110 | 7980000000-N | SP | GENERIC SIGNAL ITEM NETWORK ETHERNET SWITCH | 6 EA | | |
| 0111 | 7980000000-N | SP | GENERIC SIGNAL ITEM PUBLIC INTERNET SERVICE | 1 EA | | |
| 0112 | 7980000000-N | SP | GENERIC SIGNAL ITEM RACK CABINET | 2 EA | | |
| 0113 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOTE ACCESS SERVER | 1 EA | | |
| 0114 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE & REPLACE TRAFFIC SIGNAL SPAN POLE | 5 EA | | |
| 0115 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING CABINET FOUNDATION | 6 EA | | |
| 0116 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING CCTV ASSEMBLY | 17 EA | | |
| 0117 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING CCTV CABINET | 6 EA | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|--|-----------|-----------|--------|
| 0118 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING ELECTRICAL SERVICE | 16 EA | | |
| 0119 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING JUNCTION BOX | 30 EA | | |
| 0120 | 7980000000-N | SP | GENERIC SIGNAL ITEM REMOVE EXISTING WIRELESS RADIO AND ANTENNA | 18 EA | | |
| 0121 | 7980000000-N | SP | GENERIC SIGNAL ITEM SIGNAL SYSTEM COMMUNICATIONS SERVER | 1 EA | | |
| 0122 | 7980000000-N | SP | GENERIC SIGNAL ITEM SPARE RSU POE SURGE PROTECTOR | 6 EA | | |
| 0123 | 7980000000-N | SP | GENERIC SIGNAL ITEM SPAT GUI LAPTOP COMPUTER | 1 EA | | |
| 0124 | 7980000000-N | SP | GENERIC SIGNAL ITEM TERMINAL SPLICE BOX | 51 EA | | |
| 0125 | 7980000000-N | SP | GENERIC SIGNAL ITEM UPGRADE CCTV LIGHTNING PROTECTION | 2 EA | | |
| 0126 | 7980000000-N | SP | GENERIC SIGNAL ITEM VEHICLE PREEMPTION SYSTEM INTERSECTION EQUIPMENT | 140 EA | | |
| 0127 | 7980000000-N | SP | GENERIC SIGNAL ITEM VEHICLE PREEMPTION SYSTEM SERVER | 1 EA | | |
| 0128 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR A HMI | 1 EA | | |
| 0129 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR A OBU | 2 EA | | |
| 0130 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR A RSU | 6 EA | | |
| 0131 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR A SPARE RSU | 1 EA | | |
| 0132 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR B HMI | 1 EA | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|----------|-----------|--------|
| 0133 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR B OBU | 2 EA | | |
| 0134 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR B RSU | 6 EA | | |
| 0135 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR B SPARE RSU | 1 EA | | |
| 0136 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR C HMI | 1 EA | | |
| 0137 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR C OBU | 2 EA | | |
| 0138 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR C RSU | 6 EA | | |
| 0139 | 7980000000-N | SP | GENERIC SIGNAL ITEM VENDOR C SPARE RSU | 1 EA | | |
| 0140 | 7980000000-N | SP | GENERIC SIGNAL ITEM VIDEO CONVERTER UNIT | 4 EA | | |
| 0141 | 7980000000-N | SP | GENERIC SIGNAL ITEM VIDEO DISPLAY APPLIANCE | 9 EA | | |
| 0142 | 7980000000-N | SP | GENERIC SIGNAL ITEM VIDEO MANAGEMENT SYSTEM SERVER | 1 EA | | |
| 0143 | 7980000000-N | SP | GENERIC SIGNAL ITEM VPN FIREWALL | 1 EA | | |
| 0144 | 7980000000-N | SP | GENERIC SIGNAL ITEM WIRELESS ACCESS POINT | 1 EA | | |
| 0145 | 7980000000-N | SP | GENERIC SIGNAL ITEM WIRELESS ETHERNET RADIO SYSTEM | 13 EA | | |
| 0146 | 7985000000-N | SP | GENERIC SIGNAL ITEM COMPUTER HARDWARE INTEGRATION | Lump Sum | L.S. | |
| 0147 | 7985000000-N | SP | GENERIC SIGNAL ITEM DURHAM CITY HALL BUILDING MOD- IFICATIONS | Lump Sum | L.S. | |
| 0148 | 7985000000-N | SP | GENERIC SIGNAL ITEM DURHAM SIGNAL SHOP BUILDING MODIFICATIONS | Lump Sum | L.S. | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|---|-------------|-----------|--------|
| 0149 | 7985000000-N | SP | GENERIC SIGNAL ITEM ENTERPRISE VIDEO MANAGEMENT SYSTEM SOFTWARE | Lump Sum | L.S. | |
| 0150 | 7985000000-N | SP | GENERIC SIGNAL ITEM INTERSECTION MAP CREATION & INSTALLATION | Lump Sum | L.S. | |
| 0151 | 7985000000-N | SP | GENERIC SIGNAL ITEM LAN INTEGRATION | Lump Sum | L.S. | |
| 0152 | 7985000000-N | SP | GENERIC SIGNAL ITEM NETWORK PERFORMANCE MANAGEMENT SOFTWARE | Lump Sum | L.S. | |
| 0153 | 7985000000-N | SP | GENERIC SIGNAL ITEM SIGNAL SYSTEM SOFTWARE | Lump Sum | L.S. | |
| 0154 | 7985000000-N | SP | GENERIC SIGNAL ITEM TEST BED CONFIGURATION & TESTING | Lump Sum | L.S. | |
| 0155 | 7985000000-N | SP | GENERIC SIGNAL ITEM TRAINING | Lump Sum | L.S. | |
| 0156 | 7985000000-N | SP | GENERIC SIGNAL ITEM VEHICLE PREEMPTION SYSTEM SOFTWARE | Lump Sum | L.S. | |
| 0157 | 7985000000-N | SP | GENERIC SIGNAL ITEM VENDOR A TEST BED TRAINING | Lump Sum | L.S. | |
| 0158 | 7985000000-N | SP | GENERIC SIGNAL ITEM VENDOR B TEST BED TRAINING | Lump Sum | L.S. | |
| 0159 | 7985000000-N | SP | GENERIC SIGNAL ITEM VENDOR C TEST BED TRAINING | Lump Sum | L.S. | |
| 0160 | 7985000000-N | SP | GENERIC SIGNAL ITEM VIDEO WALL SYSTEM | Lump Sum | L.S. | |
| 0161 | 7990000000-E | SP | GENERIC SIGNAL ITEM COMMUNICATIONS CABLE (ARMORED 12-FIBER) | 1,400 LF | | |
| 0162 | 7990000000-E | SP | GENERIC SIGNAL ITEM COMMUNICATIONS CABLE (ARMORED 72-FIBER) | 2,800 LF | | |

County : Durham

| Line # | Item Number | Sec # | Description | Quantity | Unit Cost | Amount |
|--------|--------------|-------|--|--------------|-----------|--------|
| 0163 | 7990000000-E | SP | GENERIC SIGNAL ITEM DIRECTIONAL DRILL (1, 5") & (2, 2") | 1,800 LF | | |
| 0164 | 7990000000-E | SP | GENERIC SIGNAL ITEM DIRECTIONAL DRILL (1, 6") & (3, 2") | 500 LF | | |
| 0165 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH COMMUNICAITONS CABLE (144 FIBER) | 2,500 LF | | |
| 0166 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH COMMUNICATIONS CABLE (24 FIBER) | 5,000 LF | | |
| 0167 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH COMMUNICATIONS CABLE (288 FIBER) | 500 LF | | |
| 0168 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH COMMUNICATIONS CABLE (36 FIBER) | 2,500 LF | | |
| 0169 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH COMMUNICATIONS CABLE (72 FIBER) | 5,000 LF | | |
| 0170 | 7990000000-E | SP | GENERIC SIGNAL ITEM FURNISH DROP CABLE | 2,500 LF | | |
| 0171 | 7990000000-E | SP | GENERIC SIGNAL ITEM POE CABLE | 14,700 LF | | |

1452/Feb26/Q1681759.0/D1282115092200/E171

Total Amount Of Bid For Entire Project :