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

INDUSTRY DRAFT REQUEST FOR PROPOSALS

DESIGN-BUILD PROJECT
Statewide ITS Resilience Project

HO-0005

April 14, 2022

VOID FOR BIDDING

DATE AND TIME OF TECHNICAL PROPOSAL SUBMISSION: **May 31, 2022 BY 4:00 PM Local Time**

DATE AND TIME OF PRICE PROPOSAL SUBMISSION: **June 6, 2022 BY 4:00 PM Local Time**

DATE AND TIME OF PRICE PROPOSAL OPENING: **June 21, 2022 AT 2:00 PM Local Time**

CONTRACT ID: C204749

WBS ELEMENT NO.: 49858.3.1

FEDERAL-AID NO.: 00SS135

COUNTIES: Statewide

ROUTE NO. Various

LOCATION: Statewide

TYPE OF WORK: ITS DEVICE AND COMMUNICATION INFRASTRUCTURE PREVENTIVE AND RESPONSIVE MAINTENANCE, ITS DEVICE REPLACEMENT, AND FIBER ASSET MANAGEMENT SYSTEM SUPPORT AS SPECIFIED IN THE SCOPE OF WORK CONTAINED IN THE REQUEST FOR PROPOSALS

NOTICE:

ALL PROPOSERS 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 PROPOSER 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. PROPOSERS 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. NOT WITHSTANDING THESE LIMITATIONS ON BIDDING, THE PROPOSER WHO IS AWARDED ANY PROJECT SHALL COMPLY WITH CHAPTER 87 OF THE GENERAL STATUTES OF NORTH CAROLINA FOR LICENSING REQUIREMENTS WITHIN 60 CALENDAR DAYS OF PREFERRED PROCUREMENT TRACK AND PREFERRED PROPOSER ANNOUNCEMENT, REGARDLESS OF FUNDING SOURCES.

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GLOSSARY

The Glossary below provides the meaning of each of the acronyms in this document. Definitions are defined within the document.

("ADA") – Americans with Disabilities Act of 1990

(“ANSI”) – American National Standards Institute

(“APWA”) – American Public Works Association

(“ASTM”) – The American Society for Testing and Materials

(“CV”) – Connected Vehicle

(“DB”) – Design Build

(“DBE”) – Disadvantaged Business Enterprise

(“DIT”) – Department of Information Technology

(“DMS”) – Dynamic Message Signs

(“EIA”) – The Electronic Industries Association

(“FG”) – Final Grade

(“FHWA”) – The Federal Highway Administration

(“GPS”) – Global Positioning System

(“IAMS”) – ITS Asset Management System

(“IMP”) – Incident Management Plan

(“IMSA”) – The International Municipal Signal Association

(“INMS”) – ITS Network Monitoring Systems

(“ITS”) – Intelligent Transportation Systems

(“IWOMS”) – ITS Work Order Management System

(“JB”) – Junction Boxes

(“LCN”) – Lane Closure Notice

(“MUTCD”) – FHWA Manual on Uniform Traffic Control Devices

(“NCDOT”) – North Carolina Department of Transportation

(“NCSMUTCD”) – NCDOT Supplement to the Manual on Uniform Traffic Control Devices

(“NEC”) – National Electrical Code

(“NEIS”) – National Electrical Installation Standards

(“NEPA”) – National Environmental Policy Act

(“NESC”) – National Electrical Safety Code

(“NRHP”) – National Register of Historic Places

(“O&M”) – Operations and Maintenance

(“OSHA”) – Occupational Safety and Health Administration

(“PCMS”) – Portable Changeable Message Signs

(“PEF”) – Private Engineering Firm

(“PFP”) – Pay–For–Performance

(“PM”) – Preventive Maintenance

(“PMP”) – Project Management Plan

(“POR”) – Plan of Record

(“PPE”) – Personal Protective Equipment

(“PSF”) – Professional Services Firm

(“QA/QC”) – Quality Assurance and Quality Control

(“QPL”) – Qualified Products List

(“R/W”) – Right of Way

(“REU”) – Roadside Environmental Unit

(“RFC”) – Release for Construction

(“RFP”) – Request for Proposals

(“RFQ”) – Request for Qualifications

(“RM”) – Responsive maintenance

(“RSU”) – Roadside Unit

(“RWIS”) – Remote Weather Information Systems

(“SLA”) – Service Level Agreement

(“STOC”) – Statewide Transportation Operations Center

(“TMP”) – Transportation Management Plan

(“TMPC”) – Transportation Management Phasing Concept

(“TOP”) – Traffic Operations Plan

(“TRC”) – Technical Review Committee

(“TSMO”) – Transportation Systems Management and Operations

(“TSO”) – Traffic Systems Operations

(“TTC”) – Temporary Traffic Control

(“TTCP”) – Temporary Traffic Control Plans

(“UAS”) – Unmanned Aircraft Systems

(“UDPA”) – The North Carolina Underground Damage Prevention Act

(“UL”) – The Underwriters' Laboratories, Inc.

(“UPS”) – Uninterruptable Power Supplies

PART A: PROCUREMENT SCHEDULE AND BOND/SECURITY REQUIREMENTS

A-1.1. Procurement Schedule

The Department reserves the right to make changes or alterations to this schedule.

The Department is committed to procuring the Statewide ITS Resilience scope of work, as described in this RFP. The Department is also committed to the contract timeframe communicated with Proposers to date.

Activity	Date
RFQ Advertisement	March 15, 2022
Statement of Qualifications Due From Proposers	April 5, 2022
Department Announces Short-listed Teams	April 14, 2022
First Industry Draft RFP issued to Short-listed Teams	April 14, 2022
Meetings with Short-listed Teams	May 3, 2022
Department Issues Final RFP to Short-listed Teams	May 10, 2022
Technical Proposals Due	May 31, 2021
Sealed Price Proposals Due	June 6, 2022
Technical Presentations by Short-listed Teams	June 7, 2022
Open Price Proposals	June 21, 2022

Additional information may be updated to fulfill NCDOT's reporting requirements to the Joint Legislative Transportation and Oversight Committee, as required under applicable Law. All events and dates set forth in the Procurement Schedule and elsewhere in the RFP are subject to change in NCDOT's sole discretion, and the Proposer shall be solely responsibility for monitoring the Procurement Schedule for any such changes.

All times listed in the Procurement Schedule and elsewhere in the RFP are for local, Eastern Time in Raleigh, North Carolina for the applicable date. If any of the time periods set forth in the Procurement Schedule or this RFP fall on a non-Business Day, then such period shall automatically be extended to the next Business Day.

A-1.2. Bond/Security Requirements

The proposed bid bond, payment bond and performance bond requirements are set out below. Each of the bid bond, payment bond and performance bond must be substantially in the form described in the subsections further below.

Bond/Security Requirements

- Bid bond: $2 million
- Beginning on the Closing Date and continuing each year the Term thereafter, Contractor will furnish and maintain annual payment and performance bonds each in the amount equal to 100% of the total ITS Resilience Project price shown in Appendix Part C—Price Proposal.

Form of Bid Bond/Security Requirements

Please refer to Appendix Part D—Form of Bid Bond

Form of Payment and Performance Bond/Security Requirements

Proposers can access the form of Payment and Performance Bonds here:
https://connect.ncdot.gov/letting/Pages/Central-Letting-Forms.aspx

PART B: GENERAL INFORMATION FOR PROPOSERS

B-1.1. Introduction

In this Request for Proposals ("RFP"), the North Carolina Department of Transportation ("NCDOT" or the "Department"), an agency of the State of North Carolina ("State"), is soliciting Proposals from Proposers desiring to support Statewide Intelligent Transportation System (ITS) Resilience described herein (the "Project") through one contract entered into by the Proposer and NCDOT.

B-1.2. Project Scope Overview

The Project includes services related and pertaining to maintenance, repair, replacement, installation, documentation, and management of the Department's ITS devices, ITS communication infrastructure, and related infrastructure statewide across North Carolina. Project services shall include but are not limited to:

- Preventive Maintenance of ITS devices and communication infrastructure, including traffic control
- Responsive Maintenance of ITS devices, including traffic control
- Responsive Maintenance of communications cabling and electrical cabling infrastructure
- Device Replacement, including traffic control
- NC811 Underground Location Services
- Fiber Asset Management System (FAMS) support

B-1.3. Contract Term and Type

The Department anticipates one three (3) year contracted utilized on an "as needed" basis. Purchase orders will be executed and a Notice to Proceed (NTP) issued for each task order before services may commence, unless directed otherwise by the Department under emergency procedures. Task orders will be paid on a firm-fixed price basis. Task orders for specific services will be paid in accordance with specific rates of compensation as bid via the awarded Proposer's cost proposal.

B-1.4. Contract Amount

The contract maximum amount will be determined by the Department at the time of award. The maximum contract amount and the items and quantities listed in Appendix Part C – Price Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid**, **B: Repair Unit Cost Bids**, **C: Device Replacement Unit Costs**, and **D: Fiber Asset Management System Support Unit Costs)** may be adjusted, as determined by the Department, during the term of the contract as items and specific quantities of each item are realized. The compensation to the Proposer shall be subject to the terms and conditions of the contract. Such payment shall be full compensation for work performed or services rendered and for all labor, materials, supplies, and equipment necessary to complete the work specified in and within each task order. The cost of such services shall be paid in accordance with each task order.

B-1.5. Procurement Process Overview

This RFP is issued in accordance with the provisions of Section 136-18(39) and 136-18(46) of the North Carolina General Statutes (the "North Carolina Statutes") and other applicable provisions of law. The purpose of this RFP is to solicit responses from experienced firms interested in providing services outlined in the Project Scope Overview. Throughout this RFP, the terms Contractor, Proposer, Bidder, Team, Firm and Company are synonymous and may include consortia, partnerships, joint ventures, and others. Furthermore, throughout this RFP, the terms NCDOT, Department, Engineer and State are synonymous.

After issuance of this first industry draft RFP to Proposers, the Department will hold 1-on-1 meetings with Proposers and issue a final version of the RFP (if deemed necessary). After Proposals have been reviewed, concluding the RFP process, NCDOT will determine the Preferred Proposer.

This RFP seeks to obtain technical and cost proposals from such qualified teams. All respondents to this RFP are subject to instructions communicated in this document and are cautioned to completely review the entire RFP and follow instructions carefully. The Department reserves the right to modify existing provisions or include additional provisions, which are not addressed herein.

The Department reserves the right to reject any or all proposals, and to waive technicalities and informalities at its discretion. This solicitation is being conducted by the Department under its authority to procure services ancillary to the construction and maintenance of a public road.

B-1.6. Status of Federal Environmental Approval

NCDOT is currently developing the environmental documentation under FHWA's guidelines for compliance with the National Environmental Policy Act ("NEPA"). It is important for Proposers to note, at this time, that the proposed Project remains in the environmental process. It is possible that the Project scope may need to be modified to comply with the environmental process. Nothing contained in the RFP is intended to modify, limit, or otherwise constrain the environmental process or commit NCDOT or any other entity to undertake any action with respect to the Project, including any procurement or the final design and construction of the Project.

B-1.7. Disadvantage Business Enterprises

NCDOT is committed to complying with the North Carolina General Statute 136-28.4 with respect to disadvantaged minority-owned and women-owned business enterprises for state funded projects and supporting Disadvantaged Business Enterprise ("DBE") firms on federally funded projects. See Appendix F Project Special Provisions.

B-2.0. NCDOT Pre-Qualification Requirements

Separate to the Request for Qualifications ("RFQ") qualification process, certain parties within Proposer teams shall be pre-qualified by the Department for the work they are identified to perform. If the work is to be done by a Proposer office other than the one that is prequalified, it will be necessary to have that Proposer office prequalified. Prior to the deadline for submitting the

RFP Proposal response(s), the comprehensive team (Lead Contractor and/or subconsultants) shall be pre-qualified with the Department for each of the following codes:

- 000123 – Intelligent Transportation Systems (ITS) Design
- 000209 – Signal System Design
- 000541 – Traffic Management Plan – Level 1 and 2
- 000247 – Traffic Management Plan – Level 3 and 4
- 000099 – Other – ITS, CCTV, Network Equipment, Computerized Signal System & Video Wall Install
- 001700 – Traffic Signals and ITS
- 001730 – Utility Installation/Removal: Fiber Optic Cable
- 001740 – Metal Pole Installation
- 002020 – Utility Installation/Removal: Power/Electricity
- 001407 – Wood Pole Installation
- 001105 – Work Zone Traffic Control Devices
- 001110 – Work Zone Signs – Ground and Barricade Mounted
- 002005 – Directional Boring/Directional Drilling
- 003030 – Drilled Piers for Metal Poles

All Joint Ventures, LLCs, or any legal structure that is different than the existing pre-qualification status must be pre-qualified prior to the submittal deadline for Proposals. Sub-contractors need only be pre-qualified prior to performing the work.

For the NCDOT prequalification process and requirements, refer to Article 102-2 of the Standard Specifications and the following website:

http://www.ncdot.org/business/howtogetstarted/

B-2.1. Amendments

NCDOT reserves the right to issue amendments to this RFP at any time before the Proposal Response Deadline. NCDOT will distribute any amendments to this RFP to all RFP holders identified on the short-list. No oral or written response provided by NCDOT in connection with this RFP will be binding on NCDOT, nor will it change, modify, or waive the requirements of this RFP, except to the extent such response is included in an amendment issued in accordance with this Part B-2.1 (Amendments).

B-2.2. General Information

NCDOT reserves the right, at its sole discretion, to either proceed no further with the Project procurement process or to re-advertise in another public solicitation.

The NCDOT reserves the right to accept or reject any and all Proposal responses and / or discontinue the selection process at any time prior to contract execution.

The NCDOT assumes no liability and will not reimburse costs incurred by firms (whether selected or not) in developing Proposal responses to this RFP.

The NCDOT will not be bound by oral explanations or instructions given at any time during the procurement process or after award. Only information that is received in response to this RFP will be evaluated; references to information previously submitted will not suffice as a response to this solicitation.

The NCDOT reserves the right to request or obtain additional information about any and all responses to this RFP. NCDOT may also issue addenda to this RFP which will be issued to all short-listed teams.

Proposers are encouraged to familiarize themselves with the North Carolina Public Records Act, North Carolina General Statute § 132-1 et seq ("Public Records Law") and any other laws and regulations applicable to the disclosure of documents submitted under the RPF, including North Carolina General Statue § 136-28.5(c). All materials submitted by Proposers, including the Proposals, shall be subject to such laws. In no event shall NCDOT or any of its agents, representatives, consultants, directors, officers, or employees be liable to a Proposer or Proposer team member for the disclosure of any materials or information submitted in response to the RFP.

In the event the Proposer submits any documents which the Proposer believes are not subject to disclosure pursuant to the Public Records Law, it must conspicuously mark each document "CONFIDENTIAL" or "CONFIDENTIAL TRADE SECRETS" in the header or footer of each such page affected. Blanket designations that do not identify the specific information shall not be acceptable and may be cause for NCDOT to treat the entire Proposal as public information.

NCDOT will not advise a submitting party as to the nature or content of documents entitled to protection from disclosure under the Public Records Law or other applicable laws, as to the interpretation of such laws, or as to definition of trade secret. Nothing contained in this provision shall modify or amend requirements and obligations imposed on NCDOT by the Public Records Law or other applicable Law. The provisions of the Public Records Law or other Laws shall control in the event of a conflict between the procedures described above and the applicable Law. Information submitted by Proposers may be made available to USDOT representatives. NCDOT intends to follow procedures established by USDOT to avoid disclosure, to the extent possible, of such information under the Freedom of Information Act.

In the event of any proceeding or litigation concerning the disclosure of any material submitted by the submitting party, NCDOT will be the custodian retaining the material until otherwise ordered by a court or such other authority having jurisdiction with respect thereto, and the submitting party will be responsible for otherwise prosecuting or defending any action concerning the materials at its sole expense and risk; provided, however, that NCDOT reserves the right, in its sole discretion, to intervene or participate in the litigation in such manner as it deems necessary or desirable. All costs and fees (including attorneys' fees and costs) incurred by NCDOT in connection with any litigation, proceeding, or request for disclosure shall be reimbursed and paid by Proposer objecting to disclosure. Each Proposer shall be responsible for all its own costs in connection with any litigation, proceeding, or request for disclosure.

Except to the extent provided under applicable Law, in no event shall NCDOT, or any of its board members, agents, representatives, consultants, directors, officers or employees be liable to a Proposer or Proposer team member for the disclosure of all or a portion of a Proposal submitted under the RFP.

Proposers should note that the RFP and a Contract Agreement will be required to conform with federal laws and regulations applicable to projects funded in whole or in part with federal-aid highway funds, including regulations of the Federal Highway Administration, Buy America requirements, the Davis-Bacon Act, Title VI of the Civil Rights Act of 1964, as amended, and 49 C.F.R. Part 26 (regarding the participation of DBE).

Submission of a Proposal constitutes the Proposer's agreement to the provisions of this Part B-2.3.

To ensure that information is distributed equitably to all short-listed Proposers, **all questions and requests for information shall be directed to the State Contract Officer through the Design-Build e-mail address (designbuild@ncdot.gov)**. This precludes any Proposer Team member, or representative, from contacting representatives of the Department, other State Agencies or Federal Agencies either by phone, e-mail or in person concerning this Project.

B-2.3. Conflicts of Interest

Proposers shall identify any real or perceived Conflict of Interest of the Proposer or any team member or sub-consultant of the Proposer's Team with regard to the Project. Individuals and firms that are restricted from proposing or joining a Proposer team include, without limitation, the following individuals, firms, and their affiliates:

- Exult Engineering

Prior to finalizing their teams, Proposers should require their proposed team members to identify and carefully review potential Conflicts of Interest, which may preclude certain individuals, firms, and their affiliates from participating on a Proposer team for the Project. If a potential Conflict of Interest is identified, the Proposer must present the pertinent information to NCDOT. Given a real or perceived Conflict of Interest, NCDOT, in its sole discretion, will decide if a Proposer has the ability to mitigate such a conflict.

In addition to the foregoing, the organizational conflict of interest rules found in 23 CFR § 636, Subpart A, including 23 CFR § 636.116, also apply to this procurement. 23 CFR § 636.103 defines an "organizational conflict of interest" as follows:

> "Organizational conflict of interest means that because of other activities or relationships with other persons, a person is unable or potentially unable to render impartial assistance or advice to the owner, or the person's objectivity in performing the contract work is or might be otherwise impaired, or a person has an unfair competitive advantage."

If applicable, a Proposer shall provide information concerning organizational conflicts of interest and disclose all relevant facts concerning any past, present, or currently planned interests that may present an organizational conflict of interest. Such Proposer shall state how its interests or those of any of its team members, consultants, contractors, or subcontractors, including the interests of any chief executives, directors, or key personnel thereof, may result in, or could be viewed as, an organizational conflict of interest.

B-2.4. Instructions for Proposal Submittals

The following information must be submitted by the Proposer:

1. ITS Resilience Technical Proposal
2. ITS Resilience Price Proposal

For all Technical and / or Price Proposals that do not adhere to all the requirements noted below may be considered non-responsive.

GENERAL SUBMITTAL INSTRUCTIONS

Technical Proposals for all Proposers will be accepted until **May 31, 2022, at 4:00 PM Local Time** at the office of the State Contract Officer as shown below. Sealed Price Proposals for all Proposers will be accepted until **June 6, 2022, at 4:00 PM** at the office of the State Contract Officer as shown below:

Mr. Ronald E. Davenport, Jr., PE
Contract Standards and Development
1020 Birch Ridge Drive
Century Center Complex - Building B
Raleigh, NC 27610

No Proposals will be accepted after the date and time specified.

Proposals shall be submitted in separate, sealed parcels containing the Technical Proposal in one and the Price Proposal in the other parcel. Proposals shall be delivered to Door B3 of the Century Center Complex—Building B. The courier shall call either Ms. Marsha Sample at (919) 707-6915 or Mr. Ken Kennedy, PE at (919) 707-6919 to accept delivery at Door B3.

TECHNICAL PROPOSAL SUBMITTAL INSTRUCTIONS

An electronic copy of the Technical Proposal, on a thumb drive, shall be submitted in a sealed package. The electronic copy shall be created by converting all files into a PDF format. The electronic copy shall be scaled to reproduce to the appropriate page format, as defined below. The outer wrapping shall clearly indicate the following information:

Technical Proposal – Electronic Copy
Submitted By: Proposer's Name
Proposer's Address
Contract Number C204749
HO-0005
Multiple Counties
Statewide ITS Resilience

Submittal by mail shall not be permitted for this Technical Proposal.

Technical Proposal Requirements

8 ½ inch by 11-inch pages
No fold out sheets allowed

Printed on one side only

Font size 12 - Within embedded tables, charts, and graphics only, minimal font size 10 is permissible

Excluding the introductory letter to Mr. Ronald E. Davenport, Jr., P.E. (two-page maximum length), **the maximum number of allowable pages shall be 100 pages**. CVs / resumes will not be included in the page count.

The aforementioned introductory letter to Mr. Ronald E. Davenport, Jr., PE shall include a statement acknowledging that the NCDOT may destroy all ITS Resilience Technical Proposals not retained by the Department, **or** a statement that the NCDOT should return all ITS Resilience Technical Proposals not retained by the Department.

Project team members, identified in the Statement of Qualifications, shall not be modified in the ITS Resilience Technical Proposal without written approval of the Department. Any such request should be sent to the attention of Mr. Ronald E. Davenport, Jr., PE, at the address below:

NCDOT- Contract Standards and Development
Century Center Complex - Building B
1020 Birch Ridge Drive
Raleigh, NC 27610

PRICE PROPOSAL SUBMITTAL INSTRUCTIONS

Proposer must provide a hard copy and electronic copy of the Price Proposal, by completing Appendix Part C – Price Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid**, **B: Repair Unit Cost Bids**, **C: Device Replacement Unit Costs**, and **D: Fiber Asset Management System Support Unit Costs)**. The electronic copy of Appendix Part C – Price Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid**, **B: Repair Unit Cost Bids**, **C: Device Replacement Unit Costs**, and **D: Fiber Asset Management System Support Unit Costs)** must be submitted in Microsoft Excel and PDF format.

Hard copy and soft copy (submitted on a thumb drive) Price Proposals shall be submitted in a sealed package. The outer wrapping shall clearly indicate the following information:

Price Proposal
Submitted by Proposer's Name
Proposer's Address
Contract Number C204749
HO-0005
Multiple Counties

Operations & Maintenance of Statewide ITS

Proposers must take note that failure to execute the requirements in this RFP may render the Price Proposal non-responsive.

Submittal by mail shall not be permitted for this Price Proposal.

PART C: PROPOSER SELECTION

The purpose of this section is to summarize the evaluation criteria to illustrate how preferred Proposers will be selected.

C-1.1. Summary of Evaluation Criteria

As described in Part D, below is a summary of each of the evaluation criteria.

C-1.1a. Evaluation Criteria

Qualified Proposals will be evaluated according to the Proposer's Technical Proposal and Price Proposal and assigned a total score out of 100 points. The highest score will determine the Best Proposal (as defined below).

The Proposer's Technical Proposal will be evaluated out of 30 points according to the evaluation criteria in Part E, in order to determine the Proposer's Technical Proposal Score.

The Proposer's Price Proposal will be evaluated out of 70 points relative to other qualified Price Proposals, according to the formula below, in order to determine the Proposer's Price Proposal Score:

a. If the Price Proposal is the lowest price out of all qualified Proposals:
   Price Proposal Score = 70 points
b. If the Price Proposal is not the lowest price out of all qualified Proposals:
   Price Proposal Score = (Lowest Price) / (Price Proposal) x 70 points

The Proposer's Technical Proposal Score (out of 30 points) and the Proposer's Price Proposal Score (out of 70 points) will then be combined to calculate the Proposer's Score. The Proposer with the highest Proposal Score will be the "Best Proposal."

The State Contract Officer will provide each Proposer with its Technical Proposal Score, Price Proposal Score, and Proposal Score when the Department makes a Preferred Proposer announcement.

Proposers must take note of the instructions in Appendix Part C –Price Proposal.

C-1.1b. Pass/Fail and Responsiveness Evaluation

The Proposer's Technical Proposals and Price Proposals will be reviewed on a pass/fail basis (a) for the Proposal's conformance to the RFP instructions regarding organization and format and responsiveness to the requirements set forth in the RFP and (b) based on the pass/fail criteria set forth below. Any Proposal that fails on any of the pass/fail portions of the evaluation may be considered non-responsive and may not be eligible for recommendation for award. NCDOT retains the sole discretion to disregard or waive minor irregularities, omissions, nonconformities, and discrepancies.

Evaluation of Proposals will be conducted by NCDOT's Technical Review Committee ("TRC") and Financial Review Committee ("FRC"), each of which will be comprised of representatives from NCDOT. The TRC and FRC may also be assisted by advisors, including NCDOT

representatives and outside consultants who will offer advice on commercial, financial, and legal aspects of each Proposal.

NCDOT may request additional or clarifying information from a Proposer prior to a final pass/fail determination. Proposals that are deemed non-responsive to the RFP, or that do not pass the pass/fail criteria, as outlined below, may be excluded from further consideration, and the Proposer will be so advised. NCDOT may also exclude from consideration any Proposer whose Proposal contains a material misrepresentation.

Technical Proposal Pass/Fail Evaluation

Technical Proposals will be evaluated based on the following pass/fail criteria:

(a) The Technical Proposal contains the required materials as identified in Part B-2.4, Instructions for Proposal Submittals.
(b) The Technical Proposal contains the required materials as identified in Part E-1.1.

(b) Proposer has provided a statement that either (i) each of the major participants, including equity members, and key personnel listed in the Proposer's SOQ have not changed since the Proposer's submission of the SOQ or (ii) the Proposer has previously advised NCDOT of a change, NCDOT has consented to such change, and the Proposal attaches a true and correct copy of NCDOT's written consent thereto.

Price Proposal Pass/Fail Evaluation

Price Proposals will be evaluated based on the following pass/fail criteria:

(a) Each Proposer shall submit to the Department information describing any material changes to its financial condition and capabilities as evidenced by the financial and other data submitted in the SOQ.

> Proposers must submit a letter from the chief executive officer, chief financial officer or treasurer (or, if neither a chief financial officer nor treasurer exists for an entity, an individual who serves in an equivalent capacity and whose title shall be specified in the certification) for the Proposer providing information on any materially adverse change(s) in financial condition since submission of the SOQs and those that are pending or certifying that no such materially adverse changes have occurred. In instances where a materially adverse change has occurred, or is anticipated to occur, the affected entity shall provide a statement describing each materially adverse change in detail, the likelihood that the developments will continue during the period of the Proposer's performance of the Project requirements and the projected full extent of the changes likely to be experienced during the contract term.
>
> The following list identifies certain items that the Department would consider to be materially adverse changes in financial condition. This list is intended to be indicative only. At the discretion of the Department, any failure to disclose a prior or pending materially adverse change may result in disqualification from further participation in the selection process. Estimates of the effect on revenues and expenses and the change in

equity shall be provided separately for each materially adverse change as certified by the chief financial officer or treasurer (or, if neither position exists for the entity, an individual who serves in an equivalent capacity and whose title shall be specified in the certification). References to the notes in the financial statements are not sufficient to address the requirement to discuss the impact of materially adverse changes. The affected entity shall also provide a discussion of measures that would be undertaken to insulate the Project from any recent materially adverse changes, and those currently in progress or reasonably anticipated in the future.

List of indicative materially adverse changes in financial condition:

(1) An event of bankruptcy involving the affected entity, a related business unit within the same corporation or the parent corporation of the affected entity;

(2) A decrease in tangible net worth of ten percent (10%) or greater of shareholder equity;

(3) A sale, merger or acquisition exceeding ten percent (10%) of the value of shareholder equity prior to the sale, merger, or acquisition that in any way involves the affected entity, a related business unit or parent corporation of the affected entity;

(4) A downward change in credit rating for the affected entity, a related business unit or parent corporation of the affected entity;

(5) Inability to meet material conditions of loan or debt covenants by the affected entity, a related business unit or parent corporation of the affected entity that has required, or is expected to require, a waiver or modification of agreed financial ratios, coverage factors or other loan stipulations, or additional credit support from shareholders or other third parties;

(6) Other events known to the affected entity, a related business unit or parent corporation of the affected entity that represent a materially adverse change in financial condition since submission of the SOQs or may be pending for the next reporting period.

If NCDOT determines that a Proposer no longer appears to have the financial capability to fulfill its obligations, it may offer such Proposer the opportunity to meet the financial requirement through one or more guarantors acceptable to NCDOT.

PART D: INFORMATION REQUIRED FROM PROPOSERS

The purpose of Part D is to describe the information required for the Proposer.

D-1.1. ITS Resilience Scope of Work

1. General Scope of Services

1.1 Project Description

a. The NCDOT Transportation Systems Management and Operations ("TSMO") Unit - Traffic Systems Operations ("TSO") is responsible for:

   i. The operations of the Statewide Transportation Operations Center (STOC) and Regional Traffic Management Centers (RTMCs).

   ii. Using incident management, Intelligent Transportation Systems ("ITS"), traveler information strategies and signal system timing to support mobility and safety on the statewide roadway network.

b. The devices listed in **Appendix A: ITS Devices in Scope of Work**, will be operated by the STOC and/or RTMCs to support mobility and safety. TSO will provide contract and performance management oversight for this project. NCDOT Division Offices will provide maintenance validation and review.

c. The primary purpose and intent of maintaining the ITS devices and related infrastructure is to enable effective transportation operations along these corridors. The uptime and availability of each ITS device is the primary focus so the Department can effectively operate these corridors.

d. This scope of services shall be divided into 4 tasks as follows. These tasks are more fully described in the **Maintenance Phasing** section of this document:

   i. Task 1 shall include the initial assessment, Preventive Maintenance (PM) and Responsive Maintenance (RM) of ITS Devices. Task 1 shall last no more than twelve (12) months.

   ii. Task 2 shall follow Task 1 and include Pay-For-Performance Preventive Maintenance (PM) and Responsive Maintenance (RM).

   iii. Task 3 shall include Communication Infrastructure, Cabinet Replacement, and Pole Replacement Responsive Maintenance (RM) (As-Needed).

   iv. Task 4 shall include ITS device replacements (As-Needed).

   v. Task 5 shall include Fiber Asset Management Assistance (As-Needed).

e. The Contractor shall be responsible for handling and on-site storage of all waste generated during ITS RESILIENCE Work in full compliance with Applicable Laws.

f. The Contractor shall comply with all environmental requirements set forth in Applicable Law, technical guidance and policy, and all environmental related approvals required by the Department. The Contractor shall be responsible for maintaining complete, reliable operation of the Department Infrastructure.

g. The Contractor shall perform all duties, tasks, and all other responsibilities required by this Agreement in accordance with ANSI and National Electrical Installation Standards ("NEIS"), standard 301 (ANSI/NEIS 301 standards), and Good Industry Practice.

1.2 Device Descriptions and Priority

a. The following ITS devices, assets, and supporting infrastructure (collectively, the "ITS Assets") shall receive preventive and responsive maintenance by the Contractor under Tasks 1 and 2:

i. Cameras and all related and supporting infrastructure including pole, cabinet, internal cabinet components, conduit, fiber optic drop cable and related conduit, electrical service, electric service cabling and all electrical components under responsibility of the NCDOT for that device, power injectors, cat-6 and other camera cabling, and power supplies. This includes maintenance of every aspect of the camera for continuous operation other than damages to the upstream or downstream fiber trunk line that would affect the camera. This does include maintenance and repair of the fiber optic drop cable and related fiber optic splice enclosure where the drop cable splices to the fiber optic trunk line. Replacement of any camera component or related infrastructure (other than full cabinet replacement or pole replacement) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

ii. Dynamic message signs ("DMS") and all related and supporting infrastructure including the sign itself, DMS cabinet, internal cabinet components, fiber cables between cabinet and sign, LED modules, sign controller, fiber optic drop cable and related conduit, electrical service cabling and all electrical components under responsibility of the NCDOT for that device, power supplies. This includes maintenance of every aspect of the DMS for continuous operation other than damages to the upstream or downstream fiber trunk line that would affect the camera. DMS sign structure maintenance is also NOT included in this scope of work. Replacement of any DMS component or related infrastructure (other than full DMS assembly replacement, DMS structure replacement, or full cabinet replacement) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

iii. Communication and electrical cable infrastructure including:

a. Trunk line communication conduit, handholes/junction boxes and related infrastructure – junction box lids and boxes (including replacement if necessary), assessment of junction box damage, conduit sealing for both spare and occupied, tracer wire test switch, ground rod and grounding conductor connection, metal conduit bonding if applicable, verification and replacement of electronic marker balls, and delineator markers. Under Task 2, the contractor shall monitor the condition of these assets and recommend replacement/repair when necessary. Payment for replacement and repair will be accomplished under Task 3. Conduit and communication infrastructure directly related to an ITS device is included as part of PM/RM within Task 2.

iv. Splice Cabinets and Hub Cabinets including power, generator transfer switch (if applicable), aesthetics, HVAC (if applicable), UPS, electrical service, solar power unit (if applicable), batteries (if applicable), the cabinet itself, all cabling within the cabinet, fiber distribution panels within cabinets, conduits entering cabinet, cabinet base, pest control, mowing around the cabinets, graffiti removal, and any other component of a hub cabinet. This includes maintenance of every aspect of the Hub Cabinet for continuous operation other than damages to the upstream or downstream fiber trunk line. If the trunk line fiber is spliced directly to the fiber distribution panels in the cabinet or a drop cable, the demarcation point for repair shall be the fiber optic junction box external to the cabinet. All repairs (including splicing) to the fiber distribution panel within the cabinet or junction box are incidental to the daily pay-for-performance bid price for task 2. All repairs to the trunk fiber line immediately outside of the junction box will be compensated for in Task 3. This does not include maintenance of the hub switch itself, as this will be maintained by NCDIT. Replacement of any Hub cabinet component or related infrastructure (other than full hub cabinet replacement and hub switch replacement) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

v. Fiber Distribution Panels in Traffic Management Centers including only the cabling within the building, the splices to fiber distribution panels and the fiber distribution panels themselves.

vi. Hub Hut Buildings including power, generator transfer switch (if applicable), aesthetics, UPS, electrical service, all cabling within the hut building related to NCDOT ITS infrastructure, fiber distribution panels within the hut building, conduits entering the hut building, pest control, mowing around the hut building, and graffiti removal. This includes maintenance of every aspect of the Hut building other than general building maintenance and damages to the upstream or downstream fiber trunk line. If the trunk line fiber is spliced directly to the fiber distribution panels in the cabinet or has a drop cable, the demarcation point for repair shall be the fiber optic junction box(es) external to the hut building. All repairs (including splicing) to the fiber distribution panel within the hut building or junction box are incidental to the daily pay-for-performance bid price for task 2. All repairs to the trunk fiber line immediately outside of the junction box will

be compensated for in Task 3. This does not include maintenance of the hub switch itself, as this will be maintained by NCDIT. Replacement of any ITS component within the hub hut building (other than the hub switch) as described above for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

vii. Field switches, SFPs, all cabling, including all switches within ITS device cabinets. Hub switches will not be maintained by the Contractor. The demarcation point for this contractor begins with the SFP which connects to the hub switch. Replacement of any field switch, SFP, cabling or related components within ITS device cabinets or ITS hub cabinets (as long as it is not a hub switch) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

viii. Wireless radios, antennas, power supplies, cabling, and all related components located at ITS device cabinets. Replacement of any wireless radio, cabling or related components within ITS device cabinets or ITS hub cabinets (as long as it is not a hub switch) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

ix. Ramp Meter Systems ("RMS") including traffic signals, poles, cabinets, internal cabinet components, stop bar striping restoration, inductive loop detectors, video detectors and their respective cabinets and contents, wireless transmitter/receivers, and all communications equipment dedicated solely to the individual ramp meter system sites and transmission to the Ethernet switch or field side of the wireless communication device. This also includes fiber optic drop cable and related conduit, electrical service, electric service cabling and all electrical components under responsibility of the NCDOT for that device, and power supplies. This includes maintenance of every aspect of the RMS for continuous operation other than damages to the upstream or downstream fiber trunk line that would affect the RMS. This does include maintenance and repair of the fiber optic drop cable and related fiber optic splice enclosure where the drop cable splices to the fiber optic trunk line. Replacement of any RMS component or related infrastructure (other than full cabinet replacement) for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

x. Cellular modem communications equipment and supporting hardware used for any ITS devices along the corridor. NC DIT will provide the modems, SIM cards, and service. The Contractor will only be responsible for requesting new modems from NC DIT for the locations of devices without fiber optic communications, installing them, replacing them (with another modem provided by NCDIT), replacing all related cabling and hardware, and monitoring them. The labor for replacement or repair of cellular modems for any reason whatsoever is incidental to the daily pay-for-performance bid price for each ITS asset listed under task 2.

b. The following communication infrastructure shall receive responsive maintenance by the Contractor under Tasks 1 and 3:

i. Handhole/junction box repair/replacement

ii. Fiber optic splice enclosure repair/replacement (other than drop cable splice enclosures for individual ITS devices)

iii. Communications conduit repair/replacement

iv. Trunk line fiber optic cabling repair/replacement

c. Under Task 2, the Contractor shall propose a fiber optic testing plan for proactive evaluation of all fiber within the network over a 12-month period. The plan shall propose tests for dark fibers along the project to verify the validity of the fiber during each PM period. Under Task 3, the Contractor shall complete preventive maintenance testing of fiber optic cable. The Contractor shall perform bi-directional Optical Time Domain Reflectometer (OTDR) tests (where possible) on spare fibers to verify fiber validity. This may occur from the TMC, from splice cabinets, from hub cabinets, from other hub building locations, and from select device locations.

d. The Contractor shall maintain adequate reserve stocks of all hardware, software, testing tools, cabinets, cabling, racks, assemblies, special parts, and other spares to meet or exceed the performance requirements included in this scope of work. Any replacement of ITS Assets shall comply with the Department's qualified product list, most current project special provisions or be approved by the Department.

1.3 Device Priority

a. Individual ITS devices will be assigned an asset class which defines the acceptable availability and for purposes of the pay-for-performance mechanism.

b. The following asset classes are assigned on a per-device basis:

i. General

ii. Essential

iii. Vital

c. The Department has developed an ITS Resilience Classification Table to define which specific devices reside in each asset (provided in Appendix A) for informational purposes only. The Department may change these quantities at a later date at their discretion by assigning individual devices to different asset classes. After initiation of a contract the contractor would be given at least 30-day notice of any such change.

d. The Department may add future devices to the scope of work. The Department will assign a priority to each such device at the time such devices are added to the scope of work. The Contractor would be given at least 30-day notice for addition of devices.

e. The Compensation and Pay-For-Performance section of this RFP provides additional details as to how the priority of the device impacts Contractor compensation and the Contractor's cost proposal.

2. Project Management Requirements

2.1 Project Management Plan

a. The Contractor shall develop an ITS Resilience Project Management Plan ("PMP"). The PMP shall be developed as a draft in coordination with the Department and delivered to the Department for review and comment within 30 business days of the contract closing date. The Department will review and provide comments within 15 business days of receipt of the Draft PMP. The Contractor shall revise and submit a final PMP to the Department for review and comment within 60 business days of the closing date. The PMP shall, at a minimum, address the following requirements:

i. The Contractor shall monitor its own performance to ensure that the performance criteria and outcomes specified in the RFP are achieved. The PMP shall include procedures to ensure that all ITS Resilience Work meets or exceeds the performance criteria set forth in the RFP. The Contractor shall maintain a dynamic, real-time display and provide a monthly performance report detailing daily device uptime for individual devices, and device types per asset class to the Department's Project Management team.

ii. The Contractor must provide a backup dashboard for performance management and maintenance tracking outside of the ITS Work Order Management System ("IWOMS") software. The use and management of this dashboard shall be described in the PMP. The backup performance management dashboard shall display percentage availability and repair times for each asset on a daily and monthly basis. The dashboard shall also provide cumulative reporting and data displays on a per asset type and per asset class basis on a daily and monthly trend basis. The Contractor shall provide 24 hour per day, 7 day a week, 365 day a year access to their performance monitoring system. The Project Management team for the Department will monitor the dashboard. The dashboard must be in place and fully functional as described above within 150 days of contract closing. The contractor must keep detailed records of device maintenance activities immediately upon contract closing.

iii. The Contractor shall develop and maintain a library of Original Equipment Manufacturer (OEM) SOP for all Department Infrastructure, including ITS Assets for each asset type and related component (e.g., digital camera, power injector, camera mounting equipment).

iv. The Contractor shall provide detailed descriptions of the following additional project management duties in the PMP:

a. document management;

b. human resource management;

c. scope management;

d. contract administration and management;

e. communications management;

f. inventory control approach;

g. temporary traffic control approach including which NCDOT standard traffic control plan will be used for each individual ITS device listed in Appendix A. The contractor is also responsible for detailed, custom traffic control plans for any devices that do not meet the assumptions of NCDOT standard traffic control plans;

h. safety approach; and

i. 811 approach including 811 system management, subcontracting expectations, and quality control.

2.2 Quality Control Plan

a. As part of the PMP, the Contractor shall develop and implement a Quality Assurance and Quality Control ("QA/QC") Plan that ensures the Contractor will achieve quality deliverables and work products that meet the Department's standards. The Quality Control Plan shall include the QA/QC process that the Contractor will follow for each specific work product and deliverable. For example, there should be an individual QA/QC process outlined for Preventive Maintenance in the QA/QC Plan.

2.3 Staffing Plan

a. The Contractor shall provide designated and appropriate staff throughout the life of the contract. This staffing will include at least three (3) full time positions which will be dedicated full time positions for ITS maintenance under this contract. These three (3) positions shall be:

   i. Project Manager

   ii. ITS Maintenance Lead Technician

   iii. ITS Maintenance Technician

b. The staffing plan shall be a component within the PMP that provides detailed descriptions of staffing levels and an organizational chart depicting the structure, reporting hierarchy, roles, and responsibilities among Contractor staff and subcontractor staff. The Contractor shall ensure that any staff replacement meets or exceeds the qualifications of the individuals set forth in this staffing plan. For the three (3) full-time

positions listed above, the Contractor shall submit a letter requesting approval of the proposed employee replacement and the Department must approve.

2.4 Communications Management

a. The Contractor shall develop a communications plan (the "Communications Plan") to be included in the PMP that will define the communication requirements for the ITS RESILIENCE work and how information will be disseminated. The communication plan shall set forth a procedure for immediate/real-time and scheduled communication for the following specific circumstances, at a minimum:

   i. Responsive Maintenance (RM) diagnosis requests to the project manager.

   ii. Performance management plan that defines reporting including the required dashboard.

   iii. Coordination with the Department's project management team regarding maintenance notifications, requests, questions, and updates.

   iv. Coordination with NC Department of Information Technology for troubleshooting.

   v. Communication methodology used for IAMS, IWOMS, INMS and backup communication methodology for when those systems are down or unavailable.

3. Maintenance Phasing

3.1 General

a. **Task 1:** Upon award of this Contract, the Contractor shall begin preventive and responsive maintenance services for all devices identified in this scope of work for Task 1. During the initial year of the contract, concurrent with the initial Preventive Maintenance (PM) cycle for each device and communication network link, the Contractor shall perform an assessment to determine if any Responsive Maintenance (RM) work is required outside of typical PM work to bring the existing ITS infrastructure up to an appropriate level of operation.

   i. Attachment A provides a list of all existing ITS Assets that the Contractor must begin maintenance on. Attachment A also highlights the sections of roadway with NCDOT fiber optic communication infrastructure that the Contractor must begin maintenance on. In addition **Section 1.2 Device Descriptions and Priority** further describes the specific aspects of the ITS and communication assets to be maintained.

   ii. Task 1 shall include four (4) phases as follows:

      a. Phase 1 – The ITS Resilience Team shall perform PM and an assessment of each individual ITS device and communications infrastructure element. If the ITS device is determined to be fully functional without

need of RM following the PM and assessment, the device shall begin being maintained in accordance with **Section 4: Preventive Maintenance** and **Section 5: Responsive Maintenance** immediately upon completion of the PM. Similarly, as each communication infrastructure element is determined to be capable of communication/operation within acceptable tolerances, the communication infrastructure element shall begin being maintained in accordance with **Section 5: Responsive Maintenance** immediately upon completion of the PM. The initial PM activities under Phase 1 shall be incidental to Appendix C – Cost Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid)**.

b. Phase 2 – If during the assessment, it is determined that RM is required to bring an ITS device or communications infrastructure element back into operational service, The ITS Resilience Contractor shall propose a work order based on Appendix C – Cost Proposal (**B: Repair Unit Cost Bids)** for repair of the ITS device or communications infrastructure element.

c. Phase 3 – Following approval of the work order by NCDOT, the ITS Resilience Contractor shall proceed with repair of the ITS device or communications/electrical infrastructure element.

d. Phase 4 – Following repair of the ITS device or communications infrastructure element, an ITS device shall begin being maintained in accordance with **Section 4: Preventive Maintenance** and **Section 5: Responsive Maintenance** immediately upon completion of the repair. Similarly, the communication infrastructure element shall begin being maintained in accordance with **Section 4: Preventive Maintenance** and **Section 5: Responsive Maintenance** immediately upon completion of the repair.

iii. The Contractor's Project Management Plan shall include an approach and schedule for completing Preventive Maintenance on all existing ITS Assets within the first 12 months of the contract. Device Preventive Maintenance cycles shall be performed gradually with 25% of the devices undergoing Preventive Maintenance per quarter in this first 12-month period. If Responsive Maintenance is required, it shall be completed at the time of the Preventive Maintenance.

iv. The Contractor's Project Management Plan shall include an approach and schedule for assessing and completing fiber optic testing on dark fiber for all communication infrastructure identified in Appendix A within the first 12 months of the contract. Fiber assessment and testing shall be performed gradually with 25% of fiber testing being completed per quarter in this first 12-month period.

v. Preventive maintenance shall also include documenting updated asset characteristics in the ITS Asset Management System (IAMS) and the Fiber Asset

Management System (FAMS) for individual ITS assets. This does not include documenting the trunk-line communication infrastructure in the Fiber Asset Management System.

vi. The Contractor shall not be compensated for ITS Assets for daily maintenance until initial Preventive Maintenance cycles are completed.

vii. As each device's Preventive Maintenance is completed as part of Task 1, it will begin being tracked for Pay-For-Performance availability and Responsive Maintenance disincentives.

b. **Task 2:** The Contractor shall perform preventive maintenance on all infrastructure on average every 12 months as a part of Task 2. The Contractor shall also perform responsive maintenance on ITS Devices as needed as part of Task 2. Preventive maintenance, ITS device responsive maintenance, temporary traffic control, and NC 811 locate labor and material costs included in Task 2 will be incidental to the Appendix Part C – Cost Proposal (A: Pay-For-Performance – Daily Device Unit Cost Bid) provided by the Contractor.

i. Device availability performance and disincentives will not be monitored or assessed until each device has undergone an initial Preventive Maintenance process. Similarly, the Contractor will not be compensated for ITS Assets under the daily device unit cost until the first PM is completed.

ii. Responsive maintenance within Task 2 shall include repair or replacement (as necessitated as part of the repair), as needed for all infrastructure listed above, with the exception of:

a. Trunk line communications infrastructure as described in **Section 1.2 Device Descriptions and Priority**

b. Full Cabinet Replacement as described in Section 1.2 Device Descriptions and Priority.

c. Camera Pole Replacement as described in Section 1.2 Device Descriptions and Priority.

d. DMS Assembly Replacement as described in **Section 1.2 Device Descriptions and Priority**

e. DMS Structure Replacement as described in **Section 1.2 Device Descriptions and Priority**

iii. Responsive maintenance shall also include documenting updated asset characteristics in the ITS Asset Management System (IAMS) and the Fiber Asset Management System (FAMS).

iv. The Contractor shall provide a Preventive and Responsive Maintenance Plan that includes PM and RM checklists for every type of device, standard traffic control

plans for each scenario, a schedule for PM activities, and a procedure for coordination or update meetings with the Department.

c. **Task 3:** The Contractor shall perform responsive maintenance on the communications cabling infrastructure under Task 3. The Contractor shall also perform responsive maintenance to complete full cabinet replacement and pole replacement under Task 3. The Contractor shall propose Appendix Part C – Price Proposal (B: Repair Unit Cost Bids) for ITS communications infrastructure, cabinet replacement, and pole replacement RM. The Repair Unit Cost Bid items shall be used to develop a work order whenever responsive maintenance (RM) is required. The total work order amount shall include incentives and/or disincentives based on the Contractors repair time.

    i. Responsive maintenance also includes documenting updated asset characteristics in the ITS Asset Management System (IAMS) and Fiber Asset Management System (FAMS) for repaired ITS assets and sections of trunk line communications infrastructure.

d. **Task 4:** Replacement of devices as a standard element of ITS device RM are included under Task 2 as described above. However, Task 4 of the Project shall include a provision for replacement of ITS devices at NCDOT's discretion based on Appendix Part C – Price Proposal (C: Device Replacement Unit Costs). Examples could be change-out of functioning analog cameras to digital cameras or upgrading an end-of-life DMS. Traffic control costs are incidental to the Device Replacement Unit Costs within Task 4.

e. **Task 5:** The Contractor shall include a provision for fiber optic investigation (conduits, junction boxes, splice enclosures) to enable more accurate and effective documentation and population of the Department's Fiber Asset Management System (FAMS). The Contractor shall propose work orders for FAMS assistance upon the Department's request using Appendix Part C – Cost Proposal (D: Fiber Asset Management System Support Unit Costs).

f. The Contractor shall accommodate and coordinate with construction projects external to this contract whenever necessary. NCDOT will coordinate to determine priorities and suspend disincentives if NCDOT determines that a construction project shall take priority over maintenance activities.

g. When a separate construction project must interrupt ITS device connectivity and functionality:

    i. The construction project will be required to place a temporary ITS device near the existing ITS device and the construction project will maintain the temporary device.

    ii. Once the temporary device is operational and has passed Department acceptance testing, the existing device will be removed from Pay-for-Performance tracking and will no longer be maintained by the ITS Resilience Contractor.

    iii. Once the final proposed assets and network infrastructure within a construction project are constructed and have passed Department acceptance testing, the

infrastructure will undergo a 30-day burn-in period and then be added to the Pay-for-Performance tracking and will be maintained by the ITS Resilience Contractor for both preventive and responsive maintenance.

4. Preventive Maintenance

4.1 General

a. The Contractor shall perform Preventive Maintenance on all ITS Assets described in Section 4.2 on average, once every twelve (12) months. Preventive Maintenance shall be performed within eleven (11) to twelve (12) months of the previous Preventive Maintenance on the relevant ITS Asset.

b. Hardware warranties shall be managed by the Contractor on the Department's behalf.

c. The Contractor will be responsible for:

i. the development and execution of a Preventive Maintenance Plan, which will be subject to approval by the Department, that includes the following:

a. draft individual Preventive Maintenance checklists;

b. standard traffic control plans for Preventive Maintenance;

c. a schedule of Preventive Maintenance; and

d. procedures for monthly update meetings with the Department's project manager;

ii. providing traffic control that meets Department standards for all maintenance activities, including traffic control time restrictions as required by Department;

iii. following the Department's standards for safety, traffic control, and site access; and

iv. submitting an accurate record of proactive maintenance activities using the Department-provided IWOMS.

v. keeping adequate materials in stock to facilitate immediate repairs of ITS device infrastructure. The contractor shall have utilized the assessment and preventive maintenance period to stock all necessary components for these repairs. Reduction of disincentives due to lack of materials is at the Department's sole discretion and will be allowed only in rare cases of material shortages.

d. The Department will be responsible for:

i. specifying the location, asset type, and classification of ITS Assets;

ii. monitoring Preventive Maintenance schedules, activity logs, traffic safety, and routine quality control for the ITS RESILIENCE work; and

iii. monitoring performance of the Contractor, payment, and general contract management.

e. NC DIT will be responsible for Preventative Maintenance of hub switches

f. Preventive Maintenance labor and material costs are incidental to the fixed unit daily prices per asset class incidental to Appendix Part C – Price Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid).**

g. Temporary traffic control costs for Preventative Maintenance are incidental to the fixed unit daily prices per asset class incidental to Appendix Part C – Price Proposal (**A: Pay-For-Performance – Daily Device Unit Cost Bid).**

4.2 Description of Preventive Maintenance

a. Preventive Maintenance shall be performed on all ITS Assets as further described below:

i. Cameras

a. Contractor to propose camera Preventive Maintenance checklist for the camera itself, pole, pole foundations, lowering devices, power in the cabinet, GFCI testing, cabinet cooling components and replaceable filters, all cabling, electrical service and electrical cabling, fiber drop cable and conduit, drop cable splice enclosure, fiber distribution panel, UPS, UPS batteries, gasket locks, base sealing, pest control, conduit sealings, solar assemblies (and related components) and fiber to the splice enclosure.

b. Camera Preventive Maintenance shall include cleaning (or replacement, if required) of the camera dome and verification of adequate video transmission.

c. Camera Preventive Maintenance shall include Preventive Maintenance of the network switch and/or network modem in the cabinet.

ii. DMS

a. Contractor to propose DMS Preventive Maintenance checklist for the DMS sign, cabinet cooling components and replaceable filters, the DMS controller, power to the sign and controller, GFCI testing, all overhead DMS components, all cabling, conduit, fiber distribution panel, UPS, UPS batteries, gasket locks, base sealing, pest control, conduit sealings, and fiber to the splice enclosure.

b. Preventive Maintenance checklist to include a visual structural inspection of the DMS structure. Any deficiencies should be reported to the Department immediately.

c. Preventive Maintenance checklist shall include Preventive Maintenance of the network switch and/or network modem in the cabinet.

iii. Communication cable infrastructure including:

a. Handholes/junction boxes – Contractor to propose Preventive Maintenance checklist which shall include Preventive Maintenance of junction box lids and boxes (including replacement if necessary), assessment of junction box damage, conduit sealing for both spare and occupied, cable labels, tracer wire test switch, ground rod and grounding conductor connection, metal conduit bonding if applicable, verification and replacement of electronic marker balls, and delineator markers.

b. Fiber optic cable – Development of a testing plan for testing for dark fiber along the project to verify the validity of the fiber every 12 months. Assessment of fiber infrastructure and development of the testing plan will be incidental to **A: Pay-For-Performance – Daily Device Unit Cost Bids**. NCDOT will review the fiber testing plan and make recommendations for additions and removals at their sole discretion. The Contractor will then complete fiber testing in accordance with the plan. The contractor shall propose unit costs for fiber optic testing under **B: Repair Unit Cost Bids** and be compensated based on those bids and the fiber test plan.

c. Electrical meter base, electrical disconnect, breakers, grounding systems, electrical cabling, electrical conduit and related components.

iv. Hub Cabinets

a. Contractor to propose Hub Cabinet Preventive Maintenance checklist for the cabinet itself, power in the cabinet, cabinet cooling components and replaceable filters, security/door alarm, cabinet HVAC, uninterruptable power supplies (including battery replacement), all cabling, conduit, fiber distribution panels and fiber to the splice enclosure.

b. Preventive Maintenance shall not include Preventive Maintenance of the hub network switch in the cabinet.

v. Field switches and Wireless Radios

a. Contractor to propose field switch Preventive Maintenance checklist, which will be completed at the same time as Preventive Maintenance for the related device connected to each field switch.

b. Contractor to propose wireless radio (and related components) Preventive Maintenance checklist, which will be completed at the same time as Preventive Maintenance for the related device connected to each wireless radio.

c. The field switch and wireless radio Preventive Maintenance checklist shall include, at a minimum, coordination with NC DIT for determination of latest configuration that should be loaded on each switch and updates of switch firmware based on latest NC DIT standard.

vi. RMS

a. Contractor to propose RMS Preventive Maintenance checklist, for traffic signals, poles, cabinets, internal cabinet components, stop bar striping restoration, inductive loop detectors, video detectors and their respective cabinets and contents, wireless transmitter/receivers, and all communications equipment dedicated solely to the individual ramp meter system sites and transmission to the Ethernet switch or field side of the wireless communication device. This also includes fiber optic drop cable and related conduit, electrical service, electric service cabling and all electrical components under responsibility of the NCDOT for that device, and power supplies.

b. Preventive Maintenance shall include Preventive Maintenance of the network switch and/or network modem in the cabinet.

b. Preventive Maintenance includes periodic replacement for UPS and solar system batteries. The Contractor shall replace each UPS battery in Year 1 and Year 3 of the contract as part of the preventive maintenance cycle. All other ITS Assets do not require periodic replacement.

4.3 Device Quantities and Future Growth

a. ITS Assets maintained by the Contractor include existing devices listed in Attachment A and an unknown future quantity of devices. Compensation for existing and future assets is further defined in Compensation and Pay-For-Performance.

b. The quantity of infrastructure components is expected to grow at a rate of 8-15% per year after steady state quantities are reached. This growth is not guaranteed and is dependent upon future Department infrastructure needs which are currently undefined.

c. NCDOT is planning for and anticipates the construction of future broadband projects along key corridors including, but not limited to I-40, I-485, and I-85. If broadband construction occurs along these corridors, it is possible that the scope of this contract may be reduced to accommodate this construction. If this occurs, NCDOT will provide at least 6-months' notice to the ITS Resilience Contractor. This notice will include a detailed list of the ITS devices and communication infrastructure to be removed from the ITS Resilience Contract

scope of work. Since daily unit price bids are being provided as part of the proposal for this project, the reduction of scope shall not result in any change in the daily unit price bids.

d. NCDOT may remove ITS devices and communication infrastructure from the scope of work at their discretion to support construction projects and NCDOT operational needs. If this occurs, NCDOT will provide a 1-month notice and the devices will be removed from the scope of work on the first day of the following month.

e. The Contractor shall provide unit pricing per individual device per day (Appendix Part C – Price Proposal: **A: Pay-For-Performance – Daily Device Unit Cost Bid)**. This will enable the contract to be extended to add additional device days as needed to incrementally support device growth. The Contractor will consider in Year 1 of the price proposal that 25% of the devices will begin PM during each quarter with roughly 25% of PMs complete after Q1, 50% of PMs complete after Q2, 75% of PMs complete after Q3, and 100% of PMs complete by Q4 of the initial year of the contract.

5. Responsive Maintenance

5.1 General

a. Responsive Maintenance shall be performed on all ITS Assets described in **Device Descriptions and Priority (Section 1.2)**. When responsive maintenance is required, often the nature of the maintenance required is unknown until investigation of the issue has occurred. In addition, costs for ITS device repairs are relatively stable while the number and severity of communication infrastructure repairs is relatively unpredictable. For this reason, NCDOT desires a comprehensive approach to responsive maintenance, but will pay for ITS Asset and Communications Infrastructure responsive maintenance differently.

   i. ITS Asset Responsive Maintenance (Task 2) is described in Section 1.2 as mentioned above. ITS Asset Responsive Maintenance labor and material costs are incidental to the fixed unit daily prices per asset class (**Appendix Part C – Price Proposal: A: Pay-For-Performance – Daily Device Unit Cost Bid**). Responsive Maintenance labor and material costs for equipment repair are incidental for all equipment components included in the ITS Resilience work.

      a. Temporary traffic control costs for ITS Asset Responsive Maintenance are incidental to the fixed unit daily prices per asset class (Appendix Part C – Price Proposal: A: Pay-For-Performance – Daily Device Unit Cost Bid).

   ii. ITS communication infrastructure, full cabinet replacement, and pole replacement responsive maintenance (Task 3) is also described in Section 1.2 as mentioned above. Task 3 responsive maintenance labor and material costs will be compensated for in accordance with a work order derived from the bid schedule provided in (**Appendix C – Cost Proposal (B: Repair Unit Cost Bids)**). The only exception to this is the initial investigation and determination of the issue. Because the cause may be unknown, Phases I and II of ITS Communication Infrastructure Responsive Maintenance (as defined below) are incidental to the

fixed unit daily prices per asset class (Appendix Part C – Price Proposal: A: Pay-For-Performance – Daily Device Unit Cost Bid).

b. The Contractor shall be responsible for:

i. keeping adequate materials in stock to facilitate repairs of ITS device and communications infrastructure in accordance with incentive and disincentive time periods provided in the contract. The contractor shall have utilized the assessment and preventive maintenance period to stock all necessary components for these repairs. Reduction of disincentives due to lack of materials is at the Department's sole discretion and will be allowed only in rare cases of material shortages.

ii. providing unit cost bids in accordance with project special provisions provided in Appendix E

iii. submitting a Responsive Maintenance plan that provides a detailed procedure and checklist for troubleshooting each ITS Asset type and network outage scenario;

iv. facilitation of monthly Responsive Maintenance update meeting with the Department project manager;

v. following the Department standards of safety, traffic control, and site access;

vi. providing traffic control that meets Department standards for all maintenance activities including traffic control time restrictions as determined by the Department at a later date at their discretion;

vii. submitting an accurate record of Responsive Maintenance activities using IWOMS;

b. updating ITS Asset Management System (IAMS) and Fiber Asset Management System (FAMS) with updated asset information within five (5) Business Days of repair and/or replacement of infrastructure; and

c. updating ITS Network Monitoring System (INMS) with updated IP address or SNMP information within twenty-four (24) hours of repair and/or replacement of infrastructure.

c. The Department will be responsible for:

i. managing the list of assets to be maintained by the Contractor and designating the asset class for each ITS Asset;

ii. monitoring activity log, traffic safety, and routine quality control for Contractor maintenance activities; and

iii. monitoring performance of the Contractor, payment, and general contract management.

iv. approving work orders for communications infrastructure responsive maintenance, as-needed ITS maintenance, and fiber asset management system support services.

d. NC DIT will perform Responsive Maintenance for the Department's hub switches and core switches.

e. Responsive Maintenance includes response to trouble tickets which are generated automatically by the INMS or manually input by the Department or Contractor staff.

f. ITS Asset Responsive Maintenance also includes full-device replacement labor and materials for assets that are damaged in any way except for exceptions noted in Section 1.2 Device Descriptions and Priority. Replacement of these assets are incidental to the fixed unit daily prices per asset class (**Appendix Part C – Price Proposal: A: Pay-For-Performance – Daily Device Unit Cost Bid)**. Asset replacements incidental to Task 2 RM include:

i. cameras, related camera components, power over Ethernet injectors, and related cabling and power sources (replacement of poles is not part of Task 2);

ii. UPS controllers, batteries, related cabling, and power sources;

iii. Internal cabinet components, cabinet filters, fans, HVAC systems, and related cabling and power sources (replacement of entire cabinets is not part of Task 2);

iv. field switches, fiber optic transceiver modules and power sources;

v. wireless radios, antennas, and related components;

vi. fiber distribution units;

vii. fiber optic splice closures and fiber optic splices for ITS device drop cables; and

viii. conduit and cable infrastructure repairs including junction boxes, risers, all conduit, all fiber optic cabling, all Ethernet cabling, and fiber distribution panels. The demarcation for fiber optic cabling replacement is the junction box for the ITS asset. The drop cable and splice enclosure for the ITS asset shall be replaced as part of incidental to Price Proposal A (Task 2). All trunk line fiber outside of the junction box shall be replaced in accordance with Task 3.

ix. Electrical meter base, electrical disconnect, breakers, conduit, electrical cabling, and all other electrical components downstream of the electrical meter. All components upstream of the electrical meter base will be the responsibility of the power company.

5.2 Responsive Maintenance Phases

a. Responsive Maintenance shall occur in four (4) phases and shall be consistently managed using the IAMS, IWOMS, and INMS.

b. Phase I of Responsive Maintenance includes initial notification of a device or network failure which is initially triggered in INMS (or manually entered) and logged in INMS, IWOMS, and IAMS. An initial trouble ticket is logged in IWOMS. This phase lasts until the beginning of Phase II. The IWOMS will also enable trouble tickets to be opened manually for non-network related maintenance issues. The Contractor will be responsible for opening a trouble ticket when notified of maintenance issues not already logged in the IWOMS.

c. Phase II of Responsive Maintenance includes initial response of the Contractor to verify that initial diagnosis of the device or network failure has begun. This phase is logged as complete in IWOMS when a detailed report of the diagnosis and a proposed schedule to repair are submitted in IWOMS. In the case where repair warrants Communication Infrastructure Responsive Maintenance, the Contractor shall submit a work order that provides a description of the issue, the repairs needed, and the comprehensive repair costs to the NCDOT Project Management Team.

d. Phase III of Responsive Maintenance includes the Contractor proceeding with repair of the asset. This phase is complete when the device or network failure has been resolved and has been logged in IWOMS. The device status is updated in INMS and IAMS.

    i. For Task 2 ITS Asset Responsive Maintenance, the contractor must proceed immediately with repair of the asset.

    ii. For Task 3 ITS communication infrastructure, complete cabinet replacement, and pole replacement responsive maintenance, the contractor must receive written approval of the work order from the NCDOT Project Management Team prior to proceeding with repair of the asset.

e. Phase IV of the Responsive Maintenance begins a 24-hour period of operational testing of the resolved issue, where the device or network failure is being closely monitored by the Contractor and/or the Department. Once the issue has been resolved for 24 hours, the Responsive Maintenance phase is logged as complete in IWOMS. If the issue fails again within 24 hours, the Responsive Maintenance phase starts at Phase I again, but is considered part of the initial trouble ticket in IWOMS for non-performance maintenance tracking. If the device stays operational for 24 hours, Phase IV will not be included in the total time allocated for Responsive Maintenance. If the device fails within 24 hours and goes back to Phase I, then Phase IV is included in the total time allocated for Responsive Maintenance.

5.3 Pay-for-Performance Mechanism

a. The Contractor shall receive deductions when the total time for all four Responsive Maintenance phases exceeds an established time frame for each ITS Asset type and class.

i. In cases where Task 3 ITS communication infrastructure, complete cabinet replacement, and pole replacement responsive maintenance is necessary, NCDOT's work order response time will not be counted against the Contractor. NCDOT's work order response time will be calculated from the exact time that the work order email is delivered to NCDOT's Project Management Team to the exact time when NCDOT responds with approval.

b. Device downtime and network outages that result in device downtime for many devices will impact the overall percentage availability for ITS Assets which is being tracked as part of ITS Maintenance Performance Management Plan. The percent availability may impact Contractor compensation. See Compensation and Pay-For-Performance for details.

c. Network outages that impact multiple ITS Assets will have a higher impact on percent availability of devices.

d. The Contractor will not be responsible for network outages and downtime that are due to network outages caused by failures in hub switch, core switch, or firewalls maintained by NC Department of Information Technology unless these outages are caused by the Contractor.

5.4 Device Quantities and Future Growth

a. ITS Assets maintained by the Contractor include existing devices listed in Attachment A and an unknown future quantity of devices. Compensation for existing and future assets is further defined in Compensation and Pay-For-Performance.

b. The quantity of infrastructure components is expected to grow at a rate of 8-15% per year after steady state quantities are reached. This growth is not guaranteed and is dependent upon future Department infrastructure needs which are currently undefined.

c. NCDOT is planning for and anticipates the construction of future broadband projects along key corridors including, but not limited to I-40, I-485, and I-85. If broadband construction occurs along these corridors, it is possible that the scope of this contract may be reduced to accommodate this construction. If this occurs, NCDOT will provide at least 6-months' notice to the ITS Resilience Contractor. This notice will include a detailed list of the ITS devices and communication infrastructure to be removed from the ITS Resilience Contract scope of work. Since daily unit price bids are being provided as part of the proposal for this project, the reduction of scope shall not result in any change in the daily unit price bids.

d. NCDOT may remove ITS devices and communication infrastructure from the scope of work at their discretion to support construction projects and NCDOT operational needs. If this occurs, NCDOT will provide a 1-month notice and the devices will be removed from the scope of work on the first day of the following month.

e. The Contractor shall provide unit pricing per individual device per day (Appendix Part C – Price Proposal: **A: Pay-For-Performance – Daily Device Unit Cost Bid)**. This will enable the contract to be extended to add additional device days as needed to incrementally

support device growth. The Contractor will consider in Year 1 of the price proposal that 25% of the devices will begin PM during each quarter with roughly 25% of PMs complete after Q1, 50% of PMs complete after Q2, 75% of PMs complete after Q3, and 100% of PMs complete by Q4 of the initial year of the contract.

6. As-Needed Maintenance

6.1 General

a. The Contractor shall perform As-Needed Maintenance as requested by the Department.

   i. The Department will submit a written request for as-needed maintenance to the contractor.

   ii. The Contractor will respond with a work order in accordance with **Appendix C – Cost Proposal (B: Repair Unit Cost Bids)** and/or **Appendix C – Price Proposal (C: Device Replacement Unit Costs)** and/or **Appendix C – Price Proposal (D: Fiber Asset Management System Support Unit Costs).** The work order must provide a description of the as-needed maintenance including a full scope, detailed cost estimate, and detailed timeframe for delivery of the services/construction.

   iii. The Department will approve or decline (in email format) the Contractor work order.

   iv. If approved, the Contractor will proceed with the work.

b. Some device replacement included under as-needed maintenance will require design and construction of ITS devices. This may include, but is not limited to DMS design, ITS device design, ITS device foundation design and ITS communication infrastructure routing plans and splicing. The Contractor shall provide NCDOT prequalified sub-contractors for both design and construction of infrastructure. The design must be submitted and approved by the NCDOT ITS and Signals Design Unit prior to proceeding with construction. If design is required, NCDOT will request design services as part of the work order negotiation process. All designs shall be completed in accordance with the most current version of NCDOT's *Standard Specifications for Roads and Structures* and NCDOT's *Roadway Standard Drawings* and NCDOT's *ITS and Signals Generic Project Special Provisions.*

c. As-Needed Maintenance applies to assets that are not maintained under the Pay-For-Performance Mechanism.

d. The contractor shall provide **Appendix C – Cost Proposal (B: Repair Unit Cost Bids)** and/or **Appendix C – Price Proposal (C: Device Replacement Unit Costs)** in accordance with project special provisions provided in Appendix E

e. As-Needed Maintenance is defined as:

i. Tree and/or vegetation trimming for trees and/or vegetation that occludes camera vision to the roadway and/or assets.

ii. Tree removal for trees that occlude a camera's vision to the roadway and/or assets.

iii. Device replacements outside of Task 1-3 device replacements, including but not limited to the following, based on Appendix C – Price Proposal (**C: Device Replacement Unit Costs)**:

a. Cameras, supporting power over Ethernet injectors, and related cabling and power sources

b. Camera poles of various size

c. DMS assembly

d. DMS structure

e. RMS equipment components

f. Cabinets including necessary fiber repairs or replacement

g. UPS controllers and related cabling and equipment

h. UPS or solar assembly batteries

i. Solar assemblies including all related cabling and equipment

j. Hub Cabinets

k. Field switches and related power sources

l. Wireless radios, antennas, cabling, and related components

m. Fiber optic transceiver modules

n. Fiber optic splice closures and fiber optic splices

o. Conduit and cable infrastructure installation including junction boxes, risers, all conduit, all fiber optic cabling, all Ethernet cabling, and fiber distribution panels

iv. Collision repairs to DMS structure

6.2 Fiber Asset Management Assistance

a. NCDOT is currently working to populate and maintain their ITS Asset Management System (IAMS) and Fiber Asset Management System (FAMS). It is expected that updates to data within those systems be provided as part of standard Preventive and

Responsive Maintenance. However, Task 5 of this project will include provision for fiber optic investigation (conduits, junction boxes, splice enclosures) to enable more accurate and effective documentation and population of NCDOT's Fiber Asset Management System (FAMS) for existing infrastructure. The Contractor will propose work orders for FAMS assistance upon NCDOT's request using **D: Fiber Asset Management System Support Unit Costs.**

b. Specific tasks to be included under Fiber Asset Management Assistance include:

   i. GPS data location of communications infrastructure including conduit location, junction box location, splice location, pole locations (aerial), aerial fiber location, fiber storage location, fiber distribution panel location, ITS device cabinet location, hub cabinet location. This data will be provided in accordance with NCDOT GIS requirements for the FAMS, including being collected in the appropriate coordinate system and having strong accuracy. Conduit location shall have 1–3-meter accuracy while point locations shall have 1–2-meter accuracy. This would also include photos of junction box interiors or cabinets, where appropriate.

   ii. Opening of and documentation of splicing within existing fiber splice enclosures. This includes repair of any fibers damaged in the process of documentation of these splice enclosures. These splice enclosure investigations will have unit prices for extensive (large splice enclosures where more than 36 splices occur), moderate (between 12 and 36 slices occur), minimal (where less than 12 splices occur).

   iii. Documentation of fiber allocation information for individual fiber segments based on splice information (collected separately) and patch panel designation (collected from hub cabinets, TMCs, or individual device cabinets).

   iv. Population of the FAMS for collected data outside of preventive maintenance and responsive maintenance data collection and population. Population costs will be on a per mile basis and do not include data collection costs. Data will be provided by NCDOT, or data collection will be compensated for separately.

7. NC811 Underground Location Services

7.1 General

a. The North Carolina Underground Damage Prevention Act, Article 8 of Chapter 87 of the North Carolina General Statues ("UDPA"), requires all utility designees to provide the location and description of all underground facilities, which may be damaged as a result of an excavation. The Department is notified of these requests through the NC 811 system.

b. The Contractor shall provide the personnel, materials, equipment, supplies, training, traffic control, and supervision necessary for 811 locating services for all fiber optic and electrical underground utilities (the Contractor is responsible for electrical utilities 811 locating between the power service meter and the ITS assets, the power company will be responsible for 811 locates for meter service and power distribution) within the right-of-way for all ITS Assets and related power/fiber shown in Attachment A.

c. Per North Carolina General Statute 87-121, the Contractor shall provide to the excavator (a third party company) the horizontal location and description of all the operator's facilities in the area where the proposed excavation or demolition is to occur. The location shall be marked by stakes, soluble paint, flags, or any combination thereof, as appropriate, depending upon the conditions in the area of the proposed excavation or demolition.

d. The Contractor shall adhere to North Carolina Genera Statute 87-121 and the American Public Works Association ("APWA") Uniform Color Code for marking. The dimension of the facility shall be indicated at least every twenty-five (25) feet in the area of the proposed excavation or demolition if the width of the facility is greater than four inches.

e. The Contractor shall locate each individual facility when multiple facilities are in the area of the proposed excavation or demolition.

f. The Contractor shall provide traffic control (if required) and follow all Department safety guidelines for 811 locates.

g. The Contractor shall comply with all applicable safety regulations and wear appropriate personal protective equipment ("PPE") while performing work. In the event the Contractor's non-compliance with Occupational Safety and Health Administration ("OSHA") regulations results in a fine against the Department, the Contractor shall reimburse the Department for such a fine and any other costs relating to the fine.

h. All physical locates shall be in accordance with the Underground Utility Safety and Damage Prevention Act.

i. Non-emergency locate requests must be completed within seventy-two (72) hours, three (3) business days of the initial request to the designated Notification Center.

j. Emergency locate requests must be completed within four (4) hours of the initial request.

    i. The Contractor shall be available and able to respond to Emergency Locate Requests on weekends, holidays and at any time of the day or night.

    ii. The Contractor shall provide a way for emergency locate requests to be communicated to the Contractor twenty-four (24) hours a day seven (7) days a week (24/7).

    iii. Positive responses to the NC811 Notification Center are required per North Carolina General Statute 87-121.

k. The Contractor shall be responsible for configuring underground utilities in the IAMS and uploading appropriate data to NC811.

l. The Contractor shall have responsibility for opening and maintaining their own NC 811 account and paying for all related NC 811 ticketing costs.

m. Locate labor, account, ticketing costs, and material costs are incidental to the fixed unit daily prices per asset and asset class in **Appendix Part C – Price Proposal: A: Pay-For-Performance – Daily Device Unit Cost Bid.**

7.2 Performance Monitoring and Tracking

a. As part of the Contractor's proposed performance management plan (section 2.1), the Contractor shall include methodology for performance monitoring and tracking of NC811 Locate Requests within the project limits.

b. The Contractor must keep an electronic record of all locate requests for the term of the Contract and for one (1) year after Contract expiration. Electronic records shall be kept in IWOMS. The Contractor records shall include:

   i. Work order number, date of initial locate request, date of locate services performed, the locate area latitude and longitude, the length of the facilities locate – reported in feet, and when applicable, related comments; and

   ii. Digital photographs (identified by the corresponding work order number and date/time stamp) in medium resolution showing each marked site and distinguishing characteristics of the worksite.

c. The Contractor shall provide an emergency plan for responding to 811 locate requests during inclement weather or natural disaster situations.

d. The Contractor shall exercise all reasonable care and diligence in providing NC811 Services to Department. The Contractor must use techniques representative of Good Industry Practice when providing these services. If damage occurs to any portion of the Department Infrastructure and it is determined that the Contractor received a valid locate request in a timely manner and failed to do the locate in accordance with the service time responsiveness outlined in the Technical Requirements, the Contractor shall be financially responsible for the repairs to such Department Infrastructure.

7.3 Phasing for NC 811 Responsibilities

a. NCDOT is aware that inaccuracies may exist in NCDOT 811 file data. For this reason, NCDOT had developed a phased approach to the transition of NC 811 responsibilities:

   i. Step I – Within first 30 days of contract award, NCDOT will transition all NC 811 accounts with existing fiber location information to the Contractor. At the end of this 30-day period the Contractor shall be responsible for NC 811 locates for the entire project area as depicted in Appendix A. During this step, the Contractor shall rely on the completeness of the data available and will not be penalized for issues arising due to inaccuracies or gaps in data.

   ii. Step II – By the end of the first 90 days of the contract, the Contractor shall have validated NC 811 information for the Triangle Region including all infrastructure within Divisions 4, 5, and 6 as depicted in Appendix A. The Contractor will be

responsible for the accuracy and completeness of the NC 811 data at the end of this 90-day period. If damage occurs to any portion of the Department Infrastructure due to data inaccuracy, the contractor shall be financially responsible for the repairs to such Department Infrastructure.

iii. Step III - By the end of the first 120 days of the contract, the Contractor shall have validated NC 811 information for the Triad Region including all infrastructure within Divisions 7 and 9 as depicted in Appendix A. The Contractor will be responsible for the accuracy and completeness of the NC 811 data at the end of this 120-day period. If damage occurs to any portion of the Department Infrastructure due to data inaccuracy, the contractor shall be financially responsible for the repairs to such Department Infrastructure.

iv. Step IV - By the end of the first 150 days of the contract, the Contractor shall have validated NC 811 information for all communication/electrical infrastructure within the project limits as depicted in Appendix A. The Contractor will be responsible for the accuracy and completeness of all project-related NC 811 data at the end of this 150-day period. If damage occurs to any portion of the Department Infrastructure due to data inaccuracy, the contractor shall be financially responsible for the repairs to such Department Infrastructure.

8. Software Requirements

8.1 General Requirement for IAMS and FAMS

a. The Department will provide the Contractor access to a Department-provided and owned IAMS and FAMS

b. The contractor shall maintain the IAMS for the ITS Assets specified in this contract. The IAMS shall be a database that helps manage all asset types being maintained under this contract. The IAMS has the following features, which will be configured and maintained by the Contractor for all assets within this project:

i. Geographic mapping with the exact location of all ITS Assets (this feature is currently in development by the department with anticipation of being complete by contract closing date).

ii. Georeferenced databases that provide configurable fields for each device and enable device types to have related databases with complementary devices (for example, a camera may have a field Ethernet switch installed in its cabinet, and thus the two would be related)

iii. Asset status tracking (this feature is currently in development by the department with anticipation of being complete by contract closing date).

iv. Detailed fiber optic cable asset information (NCDOT is in the process of implementing this system and populating this data and will utilize the PM site visits to continue population of this data)

8.2 ITS Assets and Data Fields

a. The following ITS Assets and data fields shall be maintained by the contractor in the IAMS and FAMS software (as they are made available by NCDIT):

i. Cameras with the following data fields:

a. Camera ID, Date of Installation, Model Number, Firmware Version, Latitude, Longitude, Power Type, Communication Type, Date of Last Preventive Maintenance, Status

b. Related Switch ID

c. Related Modem ID

d. Power Injector ID, Date of Installation, Model Number, Status

i. DMS with the following data fields:

a. DMS ID, Date of Installation, Model Number, Latitude, Longitude, Communication Type, Date of Last Preventive Maintenance, Status

b. DMS Controller ID, Date of Installation, Model Number, Firmware Version, Date of Last Preventive Maintenance, Status

c. Related Switch ID

d. Related Modem ID

e. Communication Channel ID

ii. CMS with the following data fields (at this point there are no CMS in this contract):

a. CMS ID, Date Purchased, Date Placed in Current Location, Model Number, Latitude, Longitude, Date of Last Preventive Maintenance, Status

b. CMS Controller ID, Date of Installation, Model Number, Firmware Version, Date of Last Preventive Maintenance, Status

c. Modem ID

iii. Communication Conduit with the following data fields:

a. Each communication conduit shall have a unique ID for each continuous conduit section of a certain installation type.

b. Conduit ID, Color, Owner or Lessee, Type, Size, Quantity, Installation Type, Material, Total Fiber Cables, Total Fibers, Total Ethernet Cables, Date of Installation, Related TIP Project, Plans, Repair Dates, Status

c. Related Cable IDs (Many-to Many Relationship Table)

iv. Communication Cables with the following data fields:

a. Each communication cable shall have a unique ID for each continuous section of cable between terminations and splice closures.

b. Cable ID, Status, Type, Owner, Fiber Count, Fiber Material, Date of Installation, Related TIP Project, Repair Dates

c. Each cable ID shall be internally linked to a database within the IAMS that documents the allocation of each individual fiber within each individual cable ID.

d. Related Conduit IDs (Many to Many Relationship Table)

e. Related Splice Closure IDs

f. Related Panel IDs.

v. Handholes/Junction Boxes with the following data fields:

a. Junction Box ID, Status, Communication or Electrical Designation, Type, Size, Owner, Date of Installation, Related TIP Project, Repair Dates, Latitude, Longitude

b. Related Conduit IDs (Many to Many Relationship Table)

c. Related Cable IDs

d. Related Splice Closure IDs

vi. Fiber Optic Splice Closures with the following data fields:

a. Splice ID, Status, Closure Make/Model, Tray Make/Model, Existing Cassettes, Spare Cassette Slots, Existing Cables, Spare Cable Slots, Date of Installation, Related TIP Project, Repair Dates, link to splice diagram, Latitude, Longitude

b. Splice Diagram

c. Related Cable IDs

d. Related Junction Box ID

e. Related Cabinet ID, if applicable

vii. Field Network Switches with the following data fields:

a. Switch ID, Communication Channel ID, Status, Make, Model, Ports in Use, Available Ports, Firmware Version, Make/Model of SFP in Port 1, Make/Model of SFP in Port 2. SFP 1 Install Date, SFP 2 Install Date, Date Switch of Installation, Related TIP Project, Repair Dates, Latitude, Longitude

b. Related Cabinet ID

c. Related Switch ID

d. Related connected device IDs

e. Related Hub Switch IDs

viii. Cabinets with the following data fields:

a. Cabinet ID, Status, Type, Date of Installation, Related TIP Project, Repair Dates, Latitude, Longitude

b. Related Cable IDs

c. Related device IDs internal to the cabinet

d. Related device IDs externally connected to the cabinet

ix. RWIS with the following data fields:

a. RWIS ID, Status, Make, Model, Date of Installation, Latitude, Longitude

b. For up to 6 components:

a. RWIS Component ID, Type, Status, Make, Model, Date of Installation, Date of Repair

c. Related Switch ID

d. Related Cabinet ID

e. Related Modem ID

x. Ramp Meters with the following data fields:

a. connected signal ID, date of connection, latitude, longitude, communication type, date of last Preventive Maintenance, and status;

b. related switch ID;

c. related cabinet ID; and

d. related modem ID.

8.3 ITS Asset Maintenance

a. The Contractor shall maintain and regularly update all data in the IAMS throughout the contract term.

   i. IAMS status information will be used to evaluate the Contractor for performance criteria and therefore must be updated regularly.

   ii. The Contractor shall log the date and time of changes to the IAMS within the individual feature databases.

   iii. Contractor % availability performance metrics shall consider device availability in IAMS, the IWOMS, and the INMS.

b. The Contractor shall propose an IAMS Plan for maintenance of the IAMS and FAMS. Disclaimer: NCDIT may limit access to configuration of some aspects.

8.4 Work Order Management System

a. The Department will provide the Contractor access to a Department-owned IWOMS. (The system to be provided is in development by NCDOT.)

b. The Contractor must provide a backup dashboard for performance management and maintenance tracking outside of the IWOMS software. The use and management of this dashboard shall be defined in the Contractor's Performance Management Plan (Section 2.1)

c. The contractor shall configure, operate, and maintain an IWOMS. The IWOMS shall monitor and record all scheduled, requested, and performed maintenance services for this contract. The IWOMS has the following features, which will be configured and maintained by the Contractor for this project:

   i. Receive both manual trouble tickets and electronically generated trouble tickets through integration with INMS (Department staff, including STOC operators will have access to create trouble tickets).

   ii. Logging of all preventive, responsive, and emergency maintenance services with details of work performed and time and date logs.

   iii. If available, integration with IAMS for a database of all maintained ITS components and their current status (if integration is unavailable, the Contractor

shall develop a plan for how data is manually managed and updated between the two systems).

iv. Asset status tracking identical to IAMS

v. Designation of device asset type and criticality including either general, essential, or vital criticality.

vi. Provide detailed performance tracking in a dashboard that accurately evaluates the performance of the contractor in accordance with the performance metrics required in this contract for all work.

vii. Track all spare parts inventories for the maintenance contractor.

viii. Log the date, time, cost, and technician of all asset replacements.

ix. Track work order history and provide reporting on that data for the life of the system.

x. Track assets sent for repair.

d. The Preventive Maintenance IWOMS shall:

i. Track and log all scheduled Preventive Maintenance activities with date and time.

ii. Log all inputs and modifications on a user basis.

iii. Track the amount of time (in days) that has passed since the most recent Preventive Maintenance on a device.

iv. Provide for multiple configurable alerts per device that enable the Contractor and Department staff to be notified if Preventive Maintenance has not been completed within certain timeframes.

e. The Contractor shall configure and maintain the following Responsive and As-Needed Maintenance data features in IWOMS:

i. Track and log all responsive service calls with date and time.

ii. The IWOMS may undergo development to receive service calls automatically through integration with the INMS. If this integration is unavailable at the time of the contract, the Contractor shall propose a manual plan for how to reconcile the logged date/time of a device going down in the INOMS with the IWOMS service call.

iii. Log the date and time when the Contractor technician initially responds to review a service call.

iv. Log the date and time when a formal diagnosis has been made of the issue that caused the service call.

v. Document the details of the issue that caused the service call, the recommended repair proposed by the Contractor technician, and the cost of the repair recommended by the Contractor technician.

vi. Log the date and time when device repair has been completed by the Contractor Technician.

vii. Log the date and time when device repair has been validated by the Department.

viii. Have multiple configurable alerts per device that enable Contractor and Department staff to be notified as the Responsive Maintenance changes status from response phase, diagnosis phase, and repair phase.

f. NCDIT shall perform the initial configuration of data within the IWOMS by adding all existing devices as defined in the design scope of work.

g. ITS Asset Maintenance: The Contractor shall maintain and regularly update all data in the IWOMS throughout the term of the maintenance contract. IWOMS status information will be used to evaluate the Contractor for performance criteria and therefore must be updated regularly.

h. The Contractor shall propose an IWOMS Plan for this project that meets the requirements of this section for configuration and maintenance of ITS assets.

8.5 INMS Requirements

a. The Department will provide the Contractor access to a Department-owned INMS

b. The Department shall configure, operate, and maintain the data within the INMS.

c. The INMS will provide automated emails/SMS messages to designated Contractor employees whenever ITS Assets lose connectivity.

d. The Contractor shall coordination with NC Department of Information Technology (NCDIT) on any updates/changes to network address information for individual devices such that these can be updated in the INMS.

e. The Contractor shall be provided remote access to the INMS by the Department through a secure portal.

f. NCDIT may limit access to configuration of some aspects for network security purposes.

9. Compensation and Pay-For-Performance

9.1 General

a. The Contractor shall provide an Appendix C – Price Proposal with the following schedules:

i. **A: Pay-For-Performance – Daily Device Unit Cost Bids**, the Contractor shall provide a daily device unit price for Year 1 and a daily device unit price for Years 2 and 3. The Contractor will consider the gradual increase in devices being maintained over Year 1 of the contract for Year 1 unit pricing. This pricing will be used for completion of work in Tasks 1 and 2 as previously described.

ii. **B: Repair Unit Cost Bids**, the Contractor will provide unit prices for Communication Infrastructure repair in accordance with Tasks 1 and 3 as previously described.

iii. **C: Device Replacement Unit Costs**, the Contractor will provide unit prices for Communication Infrastructure repair in accordance with Task 4 as previously described.

iv. **D: Fiber Asset Management System Support Unit Costs**, the Contractor will provide unit prices for Communication Infrastructure repair in accordance with Task 5 as previously described.

Task	Scope of Work Element	Compensation Structure
1	ITS Device PM	A: Pay-For-Performance: Daily Device Unit Cost Bid with Incentives/Disincentives
	ITS Communication Infrastructure Assessment	
	Initial ITS Device RM	B: Repair Unit-Bid with Incentives/Disincentives
	Initial Communication Infrastructure RM	
2	ITS Device PM	A: Pay-For-Performance Compensation: Daily Device Unit Cost Bid with Incentives/Disincentives
	ITS Device RM	
	Communication Infrastructure PM and Fiber Test Plan	
	NC811 Underground Locate Services	
3	Communication Infrastructure RM	B: Repair Unit-Bid with Incentives/Disincentives
	Full cabinet replacement and pole replacement RM	
	Fiber Testing	
4	Device Replacement + Installation	C: Device Replacement Unit Cost
	Communication Infrastructure Construction outside of RM	
	DMS Design	
5	Fiber Asset Management System Support	D: FAMS Unit Cost

b. In accordance with Tasks 1 and 2, the Contractor will enter the Pay-For-Performance ("PFP") period for ITS Maintenance for individual infrastructure components under the following conditions:

   v. For existing ITS Assets, the Contractor will enter the PFP period after completion of the first PM service for a particular asset.

   vi. For ITS Asset being constructed by others, the Contractor will enter the PFP upon completion of system acceptance testing by the Department for a particular asset plus a 30-day burn-in period.

c. The Department's goal is for each asset to be operating at or above the base availability defined in Tables 2-4 for the defined asset classes. To assist in achieving this goal, the Department shall assess performance incentives and disincentives according to the formulas described in Section 9.6.

d. Although the Department will continue to perform daily monitoring, the Contractor is required to:

   i. Provide a Performance Management dashboard that displays percent availability and repair time for each asset on a daily and monthly basis. The dashboard shall also provide cumulative reporting and data displays on a per asset type and per asset class basis on a daily and monthly trend basis.

   ii. Monitor the operation of each asset per this specification and per the Contractor's Performance Management Plan as reviewed and agreed upon by the Department. The Contractor shall verify and report the operational performance of each asset.

a. The Contractor shall generate monthly monitoring reports showing the daily percent availability of each asset. This reporting and asset monitoring will the basis upon which incentives and disincentives will be determined under this contract – also known as Pay-For-Performance.

9.2 Task 1 and 2 Formulas for Performance Payment

a. The following asset statuses are used to calculate performance payments and non-performance deductions:

   i. Operational (O): Operational assets must meet the operation criteria listed in Definition of Operational and Demarcation Points of Assets below. Operational status positively impacts the percent availability for each asset in computation for pay-for-performance measures.

   ii. Down (D): Down status is used to classify assets that are not fully functional according to Definition of Operational and Demarcation Points of Assets below and are the responsibility of the Contractor to repair or replace. If an asset is marked as Down, there must be a work order in the IWOMS detailing the problem. Down

status negatively impacts the percent availability for each asset in computation for pay-for-performance measures.

iii. Transition (T): Transition status indicates an asset that is in the process of being turned over to the Contractor but has not yet been officially handed over. This includes assets in a 30-day burn period. Maintenance responsibility for these devices is outside the scope of the Contractor. Assets will be changed from transition to "operational" when the Contractor assumes maintenance responsibility. Transition status has no impact on the % availability for each asset in computation for pay-for-performance measures.

iv. Decommissioned (DC): Decommissioned status identifies assets that are no longer included within the scope of this ITS Maintenance contract. These assets may have been removed during a construction project, the Asset ID may have been changed, or the asset may have been removed due to an accident. Decommissioned assets are not paid. Decommissioned status has no impact on the percent availability for each asset in computation for pay-for-performance measures.

v. Waiting (W): Waiting status applies to assets that have failures beyond the demarcation point, such as a hub switch failure. Waiting assets are paid. If the asset was in a Down status prior to one of the conditions stated it should be moved to a Waiting status. The LD clock will be suspended upon the change of status to Waiting. The Contractor will perform work to make the asset operational to the extent possible. This work may be inspected in the field by Department personnel to verify. Waiting status has no impact on the percent availability for each asset in computation for pay-for-performance measures.

b. The following equations are used to calculate the percent availability of the assets:

i. Total Assets = O + D + T + W

ii. Total Maintained Assets = O + D + W

iii. Total Operational Assets = O + W

iv. % Availability = Total Operational Assets / Total Maintained Assets

c. The Contractor shall calculate the monthly ITS Maintenance Pay-for-Performance cost based on accumulative daily asset performance. The costs shall be substantiated and approved by the Department's Project Manager each month. The actual daily base price per asset class will be calculated by multiplying the daily base price for an individual asset class by the performance payment percentage based on percent availability and asset classification as detailed in Tables 2-4 below. Percent availability accuracy shall be measured by rounding to the nearest hour of downtime at a minimum although greater accuracy is acceptable to the Department.

Table 2: General Asset Class Performance Payment based on % Availability						
Asset Type	**≤ 80%**	**≤ 85%**	**< 93%**	**≥ 93%**	**≥ 95%**	**≥ 97%**
Cameras	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
DMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
Hubs	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
RMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid

Table 3: Essential Asset Class Performance Payment based on % Availability						
Asset Type	**≤ 85%**	**≤ 90%**	**< 95%**	**≥ 95%**	**≥ 97%**	**≥ 98%**
Cameras	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
DMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
Hubs	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
RMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid

Table 4: Vital Asset Class Performance Payment based on % Availability						
Asset Type	**≤ 90%**	**≤ 93%**	**< 97%**	**≥ 97%**	**≥ 98%**	**≥ 99%**
Cameras	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid

DMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
Hubs	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid
RMS	0.60 * Bid	0.70 * Bid	0.80 * Bid	Bid	1.03 * Bid	1.05 * Bid

9.3 Task 1 and 2: ITS Asset PM/RM Non-Performance Disincentives

a. The Department shall enforce non-performance disincentives for each asset type and class each day the Contractor fails to repair an asset according to the allowable repair times per asset class and asset classification. If Contractor exceeds the allowable repair time, the following equation is used to calculate the non-performance disincentive per asset classification for each day the asset is down after the allowable repair time:

b. Non-Performance Disincentive = (Bid * T * M) + P, where:

   i. T = Allowable repair time for asset class and classification in 24-hour calendar days

   ii. M = Multiplier per asset class per asset classification

   iii. P = Non-performance disincentive for the previous calendar day.

b. The requirements for the non-performance disincentives are detailed in Table 5 below:

Table 5: Non-Performance Disincentives

Asset Class	**General**		**Essential**		**Vital**	
Asset Type	**Allowable Repair Time (T)**	**Multiplier (M)**	**Allowable Repair Time (T)**	**Multiplier (M)**	**Allowable Repair Time (T)**	**Multiplier (M)**
Hubs	2	2	1	4	0.5	28
All Others	14	1	7	2	2	7

c. Non-performance disincentive example A:

   i. A DMS with an asset class of essential is down for 17 days and the daily bid amount for an essential DMS was $1.00.

      a. T = 7 days (according to Table 7 for essential asset class)

b. M = 2 (according to Table 7 for essential asset class)

c. Disincentive per day over T days = $1.00 x 7 x 2 = $14.00

d. Days over T = 17-7 = 10

e. Total Disincentive = 10 x $14.00 = $140.00

d. Non-performance disincentive example B:

i. A Hub with an asset class of vital is down for 2.5 days and the daily bid amount for a vital hub was $100.00.

a. T = 0.5 days (Table 7)

b. M = 28 (Table 7)

c. Disincentive per day after 0.5 days = $100.00 x 0.5 x 28 = $1,400

d. Days over T = 2.5 – 0.5 = 2

e. Total Disincentive = $1,400 x 2 = $2,800

9.4 Task 3 – Responsive Maintenance Non-Performance Disincentives

a. As described in the Section 5: Responsive Maintenance, the Contractor must provide a work order notice to the NCDOT Project Management Team as part of Phase II of Responsive Maintenance whenever Task 3 communication infrastructure, complete cabinet replacement, and/or pole replacement responsive maintenance is required. The NCDOT Project Management Team is responsible for reviewing the work order and approving.

b. Upon approval of a Communication Infrastructure RM work order, the Contractor must immediately repair the infrastructure. The Department shall enforce non-performance disincentives (in addition to daily device availability impacts) for each day the Contractor fails to repair fiber infrastructure according to the allowable repair times set forth below:

i. Communication Infrastructure shall be repaired within 24 hours. For each day thereafter, the contractor shall receive a $2500 per day disincentive. This disincentive amount will be pro-rated based on the exact time of repair.

c. Upon approval of a cabinet replacement and/or pole replacement RM work order, the Contractor will be assessed non-performance disincentives for the specific ITS device based on Section 9.3 Task 1 and 2: ITS Asset PM/RM Non-Performance Disincentives above. The allowable repair time will exclude the time for work order approval by NCDOT. For example, a vehicle strikes a vital DMS cabinet at 5PM and the contractor is notified immediately. The Contractor submits a work order for replacement of the DMS cabinet at 6PM. NCDOT responds at 8AM the following morning. Starting at 8AM, the allowable repair time is 47 hours.

9.8 Noncompliance Remedial Plan

a. The Department may, in its sole discretion, require the Contractor to prepare a Noncompliance Remedial Plan as further described in this section.

b. The Department will assess points using a points system (each, a "Noncompliance Point") in circumstance where the Contractor fails to meet the relevant performance standards with respect to the completion of the ITS Resilience Work. If the Contractor receives a total of five (5) Noncompliance Points (after accounting for any reduction in Noncompliance Points as set out in Table 7) or more at any time during the Term, the Contractor shall be required to prepare a Noncompliance Remedial Plan (the "Noncompliance Remedial Plan Trigger"). The relevant performance standards and maximum number of Noncompliance Points that may be assessed are set out in Table 6 below. Table 7 below describes the circumstances under which Noncompliance Points previously assessed to the Contractor will be reduced.

Table 6: Noncompliance Points	
Unsatisfactory Performance Description	**Points**
Monthly % availability for ANY general asset type remains below 85% for two months in a row	2
Monthly % availability for ANY essential asset type remains below 90% for two months in a row	2
Monthly % availability for ANY vital asset type remains below 93% for two months in a row	2
Monthly % availability for ANY general asset type remains below 85% for three months in a row	3
Monthly % availability for ANY essential asset type remains below 90% for three months in a row	3
Monthly % availability for ANY vital asset type remains below 93% for three months in a row	3
Monthly % availability for ANY general asset type remains below 85% for four months in a row	3
Monthly % availability for ANY essential asset type remains below 90% for four months in a row	3
Monthly % availability for ANY vital asset type remains below 93% for four months in a row	3
More than 25% of assets in any asset class exceed allowable repair time in 1 year.	3
More than 50% of assets in any asset class exceed allowable repair time in 1 year.	5
Two PM cycles are not provided for 100% of devices within 1 year	2

Table 6: Noncompliance Points	
Unsatisfactory Performance Description	**Points**
PM Quality Reviews Score an Average of 8 or less within 1 year	2

Table 7: Satisfactory Performance Points	
Scenario for Reduction of Noncompliance Points	**Points**
Contractor does not accrue unsatisfactory performance points for 1 year	2
Monthly % availability for all general assets is above 95% for 2 months in a row and Monthly % availability for all essential assets is above 97% for two months in a row and Monthly % availability for all vital assets is above 98% for three months in a row.	1
Monthly % availability for all general assets is above 95% for 2 months in a row and Monthly % availability for all essential assets is above 97% for two months in a row and Monthly % availability for all vital assets is above 98% for four months in a row.	1
Monthly % availability for all general assets is above 95% for 2 months in a row and Monthly % availability for all essential assets is above 97% in a row for two months and Monthly % availability for all vital assets is above 98% for five months in a row.	2
Monthly % availability for all general assets is above 95% for 2 months in a row and Monthly % availability for all essential assets is above 97% for two months in a row and Monthly % availability for all vital assets is above 98% for six months in a row.	2

c. Without prejudice to any other rights the Department may have under this Agreement, if a Noncompliance Remedial Plan trigger occurs, the Contractor shall within fourteen (14) days of such occurrence submit to the Department a remedial plan (a "Noncompliance Remedial Plan") for the Department's approval.

d. A Noncompliance Remedial Plan must set out specific actions and an associated schedule to be followed by the Contractor to improve its performance and reduce the number and frequency of Noncompliance Events occurring in the future. Such actions may include:

   i. changes in organizational and management structure;

   ii. revising and restating management plans and procedures;

   iii. improvements to quality control practices;

iv. increased monitoring and inspections;

v. changes in Key Personnel and other important personnel;

vi. replacement of subcontractors; and

vii. other reasonable measures.

e. The Contractor will implement any approved Noncompliance Remedial Plan in accordance with its terms.

f. If, after implementing any approved Noncompliance Remedial Plan, any of the following shall occur:

i. on the six (6) month anniversary of the implementation of such Noncompliance Remedial Plan, the Contractor has a higher balance of Noncompliance Points than it did when the approved Noncompliance Remedial Plan was implemented;

ii. on the nine (9) month anniversary of the implementation of such Noncompliance Remedial Plan, the Contractor has a higher balance of Noncompliance Points than it did when the approved Noncompliance Remedial Plan was implemented; or

iii. on the twelve (12) month anniversary of the implementation of such Noncompliance Remedial Plan, the Contractor is unable to improve its performance by reducing the number of Noncompliance Points below ten (10), then, the "Noncompliance Points Default Trigger" shall be deemed to have been reached and the Department may terminate this Agreement.

9.9 Handback Plan

a. The Contractor shall prepare a plan (the "Handback Plan") that sets forth the methodologies and activities that will be undertaken or employed to ensure that the Handback Requirements are achieved at the end of the Term. The Contractor shall submit the Handback Plan to the Department for review and approval at least one (1) year before the Expiry Date. The Handback Plan shall describe and identify:

i. a Responsive Maintenance Plan to ensure that all Responsive Maintenance has been completed on all ITS Assets prior to the Termination Date. ITS Assets in need of responsive maintenance shall be repaired prior to the Termination Date. The beginning and completion of Responsive Maintenance may extend past the Termination Date if necessary for assets that were defective before the Termination Date although compensation for ITS Resilience work will end on the Termination Date.

ii. a Preventive Maintenance Plan to ensure that all assets have had preventive maintenance within the twelve (12) months prior to Handback.

iii. all permits and equipment warranties that are in the OMC Contractor's name shall identify the method and timing of the transfer of same to the Department.

iv. The Department shall have twenty (20) Business Days to review the Handback Plan.

9.10 Handback Plan Testing and Inspections

a. After receiving Department approval of the Handback Plan, the Contractor shall perform all inspections and Renewal Work necessary to meet or exceed the Responsive Maintenance requirements and the Preventive Maintenance requirements at the Termination Date. At the Termination Date, the Contractor shall certify that all ITS Assets meet or exceed the above-stated requirements.

b. The Department shall have the right and opportunity to request inspections and tests for assets where Responsive Maintenance is in question within the last one hundred eighty (180) calendar days of the Term and shall be provided with a minimum notice of ten (10) Business Days before the performance of any such inspections and tests. The Contractor shall deliver to the Department, within ten (10) Business Days after they are created, the output data arising from any testing and any interpretation thereof made by the testers.

c. If the Contractor fails to undertake inspections within the relevant time periods specified above, the Department shall be entitled to undertake or arrange the relevant inspections itself, following thirty (30) days' notice to the Contractor, in which case the Contractor shall pay the Department's costs of such inspections.

9.11 Definition of Operational and Demarcation Points of Assets

a. The operational definitions and demarcation points defined in this section apply to the Department's assets as they relate to Pay-for-Performance.
   i. Cameras:
      a. A camera is considered "Operational" for daily status purposes when:
         i. The camera is communicating with the backbone network;
         ii. Usable video is present at the demarcation point; and
         iii. Pan/tilt/zoom (PTZ) control is functional from the demarcation point.
      b. Demarcation:
         i. For fiber-connected assets, the demarcation point is at the field-side port of the NC DIT managed hub switch.
         ii. For cellular modem connected assets, the demarcation point is at the field-side connection to the cellular modem, but the contractor must ensure the cellular modem must have an active connection to the service provider.

ii. DMS:

a. A DMS is considered “Operational” for daily status purposes when:

i. The sign is communicating with the backbone network;

ii. The sign responds to commands from the demarcation point;

iii. 95% or more of sign display pixels are operating properly, and the acceptable level of failed pixels do not render the display message illegible; and

iv. The brightness of the sign is correct for the ambient light present, based on readings of the photocell system.

b. Demarcation:

i. For fiber-connected assets, the demarcation point is at the field-side port of the NC DIT managed hub switch.

ii. For cellular modem connected assets, the demarcation point is at the field-side connection to the cellular modem, but the contractor must ensure the cellular modem must have an active connection to the service provider.

iii. Hubs

a. A Hub is considered “Operational” for daily status purposes when:

i. UPS is providing conditioned power to the hub switch;

ii. HVAC is operating within environmental monitoring limits;

iii. Doors, roof, and walls are free of damage and graffiti;

iv. Grounds are kept free of tall grass, limbs, and debris

iv. RMS

a. An RMS is considered “Operational” for daily status purposes when:

1. The controller is communicating with the backbone network;

2. The controller responds to commands from the demarcation point;

3. The signal heads are responding appropriately in accordance with the timing plans.

4. All detectors are functioning, and detector calls are received in the controller.

b. Demarcation:

1. For fiber-connected assets, the demarcation point is at the field-side port of the NC DIT managed hub switch.

2. For cellular modem connected assets, the demarcation point is at the field-side connection to the cellular modem, but the contractor must ensure the cellular modem must have an active connection to the service provider.

10. Traffic Control Requirements

10.1 Traffic Control Devices

a. All elements of traffic control shall comply with NCDOT Standard Specifications for Roads and Structures as well as the most current NCDOT Roadway Standard Drawings.

b. The Contractor shall use traffic control devices that conform to all NCDOT requirements and are listed on the NCDOT Approved Products List. The Approved Products List may be referenced on the website noted below: https://apps.ncdot.gov/vendor/approvedproducts/

c. The use of any devices that are not shown on the NCDOT Approved Products List shall require written approval from the Design-Build Unit prior to incorporation.

d. When within 1000’ of a signalized intersection, channelizing device spacing shall not exceed a distance in feet equal to the posted speed limit. When beyond 1000’ to a signalized intersection, channelizing device spacing shall not exceed a distance in feet equal to twice the posted speed limit. Channelizing devices shall be spaced ten feet on-center in radii. Channelizing devices shall be two feet off the edge of an open travel way when lane closures are not in effect. Skinny drums shall only be allowed as defined in Section 1180 of the NCDOT Standard Specifications for Roads and Structures.

e. Portable Changeable Message Signs (“PCMS”) should be placed off the shoulder of the roadway and outside of the clear zone. If a PCMS must be placed on the roadway shoulder or within the clear zone, it shall be delineated with retroreflective temporary traffic control (“TTC”) devices. When PCMSs are not being used to display TTC messages, they should be relocated such that they are outside of the clear zone and turned away from traffic. If relocation is not practical, the PCMS shall be delineated with retroreflective TTC devices

9.2 Lane and Shoulder Requirements

a. For any roadway facility impacted by this project, the Contractor shall not install more than two (2) miles of lane closure in any one direction, measured from the beginning of the merge taper to the end of the lane closure.

b. On two-lane, two-way facilities, that cross major facilities being maintained under this project, the Contractor shall not install more than five hundred (500) feet of lane closure in any one direction on any roadway within the project limits or in conjunction with this project, measured from the beginning of the merge taper to the end of the lane closure.

c. The Contractor shall 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.

d. The Contractor shall place the necessary traffic control procedures for either a Lane closure, Shoulder closure or the display of portable Advance Warning signs using NCDOT Roadway Standard Drawings when personnel and /or equipment are working within the following distances from an open travel lane and not protected by existing traffic barrier:

    i. All Interstates and all roads with a posted speed limit of 50 MPH or greater

        a. From 10 feet or less, close the nearest open travel lane.

        b. From 11 to 20 feet, close the nearest open shoulder.

        c. From 21 to 30 feet, display Utility Advance Warning signs (W21-7). • Greater than 30 feet, no traffic control signs, or devices are required.

    ii. All other roads:

        a. From 5 feet or less, close the nearest open travel lane.

        b. From 6 to 15 feet, close the nearest open shoulder.

        c. From 16 to 20 feet display Utility Advance Warning signs (W21-7).

        d. Greater than 20 feet, no traffic control signs, or devices are required.

9.3 Impacts to Other Network Roadways

a. The Contractor shall coordinate with the [Division Maintenance Engineer, Resident Engineer, Division Traffic Engineer, Rail Division], and STOC to manage traffic operations within the work zone and other roadways within the network that may be affected by the ITS Resilience Work activities. Coordination shall include providing notification of planned lane or shoulder closures, traffic management, access management, and incidents.

b. The Contractor shall take steps to minimize disruptions to existing roadway facilities during ITS Resilience Work and shall demonstrate how the traffic control phasing minimizes inconvenience to motorists on all roads.

9.4 Signing

a. When portable work zone signs are not in use for periods longer than 30 minutes, the Contractor shall lay the portable work zone sign flat on the ground and collapse the sign stand and lay it flat on the ground.

b. The Contractor shall ensure proper signing is in place at all times during ITS Resilience Work as required by the MUTCD. Guide signs shall be maintained or modified as required by the TMP throughout the project duration. All temporary signing shall be shown on the Traffic Control Plans or Temporary Signing Plans to be reviewed and approved by the Work Zone Traffic Control Section and the Signing and Delineation Unit prior to incorporation.

9.5 Project Requirements and Time Restrictions

a. Intermediate Contract Times 1-6 for Lane Narrowing, Lane Closure, Holiday, and Special Event Restrictions; unless the Department provides written approval to work during these restricted times.

Intermediate Contract Time	Facility	Days	Time Restrictions
1	All facilities including all ramps and loops, except Y-Lines described in ICTs 2 and 3.	Monday through Sunday	5:00 a.m. to 9:00 p.m.
2	*-Y- Lines with AADT less than 8,000	Monday through Sunday	No Restrictions
	*-Y- Lines with AADT 8,000 - 20,000	Monday through Friday	6:00 a.m. to 9:00 p.m. and 4:00 p.m. to 7:00 p.m.
3	*-Y- Lines with AADT greater than 20,000	Monday through Sunday	6:00 a.m. to 7:00 p.m.

b. The Department, at their discretion, may issue an advanced notice in writing for specific corridors or segments stating that devices that fail/require responsive maintenance along those corridors and segments will be placed into a “Waiting” status during the time restrictions listed in this section to reduce impacts on traffic. In this case, the device would be placed into a “Waiting” status at the time when it fails and would be changed to “Down” status at the end of the specified time restriction.

c. Official AADT volumes for determining time restrictions are available at the following link: https://connect.ncdot.gov/resources/State-Mapping/Pages/Traffic-Volume-Maps.aspx

d. In addition, the Contractor shall not, other than for Responsive Maintenance (except to the extent such Responsive Maintenance is caused by a breach of the Agreement by Contractor), close or narrow a lane of traffic on the aforementioned facilities, detain, and / or alter the traffic flow on or during holidays, holiday weekends, special events, or any

other time when traffic is unusually heavy. At a minimum, these requirements / restrictions shall apply to the following schedules:

i. For New Year's between the hours of 5:00 a.m. December 31st and 9:00 p.m. January 2nd. If New Year's Day is on a Friday, Saturday, Sunday, or Monday then between the hours of 5:00 a.m. December 31st and 9:00 p.m. the following Tuesday.

ii. For Easter, between the hours of 5:00 a.m. Thursday and 9:00 p.m. Monday.

iii. For Memorial Day, between the hours of 5:00 a.m. Friday and 9:00 p.m. Tuesday.

iv. For Independence Day, between the hours of 5:00 a.m. July 3rd and 9:00 p.m. July 5th. If Independence Day is on a Friday, Saturday, Sunday, or Monday, then between the hours of 5:00 a.m. the Thursday before Independence Day and 9:00 p.m. the Tuesday after Independence Day.

v. For Labor Day, between the hours of 5:00 a.m. Friday and 9:00 p.m. Tuesday.

vi. For Thanksgiving Day, between the hours of 5:00 a.m. Tuesday and 9:00 p.m. Monday.

vii. For Christmas, between the hours of 5:00 a.m. the Friday before the week of Christmas Day and 9:00 p.m. the following Tuesday after the week of Christmas Day.

e. Deductions for Intermediate Contract Time #1 for the above lane narrowing, lane closures, holiday and special event time restrictions for a single lane on All facilities including all ramps and loops, except Y-Lines described in ICTs 2 and 3 are $2,500.00 per 15-minute period or any portion thereof.

f. Deductions for Intermediate Contract Time #2 for the above lane narrowing, lane closure, holiday, and special event time restrictions on all -Y- Line Roads with AADTs between 8,000 and 20,000 are $500.00 per 15-minute period or any portion thereof.

g. Deductions for Intermediate Contract Time #3 for the above lane narrowing, lane closure, holiday, and special event time restrictions on all -Y- Line Roads with AADTs greater than 20,000, are $1250.00 per 15-minute period or any portion thereof.

h. Deductions described in Sections 9.5(e) to (g) shall not accrue with respect to Responsive Maintenance, except to the extent such Responsive Maintenance is caused by a breach of the Agreement by Contractor.

PART E: ITS RESILIENCE TECHNICAL SUBMITTAL REQUIREMENTS

E-1.1. ITS Resilience Services Submittal

E-1.1a. Approach to Services

Proposers must describe in detail the approach for ITS Resilience Services to be performed as defined in the Scope of Work. The approach section shall present the methodology that the Proposer is planning to follow for each Task (1-5) and provide a description of all required service deliverables/outputs. The Proposer shall provide process flow charts showing how interactions and work coordination with the Department shall take place. The Department encourages innovation in service delivery if substantiated and proven to be effective. Any such innovation shall be highlighted by the Proposer in their approach to ITS Resilience Services. Please address the following items in this approach to services:

E-1.1b. Relevant Experience

Proposers shall provide a narrative statement regarding ITS Resilience Services experience and expertise as it relates to the ITS Resilience Scope of Work.

Proposer shall describe the Proposer's experience in the following areas:

1. Experience in providing ITS Resilience Services that are comparable to services sought by the Department to other clients, especially other governmental entities and / or similar public/ private sector transportation organizations and/or private sector telecommunication firms;
2. Business practices that enable the Proposer to perform the required ITS Resilience Services and related tasks in an efficient, timely and expeditious manner; and
3. Any other specialized or innovative ITS Resilience Services the Proposer may offer to the Department.

Proposer shall describe at least three (3) and no more than ten (10) relevant reference projects performed within the past ten (10) years that are similar in size, complexity, and services sought by the Department for this Project. The reference projects should demonstrate the firm's experience repairing and providing corrective maintenance for fiber optic cable and related infrastructure.

For the purpose of this RFP, any experience listed as a relevant qualification shall be those in which the Proposer directly participated in the ITS Resilience Services – for required information, refer to table below.

Reference Project # 1: Project Name	
Client / Entity Name	
Period of Services Provided	
ITS Resilience Services Provided	Describe services provided, including repairing and corrective maintenance for fiber optic cable and related infrastructure; and experience in operating and maintaining a Fiber Management System
Project's Performance to date	Key performance measures
Project Reference	Provide the name of the client entity, including the name, address, and telephone number of the responsible official of the client, company, or agency who may be contacted.

Proposer shall provide a list of at least three clients for which its firm has performed similar work, as described in this RFP, within the past five (5) years. Projects referred to should be identified and the name of the client entity shown, including the name, address, and telephone number of the responsible official of the client, company, or agency who may be contacted.

OMC Technical Proposal Evaluation Criteria

1. **Project Approach – 18 points**

Proposer's approach to perform and manage ITS Resilience services required for the Project, with emphasis on the following factors:

- Proposer's understanding of the Department's objectives for the Project and Responsiveness, organization, and clarity of Proposal.
- Soundness of proposed Task 1-5 approach, methodology, and deliverables for conducting services as it relates to the requirements discussed in ITS Resilience Scope of Work of the RFP. This includes proposer's schedule and plan for initial 12-month period (Task 1), approach and plan for preventive and responsive maintenance (Tasks 2/3), approach for ITS device replacement (Task 4), and approach for FAMS support (Task 5). This includes:
    - Proposer's approach to ensuring that adequate materials, equipment, and resources available to perform the work required for this Project.
    - Extent to which Proposer's approach for ITS Resilience services is substantiated by the Good Industry Practices and standards.
    - Quality and completeness of the Proposer's approach for ITS Resilience services.

- Project management and communication approach with the NCDOT Project Management Team – How will you effectively manage the project and coordinate meetings with NCDOT?
    - Proposer's approach to maintain close coordination with the Department and other contractors throughout the length of the Project.

2. Proposer and Personnel Qualifications and Experience – 12 points

Proposer's relevant experience and expertise in providing ITS Resilience services for projects of a similar size and scope, with emphasis on the following factors:

- Proposer's relevant experience and expertise in conducting the ITS Resilience scope of work.
- Proposer's qualifications, experience, and competency of key ITS Resilience personnel.

APPENDICES

The following appendices are included as part of the RFP. Each appendix is marked with a cover sheet, followed by the appendix itself. Appendix Part C has been included as part of overall RFP document and as a Microsoft Excel file.

Appendix Part A – ITS Assets in Scope of Work

Appendix Part B – Agreement Terms

Appendix Part C – Price Proposal

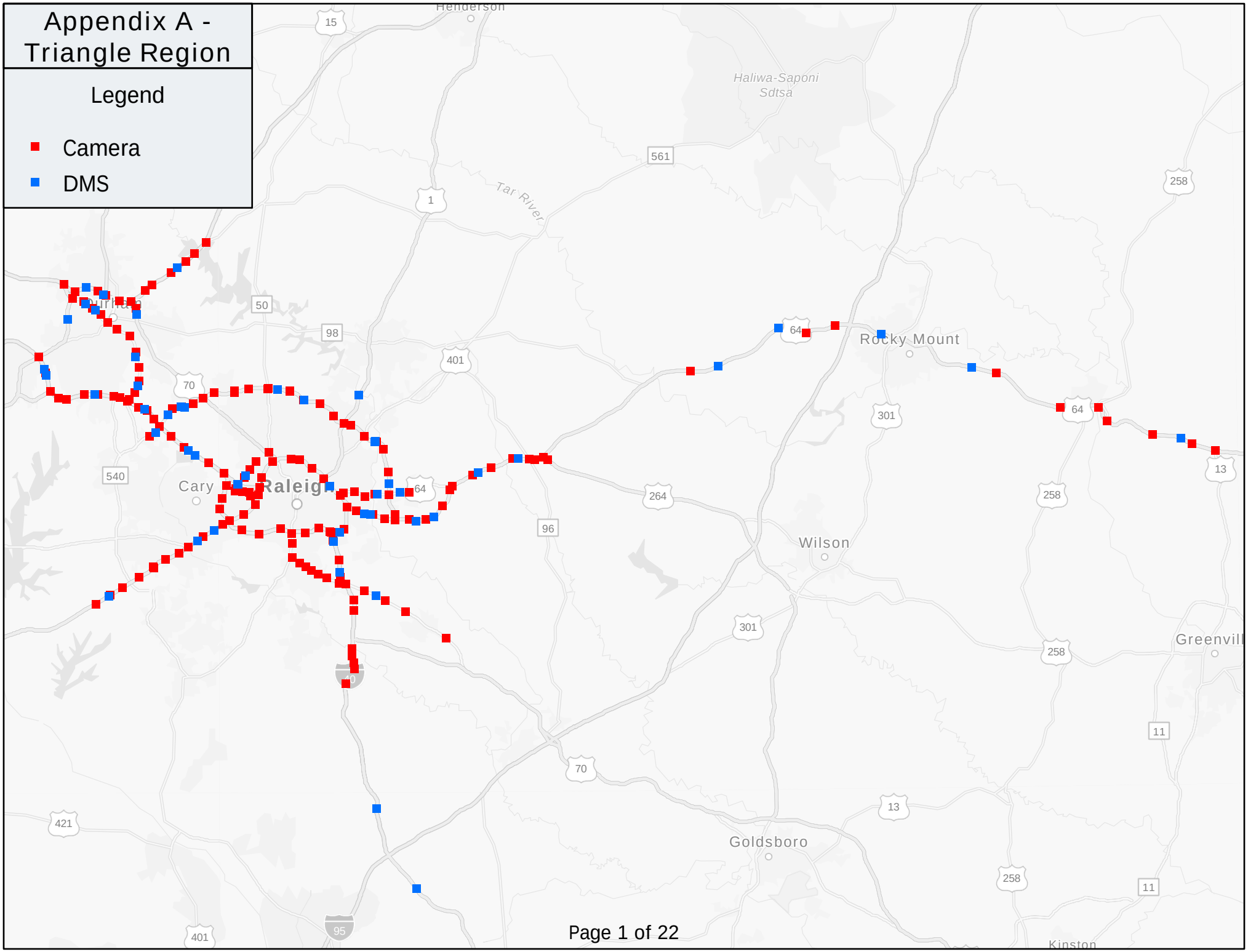
Appendix Part D – Form of Bid Bond

Appendix Part E – Project Special Provisions for Unit Bid Items

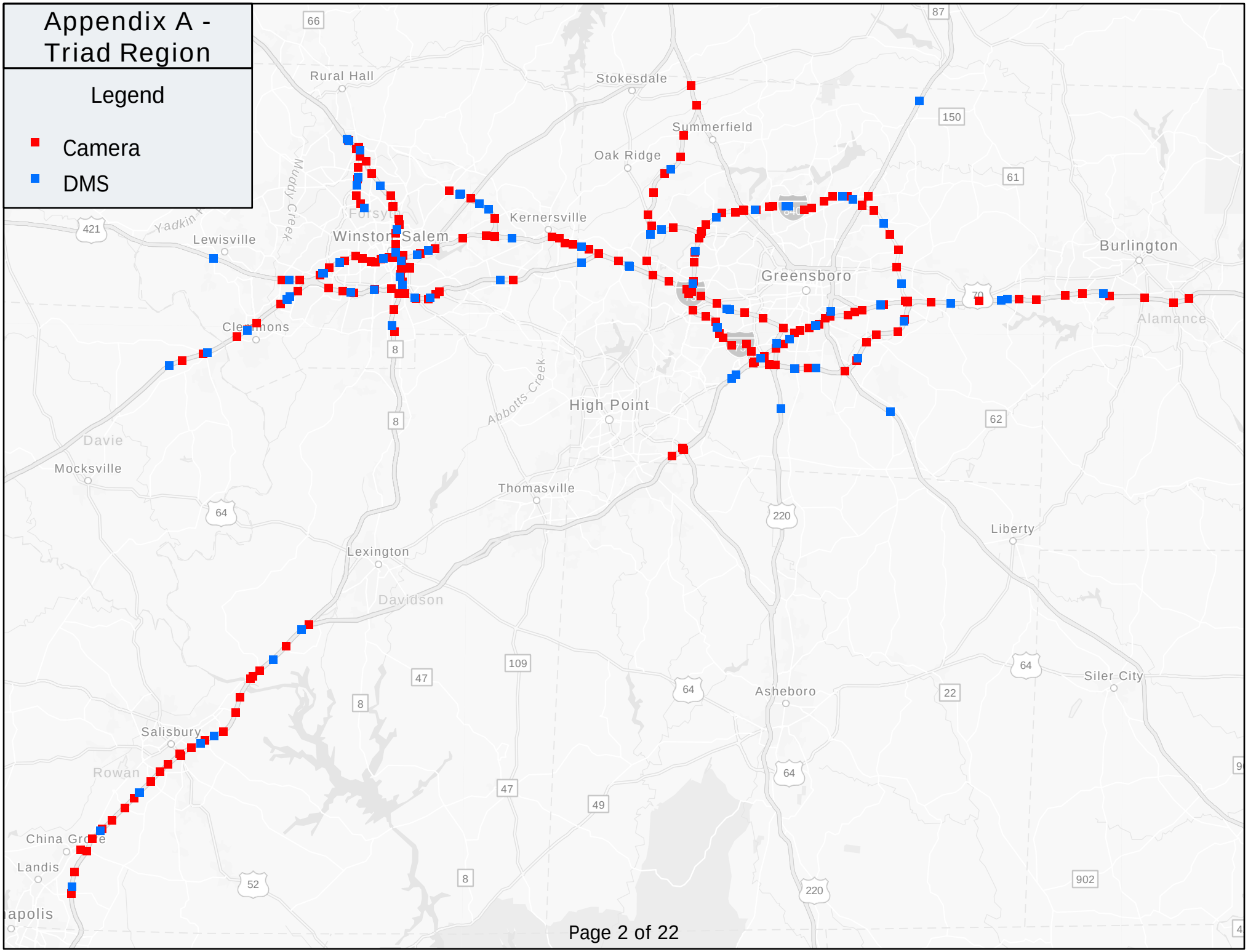
Appendix Part F – Project Special Provisions

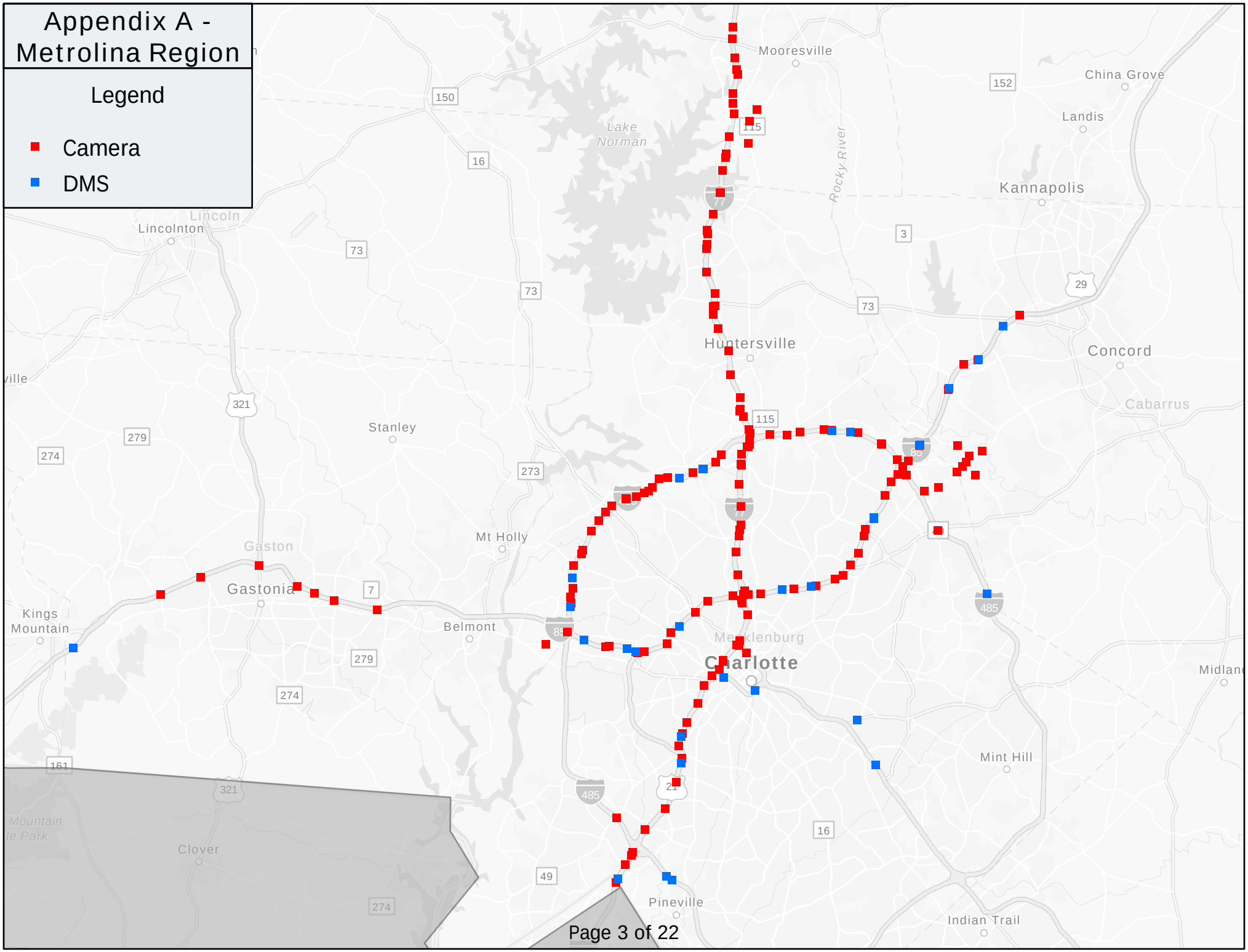
Appendix Part A – ITS Assets in Scope of Work

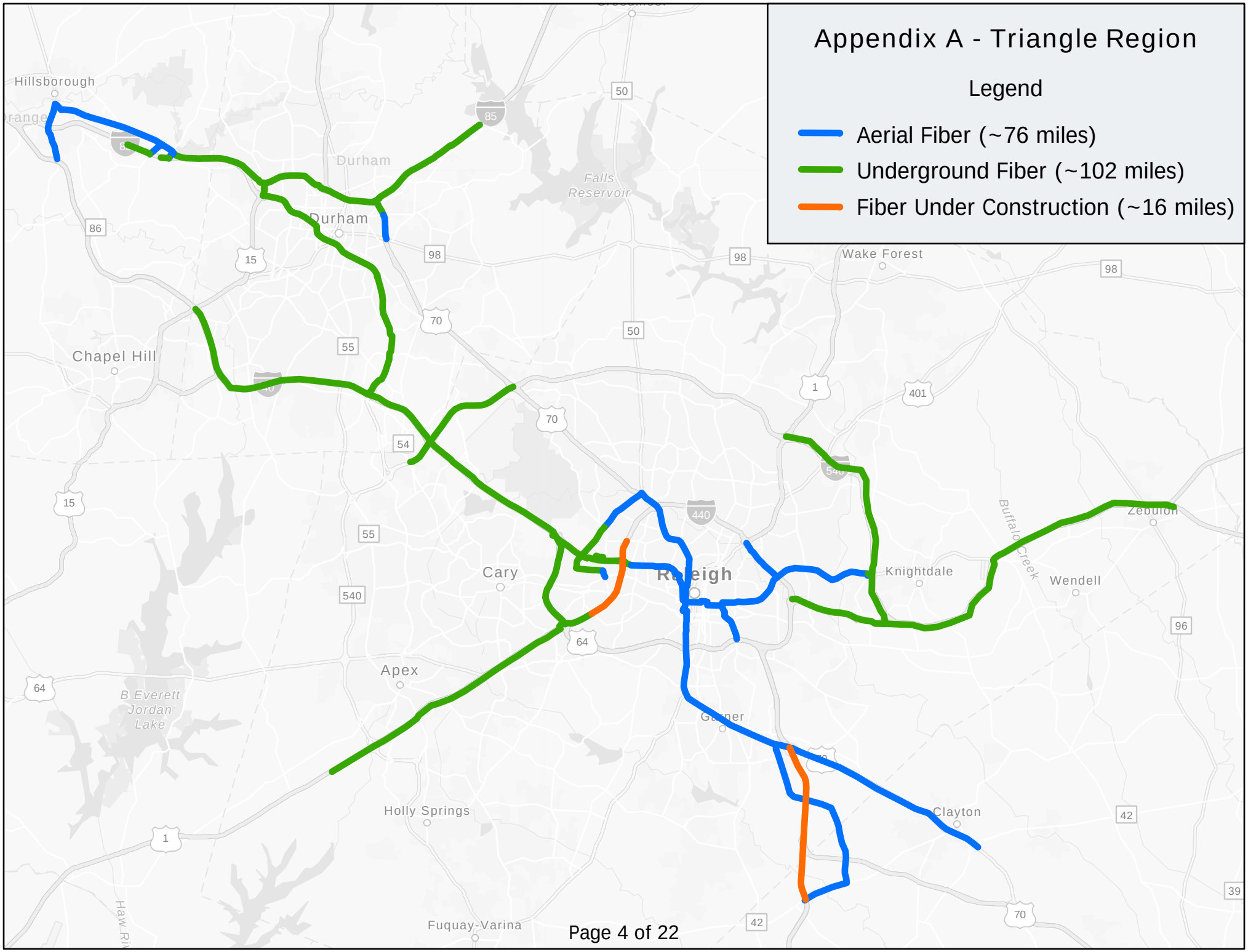
Appendix A - Triangle Region

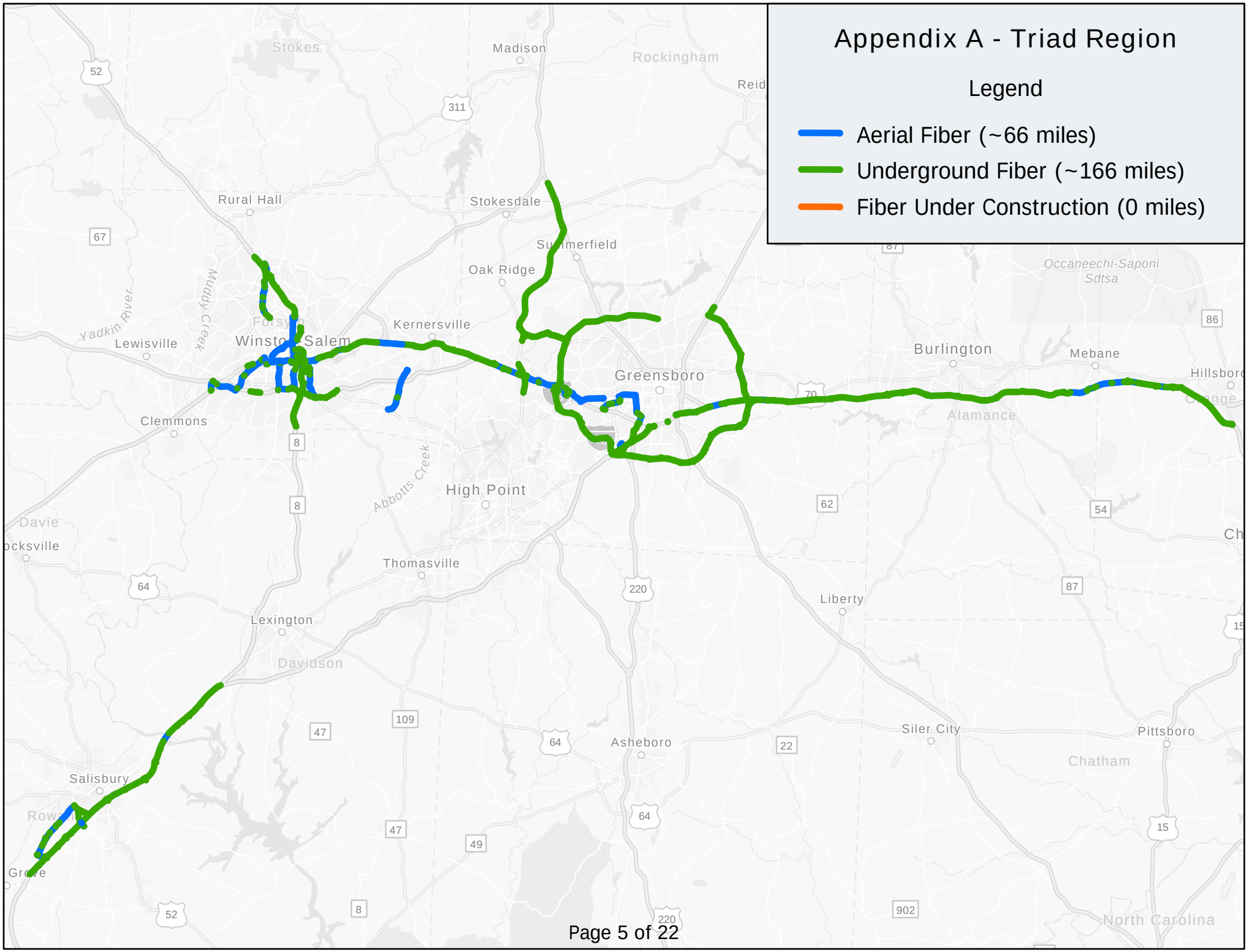


Appendix A - Triad Region




Appendix A - Metrolina Region
Legend
Camera
DMS
Mooresville
China Grove
Landis
Kannapolis
Lake Norman
Rocky River
Lincoln
Lincolnton
Huntersville
Concord
Cabarrus
Stanley
Mt Holly
Gaston
Gastonia
Kings Mountain
Belmont
Mecklenburg
Charlotte
Mint Hill
Clover
Pineville
Indian Trail
150
152
115
16
77
3
73
29
321
279
274
273
7
85
485
161
49
21


Appendix A - Triangle Region
Legend
Aerial Fiber (~76 miles)
Underground Fiber (~102 miles)
Fiber Under Construction (~16 miles)
Hillsborough
Durham
Falls Reservoir
Durham
Wake Forest
Chapel Hill
Cary
Raleigh
Knightdale
Wendell
Zebulon
Apex
B Everett Jordan Lake
Holly Springs
Clayton
Fuquay-Varina
Buffalo Creek
50
85
86
15
98
70
55
54
540
440
401
1
64
96
42
39


Appendix A - Triad Region
Legend
Aerial Fiber (~66 miles)
Underground Fiber (~166 miles)
Fiber Under Construction (0 miles)
Stokes
Madison
Rockingham
Rural Hall
Stokesdale
Summerfield
Oak Ridge
Kernersville
Winston-Salem
Lewisville
Clemmons
Greensboro
Burlington
Mebane
Hillsboro
Alamance
High Point
Thomasville
Lexington
Davidson
Liberty
Asheboro
Siler City
Pittsboro
Chatham
Salisbury
Davie
Yadkin River
Muddy Creek
Abbotts Creek
Occaneechi-Saponi Sdtsa
North Carolina

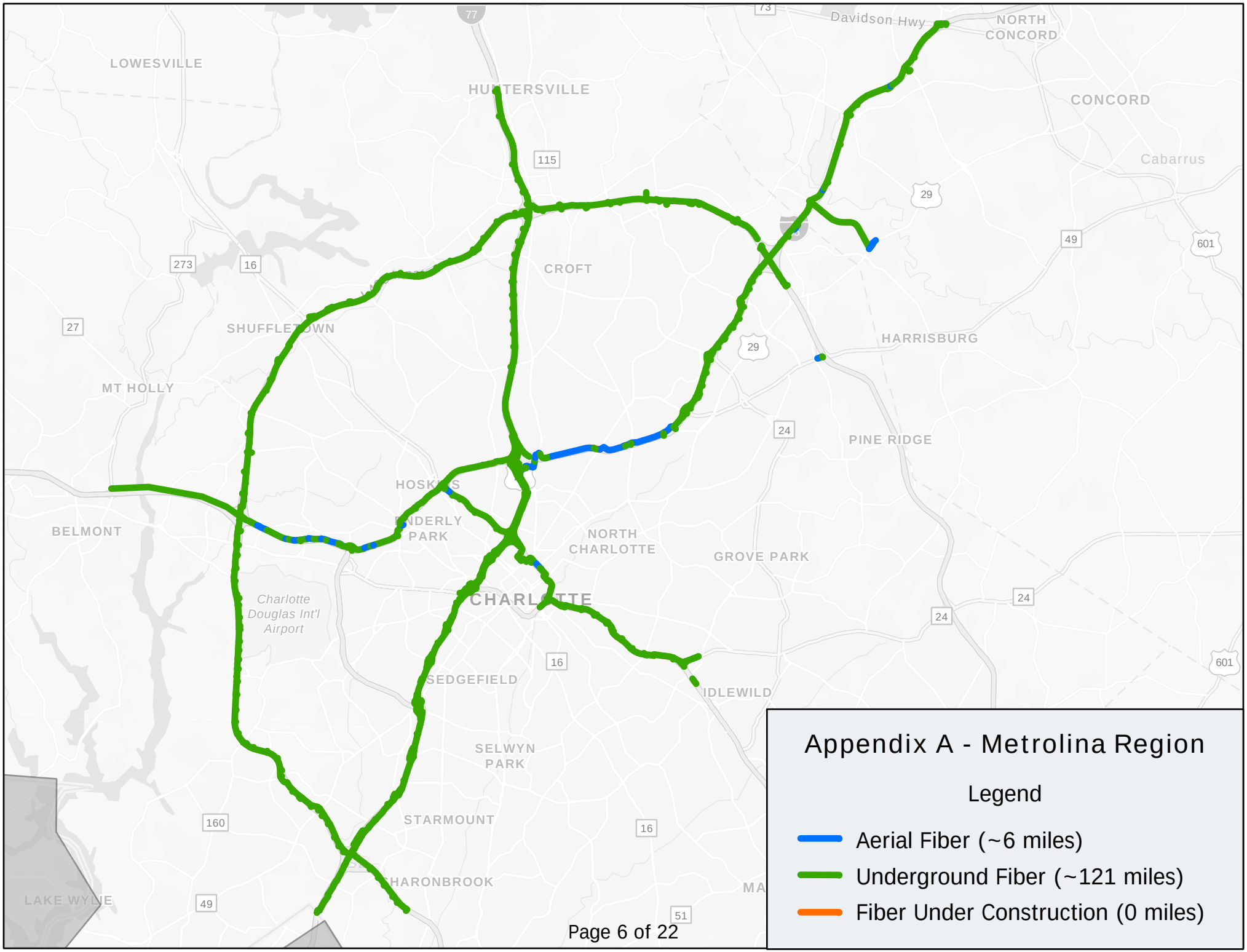

Appendix A - Metrolina Region
Legend
Aerial Fiber (~6 miles)
Underground Fiber (~121 miles)
Fiber Under Construction (0 miles)
LOWESVILLE
HUNTERSVILLE
NORTH CONCORD
CONCORD
Cabarrus
CROFT
SHUFFLETOWN
HARRISBURG
MT HOLLY
PINE RIDGE
BELMONT
NORTH CHARLOTTE
GROVE PARK
Charlotte Douglas Int'l Airport
SEDGEFIELD
IDLEWILD
SELWYN PARK
STARMOUNT
HARONBROOK
LAKE WYLIE
Davidson Hwy
77
73
115
29
49
601
273
16
27
24
160
51

Table 1: List of Cameras and DMS

Device Name	Device Type	Division	Latitude	Longitude
CCTV04-40-310.5E	Camera	4	35.62281377	-78.56731206
CCTV04-40-311E	Camera	4	35.61422	-78.56735
CCTV04-40-312E_NC42	Camera	4	35.60651012	-78.56431603
CCTV04-40-313W_SR1010	Camera	4	35.59987521	-78.5637613
CCTV04-40-314E	Camera	4	35.58302023	-78.57617676
CCTV04-64-450E_NC581	Camera	4	35.9315947	-78.09751511
CCTV04-64-461E_SR1003	Camera	4	35.97331764	-77.93769836
CCTV04-64-463W_SR1603	Camera	4	35.98113172	-77.89759398
CCTV04-64-478_SR1225	Camera	4	35.92589561	-77.67539978
CCTV04-64-484_NC122	Camera	4	35.88616428	-77.58785248
CCTV04-64-486_US258	Camera	4	35.88588613	-77.53523827
CCTV04-64-487E_NC33	Camera	4	35.87055133	-77.52356529
CCTV04-64-491E_SR1524	Camera	4	35.85400485	-77.46108055
CCTV04-64-494E_NC42	Camera	4	35.84314299	-77.40623474
CCTV04-64-496E_US13	Camera	4	35.83507172	-77.37464905
CCTV05-40-270W_US15/501	Camera	5	35.95088583	-78.99843559
CCTV05-40-271W_SR1110	Camera	5	35.93335821	-78.98874074
CCTV05-40-273.5E	Camera	5	35.90469632	-78.97114277
CCTV05-40-273E_NC54	Camera	5	35.91266057	-78.98223907
CCTV05-40-274E_NC751	Camera	5	35.90376645	-78.95980239
CCTV05-40-276W_SR1118	Camera	5	35.90923686	-78.93579796
CCTV05-40-277W_BARBEE	Camera	5	35.9091391	-78.91639352
CCTV05-40-278.5W	Camera	5	35.90540131	-78.88583913
CCTV05-40-278W_NC55	Camera	5	35.90705135	-78.89450938
CCTV05-40-279W_NC147	Camera	5	35.90121469	-78.87564003
CCTV05-40-280E_SR1999	Camera	5	35.89428684	-78.86027098
CCTV05-40-281W_SR1959	Camera	5	35.8911709	-78.84863153
CCTV05-40-282E_SR1973	Camera	5	35.88155504	-78.83945704
CCTV05-40-283E_I540	Camera	5	35.87284652	-78.83148953
CCTV05-40-284E_SR3015	Camera	5	35.86149489	-78.81544992
CCTV05-40-285W_SR1002	Camera	5	35.8491372	-78.79746437
CCTV05-40-286E_SR1795	Camera	5	35.84025987	-78.78223613
CCTV05-40-287W_SR1652	Camera	5	35.83192192	-78.76355588
CCTV05-40-288E_SR1655	Camera	5	35.82013815	-78.74284387
CCTV05-40-289E_SR1656	Camera	5	35.80629376	-78.73968154
CCTV05-40-289W_NC54	Camera	5	35.79186388	-78.74497622
CCTV05-40-291E_SR1497	Camera	5	35.7803614	-78.74901026
CCTV05-40-293W_US1	Camera	5	35.76723915	-78.73542488
CCTV05-40-294W_SR1321	Camera	5	35.75665491	-78.71839687
CCTV05-40-295E_SR1348	Camera	5	35.75163218	-78.69455338
CCTV05-40-297W_SR1009	Camera	5	35.75774539	-78.66475537
CCTV05-40-298E_US70	Camera	5	35.75246805	-78.64949226
CCTV05-40-299E_GARNER	Camera	5	35.75256601	-78.63080531
CCTV05-40-300.5W_I440	Camera	5	35.75335616	-78.59565496
CCTV05-40-300W_SR2542	Camera	5	35.75821445	-78.61254215

CCTV05-40-301W_I440	Camera	5	35.75400917	-78.59670639
CCTV05-40-302E	Camera	5	35.74442	-78.5928
CCTV05-40-303W_SR5220	Camera	5	35.72248647	-78.58421266
CCTV05-40-305.5E_SR1004	Camera	5	35.70281412	-78.58264625
CCTV05-40-306W_US70BUS	Camera	5	35.69503356	-78.57488394
CCTV05-40-307.5E_SR2700	Camera	5	35.66544658	-78.56401026
CCTV05-40-307W	Camera	5	35.67720425	-78.56403708
CCTV05-440-12E	Camera	5	35.80493965	-78.59665275
CCTV05-540-11W_SR1005	Camera	5	35.91197193	-78.65146101
CCTV05-540-12E	Camera	5	35.90232709	-78.63245353
CCTV05-540-14W_SR2000	Camera	5	35.89819354	-78.60966682
CCTV05-540-15E_SR2013	Camera	5	35.88435626	-78.59138489
CCTV05-540-16W_US1	Camera	5	35.8758393	-78.57694924
CCTV05-540-17W_TRIANGLETOWNBLVD	Camera	5	35.87371916	-78.56774792
CCTV05-540-18E_US401	Camera	5	35.86144489	-78.54872033
CCTV05-540-19W	Camera	5	35.85500922	-78.5321188
CCTV05-540-2.5W_SR1644	Camera	5	35.89489198	-78.80103841
CCTV05-540-20E_SR2215	Camera	5	35.84650215	-78.52293894
CCTV05-540-22W_SR2217	Camera	5	35.82118318	-78.51593301
CCTV05-540-24E_US64BUS	Camera	5	35.79531224	-78.51572514
CCTV05-540N-25_SR2515	Camera	5	35.77289199	-78.50664854
CCTV05-540-26E_I87	Camera	5	35.76724459	-78.50661367
CCTV05-540-2W_SR3097	Camera	5	35.89266587	-78.81351471
CCTV05-540-3W_SR1645	Camera	5	35.89843689	-78.78527641
CCTV05-540-4E_US70	Camera	5	35.90481581	-78.77174199
CCTV05-540-5.2W	Camera	5	35.91101499	-78.75610471
CCTV05-540-7E_SR1829	Camera	5	35.91097263	-78.7281923
CCTV05-540-7W_SR1829	Camera	5	35.91256064	-78.7281467
CCTV05-540-8W_SR1826	Camera	5	35.9151848	-78.7085022
CCTV05-540-9E_NC50	Camera	5	35.91447012	-78.68206233
CCTV05-540-9W_NC50	Camera	5	35.9158039	-78.68161708
CCTV05-85-172S_NC147	Camera	5	36.03276445	-78.96356419
CCTV05-85-174N_US15/US501	Camera	5	36.02424179	-78.948057
CCTV05-85-175.5N_BROAD	Camera	5	36.02490884	-78.91677976
CCTV05-85-176N_US501	Camera	5	36.02014607	-78.90551046
CCTV05-85-177N_NC55	Camera	5	36.01395328	-78.88686508
CCTV05-85-178N_US70	Camera	5	36.01327203	-78.87047946
CCTV05-85-179S_SR1671	Camera	5	36.02568435	-78.85146528
CCTV05-85-180S_SR1675	Camera	5	36.03224713	-78.84143516
CCTV05-85-182N_SR1632	Camera	5	36.04551201	-78.81560549
CCTV05-85-183N_SR1637	Camera	5	36.05784552	-78.79514024
CCTV05-85-185N	Camera	5	36.0669456	-78.78268942
CCTV05-85-186N_US15	Camera	5	36.0798177	-78.76669407
CCTV05-87-11S_SR2501	Camera	5	35.782867	-78.44161034
CCTV05-87-12.5S_US64BUS	Camera	5	35.80020277	-78.43135357
CCTV05-87-13S_US64BUS	Camera	5	35.80448392	-78.428092
CCTV05-87-4N_SR2697	Camera	5	35.77733129	-78.56044292
CCTV05-87-5S	Camera	5	35.77304868	-78.53786945

CCTV05-87-6N_SR2516	Camera	5	35.76817388	-78.52164745
CCTV05-87-8S_SR5270	Camera	5	35.76747746	-78.4876585
CCTV05-87-9N_SR2233	Camera	5	35.767373	-78.46495628
CCTV05-440-10E_SR2000	Camera	5	35.82543383	-78.62091064
CCTV05-440-11E_US1	Camera	5	35.81391554	-78.60524654
CCTV05-440-13W_US64BUS	Camera	5	35.79477161	-78.58248532
CCTV05-440-14W_I87	Camera	5	35.78154403	-78.57301712
CCTV05-440-15.5W	Camera	5	35.75656023	-78.5775876
CCTV05-440-16W_SR2544	Camera	5	35.75330392	-78.58479738
CCTV05-440-1E_ATHENS	Camera	5	35.77369282	-78.71593058
CCTV05-440-2E_SR1012	Camera	5	35.78465123	-78.69975686
CCTV05-440-2W_SR1012	Camera	5	35.78465123	-78.69975686
CCTV05-440-3W_NC54	Camera	5	35.79588659	-78.69500399
CCTV05-440-4E_SR1728	Camera	5	35.80403145	-78.69348049
CCTV05-440-5E_LAKEBOONETRAIL	Camera	5	35.81542937	-78.69105577
CCTV05-440-6W_RIDGE	Camera	5	35.83320926	-78.67544398
CCTV05-440-7.5W	Camera	5	35.83612287	-78.64984245
CCTV05-440-8W_SR1005	Camera	5	35.83479556	-78.63810092
CCTV05-147-10N_SR2163	Camera	5	35.97484385	-78.87247035
CCTV05-147-11S_NC55	Camera	5	35.98229509	-78.89048338
CCTV05-147-12S_US15BUS/US501BUS	Camera	5	35.99009092	-78.90303612
CCTV05-147-13N_SR1127	Camera	5	35.99888972	-78.9124932
CCTV05-147-14N_SR1320	Camera	5	36.00595584	-78.92445892
CCTV05-147-15_SR1321	Camera	5	36.01356059	-78.93646717
CCTV05-147-16S_US15/US501	Camera	5	36.01658058	-78.95183086
CCTV05-147-5S_I40	Camera	5	35.9034927	-78.87308657
CCTV05-147-6N_SR1121	Camera	5	35.91126373	-78.86531353
CCTV05-147-7N_SR2028	Camera	5	35.92429701	-78.86012077
CCTV05-147-8N_SR1954	Camera	5	35.9395519	-78.85939121
CCTV05-147-9N_SR1940	Camera	5	35.95685343	-78.86389732
CCTV05-540-69W_NC54	Camera	5	35.86161336	-78.84506822
CCTV05-54W-SR1664	Camera	5	35.79470199	-78.70610029
CCTV05-55S-US1	Camera	5	35.7150541	-78.84037971
CCTV05-SR1005S-I540	Camera	5	35.91247374	-78.65130812
CCTV05-SR1656W-SR1658	Camera	5	35.79908894	-78.71704102
CCTV05-SR1664S-SR1656	Camera	5	35.79849721	-78.70798588
CCTV05-SR3009N-STEPHENSTROUD	Camera	5	35.80256961	-78.72652531
CCTV05-SR3009N-SR1775	Camera	5	35.81520317	-78.71465921
CCTV05-SR3009S-GLENEDEN	Camera	5	35.83324296	-78.69850427
CCTV05-SR3009S-SR1656	Camera	5	35.79978182	-78.72746408
CCTV05-SR3009S-SR1664	Camera	5	35.82409418	-78.70691165
CCTV05-SR3009S-SR1728	Camera	5	35.80734441	-78.72382432
CCTV05-1-101S_SR1313	Camera	5	35.7628363	-78.74436468
CCTV05-1-99S_SR3977	Camera	5	35.7489275	-78.77204105
CCTV05-1-89.5N	Camera	5	35.67304808	-78.9198871
CCTV05-1-91S_SR1149	Camera	5	35.68328941	-78.90006557
CCTV05-1-92.5S_SR1170	Camera	5	35.69165275	-78.88326555
CCTV05-1-94N_SR1153	Camera	5	35.7032236	-78.85984853

CCTV05-1-95N_NC55	Camera	5	35.71376485	-78.84012222
CCTV05-1-96S_SR1010	Camera	5	35.72382457	-78.82327527
CCTV05-1-97N	Camera	5	35.73056918	-78.80498797
CCTV05-1-98S_US64/SR1009	Camera	5	35.73741663	-78.79228234
CCTV05-264-20W	Camera	5	35.8334365	-78.29632044
CCTV05-64-431W_SR2300	Camera	5	35.81683877	-78.39972496
CCTV05-64-432W_SR2329	Camera	5	35.82491189	-78.37449074
CCTV05-64-434W	Camera	5	35.83520872	-78.34409326
CCTV05-64-435W_NC96	Camera	5	35.83451505	-78.32144737
CCTV05-64-436E_SR2406	Camera	5	35.83381921	-78.31376553
CCTV05-64-437E_SR2320	Camera	5	35.83651557	-78.30149174
CCTV05-64E_SR2233	Camera	5	35.79812955	-78.48727092
CCTV05-64E_SR5275	Camera	5	35.79359026	-78.54860768
CCTV05-64W_SR2205	Camera	5	35.79753129	-78.57800335
CCTV05-64W_SR2217	Camera	5	35.79602909	-78.53458911
CCTV05-64W_SR2697/SR2036	Camera	5	35.79880287	-78.56305808
CCTV05-70-310.5E_SR2026/SR2812	Camera	5	35.71895656	-78.63906384
CCTV05-70-310E_SR2538	Camera	5	35.7249841	-78.64871979
CCTV05-70-311W_SR2539	Camera	5	35.71481019	-78.6305666
CCTV05-70-312E_SR2713	Camera	5	35.71080299	-78.6230135
CCTV05-70-SR1564	Camera	5	35.74097402	-78.64897728
CCTV05-70-286W_SR1800	Camera	5	36.00559566	-78.86402205
CCTV05-70-312.5W_NC50	Camera	5	35.70641226	-78.61331463
CCTV05-70-312E_NC50	Camera	5	35.69621855	-78.58479738
CCTV05-70-313E_SR2562	Camera	5	35.70212583	-78.60155582
CCTV05-70BUS-SR2555	Camera	5	35.68734374	-78.55015129
CCTV05-70BUS-NC42	Camera	5	35.63371663	-78.43738317
CCTV05-70BUS-SR2558	Camera	5	35.6765201	-78.52109224
CCTV05-70BUS-WHITEPINE	Camera	5	35.66400834	-78.49346817
CCTV05-70-NC50	Camera	5	35.84333867	-78.68069842
CCTV05-70-NC50	Camera	5	35.84333759	-78.68069977
CCTV07-85-171N	Camera	7	36.03784637	-78.99074301
CCTV07-40-159.5E	Camera	7	36.0747755	-79.19049946
CCTV07-40-159E	Camera	7	36.07477643	-79.19049382
CCTV07-40-160W_US70	Camera	7	36.07305402	-79.15995151
CCTV07-40-161W_US70	Camera	7	36.07206976	-79.15632248
CCTV07-40-163E_I85	Camera	7	36.05923326	-79.13039088
CCTV07-40-208W_SR1850	Camera	7	36.09262483	-79.99643594
CCTV07-40-210W_NC68	Camera	7	36.08077151	-79.95910496
CCTV07-40-211.5W_I73	Camera	7	36.06854023	-79.92287502
CCTV07-40-211W_SR1556	Camera	7	36.07542896	-79.9418664
CCTV07-40-212.5W_I73	Camera	7	36.06660196	-79.91788477
CCTV07-40-212W_I73	Camera	7	36.06788331	-79.9211584
CCTV07-40-213W_SR1546	Camera	7	36.06289764	-79.90787476
CCTV07-40-214W_US70	Camera	7	36.0564621	-79.89067778
CCTV07-40-216W_SR4239	Camera	7	36.04900575	-79.86042242
CCTV07-40-217W_SR4121	Camera	7	36.04422379	-79.84079003
CCTV07-40-218W_US220	Camera	7	36.03577395	-79.81910571

CCTV07-40-219E_I85BUS	Camera	7	36.03163653	-79.80716452
CCTV07-40-220_SR1007	Camera	7	36.0335312	-79.80069637
CCTV07-40-221E_PATTON	Camera	7	36.0390924	-79.78044301
CCTV07-40-221W_SELM-EUGENE	Camera	7	36.03577395	-79.79138374
CCTV07-40-222W_SR3762	Camera	7	36.04444934	-79.77404594
CCTV07-40-223.5E	Camera	7	36.04712009	-79.74942863
CCTV07-40-223.75W	Camera	7	36.0498623	-79.74211693
CCTV07-40-223E_US29	Camera	7	36.04605093	-79.76885051
CCTV07-40-224W_SR4240	Camera	7	36.05177063	-79.73460674
CCTV07-40-225W_SR3029	Camera	7	36.05683615	-79.71147537
CCTV07-40-226.5W_I840	Camera	7	36.05982409	-79.68837087
CCTV07-40-227E_I840	Camera	7	36.0597851	-79.68542576
CCTV07-40-227W_I840	Camera	7	36.0597851	-79.68675613
CCTV07-40-260E	Camera	7	36.03870851	-79.10842091
CCTV07-40-261W_SR1009	Camera	7	36.03704929	-79.09723341
CCTV07-40-263E_SR1723	Camera	7	36.0094296	-79.0846324
CCTV07-40-264E_SR1725	Camera	7	35.98654903	-79.07529831
CCTV07-40-266E_NC86	Camera	7	35.97119902	-79.06311035
CCTV07-40-267W	Camera	7	35.96998339	-79.03749794
CCTV07-40-269W_SR1734	Camera	7	35.9601535	-79.01212692
CCTV07-73-100.5N	Camera	7	36.04028755	-79.89176035
CCTV07-73-100.5S	Camera	7	36.03037629	-79.88749266
CCTV07-73-100N_SR4121	Camera	7	36.02675052	-79.88317966
CCTV07-73-101N_BRIDFORD	Camera	7	36.04542093	-79.90244865
CCTV07-73-102S_US70	Camera	7	36.05047492	-79.91604611
CCTV07-73-103.5N_SR1008	Camera	7	36.07595575	-79.91541311
CCTV07-73-103S_I40	Camera	7	36.0647959	-79.92118925
CCTV07-73-104S_SR2147	Camera	7	36.09247745	-79.91534606
CCTV07-73-105S_SR2181	Camera	7	36.10116285	-79.91466343
CCTV07-73-107S_I840	Camera	7	36.11695314	-79.90849866
CCTV07-73-107S_SR2137	Camera	7	36.11310735	-79.91028339
CCTV07-73-109.5	Camera	7	36.12038759	-79.95055676
CCTV07-73-109N_SR2137	Camera	7	36.12246753	-79.93841171
CCTV07-73-110_NC68	Camera	7	36.12358547	-79.96108174
CCTV07-73-111_NC68	Camera	7	36.13343831	-79.96562004
CCTV07-73-113S_SR2269	Camera	7	36.15284249	-79.95968565
CCTV07-73-114S_SR2128	Camera	7	36.16956346	-79.94786382
CCTV07-73-115N_SR2127	Camera	7	36.1842405	-79.93087471
CCTV07-73-117S_NC150	Camera	7	36.2029103	-79.92809594
CCTV07-73-119_US220	Camera	7	36.22926122	-79.91449982
CCTV07-73-120N_US158	Camera	7	36.24648828	-79.92046371
CCTV07-73-95N_SR1117	Camera	7	36.00387499	-79.83369827
CCTV07-73-95S_SR1117	Camera	7	36.00349309	-79.83369827
CCTV07-73-97N_I85BUS	Camera	7	36.00572801	-79.84982908
CCTV07-73-97S_I85BUS	Camera	7	36.0050174	-79.8511675
CCTV07-73-98.5N	Camera	7	36.02121124	-79.85861599
CCTV07-73-98N_SR1383	Camera	7	36.01524416	-79.85311747
CCTV07-73-99S_SR4205	Camera	7	36.0200517	-79.87401724

CCTV07-74-75E_I85	Camera	7	35.92881471	-79.92450714
CCTV07-74-75W_I85	Camera	7	35.93004834	-79.92592335
CCTV07-840-13E_US29	Camera	7	36.14269209	-79.73512173
CCTV07-840-13W_US29	Camera	7	36.14351518	-79.73548651
CCTV07-840-14W	Camera	7	36.15098318	-79.75107551
CCTV07-840-15W_SR2835	Camera	7	36.15102649	-79.76679325
CCTV07-840-15.5_SR2523	Camera	7	36.14660816	-79.77627754
CCTV07-840-15W_SR2835	Camera	7	36.13863612	-79.72275004
CCTV07-840-16.5_SR1001	Camera	7	36.14054337	-79.78945255
CCTV07-840-16_SR2732	Camera	7	36.12744725	-79.71200109
CCTV07-840-17W	Camera	7	36.11797825	-79.70521778
CCTV07-840-17.5_LAKEJEANETTE	Camera	7	36.1419903	-79.8142603
CCTV07-840-17_SR2348	Camera	7	36.13884515	-79.79764938
CCTV07-840-18W_SR2770	Camera	7	36.10475809	-79.69597757
CCTV07-840-19_US70	Camera	7	36.08954923	-79.69794899
CCTV07-840-20_SR3041	Camera	7	36.07503007	-79.6923472
CCTV07-840-21E_I40	Camera	7	36.05916062	-79.6861124
CCTV07-840-21W_I40/I85	Camera	7	36.05954225	-79.68572617
CCTV07-840-3W_I73	Camera	7	36.11918076	-79.90741342
CCTV07-840-4W_SR2136	Camera	7	36.12490706	-79.90285635
CCTV07-840-5.5_DRAWBRIDGE	Camera	7	36.1361786	-79.87134576
CCTV07-840-5W_HORSEPENCREEK	Camera	7	36.13556773	-79.88625214
CCTV07-840-6E_COTSWOLD	Camera	7	36.13825163	-79.84964132
CCTV07-840-6E_US220	Camera	7	36.13792671	-79.86215651
CCTV07-840-6W_COTSWOLD	Camera	7	36.13852456	-79.84865963
CCTV07-840-6W_US220	Camera	7	36.13834694	-79.86254677
CCTV07-840-8E_LAWNDALE	Camera	7	36.14157009	-79.83083367
CCTV07-840-8W_LAWNDALE	Camera	7	36.14096792	-79.83513594
CCTV07-85-112.5S_NC62	Camera	7	35.92311541	-79.93721008
CCTV07-85-122W_I73	Camera	7	36.00327502	-79.82817695
CCTV07-85-122S_I73	Camera	7	36.00333686	-79.8268345
CCTV07-85-123N_SR1007	Camera	7	36.00017423	-79.80622843
CCTV07-85-124S_SR3300	Camera	7	36.00111598	-79.79234532
CCTV07-85-126.5N	Camera	7	36.00751422	-79.74019623
CCTV07-85-126N_US421	Camera	7	35.99830805	-79.75256547
CCTV07-85-128.5S_SR3039	Camera	7	36.03018649	-79.71932888
CCTV07-85-128S_SR1005	Camera	7	36.02386975	-79.72967148
CCTV07-85-129N_SR3029	Camera	7	36.03330996	-79.69619751
CCTV07-85-130N	Camera	7	36.04375535	-79.68855858
CCTV07-85-132N_SR3045	Camera	7	36.05884622	-79.66042489
CCTV07-85-133N	Camera	7	36.05793334	-79.63914156
CCTV07-85-135S_SR3056	Camera	7	36.06046594	-79.60895866
CCTV07-85-136.5N	Camera	7	36.06110342	-79.58548665
CCTV07-85-137S_NC61	Camera	7	36.06240545	-79.56587434
CCTV07-85-138N_SR2748	Camera	7	36.06206504	-79.54736307
CCTV07-85-140N_SR1226	Camera	7	36.06568267	-79.51629639
CCTV07-85-141N_SR1158	Camera	7	36.06741717	-79.49827194
CCTV07-85-143N_NC62	Camera	7	36.06547453	-79.46908951

CCTV07-85-145S_NC49	Camera	7	36.06394814	-79.43098068
CCTV07-85-147S_NC87	Camera	7	36.05985448	-79.40008163
CCTV07-85-148N_NC54	Camera	7	36.06325431	-79.38385963
CCTV07-85-164.5N	Camera	7	36.05563919	-79.09712076
CCTV07-85-164N_SR1009	Camera	7	36.05696083	-79.10440564
CCTV07-85-165S_NC86	Camera	7	36.05932542	-79.08263281
CCTV07-85-167.5	Camera	7	36.04664623	-79.04693395
CCTV07-85-167N	Camera	7	36.04880403	-79.05343294
CCTV07-85-169N	Camera	7	36.03887768	-79.02332783
CCTV07-85BUS-34N_SR1117	Camera	7	36.01101563	-79.83917132
CCTV07-85BUS-35.5N_SR1115	Camera	7	36.0217872	-79.81852502
CCTV07-85BUS-35N_US220	Camera	7	36.01799617	-79.8264268
CCTV07-US29-136N_SR2565	Camera	7	36.15118676	-79.72877294
CCTV07-US421-219.5N_SR2007	Camera	7	36.09901949	-80.01801834
CCTV07-US421-220N	Camera	7	36.10288031	-80.02819732
CCTV07-68S-SR1008	Camera	7	36.09317427	-79.96636838
CCTV09-285-103.5N	Camera	9	36.02877221	-80.23621336
CCTV09-285-105S_SR2747	Camera	9	36.04796694	-80.23693621
CCTV09-285-107S_I40	Camera	9	36.06243364	-80.23187488
CCTV09-40-179W	Camera	9	36.00136661	-80.46384573
CCTV09-40-180_NC801	Camera	9	36.00719912	-80.44159412
CCTV09-40-182E_SR1101	Camera	9	36.02294997	-80.40517509
CCTV09-40-183W	Camera	9	36.02857655	-80.394051
CCTV09-40-184W_SR1103	Camera	9	36.03474585	-80.384624
CCTV09-40-185E_SR1137	Camera	9	36.05187472	-80.35876751
CCTV09-40-187W_JONESTOWN	Camera	9	36.06318493	-80.34070015
CCTV09-40-189E_US158	Camera	9	36.06620302	-80.307827
CCTV09-40-190E_BURKEMILL	Camera	9	36.06365977	-80.29246598
CCTV09-40-191W_EBERT	Camera	9	36.06216586	-80.28058112
CCTV09-40-192.5W_SR4311	Camera	9	36.0665174	-80.24010122
CCTV09-40-192W_NC150	Camera	9	36.06576398	-80.25798082
CCTV09-40-193.5W_OLDLEXINGTON	Camera	9	36.06206612	-80.22564143
CCTV09-40-193E_I285	Camera	9	36.06227428	-80.23192853
CCTV09-40-195.5E	Camera	9	36.05772735	-80.20029187
CCTV09-40-195E_NC109	Camera	9	36.05813717	-80.21349907
CCTV09-40-196.5W_I74/US311	Camera	9	36.06411292	-80.18830776
CCTV09-40-196W_I74/US311	Camera	9	36.06193603	-80.19244909
CCTV09-40-201E_SR2643	Camera	9	36.07511787	-80.10960102
CCTV09-85-65N_SR1221	Camera	9	35.53522964	-80.57351589
CCTV09-85-66S_SR1232	Camera	9	35.55378891	-80.57081223
CCTV09-85-68.5S	Camera	9	35.58304422	-80.55175781
CCTV09-85-68N_NC152	Camera	9	35.57223045	-80.55787325
CCTV09-85-69S	Camera	9	35.59167761	-80.54153323
CCTV09-85-70N_SR1500	Camera	9	35.59934393	-80.53131402
CCTV09-85-71N_SR2538	Camera	9	35.61055963	-80.51801696
CCTV09-85-72N_SR2539	Camera	9	35.61906359	-80.50794929
CCTV09-85-74N_SR2528	Camera	9	35.63365123	-80.49023867
CCTV09-85-75.5S_SR1002	Camera	9	35.64918432	-80.47256023

CCTV09-85-75S_US601	Camera	9	35.64250585	-80.48110843
CCTV09-85-76N_US52	Camera	9	35.65671654	-80.45848936
CCTV09-85-76S_US52	Camera	9	35.65815926	-80.45973927
CCTV09-85-77S_SR1002	Camera	9	35.66398655	-80.44757277
CCTV09-85-78S_SR2114	Camera	9	35.67037996	-80.4335314
CCTV09-85-79N_SR1915	Camera	9	35.67811063	-80.41400224
CCTV09-85-81N_SR2120	Camera	9	35.69519802	-80.40082321
CCTV09-85-81S	Camera	9	35.70843846	-80.39667707
CCTV09-85-83.5S	Camera	9	35.72701132	-80.38325608
CCTV09-85-83S	Camera	9	35.72479466	-80.38553059
CCTV09-85-84N_US29	Camera	9	35.7316807	-80.37557021
CCTV09-85-86.5S	Camera	9	35.76801066	-80.33185959
CCTV09-85-86N_SR3159	Camera	9	35.75345411	-80.34766853
CCTV09-85-87S_US29	Camera	9	35.77236971	-80.32401145
CCTV09-74-49.5W_SR2381	Camera	9	36.1496772	-80.16741738
CCTV09-74-49E_US311	Camera	9	36.15216461	-80.17952487
CCTV09-74-50W_US158	Camera	9	36.1461988	-80.15602201
CCTV09-74-51W	Camera	9	36.13672232	-80.13694078
CCTV09-74-52W_SR2377	Camera	9	36.12842106	-80.12976855
CCTV09-SR4000-BETHABARA	Camera	9	36.14678035	-80.27931243
CCTV09-SR4000-HOME	Camera	9	36.16171525	-80.27790956
CCTV09-SR4000-POLO	Camera	9	36.13988488	-80.27439594
CCTV09-SR4000-SR1672	Camera	9	36.18957024	-80.2772592
CCTV09-SR4000-SR1686	Camera	9	36.1719723	-80.27753413
CCTV09-SR4325N_SR4033	Camera	9	36.08564441	-80.220505
CCTV09-SR4325S_SR4033	Camera	9	36.08421378	-80.2205801
CCTV09-29-NC152	Camera	9	35.57339981	-80.56428909
CCTV09-421-227.5N	Camera	9	36.11333596	-80.13925284
CCTV09-421-227N_NC74	Camera	9	36.11324278	-80.12956202
CCTV09-421-227S_NC74	Camera	9	36.11250931	-80.12974441
CCTV09-421-228E_SR2662	Camera	9	36.11135003	-80.16426444
CCTV09-421-230N_US158	Camera	9	36.1016147	-80.1938948
CCTV09-421-221.5S	Camera	9	36.10807152	-80.05457242
CCTV09-421-221N_SR2601	Camera	9	36.10679294	-80.0457269
CCTV09-421-222N_NC66	Camera	9	36.11323195	-80.06855384
CCTV09-421-222S_NC66	Camera	9	36.11208135	-80.06023228
CCTV09-421-231.5N_SR4394	Camera	9	36.09549334	-80.22803664
CCTV09-421-231S_FIFTH	Camera	9	36.09735841	-80.209546
CCTV09-421-232.5S_ESALEM	Camera	9	36.09298787	-80.23948967
CCTV09-421-232E_US52	Camera	9	36.0939762	-80.2321887
CCTV09-421-233.5S_NC150	Camera	9	36.08929347	-80.2573438
CCTV09-421-233.8N_BROAD	Camera	9	36.09186082	-80.25181174
CCTV09-421-233N_SMAIN	Camera	9	36.09365542	-80.24323404
CCTV09-421-234.5S_CLOVERDALE	Camera	9	36.09253673	-80.27164811
CCTV09-421-234S_SUNSET	Camera	9	36.08999086	-80.26250894
CCTV09-421-235N_US158	Camera	9	36.0942146	-80.27897447
CCTV09-421-236.5S_WESTVIEW	Camera	9	36.09010534	-80.29060507
CCTV09-421-237.5N_OLDVINEYARD	Camera	9	36.0774895	-80.31699479

CCTV09-421-237N_NC67	Camera	9	36.08410107	-80.30720472
CCTV09-421-239N_SR1122	Camera	9	36.07290876	-80.33851147
CCTV09-421-240S_SR1891	Camera	9	36.07265511	-80.35816669
CCTV09-52-107.5N_SR4315	Camera	9	36.07217816	-80.22838667
CCTV09-52-107.5S_MOCK	Camera	9	36.07889857	-80.23039699
CCTV09-52-108.5N	Camera	9	36.08619064	-80.22885203
CCTV09-52-108.75N_SR4326	Camera	9	36.09044765	-80.22942066
CCTV09-52-108S_SR4033	Camera	9	36.08378025	-80.22949576
CCTV09-52-109.5S_THIRD	Camera	9	36.09877026	-80.23598671
CCTV09-52-110.5S_SIXTEENTH	Camera	9	36.11466746	-80.23608327
CCTV09-52-110N_US311	Camera	9	36.10521967	-80.23622274
CCTV09-52-111.5N_SR2456	Camera	9	36.12712987	-80.23325086
CCTV09-52-111S_25TH	Camera	9	36.12202555	-80.23219943
CCTV09-52-112N_SR2264	Camera	9	36.13831445	-80.23893714
CCTV09-52-112S_SR2264	Camera	9	36.13754979	-80.23974314
CCTV09-52-113.5_MOTOR	Camera	9	36.1557716	-80.2531448
CCTV09-52-113N_PATTERSON	Camera	9	36.14714964	-80.24181783
CCTV09-52-114.5N	Camera	9	36.17727425	-80.26921046
CCTV09-52-114S_SR1725	Camera	9	36.16653634	-80.26306093
CCTV09-52-115S_SR4000	Camera	9	36.18118473	-80.27579069
CCTV09-52-116.5_SR1669	Camera	9	36.19509225	-80.28819323
CCTV09-52-116N_SR1672	Camera	9	36.18785575	-80.27948007
CCTV09-52-117N_SR1669	Camera	9	36.1949797	-80.28808057
CCTV10-277-1S_I77	Camera	10	35.22542873	-80.86570501
CCTV10-277-4.5N	Camera	10	35.23901439	-80.84151099
CCTV10-485-11S	Camera	10	35.26612536	-80.96668746
CCTV10-485-12N_SR1601	Camera	10	35.27449379	-80.96546173
CCTV10-485-12S	Camera	10	35.26958862	-80.96717834
CCTV10-485-13.5N	Camera	10	35.29490912	-80.95991686
CCTV10-485-14.5N	Camera	10	35.31442482	-80.94786644
CCTV10-485-14S_NC27	Camera	10	35.28790244	-80.96519474
CCTV10-485-14S_SR1786	Camera	10	35.29698369	-80.9589386
CCTV10-485-15S	Camera	10	35.30798115	-80.95301628
CCTV10-485-16.5N	Camera	10	35.32724061	-80.92851162
CCTV10-485-16.5S	Camera	10	35.32759074	-80.92924118
CCTV10-485-16N_NC16	Camera	10	35.32316005	-80.93918995
CCTV10-485-16S_NC16	Camera	10	35.31934588	-80.94321028
CCTV10-485-17.5S	Camera	10	35.3309519	-80.91602325
CCTV10-485-17N	Camera	10	35.32874615	-80.92190266
CCTV10-485-18N_SR2042	Camera	10	35.33217078	-80.91295211
CCTV10-485-18S_SR2042	Camera	10	35.33431293	-80.91053009
CCTV10-485-19.5N	Camera	10	35.33994934	-80.89971542
CCTV10-485-19S	Camera	10	35.33921418	-80.90572357
CCTV10-485-1N_NC49	Camera	10	35.14180965	-80.93130112
CCTV10-485-20.5N	Camera	10	35.34551534	-80.8744812
CCTV10-485-20N_BEATTIESFO	Camera	10	35.34316997	-80.88181973
CCTV10-485-21N_NC24	Camera	10	35.34943582	-80.86606979
CCTV10-485-21S_NC24	Camera	10	35.35400219	-80.86220228

CCTV10-485-23S_NC115	Camera	10	35.36611301	-80.82803205
CCTV10-485-24.5S_SR2480	Camera	10	35.36782802	-80.80627799
CCTV10-485-24N_SR6029	Camera	10	35.36618759	-80.81577837
CCTV10-485-25.5S_BENFIELD	Camera	10	35.36955372	-80.78936398
CCTV10-485-26S_PROSPERITY	Camera	10	35.36932406	-80.78429192
CCTV10-485-27.5S	Camera	10	35.3683442	-80.76533675
CCTV10-485-28N_SR2467	Camera	10	35.36156359	-80.74818134
CCTV10-485-28S_SR2467	Camera	10	35.3621345	-80.74876338
CCTV10-485-30.5_I85	Camera	10	35.34893702	-80.73330045
CCTV10-485-30S_I85	Camera	10	35.35306516	-80.73707432
CCTV10-485-31N_I85	Camera	10	35.34390509	-80.73037148
CCTV10-485-33N_NC49	Camera	10	35.31225364	-80.70762634
CCTV10-77-0.5N_SR1128	Camera	10	35.11471322	-80.92434883
CCTV10-77-0.75N_I485	Camera	10	35.12008408	-80.92044353
CCTV10-77-0S	Camera	10	35.10400554	-80.93095779
CCTV10-77-10.8N_I277	Camera	10	35.24321825	-80.84681153
CCTV10-77-10.8S_I277	Camera	10	35.24363777	-80.8486893
CCTV10-77-11N_I277	Camera	10	35.24621041	-80.84660722
CCTV10-77-12.5N	Camera	10	35.2678367	-80.84521294
CCTV10-77-12N_LASALLE/ATANDO	Camera	10	35.26117907	-80.84100723
CCTV10-77-13.8S_CINDY	Camera	10	35.28429448	-80.84863544
CCTV10-77-13N_I85	Camera	10	35.26958862	-80.84581375
CCTV10-77-13S_I85	Camera	10	35.27510795	-80.84355326
CCTV10-77-14.6N	Camera	10	35.29753655	-80.85014977
CCTV10-77-16.25S	Camera	10	35.31054187	-80.84805843
CCTV10-77-16.5S	Camera	10	35.31330422	-80.8473587
CCTV10-77-16S_SR2108	Camera	10	35.30707059	-80.84830284
CCTV10-77-17.4S	Camera	10	35.33689033	-80.84902574
CCTV10-77-17N	Camera	10	35.3239588	-80.84762607
CCTV10-77-18.5N_I485	Camera	10	35.36035611	-80.84218053
CCTV10-77-18.5S_I485	Camera	10	35.35899679	-80.84386114
CCTV10-77-18.75N	Camera	10	35.35895619	-80.84289551
CCTV10-77-18N_NC24	Camera	10	35.34810568	-80.8476162
CCTV10-77-18S_NC24	Camera	10	35.34884334	-80.84796401
CCTV10-77-19.25N_SR2116	Camera	10	35.36678133	-80.84203892
CCTV10-77-19.5N_SR2116	Camera	10	35.36882539	-80.84289551
CCTV10-77-19N_I485	Camera	10	35.36329598	-80.84220886
CCTV10-77-1N_I485	Camera	10	35.12175034	-80.91939747
CCTV10-77-20.4S	Camera	10	35.3796088	-80.84944232
CCTV10-77-20.5S	Camera	10	35.38072281	-80.84924698
CCTV10-77-20S_SR2117	Camera	10	35.37645394	-80.84684372
CCTV10-77-22.5S	Camera	10	35.40047564	-80.85670611
CCTV10-77-22N	Camera	10	35.38728365	-80.84941135
CCTV10-77-23.5N	Camera	10	35.41432278	-80.85835443
CCTV10-77-24S	Camera	10	35.42725985	-80.86608037
CCTV10-77-25.5N	Camera	10	35.44748458	-80.86867505
CCTV10-77-25N_NC73	Camera	10	35.44055019	-80.86834021
CCTV10-77-25S_NC73	Camera	10	35.44004224	-80.86975145

CCTV10-77-26S	Camera	10	35.45989328	-80.87514524
CCTV10-77-27S	Camera	10	35.47364253	-80.87530883
CCTV10-77-28.25S	Camera	10	35.48449314	-80.87514382
CCTV10-77-28N_SR5544	Camera	10	35.48232911	-80.87448298
CCTV10-77-28S_SR5544	Camera	10	35.48401513	-80.87511685
CCTV10-77-29S	Camera	10	35.49377115	-80.87118601
CCTV10-77-30.25N_SR2158	Camera	10	35.50629076	-80.86585684
CCTV10-77-30.25S_SR2158	Camera	10	35.50632787	-80.86644485
CCTV10-77-3S_SR1138	Camera	10	35.13517823	-80.91108283
CCTV10-77-4N_NATIONSFO	Camera	10	35.14756472	-80.89705467
CCTV10-77-5N_SR1577	Camera	10	35.16313253	-80.88943452
CCTV10-77-6.5S	Camera	10	35.19150502	-80.88593557
CCTV10-77-6N_SR1291	Camera	10	35.17722848	-80.88611126
CCTV10-77-6S_NC49	Camera	10	35.18434898	-80.88812828
CCTV10-77-7S_CLANTON	Camera	10	35.19808399	-80.88299587
CCTV10-77-8N_REMOUNT	Camera	10	35.20917596	-80.87529123
CCTV10-77-9.5N_FOURTH	Camera	10	35.23385378	-80.85806985
CCTV10-77-9.5S_FOURTH	Camera	10	35.23460545	-80.85805875
CCTV10-77-9N_US29	Camera	10	35.22903953	-80.86038351
CCTV10-77-9S_NC160	Camera	10	35.21951921	-80.87121695
CCTV10-85-30S_I485	Camera	10	35.24924652	-80.96885204
CCTV10-85-31.5S_SR1641	Camera	10	35.24120709	-80.94157155
CCTV10-85-31S_TUCKASEEGEE	Camera	10	35.24477851	-80.95681525
CCTV10-85-32S_SR1641	Camera	10	35.24141318	-80.93868256
CCTV10-85-33.5S	Camera	10	35.23846892	-80.91379166
CCTV10-85-33N_SR5901	Camera	10	35.23795821	-80.91863114
CCTV10-85-34N_SR1894	Camera	10	35.24368508	-80.89806117
CCTV10-85-35S_NC27	Camera	10	35.25012421	-80.89548758
CCTV10-85-36.5S	Camera	10	35.26847286	-80.86982263
CCTV10-85-36N_NC16	Camera	10	35.26202006	-80.87842941
CCTV10-85-37S_BEATTIESFO	Camera	10	35.27196058	-80.85190895
CCTV10-85-38.25N_I77	Camera	10	35.2729522	-80.84083557
CCTV10-85-38N_I77	Camera	10	35.27274198	-80.84444046
CCTV10-85-38S_I77	Camera	10	35.27309234	-80.84444046
CCTV10-85-39S_SR2691	Camera	10	35.2734023	-80.83219677
CCTV10-85-40S_SR2540	Camera	10	35.27659591	-80.80899239
CCTV10-85-41S_SR2480	Camera	10	35.27883812	-80.7933712
CCTV10-85-42N_US29	Camera	10	35.28499401	-80.77423498
CCTV10-85-42S_US29	Camera	10	35.28286693	-80.77966109
CCTV10-85-43.5N_UNIVERSITYPOINTEBLVD	Camera	10	35.29807272	-80.76357208
CCTV10-85-43S_SR5383	Camera	10	35.29116914	-80.76890945
CCTV10-85-45N_NC24	Camera	10	35.30833136	-80.7598114
CCTV10-85-45S_NC24	Camera	10	35.31225364	-80.75895309
CCTV10-85-46S_SR2472	Camera	10	35.33206351	-80.74543476
CCTV10-85-47.25N_I485	Camera	10	35.34450456	-80.73659956
CCTV10-85-47S	Camera	10	35.34004998	-80.74140877
CCTV10-85-48.5S	Camera	10	35.3614411	-80.72140217
CCTV10-85-48N_I485	Camera	10	35.35231699	-80.72927177

CCTV10-85-51.8S	Camera	10	35.39408783	-80.7019186
CCTV10-85-53.5N	Camera	10	35.41171786	-80.68106174
CCTV10-85-53S	Camera	10	35.40888473	-80.69131851
CCTV10-85-55S	Camera	10	35.43815569	-80.65192223
CCTV10-NORTHLAKEMALL	Camera	10	35.35433615	-80.84753036
CCTV10-SR1300S-PERFORMANCESW	Camera	10	35.34478023	-80.68153381
CCTV10-SR2894W-ROCKYRIVERGOLDCLUB	Camera	10	35.36165109	-80.6943655
CCTV10-29-MAIN	Camera	10	35.33724496	-80.70734605
CCTV10-29-ROCKYRIVER	Camera	10	35.35875494	-80.67684531
CCTV10-29-CHARLOTTEMOTORSPEEDWAY	Camera	10	35.35563556	-80.68593264
CCTV10-29-FLOYDSMITHOFFICEPARK	Camera	10	35.34628545	-80.69480538
CCTV10-29-I485	Camera	10	35.3351154	-80.71744208
CCTV10-29-SR1300	Camera	10	35.34954958	-80.69070697
CCTV10-29-SR2894	Camera	10	35.35210479	-80.68826079
CCTV10-74-SR1625	Camera	10	35.24185	-80.98403
CCTV12-77-25.5S	Camera	12	35.4354353	-80.86953693
CCTV12-77-27.5S	Camera	12	35.47618996	-80.87516485
CCTV12-77-30.5S	Camera	12	35.51917461	-80.86510629
CCTV12-77-30.75N	Camera	12	35.52677714	-80.8628993
CCTV12-77-31N_SR1102	Camera	12	35.52880037	-80.8624392
CCTV12-77-32S	Camera	12	35.53903702	-80.86077234
CCTV12-77-33.5S	Camera	12	35.55810986	-80.85858433
CCTV12-77-33N_US21	Camera	12	35.55208498	-80.85748346
CCTV12-77-34.5N	Camera	12	35.57522491	-80.8554268
CCTV12-77-34S	Camera	12	35.56407823	-80.8587805
CCTV12-77-35.4S	Camera	12	35.58468112	-80.85785339
CCTV12-77-35S_SR1100	Camera	12	35.57800833	-80.85613846
CCTV12-77-36N_NC150	Camera	12	35.59582432	-80.8598959
CCTV12-77-37S	Camera	12	35.60256091	-80.85961304
CCTV12-85-13N_SR1307	Camera	12	35.26588652	-81.2574655
CCTV12-85-14N_NC274	Camera	12	35.27656133	-81.22931632
CCTV12-85-17S_US321	Camera	12	35.2841623	-81.18823822
CCTV12-85-19N_US7	Camera	12	35.27241474	-81.16065277
CCTV12-85-20S_NC279	Camera	12	35.26875969	-81.1486944
CCTV12-85-21N_SR2200	Camera	12	35.26477133	-81.13430248
CCTV12-85-22N_SR2329	Camera	12	35.25987778	-81.10398211
CCTV12-115-YELLOWWOODCIR	Camera	12	35.53529948	-80.84692955
CCTV12-115S-SR1135	Camera	12	35.55506329	-80.8414793
CCTV12-115S-SR1246	Camera	12	35.54811509	-80.84628582
DMS04-40-324.5E	DMS	4	35.44286707	-78.53444695
DMS04-40-331W_5POINTS	DMS	4	35.352286	-78.480309
DMS04-64-453E_SR1306	DMS	4	35.93744106	-78.05954039
DMS04-64-459E_NC58	DMS	4	35.9795147	-77.97569722
DMS04-64-467W_64BUS	DMS	4	35.97091248	-77.83374399
DMS04-64-476.5E_SR1226	DMS	4	35.93288042	-77.70956039
DMS04-64-476.5W_SR1226	DMS	4	35.93285436	-77.70957649
DMS04-64-492W	DMS	4	35.849975	-77.421926
DMS05-1-100S	DMS	5	35.75606395	-78.75690937

DMS05-147-14N	DMS	5	36.00353975	-78.92022371
DMS05-147-15S_ELBA	DMS	5	36.0106533	-78.93339872
DMS05-147-6.5N	DMS	5	35.91846705	-78.86174351
DMS05-147-8.8S	DMS	5	35.95121478	-78.86443108
DMS05-15-106.5N	DMS	5	35.99340262	-78.95796239
DMS05-1-91N_FRIENDSHIP	DMS	5	35.68226762	-78.90130877
DMS05-1-98.5N_KILDAIREFARM	DMS	5	35.74450948	-78.77967596
DMS05-1-RIVERHAVEN	DMS	5	35.90756949	-78.55594486
DMS05-40-271W	DMS	5	35.93719566	-78.99047613
DMS05-40-272E	DMS	5	35.93012653	-78.98807019
DMS05-40-276.5E_BARBEE	DMS	5	35.90906415	-78.92091036
DMS05-40-281E	DMS	5	35.89211395	-78.85209024
DMS05-40-285W_AVIATION	DMS	5	35.84614776	-78.79198998
DMS05-40-286E_OLDREEDYCREEK	DMS	5	35.84029792	-78.78226697
DMS05-40-301E_SR2542	DMS	5	35.743207	-78.592264
DMS05-40-305W_SR1004	DMS	5	35.70806752	-78.58335972
DMS05-440-12E	DMS	5	35.80497445	-78.59662592
DMS05-440-16E	DMS	5	35.75361301	-78.58346701
DMS05-540-1.2W_PLEASANTGROVECHURCH	DMS	5	35.88602086	-78.82012367
DMS05-540-10.6W	DMS	5	35.91396614	-78.66865396
DMS05-540-12.4E	DMS	5	35.90218478	-78.63203913
DMS05-540-19.2E	DMS	5	35.85495052	-78.53435576
DMS05-540-19.2W	DMS	5	35.85530705	-78.53378445
DMS05-540-2.4W_SR1644	DMS	5	35.89487351	-78.80161107
DMS05-540-2.6E	DMS	5	35.89441504	-78.79650548
DMS05-540-22.8N	DMS	5	35.80794804	-78.51555347
DMS05-540-22.8S	DMS	5	35.80785994	-78.51493925
DMS05-540-69E	DMS	5	35.86567383	-78.83693576
DMS05-540-69W	DMS	5	35.86565861	-78.83693576
DMS05-64-432W	DMS	5	35.81995329	-78.39235961
DMS05-64-434.5E_GREENPACE	DMS	5	35.83509782	-78.33640069
DMS05-64BUS-OLDMILBURNIE	DMS	5	35.79637609	-78.53156224
DMS05-64BUS-PARKSIDE	DMS	5	35.79811106	-78.5003306
DMS05-70-286W	DMS	5	35.998873	-78.863091
DMS05-70BUS-GREENGARDEN	DMS	5	35.68218265	-78.53364497
DMS05-85-174W	DMS	5	36.02913229	-78.93254042
DMS05-85-176E	DMS	5	36.02130126	-78.90851855
DMS05-85-182S	DMS	5	36.05108537	-78.80702913
DMS05-87-4.5N_ROGERS	DMS	5	35.774013	-78.54961
DMS05-87-5S_ANDERSONPOINT	DMS	5	35.77320101	-78.54092449
DMS05-87-9.5N	DMS	5	35.77013037	-78.45381707
DMS05-87-9S	DMS	5	35.76552962	-78.47819969
DMS05-EDWARDSMILL-REEDYCREEK	DMS	5	35.81765656	-78.71298552
DMS05-WADE-EDWARDSMILLEB	DMS	5	35.80785994	-78.72386456
DMS05-WADE-EDWARDSMILLWB	DMS	5	35.80765112	-78.72360706
DMS07-220-80N_VANDALIA	DMS	7	36.02198678	-79.82596278
DMS07-29-FLORIDA	DMS	7	36.05048685	-79.76797611
DMS07-29-SR2510	DMS	7	36.23420928	-79.67424363

DMS07-40-133E	DMS	7	36.05793334	-79.63914156
DMS07-40-136E	DMS	7	36.06110342	-79.58548665
DMS07-40-137W	DMS	7	36.06232848	-79.57881734
DMS07-40-142W	DMS	7	36.06756135	-79.47557375
DMS07-40-159E	DMS	7	36.07477534	-79.18979645
DMS07-40-204E	DMS	7	36.09104586	-80.03590465
DMS07-40-209E	DMS	7	36.08814685	-79.98458594
DMS07-40-209W	DMS	7	36.08873208	-79.98498157
DMS07-40-215E	DMS	7	36.05205362	-79.87977862
DMS07-40-215W	DMS	7	36.05106152	-79.87645939
DMS07-40-221E	DMS	7	36.03772816	-79.78410959
DMS07-40-221W	DMS	7	36.03798952	-79.78426248
DMS07-40-225E	DMS	7	36.05599481	-79.71433461
DMS07-40-225W	DMS	7	36.05646318	-79.71440971
DMS07-421-194N	DMS	7	35.96344039	-79.70342338
DMS07-421-220.5E	DMS	7	36.10457172	-80.03644377
DMS07-421-220.5W	DMS	7	36.10457172	-80.03644377
DMS07-68-17N	DMS	7	36.1162232	-79.96223509
DMS07-73-100N_HILLTOP	DMS	7	36.03556573	-79.88941848
DMS07-73-100S_HILLTOP	DMS	7	36.03539221	-79.8900032
DMS07-73-103.5N	DMS	7	36.07332284	-79.91615742
DMS07-73-105S_BALLINGER	DMS	7	36.10215432	-79.91424903
DMS07-73-110N	DMS	7	36.12031392	-79.95057285
DMS07-73-110S	DMS	7	36.12031392	-79.95057285
DMS07-73-114N	DMS	7	36.1730668	-79.94124681
DMS07-73-114S	DMS	7	36.1730668	-79.94124681
DMS07-73-92N_SUTTON	DMS	7	35.96525095	-79.82043475
DMS07-785-15.5N_HINESCHAPEL	DMS	7	36.12744725	-79.71200109
DMS07-785-15.5S_HINESCHAPEL	DMS	7	36.12744725	-79.71200109
DMS07-785-20M_CLAPPFARMS	DMS	7	36.07503874	-79.69234318
DMS07-840-12W	DMS	7	36.15095719	-79.7564292
DMS07-840-13W	DMS	7	36.14841018	-79.74542141
DMS07-840-5W	DMS	7	36.13185908	-79.89193171
DMS07-840-7E_COTSWORLD	DMS	7	36.13859821	-79.85060692
DMS07-840-9E	DMS	7	36.141982	-79.816976
DMS07-840-9W	DMS	7	36.14198272	-79.81427506
DMS07-85-119N	DMS	7	35.99110658	-79.87404943
DMS07-85-119S	DMS	7	35.99434879	-79.86924291
DMS07-85-123N_RANDLEMAN	DMS	7	36.00016989	-79.80632767
DMS07-85-124S	DMS	7	36.00087946	-79.78332773
DMS07-85-127N_WILEYLEWIS	DMS	7	36.01001975	-79.73894119
DMS07-85-130S	DMS	7	36.04226323	-79.68911648
DMS07-85-168.5E	DMS	7	36.04146511	-79.03197527
DMS07-85BUS-35N	DMS	7	36.00927772	-79.84295994
DMS07-85BUS-36S	DMS	7	36.02615941	-79.81196836
DMS09-40-178E_REDLAND	DMS	9	35.996588	-80.47732
DMS09-40-180E_NC801	DMS	9	36.00844455	-80.43668032
DMS09-40-183W	DMS	9	36.02853	-80.394027

DMS09-40-186E	DMS	9	36.05577797	-80.35193861
DMS09-40-187W	DMS	9	36.05839087	-80.34879237
DMS09-40-191W_EBERT	DMS	9	36.06261469	-80.28373539
DMS09-40-192E_PETERSCREEK	DMS	9	36.0651905	-80.25874123
DMS09-40-195E_NC109	DMS	9	36.05850145	-80.21511912
DMS09-40-196W_WILLARD	DMS	9	36.05904137	-80.19803882
DMS09-40-200E	DMS	9	36.07507017	-80.12337819
DMS09-421-227E	DMS	9	36.111741	-80.111339
DMS09-421-230N_NC158	DMS	9	36.09993514	-80.2010107
DMS09-421-231E_E5TH	DMS	9	36.09632	-80.212868
DMS09-421-233_BROOKSTOWN	DMS	9	36.092709	-80.248907
DMS09-421-236.5N	DMS	9	36.08838095	-80.29614329
DMS09-421-236.5S	DMS	9	36.0886443	-80.29622912
DMS09-421-237.5N	DMS	9	36.079303	-80.313336
DMS09-421-237.5S	DMS	9	36.078833	-80.314618
DMS09-421-239S_PEACEHAVEN	DMS	9	36.07277652	-80.35014689
DMS09-421-244S_WILLIAMS	DMS	9	36.09076626	-80.43145269
DMS09-52-104N	DMS	9	36.03426867	-80.23863137
DMS09-52-107N_SPRAGUE	DMS	9	36.06962426	-80.22838801
DMS09-52-107S_DIXIEBROADWAY	DMS	9	36.07651614	-80.23089856
DMS09-52-108S_RAMS	DMS	9	36.09062104	-80.229882
DMS09-52-109N_3RD	DMS	9	36.09833681	-80.23583114
DMS09-52-110S_LIBERTY	DMS	9	36.11800425	-80.23509622
DMS09-52-114N_MOTOR	DMS	9	36.1557716	-80.2531448
DMS09-52-114S_MOTOR	DMS	9	36.1557716	-80.2531448
DMS09-52-116N_ZIGLAR	DMS	9	36.19448184	-80.28747708
DMS09-52-117S_ZIGLAR	DMS	9	36.19616696	-80.2897945
DMS09-70-186E	DMS	9	36.05588639	-80.3521049
DMS09-74-49.5E_WILLISTON	DMS	9	36.14909025	-80.16785324
DMS09-74-49.5W_WILLISTON	DMS	9	36.1495689	-80.16691178
DMS09-74-50E_WALKERTOWNGUTHRIE	DMS	9	36.14126467	-80.14678448
DMS09-74-51W_WALKERTOWNGUTHRIE	DMS	9	36.13672232	-80.13694078
DMS09-85-65N_DAUGHERTY	DMS	9	35.54086946	-80.57299018
DMS09-85-69S	DMS	9	35.590195	-80.543369
DMS09-85-72N	DMS	9	35.62370005	-80.5024159
DMS09-85-72S	DMS	9	35.62412193	-80.50296038
DMS09-85-78N	DMS	9	35.66784358	-80.43785244
DMS09-85-78S	DMS	9	35.6744807	-80.42378694
DMS09-85-85E	DMS	9	35.74152046	-80.36153287
DMS09-85-87S	DMS	9	35.76801066	-80.33185959
DMS09-SR4000-CHERRY	DMS	9	36.16318538	-80.27744964
DMS09-SR4000-INDIANA	DMS	9	36.156326	-80.27878672
DMS09-SR4000N-HOWELL	DMS	9	36.13627067	-80.27009234
DMS09-SR4000-S-HOWELL	DMS	9	36.13627067	-80.27009234
DMS09-SR4000-SR1672	DMS	9	36.18689675	-80.27604416
DMS10-277-0.5E_MOREHEAD	DMS	10	35.22441207	-80.85751086
DMS10-277-2.15N_4TH	DMS	10	35.21722496	-80.83482742
DMS10-27-GREENBROOK	DMS	10	35.201236	-80.762166

DMS10-485-11.2N_WILDLIFE	DMS	10	35.263834	-80.966961
DMS10-485-12.3S	DMS	10	35.280741	-80.965954
DMS10-485-18.5W	DMS	10	35.339743	-80.891353
DMS10-485-19.5E	DMS	10	35.345489	-80.875076
DMS10-485-26.4W_PROSPERITYCHURCH	DMS	10	35.36918408	-80.78375816
DMS10-485-27.2E_OEHLERBRIDGE	DMS	10	35.36848856	-80.77082992
DMS10-485-37N	DMS	10	35.275719	-80.671698
DMS10-485-65.8N_WESTINGHOUSE	DMS	10	35.106138	-80.891122
DMS10-485-65.9S_WESTINGHOUSE	DMS	10	35.108388	-80.895346
DMS10-74-WALLACE	DMS	10	35.1753	-80.74882
DMS10-77-0.2N	DMS	10	35.10620095	-80.92939138
DMS10-77-5.5N	DMS	10	35.17424681	-80.88646933
DMS10-77-6.7S	DMS	10	35.189758	-80.88680997
DMS10-85-32.9N	DMS	10	35.240031	-80.926345
DMS10-85-33S	DMS	10	35.23846892	-80.91988564
DMS10-85-35N_GLENWOOD	DMS	10	35.253804	-80.889352
DMS10-85-39.5N	DMS	10	35.276096	-80.817242
DMS10-85-41S_SUGARCREEK	DMS	10	35.27831261	-80.79670519
DMS10-85-45N	DMS	10	35.31915219	-80.75290203
DMS10-85-45S	DMS	10	35.3183873	-80.75298116
DMS10-85-48.5N	DMS	10	35.36168609	-80.72098911
DMS10-85-51.3S_POPLARTENT	DMS	10	35.394971	-80.701507
DMS10-85-53.1N	DMS	10	35.411948	-80.680737
DMS10-85-54.7S	DMS	10	35.431627	-80.66377
DMS12-85-31S_TUCKASEEGEE	DMS	12	35.244847	-80.957048
DMS12-85-9N	DMS	12	35.233768	-81.318689

Table 2: Quantity of Hubs

Division	Quantity
5	23
7	13
10	21

Appendix Part B – Agreement Terms

Instructions: Proposers must acknowledge that they have reviewed the Statewide ITS Resilience Agreement Terms for the Project and identify any changes or specific modifications in writing that the Proposer considers essential for entering into a Contract Agreement with the Department for this Project. The Department reserves the right to consider and accept, in its sole and absolute discretion, to requested changes in the Statewide ITS Resilience Agreement Terms.

☐ **The Statewide ITS Resilience Agreement Terms were reviewed in connection with this RFP.**

Authorized Signature: _____ Date: _____

Print Name: _____ Title: _____

Firm Name: _____

List all proposed changes / modifications to the Statewide ITS Resilience Agreement Terms (if any) below:

1.

2.

3.

Appendix Part C – Price Proposal

Appendix Part D – Form of Bid Bond

Contract No. _____ Rev. 4-19-11
County _____

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH, NC

BID BOND

Principal: _____
Name of Principal Contractor

Surety: _____
Name of Surety

Contract Number: _____ County: _____

Date of Bid: _____

KNOW ALL MEN BY THESE PRESENTS, That we, the PRINCIPAL CONTRACTOR (hereafter, PRINCIPAL) and SURETY above named, are held and firmly bound unto the Department of Transportation in the full and just sum of five (5) percent of the total amount bid by the Principal for the project stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

NOW, THEREFORE, the condition of this obligation is: the Principal shall not withdraw its bid within sixty (60) days after the opening of the bids, or within such other time period as may be provided in the proposal, and if the Board of Transportation shall award a contract to the Principal, the Principal shall, within fourteen (14) calendar days after written notice of award is received by him, provide bonds with good and sufficient surety, as required for the faithful performance of the contract and for the protection of all persons supplying labor, material, and equipment for the prosecution of the work. In the event the Principal requests permission to withdraw his bid due to mistake in accordance with the provisions of Article 103-3 of the *Standard Specifications for Roads and Structures*, the conditions and obligations of this Bid Bond shall remain in full force and effect until the Department of Transportation makes a final determination to either allow the bid to be withdrawn or to proceed with award of the contract. In the event a determination is made to award the contract, the Principal shall have fourteen (14) calendar days to comply with the requirements set forth above. In the event the Principal withdraws its bid after bids are opened except as provided in Article 103-3, or after award of the contract has been made fails to execute such additional documents as may be required and to provide the required bonds within the time period specified above, then the amount of the bid bond shall be immediately paid to the Department of Transportation as liquidated damages.

IN TESTIMONY WHEREOF, the Principal and Surety have caused these presents to be duly signed and sealed.

This the _____ day of _____, 20 _____

_____
Surety

By _____
General Agent or Attorney-in-Fact Signature

Seal of Surety

_____
Print or type Signer's Name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND

CORPORATION

SIGNATURE OF CONTRACTOR (Principal)

_____
Full name of Corporation

_____
Address as prequalified

By _____
Signature of **President**, **Vice President**, **Assistant Vice President**
Select appropriate title

_____
Print or type Signer's name

Affix Corporate Seal

Attest _____
Signature of **Secretary**, **Assistant Secretary**
Select appropriate title

_____
Print or type Signer's name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND

LIMITED LIABILITY COMPANY

SIGNATURE OF CONTRACTOR (Principal)

Name of Contractor _____
Full name of Firm

_____
Address as prequalified

Signature of Member/ Manager/Authorized Agent _____
Individually

_____
Print or type Signer's name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND

INDIVIDUAL DOING BUSINESS UNDER A FIRM NAME

SIGNATURE OF CONTRACTOR (Principal)

Name of Contractor _____
Individual Name

Trading and doing business as _____
Full name of Firm

_____
Address as prequalified

Signature of Contractor _____
Individually

_____
Print or type Signer's name

_____
Signature of Witness

_____
Print or type Signer's name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND

INDIVIDUAL DOING BUSINESS IN HIS OWN NAME

SIGNATURE OF CONTRACTOR (Principal)

Name of Contractor _____
Print or type Individual Name

_____
Address as prequalified

Signature of Contractor _____
Individually

_____
Print or type Signer's name

_____
Signature of Witness

_____
Print or type Signer's name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND

PARTNERSHIP

SIGNATURE OF CONTRACTOR (Principal)

_____
Full name of Partnership

_____
Address as prequalified

By _____
Signature of Partner

_____
Print or type Signer's name

_____
Signature of Witness

_____
Print or type Signer's name

Contract No. _____ Rev. 4-19-11
County _____

BID BOND
JOINT VENTURE (2 or 3)
SIGNATURE OF CONTRACTORS (Principal)

Instructions to Bidders: **2 Joint Ventures**, Fill in lines (1), (2) and (3) and execute. **3 Joint Venturers** Fill in lines (1), (2), (3), (4) and execute. Line (1), print or type the name of Joint Venture. On line (2), print or type the name of one of the joint venturers and execute below in the appropriate manner required by Article 102-8 of the *Specifications*. On Line (3), print or type the name of second joint venturer and execute below in the appropriate manner required by said article of the Specifications. On Line (4), print or type the name of the third joint venturer, if applicable and execute below in the appropriate manner required by said article of the Specifications. This form of execution must be strictly followed.

(1) _____
Name of Joint Venture

(2) _____
Name of Contractor

_____
Address as prequalified

_____ By _____
Signature of Witness or Attest — Signature of Contractor

_____ _____
Print or type Signer's name — Print or type Signer's name

If Corporation, affix Corporate Seal

and

(3) _____
Name of Contractor

_____
Address as prequalified

_____ By _____
Signature of Witness or Attest — Signature of Contractor

_____ _____
Print or type Signer's name — Print or type Signer's name

If Corporation, affix Corporate Seal

and

(4) _____
Name of Contractor *(for 3 Joint Venture only)*

_____
Address as prequalified

_____ By _____
Signature of Witness or Attest — Signature of Contractor

_____ _____
Print or type Signer's name — Print or type Signer's name

If Corporation, affix Corporate Seal

Appendix Part E – Project Special Provisions for Unit Bid Items

Document not considered final unless all signatures completed.

Signals and Intelligent Transportation Systems
Project Special Provisions
(Version 18.6)

Prepared By: _____
13-Apr-22

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1. GENERAL REQUIREMENTS

1.1. DESCRIPTION

A. General:

Conform to these Project Special Provisions, the Signals and ITS Project Special Provisions (current version 18.6), and the *2018 Standard Specifications for Roads and Structures* (herein referred to as "Standard Specifications").

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

The NCDOT Project Management Team for the Contract is herein referred to as the "Engineer".

B. Summary of Work:

The work covered by this special provision consists of maintenance, installation, and repairs for the Statewide ITS Resilience Project (HO-0005). The purpose of this project is to support the Statewide Intelligent Transportation Systems (ITS) Resilience effort by maintaining, repairing, replacing, installing, documenting, and managing the Department's ITS devices, ITS communication infrastructure, and related infrastructure across the state of North Carolina. This includes services including, but not limited to:

- Preventive Maintenance of ITS devices and communication infrastructure, including traffic control
- Responsive Maintenance of ITS devices, including traffic control
- Responsive Maintenance of communications cabling and electrical cabling infrastructure
- Device Replacement, including traffic control
- NC811 Underground Location Services
- Fiber Asset Management System (FAMS) support

1.2. MATERIAL

Furnish materials that comply with these Project Special Provisions, the Department's Approved Product List, and the ITS and Signals Qualified Product List (QPL), or as approved by the Engineer.

Furnish new equipment, materials, and hardware unless otherwise required. Inscribe manufacturer's name, model number, serial number, and any additional information needed for proper identification on each piece of equipment housed in a case or housing.

Furnish factory assembled cables without adapters, unless otherwise approved by the Engineer, for all cables required to interconnect any field or central equipment including but not limited to fiber optic transceivers.

Certain equipment listed in these Project Special Provisions must be pre-approved on the Department's ITS & Signals Qualified Products List (QPL) by the date of installation. Equipment, material, and hardware not pre-approved when required will not be allowed for use on the project. The QPL is available on the Department's website. The QPL website is:

https://apps.ncdot.gov/vendor/approvedproducts/

All ITS materials shall conform to the latest version of the applicable standards of the National Electrical Code (NEC), National Electric Manufacturer's Association (NEMA), the Underwriters' Laboratories, Inc. (UL), the Electronic Industries Association (EIA), the International Municipal Signal Association (IMSA), and the National Electrical Safety Code (NESC). All materials and workmanship must conform to the requirements of the NESC, standards of the American Society for Testing and Materials (ASTM); American National Standards Institute (ANSI). Comply with all federal laws, state laws, and city codes in accordance with the 2018 NCDOT Standard Specifications for Roads and Structures.

Refer to Contract for Observation Period that is included as work under this Project.

1.3. CONSTRUCTION METHODS

Comply with these Project Special Provisions, the Signals and ITS Project Special Provisions (current version 18.6), and the Standard Specifications.

Comply with Section 1700 of the Standard Specifications.

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.”

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

Page 17-4, Replace the sentence beginning on line 41 with “Prior to placing signal in the steady (stop-and-go) mode, the signal should be placed in the flashing mode for up to 7 days or as directed by the Engineer. The signal should not be placed in the steady (stop-and-go) mode on a Saturday or Sunday without prior approval from the Engineer. Do not place the signal in steady (stop-and-go) mode until inspected and without the prior approval of the Engineer.”

1.4. MEASUREMENT AND PAYMENT

There will be no direct payment for work covered in this Section. Payment for the work performed under the Contract and directed by the Engineer will be paid for as specified in the contract, the Standard Specifications, and these Project Special Provisions.

Conformance to this Section of the Project Special Provisions is incidental to any work order generated under the Contract.

2. WOOD POLE

2.1. DESCRIPTION

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

For CCTV Wood Poles, furnish an air terminal and lightning protection system in accordance with the "Air Terminal & Lightning Protection System" Project Special Provisions.

2.2. MATERIAL

A. General

Refer to 1082 (Structural Timber and Lumber), 1082 (Inspection Requirements), 1091-2 (Wire), 1091-6 (Grounding Electrodes) of the Standard Specifications.

For replacements, ensure furnished wood pole type approved equivalent to previous pole type as approved by the Engineer.

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

B. CCTV Wood Pole

For CCTV Wood Poles, furnish Class 3 or better wood poles that are a minimum of 60' long to permit the CCTV camera to be mounted approximately 45 feet above the ground and a minimum 5 feet from the top of the pole, or CCTV wood pole type identical to the type previously installed as approved by the Engineer.

2.3. CONSTRUCTION METHODS

A. General

Comply with Article 1720-3 of the Standard Specifications.

B. CCTV Wood Pole

Mark final pole locations and receive approval from the Engineer before installing poles. Comply with all requirements of Section 1720-3 of the Standard Specifications.

Install the required Air Terminal & Lightning Protection System as described in the Air Terminal & Lighting Protection Specifications and as referenced in the following Typical Details:

- CCTV Camera Installation for Wood Pole with Aerial Electrical Service
- CCTV Camera Installation for Wood Pole with Underground Electrical Service

2.4. MEASUREMENT AND PAYMENT

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

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

No measurement will be made for equipment, labor and materials, to install the wood pole as these items of work will be incidental to furnishing and installing CCTV wood poles.

No measurement will be made for furnishing and installing the "Air Terminal and Lightning Protection System" as this will be considered incidental to the "CCTV Wood Pole" installation.

Payment will be made under:

Pay Item	Pay Unit
Wood Pole	Each
CCTV Wood Pole	Each

3. AIR TERMINAL & LIGHTNING PROTECTION SYSTEM

3.1. DESCRIPTION

Furnish an air terminal and lightning protection system that is comprised of items meeting UL 96 and UL 467 product standards for lightning protection and installed to be compliant with the National Fire Protection Association 780 Standards for Lightning Protection Systems. The lightning protection system shall consist of, as a minimum, an Air Terminal, vertical Air Terminal Base (wood pole) or Air Terminal Rod Clamps (metal pole), 28-Strand bare-copper lightning conductor, 4-point grounding systems (grounding electrodes), #4 AWG copper bonding conductors, marker tape and other miscellaneous hardware.

3.2. Materials

A. General

Reference the following Typical Details where applicable:

- CCTV Camera Installation for Metal Pole with Aerial Electrical Service
- CCTV Camera Installation for Metal Pole with Underground Electrical Service
- CCTV Camera Installation for Wood Pole with Aerial Electrical Service
- CCTV Camera Installation for Wood Pole with Underground Electrical Service

B. Wood Pole

Furnish a UL Listed Class II, copper clad minimum 48” long by ½” diameter air terminal. Ensure the air terminal has a tapered tip with a rounded point on one end and is threaded on the connection end with standard Unified Coarse (UNC) 13 threads per inch.

Furnish a copper vertical air terminal base that has internal threading to accept a ½” diameter air terminal with UNC 13 threads per inch. Provide a base that allows for a minimum ¼” mounting hole to secure the base to the vertical side of a wood pole. Ensure the air terminal base includes (2) 5/16” cap screws to secure the bare copper lightning conductor. Additionally, provide (2) ½” copper tube straps (conduit clamps) to secure the air terminal and bare copper lightning conductor to the pole.

C. Metal Pole

Furnish a UL Listed Class II, stainless steel minimum 48” long by ½” diameter air terminal with a tapered tip with a rounded point on one end. No threading is required on the opposing end.

Furnish an air terminal rod clamp manufactured out of 304 stainless steel. Ensure the air terminal rod clamp has two horizontal support arms that are 2” wide by 3/16” thick and design to offset the air terminal approximately 8” away from the metal pole. Ensure the support arms at the point where the air terminal is to be installed has an internal crease to secure the air terminal along with four (4) bolts to provide the clamping action between the two support arms. Provide two (2) stainless steel banding clamps to secure the air terminal rod clamp’s base plate to the metal pole.

D. Copper Lightning Conductor and Ground Rods

Furnish a Class II rated copper lightning conductor which consists of 28 strands (minimum) of 15 AWG copper wires to form a rope-lay bare copper lightning conductor. Furnish 5/8" diameter, 10-foot-long copper-clad steel ground rods with a 10-mil thick copper cladding to serve as an integral part of the 4-point grounding system. Furnish irreversible mechanical clamps to secure the 28-strand lightning conductor, #4 AWG bare copper ground wires and grounding electrodes together to complete the grounding system.

3.3. Construction Methods

A. Wood Pole

Install the vertical air terminal base approximately 12" below the top of the wood pole and install the air terminal to the threaded connection on the base. Install a ½" copper tube strap (conduit clamp) over the air terminal, 6" from the top of the pole. Additionally, secure the copper lightning conductor under both 5/16" diameter cap screws located on the base. Install an additional ½" copper tube strap (conduit clamp) over the bare copper lightning conductor, 6" below the air terminal base. Locate the ¼" mounting hole on the vertical air terminal base and install a ¼" by 3" (minimum) long lag bolt through the base and into the wood pole to support the air terminal assembly.

Route the bare copper lightning conductor to maintain maximum horizontal separation from any risers that traverse up the pole. Secure the bare copper lightning conductor to the pole on 24" centers using copper cable clips. From the bottom of the pole (ground level) install a 2" by 10' long PVC U-Guard over the bare copper lightning conductor to protect the cable from vandalism.

B. Metal Pole

Install two (2) stainless steel air terminal rod clamps to the side of the metal pole structure starting at 6" below the top of the pole with the second air terminal clamp 12" from the top of the pole (approximately 6" of separation between the 2 clamps). Secure each air terminal rod clamp to the pole structure with two (2) stainless steel banding clamps. Install the air terminal between the horizontal support arms on each air terminal rod clamp and tighten the bolts to provide a secure connection.

C. Copper Lightning Conductor and Ground Rods

Install the 4-point grounding system by installing a central grounding electrode that is surrounded by a minimum of three (3) additional grounding electrodes spaced approximately 20 feet away from the central grounding electrode and approximately 120 degrees apart. Interconnect each grounding electrode using a #4 AWG bare copper conductor back to the central grounding electrode using irreversible mechanical crimps. Additionally, using an irreversible mechanical crimp, connect the bare copper lightning conductor to the central grounding electrode. Install each grounding electrode and its corresponding #4 AWG bare copper grounding wire and 28 strand copper lightning conductor such that the wires are 24" below grade. Install marker tape 12" below grade and above all grounding conductors.

In instances where right-of-way does not allow for ground rod spacing as required above, reference the 2018 Roadway Standard Drawings - Section 1700.02 "Electrical Service Grounding" for "Limited Shoulder" or "Restricted Space" installation alternatives.

Prior to connecting the lightning protection system to an electrical service, perform a grounding electrode test on the lightning protection system to obtain a maximum of 20 ohms or less. Install additional grounding electrodes as need to obtain the 20 ohms or less requirement. The grounding electrode resistance test shall be verified or witnessed by the Engineer or the Engineer's designated representative.

Follow test equipment's procedures for measuring grounding electrode resistance. When using clamp-type ground resistance meters, readings of less than one ohm typically indicate a ground loop. Rework bonding and grounding circuits as necessary to remove ground loop circuits and retest. If a ground loop cannot be identified and removed to allow the proper use of a clamp-type ground resistance meter, use the three-point test method. Submit a completed inductive Loop & Grounding Test Form available on the Department's website.

3.4. Measurement and Payment

No measurement will be made for furnishing and installing the "Air Terminal and Lightning Protection System" as this will be considered incidental to "CCTV Metal Pole" & "CCTV Wood Pole" installations.

4. MESSENGER CABLE

4.1. DESCRIPTION

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.

4.2. MATERIAL

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

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

4.3. CONSTRUCTION METHODS

Comply with Article 1710-3 of the Standard Specifications.

4.4. MEASUREMENT AND PAYMENT

Messenger Cable (1/4'') 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.

Messenger Cable (3/8'') 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 (1/4'')	Linear Foot
Messenger Cable (3/8'')	Linear Foot

5. RISER ASSEMBLIES

5.1. DESCRIPTION

Furnish and install riser assemblies with clamp-on, aluminum weather heads or heat shrink tubing, galvanized pole attachment fittings and all necessary hardware in accordance with Section 1722 of the Standard Specifications.

5.2. MATERIAL

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

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

5.3. CONSTRUCTION METHODS

Comply with Article 1722-3 of the Standard Specifications.

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.”

5.4. MEASUREMENT AND PAYMENT

1/2" Riser with Weatherhead 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.

1" Riser with Weatherhead 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.

2" Riser with Weatherhead 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.

2" Riser with Heat Shrink Tubing 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

6. GUY ASSEMBLIES

6.1. DESCRIPTION

Furnish and install guy assemblies with all necessary hardware in accordance with Section 1721 of the Standard Specifications.

6.2. MATERIAL

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

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

6.3. CONSTRUCTION METHODS

Comply with Article 1721-3 of the Standard Specifications.

6.4. 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

7. METAL POLE SUPPORTS

7.1. METAL POLES

A. General:

Furnish and install metal poles, grounding systems, and all necessary hardware. Work covered under this special provision includes requirements for design, fabrication, and installation of standard and custom/site-specific designed metal pole supports and associated foundations.

Comply with applicable sections of the *2018 STANDARD SPECIFICATIONS FOR ROADS & STRUCTURES*, hereinafter referred to as the *Standard Specifications*. Provide designs of completed assemblies with hardware equaling or exceeding AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals* 6th Edition, 2013 (hereinafter called 6th Edition AASHTO), including the latest interim specifications. Provide assemblies with a round or near-round (18 sides or more) cross-section, or a multi-sided cross section with no less than six sides. The sides may be straight, convex, or concave.

Metal pole heights to be determined based on existing pole height for replacement or as determined by Engineer.

Standard Drawings for Metal Poles are available that supplement these project special provisions. The drawings are located on the Department's website:

https://connect.ncdot.gov/resources/safety/pages/ITS-Design-Resources.aspx

Comply with article 1098-1B of the *Standard Specifications* for submittal requirements. Furnish shop drawings for approval. Provide copies of detailed shop drawings for each type of structure as summarized below. Ensure shop drawings include material specifications for each component. Ensure shop drawings identify welds by type and size on the detail drawing only, not in table format. **Do not release structures for fabrication until shop drawings have been approved by NCDOT**. Ensure shop drawings contain an itemized bill of materials for all structural components and associated connecting hardware.

Comply with article 1098-1A of the *Standard Specifications* for Qualified Products List (QPL) submittals. All shop drawings must include project location description, signal or asset inventory number(s) and project number or work order number.

Summary of information required for metal pole review submittal:

Item	Electronic Submittal	Comments / Special Instructions
Sealed, Approved Signal or ITS Plan/Loading Diagram	1 set	All structure design information needs to reflect the latest approved Signal or ITS plans
Custom Pole Shop Drawings	1 set	Submit drawings on 11" x 17" format media. Show NCDOT signal or asset inventory number(s), Contractor's name and relevant revision number in the title block. All drawings must have a unique drawing number for each project.
Standard Strain Pole Shop Drawings (from the QPL)	1 set	Submit drawings on 11" x 17" format media. Show NCDOT signal inventory number(s), Contractor's name and relevant revision number in the title block. All drawings must have a unique drawing number for each project.
Structure Calculations	1 set	Not required for Standard QPL Poles
Standard Strain Pole Foundation Drawings	1 set	Submit drawings on 11" x 17" format media. Submit a completed Standard Foundation Selection form for each pole using foundation table on Metal Pole Drawing M8.
Custom Foundation Drawings	1 set	Submit drawings on 11" x 17" format media. Show NCDOT signal or asset inventory number(s), Contractor's name and relevant revision number in the title block. All drawings must have a unique drawing number for each project. If QPL Poles are used, include the corresponding QPL pole shop drawings with this submittal.

Foundation Calculations	1 set	**Submit copies of LPILE input, output, and pile tip deflection graph per Section titled Drilled Pier Foundations for Metal Poles of this specification for each foundation.** Not required for Standard Strain Poles (from the QPL)
Soil Boring Logs and Report	1 set	Report shall include a location plan and a soil classification report including soil capacity, water level, hammer efficiency, soil bearing pressure, soil density, etc. for each pole.

NOTE – All shop drawings and custom foundation design drawings must be sealed by a Professional Engineer licensed in the state of North Carolina. All geotechnical information must be sealed by either a Professional Engineer or Geologist licensed in the state of North Carolina. Include a title block and revision block on the shop drawings and foundation drawings showing the NCDOT signal or asset inventory number(s).

Shop drawings and foundation drawings may be submitted together or separately for approval. However, shop drawings must be approved before foundations can be reviewed. Foundation designs will be returned without review if the associated shop drawing has not been approved. Boring reports shall include the following: Engineer's summary, boring location maps, soil classification per AASHTO Classification System, hammer efficiency, and Metal Pole Standard Foundation Selection Form. Incomplete submittals will be returned without review. The Reviewer has the right to request additional analysis and copies of the calculations to expedite the approval process.

B. Materials:

Fabricate metal pole from coil or plate steel that meet the requirements of ASTM A 572 Gr 55 or ASTM A 595 Grade A tubes. For structural steel shapes, plates, and bars use, as a minimum, ASTM A572 Gr 50, AASHTO M270 Gr 50, ASTM A709 Gr 50, or an approved equivalent. Provide pole shafts of round or near round (18 sides or more) cross-section, or multi-sided tubular cross-section with no less than six sides, having a uniform linear taper of 0.14 in/ft. Construct shafts from one piece of single-ply plate or coil. For anchor base fabrication, conform to the applicable bolt pattern and orientation as shown on Metal Pole Standard Drawing Sheet M2.

Use the submerged arc process, or other NCDOT previously approved process suitable for shafts, to continuously weld pole shafts along their entire length. Finish the longitudinal seam weld flush with the outside contour of the base metal. Ensure shaft has no circumferential welds except at the lower end joining the shaft to the pole base. Use full penetration groove welds with backing ring for all tube-to-transverse-plate connections in accordance with 6th Edition AASHTO. Provide welding that conforms to Article 1072-18 of the *Standard Specifications.* No field welding on any part of the pole will be permitted unless approved by a qualified Engineer.

After fabrication, hot-dip galvanize steel poles and all assembly components in accordance with section 1076-3 of the *Standard Specifications*. Design structural assemblies with weep holes large enough and properly located to drain molten zinc during the galvanization process. Galvanize hardware in accordance with section 1076-4 of the *Standard Specifications*. Ensure threaded material is brushed and retapped as necessary after galvanizing. Perform repair of damaged galvanizing in accordance with section 1076-7 of the Standard *Specifications. Ensure* all hardware is galvanized steel or stainless steel. The Contractor is responsible for ensuring the

Designer/Fabricator specifies connecting hardware and/or materials that prevent a dissimilar metal corrosive reaction.

Ensure each anchor rod is 2-inch minimum diameter and 60-inch length. Provide 10-inch minimum thread projection at the top of the rod, and 8-inch minimum at the bottom of the rod. Use anchor rod assembly and drilled pier foundation materials complying with SP09_R005, hereinafter referred to as *Foundations and Anchor Rod Assemblies for Metal Poles*.

Ensure anchor bolt hole diameters are ¼-inch larger than the anchor bolt diameters in the base plate.

Provide a circular anchor bolt lock plate securing the anchor bolts at the embedded end with two (2) washers and two (2) nuts. Provide a base plate template matching the bolt circle diameter of the anchor bolt lock plate. Construct plates and templates from ¼-inch minimum thick steel with a minimum width of 4 inches. Hot-dip galvanizing is not required for both plates.

Provide four (4) heavy hex nuts and four (4) flat washers for each anchor bolt. For nuts, use AASHTO M291 grade 2H, DH, or DH3 or equivalent material. For flat washers, use AASHTO M293 or equivalent material. Ensure anchor bolts have required diameters, lengths, and positions, and will develop strengths comparable to their respective poles.

For each pole, provide a grounding lug with a ½-inch minimum thread diameter, coarse thread stud and nut that will accommodate #4 AWG ground wire. Ensure the lug is electrically bonded to the pole and is conveniently located inside the pole at the hand hole.

Provide a removable pole cap with stainless steel attachment screws for the top of each pole. Ensure cap is cast aluminum conforming to Aluminum Association Alloy 356.0F. Furnish cap attached to the pole with a sturdy stainless-steel chain that is long enough to permit cap to hang clear of the pole-top opening when cap is removed.

Where required by the plans, furnish couplings 42 inches above bottom of the pole base for mounting of pedestrian pushbuttons. Provide mounting points consisting of 1½-inch internally threaded half-couplings complying with the NEC, mounted within the poles. Ensure that couplings are essentially flush with the outside surfaces of the poles and are installed before any required hot-dip galvanizing. Provide a threaded plug in each mounting point. Ensure the surface of the plug is essentially flush with the outer end of the mounting point when installed and has a recessed slot that will accommodate a ½ “drive standard socket wrench.

Metal poles may be erected and fully loaded after concrete has attained a minimum allowable compressive strength of 3,000 psi.

Connect poles to grounding electrodes and bond them to the electrical service grounding electrodes.

When field drilling is necessary for wire or cable entrances into the pole, comply with the following requirements:

- Do not drill holes within 2 inches of any welds.
- Do not drill any holes larger than 3 inches in diameter without checking with the ITS & Signals Structure Engineers.
- Avoid drilling multiple holes along the same cross section of tube shafts.
- Install rubber grommets in all field drilled holes that wire, or cable will directly enter unless holes are drilled for installation of weather heads or couplings.

- Treat the inside of the drilled holes and repair all galvanized surfaces in accordance with Section 1076-7 of the latest edition of the *Standard Specification prior to installing grommets, caps, or plugs.*
- Cap or plug any existing field drilled holes that are no longer used with rubber, aluminum, or stainless-steel hole plugs.

When street lighting is installed on metal signal structures, isolate the conductors feeding the luminaires inside the pole shaft using liquid tight flexible metal conduit (Type LFMC), liquid tight flexible nonmetallic conduit (Type LFNC), high density polyethylene conduit (Type HDPE), or approved equivalent. All conductors supplying power for luminaires must run through an external disconnect prior to entrance into the structure. Comply with applicable National Electrical Safety Codes (NESC). Refer to Article "G" Luminaire Arms.

Install a ¼-inch thick plate for a concrete foundation tag to include the following information: concrete grade, depth, diameter, and reinforcement sizes of the installed foundation. Install galvanized wire mesh to cover gap between the base plate and top of foundation for debris and pest control. Refer to standard drawing M7 for further details.

Immediately notify the Engineer of any structural deficiency that becomes apparent in any assembly, or member of any assembly, because of the design requirements imposed by these specifications, the plans, or the typical drawings.

C. Design:

Unless otherwise specified, design all metal pole support structures using the following 6th Edition AASHTO specifications:

- Design for a 50-year service life as recommended by Table 3.8.3-2.
- Use wind pressure map developed from 3-second gust speeds, as provided in Section 3.8.
- Assume wind loads as shown in Figures 3.9.4.2-2 and 3.9.4.2-3 of the 6th Edition AASHTO for Group III loading with Ice.
- Ensure metal pole support structures include natural wind gust loading and truck-induced gust loading for fatigue design, as provided in Sections 11.7.1.2 and 11.7.1.3, respectively. Designs need not consider periodic galloping forces.
- Assume 11.2 mph natural wind gust speed in North Carolina. For natural wind fatigue stress calculations, utilize a drag coefficient (C_d) based on the yearly mean wind velocity of 11.2 mph.
- When selecting Fatigue Importance Factors, utilize Fatigue Importance Category II, as provided for in Table 11.6-1, unless otherwise specified.
- Calculate all stresses using applicable equations from Section 5. The Maximum allowable stress ratio for all metal pole support designs is 0.9.
- Conform to Sections 10.4.2 and 11.8 for deflection requirements. For CCTV and MVD support structures, ensure maximum deflection at top of pole does not exceed 2.0 percent of pole height.
- Assume the combined minimum weight of a messenger cable bundle (including messenger cable, signal cable and detector lead-in cables) is 1.3 lbs/ft. Assume the combined minimum diameter of the cable bundle is 1.3 inches.

- All CCTV and MVD poles shall meet the compact section limits per section 5.5.2 along with Table 5.5.2-1. Minimum thickness of CCTV and MVD pole shafts shall be ¼-inch.

- All CCTV and MVD poles shall use full-penetration groove weld tube-to-transverse plate connection with backing ring. Refer to Metal Pole Standard Drawing Sheet M9 for details. Fillet-welded tube-to-transverse-plate connections are not permitted.

  Unless otherwise specified by special loading criteria, the following computed surface area for ice load on signal heads shall be used:

  - 3-section, 12-inch, Surface area: 26.0 ft^2
  - 4-section, 12-inch, Surface area: 32.0 ft^2
  - 5-section, 12-inch, Surface area: 42.0 ft^2

  Design a base plate for each pole. The minimum base plate thickness for all poles is determined by the following criteria:

  <u>*Case 1*</u> Circular or rectangular solid base plate with the upright pole welded to the top surface of base plate with full penetration butt weld, where no stiffeners are provided. A base plate with a small center hole, which is less than 1/3 of the upright diameter, and located concentrically with the upright pole, may be considered as a solid base plate.

  The magnitude of bending moment in the base plate, induced by the anchoring force of each anchor bolt is $M = (P \times D_1) / 2$, where

  M = bending moment at the critical section of the base plate induced by one (1) anchor bolt

  P = anchoring force of each anchor bolt

  D_1 = horizontal distance between the anchor bolt center and the outer face of the upright, or the difference between the bolt circle radius and the outside radius of the upright

  Locate the critical section at the face of the anchor bolt and perpendicular to the bolt circle radius. The overlapped part of two (2) adjacent critical sections is considered ineffective.

  <u>*Case 2*</u> Circular or rectangular base plate with the upright pole socketed into and attached to the base plate with two (2) lines of fillet weld, and where no stiffeners are provided, or any base plate with a center hole that is larger in diameter than 1/3 of the upright diameter.

  The magnitude of bending moment induced by the anchoring force of each anchor bolt is $M = P \times D_2$,

  where P = anchoring force of each anchor bolt

  D_2 = horizontal distance between the face of the upright and the face of the anchor bolt nut

  Locate the critical section at the face of the anchor bolt top nut and perpendicular to the radius of the bolt circle. The overlapped part of two (2) adjacent critical sections is considered ineffective.

  If the base plate thickness calculated for Case 2 is less than Case 1, use the thickness calculated for Case 1.

  The following additional requirements apply concerning pole base plates.

  - Ensure that whichever case governs as defined above, the anchor bolt diameter is set to match the base plate thickness. If the minimum diameter required for the anchor bolt exceeds the thickness required for the base plate, set the base plate thickness equal to the required bolt diameter.
  - For all metal poles, use a full penetration groove weld with a backing ring to connect the pole upright component to the base. Refer to Metal Pole Standard Drawing Sheet M3 or M4.

The Professional Engineer is wholly responsible for the design of all poles. Review and acceptance of these designs by the Department does not relieve the said Professional Engineer of his or her responsibility.

D. CCTV and MVD Poles:

Refer to Metal Pole Standard Drawing Sheets M2, M3 and M9 for fabrication details.

Furnish hand hole covers attached to the pole by a sturdy chain or cable approved by the Engineer. Ensure chain or cable is long enough to permit cover to hang clear of the compartment opening when cover is removed and is strong enough to prevent vandalism. Ensure chain or cable will not interfere with service to cables in the pole shaft.

Furnish and install the required Air Terminal & Lightning Protection System as described in the "Air Terminal & Lightning Protection System" Project Special Provisions and as referenced in the following Typical Details:

- CCTV and MVD Camera Installation for Metal Pole with Aerial Electrical Service
- CCTV and MVD Camera Installation for Metal Pole with Underground Electrical Service

Have poles permanently stamped above the hand holes with the identification tag details as shown on Metal Pole Standard Drawing Sheets M2, M3 and M9.

Provide a 2-inch hole equipped with an associated coupling and weather head approximately 5 feet below top of pole to accommodate passage of CCTV and MVD cables from inside pole to CCTV and MVD camera.

Provide a 2-inch hole equipped with an associated coupling and conduit fittings/bodies approximately 18 inches above base of pole to accommodate passage of CCTV and MVD cables from CCTV and MVD cabinet to inside of pole. Refer to Metal Pole Standard Drawing Sheet M3 for fabrication details.

Install CCTV and MVD metal poles, hardware, and fittings as shown on the manufacturer's installation drawings. Ensure the installed pole, when fully loaded, is within 0.5 degrees of vertical. Where required, use threaded leveling nuts to establish rake.

Comply with the following requirements for CCTV and MVD Pole Anchor Bolts and Base Plates:

- Poles up to 40'-0" in length, provide a minimum of four (4) 2-inch diameter anchor bolts, and a minimum 2-inch-thick circular base plate. Provide anchor bolts of Grade 55 ksi, and base plate of Grade 50 ksi.
- Poles greater than 40'-0" and up to 100'-0" in length, provide a minimum of eight (8) 2-inch diameter anchor bolts, and a minimum 2-inch-thick circular base plate. Provide anchor bolts of Grade 55 ksi, and base plate of Grade 50 ksi.

Obtain the Structural Engineer's approval for deviations from these requirements, prior to shop drawing(s) submission.

7.2. DRILLED PIER FOUNDATIONS FOR METAL POLES

Analysis procedures and formulas shall be based on AASHTO 6th Edition, latest ACI-318 code and the *Drilled Shafts: Construction Procedures and Design Methods* FHWA-NHI-10-016 manual. Design methods based on engineering publications or research papers must have prior approval from NCDOT. The Department reserves the right to accept or reject any method used for the analysis.

Use the following Safety Factors for the foundation design:

- 1.0 x Service (Unfactored) Loads for LPile Shaft Lateral Deflection
- 1.3 x Torsion (Unfactored) Load for Drilled Shaft Concrete and Steel Strength
- (1.3 / 1.33) x Torsion (Unfactored) Load for Shaft Soil-to-Concrete Torsion Capacity
- (2.0 / 1.33) x Axial (Unfactored) Load for Shaft Axial Capacity in Soil

Ensure deflection at top of foundation does not exceed 1 inch for worst-case lateral load.

Use LPILE Plus V6.0 or later for lateral analysis. Submit inputs, results and corresponding graphs with the design calculations.

Calculate skin friction using the α-method for cohesive soils and the β-method for cohesion-less soils (**Broms method will not be accepted**). Detailed descriptions of the "α" and "β" methods can be found in *FHWA-NHI-10-016*.

Omit first 2.5 feet for cohesive soils when calculating skin friction.

Assume a hammer efficiency of 0.70 unless value is provided.

All CCTV and MVD pole drilled shafts shall be a minimum of 4'-0" diameter. Refer to Standard Drawing Nos. M7 and M8.

Design custom foundations to carry maximum capacity of each metal pole. For standard case strain poles with custom design, use actual shear, axial and moment reactions from the Standard Strain Pole Foundation Selection Table shown on Standard Drawing No. M8.

When poor soil conditions are encountered, which could create an excessively large foundation design, consideration may be given to allow an exemption to the maximum capacity design. The Contractor must gain approval from the Engineer before reducing a foundation's capacity. On projects where poor soil is known to be present, the Contractor should have foundation designs approved before releasing poles for fabrication.

Have the Contractor notify the Engineer if the proposed foundation is to be installed on a slope other than 8H: 1V or flatter.

A. Description:

Furnish and install foundations for NCDOT metal poles with all necessary hardware in accordance with the plans and specifications.

Metal Pole Standards have been developed and implemented by NCDOT for use at signalized intersections in North Carolina. If the plans call for a standard strain pole, then a standard foundation may be selected from the plans. However, the Contractor is not required to use a standard foundation. If the Contractor chooses to design a non-standard site-specific foundation for a standard strain pole or if the plans call for a non-standard site-specific pole, design the foundation to conform to the applicable provisions in the NCDOT Metal Pole Standard Drawings and Section B4 (Non-Standard Foundation Design) below. If non-standard site-specific foundations are designed for standard QPL approved strain poles, the foundation designer must use the design moment specified by load case on Metal Pole Standard Drawing Sheet M8. Failure to conform to this requirement will be grounds for rejection of the design.

If the Contractor chooses to design a non-standard foundation for a standard strain pole and the soil test results indicate a standard foundation is feasible for the site, the Contractor will be paid the cost of the standard foundation. Any additional cost associated with a non-standard site-specific foundation including additional materials, labor and equipment will be considered incidental to the cost of the standard foundation. All costs for the non-standard foundation design will be considered incidental to the cost of the standard foundation.

B. Soil Test and Foundation Determination:

1. General:

Drilled piers are reinforced concrete sections, cast-in-place against in situ, undisturbed material. Drilled piers are of straight shaft type and vertical.

2. Soil Test:

Perform a soil test at each proposed metal pole location. Complete all required fill placement and excavation at each pole location to finished grade before drilling each boring. Soil tests performed that are not in compliance with this requirement may be rejected and will not be paid. Drill one boring to a depth of 26 feet within a 25-foot radius of each proposed foundation.

Perform standard penetration tests (SPT) in accordance with ASTM D 1586 at depths of 1, 2.5, 5, 7.5, 10, 15, 20 and 26 feet. Discontinue the boring if one of the following occurs:

- A total of 100 blows have been applied in any two consecutive 6-inch intervals.
- A total of 50 blows have been applied with < 3-inch penetration.

Describe each pole location along the project corridor in a manner that is easily discernible to both the Contractor's Designer and NCDOT Reviewers. If the pole is at an intersection, label the boring the "Intersection of (*Route or SR #*), *(Street Name)* and (*Route or SR #*), *(Street Name)*, _____ County, Signal or Asset Inventory No. _____". Label borings with "B- *N, S, E, W, NE, NW, SE or SW*" corresponding to the quadrant location within the intersection.

If the pole location is located between intersections, provide a coordinate location and offset, or milepost number and offset. Pole numbers should be made available to the Drill Contractor. Include pole numbers in the boring label if they are available. If they are not available, ensure the boring labels can be cross-referenced to corresponding pole numbers. For each boring, submit a legible (hand-written or typed) boring log signed and sealed by a licensed Geologist or Professional Engineer registered in North Carolina. Include on each boring the SPT blow counts and N-values at each depth, depth of the boring, hammer efficiency, depth of water table and a general description of the soil types encountered using the AASHTO Classification System.

Borings that cannot be easily correlated to their specific pole location will be returned to the Contractor for clarification; or if approved by the Engineer, the foundation may be designed using the worst-case soil condition obtained as part of this project.

3. Standard Foundation Determination:

Use the following method for determining the Design N-value:

$$N_{AVG} = \frac{N_{@1'} + N_{@2.5'} + \cdots + N_{@Deepest\ Boring\ Depth}}{Total\ Number\ of\ N\ values}$$

$$Y = (N_{@1'})^2 + (N_{@2.5'})^2 + \cdots + (N_{@Deepest\ Boring\ Depth})^2$$

$$Z = N_{@1'} + N_{@2.5'} + \cdots + N_{@Deeepest\ Boring\ Depth}$$

$$N_{STD\ DEV} = \sqrt{\left(\frac{(Total\ Number\ of\ N\ values\ \times Y) - Z^2}{(Total\ Number\ of\ N\ values) \times (Total\ Number\ of\ N\ values - 1)}\right)}$$

Design N-value equals lesser of the following two conditions:

$$N_{AVG} - (N_{STD\ DEV} \times 0.45)$$

OR

$$Average\ of\ First\ Four\ (4) N\ values = \frac{N_{@1'} + N_{@2.5'} + N_{@5'} + N_{@7.5'}}{4}$$

Note: If less than four (4) N-values are obtained because of criteria listed in Section 2 above, use average of N-values collected for second condition. Do not include the N-value at the deepest boring depth for above calculations if the boring is discontinued at or before the required boring depth because of criteria listed in Section 2 above. Use N-value of zero (0) for weight of hammer or weight of rod. If N-value is greater than fifty (50), reduce N-value to fifty (50) for calculations.

If standard NCDOT strain poles are shown on the plans and the Contractor chooses to use standard foundations, determine a drilled pier length, "L," for each signal pole from the Standard Strain Pole Foundations Chart (sheet M8) based on the Design N-value and the predominant soil type. For each standard pole location, submit a completed "Metal Pole Standard Foundation Selection Form" signed by the Contractor's representative. Signature on form is for verification purposes only. Include the Design N-value calculation and resulting drilled pier length, "L," on each form.

If non-standard site-specific poles are shown on the plans, submit completed boring logs collected in accordance with Section 2 (Soil Test) along with pole loading diagrams from the plans to the Contractor-selected pole Fabricator to assist in the pole and foundation design.

If one of the following occurs, the Standard Foundations Chart shown on the plans may not be used and a non-standard foundation may be required. In such case, contact the Engineer.

- The Design N-value is less than four (4).
- The drilled pier length, "L", determined from the Standard Foundations Chart, is greater than the depth of the corresponding boring.

In the case where a standard foundation cannot be used, the Department will be responsible for the additional cost of the non-standard foundation.

Foundation designs are based on level ground around the traffic signal pole. If the slope around the edge of the drilled pier is steeper than 8:1 (H:V) or the proposed foundation will be less than 10 feet from the top of an embankment slope, the Contractor is responsible for providing slope information to the foundation Designer and to the Engineer so it can be considered in the design.

The "Metal Pole Standard Foundation Selection Form" may be found at:

https://connect.ncdot.gov/resources/safety/Pages/ITS-Design-Resources.aspx

If assistance is needed, contact the Engineer.

4. Non-Standard Foundation Design:

Design non-standard foundations based upon site-specific soil test information collected in accordance with Section 2 (Soil Test). Design drilled piers for side resistance in accordance with

Section 4.6 of the *2002 AASHTO Standard Specifications for Highway Bridges, 17th Edition*. Use computer software LPILE version-6.0 or later manufactured by Ensoft, Inc. to analyze drilled piers. Use computer software gINT V8i or later manufactured by Bentley Systems, Inc. with the current NCDOT gINT library and data template to produce SPT boring logs. Provide a drilled pier foundation for each pole with a length and diameter resulting in horizontal lateral movement less than 1 inch at top of the pier, and horizontal rotational movement less than 1 inch at the edge of pier. Contact the Engineer for pole loading diagrams of standard poles used for non-standard foundation designs. Submit non-standard foundation designs including drawings, calculations, and soil boring logs to the Engineer for review and approval before construction.

C. Drilled Pier Construction:

Construct drilled pier foundation and Install anchor rod assemblies in accordance with the *Foundations and Anchor Rod Assemblies for Metal Poles* Standard Special Provision SP09-R005 located at:

https://connect.ncdot.gov/resources/Specifications/Pages/2018-Specifications-and-Special-Provisions.aspx

7.3. METAL POLE REMOVALS

A. Description:

Remove and dispose of existing metal support poles, and remove and dispose of existing foundations, associated anchor bolts, electrical wires and connections.

B. Construction Methods:

5. Foundations:

Remove and promptly dispose of the metal support pole foundations including reinforcing steel, electrical wires, and anchor bolts to a minimum depth of 2 feet below the finished ground elevation. At the Contractor's option, remove the complete foundation.

6. Metal Poles:

Consult Division Traffic Services regarding ownership of poles. If the Division chooses to maintain these structures in their inventory for future use, permanently mark the pole with the signal inventory number, asset inventory number or some identifying information that identifies where the pole came from

Remove the metal support poles, and promptly transport the metal support poles from the project. Use methods to remove the metal support poles and attached equipment that will not result in damage to other portions of the project or facility. Repair damages that are a result of the Contractor's actions at no additional cost to the Department.

Transport and properly dispose of the materials.

Backfill and compact disturbed areas to match the finished ground elevation. Seed unpaved areas.

Use methods to remove the foundations that will not result in damage to other portions of the project or facility. Repair damages that are a result of the Contractor's actions at no cost to the Department.

7.4. POLE NUMBERING SYSTEM

A. New Poles

Attach an identification tag to each pole shaft section as shown on Metal Pole Standard Sheet M2 "Typical Fabrication Details for All Metal Poles."

B. Reused Poles

Do not remove the original identification tag(s) from the pole shaft sections. Add a new identification tag based on the new location for any reused poles.

7.5. REUSED POLE SHAFTS

Provide shop drawings along with new foundation designs for review and approval prior to furnishing and/or installing any reused metal poles. Use the same requirements as specified for new materials as stated above in these Special Provision.

7.6. REUSED MAST ARM SHAFTS

For reused pole shaft and mast arm combinations, it is preferable to use the original shafts and arms that were used together at the time of original installation.

7.7. MEASUREMENT AND PAYMENT

Metal Pole Foundation Removal will be measured and paid for as actual number of metal signal pole foundations removed and disposed.

Metal Pole Removal will be measured and paid for as actual number of metal signal poles removed and disposed.

CCTV or MVD Metal Pole will be measured and paid for as actual number of CCTV or MVD Metal Poles furnished, installed and accepted.

Soil Test will be measured and paid for as actual number of soil tests with SPT borings drilled furnished and accepted.

Drilled Pier Foundation will be measured and paid for as actual volume of concrete poured in cubic yards of drilled pier foundation furnished, installed and accepted.

No measurement will be made for foundation designs prepared with metal pole designs, as these will be considered incidental to designing Traffic Signal, CCTV or MVD support structures.

Payment will be made under:

Pay Item	Pay Unit
Metal Pole Foundation Removal	Each
Metal Pole Removal	Each
CCTV or MVD Metal Pole	Each
Soil Test	Each
Drilled Pier Foundation	Cubic Yard

8. ELECTRICAL SERVICE

8.1. DESCRIPTION

Furnish and install new electrical service equipment including, but not limited to service entrance equipment, service entrance conductors, feeder conductors, disconnects, junction boxes, risers, guy assemblies, and wood poles with all necessary hardware at the direction of the Engineer. Comply with Section 1700 of the Standard Specifications, the National Electric Code (NEC), the National Electrical Safety Code (NESC), the Standard Specifications, and these Project Special Provisions.

Coordinate all work with electrical services with the Engineer and the appropriate utility company.

8.2. MATERIAL

Refer to Article 1098-1 of the Standard Specifications.

Provide new electrical services rated 100 Amps for overhead service or 200 Amps for underground service, 240/120 VAC service drops.

Electrical Services and Service Disconnects with regards to voltage drop calculations shall be rated to accommodate the breaker sizes specified in these Project Special Provisions. Calculations using actual equipment load amperage will not be allowed.

A. Meter Base/Disconnect Combination Panel

Furnish and install new meter base/disconnect combination panels as directed by the Engineer. Provide meter base/disconnect combination panels that have a minimum of four (4) spaces in the disconnect. Furnish a single pole 15A circuit breaker at CCTV locations. Furnish a double pole 50A circuit breaker at DMS locations. Furnish each 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.

Furnish NEMA Type 3R combinational panel rated 100 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 as directed by the Engineer. Furnish double pole 50A or 30A (dependent on sign manufacturer) circuit breakers at DMS locations. Furnish single pole 15A circuit breaker at CCTV locations. 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.

Coordinate with the Engineer for wire sizes and quantities as needed.

D. 4-Wire Copper Feeder Conductors

Furnish 4-wire stranded copper feeder conductors with THWN rating for supplying power to DMS field equipment cabinets. Provide conductors with black, 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.

Coordinate with the Engineer for wire sizes and quantities as needed.

E. 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.

Coordinate with the Engineer for wire sizes and quantities as needed.

F. 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.

8.3. 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 directed by the Engineer, or specified in the Contract. At DMS locations, route the feeder conductors from the meter base/disconnect to the DMS equipment cabinet in conduit. At CCTV locations, route the feeder conductors from the meter base/disconnect to the CCTV 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 directed by the Engineer, or specified in the Contract. Install THWN stranded copper feeder conductors as directed by the Engineer 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

As directed by the Engineer, or specified in the Contract, 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 specified by the Engineer. Comply with the Standard Specifications and Standard Drawings and all applicable electrical codes.

E. 4-Wire Copper Feeder Conductors

As directed by the Engineer, or specified in the Contract,, install 4-wire THWN stranded copper feeder conductors to supply 240/120 VAC to the DMS field equipment cabinets. Size the conductors as specified by the Engineer. Comply with the Standard Specifications and Standard Drawings and all applicable electrical codes.

F. 3-Wire Copper Feeder Conductors

As directed by the Engineer, or specified in the Contract,, install 3-wire THWN stranded copper feeder conductors to supply 120 VAC to the CCTV field equipment cabinets. S Size the conductors as specified by the Engineer. Comply with the Standard Specifications and Standard Drawings and all applicable electrical codes.

G. 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.

8.4. MEASUREMENT AND PAYMENT

New electrical service will be measured and paid for as the actual number of complete functional electrical service locations furnished, installed and tested, regardless of type (i.e., CCTV cabinet only, DMS cabinet only, shared services). When new electrical service is created all other items listed within this Section shall be considered incidental.

Remove electrical service will be measured and paid for as the actual number of complete functional electrical service locations completed removed, disconnected, and accepted.

Meter base/disconnect combination panel will be measured and paid as the actual number of complete and functional meter base/disconnect combination panel service locations furnished, installed and accepted. Breakers, lightning arrestors, exposed vertical conduit runs to the cabinet, and any remaining hardware, fittings, and conduit bodies to connect the electrical service to the cabinet will be considered incidental to meter base/disconnect combination panels. All other required feeder conductors will be paid for separately.

Equipment cabinet disconnect will be measured and paid as the actual number of complete and functional equipment cabinet disconnects furnished, installed and accepted. Breakers, exposed vertical conduit runs to the cabinet, ground rods, ground wire and any remaining hardware and conduit to connect the equipment cabinet disconnect to the cabinet will be considered incidental to the equipment cabinet subpanel.

3-Wire copper service entrance conductors will be incidental to furnish and installing the meter base/disconnect combination panel.

4-*Wire copper feeder conductors* will be measured and paid as the actual linear feet of 4-wire THWN stranded copper feeder conductors furnished, installed and accepted. Payment is for all four conductors. Measurement will be for the actual linear footage of combined conductors after all terminations are complete. No separate payment will be made for each individual conductor. No separate payment will be made for different wire sizes. No payment will be made for excess wire in the cabinets.

3-Wire copper feeder conductors will be measured and paid as the actual linear feet of 3-wire THWN stranded copper feeder conductors furnished, installed and accepted. Payment is for all three conductors. Measurement will be for the actual linear footage of combined conductors after all terminations are complete. No separate payment will be made for each individual conductor. No separate payment will be made for different wire sizes. No payment will be made for excess wire in the cabinets.

5/8" X 10' grounding electrode (ground rod) will be measured and paid as the actual number of 5/8" copper clad steel ground rods furnished, installed and accepted. No separate payment will be made for exothermic welding kit as they will be considered incidental to the installation of the ground rod.

#4 solid bare grounding conductor will be measured and paid as the actual linear feet of #4 AWG solid bare copper grounding conductor furnished, installed and accepted. Measurement will be along the approximate centerline from the base of the electrical service disconnect to the last grounding electrode.

Payment will be made under:

Pay Item	Pay Unit
New Electrical Service	Each
Remove Electrical Service	Each
Meter Base/Disconnect Combination Panel	Each
Equipment Cabinet Disconnect	Each
3-Wire Copper Service Entrance Conductors	Linear Foot
4-Wire Copper Feeder Conductors	Linear Foot
3-Wire Copper Feeder Conductors	Linear Foot
5/8" X 10' Grounding Electrode	Each
#4 Solid Bare Grounding Conductor	Linear Foot

9. UNDERGROUND CABLE INSTALLATION

9.1. DESCRIPTION

Furnish and install conduit for underground cable installation with tracer wire, 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.

9.2. MATERIAL

Refer to 1091-3 (Conduit), 1091-3(G) (Conduit Plugs, Pull Line, and Tracer Wire), 1091-4 (Duct and Conduit Sealer), 1018-2 (Backfill), 545-2 and 545-3 (Graded Stone) of the Standard Specifications.

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

9.3. CONSTRUCTION METHODS

Comply with Article 1715-3 of the Standard Specifications.

9.4. 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) & (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) & (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.

Plowing (qty)(size) & (qty)(size) will be measured horizontal linear feet of plowing 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.

Directional Drill (qty)(size) & (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.

Bore and Jack (qty)(size) & (qty)(size) will be measured in horizontal linear feet of bore and jack for underground conduit installation furnished, installed and accepted. Measurement will be along the approximate centerline of the bore from junction box to junction box. 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, paving materials, miscellaneous fittings, non-detectable marker tape, pull lines and seeding and mulching as these will be incidental to conduit installation.

Conduit will be paid per linear foot based on quantity and size of conduits. As examples, an installation of a single 1.25 inch HDPE conduit would be paid as:

Directional Drill (1)(1.25") Linear Foot, and

Payment will be made under:

Pay Item	**Pay Unit**
Tracer Wire	Linear Foot
Unpaved Trenching (1)(1’’)	Linear Foot
Unpaved Trenching (2)(2’’)	Linear Foot
Unpaved Trenching (3)(2’’)	Linear Foot
Paved Trenching (1)(1’’)	Linear Foot
Paved Trenching (2)(2’’)	Linear Foot
Paved Trenching (3)(2’’)	Linear Foot
Plowing (1)(1’’)	Linear Foot
Plowing (2)(2’’)	Linear Foot
Plowing Trenching (3)(2’’)	Linear Foot
Directional Drill (1)(1’’)	Linear Foot
Directional Drill (2)(2’’)	Linear Foot
Directional Drill (3)(2’’)	Linear Foot
Bore and Jack (3)(2’’) (1)(4”)	Linear Foot

10. FIBER OPTIC CABLE

10.1. DESCRIPTION

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

10.2. MATERIAL

Refer to 1098-6 (Lashing Wire and Hardware), 1098-10 (Cable Identification Markers), 1098-10 (Fiber-Optic Cable), and 1098-10 (Storage Racks) of the Standard Specifications.

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

10.3. CONSTRUCTION METHODS

Comply with Article 1730-3 of the Standard Specifications.

10.4. 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.

Drop Cable will be measured and paid as linear feet of fiber-optic drop cable 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
Communication Cable (12-Fiber)	Linear Foot
Communication Cable (24-Fiber)	Linear Foot
Communication Cable (36-Fiber)	Linear Foot
Communication Cable (48-Fiber)	Linear Foot
Communication Cable (72-Fiber)	Linear Foot
Communication Cable (96-Fiber)	Linear Foot
Communication Cable (144-Fiber)	Linear Foot
Communication Cable (288-Fiber)	Linear Foot
Drop Cable	Linear Foot

11. REMOVE EXISTING COMMUNICATIONS CABLE

11.1. DESCRIPTION

Remove existing aerial and underground communication cables.

11.2. CONSTRUCTION METHODS

Comply with Article 1734-2 of the Standard Specifications.

11.3. 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, pole attachment hardware and junction boxes, 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

12. BACK PULL FIBER OPTIC CABLE

12.1. DESCRIPTION

Back pull and store or back pull and reinstall existing communications cable.

12.1. CONSTRUCTION

During project construction where instructed to back pull existing aerial sections of fiber optic communications cable, de-lash the cable from the messenger cable and back pull the cable to a point where it can be stored or re-routed as shown on the plans. If instructed, remove and discard the existing messenger cable and pole mounting hardware once the cable is safely out of harm's way.

During project construction where instructed to back pull existing underground sections of fiber optic communications cable, back pull the cable to a point where it can be stored or re-routed as shown on the plans. If instructed, remove abandoned junction boxes and backfill with a suitable material to match the existing grade. Leave abandoned conduits in place unless otherwise noted.

Where instructed, re-pull the fiber optic cable back along messenger cable or through conduit systems.

12.2. MEASUREMENT AND PAYMENT

Back Pull Fiber Optic Cable will be paid for as the actual linear feet of fiber optic cable back pulled and either stored or back pulled and rerouted. Payment is for the actual linear feet of cable back pulled.

No payment will be made for removing messenger cable and pole mounting hardware or removing junction boxes and back filling to match the surrounding grade as these items of work will be considered incidental to back pulling the fiber optic cable.

Payment will be made under:

Back Pull Fiber Optic Cable ..... Linear Feet

13. FIBER-OPTIC SPLICE CENTERS

13.1. 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 directed by the Engineer. Refer to manufacturer's recommendations for opening, modifying and re-sealing the existing fiber optic interconnect center and/or fiber optic splice enclosures.

13.2. MATERIAL

Refer to Article 1098-11 (Fiber Optic Splice Centers) of the Standard Specifications.

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

13.3. CONSTRUCTION METHODS

Comply with Article 1731-3 of the Standard Specifications.

13.4. MEASUREMENT AND PAYMENT

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

Small Splice Enclosure (Less than 48-fiber Cables) will be measured and paid as the actual number of fiber-optic splice enclosures that have all cables less than 48-fiber cables that is furnished, installed and accepted. No measurement will be made between aerial, underground, manhole or junction box installation of the fiber-optic splice enclosure.

Large Splice Enclosure (Greater than 48-fiber Cables) will be measured and paid as the actual number of fiber-optic splice enclosures that have any cables greater than 48-fiber cables that is furnished, installed and accepted. No measurement will be made between aerial, underground, manhole or junction box installation of the fiber-optic splice enclosure.

Modify 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, 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 incidental to furnishing and installing fiber-optic interconnect centers and splice enclosures and modifying splice enclosures.

Payment will be made under:

Pay Item	**Pay Unit**
Interconnect Center	Each
Small Splice Enclosure (Less than 48-fiber Cables)	Each

Large Splice Enclosure (Greater than 48-fiber Cables).....Each
Modify Splice Enclosure.....Each

14. SPLICE CABINET (FIBER OPTICS)

14.1. DESCRIPTION

Furnish and install splice cabinets and all necessary hardware in accordance with the plans and specifications for the purpose of splicing and terminating fiber-optic cable.

14.2. MATERIALS

Furnish NEMA Type 4 splice cabinets of sufficient size to accommodate the fiber-optic interconnect center. Provide sufficient size so that the equipment installed will not occupy more than 60 percent of the total cabinet volume.

14.3. CONSTRUCTION METHODS

A. General:

Locate cabinets so as not to obstruct sight distance of vehicles turning on red.

B. Pole Mounted:

Install pole-mounted splice cabinets. Install cabinets approximately five feet from the ground line to the top of the cabinet. Secure the cabinet to the pole using an approved installation method.

C. Base Mounted:

Install base mounted cabinets as shown on the plans and as approved by the Engineer. Refer to Section 1750 - Signal Cabinet Foundations of the *Standard Specifications* for installation requirements for the foundations. The following exceptions are made:

- Install only the required number of conduits as shown on the plans plus one additional spare stub out conduit.
- Do not provide a 24-inch working area on the backside of the cabinet. Provide only a 24-inch working area measured from the front of the cabinet and 3 inch lip measured from the sides and back of the cabinet.
- All other requirements apply.

14.4. MEASUREMENT AND PAYMENT

Fiber-Optic Splice Cabinet (Pole Mounted) will be measured and paid for as actual number of fiber-optic splice cabinets (pole mounted) furnished, installed, and accepted.

Fiber-Optic Splice Cabinet (Base Mounted) will be measured and paid for as actual number of fiber-optic splice cabinets (base mounted) furnished, installed, and accepted.

No measurement will be made for the cabinet foundation as it will be covered under Section 1750 – Signal Cabinet Foundations of the Standard Specifications.

Payment will be made under:

Pay Item **Pay Unit**

Fiber-Optic Splice Cabinet (Pole Mounted) .....Each
Fiber-Optic Splice Cabinet (Base Mounted).....Each

15. HUB CABINET

15.1. DESCRIPTION

Furnish and install air-conditioned hub cabinets, hub cabinet base extenders, hub cabinet foundations and all necessary hardware as described herein. Size the cabinet appropriately to fit all the equipment and to allow for 25% free space available after all equipment is installed. Size the cabinet to ensure ease of access to equipment and provide proper ventilation in order to maintain an internal operating environment that does not exceed the environmental operating ranges for devices placed within the cabinet.

15.2. MATERIAL

A. Hub Cabinet

1. Standards

Ensure that the hub cabinets comply with the following standards:

- ANSI;
- ASTM;
- IMSA ;
- ISO 9001;
- NEC;
- NEMA TS-2; and
- UL listed.

2. Functional

Furnish Caltrans Type 340 base-mounted hub cabinets meeting the following minimum requirements:

- Side-by-side, double doors on both front and rear of cabinet.
- Fiber-optic interconnect centers (paid separately).
- Grounding bus bar.
- 19-inch rack system for mounting of all devices in the cabinet.
- Pull-out shelf for laptop and maintenance use.
- Maintenance access connections.
- LED lighting.
- Ventilation fans.
- 120VAC power supply.
- 120VAC ground fault circuit interrupter (GFCI)-protected duplex outlets for tools.
- 120VAC surge-protected duplex outlets for equipment.
- Sunshields constructed of light gauge aluminum that sit approximately one inch above the surface of the cabinet on all sides, including doors.
- Lightning and surge protection on incoming and outgoing electrical lines (power and data).
- Managed Ethernet switch (provided by DIT).
- Door status sensors compatible with provided Managed Ethernet switches

- Power strip along vertical rail.
- HVAC system to maintain optimal temperature and humidity for the Ethernet hub switches and other powered electronics in the cabinet.
- UPS with sufficient capacity to hold hub's electrical load (minus the HVAC) for 4 hours. Cabinet AC system will not be connected to the UPS.

3. Physical Features

Provide cabinets that are completely weatherproof to prevent the entry of water. Provide cabinet and door exterior seams that are continuously welded, and all exterior welds are smooth. Provide cabinets with four full-size doors with full-length stainless-steel piano hinges, with stainless steel pins spot-welded at the top. Provide hinges that utilize stainless steel hinge pins. Provide hinges that are mounted so that they cannot be removed from the door or cabinet without first opening the door. Provide door and hinges braced to withstand a 100-pound per vertical foot of door height load applied vertically to the outer edge of the door when standing open. Ensure that there is no permanent deformation or impairment of any part of the door or cabinet body when the load is removed. Provide cabinet door fitted with a #2 Corbin lock. Provide two keys for each cabinet. Provide cabinet doors that are also pad lockable. Provide door openings that are double flanged on all four sides.

Provide cabinets constructed of unpainted sheet aluminum alloy H5052-H32 with a minimum thickness of 0.125 inch.

Provide the hub cabinet with sunshields outside to deflect solar heat away from the cabinet. The sunshields must be offset a minimum of one inch from the exterior cabinet walls. Ensure that the sunshields are fabricated from 5052-H32 aluminum sheet that is 0.125-inch-thick, and that sunshield corners are rounded and smoothed for safety. Mount the sunshields on standoffs on the top and on each side of the cabinet including the doors. Provide doorstops at 90 and 180-degree positions. Ensure that both the door and the doorstop mechanism are of sufficient strength to withstand a simulated wind load of five pounds per square foot of door area applied to the both inside and outside surfaces without failure, permanent deformation, or compromising of door position and normal operation. Do not provide auxiliary police doors.

Ensure that cabinet doors include a gasket to provide a dust and weather-resistant seal when closed. Ensure that the gasket material is closed-cell neoprene and maintains its resiliency after exposure to the outdoor environment. Ensure that the gasket shows no sign of rolling or sagging and provide a uniform dust and weather-resistant seal around the entire door facing.

Provide door alarms for all 4 doors that are compatible with the hub switches to be provided and installed by DIT. Door alarms should send a network alert to the switch when a hub cabinet door is opened or if the door alarm fails or is tampered with.

Coordinate with the Engineer and DIT for hub switch model information.

Provide cabinets that include predrilled holes of standard diameter and bolt pattern with four (4) anchor bolts with each cabinet unit. Provide a panel with each cabinet that matches the rest of the cabinet; and is held in place by four bolts provided with the panel. Drill or punch the panel to accommodate the bolts; the drill holes shall match the bolt pattern of the base cabinet of the cabinet. Provide a panel designed to be fitted in the interior of the cabinet and fabricated of the same material and thickness as the cabinet bottom.

Provide rails to create a cage to mount hardware, wiring panels and miscellaneous mounting brackets. Provide rails constructed of .1345-inch steel or .105-inch stainless steel. Provide rails with

a keyhole design with slots 2 inches on center with a top opening of 5/8 inch in diameter to allow the insertion of a .625-inch by 1-inch carriage bolt.

Ensure that the rails are 1.5 to 2 inches wide by .5 inches deep. Drill and tap the rails for 10-32 screws or rack screws with EIA universal spacing.

Provide rack assemblies that have a removable, standard 19-inch EIA compliant rack.

The rack shall have a clearance between the rails of 17.5 inches.

Equip each cabinet with an aluminum storage compartment mounted in the rack assembly with the following dimensions (0.5 inch): 16 inches wide, 14 inches long, and 1.75 inches deep. Provide compartment with ball-bearing telescoping drawer guides to allow full extension from the rack assembly. Ensure that when extended, the storage compartment opens to provide storage space for cabinet documentation and other miscellaneous items. Ensure that the storage compartment is of adequate construction to support a weight of 20 pounds when extended without sagging. Provide a top to the storage compartment that is hinged aluminum. Provide two (2) removable metal shelves with each cabinet.

Furnish a cabinet base extender with each hub cabinet that complies with the requirements of the "Cabinet Base Adapter and Base Extender" section of these Project Special Provisions.

Install an external generator connection port on the side of the cabinet opposite the air conditioning unit. Port should be designed and sized for the appropriate electrical requirements of the cabinet.

4. Lighting

Provide the field cabinet with four LED lamps (one above each door) and clear shatterproof shield assemblies which are mounted on the inside front and rear top of the cabinet. Ensure that these lamps are unobstructed and able to cast light on the equipment. Equip the field cabinet with door-actuated switches so that the lamps automatically turn on when any cabinet door is opened and go off when all the doors are closed.

5. Electrical

Provide a service panel assembly to function as the entry point for AC power to the cabinet and the location for power filtering, transient suppression, and equipment grounding. Provide AC isolation within the cabinet. Configure cabinet to accept 120 VAC from the utility company.

Provide circuit breakers that meet the NEC requirements, are UL listed and have an interrupt capacity of 5,000 amperes and insulation resistance of 100 MΩ at 500 VDC. Provide the hub cabinet with a main circuit breaker sized according to the NEC. Use appropriately sized branch circuit breakers to protect the electronics in the hub cabinet. Provide a dedicated branch circuit for each of the following items:

- HVAC
- Lighting
- Receptacles
- Ventilation fan
- One circuit per rack
- Others as needed.

Provide UL listed surge protection devices according to the UL 1449, 2nd edition

standard that comply with the NEMA requirements as detailed in the NEMA LS 1 (1992) standard.

Provide branch circuits, surge protection devices, and grounding for the connected load served by the cabinet, including ventilation fans, internal lights, electrical receptacles, etc., as directed by the Engineer.

Furnish a power distribution assembly that fits in the EIA 19-inch rack and provides for protection and distribution of 120VAC power.

Ensure that ground bus bars are fabricated from a copper alloy material compatible with copper wire. Use ground bus bars that have at least two positions where a #6 AWG stranded copper wire can be attached.

Mount the ground bus bar on the side of the cabinet wall adjacent to the service panel assembly for the connection of AC neutral wires and chassis ground wires. If more than one ground bus bar is used in a cabinet, use a minimum of a #10 AWG copper wire to interconnect them.

Provide a detailed plan for power distribution within the cabinet. Label all breakers and conductors with size and loads. Have the plans signed and sealed by a registered PE and submit the plans for review and approval.

6. Ventilation

Ensure the cabinet assembly can maintain the temperature and humidity within the environmental requirements of the hub switches and other powered electronics in the cabinet.

Include two cooling fans with 100 CFM, minimum capacity. Provide thermostats to be incorporated into the ventilation system. Mount fans in the top of the cabinet.

Provide the cabinets with vent openings in the lower portion of the door to allow convection cooling of electronic components. Cover them fully on the inside with a commercially available disposable three-layer graded type filter. All air entering the cabinet must pass through the air filter.

7. Air Conditioner

Furnish each hub cabinet with a rack mounted air-cooled air conditioner that operates on 120VAC. The air conditioner shall be fit within a 19-inch EIA communications rack and shall not be external mounted on the cabinet. The air conditioner shall be mounted in the bottom of the cabinet to avoid damage to any communications equipment.

The air conditioners shall have a built-in condensate evaporator and condensate drain fitting and hose that is plumbed to the outside of the cabinet. The air conditioner shall be rated for a minimum of 3500 BTU. There shall be low temperature control to prevent overcooling.

Provide EMI/RFI transient spike protection. Equip the cabinet and air conditioner with remote monitoring of high temperature and low airflow conditions. Intake air shall enter through cabinet door vent and be exhausted through top cabinet vents. Air conditioners shall be CFC free or low ODP (R-22) refrigerant and shall use closed loop cooling. Insulate all cold components (coolant lines, compressor, evaporator, etc.) with high-performance insulation.

Blower motors shall be UL listed. Ensure the blower motors are equipped with automatic reset thermal overload protection. Provide double sealed and double shielded ball bearings.

The air conditioners shall have permanent corrugated aluminum or stainless steel air filters. The filters shall be removable and washable.

All grilles shall be stainless steel.

B. Hub Cabinet Base Extender

Fabricate hub cabinet base extenders from the same materials and with the same finish as the hub cabinet housing. Fabricate base extender in the same manner as hub cabinets, meeting all of the same applicable specifications called for in these project special provisions. Provide cabinet base extenders with a height of at least 8 inches.

C. Hub Cabinet Foundation

Furnish either poured concrete hub cabinet foundations or preformed hub cabinet foundations. Obtain approval of foundation type from the engineer.

Comply with Section 1000-4 of the 2018 Standard Specifications for Road and Structures.

Provide hub cabinet foundations with a minimum pad area that extend 24 inches from the front and back of the hub cabinet and 3 inches from the sides of the cabinet.

On the same side as the cabinet generator hookup, cast a three inch inside width galvanized steel U-bolt into the cabinet foundation. A minimum of four inches of the U-bolt shall be cast into the concrete and a minimum of three inches of the U-bolt shall be exposed for securing a generator to the foundation.

Furnish hub cabinet foundations with chamfered top edges. Provide minimum class B concrete.

Provide preformed hub cabinet foundations with 7" (L) x 18" (W) minimum opening for the entrance of conduits. For precast hub cabinet foundations, include steel reinforcement to ensure structural integrity during shipment and placing of item. Include four ¾ inch coil thread inserts for lifting. Comply with Article 1077-16 of the *2018 Standard Specifications for Road and Structures*.

D. Hub Cabinet UPS

Furnish and install one rack mounted UPS in each new cabinet.

Furnish UPS with external temperature monitoring that will shut off when running on battery power and the maximum operating temperature for the hub switch is reached.

Install UPS with RJ-45 ethernet network monitoring ports that can be disabled via the UPS software/firmware.

UPS shall meet the following minimum specifications:

Output

Output Power Capacity	480 Watts / 750 VA
Max Configurable Power	480 Watts / 750 VA
Nominal Output Voltage	120V
Output Voltage Distortion	Less than 5% at full load
Output Frequency (sync to mains)	57 - 63 Hz for 60 Hz nominal
Crest Factor	up to 5:1
Waveform Type	Sine wave
Output Connections	(4) NEMA 5-15R

Input

Nominal Input Voltage	120V
Input Frequency	50/60 Hz +/- 3 Hz (auto sensing)
Input Connections	NEMA 5-15P
Cord Length	6 feet
Input voltage range for main operations	82 - 144V
Input voltage adjustable range for mains operation	75 -154 V

Battery Type

Maintenance-free sealed Lead-Acid battery with suspended electrolyte, leak-proof.

Typical recharge time	2 hours

Communications & Management

Interface Port(s)	RJ, 45, DB-9 RS-232, USB
Control panel	LED status display with load and battery bar-graphs

Surge Protection and Filtering

Surge energy rating	480 Joules

Environmental

Operating Environment	-32 - 104 °F
Operating Relative Humidity	0 - 95%
Storage Temperature	5 - 113 °F
Storage Relative Humidity	0 - 95%

Conformance

Regulatory Approvals	FCC Part 15 Class A, UL 1778

15.3. CONSTRUCTION METHODS

A. Hub Cabinet

Ensure all cabinet wiring is tagged and identified using insulated pre-printed sleeves and follows the project's cable identification scheme. Ensure that the wire markers identify usage in plain words with sufficient details without abbreviations or codes.

Use stranded copper for all conductors, including those in jacketed cables and solid copper for all grounding. Neatly arrange all wiring, firmly lace or bundle it, and mechanically secure the wiring

without the use of adhesive fasteners. Route and secure all wiring and cabling to avoid sharp edges and to avoid conflicts with other equipment or cabling. Terminate all wiring on a terminal block, strip, bus bar, device clamp, lug, or connector. Do not splice any wiring. Label all wiring, cables, terminal strips, and distribution blocks with permanent and waterproof tags. Provide strain relief for all cabling with connectors, all cabling entering knockouts or ports at the equipment, and where appropriate.

Fasten all components of the cabinet assembly to be mounted on cabinet side panels with hex-head or Phillips-head machine screws. Install the screws into tapped and threaded holes in the panels. The components include, but are not limited to, terminal blocks; bus bars, panel and socket mounted TVSS, circuit breakers, accessory and equipment outlets, and DC power supply chassis.

Fasten all other cabinet components with hex-head or Phillips-head machine screws installed with nuts (with locking washer or insert) or into tapped and threaded holes. Fasten stud-mounted components to a mounting bracket providing complete access to the studs and mounting nuts. Ensure that all fastener heads and nuts (when used) are fully accessible within a complete cabinet assembly, and any component is removable without requiring removal of other components, panels or mounting rails. Do not use self-tapping or self-threading fasteners.

Mount the air conditioner in the bottom of the cabinet and do not obstruct any cable entry into the cabinet. Install condensate drains to drain condensation water out of the cabinet. Ensure the cabinet has provisions to route conduit to the existing cabinet as shown in the drawings.

Furnish and install a 48” 120 VAC power strip vertically along one of the rear rails of the communications rack. Provide a power strip that has at least eight outlets along its length.

Provide a cabinet that is ISO 9001 certified at the time of installation.

Locate cabinets as close to the edge of the controlled access as possible and protect hub cabinets with guardrail unless instructed otherwise by the engineer.

Install base mounted cabinets as shown on the Plans and as approved by the Engineer. Refer to the “Hub Cabinet Foundation” section of these Project Special Provisions for installation requirements for the hub cabinet foundations. Install only the required number of conduits as shown on the Plans plus one additional spare stub out conduit. Position the ends of conduits approximately 2 inches above the finished surface of the concrete base.

Mount the hub cabinets on cabinet base extenders in accordance with the “Hub Cabinet Base Extender” section of these Project Special Provisions.

Mount surge protection devices in the cabinet for the field devices that will be connected to that cabinet.

Terminate power service wire, video, and data cabling on the appropriate terminal strips, surge protection devices or jacks in the cabinet with insulated terminal lugs or connectors. Use a calibrated ratchet-type crimping tool to install the insulated terminal lugs onto the field wires.

Label spare circuits of the data cables and connect them to the cabinet ground bus bar.

Neatly bundle and identify all field wiring cables in the cabinet with permanent waterproof tags.

Ground all hub cabinets in accordance with NEC requirements and the Hub Cabinet Grounding Detail included in these Project Special Provisions. Keep the ground wire from the cabinet ground bus bar to the ground rod assembly or array as short as possible. Ensure the ground wire is not in contact with any other part of the cabinet.

B. Hub Cabinet Base Extender

Install hub cabinet base extender at all hub cabinet locations.

Use permanent, flexible, waterproof sealing material to:

(a) Seal between the hub cabinet base and hub cabinet base extender.

(b) Seal 2-piece hub cabinet base extender seams.

(c) Seal space between hub cabinet base extender and the hub cabinet foundation.

C. Hub Cabinet Foundation

Comply with Section 825 of the *2018 Standard Specifications for Road and Structures.*

When using poured concrete foundations and preformed concrete foundations, use procedures, equipment and hardware as follows:

(d) Locate new hub cabinets in locations as shown on the plans and approved by the Engineer.

(e) Do not install foundations over uncompacted fill or muck.

(f) Do not install foundations in low areas or locations prone to standing water.

(g) Hand tamp soil before placing concrete to ensure ground is level.

(h) Use a minimum of four ½ inch diameter expanding type anchor bolts to secure cabinet to foundation.

(i) Install minimum 4 inches above and 4 inches below finished grade.

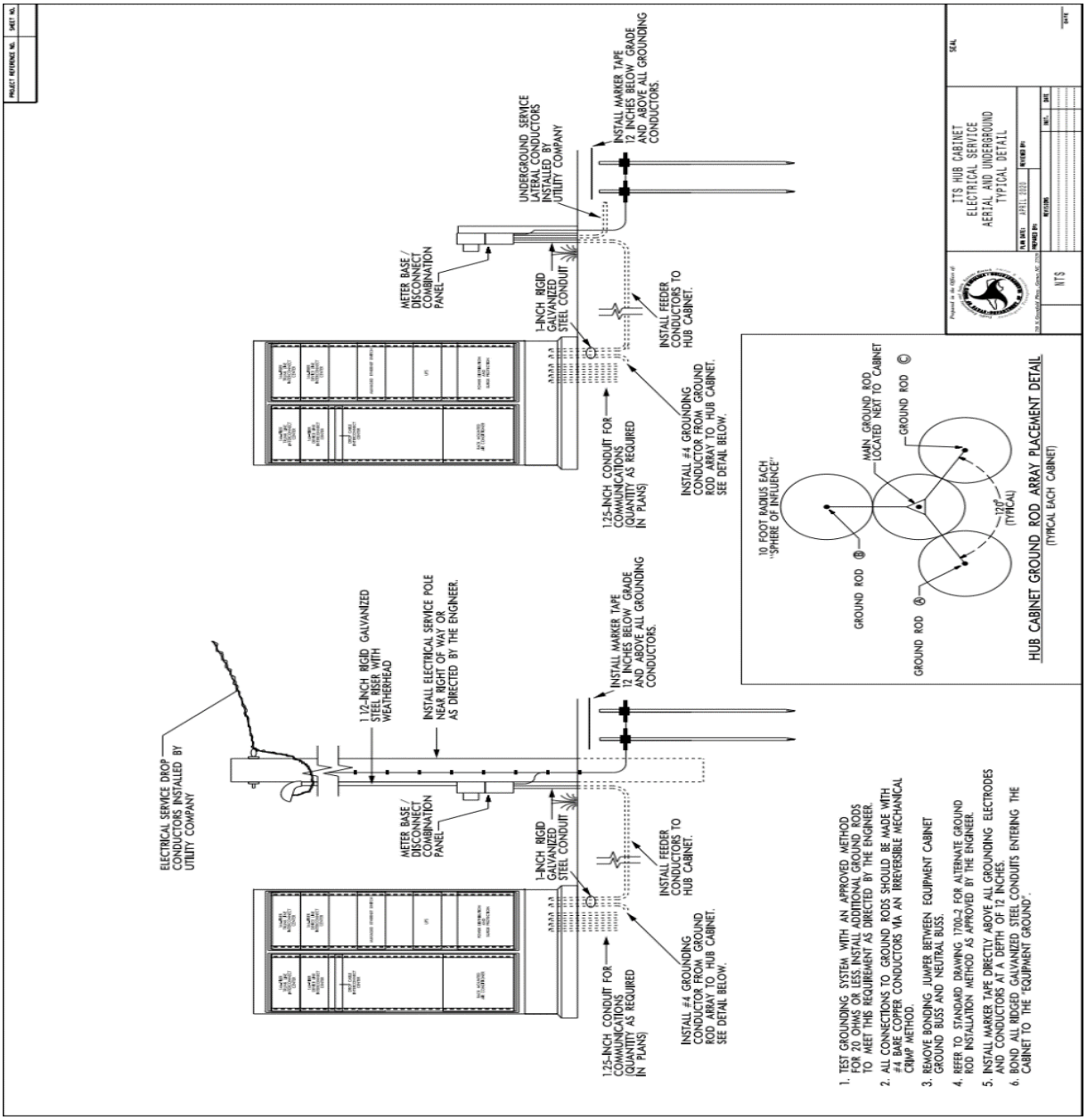
(j) Locate external stubbed out conduit at cabinet foundation so conduit is located on the side of the hub cabinet with the UPS, do not locate conduit under the air conditioning system. Install a minimum of 6 conduit stub-outs.

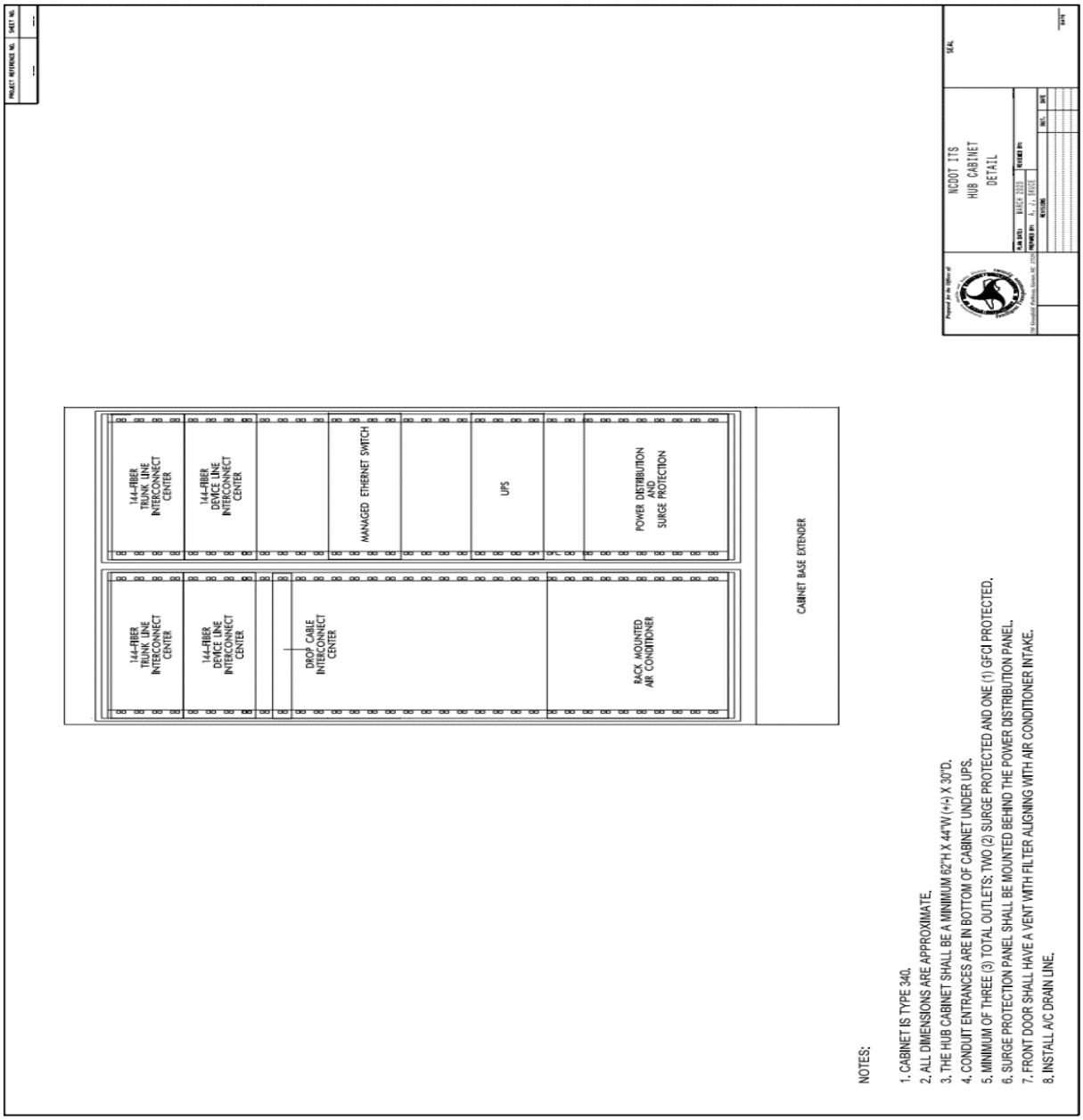
(k) Give hub cabinet foundation a broom finish and chamfered edges.

(l) Seal space between cabinet base and foundation with a permanent, flexible, waterproof sealing material.

D. Hub Cabinet UPS

Install rack mounted UPS in each hub cabinet in accordance with the plans and detail drawings.


ELECTRICAL SERVICE DROP CONDUCTORS INSTALLED BY UTILITY COMPANY
1-1/2-INCH RIGID GALVANIZED STEEL RISER WITH WEATHERHEAD
INSTALL ELECTRICAL SERVICE POLE NEAR RIGHT OF WAY OR AS DIRECTED BY THE ENGINEER.
METER BASE / DISCONNECT COMBINATION PANEL
1-INCH RIGID GALVANIZED STEEL CONDUIT
INSTALL FEEDER CONDUCTORS TO HUB CABINET.
INSTALL MARKER TAPE 12 INCHES BELOW GRADE AND ABOVE ALL GROUNDING CONDUCTORS.
UNDERGROUND SERVICE LATERAL CONDUCTORS INSTALLED BY UTILITY COMPANY
1.25-INCH CONDUIT FOR COMMUNICATIONS (QUANTITY AS REQUIRED IN PLANS)
INSTALL #4 GROUNDING CONDUCTOR FROM GROUND ROD ARRAY TO HUB CABINET. SEE DETAIL BELOW.
10 FOOT RADIUS EACH "SPHERE OF INFLUENCE"
MAIN GROUND ROD LOCATED NEXT TO CABINET
GROUND ROD
GROUND ROD
GROUND ROD
120° (TYPICAL)
HUB CABINET GROUND ROD ARRAY PLACEMENT DETAIL
(TYPICAL EACH CABINET)
1. TEST GROUNDING SYSTEM WITH AN APPROVED METHOD FOR 20 OHMS OR LESS. INSTALL ADDITIONAL GROUND RODS TO MEET THIS REQUIREMENT AS DIRECTED BY THE ENGINEER.
2. ALL CONNECTIONS TO GROUND RODS SHOULD BE MADE WITH #4 BARE COPPER CONDUCTORS VIA AN IRREVERSIBLE MECHANICAL CRIMP METHOD.
3. REMOVE BONDING JUMPER BETWEEN EQUIPMENT CABINET GROUND BUSS AND NEUTRAL BUSS.
4. REFER TO STANDARD DRAWING 1700-2 FOR ALTERNATE GROUND ROD INSTALLATION METHOD AS APPROVED BY THE ENGINEER.
5. INSTALL MARKER TAPE DIRECTLY ABOVE ALL GROUNDING ELECTRODES AND CONDUCTORS AT A DEPTH OF 12 INCHES.
6. BOND ALL RIDGED GALVANIZED STEEL CONDUITS ENTERING THE CABINET TO THE "EQUIPMENT GROUND".
ITS HUB CABINET
ELECTRICAL SERVICE
AERIAL AND UNDERGROUND
TYPICAL DETAIL
ITS


144-FIBER TRUNK LINE INTERCONNECT CENTER
144-FIBER DEVICE LINE INTERCONNECT CENTER
DROP CABLE INTERCONNECT CENTER
MANAGED ETHERNET SWITCH
UPS
POWER DISTRIBUTION AND SURGE PROTECTION
BACK MOUNTED AIR CONDITIONER
CABINET BASE EXTENDER
NCDOT ITS
HUB CABINET
DETAIL
NOTES:
1. CABINET IS TYPE 340.
2. ALL DIMENSIONS ARE APPROXIMATE.
3. THE HUB CABINET SHALL BE A MINIMUM 62"H X 44"W (+/-) X 30"D.
4. CONDUIT ENTRANCES ARE IN BOTTOM OF CABINET UNDER UPS.
5. MINIMUM OF THREE (3) TOTAL OUTLETS: TWO (2) SURGE PROTECTED AND ONE (1) GFCI PROTECTED.
6. SURGE PROTECTION PANEL SHALL BE MOUNTED BEHIND THE POWER DISTRIBUTION PANEL.
7. FRONT DOOR SHALL HAVE A VENT WITH FILTER ALIGNING WITH AIR CONDITIONER INTAKE.
8. INSTALL A/C DRAIN LINE.

16. OTDR TESTING

16.1. DESCRIPTION

After installation or replacement of any fiber cable at the direction of the Engineer, set up and perform bi-directional OTDR test.

As requested by the Department, perform bi-directional OTDR test to verify validity of existing fiber and document results.

16.2. MATERIAL

Contractor responsible for all materials necessary to successfully conduct OTDR testing.

16.3. CONSTRUCTION METHODS

Perform OTDR Testing upon successful installation or replacement of communication cables or as specified in the contract or directed by the Engineer for the purposes of identifying gaps or dark fiber in the fiber network.

Provide written notification to the Engineer a minimum of 10 days before beginning OTDR tests.

Perform bi-directional OTDR tests on each fiber, including unused fibers. Install a 1,000 foot pre-tested launch cable between the OTDR and fiber optic cable to be tested and a 1,000 foot pre-tested destination cable on the end of the fiber optic cable to be tested. Ensure each launch cable has been tested and is compatible with the fiber being installed. Provide Engineer with test results of the launch cable before use. Re-test or replace launch cable at Engineer's request.

Ensure fusion splice losses do not exceed 0.05 dB and connectors have a loss of 0.5 dB or less. If any fiber exceeds maximum allowable attenuation or if fiber properties of the cable have been impaired, take appropriate actions up to and including replacement of the fiber cable.

Clearly label each OTDR trace identifying a starting and ending point for all fibers being tested. Record the attenuation level of each fiber and clearly indicate OTDR trace results in report format. Furnish 2 hard copies of each of the OTDR trace results and electronic copies of all trace results along with digital photographs showing workmanship for each splice. Furnish the manufacturer's make, model number and software version of the OTDR used for testing.

Furnish to the Engineer 2 copies of the software needed to view the OTDR traces electronically.

16.4. MEASUREMENT AND PAYMENT

OTDR Test Set-up will be measured and paid as the actual number of fiber-optic tests, set-up, performed, and accepted.

OTDR Test will be measured and paid as the actual number of fiber-optic tests, set-up, performed, and accepted.

No measurement will be made for equipment, materials, or technologies needed to properly perform the OTDR Test.

Payment will be made under:

Pay Item	**Pay Unit**
OTDR Test Set-up	Each
OTDR Test	Each

17. JUNCTION BOXES & MARKER BALLS

17.1. DESCRIPTION

Furnish and install junction boxes (pull boxes) with covers, graded stone, grounding systems and all necessary hardware. Furnish and install junction box covers at the direction of the Engineer and in accordance with the Contract. Furnish and install electronic marker balls, at the direction of the Engineer and in accordance with the Contract.

17.2. MATERIAL

A. Junction Boxes

Refer to 1098-5 and 1005 (#57 or #67 Washed Sone) of the Standard Specifications.

Provide special oversized junction boxes and covers with minimum outside dimensions of 48" (l) x 30" (w) x 36" (d) where underground fiber-optic splice enclosures are to be installed.

Furnish material, equipment, and hardware under this Section that is pre-approved and on the ITS and Signals QPL, or Department's Approved Product List.

B. Marker Balls

Furnish an electronic marking balls, with a minimum life expectance of 15 years and that are locatable when buried up to 5 feet deep to aid in locating buried Junction Boxes. Ensure the marking ball is designed to be self-leveling to provide precise horizontal positioning of the marker ball electronics (internal passive antenna) once installed in a junction box. Ensure the marker balls are compatible with a Metro Mark - Passive Marker Locator Model #760DX or approved equivalent and are tuned to the following frequencies:

- Orange Ball – 101.4 KHz - Fiber Installations
- Red Ball – 169.8 KHz – Power Cable Installations

17.3. CONSTRUCTION METHODS

A. Junction Boxes

Comply with Article 1716-3 of the Standard Specifications.

B. Marker Balls

Install the appropriate colored Marker Ball in each junction box upon completion of the junction

box installation, or at locations as requested by the Engineer. Test to ensure that the Marker Ball is functioning properly with the approved electronic locater device. Record precise latitudinal and longitudinal coordinates for the location of each locate ball/junction box. See "GPS Coordinates" requirements below.

C. GPS Coordinates

Provide real world coordinates for all junction boxes and equipment cabinets installed or used under this project. Provide the coordinates in feet units using the North Carolina State Plane coordinate system (1983 North American Datum also known as NAD '83). Furnish coordinates that do not deviate more than 1.7 feet in the horizontal plane and 3.3 feet in the vertical plane. Global positioning system (GPS) equipment able to obtain the coordinate data within these tolerances may be used. Submit cut sheets on the GPS unit proposed to collect the data for approval by the Engineer.

Provide a digital copy of all information regarding the location (including, but not limited to, manufacturer, model number, and NCDOT inventory number) in the Microsoft® spreadsheet shown by example below. Provide this information to the Engineer and the NCDOT ITS (TSMO) Unit.

NCDOT Inv #	Name	Location	Latitude	Longitude	Manufacturer	Model #
05-0134	Equipment Cabinet	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5500	35.6873	McCain	Type-332
05-0134	Junction Box # 1 (Phase 2 Side)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5516	35.6879	Quazite	PG1118BA12(Box) PG118HA00(Cover)
05-0134	Junction Box # 2 (Phase 2 Side)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5506	35.6876	Quazite	PG1118BA12(Box) PG118HA00(Cover)
05-0134	Junction Box # 3 (Near Cabinet)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5501	35.6873	Quazite	PG1118BA12(Box) PG118HA00(Cover)
05-0134	Junction Box # 4 (Phase 6 Side)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5486	35.6873	Quazite	PG1118BA12(Box) PG118HA00(Cover)
05-0134	Junction Box # 5 (Phase 6 Side)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5493	35.6876	Quazite	PG1118BA12(Box) PG118HA00(Cover)
05-0134	Junction Box # 6 (Phase 4 Side)	US 70 at Raynor Rd./ Auburn-Knightdale	-78.5503	35.6879	Quazite	PG1118BA12(Box) PG118HA00(Cover)

17.4. MEASUREMENT AND PAYMENT

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

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

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

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

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

Junction Box Cover (Special Oversized, Heavy Duty) 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.

Marker Ball (Orange) will be measured and paid in actual number of marker balls of each type furnished, installed, and accepted.

Marker Ball (Red) will be measured and paid in actual number of marker balls of each type furnished, installed, and accepted.

No measurement will be made of covers, washed stone, and grounding systems as these will be incidental to furnishing and installing junction boxes.

Payment will be made under:

Pay Item	Pay Unit
Junction Box (Standard Size)	Each
Junction Box Cover (Standard Size)	Each
Junction Box (Oversized, Heavy Duty)	Each
Junction Box Cover (Oversized, Heavy Duty)	Each
Junction Box (Special Oversized, Heavy Duty)	Each
Junction Box Cover (Special Oversized, Heavy Duty)	Each
Remove Existing Junction Box	Each
Marker Ball (Orange)	Each
Marker Ball (Red)	Each

18. DELINEATOR MARKERS

18.1. DESCRIPTION

Furnish and install delineator markers with all necessary hardware in accordance with Section 1733 of the Standard Specifications.

18.2. MATERIAL

Refer to 1098-13 (Delineator Markers) of the Standard Specifications.

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

18.3. CONSTRUCTION METHODS

Comply with Article 1733-3 of the Standard Specifications.

18.4. MEASUREMENT AND PAYMENT

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

Payment will be made under:

Pay Item	Pay Unit
Delineator Marker	Each

19. JUNCTION BOX MARKERS

19.1. DESCRIPTION

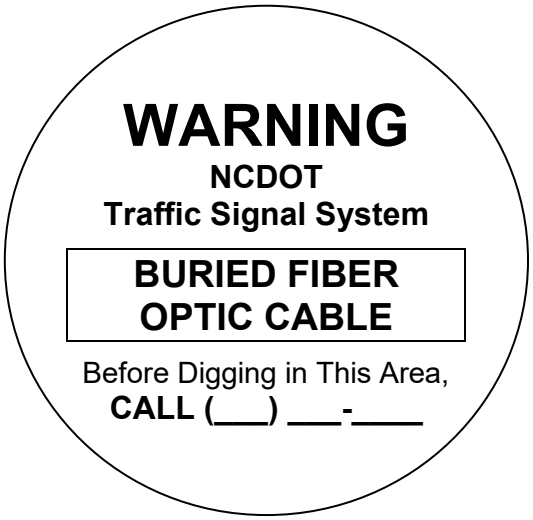
Furnish and install junction box markers with all necessary hardware and adhesives to warn of buried fiber-optic communications cable.

19.2. MATERIALS

A. Junction Box Markers

Furnish durable, non-reflective junction box markers, also known as curb markers, fabricated from UV-resistant, non-metallic materials other than ceramic material, such as polyurethane or high impact polypropylene or other high impact plastic. Provide junction box markers that are designed for outdoor use, that are waterproof, that resist fading, that are temperature stable and that resist chemical and mechanical abrasion. Furnish junction box markers with a quick-setting adhesive designed for use with the junction box markers supplied and designed to permanently adhere junction box markers to Portland cement/concrete, steel, and cast iron as well as other non-porous hard surfaces. Do not provide markers that require intrusive fasteners to secure the marker to the surface. Do not provide adhesives that are not designed for use with the junction markers supplied. Provide junction box markers that do not require special tools such as torches, tamping machines or drills or hardware or special surface preparation for installation. Furnish junction box markers from a manufacturer that has been producing such junction box markers (i.e., curb markers) for a minimum of 10 consecutive years.

Order the junction box marker with the Division's Phone Number printed on the marker, hand written sharpie labeling is not acceptable. Consult with the Engineer to ensure the junction box labels are ordered with the correct Division phone number. Provide junction box markers that contain the text and symbols, text emphasis and text proportions depicted in the example format shown below.:



Overall Junction Box Marker Dimensions: 2.5" diameter
Text: Black
Background: Light Gray (to blend with concrete and granite surfaces)

Submit samples of proposed junction marker to the Engineer for approval before installation. In lieu of designing a custom junction box marker, the Contractor may submit for the Engineer's approval a stock/standard junction box marker format (i.e., off-the-shelf format) from the junction box marker manufacturer that differs from the example format proposed above but that still embodies the content and intent conveyed by the example format.

Have the junction box marker manufacturer provide a list of references along with contract information for at least five different municipal government agencies and/or state departments of transportation that have installed the proposed manufacturer's markers and can attest to the performance of the manufacturer's markers over a continuous period of no less than seven years. Submit these references to the Engineer for review in conjunction with submission of the sample.

19.3. CONSTRUCTION METHODS

A. Junction Box Markers

Apply junction box markers to the surface of the junction box cover/lid on all new and/or existing junction boxes that are to be reused to house the fiber-optic communications cable. Additionally, at locations where a junction box is perpendicular to a raised curb place an additional junction box marker on the curb.

Clean surface to which the junction box marker will be applied. Make sure application surface is dry and free of any loose debris or cracks. Apply adhesive to back side of the junction box marker in accordance with manufacturer's instructions. Apply additional adhesive when surface is uneven or textured to fill voids and assure secure adhesion. Apply the junction box marker to the application surface and press firmly. Ensure that entire edge around perimeter of marker is sealed to the application surface.

Position the marker in the approximate center of the junction box cover and orient the marker so that its text is parallel to long side of the cover. On curb sections install the marker on the flattest surface of the curb at a point that is perpendicular to the junction box.

Junction box markers are not required to be place on flat surfaces of the roadway where there is no curbing, unless required by the Engineer.

19.4. MEASUREMENT AND PAYMENT

Junction Box Marker will be measured and paid for as the actual number of junction box markers furnished, installed, and accepted.

No measurement will be made of junction box marker adhesive as this will be considered incidental to furnishing and installing the junction box marker.

Payment will be made under:

Pay Item	Pay Unit
Junction Box Marker	Each

20. MODIFY CABINET FOUNDATIONS

20.1. DESCRIPTION

Where directed by the Engineer, install conduit entrances into existing foundations. Modify existing foundations at the direction of the Engineer.

20.2. MATERIAL

Refer to Article 1752-2 of the Standard Specifications.

20.3. CONSTRUCTION METHODS

Comply with Article 1752-3 of the Standard Specifications.

20.4. 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 Hub Cabinet will be measured and paid as the actual number of existing Hub cabinet foundations modified and accepted.

Modify Foundation for RMS Cabinet will be measured and paid as the actual number of existing RMS cabinet foundations modified and accepted.

Modify Foundation for CCTV Cabinet will be measured and paid as the actual number of CCTV existing cabinet foundations modified and accepted.

Modify Foundation for DMS Cabinet will be measured and paid as the actual number of existing DMS cabinet foundations modified and accepted.

Payment will be made under:

Pay Item	Pay Unit
Conduit Entrance into Existing Foundation	Each
Modify Foundation for Hub Cabinet	Each
Modify Foundation for RMS Cabinet	Each
Modify Foundation for CCTV Cabinet	Each
Modify Foundation for DMS Cabinet	Each

21. BUILDING ENTRANCE CONDUIT MODIFICATIONS

21.1. DESCRIPTION

At the direction of the Engineer, furnish and install conduits and communications cables that enter into NCDOT-owned facilities. Coordinate with DIT for conduit and cable pathways and termination.

All construction to reach the building entrance is paid for using other pay items listed in these Project Special Provisions. All conduit work necessary relating to the entrance of the building is paid for under this Building Entrance Conduit Modification Section of the Project Special Provisions.

21.2. MATERIAL

Use riser, conduit material, and communication cables as specified in the Standard Specifications or these Project Special Provisions.

Ensure conduit and cabling are in compliance with the NEC and ANSI/TIA Standard 569 for telecommunication pathway and spaces in commercial buildings.

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

21.3. CONSTRUCTION METHODS

Contact the Engineer prior to entering any building. Coordinate and obtain approval from the Engineer regarding allowable working times and approval of methods and materials.

Whenever possible, use existing cable raceways, ducts and drop ceilings to route fiber-optic cables.

When working inside the building cover all furnishings, including furniture, and electronic and computer equipment with drop clothes to prevent them from debris to aid in cleanup. Replace raised floor panels and ceiling panels to clean up the dust and debris by the end of each work period unless otherwise approved by the Engineer. Replacement of any floor panels damaged during installation of the above ceiling conduit shall be considered incidental to this Section and will be at no expense to the Department.

Terminate all optic fibers in splice centers unless otherwise directed by the Engineer.

Install splice center with connector panels, splice trays, storage for slack cable or fibers, mounting and strain relief hardware, and all necessary hardware. Comply with all requirements of the “Fiber-Optic Splice Centers” Section of these Project Special Provisions.

Apply an Engineer-approved, UL-listed fire-stop sealant (putty, caulk, mortar, etc.) to reseal gaps between any existing conduits and holes through interior building wall and partitions.

21.4. MEASUREMENT AND PAYMENT

Building Entrance Conduit Modification will be measured and paid for as the actual number of each item type removed and accepted.

No measurement or payment will be made for sealant, mounting hardware, testing, cost of materials, and all other equipment necessary for proper installation of the conduit and cabling as such work will be considered incidental to the building entrance conduit modification.

No measurement or payment will be made for communication cabling as this is considered incidental to this Building Entrance Conduit Modification.

Payment will be made under:

Pay Item	Pay Unit
Building Entrance Conduit Modification	Each

22. ETHERNET EDGE SWITCH

Furnish and install a managed Ethernet edge switch as specified below that is fully compatible, interoperable, and completely interchangeable and functional within the existing City or Division traffic signal system communications network.

22.1. DESCRIPTION

A. Ethernet Edge Switch:

Furnish and install a hardened, field Ethernet edge switch (hereafter “edge switch”) for ITS devices as specified below. Ensure that the edge switch provides wire-speed, fast Ethernet connectivity at transmission rates of 100 megabits per second from each remote ITS device location to the routing switches.

Contact the DIT to arrange for the programming of the new Field Ethernet Switches with the necessary network configuration data, including but not limited to, the Project IP Address, Default Gateway, Subnet Mask and VLAN ID information. Provide a minimum five (5) days working notice to allow the City or Division to program the new devices.

B. Network Management:

Ensure that the edge switch is fully compatible with the Department’s existing Network Management Software.

22.2. MATERIALS

A. General:

Ensure that the edge switch is fully compatible and interoperable with the trunk Ethernet network interface and that the edge switch supports half and full duplex Ethernet communications.

Furnish an edge switch that provide 99.999% error-free operation, and that complies with the Electronic Industries Alliance (EIA) Ethernet data communication requirements using single-mode fiber-optic transmission medium and copper transmission medium. Ensure that the edge switch has a minimum mean time between failures (MTBF) of 10 years, or 87,600 hours, as calculated using the Bellcore/Telcordia SR-332 standard for reliability prediction.

B. Compatibility Acceptance

The Engineer has the authority to require the Contractor to submit a sample Field Ethernet Switch and Field Ethernet Transceiver along with all supporting documentation, software and testing procedures to allow a compatibility acceptance test be performed prior to approving the proposed Field Ethernet Switch and Field Ethernet Transceiver for deployment**. The Compatibility Acceptance testing will ensure that the proposed device is 100% compatible and interoperable with the existing City Signal System network, monitoring software and Traffic Operations Center network hardware.** Allow fifteen (15) working days for the Compatibility Acceptance Testing to be performed.

C. Standards:

Ensure that the edge switch complies with all applicable IEEE networking standards for Ethernet communications, including but not limited to:

- IEEE 802.1D standard for media access control (MAC) bridges used with the Spanning Tree Protocol (STP);
- IEEE 802.1Q standard for port-based virtual local area networks (VLANs);
- IEEE 802.1P standard for Quality of Service (QoS);
- IEEE 802.1w standard for MAC bridges used with the Rapid Spanning Tree Protocol (RSTP);
- IEEE 802.1s standard for MAC bridges used with the Multiple Spanning Tree Protocol;
- IEEE 802.1x standard for port based network access control, including RADIUS;
- IEEE 802.3 standard for local area network (LAN) and metropolitan area network (MAN) access and physical layer specifications;
- IEEE 802.3u supplement standard regarding 100 Base TX/100 Base FX;
- IEEE 802.3x standard regarding flow control with full duplex operation; and
- IFC 2236 regarding IGMP v2 compliance.
- IEEE 802.1AB Link Layer Discovery Protocol (LLDP)
- IEEE 802.3ad Ethernet Link Aggregation
- IEEE 802.3i for 10BASE-T (10 Mbit/s over Fiber-Optic)
- IEEE 802.3ab for 1000BASE-T (1Gbit/s over Ethernet)
- IEEE 802.3z for 1000BASE-X (1 Gbit/s Ethernet over Fiber-Optic)

D. Functional:

Ensure that the edge switch supports all Layer 2 management features and certain Layer 3 features related to multicast data transmission and routing. These features shall include, but not be limited to:

- An STP healing/convergence rate that meets or exceeds specifications published in the IEEE 802.1D standard.

- An RSTP healing/convergence rate that meets or exceeds specifications published in the IEEE 802.1w standard.
- An Ethernet edge switch that is a port-based VLAN and supports VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard, and has a minimum 4-kilobit VLAN address table (254 simultaneous).
- A forwarding/filtering rate that is a minimum of 14,880 packets per second for 10 megabits per second and 148,800 packets per second for 100 megabits per second.
- A minimum 4-kilobit MAC address table.
- Support of Traffic Class Expediting and Dynamic Multicast Filtering.
- Support of, at a minimum, snooping of Version 2 & 3 of the Internet Group Management Protocol (IGMP).
- Support of remote and local setup and management via telnet or secure Web-based GUI and command line interfaces.
- Support of the Simple Network Management Protocol version 3 (SNMPv3). Verify that the Ethernet edge switch can be accessed using the resident EIA-232 management port, a telecommunication network, or the Trivial File Transfer Protocol (TFTP).
- Port security through controlling access by the users. Ensure that the Ethernet edge switch has the capability to generate an alarm and shut down ports when an unauthorized user accesses the network.
- Support of remote monitoring (RMON-1 & RMON-2) of the Ethernet agent.
- Support of the TFTP and SNTP. Ensure that the Ethernet edge switch supports port mirroring for troubleshooting purposes when combined with a network analyzer.

E. Physical Features:

Ports: Provide 10/100/1000 Mbps auto-negotiating ports (RJ-45) copper Fast Ethernet ports for all edge switches. Provide auto-negotiation circuitry that will automatically negotiate the highest possible data rate and duplex operation possible with attached devices supporting the IEEE 802.3 Clause 28 auto-negotiation standard.

Optical Ports: Ensure that all fiber-optic link ports operate at 1310 or 1550 nanometers in single mode. Provide Type LC connectors for the optical ports, as specified in the Plans or by the Engineer. Do not use mechanical transfer registered jack (MTRJ) type connectors.

Provide an edge switch having a minimum of two optical 100/1000 Base X ports capable of transmitting data at 100/1000 megabits per second. Ensure that each optical port consists of a pair of fibers; one fiber will transmit (TX) data and one fiber will receive (RX) data. Ensure that the optical ports have an optical power budget of at least 15 dB.

Copper Ports: Provide an edge switch that includes a minimum of four copper ports. Provide Type RJ-45 copper ports and that auto-negotiate speed (i.e., 10/100/1000 Base) and duplex (i.e., full or half). Ensure that all 10/100/1000 Base TX ports meet the specifications detailed in this section and are compliant with the IEEE 802.3 standard pinouts. Ensure that all Category 5E unshielded twisted pair/shielded twisted pair network cables are compliant with the EIA/TIA-568-B standard.

*Port Security***:** Ensure that the edge switch supports/complies with the following (remotely) minimum requirements:

- Ability to configure static MAC addresses access;

- Ability to disable automatic address learning per ports; know hereafter as Secure Port. Secure Ports only forward; and
- Trap and alarm upon any unauthorized MAC address and shutdown for programmable duration. Port shutdown requires administrator to manually reset the port before communications are allowed.

F. Management Capabilities:

Ensure that the edge switch supports all Layer 2 management features and certain Layer 3 features related to multicast data transmission and routing. These features shall include, but not be limited to:

- An STP healing/convergence rate that meets or exceeds specifications published in the IEEE 802.1 D standards;
- An RSTP healing/convergence rate that meets or exceeds specifications published in the IEEE 802.1w standard;
- An Ethernet edge switch that is a port-based VLAN and supports VLAN tagging that meets or exceeds specifications as published in the IEEE 802.1Q standard, and has a minimum 4-kilobit VLAN address table (254 simultaneous);
- A forwarding/filtering rate that is a minimum of 14,880 packets per second for 10 megabits per second, 148,800 packets per second for 100 megabits per second and 1,488,000 packets per second for 1000 megabits per second;
- A minimum 4-kilobit MAC address table;
- Support of Traffic Class Expediting and Dynamic Multicast Filtering.
- Support of, at a minimum, snooping of Version 2 & 3 of the Internet Group Management Protocol (IGMP);
- Support of remote and local setup and management via telnet or secure Web-based GUI and command line interfaces; and
- Support of the Simple Network Management Protocol (SNMP). Verify that the Ethernet edge switch can be accessed using the resident EIA-232 management port, a telecommunication network, or the Trivial File Transfer Protocol (TFTP).

*Network Capabilities***:** Provide an edge switch that supports/complies with the following minimum requirements:

- Provide full implementation of IGMPv2 snooping (RFC 2236);
- Provide full implementation of SNMPv1, SNMPv2c, and/or SNMPv3;
- Provide support for the following RMON–I groups, at a minimum:
  - Part 1: Statistics
  - Part 2: History
  - Part 3: Alarm
  - Part 9: Event
- Provide support for the following RMON–2 groups, at a minimum:
  - Part 13: Address Map
  - Part 16: Layer Host
  - Part 17:Layer Matrix
  - Part 18:User History
- Capable of mirroring any port to any other port within the switch;
- Meet the IEEE 802.1Q (VLAN) standard per port for up to four VLANs;
- Meet the IEEE 802.3ad (Port Trunking) standard for a minimum of two groups of four ports;
- Password manageable;

- Telnet/CLI;
- HTTP (Embedded Web Server) with Secure Sockets Layer (SSL); and
- Full implementation of RFC 783 (TFTP) to allow remote firmware upgrades.

*Network Security***:** Provide an edge switch that supports/complies with the following (remotely) minimum network security requirements:

- Multi-level user passwords;
- RADIUS centralized password management (IEEE 802.1X);
- SNMPv3 encrypted authentication and access security;
- Port security through controlling access by the users: ensure that the Ethernet edge switch has the capability to generate an alarm and shut down ports when an unauthorized user accesses the network;
- Support of remote monitoring (RMON-1&2) of the Ethernet agent; and
- Support of the TFTP and SNTP. Ensure that the Ethernet edge switch supports port mirroring for troubleshooting purposes when combined with a network analyzer.

G. Electrical Specifications:

Ensure that the edge switch operates and power is supplied with 115 volts of alternating current (VAC). Ensure that the edge switch has a minimum operating input of 110 VAC and a maximum operating input of 130 VAC. Ensure that if the device requires operating voltages other than 120 VAC, supply the required voltage converter. Ensure that the maximum power consumption does not exceed 50 watts. Ensure that the edge switch has diagnostic light emitting diodes (LEDs), including link, TX, RX, speed (for Category 5E ports only), and power LEDs.

H. Environmental Specifications:

Ensure that the edge switch performs all of the required functions during and after being subjected to an ambient operating temperature range of -30 degrees to 165 degrees Fahrenheit as defined in the environmental requirements section of the NEMA TS 2 standard, with a noncondensing humidity of 0 to 95%.

Provide certification that the device has successfully completed environmental testing as defined in the environmental requirements section of the NEMA TS 2 standard. Provide certification that the device meets the vibration and shock resistance requirements of Sections 2.1.9 and 2.1.10, respectively, of the NEMA TS 2 standard. Ensure that the edge switch is protected from rain, dust, corrosive elements, and typical conditions found in a roadside environment.

The edge switch shall meet or exceed the following environmental standards:

- IEEE 1613 (electric utility substations)
- IEC 61850-3 (electric utility substations)
- IEEE 61800-3 (variable speed drive systems)
- IEC 61000-6-2 (generic industrial)
- EMF – FCC Part 15 CISPR (EN5502) Class A

I. Ethernet Patch Cable:

Furnish a factory pre-terminated/pre-connectorized Ethernet patch cable with each edge switch. Furnish Ethernet patch cables meeting the following physical requirements:

- Five (5)-foot length

- Category 5e or better
- Factory-installed RJ-45 connectors on both ends
- Molded anti-snag hoods over connectors
- Gold plated connectors

Furnish Fast Ethernet patch cords meeting the following minimum performance requirements:

- TIA/EIA-568-B-5, Additional Transmission Performance Specifications for 4-pair 100 Ω Enhanced Category 5 Cabling
- Frequency Range: 1-100 MHz
- Near-End Crosstalk (NEXT): 30.1 dB
- Power-sum NEXT: 27.1 dB
- Attenuation to Crosstalk Ratio (ACR): 6.1 dB
- Power-sum ACR: 3.1 dB
- Return Loss: 10dB
- Propagation Delay: 548 nsec

22.3. CONSTRUCTION METHODS

A. General:

Ensure that the edge switch is UL listed.

Verify that network/field/data patch cords meet all ANSI/EIA/TIA requirements for Category 5E and Category 6 four-pair unshielded twisted pair cabling with stranded conductors and RJ45 connectors.

Contact the Signal Shop a minimum of 5 days prior to installation for the most current edge switch IP Address, VLAN, subnet mask, default gateway and configuration files.

B. Edge Switch:

Mount the edge switch inside each field cabinet by securely fastening the edge switch to the upper end of the right rear vertical rail of the equipment rack using manufacturer-recommended or Engineer-approved attachment methods, attachment hardware and fasteners.

Ensure that the edge switch is mounted securely in the cabinet and is fully accessible by field technicians without blocking access to other equipment. Verify that fiber-optic jumpers consist of a length of cable that has connectors on both ends, primarily used for interconnecting termination or patching facilities and/or equipment.

22.4. MEASURMENT AND PAYMENT

Ethernet edge switch will be measured and paid as the actual number of Ethernet edge switches furnished, installed, and accepted.

Ethernet Cable will be measured and paid as the actual linear feet of Ethernet Cable furnished, installed, and accepted under PSP 23.

No separate measurement will be made for power cord, mounting hardware, nuts, bolts, brackets, or edge switch programming as these will be considered incidental to furnishing and installing the edge switch.

Payment will be made under:

Pay Item **Pay Unit**

Ethernet Edge Switch..... Each

23. ETHERNET CABLE

23.1. DESCRIPTION

Furnish and install Ethernet cable to serve as interconnect between Ethernet switches, PoE injectors, Signal Controllers and ITS devices.

23.2. MATERIALS

Furnish CAT6 Ethernet cable or better that complies with ANSI/TIA Standards for Balanced Twisted-Pair Telecommunications Cabling and Components Standards. Furnish cable that is suitable for outdoor installation with UV stabilization and meets or exceeds the following:

- Meets ANSI/TIA 568C.2 Networking Standard
- Supports 10/100/1,000/10,000Mbps
- 1,000Mbps @ 300 Meter Cable Length
- 10,000Mpbs @ 50 Meter Cable Length
- 4 twisted pair cables
- 23 AWG (minimum) solid bare copper conductors (Copper clad aluminum is not allowed)
- 2+ twists per centimeter
- Nylon Spline to reduce cross talk
- Gel Filled High-density polyethylene insulation, PVC jacket
- Ascending / Descending Sequential Foot Markings
- Compliant with EIA/TIA standards
- UL/CSA listed
- UV Stabilized PE Jacket
- Meets the following Minimum Electrical Operating Characteristics:
- Frequency Bandwidth: 1 – 250 MHz
- Attenuation (Insertion Loss): 19.8 dB
- Characteristic Impedance: 100 Ohms +/- 15
- Near-End Cross Talk - NEXT (Min.): 44.3 dB
- Power Sum Near-End Cross Talk PS-NEXT (Min.): 42.3 dB
- Equal-Level Far End Crosstalk (ELFEXT): 27.8 dB
- Power Sum Equal-Level Far End Crosstalk (PS-ELFEX): 24.8 dB
- Return Loss: 20.1 dB
- Delay Skew: 45 ns
- Connector Type: RJ45

The Ethernet 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 that are terminated according to EIA/TIA 568 standards. Provide connectors with eight contacts. Furnish connectors appropriately rated for the cable being installed.

Ethernet patch cables used to interconnect equipment inside of a cabinet or equipment rack shall be factory terminated. Ethernet cables which run outside of the cabinet may be field terminated. Ethernet cables installed inside of buildings to interconnect switching rack equipment shall bare the Low Smoke/Zero Halogen (LSZH) designation. Ethernet cables installed inside of buildings and passes from one equipment room to another may be field terminated. For Ethernet patch cables used to connect equipment inside an equipment rack cabinet provide factory preterminated jumpers that minimize excessive slack that must be dressed inside the cabinet but provides sufficient slack to make neat runs.

23.3. CONSTRUCTION METHODS

Install Ethernet cable in conduits, cabinets, junction boxes, risers, and on aerial messenger cable at locations shown in the Plans. Allow a minimum of 10 feet of cable slack in the cabinet.

Ethernet cables shall not be spliced. Ethernet cables should not exceed lengths of 100 meters or 328 feet. In cases where the Ethernet cables exceed lengths of 100 meters or 328 feet a signal regenerator or Ethernet extender shall be used. All Ethernet cables shall be labeled with waterproof, smear resistant labels. The labels shall denote the equipment cabinets or housing they are routed from and the device and device identifier they are connected to.

The contractor shall not exceed 80 percent of the manufacturer's maximum pulling tension when installing underground Ethernet 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.

23.4. MEASURMENT AND PAYMENT

Ethernet Cable will be measured and paid as the actual linear feet of Ethernet Cable furnished, installed, and accepted.

Payment will be made under:

Pay Item	**Pay Unit**
Ethernet Cable	Each

24. SOLAR POWER ASSEMBLY

24.1. DESCRIPTION

Furnish an operational Solar Power Assembly installed in a NEMA Type 3R enclosure for pole mounting.

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. Comply with all regulations and codes imposed by the owner of affected utility poles.

24.2. MATERIALS

A. Solar Powered Assembly:

A.1 General:

Furnish a Solar Power Assembly consisting of the following:

- Solar Array
- Solar Charge Controller
- Load Controller
- Battery(ies)
- NEMA 3R Equipment Cabinet

Ensure that DC disconnects are supplied between the Solar Array and the Solar Charge Controller, and between the Solar Charge Controller and the Battery(ies), and between the Battery(ies) and any other equipment.

A.2 Solar Power System Design Requirements:

Provide to the Engineer for Approval, a submittal package with Engineering Calculations consisting of, as a minimum, schematic drawing, technical data sheets, and supporting documentation. Ensure the documentation demonstrates, in theory, that the battery(ies) will provide for continuous operation for a minimum of ten (10) consecutive days with no additional charging under the following conditions:

a) Fully powering the Wireless Repeater Radio operating 24 hours a day with 50% of that time being in a standby (sleep) mode; and 50% of the time being in operational mode.

Provide drawings showing dimension, location of required equipment, cabinet electrical diagrams, part numbers and descriptions of required equipment and accessories to the Engineer.

A.3 Solar Array:

Furnish solar modules made in North America and have a minimum 20 year factory warranty. The solar array should have a minimum peak output of 80 Watts. Solar modules must be UL listed, FM Class I, Div II, Group C&D approved. For the solar array, power wiring should be 10-2, stranded copper, double insulated, sunlight resistant, 600V 90C rated cable. Ensure the solar array mount is manufactured from an aluminum alloy or stainless steel and is capable of withstanding 140 mph winds.

A.4 Solar Charger Controller:

Furnish a Pulse Width Modulation (PWM) solar charge controller that is UL listed, with a minimum 20A solid state, low voltage disconnect. The solar charge controller must be sealed with internal temperature compensation, lightning protection, reverse polarity protection, and LED indicators. Furnish controllers with the capability of 3 functions: battery charging, load control, and diversion regulation. Controllers must be furnished with fully adjustable DIP switches and RS-232

communications port to adjust the unit's operational modes. Ensure the solar charge controller is listed as a FM Class I, Div. II, Groups ABCD device and has the CE mark.

A.5 Load Controller:

Furnish a load controller that is identical to the solar charger controller provided as part of the solar power assembly. Configure the load controller to regulate the voltage of the assembly according to the manufacturer's recommendation.

A.6 Batteries:

Provide a 12V gel electrolyte, non-spillable, maintenance free battery. The battery(ies) should be able to provide power for 10 days without being charged by the Solar Array. Furnish battery(ies) with a minimum operating temperature of -76° F to 140°F.

A.7 NEMA 3R Equipment Cabinet:

Provide a NEMA 3R type Equipment Cabinet enclosure that is of a pole mount design, with compartments to house the battery(ies) and electronic components separately. Ensure that the equipment installed inside the cabinet does not occupy more than 60% of the total cabinet volume.

Ensure that the battery compartment and the electronic equipment compartments are ventilated with a screen and louvered vents. Equip vents with standard-size, replaceable furnace type vent filters. Size the filter tray to adequately house and secure the filter in place. Ensure there are no obstructions on the interior face of the door to interfere with easy removal and replacement of filter.

Provide an enclosure that is fabricated with unpainted, natural, aluminum that complies with Section 7 of NEMA TS-2-1998. Ensure the equipment cabinet enclosure shell is fitted with one (1) Corbin Number 2 Key, lifting handles, exhaust ports. Provide all necessary hardware to mount the enclosure securely to the pole. Provide hardware that is stainless steel or a Department approved non-corrosive alternate including the hinges and lifting handle.

Provide roof with slope (from front to back) at a minimum ratio of 1" drop per 2 feet. Ensure roof is flush with front of the door. Ensure each exterior cabinet plane surface is constructed of a single sheet of seamless aluminum.

Provide a handle and three point latching mechanism designed to be disassembled using hand tools. Provide a shaft connecting the latching plate to the door handle by passing through the door within a bushing, bearing, or equivalent device. Provide a latching plate at least 1/8 inch thick and that mates securely with the lock bolt. Provide a lock bolt with a flat end (no bevel) and that has at least 1/4 inch of length in contact with the latching plate.

Ensure that the handle and lock are positioned so that the lock does not lie in the path of the rotating handle as the door is unlatched and that the handle points down in the latched position.

Provide a main door opening that encompasses the full frontal area of the cabinet shell. Ensure that the cabinet shell is sturdy and does not exhibit noticeable flexing, bending or distortion under normal conditions, except that a minor amount of flexing is permitted in the main door when the cabinet is open. In such case, the flexing must not result in permanent deformation of the door.

A police panel door is not required for these cabinets.

Equipment in the equipment cabinet enclosure will be shelf mounted. Provide one equipment shelf in the cabinet that extends the practical width of the cabinet. Ensure that the shelf can be moved up and down within the cabinet. Do not locate permanently mounted equipment in such a

way that will restrict access to terminals. Ensure all components are arranged for easy access during servicing. When modular in construction, provide guides and positive connection devices to ensure proper pin alignment and connection.

Arrange equipment and terminals within the cabinet so that they will not interfere with the entrance, tracing and connection of conductors or other cables. Ensure all incoming and outgoing conductors are connected to terminal blocks. Ensure all field terminals are readily accessible without having to remove equipment to gain access. Ensure terminals are not located on the underside of shelf or at any other place where they are not readily visible or where they may present a hazard to personnel who might inadvertently touch them.

Provide terminal blocks that 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 consists of two terminal screws with removable shorting bar between them. Ensure all terminal blocks and terminals are labeled with their intended functions. Provide labels that are visible and easy to read when the terminal blocks are wired.

24.3. CONSTRUCTION METHODS

A. Solar Power Assembly:

Do not obstruct the sight distance of vehicles when locating and installing the equipment cabinet. Mount equipment cabinet so that the height to the middle of the cabinet is 4 feet above grade. Secure the cabinet to the pole using ¾" stainless steel straps or a method approved by the Engineer.

Ensure that the equipment cabinet along with solar array(s) and its mounting hardware are capable of surviving sustains winds of 140 MPH. Ensure the solar array(s) does not obstruct the view of traffic and that the array(s) are arranged for optimal sunlight exposure for charging of the battery(ies). Mount the array(s) at a minimum height of 25 feet above ground level.

Run field wiring from the solar power array(s) to the equipment cabinet through 1 inch riser with weatherhead and make connections inside the equipment cabinets as required. Install separate DC disconnects between the solar array and the solar charger controller and between the solar charger controller and the battery(ies), and between the battery(ies) and any other equipment. Ensure the DC disconnect allows personnel working on the system to safely isolate critical items from each other while performing maintenance and trouble shooting. Ensure that all wiring including grounding of the solar photovoltaic system meets the requirements of Article 690 of the National Electric Code (NEC) and these project special provisions.

To protect against high voltage power surges, furnish and install one grounding electrode at the equipment cabinet.

Terminate all wires using spade connectors under binding screws on terminal blocks. Label all terminal blocks and terminals for easy identification. Label all wires and harnesses for easy identification. Neatly secure all wiring and harness inside the cabinet in a method approved by the Engineer.

Provide and leave all data interface cables, installation manuals, and specifications and materials used to program any equipment in the Equipment Cabinet. Program all equipment for operation.

24.4. MEASURMENT AND PAYMENT

Solar Power Assembly will be measured and paid for as the actual number of solar power assemblies furnished, installed and accepted.

This item includes the appropriate sized Solar Power Assembly (Solar Array, Solar Charger Controller, Battery, NEMA 3R equipment cabinet), 1 inch riser with weatherhead, 2 inch riser with weatherhead, data interface cable/serial cable, cabling, lightning arrestor, labeling and any integration, installation materials and configuration software necessary to complete this work, including the Solar Power System Design Calculations and warranties, will be incidental.

Payment will be made under:

Solar Power Assembly .....Each

25. WIRELESS ETHERNET SYSTEM

25.1. DESCRIPTION

Furnish and install a spread spectrum wireless Ethernet 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 wireless 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. Wireless systems for transmission of compressed digital video shall operate at the 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.

At certain locations it will be necessary to integrate the radio system with a fiber-optic system.

25.2. MATERIALS

A. 5.8 GHz Wireless Radio System:

Furnish license free 5.8 GHz wireless broadband Integrated Ethernet radio system with antennas, cabling and mounting hardware, and configuration software. The 5.8 GHz wireless broadband Integrated Ethernet radio system shall include the radio, antennas, power supply, power injector, cabling and connectors, and surge protection. Design radio modem to work in "point-to-point", "point-to-multipoint", "multipoint-to-point", and "multipoint-to-multipoint" configurations. Ensure the wireless broadband Ethernet radio meets the following minimum requirements:

Wireless Interface

Radios:	1 2x2 MIMO transmitter and/or receiver
	2 2x2 MIMO transmitter and/or receiver

Antennas:	18dBi, 24deg Integrated MIMO panel
Data Connect Rate:	300 Mbps
Data Throughput Rate:	230 Mbps[1]
Frequency:	4900 - 5920 MHz[2] (Dynamic Freq Selection)
Transmit Power (Ant 1):	1000mW (30dBm)[2]
Transmit Power (Ant 2):	630mW (28dBm)[2]
Supported Channels:	10/20/40 MHz
Wireless Standards:	802.11a/n (Standard & Proprietary modes)
MAC protocols:	TDMA, CSMA/CA, Polling
Modulation:	OFDM (BPSK, QPSK,16-QAM, 64-QAM)
Quality of Service:	4 QoS class levels (voice, video, high, low)
Range:	5 miles at MCS7 with 18dBi antenna
TX Power / RX Sensitivity:	TX/RX at MCS0 30dBm / -96dBm TX/RX at MCS7 26dBm / -75dBm TX/RX at 6Mbit 30dBm / -96dBm TX/RX at 54Mbit 27dBm / -78dBm

Power

POE Input :	48VDC power injector and/or POE (802.3at) compatible switch on port 1
Consumption:	11 Watts maximum

Interfaces

Ethernet	1 Gigabit Ethernet port , 802.3af with Auto-MDI/X

Authentication, Security, and Encryption

Authentication:	RADIUS server MAC enabled
Security:	SSL based authentication
Local/Remote Admin:	SSH, IP/MAC Telnet, Win GUI, HTTPS, FTP, Serial Console
Encryption:	AES 128/256, Triple DES with CBC-MAC, RADIUS, EAP
VPN:	EOIP, VLAN, PPOE, PPTP, IPIP, L2TP
VLAN:	802.1Q / 802.1QinQ / 802.1ad

Protocols:	RTP/IP, UDP/IP, TCP/IP, HTTPS, VRRP, NTP, DNS, DHCP, ARP, WDS
GPS Support:	Asynchronous NMEA0183, NMEA/RTCM or simple text

Environmental & Enclosure Specifications

Material:	Cast aluminum
Finish:	Powder coat paint
Rating:	IP67, IP66
Temperature:	-40C to +70C
Humidity:	0-95% (wind driven rain)
Dimensions:	7.5” x 7.5” x 2.75”
Weight:	3 Lbs.
Connectors:	1 Weatherized feed thru for cables or conduit
LEDs:	Power, Ethernet Activity
Mounting:	Mast or pole
Grounding:	DC Ground
Vibration:	IEC 60721-3-4 4M5 Random
Mechanical:	IEC 60721-3-4 4M5
Solar Radiation:	ASTM G53 1000 hours
Ice Load:	25mm radial
Salt Fog:	IEC 68-2-11 Ka 500 hours
Regulations	FCC Part 15, Class B

Wireless Repeater System:

Furnish an operational wireless repeater system installed in a NEMA Type 3R enclosure for pole mounting. At a minimum, ensure the Wireless repeater meets the specifications provided above.

B. Software:

Furnish units with a Windows Based™ software program that uses a GUI (Graphical User Interface) to provide “remote programming, radio configuration, remote maintenance, diagnostics and spectrum analyzer” features. Ensure the software will operate on Microsoft ® Windows Operating Platforms. Provide configuration software that can be upgraded in the future at no additional charge.

Ensure the radio modem is configurable from a single location (i.e. master radio location) via supplied software (no extra cost). Furnish software supplied with drivers to allow easy set-up with all field devices that will be utilized on this project.

C. Antenna Mounting Hardware Kit:

Furnish an antenna mounting kit to support the antenna when attached to a metal pole, mast arm, or wood pole. Furnish PELCO – "Antenna Mount, Cable Astro-Brac for Yagi Antenna" or an approved equivalent.

Ensure the Antenna Mounting Hardware Kit includes a minimum of a 96" galvanized cable with stainless steel bolt with a nut and lock washer assembly on each end. Ensure the 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 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. Proved a 90 degree elbow with internal threads on both ends to accommodate 1 ½" NPT aluminum pipes. Provide a 1 ½" x 18" long aluminum pipe threaded on both ends and a 1 ½" x 24" aluminum pipe threaded on 1 end with an end cap.

PELCO PART #'s	DESCRIPTION	QUANTITY
AB-3034-96-PNC	Astro-Brac Clamp Kit, 1 ½" NPS, Galv Cable, Alum	1
AB-0260	TUBE CAP, PLASTIC	1
SE-0436-18	NIPPLE, 1 ½" x 18" LONG, ALUM, THREADED ON BOTH ENDS	1
SE-0457-DS-PNC	ELL, SERRATED, 1 ½", DOUBLE SET SCREW, DIE CAST ALUM	1
SE-0326-24	SUPPORT TUBE, SCH 40, 1 ½" NPS x 24" LONG, ALUM, THREADED ON ONE END	1

D. Coaxial Cable:

Furnish 400 Series coaxial cable to provide a link between the antenna and the lightning arrestor that meets the following minimum specifications:

Attenuation (dB per 100 feet) @ 900 MHz	3.9 dB
Power Rating @ 900 MHz	0.58 kW
Center Conductor	0.108" Copper Clad Aluminum
Dielectric: Cellular PE	0.285"
Shield	Aluminum Tape – 0.291" Tinned Copper Braid – 0.320"
Jacket	Black UV protected polyethylene
Bend Radius	1" with less than 1 ohm impedance change at bend
Impedance	50 ohms
Capacitance per foot	23.9 pf/ft
End Connectors	Standard N-Type Male Connectors on both ends

E. Standard N-Type Male Connector:

Furnish Standard N-Type Male Connector(s) of proper sizing to mate with the 400 series coaxial cable and utilize a crimping method to secure the connector to the coaxial cable. Furnish a connector that meets the following minimum specifications:

- Center Contact: Gold Plated Beryllium Copper-(spring loaded – Non-solder)
- Outer Contact: Silver Plated Brass
- Body: Silver Plated Brass
- Crimp Sleeve: Silver Plated Copper
- Dielectric: Teflon PTFE
- Water Proofing Sleeve: Adhesive Lined Polyolefin – Heat Shrink
- Attachment Size: Crimp Size 0.429" (minimum) hex

Electrical Properties:

- Impedance: 50 ohms
- Working Voltage: 1000 vrms (max)
- Insertion loss: 0.1 x √ Fghz
- VSWR: 1.25:1 (max) up to 3GHz

Provide instructions on properly installing the connector.

F. Coaxial Cable Shield Grounding and Weatherproofing Kits:

Furnish a Coaxial Cable Shield Grounding Kit containing components that will adequately bond and ground the cable shield to the pole ground. Ensure the grounding kit complies with MIL-STD-188-124A Specifications "Military Standard for Grounding, Bonding and Shielding" for coaxial cable and protects the cable from lightning currents in excess of 200kA. Ensure each kit is supplied, as a minimum, with the following:

- Preformed Strap: 24 Gauge copper strap that is a minimum of 1 5/8 inch long and is sized to mate with the 400 series coaxial cable
- Tensioning Hardware: Copper nuts and lock washers
- Grounding Lead Cable: #6 AWG, stranded, insulated copper wire
- Instructions on properly installing the shield grounding system

Furnish a Weatherproofing Kit containing components that will protect the coaxial cable shield grounding system against the ingress of moisture and prevent vibrations from loosening the connections. Ensure the weatherproofing kit is supplied, as a minimum, with the following:

- Butyl Mastic Tape: 3 3/4 inches wide by 24 inches long (approximately)
- Electrical Tape: 2 inch wide by 20 inches long (approximately)
- Instructions on properly installing the weatherproofing system

G. Lightning Arrestor:

Furnish a lightning arrestor installed in line between each antenna and its designated radio modem inside the equipment cabinet. Furnish a Polyphaser Model # DSXL-BF lightning arrestor or an approved equivalent that meets the following minimum specifications:

- Filter Type – DC Block (None gas tube design)
- Surge: 20kA, 800MHz to 2.0GHz $\leq$ 1.1 : 1 VSWR
  18kA, 800MHz to 2.3GHz $\leq$ 1.1 : 1 VSWR
  700MHz to 2.7GHz $\leq$ 1.2 : 1 VSWR
- Insertion Loss: ≤0.1 dB over frequency range
- Max Power: 500 w @ 920MHz (750 W @ at 122° F)
- RF Power: 300 Watts
- Let Through Voltage: ≤+/- 3 Volts for 3kA @ 8/20 µs Waveform
- Throughput energy: ≤ 0.5 µJ for 3kA @ 8/20 µs Waveform

- Temperature: -40 to 185° F Storage/Operating 122° F
- Vibration: 1G at 5 Hz up to 100Hz
- Unit Impedance: 50Ω
- VSWR: 1.1:1
- Frequency Range: 800 MHz to 2200 MHz
- Multistrike capability
- Low strike throughput energy
- Flange mount and bulkhead mount options
- Standard N-Type Female Connector on both the surge side and protected side connectors

H. Coaxial Cable – Power Divider (Splitter):

Furnish a coaxial cable – power divider for repeater radio sites. Ensure the power divider accommodates a single primary input RF source and divides/splits the signal (power) equally between two output ports. Furnish a Telewave Inc., Model ANT-PD29 power divider or an approved equivalent that meets the following minimum specifications.

Power Division	2 – Way
Frequency	900 – 1100 MHz
Insertion Loss	0.22 dB
Impedance	50 Ohm
VSWR ref. to 50 Ohm (max)	1.3:1
Max. Input Power	500 Watts
Connectors	Standard N-Type Female
Dimension	2.5”W x 5”L
Weight	1.5 lbs (approximately)

I. Surge Suppression:

Provide surge protection in the equipment cabinet. All surge protection devices shall have an ambient operating temperature of -40 degrees F to 165 degrees F with 95 percent non-condensing relative humidity. All surge protection devices shall comply with UL 497A for paired data communications.

Provide specialized surge protection devices at the supply side of all low voltage connections to the radios. These connections include Ethernet data cables that comply with EIA requirements.

These specialized surge protection units shall be UL listed according to the UL 497A. The minimum surge current rating for the surge protection shall be 2,000 amps for data and telecommunications.

25.3. CONSTRUCTION METHODS

A. General

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 – power divider, antenna splitter cable 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.

Install the coaxial cable shield grounding system by carefully removing the outer jacket of the coaxial cable without damaging the cable shield. Install the shield grounding system following the cable manufacturer's recommendations. Install and weatherproof the connection using the appropriate weatherproofing materials and following the manufacturer's recommendations. On wood poles, secure the #6 AWG grounding lead cable to the pole ground using split bolt or compression type fitting or an Engineer approved method. On metal poles, secure the #6 AWG grounding lead cable to the pole using an Engineer approved method.

Do not exceed the 1-inch bend radius of the coaxial cable as it traverses from the cabinet to the antenna assembly. Connect the lightning arrestor to the coaxial cable in the equipment cabinet. Properly ground and secure the arrestor in the cabinet. Permanently label all cables entering the cabinet. Ensure the power supply for the wireless Ethernet 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 wireless Ethernet system with a fiber optic system. Follow the details shown in the fiber optic splice plans.

Repeater Cabinets:

Do not obstruct the sight distance of vehicles when locating and installing cabinets.

Install the pole-mounted cabinet approximately five feet from the ground line to the top of the cabinet. Secure the cabinet to the pole using 'Band-It' brackets or a method approved by the Engineer. Leave the RS-232 data interface cable in the cabinet.

25.4. MEASUREMENT AND PAYMENT

Wireless Ethernet System will be measured and paid for as the actual number of wireless systems furnished, installed and accepted. A system is defined as a point-to-point or point-to-multipoint configuration of wireless radios that are integrated with the fiber optic network.

This item includes the appropriately sized radios, antennas, power supplies and POE injectors, disconnect/snap switches, vertical risers with weatherheads, interface cabling, coaxial cabling, lightning arrestors, radio frequency signal jumpers, coaxial cable power dividers (Splitter), coaxial cable connectors, coaxial cable shield grounding systems with weatherproofing, and labeling. Any integration between the wireless 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.

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

This item includes the appropriately sized NEMA 3R cabinet, radios, antennas, conduit, vertical risers with weatherheads, power supplies and injectors, disconnect/snap switch, interface cabling, coaxial cabling, lightning arrestors, radio frequency signal jumpers, coaxial cable power dividers (Splitter), coaxial cable connectors, coaxial cable shield grounding systems with weatherproofing, and labeling. Any integration, 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 System	Each
Wireless Ethernet Repeater System	Each

26. DIGITAL CCTV CAMERA ASSEMBLY

26.1. DESCRIPTION

Furnish and install a Digital CCTV Camera Assembly as described in these Project Special Provisions. All new CCTV cameras shall be fully compatible with the video management software currently in use by the Region and the Statewide Traffic Operations Center (STOC). Provide a Pelco Spectra Enhanced low light 30X minimum zoom, Axis Dome Network Camera low light 30X minimum zoom or an approved equivalent that meets the requirements of these Project Special Provisions.

26.2. MATERIALS

A. General

Furnish and install new CCTV camera assembly at the locations shown on the Plans and as approved by the Engineer. 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
- A NEMA-rated enclosure constructed of aluminum with a clear acrylic dome or approved equal Camera Unit housing.
- Motorized pan, tilt, and zoom
- Built-in video encoder capable of H.264/MPEG-4 compression for video-over IP transmission
- Pole-mount camera attachment assembly
- A lightning arrestor installed in-line between the CCTV camera and the equipment cabinet components.
- All necessary cable, connectors and incidental hardware to make a complete and operable system.

B. Camera and Lens

1. Cameras

Furnish a new CCTV camera that utilizes charged-coupled device (CCD) technology or Complementary Metal-Oxide-Semiconductor (CMOS) technology. The camera must meet the following minimum requirements:

- Video Resolution: Minimum 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 (EIS)
- Automatic focus with manual override

2. Zoom Lens

Furnish each camera with a motorized zoom lens that is a 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 minimum optical zoom, and 12X minimum digital zoom
- Preset positioning: minimum of 128 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.

Communication Standards:

The CCTV camera shall support the appropriate NTCIP 1205 communication protocol (version 1.08 or higher), ONVIF Profile G protocol, or approved equal.

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, IP6
- 130 db Wide Dynamic Range (WDR)

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 assembly. 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. The pendant must meet NEMA Type 4X, IP66 rating and use 1-1/2-inch NPT thread. The sustained operating temperature must be -50 to 60C (-58 to 144F), condensing temperature 10 to 100% Relative Humidity (RH).

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 rotation
- Tilt: up/down +2 to -90 degrees minimum
- Motors: Two-phase induction type, continuous duty, instantaneous reversing
- Preset Positioning: minimum of 128 presets
- Low latency for improved Pan and Tilt Control
- FCC, Class A; UL/cUL Listed

E. Video Ethernet Encoder

Furnish cameras with a built-in digital video Ethernet encoder to allow video-over-IP transmission. The encoder units must be built into the camera housing and require no additional equipment to transmit encoded video over IP networks.

Encoders must have the following minimum features:

- Network Interface: Ethernet 10/100Base-TX (RJ-45 connector)
- Protocols: IPv4, Ipv6, HTTP, UpnP, DNS, NTP, RTP, RTSP, TCP, UDP, IGMP, and DHCP
- Security: SSL, SSH, 802.1x, HTTPS encryption with password-controlled browser interface
- Video Streams: Minimum 2 simultaneous streams, user configurable
- Compression: H.264 (MPEG-4 Part 10/AVC)
- Resolution Scalable: NTSC-compatible 320x176 to 1920x1080 (HDTV 1080p

- Aspect Ratio: 16:9
- Frame Rate: 1-30 FPS programmable (full motion)
- Bandwidth: 30 kbps – 6 Mbps, configurable depending on resolution
- Edge Storage: SD/SDHC/SDXC slot supporting up to 64GB memory card

F. 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 128 preset positions for pan, tilt, and zoom, 16 Preset Tours, 256 Dome Presets
- Up to 32 Window Blanks.

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.

G. Electrical

The camera assembly shall support Power-over-Ethernet (PoE) in compliance with IEEE 802.3. Provide any external power injector that is required for PoE with each CCTV assembly.

H. 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).

I. Riser

Furnish material meeting the requirements of Section 1091-3 and 1098-4 of the 2018 Standard Specifications for Roads and Structures. Furnish a 1" riser with weatherhead for instances where the riser is only carrying an Ethernet cable. For installations where fiber optic cable is routed to the

cabinet through a 2" riser with heat shrink tubing the Contractor may elect to install the Ethernet cable in the same riser with the fiber cable.

J. Data line Surge Suppression

Furnish data line surge protection devices (SPD) shall meet the following minimum requirements:

- UL497B
- Service Voltage: < 60 V
- Protection Modes: L-G (All), L-L (All)
- Response Time: <5 nanoseconds
- Port Type: Shielded RJ-45 IN/Out
- Clamping Level: 75 V
- Surge Current Rating: 20 kA/Pair
- Power Handling: 144 Watts
- Data Rate: up to 10 GbE
- Operating Temperature: -40º F to + 158º F
- Standards Compliance: Cat-5e, EIA/TIA 568A and EIA/TIA 568B
- Warranty: Minimum of 5-year limited warranty

The data line surge protector shall be designed to operate with Power Over Ethernet (POE) devices. The SPD shall be designed such that when used with shielded cabling, a separate earth ground is not required. It shall be compatible with Cat-5e, Cat 6, and Cat-6A cablings.

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.

K. POE Injector

Furnish POE Injectors meeting the following minimum performance requirements and that is compatible with the CCTV Camera and Ethernet Switch provided for the project.

- Working temp/humidity: 14º F to 131º F/maximum 90%, non-condensing
- Connectors: Shielded RJ-45, EIA 568A and EIA 568B
- Input Power: 100 to 240 VAC, 50 to 60 Hz
- Pass Through Data Rates: 10/100/1000 Mbps
- Regulatory: IEEE 802.3at (POE)
- Number of Ports: 1 In and 1 Out
- Safety Approvals: UL Listed

Ensure the POE Injector is designed for Plug-and-Play installation, requiring no configurations and supports automatic detection and protection of non-standard Ethernet Terminal configurations.

26.3. CONSTRUCTION METHODS

L. General

Obtain approval of the camera locations and orientation from the Engineer prior to installing the CCTV camera assembly.

Mount CCTV camera units at a height to adequately see traffic in all directions and as approved by the Engineer. The maximum attachment height is 45 feet above ground level unless specified elsewhere or directed by the Engineer.

Mount the CCTV camera units such that a minimum 5 feet of clearance is maintained between the camera and the top of the pole.

Mount CCTV cameras on the side of poles nearest intended field of view. Avoid occluding the view with the pole.

Install the data line surge protection device and POE Injector in accordance with the manufacturer's recommendations.

Install the riser in accordance with Section 1722-3 of the 2018 Standard Specifications for Roads and Structures. Install the Ethernet cable in the riser from the field cabinet to the CCTV camera.

M. Electrical and Mechanical Requirements

Install an "Air Terminal and Lightning Protections System" in accordance with the Air Terminal and Lightning Protection System Specification for the the CCTV Camera Assembly. 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.

26.4. GENERAL TEST PROCEDURE

Test the CCTV Camera and its components in a series of functional tests and ensure the results of each test meet the specified requirements. These tests should not damage the equipment. The Engineer will reject equipment that fails to fulfill the requirements of any test. Resubmit rejected equipment after correcting non-conformities and re-testing; completely document all diagnoses and corrective actions. Modify all equipment furnished under this contract, without additional cost to the Department, to incorporate all design changes necessary to pass the required tests.

Provide 4 copies of all test procedures and requirements to the Engineer for review and approval at least 30 days prior to the testing start date.

Only use approved procedures for the tests. Include the following in the test procedures:

- A step-by-step outline of the test sequence that demonstrates the testing of every function of the equipment or system tested
- A description of the expected nominal operation, output, and test results, and the pass / fail criteria
- An estimate of the test duration and a proposed test schedule
- A data form to record all data and quantitative results obtained during the test

- A description of any special equipment, setup, manpower, or conditions required by the test

Provide all necessary test equipment and technical support. Use test equipment calibrated to National Institute of Standards and Technology (NIST) standards. Provide calibration documentation upon request.

Conform to these testing requirements and the requirements of these specifications. It is the Contractor's responsibility to ensure the system functions properly even after the Engineer accepts the CCTV test results.

Provide 4 copies of the quantitative test results and data forms containing all data taken, highlighting any non-conforming results and remedies taken, to the Engineer for approval. An authorized representative of the manufacturer must sign the test results and data forms.

26.5. COMPATIBILITY TESTS

A. CCTV System

Compatibility Tests are applicable to CCTV cameras that the Contractor wishes to furnish but are of a different manufacturer or model series than the existing units installed in the Region. If required, the Compatibility Test shall be completed and accepted by the Engineer prior to approval of the material submittal.

The Compatibility Test shall be performed in a laboratory environment at a facility chosen by the Engineer based on the type of unit being tested. Provide notice to the Engineer with the material submitted that a Compatibility Test is requested. The notice shall include a detailed test plan that will show compatibility with existing equipment. The notice shall be given a minimum of 15 calendar days prior to the beginning of the Compatibility Test.

The Contractor shall provide, install, and integrate a full-functioning unit to be tested. The Department will provide access to existing equipment to facilitate these testing procedures. The Engineer will determine if the Compatibility Test was acceptable for each proposed device. To prove compatibility the Contractor is responsible for configuring the proposed equipment at the applicable Traffic Operations Center (TOC) with the accompaniment of an approved TOC employee.

26.6. OPERATIONAL FIELD TEST (ON-SITE COMMISSIONING)

A. CCTV System

Final CCTV locations must be field verified and approved by the Engineer. Perform the following local operational field tests at the camera assembly field site in accordance with the test plans and in the presence of the Engineer. The Contractor is responsible for providing a laptop for camera control and positioning during the test. After completing the installation of the camera assemblies, including the camera hardware, power supply, and connecting cables, the contractor shall:

Local Field Testing

Furnish all equipment and labor necessary to test the installed camera and perform the following tests before any connections are made.

- Verify that physical construction has been completed.
- Inspect the quality and tightness of ground and surge protector connections.

- Check the power supply voltages and outputs, check connection of devices to power source.
- Verify installation of specified cables and connection between the camera, PTZ, camera control receiver, and control cabinet.
- Make sure cabinet wiring is neat and labeled properly; check wiring for any wear and tear; check for exposed or loose wires.
- Perform the CCTV assembly manufacturer's initial power-on test in accordance with the manufacturer's recommendation.
- Set the camera control address.
- Exercise the pan, tilt, zoom, and focus operations along with preset positioning, and power on/off functions.
- Demonstrate the pan, tilt and zoom speeds and movement operation meet all applicable standards, specifications, and requirements.
- Define, test and/or change presets.
- Ensure camera field of view is adjusted properly and there are no objects obstructing the view.
- Ensure camera lens is dust-free.
- Ensure risers are bonded and conduits entering cabinets are sealed properly.
- Lightning arrestor bonded correctly.

Central Operations Testing

- Interconnect the CCTV Camera's communication interface device with one of the following methods as depicted on the plans:
    - communication network's assigned Ethernet switch and assigned fiber-optic trunk cable and verify a transmit/receive LED is functioning and that the CCTV camera is fully operational at the TOC.

    OR

    - to the DOT furnished cellular modem and verify a transmit/receive LED is functioning and that the CCTV camera is fully operational at the TOC.
- Exercise the pan, tilt, zoom, and focus operations along with preset positioning, and power on/off functions.
- Demonstrate the pan, tilt and zoom speeds and movement operation meet all applicable standards, specifications, and requirements.
- Define, test and/or change presets.

Approval of Operational Field Test results does not relieve the Contractor to conform to the requirements in these Project Special Provisions. If the CCTV system does not pass these tests,

document a correction or substitute a new unit as approved by the Engineer. Re-test the system until it passes all requirements.

26.7. 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, risers, grounding equipment, surge protectors, PoE Injectors, PoE Cable, Air Terminal and Lightning Protection System, compatibility testing, operational testing or any other equipment or labor required to install the digital CCTV assembly.

Payment will be made under:

Pay Item	Pay Unit
Digital CCTV Camera Assembly	Each

27. CCTV FIELD EQUIPMENT CABINET

27.1. DESCRIPTION

For standalone CCTV Camera installations, furnish 336S pole mounted cabinets to house CCTV control and transmission 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.

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 terminal blocks for power for cabinet CCTV and communications devices as needed to accommodate the number of devices in the cabinet.

Furnish all conduits, shelving, mounting adapters, and other equipment as necessary to route cabling, mount equipment and terminate conduit in the equipment cabinet.

27.2. MATERIALS

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.

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.

3. Uninterruptible Power Supply (UPS)

Furnish and install one rack mounted UPS in each new cabinet that meet the following minimum specifications:

Output

Output Power Capacity	480 Watts / 750 VA
Max Configurable Power	480 Watts / 750 VA
Nominal Output Voltage	120V
Output Voltage Distortion	Less than 5% at full load
Output Frequency (sync to mains)	57 - 63 Hz for 60 Hz nominal
Crest Factor	up to 5:1
Waveform Type	Sine wave
Output Connections	(4) NEMA 5-15R

Input

Nominal Input Voltage	120V
Input Frequency	50/60 Hz +/- 3 Hz (auto sensing)
Input Connections	NEMA 5-15P
Cord Length	6 feet
Input voltage range for main operations	82 - 144V
Input voltage adjustable range for mains operation	75 -154 V

Battery Type

Maintenance-free sealed Lead-Acid battery with suspended electrolyte, leak-proof.

Typical recharge time	2 hours

Communications & Management

Interface Port(s)	DB-9 RS-232, USB
Control panel	LED status display with load and battery bar-graphs

Surge Protection and Filtering	
Surge energy rating	480 Joules
Environmental	
Operating Environment	-32 - 104 °F
Operating Relative Humidity	0 - 95%
Storage Temperature	5 - 113 °F
Storage Relative Humidity	0 - 95%
Conformance	
Regulatory Approvals	FCC Part 15 Class A, UL 1778

27.3. CONSTRUCTION METHODS

A. General

For each field equipment cabinet installation, use stainless steel banding or other methods approved by the Engineer to fasten the cabinet to the pole. Install field equipment cabinets so that the height to the middle of the enclosure is 4 feet from ground level. No risers shall enter the top or sides of the equipment cabinet.

Install all conduits, condulets, and attachments to equipment cabinets in a manner that preserves the minimum bending radius of cables and creates waterproof connections and seals.

Install a UPS in each cabinet and power all CCTV cameras from the UPS.

27.4. MEASUREMENT AND PAYMENT

Field equipment cabinet will be measured and paid as the actual number of CCTV equipment cabinets furnished, installed and accepted.

No payment will be made for the UPS, 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 CCTV equipment.

Payment will be made under:

Pay Item	Pay Unit
Field Equipment Cabinet	Each

28. CCTV CAMERA LOWERING SYSTEM

28.1. DESCRIPTION

Provide a CCTV lowering system for a digital CCTV camera as an integral part of the CCTV metal pole. The lowering system will consist of a support arm, camera connection unit, internal lowering system and winch cable, metal frame with winch, and all necessary cabling and wiring for installation. The camera connection unit serves a dual role as it identifies the mechanical point were the unit attaches and detaches to the support arm to carry the CCTV camera and where the power and data cable connections occur. The camera connection unit is made up of two halves, the upper

halve is permanently affixed to the support arm and the lower halve is affixed to the CCTV for lowering and raising operations.

Provide a portable metal frame and winch assembly to facilitate raising and lowering of the CCTV Camera.

Ensure that all exposed components of the lowering system (support arm, camera connection unit) are made of corrosion-resistant materials that are powder-coated or galvanized or otherwise protected from the environment by industry-accepted coatings that withstand exposure to the environment. Ensure the internal components of the camera connection unit (power and data cable interface and locking/latching mechanism) are protected from exposure to external environmental conditions (rain, snow, ice, and UV) by an outer covering or shield made of aluminum or other acceptable materials.

28.2. MATERIALS

A. Winch Cable

The winch cable shall be a minimum diameter of 0.125 inch and constructed of a minimum of 7 strands, 19-gauge, stainless-steel aircraft cable with a minimum breaking strength of 1,740 pounds. Provide materials as recommend by the Manufacturer to connect one end of the winch cable to the lower halve of the camera connection unit, on the opposite end provide a quick release cable connect loop.

Ensure the stainless-steel winch cable when installed will not flex and twist and ensure that only the winch cable will be in motion inside the metal pole when the lowering device is operated. Provide a bracket inside the lower position of the pole to secure the loose end of the winch cable when not in use. Ensure that all other cables remain stable and secure during lowering and raising operations.

B. Camera Connection Unit

Camera Connection Unit (Electrical):

Ensure that the camera connection unit makes accommodations for an internal terminal adapter for power and data cable connections between the cabinet and the equipment installed at the support arm. Ensure the lowering system and its camera wiring connection system are designed so that no degradation in functionality of the cameras overall performance is affected when the CCTV camera is installed and operational. Ensure that the camera connection unit design ensures proper alignment of the power and data cable conductors when the CCTV Camera is being lifted into place.

As an integral part of the camera connection unit, provide molded electrical terminal block halves equipped with modular, self-aligning and self-adjusting female and male socket contacts. The molded electrical terminal block halves must be equipped with sufficient contacts to permit operation of all required functions of the camera.

The female socket contacts and the male contact halves must be of heavy-duty construction and the connector blocks made of molded synthetic rubber, molded chlorosulfonated polyethylene, polymer body or approved equal. The connector pins shall be made of brass or gold-plated nickel, or gold-plated copper. The current-carrying male and female contacts shall have a minimum diameter of 0.09 inch.

Provide cored holes in the molded electrical terminal block halves to create moisture-tight seals when mated. All wire leads from both the male and female contacts shall be permanently molded in a body of chlorosulfonated polyethylene, or an approved equivalent. All contacts shall be self-wiping with a shoulder at the base of each male contact so that it recesses in the female block, thereby giving each contact a rain-tight seal when mated. The molded electrical terminal block

halves shall be rated to carry the full amperage load of the camera. Upon request by the Engineer, submit documentation showing pin assignments and verification that the molded electrical terminal block halves are design sufficiently to withstand continuous operation of the camera at full load conditions.

Camera Connection Unit (Mechanical)

Ensure the camera connection unit has a minimum load capacity of 200 pounds with a 4:1 safety factor. Fixed and movable components of the camera connection unit must have a mechanical locking mechanism which automatically locks and unlocks the physical connections when engaging or disengaging the two halves. Provide a minimum of two mechanical latches for the movable assembly and, when latched, ensure that all weight is removed from the winch cable. Provide the upper halve of the unit with a heavy-duty tracking guide and a means to control the latching operation in the same position each time.

Fabricate the camera connection unit to allow the winch cable to pass through itself at the point where the upper halve connects with the lower halve. Ensure the assembly provides an internal guide to ensure the lowering cable does not scrub against the molded electrical termination block and cannot come entangled with the mechanical locking mechanisms of the unit.

For lowering of the CCTV Camera design the locking system such that by first tightening the winch cable it will allow the latching arms to re-set into a static state so that when the winch is reversed it will cause the locking arms to release so that the CCTV Camera can be lowered. For raising of the CCTV Camera design the locking system such that by first tightening the winch cable it will allow the latching arms to re-set into a static state so that when the winch is reversed it will cause the locking arms to engage so that the CCTV Camera will be supported in its operational state. When the CCTV Camera is in its operational state, ensure that all weight and pulling forces are removed from the winch cable. Design the unit with a tracking guide pin to align the bottom moving halve with the top stationary halve to ensure proper alignment of the connector pins and mechanical locking features of the unit.

Provide a protective shell around the Camera Connection Unit constructed of aluminum or other approved materials.

C. Metal Frame and Winch Assembly

Provide a portable metal-frame with winch assembly that can be temporarily fasten and secured to the pole structure and connected to the winch cable to facilitate lowering and raising of the CCTV Camera. Ensure the metal frame and winch's combined weight is less than 35 pounds. Provide a quick release cable connector to secure the winch cables to one another. Ensure the winch is of a design that includes an adjustable safety clutch that incorporates a positive braking mechanism to secure the cable reel during raising and lowering operations to prevent freewheeling and has gearing that reduces the manual effort required to operate the manual lifting handle (handle crank) to raise and lower the load.

The physical process of lowering or raising the CCTV Camera shall be accomplished through a handle crank supplied with the lowering unit or via a portable lowering device to operate the winch assembly such as a variable-speed reversible electric drill or a lowering unit with a built-in electrical motor.

All lowering equipment shall be manufactured of durable, corrosion resistant materials, powder coated, galvanized, or otherwise protected from the environment by industry-accepted coatings to withstand exposure to corrosive environment. All pulleys installed for the lowering device and

portable tool must have sealed self-lubricated bearings, oil-tight bronze bearings or sintered bronze bushings.

D. Variable Speed Drill

Furnish a half-inch chuck, variable-speed reversible industrial-duty electric drill that matches the manufacturer-recommended revolutions per minute or supply the metal frame with winch with a permanently attached 120 Volt electric motor. If required furnish an adapter to transition from hand crack operation to portable drill operation.

28.3. CONSTRUCTION METHODS

Assemble the CCTV lowering systems internal components inside the metal pole cavity, consisting of the winch cable, pulleys and other hardware. Secure the support arm to the metal pole using stainless steel bolts, washers and hardware and tightened to specifications provide by the manufacturer. Fish the winch cable through the metal pole and out the support arm and thought the upper halve of the connection unit and secure the winch cable to the bottom halve of the connection unit. Terminate the power and data cable to the molded termination block located in the upper connection unit. Ensure that the lower halve of the connection unit, with the CCTV Camera attached, aligns with the upper halve of the connection unit. Ensure the completed assembly aligns correctly and that the power and data cable termination points align correctly, and that the installation will not allow the unit to twist when subject to sustained 140 MPH wind speeds.

Provide 1.25-inch-diameter PVC conduit inside the metal pole cavity and install the power and data cable. Ensure the power and data cable is supported with a strain relief sleeve and routed in such a manner that it will not come into contact with the winch cable and its pully system once installed.

28.4. MEASUREMENT AND PAYMENT

CCTV Camera Lowering System will be measured and paid as the actual number of CCTV Camera Lowering Systems furnished, installed, integrated and accepted.

Variable Speed Drill will be measured and paid as the actual number of Variable Speed Drills furnished, installed and accepted.

No payment will be made for PVC conduits installed inside the CCTV Pole, winch cable, metal frame and winch assembly, camera connection unit, support sleeves, pully and any other hardware as these will be considered incidental to furnishing and installing a CCTV Camera lowering System.

Payment will be made under:

Pay Item	Pay Unit
CCTV Camera Lowering System	Each
Variable Speed Drill	Each

29. DYNAMIC MESSAGE SIGN (DMS)

29.1. DESCRIPTION

To ensure compatibility with the existing DMS Control Software deployed in the State, furnish NTCIP compliant DMSs that are fully compatible with Daktronics, Inc. Vanguard V4 or latest version software (also referred to hereinafter as the "Control Software"). Contact the engineer to inquire about the current version being used.

Furnish and install DMSs compliant with UL standards 48, 50 and 879.

Add and configure the new DMSs in the system using the Control Software and computer system. Furnish, install, test, integrate and make fully operational the new DMSs at locations shown in the Project Plans.

Furnish operating Dynamic Message Signs, not limited to, the following types. Dimensions represent DMS sizes commonly used by the Department, other size DMS may be specified in the project plans.

DMS Naming Convention	
Type	Color
Type 1 – Front Access Type 2 – Walk-in Type 3 – Embedded Type 4 – Lane Control	A – Amber – 66mm C – Full Color – 20mm

- **DMS Type 1A** – Front Access Amber 66mm – 27 pixels high by 60 pixels wide
  - 3 lines, 10 characters per line, using 18" high characters.
- **DMS Type 1C** – Front Access Full Color 20mm – 96 pixels high by 208 pixels wide
  - 3 lines, 11 characters per line, using 18" high characters.
- **DMS Type 2A** – Walk-in Amber 66mm – 27 pixels high by 90 pixels wide
  - 3 lines, 15 characters per line, using 18" high characters.
- **DMS Type 2C** – Walk-in Full Color 20mm – 96 pixels high by 288 pixels wide
  - 3 lines, 15 characters per line, using 18" high characters.
- **DMS Type 3A** – Embedded Front Access Tri-color 66mm – 7 pixels high by 35 pixels wide
  - 1 line, 7 characters per line, using 18" high characters.
- **DMS Type 3C** – Embedded Front Access Full Color 20mm – 24 pixels high by 160 pixels wide
  - 1 line, 8 characters per line, using 18" high characters.
- **DMS Type 4C** – Lane Control Sign Full Color 20mm – 48- or 64-pixels square

- 48 pixels high by 48 pixels wide
  - 1 line, 2 characters per line using 18” high characters
- 64 pixels high x 64 pixel wide
  - 2 lines, 3 characters per line using 18” high characters

Use only UL listed and approved electronic and electrical components in the DMS system.

Use only approved DMS models listed on the NCDOT Qualified Products List (QPL) at the time of construction. NCDOT Qualified Products List can be accessed via official website at https://apps.ncdot.gov/products/qpl/

29.2. MATERIALS

A. Environmental Requirements

Construct the DMS and DMS controller cabinet so the equipment within is protected against moisture, dust, corrosion, and vandalism.

Design the DMS system to comply with the requirements of Section 2.1 (Environmental and Operating Standards) of NEMA TS 4-2016.

B. Viewing Requirements for all DMS

Each line of text should be clearly visible and legible to a person with 20/20 corrected vision from a distance of 900 feet in advance of the DMS at an eye height of 3.5 feet along the axis.

Any line must display equally spaced and equally sized alphanumeric individual characters. Each character must be at least 18 inches in height (unless otherwise noted in the plans) and composed from a luminous dot matrix.

C. Housing Requirements for all DMS

Construct the external skin of the sign housing out of aluminum alloy 5052 H32 that is a minimum of 1/8 inches thick for all walk-in DMS and 0.090-inch-thick for all front access or embedded DMS. Ensure the interior structure is constructed of aluminum. Ensure that no internal frame connections or external skin attachments rely upon adhesive bonding or rivets. Ensure the sign housing meets the requirements of Section 3 of NEMA TS 4-2016.

Ensure that all drain holes and other openings in the sign housing are screened to prevent the entrance of insects. Design and construct the DMS unit for continuous usage of at least 20 years. Ensure that the top of the housing includes multiple steel lifting eyebolts or equivalent hoisting points. Ensure hoist points are positioned such that the sign remains level when lifted. Ensure that the hoist points and sign frame allow the sign to be shipped, handled, and installed without damage. Ensure all external assembly and mounting hardware, including but not limited to; nuts, bolts, screws, and locking washers are corrosion resistant galvanized steel and are sealed against water intrusion. Ensure all exterior housing surfaces, excluding the sign face, and all interior housing surfaces are a natural aluminum mill finish. Ensure signs are fabricated, welded, and inspected in accordance with the requirements of the current ANSI/AWS Structural Welding Code-Aluminum. Do not place a manufacturer name, logo, or other information on the front face of the DMS or shield visible to the motorist. Provide power supply monitoring circuitry to detect power failure in the DMS and to automatically report this fault to the Control Software. This requirement is in addition to reporting power failure at the controller cabinet. Do not paint the stainless-steel bolts on the Z-bar assemblies used for mounting the enclosure.

D. Housing Requirements for Walk-in type DMS

Ensure the sign housing meets the requirements of Section 3.2.8 of NEMA TS 4-2016. Ensure that exterior seams and joints, except the finish coated face pieces, are continuously welded using an inert gas welding method. Stitch weld the exterior housing panel material to the internal structural members to form a unitized structure. Ensure that exterior mounting assemblies are fabricated from aluminum alloy 6061-T6 extrusions a minimum of 3/16 inches thick. Ensure housing access is provided through an access door at each end of the sign enclosure that meets the requirements of NEMA TS 4-2016, Section 3.2.8.1. Ensure the access doors include a keyed tumbler lock and a door handle with a hasp for a padlock. Ensure the doors include a closed-cell neoprene gasket and stainless-steel hinges. Install one appropriately sized fire extinguisher within 12 inches of each maintenance door. Ensure the sign housing meets the requirements of NEMA TS 4-2016, Section 3.2.8.3 for service lighting. All service lighting should be LED, incandescent and fluorescent lamps are not permitted. Ensure that the sign housing includes LED emergency lighting that automatically illuminates the interior when the door is open in the event of a power outage. Emergency lighting must be capable of operation without power for at least 90 minutes. Ensure the sign housing meets the requirements of NEMA TS 4-2016, Section 3.2.9 for convenience outlets.

E. Housing Requirements for Front Access DMS

Comply with the requirements of Section 3.2.5 and 3.2.6 of NEMA TS 4-2016 as it applies to front access enclosures. The following requirements complement TS 4-2016. Ensure access door does not require specialized tools or excessive force to open. Provide multiple access doors that allow maintenance personnel access to 2 or 3 sign modules are a time. Vertically hinge the doors and design to swing out from the face to provide access to the enclosure interior. Extend each door the full height of the display matrix. Provide a retaining latch mechanism for each door to hold the door open at a 90-degree angle. Each door will form the face panel for a section of the sign. Mount the LED modules to the door such that they can be removed from the door when in the open position. Other sign components can be located inside the sign enclosure and be accessible through the door opening. Provide for each door a minimum of two (2) screw-type captive latches to lock them in the closed position and pull the door tight and compress a gasket located around the perimeter of each door. Install the gasket around the doors to prevent water from entering the cabinet.

F. Housing Face Requirements for all DMS

Ensure the sign face meets the requirements of NEMA TS 4-2016, Section 3.1.3. Protect the DMS face with contiguous, weather-tight, removable panels. The DMS front face shall be constructed with multiple rigid panels, each of which supports and protects a full-height section of the LED display matrix. The panels shall be fabricated using aluminum sheeting on the exterior and polycarbonate sheeting on the interior of the panel. These panels must be a polycarbonate material that is ultraviolet protected and have an antireflection coating. Prime and coat the front side of the aluminum mask, which faces the viewing motorists, with automotive-grade semi-gloss black acrylic enamel paint or an approved equivalent. Guarantee all painted surfaces provide a minimum outdoor service life of 20 years. Design the panels so they will not warp nor reduce the legibility of the characters. Differential expansion of the DMS housing and the front panel must not cause damage to any DMS component or allow openings for moisture or dust. Glare from sunlight, roadway lighting, commercial lighting,

or vehicle headlights must not reduce the legibility or visibility of the DMS. Install the panels so that a maintenance person can easily remove or open them for cleaning.

G. Housing Face Requirements for Walk-in type DMS

The DMS front face shall be constructed with multiple rigid panels, each of which supports and protects a full-height section of the LED display matrix.

No exposed fasteners are allowed on the housing face. Ensure that display modules can be easily and rapidly removed from within the sign without disturbing adjacent display modules.

H. Housing Face Requirements for Front Access type DMS

The DMS front face shall be constructed with multiple vertically hinged rigid door panels, each of which contains a full-height section of the LED display matrix.

Any exposed fasteners on the housing face must be the same color and finish as the housing face. Only captive fasteners may be used on the housing face.

I. Housing Face Requirements for Embedded Front Access type DMS

Front Face shall be constructed with a single, horizontally hinged rigid face panel which contains a full-height section of the LED display matrix.

Any exposed fasteners on the housing face must be the same color and finish as the housing face. Only captive fasteners may be used on the housing face.

J. Sign Housing Ventilation System for all DMS

Install a minimum of one (1) temperature sensor that is mounted near the top of the DMS interior. The sensor(s) will measure the temperature of the air in the enclosure over a minimum range of -40ºF to +176ºF. Ensure the DMS controller will continuously monitor the internal temperature sensor output and report to the DMS control software upon request.

Design the DMS with systems for enclosure ventilation, face panel fog and frost prevention, and safe over-temperature shutdown.

Design the DMS ventilation system to be thermostatically controlled and to keep the internal DMS air temperature lower than +140ºF, when the outdoor ambient temperature is +115ºF or less.

The ventilation system will consist of two or more air intake ports located near the bottom of the DMS rear wall. Cover each intake port with a filter that removes airborne particles measuring 500 microns in diameter and larger. Mount one or more ball bearing-type ventilation fans at each intake port. These fans will positively pressure the DMS enclosure.

Design the ventilation fans and air filters to be removable and replaceable from inside the DMS housing. To ease serviceability, mount the ventilation fans no more than four (4) feet from the floor of the DMS enclosure. Position ventilation fans so they do not prevent removal of an LED pixel board or driver board.

Provide each ventilation fan with a sensor to monitor its rotational speed, measured in revolutions per minute and report this speed to the sign controller upon request.

The ventilation system will move air across the rear of the LED modules in a manner such that heat is dissipated from the LED's. Design the airflow system to move air from the bottom of the enclosure towards the top to work with natural convection to move heat away from the modules.

Install each exhaust port near the top of the rear DMS wall. Provide one exhaust port for each air intake port. Screen all exhaust port openings to prevent the entrance of insects and small animals.

Cover each air intake and exhaust port with an aluminum hood attached to the rear wall of the DMS. Thoroughly seal all intakes and exhaust hoods to prevent water from entering the DMS. Provide a thermostat near the top of the DMS interior to control the activation of the ventilation system.

The DMS shall automatically shut down the LED modules to prevent damaging the LEDs if the measured internal enclosure air temperature exceeds a maximum threshold temperature. The threshold temperature shall be configurable and shall have a default factory setting of 140ºF. The DMS provide an output to the controller to notify the Vanguard client when the DMS shuts down due to high temperature.

K. Sign Housing Ventilation System for Walk-in DMS

Ensure the sign includes a fail-safe ventilation subsystem that includes a snap disk thermostat that is independent of the sign controller. Preset the thermostat at 140°F. If the sign housing's interior reaches 140°F, the thermostat must override the normal ventilation system, bypassing the sign controller and turning on all fans. The fans must remain on until the internal sign housing temperature falls below 115°F.

L. Sign Housing Photoelectric sensors

Install three photoelectric sensors with ½ inch minimum diameter photosensitive lens inside the DMS enclosure. Use sensors that will operate normally despite continual exposure to direct sunlight. Place the sensors so they are accessible and field adjustable. Point one sensor north or bottom of the sign. Place the other two, one on the back wall and one on the front wall of the sign enclosure. Alternate designs maybe accepted, provided the sensor assemblies that are accessible and serviceable from inside the sign enclosure.

Provide controls so that the Engineer can field adjust the following:

- The light level emitted by the pixels in each Light Level Mode,
- The ambient light level at which each Light Level Mode is activated.

M. Display Modules

Manufacture each display module with a standard number of pixels which can be easily removed. Assemble the modules onto the DMS assemblies contiguously to form a continuous matrix to display the required number of lines, characters, and character height.

Design display modules that are interchangeable, self-addressable, and replaceable without using special tools. Provide plug-in type power and communication cables to connect to a display module. Ensure that the sign has a full matrix display area as defined in NEMA TS 4-2016, Section 1.6.

Design each module to display:

- All upper- and lower-case letters,
- All punctuation marks,
- All numerals 0 to 9,
- Special user-created characters.

Display upper-case letters and numerals over the complete height of the module. Optimize the LED grouping and mounting angle within a pixel for maximum readability.

Design Type 3A and 3C DMS with at least the following message displays:

- A static display, green in color, reading “OPEN”
- A static display, red in color, reading “CLOSED”
- A static display, amber in color, with the ability to display a toll rate in the following format “$ XX.XX”

Furnish two (2) spare display modules per each DMS installed for emergency restoration.

N. Discrete LEDs

Provide discrete LEDs with a nominal viewing cone of 30 degrees with a half-power angle of 15 degrees measured from the longitudinal axis of the LED. Make certain, the viewing cone tolerances are as specified in the LED manufacturer’s product specifications and do not exceed +/- 3 degrees half-power viewing angle of 30 degrees.

Provide LEDs that are untinted, non-diffused, high output solid state lamps utilizing AlInGaP technology for Red and InGaN technology for Green and Blue. No substitutions will be allowed. Provide LEDs that emit a full color.

Provide LEDs with a MTBF (Mean Time Before Failure) of at least 100,000 hours of permanent use at an operating point of 140° F or below at a specific forward current of 20mA. Discrete LED failure is defined as the point at which the LED’s luminous intensity has degraded to 50% or less of its original level.

Obtain the LEDs used in the display from a single LED manufacturer. Obtain them from batches sorted for luminous output, where the highest luminosity LED is not more than fifty percent more luminous than the lowest luminosity LED when the LEDs are driven at the same forward current. Do not use more than two successive and overlapping batches in the LED display.

Individually mount the LEDs on circuit boards that are at least 1/16” thick FR-4 fiberglass, flat black printed circuit board in a manner that promotes cooling. Protect all exposed metal on both sides of the LED pixel board (except the power connector) from water and humidity exposure by a thorough application of acrylic conformal coating. Design the boards so bench level repairs to individual pixels, including discrete LED replacement and conformal coating repair is possible.

Operate the LED display at a low internal DC voltage not to exceed 24 Volts.

Design the LED display operating range to be –20° F to +140° F at 95% relative humidity, non-condensing.

Supply the LED manufacturer’s technical specification sheet with the material submittals.

O. LED Power Supplies

Power the LED Display by means of multiple regulated switching DC power supplies that operate from 120 volts AC input power and have an output of 24 volts DC or less. Wire the power supplies in a redundant parallel configuration that uses multiple power supplies per display. Provide the power supplies with current sharing capability that allows equal amounts of current to their portion of the LED display. Provide power supplies rated such that if one supply fails the remaining supplies will be able to operate their portion of the display under full load conditions (i.e. all pixels on at maximum brightness) and at a temperature of 140° F.

Provide power supplies to operate within a minimum input voltage range of +90 to +135 volts AC and within a temperature range of –22° F to 140° F. Power supply output at 140° F must not deteriorate to less than 65% of its specified output at 70° F. Provide power supplies that are overload protected by means of circuit breakers, that have an efficiency rating of at least 75%, a

power factor rating of at least .95, and are UL listed. Provide all power supplies from the same manufacturer and with the same model number for each Type of DMS. Design the power driver circuitry to minimize power consumption.

Design the field controller to monitor the operational status (normal or failed) of each individual power supply and be able to display this information on the Client Computer screen graphically. Color code power supply status, red for failed and green for normal.

P. LED Pixels

A pixel is defined as the smallest programmable portion of a display module that consists of a cluster of closely spaced discrete LEDs. Design each pixel with either 66mm or 20mm spacing depending on the type of DMS called for in the plans.

Construct the pixels with strings of LEDs. It is the manufacturer's responsibility to determine the number of LEDs in each string to produce the candela requirement as stated herein.

Use continuous current to drive the LEDs at the maximum brightness level. Design the light levels to be adjustable for each DMS / controller so the Engineer may set levels to match the luminance requirements at each installation site.

Ensure each pixel produces a luminous intensity of 40 Cd when driven with an LED drive current of 20 mA per string.

Power the LEDs in each pixel in strings. Use a redundant design so that the failure of an LED in one string does not affect the operation of any other string within the pixel and does not lower the luminous intensity of the pixel more than 25% of the 40Cd requirement. Provide the sign controller with the ability to detect the failure of any LED string and identify which LED string has failed.

Q. DMS Mini Controller

For Walk-In and Front Access DMS Types only, furnish and install a mini controller inside the DMS that is interconnected with the main controller using a fiber-optic cable. The mini controller will enable a technician to perform all functions available from the main controller. Provide the mini controller with an LCD/keypad interface. Size the LCD display screen to allow preview of an entire one-page message on one screen. Provide a 4 X 4 keypad.

R. DMS Enclosure Structure Mounting

Mount the DMS enclosure and interconnect system securely to the supporting structures. Design the DMS enclosure supports and structure to allow full access to the DMS enclosure inspection door. Mount the DMS enclosure according to the manufacturer's recommendations.

Furnish and install U-bolt connections of hanger beams to truss chords with a double nut at each end of the U-bolt. Bring the double nuts tight against each other by the use of two wrenches.

Submit plans for the DMS enclosure, structure, mounting description and calculations to the Engineer for approval. Have such calculations and drawings approved by a Professional Engineer registered in the state of North Carolina, and bear his signature, seal, and date of acceptance.

Provide removable lifting eyes or the equivalent on the DMS enclosure rated for its total weight to facilitate handling and mounting the DMS enclosure.

Design the DMS structure to conform to the applicable requirements of the most recent version of the *Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, currently in use by the department and the section titled "DMS Assemblies" of these Project Special Provisions.

S. DMS / DMS Controller Interconnect

Furnish and install all necessary cabling, conduit, and terminal blocks to connect the DMS and the DMS controller located in the equipment cabinet. Use approved manufacturer's specifications and the Project Plans for cable and conduit types and sizes. Use fiber-optic cable to interconnect sign and controller. Install fiber-optic interconnect centers in the sign enclosure and cabinet to securely install and terminate the fiber-optic cable. Submit material submittal cut sheets for the interconnect center.

T. DMS Controller and DMS Cabinet

Furnish and install one DMS controller with accessories per DMS in a protective cabinet. Controlling multiple DMS with one controller is allowed when multiple DMS are mounted on the same structure. Mount the controller cabinet on the Sign support structure. Install cabinet so that the height from the ground to the middle of the cabinet is 4 feet. Ensure a minimum of 3’ x 3’ level working surface under each cabinet that provides maintenance technicians with a safe working environment.

Provide the DMS controller as a software-oriented microprocessor and with resident software stored in non-volatile memory. The Control Software, controller and communications must comply with the NTCIP Standards identified in these Project Special Provisions. Provide sufficient non-volatile memory to allow storage of at least 500 multi-page messages and a test pattern program.

For DMS Type 4C installations provide a single controller that can control up to eight (8) signs simultaneously.

Furnish the controller cabinet with, but not limited to, the following:

- Power supply and distribution assemblies,
- Power line filtering hybrid surge protectors,
- Radio Interference Suppressor,
- Communications surge protection devices,
- Industrial-Grade UPS system and local disconnect,
- Microprocessor based controller,
- Display driver and control system (unless integral to the DMS),
- RJ45 Ethernet interface port for local laptop computer,
- Local user interface,
- Interior lighting and duplex receptacle,
- Adjustable shelves as required for components,
- Temperature control system,
- All interconnect harnesses, connectors, and terminal blocks,
- All necessary installation and mounting hardware.

Furnish the DMS controller and associated equipment completely housed in a NEMA 3R cabinet made from 5052 H32 sheet aluminum at least 1/8” thick. Use natural aluminum cabinets. Perform all welding of aluminum and aluminum alloys in accordance with the latest edition of AWS D1.2, Structural Welding Code - Aluminum. Continuously weld the seams using Gas Metal Arc Welding (GMAW).

Slant the cabinet roof away from the front of the cabinet to prevent water from collecting on it.

Do not place a manufacturer name, logo, or other information on the faces of the controller cabinet visible to the motorist.

Provide cabinets capable of housing the components and sized to fit space requirement. Design the cabinet layout for ease of maintenance and operation, with all components easily accessible. Submit a cabinet layout plan for approval by the Engineer.

Locate louvered vents with filters in the cabinet to direct airflow over the controller and auxiliary equipment, and in a manner that prevents rain from entering the cabinet. Fit the inside of the cabinet, directly behind the vents, with a replaceable, standard size, commercially available air filter of sufficient size to cover the entire vented area.

Provide a torsionally rigid door with a continuous stainless-steel hinge on the side that permits complete access to the cabinet interior. Provide a gasket as a permanent and weather resistant seal at the cabinet door and at the edges of the fan / exhaust openings. Use a non-absorbent gasket material that will maintain its resiliency after long term exposure to the outdoor environment. Construct the doors so that they fit firmly and evenly against the gasket material when closed. Provide the cabinet door with louvered vents and air filters near the bottom as described in the paragraph above.

The cabinet shall contain a full-height standard EIA 19-inch rack. The rack shall be secured within the cabinet by mounts at the top and bottom.

The rack shall contain a minimum of one (1) pullout drawer. The drawer shall be suitable for storing manuals and small tools. The drawer shall be able to latch in the out position to function as a laptop/utility shelf.

Provide a convenient location on the inside of the door to store the cabinet wiring diagrams and other related cabinet drawings. Provide a Corbin #2 main door lock made of non-ferrous or stainless-steel material. Key all locks on the project alike and provide 1 key per lock to the Engineer. In addition, design the handle to permit padlocking.

Provide the interior of the cabinet with ample space for housing the controller and all associated equipment and wiring. Provide ample space in the bottom of the cabinet for the entrance and exit of all power, communications, and grounding conductors and conduit.

Arrange the equipment to permit easy installation of the cabling through the conduit so that they will not interfere with the operation, inspection, or maintenance of the unit. Provide adjustable metal shelves, brackets, or other support for the controller unit and auxiliary equipment. Leave a 3-inch minimum clearance from the bottom of the cabinet to all equipment, terminals, and bus bars.

Provide power supply monitoring circuitry to detect power failure and to automatically report the occurrence to the Control Software.

Install two 15-watt fluorescent light strips with shields, one in the top of the cabinet and the other under the bottom shelf. Design both lights to automatically turn on when the cabinet door is opened and turn off when the door closes.

Mount and wire a 120V (+10%) GFCI duplex receptacle of the 3-wire grounding type in the cabinet in a location that presents no electrical hazard when used by service personnel for the operation of power tools and work lights.

No cabinet resident equipment may utilize the GFCI receptacle. Furnish one spare non-GFCI duplex receptacle for future equipment.

Mount a bug-proof and weatherproof thermostatically controlled fan and safety shield in the top of the cabinet. Size the fan to provide at least for two air exchanges per minute. Fuse the fan at 125% of the capacity of the motor. The magnetic field of the fan motor must not affect the performance of the control equipment. Use a fan thermostat that is manually adjustable to turn on

between 80° F and 160° F with a differential of not more than 10° F between automatic turn on and turn off. Mount it in an easily accessible location, but not within 6 inches of the fan.

Install additional fans and/or heaters as needed to maintain the temperature inside the cabinet within the operating temperature range of the equipment within the cabinet as recommended by equipment manufacturer(s).

1. Wiring

The requirements stated herein apply wherever electrical wiring is needed for any DMS system assemblies and subassemblies such as controller cabinet, DMS enclosure, electrical panel boards etc.

Neatly arrange and secure the wiring inside the cabinet. Where cable wires are clamped to the walls of the control cabinet, provide clamps made of nylon, metal, plastic with rubber or neoprene protectors, or similar. Lace and jacket all harnesses or tie them with nylon tie wraps spaced at 6 inches maximum to prevent separation of the individual conductors.

Individually and uniquely label all conductors. Ensure all conductor labels are clearly visible without moving the conductor. Connect all terminal conductors to the terminal strip in right angles. Remove excess conductor before termination of the conductor. Mold the conductor in such a fashion as to retain its relative position to the terminal strip if removed from the strip. Do not run a conductor across a work surface with the exception of connecting to that work surface. No conductor bundles can be support by fasteners that support work surfaces. Install all connectors, devices and conductors in accordance to manufactures guidelines. Comply with the latest NEC guideline in effect during installation. No conductor or conductor bundle may hang loose or create a snag hazard. Protect all conductors from damage. Ensure all solder joints are completed using industry accepted practices and will not fail due to vibration or movement. Protect lamps and control boards from damage.

No splicing will be allowed for feeder conductors and communication cables from the equipment cabinet to the DMS enclosure.

Insulate all conductors and live terminals so they are not hazardous to maintenance personnel.

Route and bundle all wiring containing line voltage AC and / or shield it from all low voltage control circuits. Install safety covers to prevent accidental contact with all live AC terminals located inside the cabinet.

Use industry standard, keyed type connectors with a retaining feature for connections to the controller.

Label all equipment and equipment controls clearly.

Supply each cabinet with one complete set of wiring diagrams that identify the color-coding or wire tagging used in all connections. Furnish a water-resistant packet adequate for storing wiring diagrams, operating instructions, and maintenance manuals with each cabinet.

2. Power Supply and Circuit Protection

Design the DMS and controller for use on a system with a line voltage of 120V + 10% at a frequency of 60 Hz ± 3 Hz. Under normal operation, do not allow the voltage drop between no load and full load of the DMS and its controller to exceed 3% of the nominal voltage.

Blackout, brownout, line noise, chronic over-voltage, sag, spike, surge, and transient effects are considered typical AC voltage defects. Protect the DMS system equipment so that these defects do not damage the DMS equipment or interrupt their operation. Equip all cabinets with devices to protect the equipment in the cabinet from damage due to lightning and external circuit power and current surges.

3. Circuit Breakers

Protect the DMS controller, accessories, and cabinet utilities with thermal magnetic circuit breakers. Provide the controller cabinet with a main circuit breaker sized according to the NEC. Use appropriately sized branch circuit breakers to protect the controller, sign display and accessories and for servicing DMS equipment and cabinet utilities.

Provide a subpanel in the sign enclosure with a main and branch circuit breakers sized appropriately per NEC.

Provide a detailed plan for power distribution within the cabinet and the sign. Label all breaker and conductor with size and loads. Have the plans signed and sealed by a NC registered PE and submit the plans for review and approval.

4. Surge Suppressor

Install and clearly label filtering hybrid power line surge protectors on the load side of the branch circuit breakers in a manner that permits easy servicing. Ground and electrically bond the surge protector to the cabinet within 2 inches.

Provide power line surge protector that meets the following requirements:

Peak surge current occurrences	20 minimum
Peak surge current for an 8 x 20 microsecond waveshape	50,000 Amperes
Energy Absorption	> 500 Joules
Clamp voltage	240 Volts
Response time	<1 nanosecond
Minimum current for filtered output	15 Amperes for 120VAC*
Temperature range	-40°F to +158°F

*Capable of handling the continuous current to the equipment

5. Transients and Emissions

DMS and DMS controller will be designed in such a way to meet the latest NEMA TS-4 for Transients and Emissions.

6. Transient Protection

The RS232 and Ethernet communication ports in the DMS sign controller shall be protected with surge protection between each signal line and ground. This surge protection shall be integrated internally within the controller.

7. Lightning Arrester

Protect the system with an UL approved lightning arrester installed at the main service disconnect that meets the following requirements:

Type of design	Silicon Oxide Varistor
Voltage	120/240 Single phase, 3 wires
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

8. Uninterruptible Power Supply (UPS)

Provide the cabinet with an industrial grade power conditioning UPS unit to supply continuous power to operate the equipment connected to it if the primary power fails. **The UPS must continue to condition power supplied to the DMS controller in the event of battery failure within the UPS.** The UPS must detect a power failure and provide backup power within 20 milliseconds. Transition to the UPS source from primary power must not cause loss of data or damage to the equipment being supplied with backup power. Provide an UPS with at least three outlets for supplying conditioned AC voltage to the DMS controller. Provide a unit to meet the following requirements:

Input Voltage Range	120VAC +12%, -25%
Power Rating	1000 VA, 700 Watts
Input Frequency	45 to 65 Hz
Input Current	7.2A
Output Voltage	120VAC +/- 3%
Output Frequency	50/60 +/-1 Hz
Output Current	8.3A
Output Crest Factor Ratio	@50% Load Up to 4.8:1 @75% Load Up to 3.2:1 @100% Load Up to 2.4:1
Output THD	3% Max. (Linear) 5% Max. (Non-Linear)
Output Overload	110% for 10 min; 200% for 0.05 sec.
Output Dynamic Response	+/- 4% for 100% Step Load Change 0.5 ms Recovery Time.
Output Efficiency @ 100% Load	90% (Normal Mode)
Operating Temperature	-40° F to +165 ° F
Humidity	0% to 95% Non-condensing
Remote Monitoring Interface	RS-232
Protection	Input/Output Short Circuit

	Input/Output Overload Excessive Battery Discharge
Specifications	UL1778, FCC Class A, IEE 587

Provide the UPS unit capable of supplying **30 minutes** of continuous backup power to the cabinet equipment connected to it when the equipment is operating at full load.

9. Controller Communications Interface

Provide the controller with the following interface ports:

- An EIA/TIA-232E port for remote communication using NTCIP,
- An 10/100 Ethernet port for remote communication using NTCIP,
- An EIA/TIA-232E port for onsite access using a laptop,
- An EIA/TIA-232E auxiliary port for communication with a field device such as a UPS,
- Fiber-optic ports for communication with the sign,
- RJ45 ports for communication with the sign using CAT-5 cable,
- RJ45 ports for communication with mini controller located inside the sign enclosure.

10. Controller Local User Interface

Provide the controller with a Local User Interface (LUI) for at least the following functions:

- On / Off Switch: controls power to the controller,
- Control Mode Switch: for setting the controller operation mode to either remote or local mode,
- LCD Display and Keypad: Allow user to navigate through the controller menu for configuration (display, communications parameter, etc.) running diagnostics, viewing peripherals status, message creation, message preview, message activation, etc. Furnish a LCD display with a minimum size of 240x64 dots with LED back light.

Protected access to the LUI with an alphanumeric and PIN passwords. Allow the user to select a preferred method of password protection. Default and hardcoded passwords are not allowed.

11. Controller Address

Assign each DMS controller a unique address. Preface all commands from the Control Software with a particular DMS controller address. The DMS controller compares its address with the address transmitted; if the addresses match, then the controller processes the accompanying data.

12. Controller Functions

Design the DMS controller to continuously control and monitor the DMS independent of the Control Software. Design the controller to display a message on the sign sent by the Control Software,

a message stored in the sign controller memory, or a message created on site by an operator using the controller keypad.

Provide the DMS controller with a watchdog timer to detect controller failures and to reset the microprocessor, and with a battery backed up clock to maintain an accurate time and date reference. Set the clock through an external command from the Control Software or the Local User Interface.

13. DMS Controller Memory

Furnish each DMS controller with non-volatile memory. Use the non-volatile memory to store and reprogram at least one test pattern sequence and 500 messages containing a minimum of two pages of 45 characters per page. The Control Software can upload messages into and download messages from each controller's non-volatile memory remotely.

Messages uploaded and stored in the controller's non-volatile memory may be erased and edited using the Control Software and the controller. New messages may be uploaded to and stored in the controller's non-volatile memory using the Control Software and the controller.

U. Equipment List

Provide a general description of all equipment and all information necessary to describe the basic use or function of the major system components. Include a general "block diagram" presentation. Include tabular charts listing auxiliary equipment, if any is required. Include the nomenclature, physical and electrical characteristics, and functions of the auxiliary equipment unless such information is contained in an associated manual; in this case include a reference to the location of the information.

Include a table itemizing the estimated average and maximum power consumption for each major piece of equipment.

V. Physical Description

Provide a detailed physical description of size, weight, center of gravity, special mounting requirements, electrical connections, and all other pertinent information necessary for proper installation and operation of the equipment.

W. Parts List

Provide a parts list that contains all information needed to describe the characteristics of the individual parts, as required for identification. Include a list of all equipment within a group and a list of all assemblies, sub-assemblies, and replacement parts of all units. Arrange this data in a table, in alpha numerical order of the schematic reference symbols, which gives the associated description, manufacturer's name, and part number, as well as alternate manufacturers and part numbers. Provide a table of contents or other appropriate grouping to identify major components, assemblies, etc.

X. Character Set Submittal

Submit an engineering drawing of the DMS character set including at a minimum, 26 upper case and lower case letters, 10 numerals, 9 punctuation marks (. , ! ? – ‘ “ ; :) 12 special characters (# & * + / ( ) [ ] < > @) and arrows at 0, 45, 90, 135, 180, 225, 270, and 315 degrees.

Y. Wiring Diagrams

Provide a wiring diagram for each DMS and each controller cabinet, as well as interconnection wiring diagrams for the system as a whole.

Provide complete and detailed schematic diagrams to component level for all DMS assemblies and subassemblies such as driver boards, control boards, DMS controller, power supplies, and etc. Ensure that each schematic enables an electronics technician to successfully identify any component on a board or assemblies and trace its incoming and outgoing signals.

Z. Routine of Operation

Describe the operational routine, from necessary preparations for placing the equipment into operation to securing the equipment after operation. Show appropriate illustrations with the sequence of operations presented in tabular form wherever applicable. Include in this section a total list of the test instruments, aids and tools required to perform necessary measurements and measurement techniques for each component, as well as set up, test, and calibration procedures.

AA. Maintenance Procedures

Specify the recommended preventative maintenance procedures and checks at pre-operation, monthly, quarterly, semiannual, annual, and "as required" periods to assure equipment operates reliably. List specifications (including tolerances) for all electrical, mechanical, and other applicable measurements and / or adjustments.

BB. Repair Procedures

Include in this section all data and step by step procedures necessary to isolate and repair failures or malfunctions, assuming the maintenance technicians are capable of analytical reasoning using the information provided in the section titled “Wiring Diagrams and Theory of Operation.”

Describe accuracy, limits, and tolerances for all electrical, physical, or other applicable measurements. Include instructions for disassembly, overhaul, and reassembly, with shop specifications and performance requirements.

Give detailed instructions only where failure to follow special procedures would result in damage to equipment, improper operation, danger to operating or maintenance personnel, etc. Include such instructions and specifications only for maintenance that specialized technicians and engineers in a modern electromechanical shop would perform. Describe special test set up, component fabrication, and the use of special tools, jigs, and test equipment.

CC. Warranty

Ensure that the DMS system and equipment has a manufacturer’s warranty covering defects for a minimum of five (5) years from the date of final acceptance by the Engineer.

29.3. CONSTRUCTION METHODS

A. Description

This article establishes practices and procedures and gives minimum standards and requirements for the installation of DMS systems, auxiliary equipment and the construction of related structures.

Provide electrical equipment described in this specification that conforms to the standards of NEMA, UL, or Electronic Industries Association (EIA), wherever applicable. Provide connections between DMS equipment and DMS sign housing and electric utilities that conform to NEC standards.

Provide stainless steel screws, nuts, and locking washers in all external locations. Do not use self-tapping screws unless specifically approved by the Engineer. Use parts made of corrosion resistant materials, such as plastic, stainless steel, brass, or aluminum. Use construction materials that resist fungus growth and moisture deterioration. Separate dissimilar metals by an inert dielectric material.

B. Layout

The Regional ITS engineer or Division Traffic Engineer will establish the actual location of each DMS assembly. It is the Contractor's responsibility to ensure proper elevation, offset, and orientation of all DMS assemblies. The location of service poles as well as conduit lengths shown in the Project Plans, are approximate based on available project data. Make actual field measurements to place conduit and equipment at the required location.

C. Construction Submittal

When the work is complete, submit "as built" plans, inventory sheets, and any other data required by the Engineer to show the details of actual construction and installation and any modifications made during installation.

The "as built" plans will show: the DMS, controller, and service pole locations; DMS enclosure and controller cabinet wiring layouts; and wire and conduit routing. Show all underground conduits and cables dimensioned from fixed objects.

Include detailed drawings that identify the routing of all conductors in the system by cable type, color code, and function. Clearly label all equipment in the DMS system, controller cabinet, and DMS enclosure.

D. Conduit

Install the conduit system in accordance with Section 1715 of the Standard Specifications and NEC requirements for an approved watertight raceway.

Make bends in the conduit so as not to damage it or change its internal diameter. Install watertight and continuous conduit with as few couplings as standard lengths permit.

Clean conduit before, during, and after installation. Install conduit in such a manner that temperature changes will not cause elongation or contraction that might damage the system.

Attach the conduit system to and install along the structural components of the Sign structure assemblies with beam clamps or stainless-steel strapping or inside the structure if there is available space. Install strapping according to the strapping manufacturer's recommendations and according to NEC requirements. Do not use welding or drilling to fasten conduit to structural components. Space the fasteners at no more than 4 feet for conduit 1.5 inches and larger or 6 feet for conduit smaller than 1.25 inches. Place fasteners no more than 3 feet from the center of bends, fittings, boxes, switches, and devices.

Flexible conduit will only be allowed when the conduits transition from the horizontal structure segment to the horizontal truss segment and from the horizontal truss segment to the rear entrance of the DMS when installing the DMS communications and feeder cables. The maximum length of flexible conduit allowed at each transition will be 5 feet.

Do not exceed the appropriate fill ratio on all cable installed in conduit as specified in the NEC.

E. Wiring Methods (Power)

Do not pull permanent wire through a conduit system until the system is complete and has been cleaned.

Color-code all conductors per the NEC. Use approved marking tape, paint, sleeves or continuous colored conductors for No.8 AWG and larger. Do not mark a white conductor in a cable assembly any other color.

Do not splice underground circuits unless specifically noted in the Project Plans.

F. Equipment and Cabinet Mounting

Mount equipment securely at the locations shown in the Project Plans, in conformance with the dimensions shown. Install fasteners as recommended by the manufacturer and space them evenly. Use all mounting holes and attachment points for attaching DMS enclosures and controller cabinets to the structures.

Drill holes for expansion anchors of the size recommended by the manufacturer of the anchors and thoroughly clean them of all debris.

Provide cabinets with all strapping hardware and any other necessary mounting hardware in accordance with these Project Special Provisions and the Project Plans.

Seal all unused conduit installed in cabinets at both ends to prevent water and dirt from entering the conduit and cabinet with approved sealing material.

Install a ground bushing attached inside the cabinet on all metal conduits entering the cabinet. Connect these ground bushings to the cabinet ground bus.

Install a level concrete technician pad measuring a minimum 4 inches thick, 36 inches wide and 36 inches long at the front door of the DMS equipment cabinet as shown on the Typical Details sheet within the Project Plans.

G. Work Site Clean-Up

Clean the site of all debris, excess excavation, waste packing material, wire, etc. Clean and clear the work site at the end of each workday. Do not throw waste material in storm drains or sewers.

29.4. GENERAL TEST PROCEDURE

Test the DMS and its components in a series of functional tests and ensure the results of each test meet the specified requirements. These tests should not damage the equipment. The Engineer will reject equipment that fails to fulfill the requirements of any test. Resubmit rejected equipment after correcting non-conformities and re-testing; completely document all diagnoses and corrective actions. Modify all equipment furnished under this contract, without additional cost to the Department, to incorporate all design changes necessary to pass the required tests.

Provide 4 copies of all test procedures and requirements to the Engineer for review and approval at least 30 days prior to the testing start date.

Only use approved procedures for the tests. Include the following in the test procedures:

- A step-by-step outline of the test sequence that demonstrates the testing of every function of the equipment or system tested

- A description of the expected nominal operation, output, and test results, and the pass / fail criteria
- An estimate of the test duration and a proposed test schedule
- A data form to record all data and quantitative results obtained during the test
- A description of any special equipment, setup, manpower, or conditions required by the test

Provide all necessary test equipment and technical support. Use test equipment calibrated to National Institute of Standards and Technology (NIST) standards. Provide calibration documentation upon request.

Conform to these testing requirements and the requirements of these specifications. It is the Contractor's responsibility to ensure the system functions properly even after the Engineer accepts the CCTV test results.

Provide 4 copies of the quantitative test results and data forms containing all data taken, highlighting any non-conforming results and remedies taken, to the Engineer for approval. An authorized representative of the manufacturer must sign the test results and data forms.

29.5. COMPATIBILITY TESTS

A. DMS System

Compatibility Tests are applicable to DMS that the Contractor wishes to furnish but are of a different manufacturer or model series than the existing units installed in the Region. If required, the Compatibility Test shall be completed and accepted by the Engineer prior to approval of the material submittal.

The Compatibility Test shall be performed in a laboratory environment at a facility chosen by the Engineer based on the type of unit being tested. Provide notice to the Engineer with the material submitted that a Compatibility Test is requested. The notice shall include a detailed test plan that will show compatibility with existing equipment. The notice shall be given a minimum of 15 calendar days prior to the beginning of the Compatibility Test.

The Contractor shall provide, install, and integrate a full-functioning unit to be tested. The Department will provide access to existing equipment to facilitate these testing procedures. The Engineer will determine if the Compatibility Test was acceptable for each proposed device. To prove compatibility the Contractor is responsible for configuring the proposed equipment at the applicable Traffic Operations Center (TOC) with the accompaniment of an approved TOC employee.

29.6. OPERATIONAL FIELD TEST (ON-SITE COMMISSIONING)

A. DMS System

Final DMS locations must be field verified and approved by the Engineer. Perform the following local operational field tests at the DMS assembly field site in accordance with the test plans. The Contractor is responsible for providing a laptop for camera control and positioning during the test. After completing the installation of the camera assemblies, including the camera hardware, power supply, and connecting cables, the contractor shall:

Local Field Testing

Furnish all equipment and labor necessary to test the installed camera and perform the following tests before any connections are made.

- Verify that physical construction has been completed.
- Inspect the quality and tightness of ground and surge protector connections.
- Check the power supply voltages and outputs, check connection of devices to power source.
- Verify installation of specified cables and connection between the DMS and control cabinet,
- Make sure cabinet wiring is neat and labeled properly; check wiring for any wear and tear; check for exposed or loose wires.
- Perform the DMS assembly manufacturer's initial power-on test in accordance with the manufacturer's recommendation.
- Set the DMS control address.

Central Operations Testing

- Interconnect the DMS's communication interface device with one of the following methods as depicted on the plans:
    - communication network's assigned Ethernet switch and assigned fiber-optic trunk cable and verify a transmit/receive LED is functioning and that the DMS is fully operational at the TOC.

    OR

    - to the DOT furnished cellular modem and verify a transmit/receive LED is functioning and that the DMS is fully operational at the TOC.
- Review DMS date and time and DMS controller information.
- Run DMS diagnostics and review results.
- Run DMS pixel test and review results.
- Run test message.
- Run test schedule.
- Program burn-in scenario.

Approval of Operational Field Test results does not relieve the Contractor to conform to the requirements in these Project Special Provisions. If the DMS system does not pass these tests, document a correction or substitute a new unit as approved by the Engineer. Re-test the system until it passes all requirements.

29.7. MEASUREMENT AND PAYMENT

Dynamic Message Sign (_____) will be measured and paid as the actual type and number of DMS furnished, installed, and accepted. Each DMS consists of a LED Dynamic Message Sign, spare

display modules, warranty, strapping hardware, controller, UPS, controller cabinet, concrete technician pad, conduit, fittings, couplings, sweeps, conduit bodies, wire, flexible conduit, feeder conductors and communications cable between the controller cabinet and the DMS enclosure, connectors, circuit protection equipment, photo-electric sensors, tools, materials, all related testing, cost of labor, cost of transportation, incidentals, and all other equipment necessary to furnish and install the DMS system.

DMS Cabinet will be measured and paid as the number of cabinets furnished, installed, and accepted.

DMS Pixel Replacement will be measured and paid as the number of LED Modules furnished, installed, and accepted.

Payment will be made under:

Pay Item	Pay Unit
Dynamic Message Sign (_____)	Each
DMS Cabinet	Each
DMS LED Module Replacement	Each

30. DMS PEDESTAL STRUCTURE

30.1. DESCRIPTION

This section includes all design, fabrication, furnishing, and erection of the DMS pedestal structure, platforms, walkways, ladders for access to the DMS inspection doors, and attachment of the DMS enclosures to the structure in accordance with the requirements of these Project Special Provisions and the Project Plans. Fabricate the supporting DMS assemblies from tubular steel. Furnish pedestal type DMS assemblies as shown in the Project Plans.

Provide pedestal DMS structures with a minimum clearance from the high point of the road to the bottom of the DMS enclosure of 25 feet for Walk-In DMS and 20 feet for Front Access DMS.

Design the new DMS assemblies (including footings), DMS mounting assemblies, maintenance platforms, and access ladders and submit shop drawings for approval. A Professional Engineer that is registered in the state of North Carolina will prepare such computations and drawings. These must bear his signature, seal, and date of acceptance.

The provisions of Section 900 of the Standard Specifications apply to all work covered by this section.

The Standard Provisions SP09R005 and SP09R007 found at the link below apply to all work covered by this section.

https://connect.ncdot.gov/resources/Specifications/Pages/2018-Specifications-and-Special-Provisions.aspx

It is the Contractor's responsibility to verify DMS S-dimension elevation drawings for the DMS locations and provide them with the DMS shop drawings for the Engineer's approval.

30.2. MATERIALS

Use materials that meet the requirements of:

- Section 906 of the *2018 Standard Specification for Roads and Structures*.
- Standard Provision SP09R005 *Foundations and Anchor Rod Assemblies for Metal Poles*.
- Standard Provision SP09R007 *Overhead and Dynamic Message Sign Foundations*.

30.3. CONSTRUCTION METHODS

A. General

Construct DMS structures and assemblies in accordance with the requirements of:

- Section 906 of the *2018 Standard Specification for Roads and Structures*.
- Standard Provision SP09R005 *Foundations and Anchor Rod Assemblies for Metal Poles*.
- Standard Provision SP09R007 *Overhead and Dynamic Message Sign Foundations*.

B. DMS Maintenance Platform (Walkway)

Provide a maintenance platform (walkway), a minimum of three feet wide with open skid resistant surface and safety railing on the DMS assemblies for access to one of the DMS inspection doors as shown on the plans. Provide platforms with fixed safety railings along both sides from the beginning of the platform to the inspection door. No gap is allowed between walkway and inspection door or along any part of the safety rails.

Ensure the design, fabrication and installation of the access platforms on new DMS structures complies with the following:

A. The top of the platform grading surface is vertically aligned with the bottom of the DMS door,

B. The DMS door will open 90-degrees from its closed position without any obstruction from the platform or safety handrails,

C. The platform is rigidly and directly connected to the walkway brackets and there is no uneven surface between sections,

D. Install a 4" x 4" safety angle parallel to and along both sides of the platform and extend it the entire length of the platform. Design the safety angle to withstand loading equivalent to the platform,

E. Ensure the platform design allows full access to the DMS enclosure inspection door with no interference or obstructions.

C. DMS Access Ladder

Provide a fixed ladder, of the same material as the pedestal structures, leading to and ending at the access platform. Equip the ladder with a security cover (ladder guard) and lock to prohibit access by unauthorized persons. Furnish the lock to operate with a Corbin #2 key and furnish two keys per lock. Design the rungs on 12-inch center to center typical spacing. Start the first ladder

rung no more than 18 inches above the landing pad. Attach the security cover approximately 6 feet above the finished ground. Design the ladder and security cover as a permanent part of the DMS assembly and include complete design details in the DMS assembly shop drawings. Fabricate the ladder and cover to meet all OSHA requirements and applicable state and local codes, including but not limited to providing a ladder cage.

Furnish and install a level concrete pad a minimum of 4 inches deep, 24 inches wide, and 36 inches long to service as a landing pad for accessing the ladder. Design the landing pad to be directly below the bottom rung. Access to the ladder shall not be obstructed by the DMS foundation. Provide pre-formed or cast-in place concrete pads.

30.4. MEASUREMENT AND PAYMENT

DMS Pedestal Structure will be measured and paid as the actual number of dynamic message sign pedestal structure assemblies furnished, installed, and accepted. Payment includes all design, fabrication, construction, transportation, and attachment of the complete relocated dynamic message sign assemblies, supporting structure, hardware, access platform, direct tension indicators, preparing and furnishing shop drawings, additional documentation, incidentals, and all other equipment and features necessary to furnish the system described above.

DMS Access Ladder will be measured and paid as the actual number of DMS access ladders, platform, walkway furnished, installed and accepted. Payment includes design, fabrication, transportation, attachment to the DMS assembly as described above, lock with two keys each, and concrete pad.

Overhead Footing will be measured and paid in cubic yards and will be full compensation for all materials and labor required in *Overhead and Dynamic Message Sign Foundations (SP09 R007) and Foundations and Anchor Rod Assemblies for Metal Poles* (PS09 R005) referred in the link above. Payment will be made according to PS09 R007

The contract unit price for Overhead Footings will be full compensation for providing labor, tools, equipment and foundation materials, stabilizing or shoring excavations, supplying and placing concrete, reinforcing steel, conduit, anchor rod assemblies and any incidentals necessary to construct sign foundations. Subsurface investigations required by the Engineer will be paid as extra work in accordance with Article 104-7 of the *2018 Standard Specifications for Roads and Structures*.

Payment will be made under:

Pay Item	Pay Unit
DMS Pedestal Structure	Each
DMS Access Ladder	Each
Overhead Footing	Each

31. NTCIP REQUIREMENTS

This Section defines the NTCIP requirements for the DMSs covered by these Project Special Provisions and Standard Specifications.

31.1. References

A. Standards

This specification references several standards through their NTCIP designated names. The following list provides the full reference to the current version of each of these standards.

Implement the most recent version of the standard including any and all Approved or Recommended Amendments to these standards for each NTCIP Component covered by these project specifications. Refer to the NTCIP library at www.ntcip.org for information on the current status of NTCIP standards.

Abbreviated Number	Title
NTCIP 1201	*Global Object (GO) Definitions*
NTCIP 1203	*Object Definitions for Dynamic Message Signs*
NTCIP 2101	*SP-PMPP/232* *Subnet Profile for PMPP over RS-232*
NTCIP 2104	*SP-Ethernet* *Subnet Profile for Ethernet*
NTCIP 2201	*TP-Null* *Transport Profile*
NTCIP 2202	*Internet Transport Profile (TCP/IP and UDP/IP)*
NTCIP 2301	*AP for Simple Transportation Management Framework*

B. Features

Each DMS shall be required to support the following optional features, conformance groups and all functional requirements and objects that apply herein.

Feature	Reference
Time Management	NTCIP 1201 v3
Timebase Event Schedule	NTCIP 1201 v3
PMPP	NTCIP 1201 v3
Determine Sign Display Capabilities	NTCIP 1203 v03
Manage Fonts	NTCIP 1203 v03
Manage Graphics	NTCIP 1203 v03
Schedule Messages for Display	NTCIP 1203 v03

Change Message Display Based on and Internal Event	NTCIP 1203 v03
Control External Devices	NTCIP 1203 v03
Monitor Sign Environment	NTCIP 1203 v03
Monitor Door Status	NTCIP 1203 v03
Monitor Controller Software Operations	NTCIP 1203 v03
Monitor Automatic Blanking of Sign	NTCIP 1203 v03
Report	NTCIP 1103 v03

C. Objects

The following table represents objects that are considered optional in the NTCIP standards but are required by this specification. It also indicated modified objects value ranges for certain objects. Each DMS shall provide the full, standard object range support (FSORS) of all the objects required by these specifications unless otherwise stated below.

Object	Reference	Requirement
moduleTable	NTCIP 1201 – 2.2.3	Shall contain at least one row with moduleType equal to 3 (software) The moduleMake specifies the name of the manufacturer, the moduleModel specifies the manufacturer's name of the component and the moduleVersion indicates the model version number of the component.
maxTimeBaseScheduleEntries	NTCIP 1201 – 2.4.3.1.	Shall be at least 28
maxDayPlans	NTCIP 1201 – 2.4.4.1	Shall be at least 20
maxDayPlanEvents	NTCIP 1201 – 2.4.4.2	Shall be at least 12
maxGroupAddresses	NTCIP 1201 – 2.7.1	Shall be at least 1
maxEventLogConfigs	NTCIP 1103 – A.7.4	Shall be at least 50
eventConfigMode	NTCIP 1103 – A.7.5.3	The DMS shall support the following Event Configurations: onChange, greaterThanValue, smallerThanValue
eventConfigLogOID	NTCIP 1103 – A.7.5.7	FSORS
eventConfigAction	NTCIP 1103 – A.7.5.8	FSORS
maxEventLogSize	NTCIP 1103 – A.7.6	Shall be at least 20
maxEventClasses	NCTIP 1103 – A.7.2	Shall be at least 16
eventClassDescription	NTCIP 1103 – A.7.3.4	FSORS
communityNamesMax	NTCIP 1103 – A.7.8	Shall be at least 3
numFonts	NTCIP 1203 – 5.4.1	Shall be at least 12
maxFontCharacters	NTCIP 1203 – 5.4.3	Shall be at least 255

defaultFlashOn	NTCIP 1203 – 5.5.3	The DMS shall support flash “on” times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultFlashOnActive	NTCIP 1203 – 5.5.4	The DMS shall support flash “on” times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultFlashOff	NTCIP 1203 - 5.5.5	The DMS shall support flash “off” times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultFlassOffActive	NTCIP 1203 – 5.5.6	The DMS shall support flash “off” times ranging from 0.1 to 9.9 seconds in 0.1 second increments
defaultBackgroundColor	NTCIP 1203 – 5.5.2	The DMS shall support the black background color
defaultForegroundColor	NTCIP 1203 - 5.5.2	The DMS shall support the amber foreground color
defaultJustificationLine	NTCIP 1203 - 5.5.9	The DMS shall support the following forms of line justification: left, center, and right
defaultJustificationPage	NTCIP 1203 - 5.5.11	The DMS shall support the following forms of page justification: top, middle, and bottom
defaultPageOnTime	NTCIP 1203 - 5.5.13	The DMS shall support page “on” times ranging from 0.1 to 25.5 seconds in 0.1 second increments
defaultPageOffTime	NTCIP 1203 - 5.5.15	The DMS shall support page “off” times ranging from 0.0 to 25.5 seconds in 0.1 second increments
defaultCharacterSet	NTCIP 1203 - 5.5.21	The DMS shall support the eight bit character set
dmsMaxChangeableMsg	NTCIP 1203 - 5.6.3	Shall be at least 100.
dmsMessageMultiString	NTCIP 1203 - 5.6.8.3	The DMS shall support any valid MULTI string containing any subset of those MULTI tags listed in Table 3 (below)
dmsControlMode	NTCIP 1203 - 5.7.1	Shall support at least the following modes: local, central, and centralOverride
dmsSWReset	NTCIP 1203 - 5.7.2	FSORS
dmsMessageTimeRemaining	NTCIP 1203 - 5.7.4	FSORS

dmsShortPowerRecoveryMessage	NTCIP 1203 - 5.7.8	FSORS
dmsLongPowerRecoveryMessage	NTCIP 1203 - 5.7.9	FSORS
dmsShortPowerLossTime	NTCIP 1203 – 5.7.14	FSORS
dmsResetMessage	NTCIP 1203 - 5.7.11	FSORS
dmsCommunicationsLossMessage	NTCIP 1203 - 5.7.12	FSORS
dmsTimeCommLoss	NTCIP 1203 - 5.7.13	FSORS
dmsEndDurationMessage	NTCIP 1203 - 5.7.15	FSORS
dmsMultiOtherErrorDescription	NTCIP 1203 - 5.7.20	If the vendor implements any vendor-specific MULTI tags, the DMS shall provide meaningful error messages within this object whenever one of these tags generates an error
dmsIllumControl	NTCIP 1203 - 5.8.1	The DMS shall support the following illumination control modes: Photocell, and Manual
dmsIllumNumBrightLevels	NTCIP 1203 - 5.8.4	Shall be at least 100
dmsIllumLightOutputStatus	NTCIP 1203 - 5.8.9	FSORS
numActionTableEntries	NTCIP 1203 - 5.9.1	Shall be at least 200
watcdogFailureCount	NTCIP 1203 - 5.11.1.5	FSORS
dmsStatDoorOpen	NTCIP 1203 - 5.11.1.6	FSORS
fanFailures	NTCIP 1203 - 5.11.2.3.1	FSORS
fanTestActivation	NTCIP 1203 - 5.11.2.3.2	FSORS
tempMinCtrlCabinet	NTCIP 1203 - 5.11.4.1	FSORS
tempMaxCtrlCabinet	NTCIP 1203 - 5.11.4.2	FSORS
tempMinSignHousing	NTCIP 1203 - 5.11.4.5	FSORS
tempMaxSignHousing	NTCIP 1203 - 5.11.4.6	FSORS

D. MULTI Tags

Each DMS shall support the following message formatting MULTI tags. The manufacturer may choose to support additional standard or manufacturer specific MULTI tags.

Code	Feature
f1	field 1 - time (12hr)
f2	field 2 - time (24hr)
f8	field 8 – day of month
f9	field 9 – month

Code	Feature
f10	field 10 - 2 digit year
f11	field 11 - 4 digit year
fl (and /fl)	flashing text on a line by line basis with flash rates controllable in 0.5 second increments.
fo	Font
jl2	Justification – line – left
jl3	Justification – line – center
jl4	Justification – line – right
jl5	Justification – line – full
jp2	Justification – page – top
jp3	Justification – page – middle
jp4	Justification – page – bottom
mv	moving text
nl	new line
np	new page, up to 2 instances in a message (i.e., up to 3 pages/frames in a message counting first page)
pt	page times controllable in 0.5 second increments.

E. Documentation

Supply software with full documentation, including a CD-ROM containing ASCII versions of the following MIB files in Abstract Syntax Notation 1 (ASN.1) format:

- The relevant version of each official standard MIB Module referenced by the device functionality.
- If the device does not support the full range of any given object within a Standard MIB Module, a manufacturer specific version of the official Standard MIB Module with the supported range indicated in ASN.1 format in the SYNTAX and/or DESCRIPTION fields of the associated OBJECT TYPE macro. Name this file identical to the standard MIB Module, except that it will have the extension ".man".
- A MIB Module in ASN.1 format containing any and all manufacturer-specific objects supported by the device with accurate and meaningful DESCRIPTION fields and supported ranges indicated in the SYNTAX field of the OBJECT-TYPE macros.
- A MIB containing any other objects supported by the device.

Allow the use of any and all of this documentation by any party authorized by the Department for systems integration purposes at any time initially or in the future, regardless of what parties are involved in the systems integration effort.

F. NTCIP Acceptance Testing

Test the NTCIP requirements outlined above by a third party testing firm. Submit to the Engineer for approval a portfolio of the selected firm. Include the name, address, and a history of the selected firm in performing NTCIP testing along with references. Also provide a contact person's name and phone number. Submit detailed NTCIP testing plans and procedures, including a list of hardware and software, to the Engineer for review and approval 10 days in advance of a scheduled testing date. Develop test documents based on the NTCIP requirements of these Project Special Provisions. The acceptance test will use the NTCIP Exerciser, and/or other authorized

testing tools and will follow the guidelines established in the ENTERPRISE Test Procedures. Conduct the test in North Carolina on the installed system in the presence of the Engineer. Document and certify the results of the test by the firm conducting the test and submit the Engineer for review and approval. In case of failures, remedy the problem and have the firm retest in North Carolina. Continue process until all failures are resolved. The Department reserves the right to enhance these tests as deemed appropriate to ensure device compliance.

31.2. Measurement and Payment

There will be no direct payment for the work covered by this section.

Payment for this work will be covered in the applicable sections of these Project Special Provisions at the contract unit price for "Dynamic Message Sign ( )" and will be full compensation for all work listed above.

32. DAMAGED MATERIAL REMOVAL

32.1. DESCRIPTION

This Project includes the removal of existing materials and equipment that are damaged. At the direction of the Engineer, remove existing damaged materials and equipment as detailed in these Project Special Provisions.

32.2. CONSTRUCTION METHODS

A. Remove Damaged Pole

Remove damaged poles at locations directed by the Engineer. Restore the existing unpaved ground or sidewalk to as close to its original condition as possible, as approved by the Engineer. Ensure that all attachments to pole have been removed prior to damaged pole removal.

Coordinate with the Engineer on utility attachments that have not been removed.

Dispose of in accordance with Engineer's direction and in a manner consistent with local laws and regulations.

B. Remove Damaged Cabinet

Remove damaged cabinets at location directed by the Engineer. Where applicable, maintain as little disturbance to the existing cabinet foundation or unpaved ground, as approved by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

C. Remove Damaged Junction Box

Remove damaged junction boxes at locations directed by the Engineer. Restore the existing unpaved ground or sidewalk to as close to its original condition as possible, as approved by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

D. Remove Damaged Ramp Metering Signal Head/Pole

Remove damaged ramp metering signal heads and/or support poles as directed by the Engineer. Coordinate with the Engineer to ensure all cabling and conduit is maintained in an undisturbed manner, as approved by the Engineer.

Restore the existing unpaved ground or sidewalk to as close to its original condition as possible, as approved by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

E. Remove Damaged DMS Assembly

Remove damaged DMS assembly including all components and wires, as directed by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

F. Remove Damaged DMS Structure

Remove damaged DMS Structure, as directed by the Engineer. Restore the existing unpaved ground or sidewalk to as close to its original condition as possible, as approved by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

G. Remove Damaged ITS Device

Remove damaged ITS Device, including cameras, solar assemblies, or microwave vehicle detection system components and any associated hardware, as directed by the Engineer.

Dispose of in accordance with Engineer's discretion and in a manner consistent with local laws and regulations.

32.3. MEASUREMENT AND PAYMENT

Remove Damaged Pole will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged Cabinet will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged Junction Box will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged Ramp Metering Signal Head/Pole will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged DMS Assembly will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged DMS Structure will be measured and paid for as the actual number of each item type removed and accepted.

Remove Damaged ITS Device will be measured and paid for as the actual number of each item type removed and accepted.

No measurement or payment will be made for storage, disposal, cost of transportation, tools, materials, cost of labor, incidentals, related testing, 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 surface in accordance with these Project Special Provisions as such work will be considered incidental to this Section of the Project Special Provisions.

Payment will be made under:

Pay Item	Pay Unit
Remove Damaged Pole	Each
Remove Damaged Cabinet	Each
Remove Damaged Junction Box	Each
Remove Damaged Ramp Metering Signal Head/Pole	Each
Remove Damaged DMS Assembly	Each
Remove Damaged DMS Structure	Each
Remove Damaged ITS Device	Each

33. TREE TRIMMING AND REMOVAL

33.1. DESCRIPTION

Perform tree trimming for trees obstructing normal function of device equipment within the project limits as directed by the Engineer. Perform tree removal for wooded areas that impact normal function of device equipment within the project limits as directed by the Engineer.

“Trimming” is defined as cutting and satisfactory disposal of wooded vegetation and debris.

“Removal” is defined as complete removal and satisfactory disposal of a tree and roots.

33.2. MATERIAL

Refer to Division 10 of the Standard Specifications.

33.3. CONSTRUCTION METHODS

A. Tree Trimming

Trim or cut branches of trees that obstruct any device use or personnel access to device equipment at the direction of the Engineer.

Trim or cut branches of trees that impede the view of CCTV cameras, as approved by the Engineer.

B. Tree Removal

The Engineer may elect to have select trees removed from the project area to improve device functionality or maintenance accessibility. Trees removed in this manner shall have an average cross section diameter of at least 4 inches at a point 2 feet above the ground level. Completely remove the select trees including the root ball and properly backfill unless otherwise directed by the Engineer.

33.4. MEASUREMENT AND PAYMENT

Tree Trimming will be measured and paid on a lump-sum basis. No measurement will be made of any amount of trimming performed or labor expended.

Selective Tree Removal will be measured and paid as the actual number of select trees removed from the project area. Each tree removed will be paid at the contract unit price for the pay item size applicable to the actual tree diameter measured at a height of 4.5 feet above the ground, as indicated in the Table below.

Pay Item Size	Actual Tree Diameter
6 inch	4 inches up to 8 inches
10 inch	8 inches up to 12 inches
15 inch	12 inches up to 18 inches
18 inches	18 inches and over

Payment will be made under:

Pay Item **Pay Unit**

Tree Trimming ..... Lump Sum
Selective Tree Removal, 6'' ..... Each
Selective Tree Removal, 10'' ..... Each
Selective Tree Removal, 15'' ..... Each
Selective Tree Removal, 18'' ..... Each

34. TEMPORARY TRAFFIC CONTROL

34.1. DESCRIPTION

Perform temporary traffic control as specified in the Contract or directed by the Engineer. Ensure practices align with the Standard Specifications, these Project Special Provisions, the Transportation Management Plan, The MUTCD, and Roadway Standard Drawings to maintain traffic control in a safe an efficient manner during construction of this project. All temporary traffic control materials and devices will be furnished by the Contractor and remain property of the contractor, unless otherwise specified.

34.2. MATERIAL

Refer to Division 11 – Work Zone Traffic Control of the Standard Specifications.

34.3. CONSTRUCTION METHODS

Refer to Division 11 – Work Zone Traffic Control of the Standard Specifications.

Comply with Division 11 of the NCDOT 2018 Roadway Standard Drawings or Engineer pre-approved traffic control methods.

34.4. MEASUREMENT AND PAYMENT

Traffic Control – No Shoulder/Lane Closure will be measured and paid as each for the actual number of work zone installations performed as a part of the Contract that do not include a shoulder or lane closure, or as directed by the Engineer. Such prices and payment will be compensation for all materials, labor, tools, equipment and incidentals necessary to complete this work.

Traffic Control – Shoulder Closure will be measured and paid as each for the actual number of shoulder closures performed as a part of the Contract, or as directed by the Engineer. Such prices and payment will be compensation for all materials, labor, tools, equipment and incidentals necessary to complete this work.

Traffic Control – Lane Closure will be measured and paid as each for the actual number of lane closures performed as a part of the Contract, or as directed by the Engineer. Such prices and payment will be compensation for all materials, labor, tools, equipment and incidentals necessary to complete this work.

Temporary Traffic Control will be paid and measure for as each occurrence. All materials and devices (such as work zone signs, drums, cones, flaggers, barriers, etc.) necessary for safe and successful traffic control shall be considered incidental to the Shoulder Closure or Lane Closure Pay Items.

Payment will be made under:

Pay Item	Pay Unit
Traffic Control - No Shoulder/Lane Closure	Each
Traffic Control – Shoulder Closure	Each
Traffic Control – Lane Closure	Each

35. RAMP METERING SIGNALS (RMS) EQUIPMENT

35.1. DESCRIPTION

Furnish and install ramp metering signals equipment and associated hardware at the direction of the Engineer in accordance with these Project Special Provision and the Standard Specifications.

35.2. MATERIAL

A. RMS Controller and Cabinets

1. General

Provide either ATC controller that supports Type 332 cabinets.

Detector Type

Provide controllers that supports inductive loop, passive microwave radar detectors.

Number of Detectors
Provide controllers that supports 64 detectors.

Number of Freeway Lanes
Provide controllers that supports six freeway lanes.

Number of Ramp Lanes
Provide controllers that supports four ramp lanes.

2. ATC Controller

A. Standards

The ATC controller shall comply with the following standards:

- Busybox version 1.18.5
- Caltrans TEES 2009
- EIA-485
- EIA-574
- GNU Coding Standards, 1 January 2005
- IEEE 802.3-2002 Specification
- IEEE P1014/D1.2, standard for Versa Module Eurocard (VMEbus)
- IEEE Recommended Practice for Software Design Descriptions, IEEE Standard 1016-1998ITE Advanced Transportation Controller (ATC) version 5.2a
- IEEE Recommended Practice for Software Requirements Specifications, IEEE Standard 830-1998
- ISO/IEC 9899:1999 Programming Language C
- ITE ATC API version 2.06b
- ITE ATC API version 2.17 draft
- LINUX 2.6.x
- Military Specification MIL-P-13949 for Fabrication of printed circuit boards
- Military Specification MIL-P-13949G Grade of Pits and Dents for all printed circuit boards
- Military Specification MILSTD-275E for mounting of parts and assemblies on the printed circuit boards
- Military Specification MIL-STD-2000 for hand soldering
- Military Specifications MIL-R-11F or MIL-R-22684 for fixed carbon film, deposited carbon, or composition- insulated resistors
- NEMA TS-2
- NTCIP 1201 Global Object (GO) Definitions – version 02, v02.32
- NTCIP 1207 Object Definitions for Ramp Meter Control (RMC) Units – Version 02, v02.06b
- NTCIP 1209 Data Element Definitions for Transportation Sensor Systems, v02.10
- NTCIP 2104 Ethernet Subnetwork Profile, v01.11
- NTCIP 2202 Internet (TCP/IP and UDP/IP) Transport Profile, v01.15
- NTCIP 2301 Simple Transportation Management Framework Application Profile, v01.08 x NTCIP AB3418b Standard Communications Protocol for Traffic Signals in California,

Specification and Implementation Requirements
- UClibe version 0.9.32
- USB Specifications, Revision 1.1, © 1998 Compaq Computer Corporation, Intel Corporation, Microsoft Corporation, NEC Corporation
- USB Mass Storage Bulk Only 1.0
- USB Mass Storage Control/Bulk/Interrupt (CBI) Specification 1.1
- USB Mass Storage Overview 1.2
- USB Mass Storage UFI Command Specification 1.0

B. Operating System

Provide an open architecture embedded Linux Kernel 3.0 operating system.

C. Hardware

Provide the ATC controller with the following modules and boards:
- Chassis
- Host board
- 2070-ATC CPU Module
- 2070-2A or approved 2070-2E field input/output module
- 2070-3B 16 line x 40 character front panel color touch screen (320x240)
- 2070-4 Power supply
- 2070-7A async. communications module
- 2070-9 Comm module FSK/.dial-up modem communications module

Provide the ATC controller host board with:
- 2070-1C Engine board
- Freescale 400 MHz 600 MIPS processor
- 64 MB RAM
- 64 Flash Memory

Provide the ATC controller with the following I/O ports:
- A minimum of two front and two rear Ethernet ports
- Seven serial ports
- C50 serial port
- Three USB 2.0 ports
- Provide a controller power supply meeting the following requirements:
- + 5 VDC source
- + 12 VDC isolated source
- +/- 12 VDC source
- 30 day backup power source
- Power condition indicators
- Input power switch

3. Type 332 Cabinet

B. RMS Digital Video Equipment System

C. RMS Signal Pole

Comply with Section 1743 of the Standard Specifications.

D. RMS Signal Head

4. General

Furnish materials, equipment, and hardware under this Section that is pre-approved on the ITS and Signals QPL and in accordance with Section 1705 of the Standard Specifications, or otherwise approved by the Engineer.

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 a 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

   (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).

5. Vehicle Signal Heads:

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

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.

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.

6. 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:

Module Type	Max. Wattage at 165° F	Nominal Wattage at 77° F
12-inch red circular	17	11

12-inch green circular	15	15

For yellow circular signal modules, provide modules tested under the procedures outlined in the VTCSH Circular Supplement to insure 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 ±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.

E. RMS Signal Cable

Furnish materials, equipment, and hardware under this Section that is pre-approved on the ITS and Signals QPL and in accordance with Section 1705 of the Standard Specifications, or otherwise approved by the Engineer.

F. RMS Inductive Loop

Furnish materials, equipment, and hardware under this Section that is pre-approved on the ITS and Signals QPL and in accordance with Section 1726 of the Standard Specifications, or otherwise approved by the Engineer.

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

G. RMS Lead-in Cable

Furnish materials, equipment, and hardware under this Section that is pre-approved on the ITS and Signals QPL and in accordance with Section 1726 of the Standard Specifications, or otherwise approved by the Engineer.

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

35.3. CONSTRUCTION METHODS

A. RMS Controller and Cabinet

B. RMS Video Detection System

C. RMS Signal Pole

Comply with Section 1743 of the Standard Specifications.

D. RMS Signal Head

1. General

Bag new vehicle signal heads with burlap bags or bags made of non-ripping material specifically designed for covering signal heads until signal heads are placed in operation. Do not use trash bags of any type.

When new signal heads are placed into operation, immediately bag and remove signals heads that are not to be reused.

Adjust each signal head vertically and horizontally so that light output will be of maximum effectiveness for traffic and pedestrians. Do not tilt signal heads forward.

2. Vehicle Signal Heads (1- and 2- Section Heads)

Install vehicle signal heads on roadside signal pedestals such that the bottom of the signal housing (including brackets) of the lowest signal head is a minimum of 5 ft. above grade at the base of the pedestal. Install the uppermost signal head so that the top of the housing (including brackets) is no more than 14 ft. above grade at the base of the pedestal.

Install signal cable in continuous lengths between signal controller cabinets and signal heads.

Route signal cable to minimize the length of cable installed and the number of cables and conductors in each run. Pull 36 inches of additional signal cable into controller cabinets.

Make electrical connections inside each signal head, signal controller cabinet, and termination compartment in metal poles. Do not splice cable at any other point between signal heads and controller cabinet.

For final signal head locations, coil 36 inches on each side of signal head if signal cable comes from both directions.

3. RMS Signal Cable

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

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. RMS Inductive Loop

Comply with Section 1725 of the Standard Specifications.

F. RMS Lead-in Cable

Comply with Section 1726 of the Standard Specifications.

35.4. MEASUREMENT AND PAYMENT

Ramp Meter Controller will be measured and paid as the actual number of ramp meter controllers furnished, installed, and accepted.

Ramp Meter Cabinet will be measured and paid as the actual number ramp meter cabinets furnished, installed, and accepted.

No measurement will be made of conflict monitors, malfunction management units, external electrical service disconnect, grounding systems, modems, meter bases and workshop as these will be incidental to furnishing and installing of ramp meter cabinets.

Ramp Meter Load Switch will be measured and paid as the actual number of ramp meter load switches furnished, installed, and accepted.

Ramp Meter Detector Card (Model 222) will be measured and paid as the actual number of detector cards furnished, installed, and accepted.

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

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

Ramp Meter Lead-in Cable (14-2) will be measured and paid as the actual linear feet of ramp meter 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.

Ramp Meter Digital Video Detection System will be measured and paid as the actual number of digital video equipment systems furnished, installed, and accepted.

Ramp Meter Type III Pedestal with Foundation will be measured and paid as the actual number of Ramp Meter Type III Pedestals with Foundations furnished, installed, and accepted.

Ramp Meter Vehicle signal head (12'', 2-Section) will be measured and paid for as the actual number of signal heads of each type, size, and number of sections furnished, installed, and accepted.

Ramp Meter Vehicle signal head (12'', 1-Section) will be measured and paid for as the actual number of signal heads of each type, size, and number of sections furnished, installed, and accepted.

No measurement will be made of visors, wire entrance fittings, interconnecting brackets, mounting assemblies, pedestrian pushbuttons, and pedestrian signal signs as these will be considered incidental to furnishing and installing vehicle signal heads.

RMS 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.

Payment will be made under:

Pay Item	**Pay Unit**
Ramp Meter Controller	Each
Ramp Meter Cabinet	Each
Ramp Meter Load Switch	Each
Ramp Meter Detector Card (Model 222)	Each
Ramp Meter Inductive Loop Sawcut	Linear Foot
Ramp Meter Lead-in Cable (14-2)	Linear Foot
Ramp Meter Video Detection System	Each

Ramp Meter Type III Pedestal with Foundation.....Each
Ramp Meter Vehicle Signal Head (12'', 1- Section) .....Each
Ramp Meter Vehicle Signal Head (12'' , 2-Section).....Each
Ramp Meter Signal Cable.....Linear Foot

Appendix Part F – Project Special

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CONFIDENTIAL QUESTIONS

(1-5-07) DB1 G56B

The Design-Build Team will be permitted to ask confidential questions of the Department, which neither the question nor answer will be shared with other proposing Design-Build Teams. For the purpose of this provision, "confidential question" shall be defined as a private inquiry containing information whose disclosure could alert others to certain details of doing business in a particular manner. The Department will determine if the question is considered a confidential question.

I. Confidential questions arising prior to issuance of the Final Request for Proposals will be allowed during the industry review of the draft RFPs with the individual Design-Build Teams.

   The Department will answer the confidential question verbally at the meeting, if possible. If not answered verbally during the meeting, the Department will answer the confidential question by subtle changes in the Final Request for Proposals, which will clarify the scope by either allowing or disallowing the request. The revision will be made in such a manner as to not disclose the confidential question.

II. After issuance of the Final Request for Proposals, confidential questions may be asked by requesting a meeting with the State Contract Officer via the Design-Build e-mail address (designbuild@ncdot.gov). The request shall be in writing and provide sufficient detail to evaluate the magnitude of the request. Questions shall be of such magnitude as to warrant a special meeting. Minor questions will not be acknowledged or answered.

   After evaluation, the State Contract Officer will respond to the question in writing to the Design-Build Team only and / or through subtle changes in the Final RFP, as reflected in an Addendum, which will clarify the scope by either allowing or disallowing the request. To the greatest extend possible, the revision will be made in such a manner as to not disclose the confidential question. Other Design-Build Teams will not be notified of the question or answer.

If the Design-Build Team includes work based on the confidential questions and answers, the work shall be included and discussed in the Technical Proposal. The Technical Proposal evaluations will be based solely on the evaluation criteria defined elsewhere in this RFP, regardless of the inclusion or absence of work based on the confidential questions and answers.

DISADVANTAGED BUSINESS ENTERPRISE

(10-16-07) (Rev. 8-17-21) 102-15(J) SP1 G61 DB1 G061

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 the Price Proposal is submitted 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 the Price Proposal is submitted 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 Proposer confirming the Design-Build Team'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 Design-Build Team.

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 Design-Build Team 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.

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 the Price Proposal is submitted.

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 contained elsewhere in this RFP.

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 **X.X%**

(A) *If the DBE goal is more than zero*, the Design-Build Team 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 Design-Build Team 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.

This goal is to be met through utilization of highway construction contractors and / or right of way acquisition firms. Utilization of DBE firms performing design, other preconstruction services, or Construction Engineering and Inspection are not included in this goal.

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

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 the Price Proposal is submitted, Proposers 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 the Price Proposal is submitted will be used toward the Department's overall race-neutral goal. Only those firms with current DBE certification at the time of Price Proposal opening will be acceptable for listing in the Proposer's submittal of DBE participation. The Design-Build Team shall indicate the following required information:

(1) *If the DBE goal is more than zero,*

(a) Proposers, at the time the Price 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 Price Proposal to be

considered responsive. Proposers shall indicate the total dollar value of the DBE participation for the contract.

(b) If Proposers 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**. Price Proposals submitted that do not have DBE participation indicated on the appropriate form will not be read publicly during the opening of the Price Proposals. The Department will not consider these Price Proposals for award and the proposal will be rejected.

(c) The Proposer shall be responsible for ensuring that the DBE is certified at the time the Price Proposal is submitted by checking the Directory of Transportation Firms. If the firm is not certified at the time of the opening of the Price Proposals, 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 this special provision.

DBE Prime Contractor

When a certified DBE firm proposes 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 proposer. In most cases, a DBE proposer 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 proposer and any other DBE subcontractors will count toward the DBE goal. The DBE proposer 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 45.0% and the DBE proposer will only perform 40.0% of the contract work, the prime will list itself at 40.0%, and the additional 5.0% 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 proposer would.

Written Documentation - Letter of Intent

The Proposer shall submit written documentation for each DBE that will be used to meet the DBE goal of the contract, indicating the Proposer'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. on the sixth calendar day following opening of Price Proposals, 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 Proposer 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 Design-Build Team 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 the Price Proposals, 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 Proposer fails to meet or exceed the DBE goal the Proposer with the apparent adjusted low price 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 the Price Proposals 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 Design-Build Team cannot send the information electronically, then one complete set and five 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 Proposer 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 Proposer 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 Proposer has made. Listed below are examples of the types of actions a proposer 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 Proposer must solicit this interest within at least ten days prior to the opening of the Price Proposals 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 Proposer 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 Proposer'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 proposer 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 proposer'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 Proposer of the responsibility to make good faith efforts. Proposing Design-Build Teams 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 Proposer'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 Proposer'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 proposer.

(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 seven days from the Price Proposals opening the Business Opportunity and Work Force Development Unit at BOWD@ncdot.gov to give notification of the Proposer's inability to get DBE quotes.

(I) Any other evidence that the Proposer submits which shows that the Proposer has made reasonable good faith efforts to meet the DBE goal.

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

(1) Whether the Proposer's documentation reflects a clear and realistic plan for achieving the DBE goal.

(2) The Proposer's past performance in meeting the DBE goals.

(3) The performance of other proposers in meeting the DBE goal. For example, when the Proposer with the apparent adjusted low price fails to meet the DBE goal, but others meet it, you may reasonably raise the question of whether, with additional reasonable efforts the Proposer with the apparent adjusted low price could have met the goal. If the Proposer with the apparent adjusted low price fails to meet the DBE goal, but meets or exceeds the average DBE participation obtained by other proposers, the Department may view this, in conjunction with other factors, as evidence of the Proposer with the apparent adjusted low price having made a good faith effort.

If the Department does not award the contract to the Proposer with the apparent adjusted low price, the Department reserves the right to award the contract to the Proposer with the next apparent adjusted low price that can satisfy 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 Prequalification Engineer will notify the Design-Build Team verbally and in writing of non-good faith. A Design-Build Team may appeal a determination of non-good faith made by the Goal Compliance Committee. If a Design-Build Team wishes to appeal the determination made

by the Committee, they shall provide written notification to the State Prequalification Engineer or at DBE@ncdot.gov. The appeal shall be made within two 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 Design-Build Team.

(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 Design-Build Team 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 Design-Build Team may count toward its DBE requirement 60.0 percent of its expenditures for materials and supplies required to complete the contract and obtained from a DBE regular dealer and 100.0 percent of such expenditures from a DBE manufacturer.

(F) Manufacturers and Regular Dealers

A Design-Build Team 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 Design-Build Team 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 Design-Build Team 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 clearly display 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 Design-Build Team 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 Design-Build Team shall not terminate the DBE for convenience. This includes, but is not limited to, instances in which the Design-Build Team 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 Design-Build Team must give notice in writing both by certified mail and e-mail 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 Design-Build Team must give the DBE subcontractor five (5) business days to respond to the Design-Build Team'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 Design-Build Team 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 Design-Build Team 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 the Price Proposal was submitted 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 the Price Proposal was submitted 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 Design-Build Team 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 Design-Build Team.

(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 Design-Build Team 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 Design-Build Team 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).

(3) Exception: If the DBE's ineligibility is caused solely by its having exceeded the size standard during the performance of the contract, the Department will not require the Design-Build Team 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 and Department’s overall race-neutral goals.

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 Prime Contractor or any affiliated companies within the Design-Build Team fails to follow this procedure they may be disqualified from further bidding for a period of up to six 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 Design-Build Team 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 Design-Build Team'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 Design-Build Team 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 Design-Build Team shall seek participation by DBEs unless otherwise approved by the Engineer.

When the Design-Build Team requests changes in the work that result in the reduction or elimination of work that the Design-Build Team committed to be performed by a DBE, the Design-Build Team 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 Design-Build Team 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 Design-Build Team shall furnish the Engineer a copy of the agreement. The documentation shall also indicate the percentage (60.0% or 100.0%) of expenditures claimed for DBE credit.

Reporting Disadvantaged Business Enterprise Participation

The Design-Build Team 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 Prime Contractor or other affiliated companies within the Design-Build Team 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 Design-Build Team to submit the required information in the time frame specified may result in the disqualification of that Prime Contractor and any affiliate companies within the Design-Build Team 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 Prime Contractor or any affiliate companies within the Design-Build Team from being approved for work on future NCDOT projects until the required information is submitted.

Design-Build Teams 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 Design-Build Team 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 for Roads and Structures* may be cause to disqualify the Prime Contractor or any affiliated companies within the Design-Build Team from further bidding for a specified length of time.

CERTIFICATION FOR FEDERAL-AID CONTRACTS

(3-21-90) DB1 G85

The Proposer certifies, by signing and submitting a Design-Build Proposal, to the best of his or her knowledge and belief, that:

(1) 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.

(2) 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 Proposer also agrees by submitting a Design-Build 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 sub-recipients shall certify and disclose accordingly.

CONTRACTOR'S LICENSE REQUIREMENTS

(7-1-95) DB1 G88

If the Design-Build Team does not hold the proper license to perform any plumbing, heating, air conditioning, or electrical work in this contract, he shall 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).

USE OF UNMANNED AIRCRAFT SYSTEM (UAS)

(7-1-19) DB1 G092

The Design-Build Team shall adhere to all Federal, State and Local regulations and guidelines for the use of Unmanned Aircraft Systems (UAS). This includes, but is not limited to, US 14 CFR Part 107 *Small UAS Rule*, NC GS 15A-300.2 *Regulation of launch and recovery sites,* NC GS 63-95 *Training required for the operation of unmanned aircraft systems*, NC GS 63-96 *Permit required for commercial operation of unmanned aircraft system,* and NCDOT UAS Policy. The required operator certifications include possessing a current Federal Aviation Administration (FAA) Remote Pilot Certificate, a NC UAS Operator Permit, as well as operating a UAS registered with the FAA.

Prior to beginning operations, the Design-Build Team shall complete the NCDOT UAS - Flight Operation Approval Form and submit it to the Engineer for approval. All UAS operations shall be approved by the Engineer, in writing, prior to beginning the operations.

All Design-Build team members operating UAS shall have UAS specific general liability insurance to cover all operations under this contract.

The use of UAS shall be at the Design-Build Team's discretion. Except as allowed otherwise below, no measurement or payment will be made for the use of UAS. In the event that the Department directs the Design-Build Team to utilize UAS, all costs associated with using UAS will be paid for as extra work, in accordance with Subarticle 104-8(A) of the *Standard Specifications for Roads and Structures*.

U.S. DEPARTMENT OF TRANSPORTATION HOTLINE

(11-22-94) 108-5 DB1 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) DB1 G100

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."

COOPERATION BETWEEN CONTRACTORS

(9-1-11) (Rev. 9-7-17) DB1 G133

The Design-Build Team's attention is directed to Article 105-7 of the 2018 *Standard Specifications for Roads and Structures*.

The Design-Build Team on this project shall cooperate with the Contractor or Design-Build Team working within or adjacent to the limits of this project, to the extent that the work can be carried out to the best advantage of all concerned.

***** STANDARD SPECIAL PROVISIONS *****

VALUE ENGINEERING PROPOSALS

(4-6-15) 104 DB01 G116

Value Engineering Proposals (VEP), as specified in Article 104-12 of the 2018 *Standard Specifications for Roads and Structures* will be accepted. Only proposals, which alter the Technical Proposal submitted by the Design-Build Team and / or the requirements of the RFP issued by the Department, will be considered as Value Engineering Proposals.

Revise the 2018 *Standard Specifications for Roads and Structures* as follows:

Page 1-40, Subarticle 104-12(B), Evaluation of Proposals, lines 42-44, replace the fourth sentence of the second paragraph with the following:

Pending execution of a formal supplemental agreement implementing an approved VEP and transferal of final plans (hard copy and electronic), sealed by an engineer licensed in the State of North Carolina, incorporating an approved VEP to the State Value Management Engineer, the Resident Engineer and the Design-Build Unit, the Design-Build Team shall remain obligated to perform the work in accordance with the terms of the existing contract with no additional contract time or compensation.

Page 1-41, Subarticle 104-12(D), Preliminary Review, lines 9-12, replace the first sentence of the first paragraph with the following:

Should the Design-Build Team desire a preliminary review of a possible VEP, prior to expending considerable time and expense in full development, a copy of the Preliminary VEP shall be concurrently submitted to the State Value Management Engineer at **ValueManagementUnit@ncdot.gov**, the Resident Engineer and the Design-Build Unit.

Page 1-41, Subarticle 104-12(E), Final Proposal, lines 22-23, replace the first sentence of the first paragraph with the following:

The Design-Build Team shall concurrently submit a copy of the Final VEP to the State Value Management Engineer at **ValueManagementUnit@ncdot.gov,** the Resident Engineer and the Design-Build Unit.

Page 1-42, Subarticle 104-12(F), Modifications, lines 2-10, replace the first paragraph with the following:

The preparation of new design drawings by the Design-Build Team shall be coordinated with the appropriate Department personnel through the State Value Management Engineer. The Design-Build Team shall provide, at no charge to the Department, one set of reproducible drawings of the approved design needed to implement the VEP. Drawings (hard copy and electronic) which are sealed by an engineer licensed in the State of North Carolina shall be concurrently submitted to the State Value Management Engineer, the Resident Engineer and the Design-Build Unit no later than ten (10) business days after acceptance of a VEP, unless otherwise permitted in writing.

Page 1-43, Subarticle 104-12(F), Modifications, lines 1-5, replace the eighth paragraph with the following:

Unless and until a supplemental agreement is executed and issued by the Department; and final plans (hard copy and electronic) sealed by an engineer licensed in the State of North Carolina incorporating an approved VEP have been concurrently provided to the State Value Management Engineer, the Resident Engineer and the Design-Build Unit, the Design-Build Team shall remain obligated to perform the work in accordance with the terms of the existing contract with no additional contract time or compensation.

PLANT AND PEST QUARANTINES
(Imported Fire Ant, Gypsy Moth, Witchweed, Emerald Ash Borer And Other Noxious Weeds)
08/31/2013(Rev. 12-20-16) DB1 G130

Within Quarantined Area

This project may be within a county regulated for plant and/or pests. If the project or any part of the Design-Build Team'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 or other noxious weeds.

GIFTS FROM VENDORS AND CONTRACTORS

(12-15-09) DB1 G152

By Executive Order 24, issued by Governor Perdue, and *N.C. G.S.§ 133-32,* it is unlawful for any vendor or contractor (i.e. architect, bidder, contractor, construction manager, design professional, engineer, landlord, offeror, seller, subcontractor, supplier, or vendor), to make gifts or to give favors to any State employee of the Governor's Cabinet Agencies (i.e. Administration, Commerce, Correction, Crime Control and Public Safety, Cultural Resources, Environment and Natural Resources, Health and Human Services, Juvenile Justice and Delinquency Prevention, Revenue, Transportation, and the Office of the Governor). This prohibition covers those vendors and contractors who:

(1) have a contract with a governmental agency; or
(2) have performed under such a contract within the past year; or
(3) anticipate bidding on such a contract in the future.

For additional information regarding the specific requirements and exemptions, vendors and contractors are encouraged to review Executive Order 24 and *G.S. § 133-32*.

Executive Order 24 also encouraged and invited other State Agencies to implement the requirements and prohibitions of the Executive Order to their agencies. Vendors and contractors should contact other State Agencies to determine if those agencies have adopted Executive Order 24.

MATERIAL AND EQUIPMENT STORAGE & PARKING OF PERSONAL VEHICLES

(10-19-21) 1101 DB11 R03

Revise the 2018 *Standard Specifications for Roads and Structures* as follows:

Page 11-2, Article 1101-8 MATERIAL AND EQUIPMENT STORAGE, Lines 35 - 38, delete and replace with the following:

Except as allowed otherwise below, when work is not in progress, keep all personnel, equipment, machinery, tools, construction debris, materials and supplies away from active travel lanes in accordance with Table 1101-1.

TABLE 1101-1
MATERIAL AND EQUIPMENT STORAGE FROM ACTIVE TRAVEL LANES

Posted Speed Limit (mph)	Distance (ft)
40 or less	≥ 18
45 - 50	≥ 28
55	≥ 32
60 or higher	≥ 40

When vehicles, equipment and / or materials are protected by concrete barrier or guardrail, they shall be offset at least five feet from the barrier or guardrail.

Page 11-2, Article 1101-9 PARKING OF PERSONAL VEHICLES, Lines 40 - 41, delete and replace with the following:

In accordance with Section 1101-8, or as directed by the Engineer, provide staging areas for personal vehicle parking before use.

WORK ZONE INSTALLER

(7-20-21) 1101, 1150 DB11 R04

The Design-Build Team shall provide the service of at least one qualified work zone installer during the setup, installation, and removal of temporary traffic control devices within any highway right of way. The qualified work zone installer shall serve as crew leader and shall be on site and directing the installation and removal of temporary traffic control devices. If multiple temporary traffic control installations and / or removals are occurring simultaneously, then each crew leader shall be a qualified work zone installer.

The work zone installer shall be qualified by an NCDOT approved training agency in the safe and competent set up of temporary traffic control. For a complete listing of approved training agencies, reference the Work Zone Safety Training webpage noted below:

https://connect.ncdot.gov/projects/WZTC/Pages/Training.aspx

In accordance with Article 1101-13 of the 2018 *Standard Specifications for Roads and Structures*, a work zone supervisor may fulfill the role of the work zone installer during the setup, installation and removal of temporary traffic control devices within any highway right of way, provided they are on site and directing the installation and removal of temporary traffic control devices.

At a minimum, all other individuals participating in the setup, installation, and removal of temporary traffic control devices within any highway right of way shall be certified as a qualified flagger in accordance with Article 1150-3 of the 2018 *Standard Specifications for Roads and Structures*, even if flagging is not being performed as part of the traffic control operation.

Prior to or at the preconstruction conference, the Design-Build Team shall provide the name and contact information of all qualified work zone installers to the Engineer. Additionally, the Design-Build Team shall provide a qualification statement that all other individuals participating in the setup, installation and removal of temporary traffic control devices are qualified flaggers that have been properly trained through an NCDOT approved training agency.

ON-THE-JOB TRAINING

(2-24-15) (Rev. 7-20-17) 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

AVAILABILITY OF FUNDS – TERMINATION OF CONTRACTS

(9-1-11) 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 Article 108-13(E), of the *North Carolina Department of Transportation Standard Specifications for Roads and Structures*, dated January 2018 and as amended by the Standard Special Provision, Division One found elsewhere in this RFP.

***** STANDARD SPECIAL PROVISIONS *****

AWARD OF CONTRACT

(6-28-77)(Rev. 1-8-16) Z-6

"The North Carolina Department of Transportation, in accordance with the provisions of *Title VI of the Civil Rights Act of 1964* (78 Stat. 252) and the Regulations of the Department of Transportation (*49 C.F.R., Part 21*), issued pursuant to such act, hereby notifies all bidders that it will affirmatively insure that the contract entered into pursuant to this advertisement will be awarded to the lowest responsible bidder without discrimination on the ground of race, color, or national origin".

TITLE VI AND NONDISCRIMINATION

I. Title VI Assurance

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:

(1) Compliance with Regulations: The contractor shall comply with the Regulation relative to nondiscrimination in Federally-assisted programs of the Department of Transportation (hereinafter, "DOT") Title 49, Code of Federal Regulations, Part 21, as they may be amended from time to time, (hereinafter referred to as the Regulations), which are herein incorporated by reference and made a part of this contract.

(2) 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 either directly or indirectly in the discrimination prohibited by section 21.5 of the Regulations, including employment practices when the contract covers a program set forth in Appendix B of the Regulations.

(3) 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 Regulations relative to nondiscrimination on the grounds of race, color, or national origin.

(4) Information and Reports: The contractor shall provide all information and reports required by the Regulations or 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 North Carolina Department of Transportation (NCDOT) or the Federal Highway Administration (FHWA) to be pertinent to ascertain compliance with such Regulations, orders and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor shall so certify to the NCDOT, or the FHWA as appropriate, and shall set forth what efforts it has made to obtain the information.

(5) Sanctions for Noncompliance: In the event of the contractor's noncompliance with the nondiscrimination provisions of this contract, the NCDOT shall impose such contract sanctions as it or the FHWA may determine to be appropriate, including, but not limited to:

(a) Withholding of payments to the contractor under the contract until the contractor complies, and / or
(b) Cancellation, termination or suspension of the contract, in whole or in part.

(6) Incorporation of Provisions: The contractor shall include the provisions of paragraphs (1) through (6) in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Regulations, or directives issued pursuant thereto.

The contractor shall take such action with respect to any subcontractor procurement as the NCDOT or the FHWA may direct as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that, in the event a contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier as a result of such direction, the contractor may request the NCDOT to enter into such litigation to protect the interests of the NCDOT, and, in addition, the contractor may request the United States to enter into such litigation to protect the interests of the United States.

II. Title VI Nondiscrimination Program

Title VI of the 1964 Civil Rights Act, 42 U.S.C. 2000d, provides that: "No person in the United States shall, on the grounds of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance." The broader application of nondiscrimination law is found in other statutes, executive orders, and regulations (see Section III, Pertinent Nondiscrimination Authorities), which provide additional protections based on age, sex, disability and religion. In addition, the 1987 Civil Rights Restoration Act extends nondiscrimination coverage to all programs and activities of federal-aid recipients and contractors, including those that are not federally-funded.

Nondiscrimination Assurance

The North Carolina Department of Transportation (NCDOT) hereby gives assurance that no person shall on the ground of race, color, national origin, sex, age, and disability, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity conducted by the recipient, as provided by Title VI of the Civil Rights Act of 1964, the Civil Rights Restoration Act of 1987, and any other related Civil Rights authorities, whether those programs and activities are federally funded or not.

Obligation

During the performance of this contract, the Contractor and its subcontractors are responsible for complying with NCDOT's Title VI Program. The Contractor must ensure that NCDOT's Notice of

Nondiscrimination is posted in conspicuous locations accessible to all employees and subcontractors on the jobsite, along with the Contractor's own Equal Employment Opportunity (EEO) Policy Statement. The Contractor shall physically incorporate this "**TITLE VI AND NONDISCRIMINATION**" language, in its entirety, into all its subcontracts on federally-assisted and state-funded NCDOT-owned projects, and ensure its inclusion by subcontractors into all subsequent lower tier subcontracts. The Contractor and its subcontractors shall also physically incorporate the **FHWA-1273**, in its entirety, into all subcontracts and subsequent lower tier subcontracts on **Federal-aid highway** construction contracts only. The Contractor is also responsible for making its subcontractors aware of NCDOT's Discrimination Complaints Process, as follows:

FILING OF COMPLAINTS

1. **Applicability** – These complaint procedures apply to the beneficiaries of the NCDOT's programs, activities, and services, including, but not limited to, members of the public, contractors, subcontractors, consultants, and other sub-recipients of federal and state funds.

2. **Eligibility** – Any person or class of persons who believes he/she has been subjected to discrimination or retaliation prohibited by any of the Civil Rights authorities, based upon race, color, sex, age, national origin, or disability, may file a written complaint with NCDOT's Civil Rights office. The law prohibits intimidation or retaliation of any sort. The complaint may be filed by the affected individual or a representative, and must be in writing.

3. **Time Limits and Filing Options** – A complaint must be filed no later than 180 calendar days after the following:

   - The date of the alleged act of discrimination; or
   - The date when the person(s) became aware of the alleged discrimination; or
   - 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 other discrimination complaints may be submitted to the following entities:

   - **North Carolina Department of Transportation**, Office of Equal Opportunity & Workforce Services (EOWS), External Civil Rights Section, 1511 Mail Service Center, Raleigh, NC 27699-1511; 919-508-1808 or toll free 800-522-0453

   - **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

     Federal Highway Administration, North Carolina Division Office, 310 New Bern Avenue, Suite 410, Raleigh, NC 27601, 919-747-7010

Federal Highway Administration, Office of Civil Rights, 1200 New Jersey Avenue, SE, 8th Floor, E81-314, Washington, DC 20590, 202-366-0693; 202-366-0752
Federal Transit Administration, Office of Civil Rights, ATTN: Title VI Program Coordinator, East Bldg. 5th Floor – TCR, 1200 New Jersey Avenue, SE, Washington, DC 20590

Federal Aviation Administration, Office of Civil Rights, 800 Independence Avenue, SW, Washington, DC 20591, 202-267-3258

- **US Department of Justice**, Special Litigation Section, Civil Rights Division, 950 Pennsylvania Avenue, NW, Washington, DC 20530, 202-514-6255 or toll free 877-218-5228

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 EOWS at the phone number above 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, sex, age, or disability. The term "basis" refers to the complainant's membership in a protected group category. Contact this office to receive a Discrimination Complaint Form.

Protected Categories	Definition	Examples	Applicable Statutes and Regulations	
			FHWA	FTA
Race	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	Title VI of the Civil Rights Act of 1964; 49 CFR Part 21; Circular 4702.1B
Color	Color of skin, including shade of skin within a racial group	Black / White /Brown / Yellow / etc.		
National Origin	Place of birth. Citizenship is not a factor. Discrimination based on language or a person's accent is also covered.	Mexican / Cuban / Japanese / Vietnamese / Chinese		
Sex	Gender	Women and Men	1973 Federal-Aid Highway Act	Title IX of the Education Amendments of 1972
Age	Persons of any age	21-year-old person	Age Discrimination Act of 1975	
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	

III. 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:

- 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.
- 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);
- Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 *et seq*.), (prohibits discrimination on the basis of sex);
- 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;

- The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 *et seq*.), (prohibits discrimination on the basis of age);
- 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);
- 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);
- 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;
- The Federal Aviation Administration's Non-discrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
- Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures discrimination 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;
- 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);
- 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).
- 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);
- 49 CFR Part 26, regulation to ensure nondiscrimination in the award and administration of DOT-assisted contracts in the Department's highway, transit, and airport financial assistance programs, as regards the use of Disadvantaged Business Enterprises (DBEs);
- Form FHWA-1273, "Required Contract Provisions," a collection of contract provisions and proposal notices that are generally applicable to *all Federal-aid construction projects* and must be made a part of, and physically incorporated into, *all federally-assisted contracts*, as well as appropriate subcontracts and purchase orders, particularly Sections II (Nondiscrimination) and III (Nonsegregated Facilities).

***** STANDARD SPECIAL PROVISIONS *****

MINORITY AND FEMALE EMPLOYMENT REQUIREMENTS
(12-18-07) 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 or 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

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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.
   a. The contractor shall notify all potential subcontractors and suppliers and lessors of their EEO obligations under this contract.
   b. The contractor will use good faith efforts to ensure subcontractor compliance with their EEO obligations.
10. **Assurance Required by 49 CFR 26.13(b):**
   a. The requirements of 49 CFR Part 26 and the State DOT's U.S. DOT-approved DBE program are incorporated by reference.
   b. 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.
   a. The records kept by the contractor shall document the following:
      (1) The number and work hours of minority and non-minority group members and women employed in each work classification on the project;
      (2) The progress and efforts being made in cooperation with unions, when applicable, to increase employment opportunities for minorities and women; and
      (3) The progress and efforts being made in locating, hiring, training, qualifying, and upgrading minorities and women;
   b. 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**
   a. 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 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 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.

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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.

MINIMUM WAGES
(07-21-09) Z-5

FEDERAL: The Fair Labor Standards Act provides that with certain exceptions every employer must pay wages at the rate of not less than SEVEN DOLLARS AND TWENTY FIVE CENTS ($7.25) per hour.

STATE: The North Carolina Minimum Wage Act provides that every employer shall pay to each of his employee's wages at a rate of not less than SEVEN DOLLARS AND TWENTY FIVE CENTS ($7.25) per hour.

The minimum wage paid to all skilled labor employed on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS ($7.25) per hour.

The minimum wage paid to all intermediate labor employed on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS ($7.25) per hour.

The minimum wage paid to all unskilled labor on this contract shall be SEVEN DOLLARS AND TWENTY FIVE CENTS ($7.25) per hour.

The determination of the intent of the application of these Acts to the project's contract shall be the Design-Build Team's responsibility.

The Design-Build Team shall have no claim against the Department of Transportation for any changes in the minimum wage laws, State or Federal. It is the responsibility of the Design-Build Team to be fully informed of all Federal and State Laws affecting the project's contract.

***** STANDARD SPECIAL PROVISIONS *****

(10-23-17)

DIVISION ONE OF STANDARD SPECIFICATIONS

Division One of the 2018 NCDOT *Standard Specifications for Roads and Structures* (*Standard Specifications*) shall apply except as follows:

Definitions: Throughout Division One of the 2018 *Standard Specifications*, the term "Contractor" is replaced with "Design-Build Team", the term "Bidder" is replaced with "Proposer," the term "Bid" is replaced by "Price Proposal," and the phrase "lowest Responsible Bidder" is replaced with "responsible Proposer with the lowest adjusted price." The replacement of "Contractor" with "Design-Build Team" does not apply to Article 102-2. The replacement of the above terms also does not apply when the terms are part of a phrase (e.g. bid bond, prime contractor, total amount bid, etc.)

Deletions: Articles 102-3(B), 102-4, 102-8(B), 102-9(C)(2), 103-2(B), and 103-4(C) of the 2018 *Standard Specifications for Roads and Structures* are deleted from Design-Build Contracts.

Modifications: The remainder of this Standard Special Provision includes modifications to Division One of the 2018 *Standard Specifications for Roads and Structures*.

SECTION 101
DEFINITION OF TERMS

Page 1-3, Article 101-3, replace and add certain definitions as follows:

ADDITIONAL WORK

Additional work is that which results from a change or alteration to the contract and for which there are contract unit prices in the original contract or an executed supplemental agreement.

ADVERTISEMENT

The public advertisement inviting Statements of Qualifications for the design and construction of specific projects.

AWARD

The decision of the Department of Transportation to accept the proposal of the selected Design-Build Team for work which is subject to the furnishing of payment and performance bonds, and such other conditions as may be otherwise provided by law, the Request for Proposals, and the 2018 *Standard Specifications for Roads and Structures*.

CONTRACT

The executed agreement between the Department and the successful proposer, covering the performance of, and compensation for, the work. The term contract is all inclusive with reference to all written agreements affecting a contractual relationship and all documents referred to therein. The contract shall include, but not be limited to, the Request for Proposals, the Technical Proposal, the Price Proposal, the printed contract form and attachments, contract bonds, plans

and associated special provisions prepared by the Design-Build Team, standard specifications and supplemental specifications, standard special provisions and project special provisions contained in the Request for Proposals or as developed by the Design-Build Team and accepted by the Department, and all executed supplemental agreements. The contract shall constitute one instrument.

DATE OF AVAILABILITY

That date, established as set forth in the Request for Proposals, by which it is anticipated that the Contract will be executed and sufficient design efforts or work sites within the project limits will be available for the Design-Build Team to begin his controlling operations or design.

DESIGN-BUILD

A form of contracting in which the successful proposer undertakes responsibility for both the design and construction of a project.

DESIGN-BUILD TEAM

An individual, partnership, joint venture, corporation or other legal entity that furnishes the necessary design and construction services, whether by itself or through subcontracts.

DESIGN-BUILD PROPOSAL

A proposal to contract consisting of a separately sealed Technical Proposal and a separately sealed Price Proposal submitted in response to a Request for Proposals on a Design-Build project.

PLANS

The project plans, Standard Drawings, working drawings and supplemental drawings, or reproductions thereof, accepted by the Engineer, which show the location, character, dimensions and details of the work to be performed. Unless otherwise noted within the Request for Proposals, the term "plans" refers to plans as developed by the Design-Build Team and accepted by the Department.

(A) Standard Drawings:

Drawings approved for repetitive use, showing details to be used where appropriate. All Standard Drawings approved by the Department plus subsequent revisions and additions. Standard Drawings are available for purchase from:

State Contract Officer
1591 Mail Service Center
Raleigh, NC 27699-1591

(B) Preliminary Plans:

Department-furnished drawings distributed in concert with a Request for Proposals, or as developed by the Design-Build Team.

(C) Project Plans:

Construction drawings prepared, sealed and completed by the Design-Build Team, or as provided by the Department, that contain specific details and dimensions peculiar to the work.

(D) Working Drawings and Supplemental Drawings:

Supplemental design sheets, shop drawings, or similar data which the Design-Build Team is required to submit to the Engineer.

(E) As-Constructed Drawings:

Red-lined mark-up of the latest Released for Construction (RFC) Plans containing the information listed under As-Constructed Plans in the Records and Reports Section of the NCDOT Construction Manual.

(F) As-Built Plans:

Coordinately correct plans documenting the details, dimensions and locations of the completed work.

PRICE PROPOSAL

The offer of a Proposer, submitted on the prescribed forms, to perform the work and furnish the labor and materials at the price quoted.

PROPOSAL (OR REQUEST FOR PROPOSALS)

The paper document provided by the Department that the proposer uses to develop his paper offer to perform the work at designated bid prices.

PROPOSER

An individual, partnership, firm, corporation, LLC, or joint venture formally submitting a Technical Proposal and Price Proposal in response to a Request for Proposals.

RIGHT OF WAY

The land area shown on the plans as right of way within which the project is to be constructed.

SCHEDULE OF VALUES

A schedule of work items necessary to complete work, along with the progress of each work item, primarily for the purpose of partial payments.

TABLE OF QUANTITIES

A listing of work items (corresponding to the items in the Trns*port pay item list) that contributes to a project completion. The table shall include estimated quantities for each work item.

TECHNICAL PROPOSAL

A submittal from a proposer, in accordance with requirements of the Request for Proposals, for the purpose of final selection. The Technical Proposal is defined to also include any supplemental information requested by the Department from a proposer prior to opening bids.

SECTION 102
PROPOSAL REQUIREMENTS AND CONDITIONS

Page 1-9, delete Article 102-1 and replace with the following:

102-1 INVITATION TO BID

After the advertisement has been made, an Invitation to Bid will be made available to known prequalified contractors and any other contracting firms, material suppliers and other interested parties who have requested they be placed on the Invitation to Bid mailing list, informing them that Statements of Qualifications and Proposals will be received for the construction of specific projects. Such invitation will indicate the contract identification number, length, locations and descriptions; a general summary of the scope of work to be performed; and information on how to receive a Request for Qualifications.

All projects will be advertised in daily newspapers throughout the state before the bid opening.

Page 1-12, delete Article 102-3 and replace with the following:

102-3 CONTENTS OF REQUEST FOR PROPOSALS

A Request for Proposals will be furnished by the Department to the selected proposers from among the respondents to the Request for Qualifications. Each Request for Proposals will be marked on the front cover by the Department with an identifier of the Proposer to whom it is being furnished. This Request for Proposals will state the location of the project and will show a schedule of contract items for which Technical and Price Proposals are invited. It will set forth the date and time Technical and Price Proposals are to be submitted and when the Price Proposals will be opened. The Request for Proposals will also include special provisions or requirements that vary from or are not contained in any preliminary design information or standard specifications.

The Request for Proposals will also include the printed contract forms and signature sheets for execution by both parties to the contract. In the event the Proposer is awarded the contract, execution of the Request for Proposals by the Proposer is considered the same as execution of the contract.

Standard specifications, sealed plans specifically identified as the Department's responsibility and other documents designated in the Request for Proposals shall be considered a part of the Request for Proposals whether or not they are attached thereto. All papers bound with the proposal are necessary parts thereof and shall not be detached, taken apart, or altered.

The names and identity of each prospective Proposer that receives a copy of the Request for Qualifications for the purposes of submitting a Statement of Qualifications shall be made public,

except that a potential Proposer who obtains a Request for Qualifications may, at the time of ordering, request that his name remain confidential.

One copy of the Final Request for Proposals will be furnished to each prospective Proposer. Additional copies may be purchased for the sum of $25 each. The copy of the Final Request for Proposals marked with the Proposer's name and prequalification number shall be returned to the Department as the Proposer's Price Proposal.

Pages 1-14, delete Article 102-8 and replace with the following:

102-8 PREPARATION AND SUBMISSION OF BIDS

All Price Proposals shall be prepared and submitted in accordance with the following requirements:

1. The Request for Proposals provided by the Department shall be used and shall not be taken apart or altered. The Price Proposal shall be submitted on the same form, which has been furnished to the Proposer by the Department as identified by the Proposer's name marked on the front cover by the Department.
2. All entries including signatures shall be written in ink.
3. The Proposer shall submit a lump sum or unit price for every item in the Price Proposal. The lump sum or unit prices bid for the various contract items shall be written in figures.
4. An amount bid shall be entered in the Request for Proposals for every item and the price shall be written in figures in the "Amount Bid" column in the Request for Proposals.
5. An amount bid shall be entered in the proposal for every item on which a unit price has been submitted. The amount bid for each item other than lump sum items shall be determined by multiplying each unit bid price by the quantity for that item and shall be written in figures in the Amount Bid column in the proposal.
6. The total amount bid shall be written in figures in the proper place in the Request for Proposals. The total amount bid shall be determined by adding the amounts bid for each lump sum item.
7. Changes in any entry shall be made by marking through the entry in ink and making the correct entry adjacent thereto in ink. A representative of the Proposer shall initial the change in ink.
8. The Price Proposal shall be properly executed. To constitute proper execution, the Price Proposal shall be executed in strict compliance with the following:
    a. If a Price Proposal is by an individual, it shall show the name of the individual and shall be signed by the individual with the word "Individually" appearing under the signature. If the individual operates under a firm name, the bid shall be signed in the name of the individual doing business under the firm name.
    b. If the Price Proposal is by a corporation, it shall be executed in the name of the corporation by the President, Vice President, or Assistant Vice President. It shall be attested by the Secretary or Assistant Secretary. The seal of the corporation shall be affixed. If the Price Proposal is executed on behalf of a corporation in any other

manner than as above, a certified copy of the minutes of the Board of Directors of said corporation authorizing the manner and style of execution and the authority of the person executing shall be attached to the Price Proposal or shall be on file with the Department.

c. If the Price Proposal is made by a partnership, it shall be executed in the name of the partnership by one of the general partners.

d. If the Price Proposal is made by a limited liability company, it shall be signed by the manager, member, or authorized agent.

e. If the Price Proposal is made by a joint venture, it shall be executed by each of the joint venturers in the appropriate manner set out above. In addition, the execution by the joint venturers shall appear below their names.

9. The Price Proposal shall not contain any unauthorized additions, deletions, or conditional bids.

10. The Proposer shall not add any provision reserving the right to accept or reject an award or to enter into a contract pursuant to an award.

11. The Price Proposal shall be accompanied by a bid bond on the form furnished by the Department or by a bid deposit. The bid bond shall be completely and properly executed in accordance with the requirements of Article 102-10 and as modified herein. The bid deposit shall be a certified check or cashier check in accordance with Article 102-10 and as modified herein.

12. The Price Proposal shall be placed in a sealed envelope and shall have been delivered to and received by the Department prior to the time specified in the Request for Proposals.

Page 1-17, Article 102-10, 3rd paragraph, delete the fifth sentence and replace with the following:

The condition of the bid bond or bid deposit is: the Principal shall not withdraw its bid within 75 days after the submittal of the same, and if the Department shall award a contract to the Principal, the Principal shall within 14 calendar days after the notice of award is received by him, give payment and performance bonds with good and sufficient surety as required for the faithful performance of the contract and for the protection of all persons supplying labor and materials in the prosecution of the work.

Page 1-18, Article 102-10, delete the end of the Article beginning with, and inclusive of, the 6th paragraph.

Pages 1-18, delete Article 102-12 and replace with the following:

102-12 WITHDRAWAL OR REVISION OF BIDS

A Design-Build Team will not be permitted to withdraw its Technical and Price Proposals after they have been submitted to the Department, unless allowed under Article 103-3 or unless otherwise approved by the Chief Engineer.

Page 1-19, delete Article 102-13 and replace with the following:

102-13 RECEIPT AND OPENING OF BIDS

Price Proposals from shortlisted Proposers will be opened and read publicly on the date and time indicated in the Request for Proposals. The Technical Scores of the previously conducted evaluation of the Technical Proposals will also be read publicly in accordance with the procedures outlined in the Request for Proposals. Proposers, their authorized agents, and other interested parties are invited to be present.

Page 1-19, Article 102-14, replace the 1st paragraph with the following:

102-14 REJECTION OF BIDS

Any Price Proposal submitted which fails to comply with any of the requirements of Articles 102-8, 102-9 or 102-10, or with the requirements of the project scope and specifications shall be considered irregular and may be rejected. A Price Proposal that does not contain costs for all proposal items shall be considered irregular and may be rejected.

SECTION 103
AWARD AND EXECUTION OF CONTRACT

Page 1-21, delete Article 103-1 and replace with the following:

103-1 CONSIDERATION OF PRICE PROPOSALS

After the Price Proposals are opened and read, they will be tabulated. The Price Proposal and Technical Score of the Technical Proposal will be made available in accordance with procedures outlined in the Request for Proposals. In the event of errors, omissions, or discrepancies in the Price Proposal, corrections to the Price Proposal will be made in accordance with the provisions of Article 103-2. Such corrected bid prices will be used to determine the lowest adjusted price.

After the reading of the Price Proposals and Technical Scores, the Department will calculate the lowest adjusted price as described in the Request for Proposals.

The right is reserved to reject any or all Price Proposals, to waive technicalities, to request the Proposer with the lowest adjusted price to submit an up-to-date financial and operating statement, to advertise for new proposals, or to proceed to do the work otherwise, if in the judgment of the Department, the best interests of the State will be promoted thereby.

Page 1-21, Subarticle 103-2(A), add items (6) and (7) as follows:

(6) **Discrepancy in the "Total Amount Bid" and the addition of the "Amount Bid" for each line Item**

In the case of the Total Amount Bid does not equal the summation of each Amount Bid for the line items, the summation of each Amount Bid for the line items shall be deemed to be the correct Total Amount Bid for the entire project.

(7) **Omitted Total Amount Bid –Amount Bid Completed**

If the Total Amount Bid is not completed and the Amount Bid for all line items is completed the Total Amount Bid shall be the summation of the Amount Bid for all line items.

Page 1-23, Subarticle 103-4(A), first paragraph, replace the 3rd and 4th sentences with the following:

Where award is to be made, the notice of award will be issued within 75 days after the submittal of Price Proposals, except with the consent of the responsible Proposer with the lowest adjusted price the decision to award the contract to such bidder may be delayed for as long a time as may be agreed upon by the Department and such Proposer. In the absence of such agreement, the Proposer may withdraw his Price Proposal at the expiration of the 75 days without penalty if no notice of award has been issued.

Page 1-29, Article 103-6, delete the 1st and 2nd paragraphs and replace with the following:

Checks that have been furnished as a bid deposit will be retained until after the contract bonds have been furnished by the successful proposer, at which time the checks that were furnished as a bid deposit will be returned.

SECTION 104
SCOPE OF WORK

Page 1-30, delete Article 104-1 and replace with the following:

104-1 INTENT OF CONTRACT

The intent of the contract is to prescribe the work or improvements that the Design-Build Team undertakes to perform, in full compliance with the contract documents. In case the method of construction or character of any part of the work is not covered by the contract, this section shall apply. The Design-Build Team shall perform all work in accordance with the contract or as may be modified by written orders, and shall do such additional, extra, and incidental work as may be considered necessary to complete the work to the full intent of the contract. Unless otherwise provided elsewhere in the contract, the Design-Build Team shall furnish all implements, machinery, equipment, tools, materials, supplies, transportation, and labor necessary for the design, prosecution and completion of the work.

Page 1-30, Article 104-3, replace "plans or details of construction" with "contract" in all instances within this Article.

SECTION 105
CONTROL OF WORK

Pages 1-44, delete Article 105-2 and replace with the following:

105-2 PLANS AND WORKING DRAWINGS

All plans shall be supplemented by such approved working drawings as are necessary to adequately control the work. Working drawings furnished by the Design-Build Team and approved by the Engineer shall consist of such detailed drawings as may be required to adequately control the work. They may include stress sheets, shop drawings, erection drawings, falsework drawings, cofferdam drawings, bending diagrams for reinforcing steel, catalog cuts, or any other supplementary drawings or similar data required of the Design-Build Team. When working drawings are approved by the Engineer, such approval shall not operate to relieve the Design-Build Team of any of his responsibility under the contract for the successful completion of the work.

Changes on shop drawings after approval and/or distribution shall be subject to the approval of the Engineer and he shall be furnished a record of such changes.

Page 1-45, Article 105-3, add the following after the 3rd paragraph:

The Design-Build Team shall bear all the costs of providing the burden of proof that the nonconforming work is reasonable and adequately addresses the design purpose. The Design-Build Team shall bear all risk for continuing with nonconforming work in question until it is accepted.

The Engineer may impose conditions for acceptance of the nonconforming work. The Design-Build Team shall bear all costs for fulfilling the conditions.

The decisions whether the product satisfies the design purpose, whether the nonconforming work is reasonably acceptable and the conditions for acceptance are at the sole discretion of the Engineer.

Pages 1-45, delete Article 105-4 and replace with the following:

105-4 COORDINATION OF PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

The Request for Proposals, all construction Plans, the Standard Specifications, Supplemental Specifications and Special Provisions and all supplementary documents are essential parts of the contract and a requirement occurring in one is as binding as though occurring in all. They are complementary and describe and provide the complete contract.

In case of discrepancy or conflict, the order in which they govern shall be as follows:

(A) Request for Proposals, in which Project Special Provisions govern Standard Special Provisions

(B) Technical Proposal from the Design-Build Team

(C) Accepted Plans and Details from the Design-Build Team, or sealed plans provided by the Department, as applicable

(D) Standard Drawings

(E) Standard Specifications

Where dimensions on the plans are given or can be computed from other given dimensions they shall govern over scaled dimensions.

The Design-Build Team shall take no advantage of any error or omission in the plans, estimated quantities, or specifications. In the event the Design-Build Team discovers an error or omission, he shall immediately notify the Engineer.

SECTION 106
CONTROL OF MATERIAL

Page 1-55, Article 106-6, add the following after the last paragraph:

For items normally pretested by the Department, the Design-Build Team shall provide a minimum of 30 days notice prior to the beginning of production of the items for this project along with final approved shop drawings.

SECTION 108
PROSECUTION AND PROGRESS

Page 1-68, Article 108-2, replace the 2nd paragraph with the following:

The Design-Build Team shall submit a Progress Schedule for review within thirty (30) calendar days of receiving Notice of Award. The Department will review the Progress Schedule within twenty-one (21) calendar days of receipt. The Design-Build Team shall make any necessary corrections and adjustments to the Progress Schedule as necessitated by the Department's review within seven (7) calendar days. The Department will review the revised Progress Schedule within seven (7) calendar days of receipt.

Page 1-68, Subarticle 108-2(A)(1), add the following:

(k) Utility relocation and construction

Page 1-69, Subarticle 108-2(A)(2), add the following:

(h) Critical design submittal dates

(i) Critical permitting dates

(j) Completion of right of way acquisition

(k) Completion of utility relocation and construction

Page 1-69, Article 108-2, add the following:

(D) The Design-Build Team shall provide a written narrative each month detailing the work and percentage of work completed, anticipated sequence of upcoming work (two-month forecast), controlling operation(s), intermediate completion dates, and milestones. If any milestones are exceeded or will not be achieved, the Design-Build Team shall provide in the

written narrative details of the delay; controlling operation affected, impacts to other operations, revisions to future intermediate completion dates and milestones, and remedial action necessary to get the project back to the original completion date.

Page 1-69, Article 108-4, add the following sentence to the end of this article:

The Design-Build Team shall record the proceedings of these conferences and distribute the final minutes of the conferences to all attendees.

Page 1-70, Article 108-6, replace "40%" with "30%" in the 1st paragraph.

Page 1-71, Article 108-6, replace "35%" with "25%" in the 2nd paragraph.

Pages 1-72, delete Article 108-8 and replace with the following:

108-8 FAILURE TO MAINTAIN SATISFACTORY PROGRESS

The Engineer will check the Design-Build Team's progress at the time each partial pay request is received. The Design-Build Team's progress may be considered as unsatisfactory if, according to the Progress schedule, the projected finish date for all work exceeds the scheduled finish date by more than 10%.

When the Design-Build Team's progress is found to be unsatisfactory as described above, the Engineer may make written demand of the Design-Build Team to state in writing the reason for the unsatisfactory progress and produce such supporting data as the Engineer may require or the Design-Build Team may desire to submit. The Engineer will consider the justifications submitted by the Design-Build Team and extensions of the completion date that have or may be allowed in accordance with Article 108-10(B) and as modified herein.

When the Design-Build Team cannot satisfactorily justify the unsatisfactory progress the Engineer may invoke one or more of the following sanctions:

1. Withhold anticipated liquidated damages from amounts currently due or which become due.
2. Remove the Design-Build Team and individual managing firms of the Design-Build Team and / or prequalified design firms from the Department's Prequalified Bidders List.

When any of the above sanctions have been invoked, they shall remain in effect until rescinded by the Engineer.

Page 1-75, Article 108-10(B), add the following as the first paragraph:

Only delays to activities which affect the completion date or intermediate contract date will be considered for an extension of contract time. No extensions will be granted until a delay occurs which impacts the project's critical path and extends the work beyond the contract completion date or intermediate completion date. Any extension to the completion date or intermediate contract date will be based on the number of calendar days the completion date or intermediate completion date is impacted as determined by the Engineer's analysis.

Pages 1-75, delete Subarticle 108-10(B)(1) in its entirety.

Page 1-78, Article 108-13, delete bullet (D)(2) in its entirety.

SECTION 109
MEASUREMENT AND PAYMENT

Page 1-80, Article 109-2, delete the last sentence of the 1st paragraph and replace with the following:

Payment to the Design-Build Team will be made only for the work completed, certified and accepted in accordance with the terms of the contract.

Pages 1-85, delete Article 109-4(A) and replace with the following:

109-4 PARTIAL PAYMENTS

(A) General:

Partial payments will be based upon progress estimates prepared by the Engineer at least once each month on the date established by the Engineer. Partial payments may be made twice each month if in the judgment of the Engineer the amount of work performed is sufficient to warrant such payment. No partial payment will be made when the total value of work performed since the last partial payment amounts to less than $10,000.00. Partial payments will be approximate only and will be subject to correction in the final estimate and payment.

When the contract includes one lump sum price for the entire work required by the contract, partial payments for the lump sum design-build price shall be based on a certified Schedule of Values submitted by the successful Design-Build Team and approved by the Engineer. The certification shall indicate the Design-Build Team has reviewed the information submitted and the information accurately represents the work performed for which payment is requested. The certified Schedule of Values shall be submitted no later than 30 calendar days after the date of award. Each item on the certified Schedule of Values shall be assigned a cost and quantity and shall be identified as an activity on the progress schedule. A revised certified Schedule of Values shall be submitted with each update of the Progress schedule as described in Article 108-2, and as modified herein, or when requested by the Engineer. A certified copy of the Table of Quantities shall also be submitted with each payment request. The certification of the Table of Quantities shall indicate the Design-Build Team has reviewed the information submitted and the information accurately represents the materials for the work performed for which payment is requested.

When the contract includes lump sum items for portions of the work required by the contract, and the applicable section of the Specifications or Request for Proposals specify the means by which the total amount bid be included in the partial pay estimates, the Engineer will determine amounts due on the partial pay estimate in accordance with the applicable portion of the Specifications or Request for Proposals.

The Engineer will withhold an amount sufficient to cover anticipated liquidated damages as determined by the Engineer.

Page 1-86, Subarticle 109-5(D), delete the 4th and 5th paragraphs and replace with the following:

Partial payments will not be made on seed or any living or perishable plant materials.

Partial payment requests shall not be submitted by the Design-Build Team until those items requested have corresponding signed and sealed RFC plans accepted by the Department.

Pages 1-88, Article 109-10, add the following as bullets (E) and (F) under the 1st paragraph.

(E) As-Constructed Drawings, As-Built Plans and other documents required elsewhere in this RFP.

(F) Documents or guarantees to support any warranty provided by the Design Build Team.