



# **CASHLESS TOLLING**

## **DESIGN-BUILD PROJECT**

**TA 19-1, Contract No. D800002**

### **Request for Proposals**

**Addendum #9**

**April 30, 2019**

Modification to the Request for Proposals

CASHLESS TOLLING

Design-Build Project

TA 19-1, Contract No. D800002

**Note to Proposers**

Differences between the deleted pages and the revised pages have been identified as follows:

- Brackets have been inserted on the left-hand margin of the pages to indicate where changes have been made to the documents; and
- Text additions have been shown in underlined red font and text deletions have been shown in crossed out red font.

**General Instructions**

Delete Pages 13 through 17 of the DB Contract Documents, Part 1, DB Agreement, and substitute the attached revised Pages 13 through 17.

Delete Pages 70, 78, 82, 99, 100, 114, 142 and 155 of the DB Contract Documents, Part 3, Project Requirements and substitute the attached revised Pages 70, 78, 82, 99, 100, 114, 142 and 155.

Delete Drawing Ripley Terminus Location of the DB Contract Documents, Part 6 – RFP Plans – Indicative/Concept Plans.

Delete Drawings Interchange 23 Concept, Interchange 24 Concept, Interchange 25 Concept, and Interchange 45 Concept of the DB Contract Documents, Part 6 – RFP Plans – Indicative/Concept Plans and replace with the attached revised Drawings Interchange 23 Concept, Interchange 24 Concept, Interchange 25 Concept, and Interchange 45 Concept.

Note to Design Build Proposers, the following changes have been made to Final RFP Part 7 – Engineering Data since Amendment #6 was posted on April 19, 2019:

Part 7, Section 2 - ORT Concept Plans: Updated Exit 49 Concept Plans – 4/30/19

Part 7, Section 5 - Terminus Concept Plans: Updated Terminus Location Woodbury Concept Plans – 4/30/19

Part 7, Section 14 - Pavement Repairs: Updated Pavement Repair Drawings – 4/29/19

Part 7, Section 23 - Record Plans: Updated Exit 49 Record Plans – 4/29/19

Part 7, Section 23 - Record Plans: Updated Terminus Location Williamsville Record Plans – 4/29/19

Delete the specification for Item 645.4530--25 Dynamic Message Sign (DMS) Full Matrix, Front Access Led in the DB Contract Documents, Part 8, Special Specifications and replace with the attached specification for Item 645.4530--25.

No other provision of the solicitation is otherwise changed or modified.

- a. Policies required under Articles 14.2(A), (B), (G), and (J) shall name the Authority, New York State and their respective employees, agents, and consultants, any municipality in which the Work is being performed, and any public benefit corporation, railroad or public utility whose property or facilities are affected by the Work as additional insureds. The endorsement shall be effected by endorsement of the applicable policy using ISO Additional Insured Endorsements CG 20 10 04 13 and CG20 37 04 13 or an equivalent, under the CGL and Umbrella policies, as required.
- b. Policies required under Articles 14.2(A), (B), ~~(F)~~, (G), and (J) shall include a waiver of any right of subrogation against the additional insureds and their respective members, directors, officers, employees, agents, and consultants. The Design-Builder waives any right of action it and/or its insurance carrier might have against the Authority (including its employees, Board members or agents) for any loss, whether or not such loss is insured.
- c. Policies required under Article 14.2, except Professional Liability/Errors & Omissions, shall provide coverage on an “occurrence” basis, not a “claims made” basis.

**ARTICLE 14.2 Coverages and Limits – Design-Builder**

The specific types and amounts of insurance that the Design-Builder must provide pursuant to this Contract are as follows:

- A. Commercial General Liability Insurance --- The Design-Builder shall maintain through a combination of Commercial General Liability (CGL) and Commercial Umbrella Liability insurance, with no less than the following limits and coverages:

Each Occurrence Limit:	\$50,000,000
General Aggregate:	\$50,000,000
Products/Completed Operations Aggregate:	\$50,000,000
Personal/Advertising Injury Liability:	\$2,000,000
Fire Damage Legal Liability:	\$100,000
Medical Expense:	\$5,000

CGL Insurance shall cover liability arising from premises, operations, independent contractors, products/completed operations, personal injury, advertising injury, and contractual liability. Such coverage shall be written on ISO Form CG 00 01 01 96 or a policy form providing equivalent coverage.

Where Work will be performed by unregistered off-road equipment, the Design-Builder shall provide documentation of a blanket Pollution Liability policy, or an endorsement to cover short- term pollution events, using ISO form CG 04 33 10 01 or its equivalent.

Explosion, Collapse and Underground Hazards coverage (XCU) is required.

If the activity involves construction or demolition within 50 feet of railroad stations, yards, or tracks, the CGL policy must be endorsed to delete the exclusion of coverage for work done within 50 feet of railroad property.

The General Aggregate shall apply separately to the subject matter (Project) of the Contract, and the Design-Builder shall provide an appropriate Project Endorsement, using ISO Additional Insured Endorsements CG 20 10 04 13 and CG20 37 04 13 or an equivalent, to the Authority for this purpose.

- B. Commercial Umbrella and/or Excess Liability Insurance --- When the limits of the CGL and Auto policies procured are insufficient to meet the limits specified, the Design-Builder shall procure and maintain Commercial Umbrella and/or Excess Liability policies with limits in excess of the primary; provided, however, that the total amount of insurance coverage is at least equal to the requirements set forth above. Such policies shall follow the same form as the primary policies. Any insurance maintained by the Authority or any additional insured shall be considered excess of and shall not contribute to any other insurance procured and maintained by the Design-Builder including primary, umbrella and excess liability regardless of the “other insurance” clause contained in either parties policy.
- C. Owners/Contractors Protective Liability Insurance --- The Design-Builder shall obtain a separate Owners/Contractors Protective Liability (“OCP”) Policy written on Form CG 00 09 12 07, Owners and Contractors Protective Liability Coverage form – Coverage for Operations of the Designated Contractor.

The policy shall be written on a project basis for the benefit of the Authority, its officers, agents, and employees, and the People of the State of New York, with respect to all operations under this Agreement by the Design-Builder or its subcontractors, including in such coverage any omissions and supervisory acts of the Authority, its officers, agents, and employees.

The Authority shall be the named insured in the OCP Policy, which shall be promptly furnished to the Authority. OCP policy limits shall be no less than: **\$2,000,000** per occurrence/**\$2,000,000** aggregate.

- D. Builders’ Risk Insurance --- The Design-Builder shall provide a Builders’ Risk Insurance policy covering all risks in completed value form. Such policy shall cover the total value of the work performed, as well as the value of any equipment, supplies, and/or material for the Project that may be in storage (on or off the site) or in transit. The policy shall cover the cost of removing debris, including demolition as may be legally necessary by the operation of any law, ordinance or regulation, and for loss or damage to any owned, borrowed, leased or rented capital equipment, tools, including tools of their agents and employees, staging towers and forms, and property of the Authority, New York State and their agents held in their care, custody and/or control. Such policy shall name as insureds the Authority, and the Design-Builder. The Builders’ Risk policy shall contain endorsements that provide for the following:
- 1) The Authority and the Design-Builder shall be named as loss payee for the Work in order of precedence as their interest may appear;
  - 2) In the event the loss occurs at an occupied facility, the policy shall permit occupancy without the consent of the Insurance Company; and
  - 3) In the event that the insurance policy has been issued by a mutual insurance company, the following language shall be included: the “Authority is not liable for any premium or assessment under this policy of insurance. The First Named Insured is solely liable therefore.”

- E. Professional Liability/Errors and Omissions --- The Design-Builder shall maintain Professional Liability or Errors and Omission Insurance with coverage limits of no less than **\$5,000,000**. *(Applicable to professional services requiring the signature, stamp, or certification of a licensed professional, including, without limitation, erection plans, demolition plans, containment plans, coffer dams, and temporary sheeting).* The ~~Design-Builder~~Professional and any professional sub-consultant retained by the ~~Design-Builder~~Professional to work on the Project shall procure and maintain during and for a period of 3 years after completion of this Project, Professional Liability Insurance in the

required amount issued to and covering damage for liability imposed on the Design-Builder~~Professional~~ by contract or law arising out of any negligent act, error, or omission in the rendering of or failure to render professional services required. The ~~p~~Professional ~~H~~Liability insurance may be issued on a claims-made policy form, in which case the ~~Design-Builder~~Professional shall purchase at its sole expense, with extended Discovery Clause coverage of up to 3 years after work is completed if coverage is cancelled or not renewed.

If applicable, the ~~Design-Builder~~Professional shall provide coverage of the ~~Design-Builder~~Professional's negligent act, error or omission in rendering or failing to render professional services required arising out of specifications, installation, modification, abatement, replacement or approval of products, materials or processes containing pollutants, and the failure to advise of or detect the existence or the proportions of pollutants.

F. Railroad Protective Liability Insurance --- In the event that any work is to be performed on or within 50 ft. of railroad property or railroad right-of-way, the Design-Builder shall provide and maintain a Railroad Protective Liability ("RRP") Policy in the amounts required by the respective railroad.

- 1) The policy must name the railroad as the named insured. No additional insureds will be listed on the policy (see requirements for the deletion of the 50' Railroad Exclusion on the Commercial General Liability policy).
- 2) Evidence of Railroad Protective Liability Insurance must be provided on the ACORD 25 insurance certificate form, a detailed Binder pending issuance of the policy, or on an ISO-RIMA or equivalent form approved by the railroad and meet any other requirements as specified by the railroad and/or the Authority.
- 3) Definition of "physical damage to property" must be amended to mean direct and accidental loss of or damage to "*all property of any Named Insured and all property in any Named Insured's care, custody or control*".

G. Business Auto Liability Insurance --- The Design-Builder shall maintain Business Automobile Liability coverage, with no less than a **\$5,000,000** Combined Single Limit, which shall cover liability arising out of the Design-Builder's use of any motor vehicle, whether owned, leased, hired, or non-owned.

If the Contract involves removing hazardous waste from the Project site, or the Project involves environmental exposures, pollution liability coverage equivalent to that provided under the ISO Broadened Pollution Liability Coverage for Covered Autos endorsement (ISO Form CA 99 48 03 06) shall be provided, and the Motor Carrier Act endorsement (MCS 90) shall be attached.

H. Workers' Compensation Insurance --- For work to be performed in New York State, the Design-Builder shall provide and maintain coverage during the life of this Agreement for the benefit of such employees as are required to be covered by the Workers' Compensation Law.

Evidence of Workers' Compensation coverage must be provided on one of the following forms specified by the Commissioner of the Workers' Compensation Board:

- 1) C-105.2 – Certificate of Workers' Compensation Insurance.
- 2) U-26.3 – Certificate of Workers' Compensation Insurance from the State Insurance Fund.

- 3) GSI-105/SI-12 – Certificate of Workers’ Compensation Self Insurance.

All forms are valid for 1 year from the date the form is signed/stamped, or until policy expiration, whichever is earlier.

- I. NYS Disability Benefits Insurance --- For work to be performed in New York State, the Design-Builder shall provide and maintain coverage during the life of this Agreement for the benefit of such employees as are required to be covered by the Disability Benefits Law.

Evidence of Disability Benefits coverage must be provided on one of the following forms specified by the Commissioner of the Workers’ Compensation Board:

- 1) DB-120.1 – Certificate of Insurance Coverage under the NYS Disability Benefits Law.
- 2) DB-155 – Certificate of Disability Self Insurance.
- 3) CE-200 – Certificate of Attestation of Exemption. (Note: This form will only be accepted as evidence of an exemption from providing Disability Benefits.)

- J. Environmental Liability --- If the work involves abatement, repair, replacement, enclosure, encapsulation and/or disposal of any pollutants, which includes but are not limited to, petroleum, petroleum product, hazardous material or substance including asbestos, lead and those defined by applicable State and federal laws and regulations, the Design-Builder shall procure, or otherwise obtain and maintain in full force and effect throughout the term of a contract, and for 2 years after completion hereof, pollution legal liability insurance with limits of not less than **\$5,000,000**, providing coverage for bodily injury and property damage, including loss of use of damaged property or of property that has not been physically injured. Such policy shall provide coverage for actual, alleged or threatened emission, discharge, dispersal, seepage, release or escape of pollutants or in the investigation, settlement or defense of any claim, suit, or proceedings against the Authority arising from the Design-Builder’s work. The Authority shall be named as additional insured and coverage shall be primary.

**ARTICLE 14.3 Coverages and Limits – Sub-Contractor**

Sub-Contractor shall provide insurance containing the same provisions and format as required of the Design-Builder as specified in Articles 14.1 and 14.2. The specific types and amounts of insurance that the Design-Builder’s sub-contractor(s) must provide pursuant to this Contract are as follows:

SUB-CONTRACTOR INSURANCE REQUIREMENTS						
Insurance Type	Sub-Contractor Contract Value (Millions)					
	\$0-\$1	\$1-\$10	\$10-\$25	\$25-\$50	\$50-\$100	\$100-\$250
Commercial General Liability Insurance (CGLI)	\$2 million per occurrence; \$2 million aggregate	\$2million per occurrence; \$2 million aggregate	\$2 million per occurrence; \$2 million aggregate			

<b>Commercial Auto</b>	\$1 million Combined Single limit	\$1 million Combined Single limit	\$2 million Combined Single limit	\$2 million Combined Single limit	\$5 million Combined Single limit	\$5 million Combined Single limit
<b>Umbrella / Excess Liability</b>	None required	At least \$5 million when combined with CGLI	At least \$10 million when combined with CGLI	At least \$10 million when combined with CGLI	At least \$10 million when combined with CGLI	At least \$25 million When combined with CGLI
<b>Professional Liability / Errors &amp; Omissions</b>	\$2 Million	\$2 Million	\$2 million	\$5 million	\$5 million	\$5 million
<b>Environmental Liability (1)</b>	\$1 Million	\$1 Million	\$2 Million	\$3 Million	\$3 Million	\$5 Million
<b>Workers Compensation and Disability Benefits</b>	As required by Law	As required by Law	As required by Law	As required by Law	As required by Law	As required by Law

**Notes:**

(1.) Additional coverage may be required at the Authority’s discretion.

**ARTICLE 14.4 Coverages and Limits – Warranty Period Work**

Design-Builder or their designee shall provide insurance containing the same provisions and format as required of the Design-Builder as specified in Articles 14.1 and 14.2. The specific types and amounts of insurance that the Design-Builder or their designee must provide on a per site basis are as follows:

<b>WARRANTY PERIOD INSURANCE REQUIREMENTS</b>	
<b>Insurance Type</b>	<b>Limits</b>
<b>Commercial General Liability Insurance (CGLI)</b>	\$2 million per occurrence; \$2 million aggregate
<b>Commercial Auto</b>	\$2 million Combined Single limit
<b>Umbrella / Excess Liability</b>	At least \$5 million when combined with CGLI
<b>Owners/Contractors Protective Liability (“OCP”)</b>	\$1 million per occurrence; \$2 million aggregate
<b>Professional Liability / Errors &amp; Omissions</b>	<del>\$2</del> 5 million
<b>Environmental Liability (1)</b>	\$1 million
<b>Railroad Protective Liability (“RRP”)</b>	As required by the respective Railroad

The Lighting Systems installed by the Design-Builder within the Project limits shall be fully maintained by the Design-Builder for the duration of the Project.

#### 13.3.1.1 Power Supply Requirements

For reference, the lighting installation shall comply with the following:

- A) Meet all requirements of NFPA 70 – National Electrical Code (NEC);
- B) All outdoor electrical enclosures shall be type 316 stainless steel, rated NEMA 4X or a higher degree of protection; and
- C) Meet all requirements of applicable IEEE and ANSI power engineering standards.

#### 13.3.1.2 Removal of Existing Equipment

The Design-Builder shall be responsible for ensuring that:

- A) All wiring, conduits, switches, electrical junction boxes, panels, cabinets, enclosures, and other electrical equipment in working condition shall be turned over to the Authority for storage and re-use at other locations.

### 13.3.2 Permanent Lighting System

#### 13.3.2.1 Lighting Locations

Exit 39 – A new Park and Ride Lot is to be constructed at the Exit. The lighting at the new Park and Ride Lot must illuminate the entire new Park and Ride Lot and meet, as a minimum, the lighting requirements under 13.3.1. Design-Builder is responsible for the design and construction, electrical connection to the nearby power source. See information relative to GPS located utilities provided by the Thruway under Part 7 - Engineering Data, Section 9.

Exit 27, 29 (North Lot), 45, 46, 57, Ripley (Westbound): Some illuminators exist at thesethis Tandem Lots already. The Design-Builder shall design and construct additional lighting to illuminate the dark areas of the Tandem Lot. The Lot lighting not consistently or comparably illuminated are not accepted. The Design-Builder is responsible for providing the comparable lighting so the illumination is consistent across the Tandem Lots. Existing Power is already at these Tandem Lots providing power to the initial lighting. The Design-Builder shall be aware of Part 7 - Engineering Data, Section 13 for other potential electrical sources.

Exits/Locations Ripley Eastbound, Exits 19, 22 and 24

Ripley Eastbound has no lighting in the Tandem Lot. Check Part 7 – Engineering Data, Section 9 for the GPS of Utility locations at the Ripley Terminus location. There is a need for lighting at this location and the entire lot needs illumination. Power does exist in Ripley Westbound Lot.

### 15.3.7 Access to Commercial Properties and Driveways

The Design-Builder shall provide uninterrupted access to all commercial properties and driveways within the Project Limits at all times, if any exist.

### 15.3.8 Closure Restrictions

Additional lane closures and time periods can be found on the Thruway Authority's Standard Sheets. Failure of the Design-Builder to stay within the restrictions defined shall result in liquidated damages applied under Section 619 of the Standard Specifications. This is considered a major violation act.

#### 15.3.8.1 Closure Restrictions on the NYSDOT System

As a general rule, all the general rules outlined for the Authority's system apply on the NYSDOT system.

More specifically, for work on the Interstate system of NYSDOT, no physical traffic control shall be out on the NYSDOT Interstate system between the hours of 6 AM to 9 AM nor 3:30 PM to 6 PM Monday through Friday. Overhead sign panels that are required to be removed and/or installed by the Design-Builder shall be removed at night, beginning no earlier than 9 PM. Advance warning of work zone traffic control on the interstate system is required via portable VMS devices one week in advance of intended work. Work zone traffic control shall be off the NYSDOT interstate system by 5 AM each morning.

Relative to the NYSDOT non-interstate system roads, the basic restrictions still apply and no work zones shall be on the roadways between the hours of 6 AM to 9 AM nor 3:30 PM to 6 PM Monday through Friday. ~~As normal course of work for VMS placements on the non-interstate systems requiring shoulder closures, work zone traffic control can begin at 9 AM and end with complete removal by 3:30 PM.~~ Work zone traffic control on the shoulders can also begin at 6 PM and shall be off the roadway system by 5 AM. This applies to ~~VMS placements~~, guiderail modifications, ground mounted sign removals and/or placements.

As a general rule, single lane closures on NYSDOT non-interstate roads on roadways with multiple lanes heading in one direction can occur between 9 AM and 3:30 PM and also between 6 PM and 5 AM. On single lane roads on the NYSDOT system, the Design-Builder shall assume that work cannot occur (except shoulder closures) until after 6 PM and prior to 5 AM. Once the contract is awarded, there may be opportunities to negotiate some flexibility at specific sites. That negotiation (or request) shall have to be justified and shall have to be passed through the Authority's project manager. The request for deviation shall be presented in excess of 3 weeks in advance of the scheduled work effort.

### 15.3.9 Minimum Lane Widths during Construction

In general, the Design-Builder shall maintain a minimum travel lane width of 11 feet during construction. Shoulder widths during construction shall be 1 foot minimum.

The allowable minimum lane widths and shoulder widths are only allowable during the construction season of March 15<sup>th</sup> to December 1<sup>st</sup>. Outside that period, the original lane widths and shoulder widths shall be returned to the work site for snow and ice control.

#### 15.3.10 Portable Variable Message Signs

The Design-Builder shall provide, as a minimum, **eight (8)** Portable Variable Message Signs, but more should the Design-Builders design dictate, for the duration of this Contract. The Portable

Except as noted in this Section, all asphalt pavement on the Thruway mainline shall be designed in accordance with the requirements of Chapter 6 of the Comprehensive Pavement Design Manual (CPDM) including Performance Graded Binder Selection, Compaction Monitoring, and Friction Aggregate Requirements.

If the existing roadway section(s) at the project limits varies from the standards applicable for new or resurfaced sections, the roadway features (lane & shoulder widths, superelevation and/or cross slope) shall be transitioned to meet the existing conditions.

Straight Tack Coat is required for all Mainline and Ramp pavement installations.

For HMA pavements, NYSDOT EI 18-016: New Standard Specification Section 653 Pavement Ride Quality Smoothness applies to this project. Pavement installation at Interchanges 23, 24, 25, 25A, 34A, 36, 39, 44, 45, 46, 47 shall be performed to the same ride quality requirements as Interstates.

### **16.3.1 Full Depth Reconstruction**

Where the Design-Builder is required to do Full Depth Reconstruction, the Design-Builder shall develop and construct pavement section(s) for full depth reconstruction, including subbase, of the Project roadways in conformance with the Comprehensive Pavement Design Manual, using the ESAL-based pavement design method.

Full depth reconstruction is required within the limits of any horizontal alignment changes, or vertical alignment changes until such point as the revised alignment meets the existing alignment. However, increases in profile elevations, up to eight inches (8"), may be made through asphalt and concrete overlays without the requirement of full depth reconstruction. The Authority is allowing one exception to this 8" limitation and that exception is allowed at Interchange 25 where the limitation is set at 12". No partial-width full depth reconstruction will be permitted; any roadway requiring full depth reconstruction shall be reconstructed for its full width, including shoulders, curbs and/or sidewalks.

If any roadway is permanently widened, beyond the limits of the existing travel lanes, for the purpose of providing additional travel and/or turning lanes, new full depth pavement need only be developed and constructed for the widened section, provided that no other portion of the pavement within the widened section requires full depth reconstruction for any other purpose. However, the existing pavement within the widened section shall be milled and resurfaced from curb to curb or edge of pavement to edge of pavement to provide a uniform pavement as specified in Section 16.3.3. The exceptions to this requirement are the widened shoulders or turning radii to accommodate tandem truck routing as shown in Part 7 – Engineering Data, Section 3.

### **16.3.2 Existing Concrete to Remain**

#### **16.3.2.1 Existing Concrete Pavement to Remain at ORT Exit Locations**

Where full depth reconstruction is not required, all existing exposed (non asphalt overlaid) concrete pavement to remain as permanent with travel lanes at ORT Exit locations shall be repaired, crack sealed, tack coated and overlaid with a minimum 2" Binder course and minimum 1" Top course.

#### **16.3.2.2 Existing Concrete Pavement to Remain at Interchanges and Terminus Locations**

Where full depth reconstruction is not required, all existing exposed (non asphalt overlaid) concrete pavement to remain as permanent travel lanes at interchange and terminus locations shall be repaired, crack sealed, tack coated and overlaid with a minimum 2 ½ " Binder course and 1 ½ " Top course.

### **16.3.3 Gantry Approach Pavement**

Non-metallic reinforced concrete pavement installed at the Gantry treadle detector slabs shall be placed at locations in accordance with Part 7, Engineering Data, Sections 4 and 25. Other new or reconstructed pavement within the Project limits that are not required to be non-metallic reinforced shall be designed and installed in accordance with Section 16.3.1.

The Design-Builder is responsible for the foundation design for all Mainline Gantries. See Part 3, Project Requirements, Section 9 – Geotechnical Requirements.

Since the equipment shall be accessed from the Mainline Gantry walkway, the amount of effort to raise any of the pieces of equipment shall be small to prevent injury. Access to the equipment shall not require any employee to lean over the railing or the Mainline Gantry itself to bring equipment up or to work on the equipment. The nVDC unit shall be brought to the Mainline Gantry walkway area where employees can repair, replace or adjust their functions. As the nVDC unit is being worked on, no openings to the traffic below shall be allowed and movement by employees around or across from the nVDC being worked on shall be safe and include preventing employees from falling by eliminating any walkway openings.

All Mainline Gantry Components shall have a protective coating system such as galvanizing or metalizing, use of aluminum or aluminum components are acceptable to ensure long term durability and resistance to corrosion or degradation of the initial design strength. Painting is not an acceptable solution.

The span length of each Mainline Gantry shall be determined by the Design-Builder. The Gantries may span across traffic in both directions or they could be two separate Gantries each handling traffic in opposing directions. Regardless of span choices the vertical supports of the Mainline Gantry shall be protected via an appropriate barrier system in compliance with the design standards. Under no circumstance, even if the vertical supports are outside the clear zone, can they be unprotected.

The placement of the Mainline Gantries shall not include mainline deceleration or acceleration ramps, rest area access ramps, service area ramps, rest stop locations or welcome center ramps. Mainline Gantry shall not be located within 1000' to existing Toll Booths at the Terminus locations.

Mainline Gantries shall not be located within 800 feet before or 100 feet after overhead roadway signage.

#### **21.4 HIGHWAY REQUIREMENTS AT MAINLINE GANTRY LOCATIONS:**

Requirements of the Highway at the Mainline Gantry Locations is as follows:

- Treadle Frame shall be installed as per Specification Item 690.6202—25
- The Treadle Frame shall be located as per Part 7 – Engineering Data, Section 21.
- Concrete Pavement (approximately 104 ft. in length including treadle frame) shall be installed so that 70 ft. of slab exists prior to the treadle frame and 30 ft. after the treadle frame in the direction of travel for each lane of travel. The treadle frame must be centered within the travel lane as the treadle frame is typically 10 ft. in length. Details about the treadle frames can be found in [Part 7, Section 25](#) ~~the Thruway Authority's standard sheets.~~
- Prior to placement of the concrete slabs that should reside under the Mainline Gantries the existing slabs are required to be removed and proper sub-base and/or asphalt placed depending on the existing highway section makeup. The removal of existing slabs shall be 50 feet beyond the limits of the proposed new slab locations (begin and end limits). Proper drainage such as underdrain shall be included in the reconstructed sections as defined above (approximately 104'+100'). If drainage structures are within the limits of the new Mainline Gantry proper, adjustments to elevation, stormwater flow and drainage capacity shall be the responsibility of the Design-Builder under the New York State's DOT Highway Design Manual.

- The Design-Builder shall reconstruct the entire pavement shoulders within the reconstruction limits defined above. The shoulders to be reconstructed shall be full depth asphalt to allow for loops to be cut into the asphalt. The Design-Builder is responsible to ensure proper drainage of the shoulder areas and treadle slabs.
- The Mainline Gantries shall be fully completed and conduits from the Communication Building to the Mainline Gantries along with all the mounting hardware, brackets or arms shall be in place so that cameras, antennas, laser scanners and illuminators can be attached by Kapsch and adjusted.
- Cashless Toll lanes and shoulders shall as a minimum match the maximum number of approach lanes and shoulders entering the Cashless Toll Collection Zone;
- Design-Builder shall ensure the slab containing the treadle and trench drain shall be embedded in a minimum of 22 inch of heavily reinforced Portland Cement Concrete (PCC) ~~utilizing fiber reinforced polymer (FRP) reinforcing bars so as not to interfere with the Authority's toll collection system~~

#### **21.4.1 Woodbury Terminus Location**

Terminus location at Woodbury requires the design and construction of a vehicle enforcement area for the State Police. It shall be provided after the mainline gantry as traffic heads South. The required enforcement area shall be constructed utilizing the current available concrete pavement located to the West of the traffic headed South. Proper deceleration and acceleration lanes shall be applied. The vehicle enforcement pertains to all types of vehicles utilizing the Thruway, from tandems to passenger vehicles. Proper pavement striping, signage is required. The Design-Builder is responsible for the full design and construction at this location. Refer to Part 7 – Engineering Data, Section 5 for concept drawings. This particular location does not require a reduction of the overall infrastructure foot print, with the exception of the area specifically designated to be removed involving the deceleration lane and ramp to Exit 16 for traffic heading South, and area heading North as shown on the concept drawings. The Design-Builder shall be aware for traffic heading North that the pavement area is more than required. The Design-Builder based on the design shall be required to properly channelize traffic with, as a minimum proper striping, cross hatching, and signage to ensure the proper and safe passage of traffic heading North to through the mainline gantry or Exit 16.

The design speed at the Woodbury terminus location is 80 mph and is designated a rural/suburban area. The  $e_{max}$  in this area shall be 8%.

#### **21.4.2 Williamsville and Lackawanna Terminus Locations**

Terminus locations at Williamsville and Lackawanna have design speeds of 70 mph and are designated as urban areas. The  $e_{max}$  in these areas shall be 6%.

At Terminus location Lackawanna, the bridge to the east, Route 219 over I-90 BIN 1062961, MP 430.43 current vertical clearances are shown in Part 7, Section 26. The Design-Builder shall provide a minimum vertical clearance of 14'-6" under the Route 219 over I-90 bridge structure.

#### **21.4.3 Canaan and Ripley Terminus Locations**

Terminus locations at Canaan and Ripley have design speeds of 80 mph and are designated as rural areas. The  $e_{max}$  in these areas shall be 8%.

### **21.5 KAPSCH REQUIREMENTS**

The Authority has selected Kapsch TrafficCom USA Inc. (Kapsch) to supply, install and monitor the Cashless Tolling system at all Mainline Gantries. The Design-Builder shall coordinate activities with Kapsch for installation at each Communication Building site as per the following requirements:

Equipment heights specified in this section are relative to the pavement in the lane over which the equipment is mounted.

A schematic of the ORT Gantry with various lane configurations is provided in the Part 7 – Engineering Data, Section 4.

### **22.3.2 ORT Toll Lane Requirements**

Travel lanes shall be 12 feet wide. Lanes approaching the tolling area that are wider than 12 feet shall taper so that lanes passing under the mini-gantry shall be 12 feet exactly.

Exit lanes shall be constructed of concrete, as described below. Entry lanes shall be constructed of full depth asphalt.

For sites where there are two or more travel lanes in one direction, right shoulders shall be a minimum of 6 feet wide. For sites with only one travel lane in a given direction, right shoulders shall be a minimum of 10 feet wide. Shoulders with a width greater than 6 feet shall be fully instrumented with toll equipment for ORT.

Exit 49 is an exception to the minimum 6' wide right shoulder requirement due to limitations associated with the cross culvert approaching the intersection. The existing right shoulder widths can be maintained at this Exit location.

Concrete slabs containing the treadle shall be 22 inch reinforced Portland cement concrete (PCC). Concrete slabs containing the loops shall be ~~13~~12" inch reinforced Portland cement concrete (PCC) utilizing fiber reinforced polymer (FRP) reinforcing bars so as to not interfere with the Authority's toll collection system for ORT. Refer to Part 7, Section 4 for details of the concrete slab details.

In exit lanes, each loop must be contained in a single concrete slab.

If the treadle slab is constructed within pavement super elevation transitions, the maximum cross slope shall not exceed 3 percent (%).

Treadle approach pavement shall be a minimum of 18-feet long of new, full depth concrete pavement.

Treadle departure pavement shall be a minimum of 18-feet long of new, full depth concrete pavement.

Cross-slope through the plaza shall not exceed 3 percent (%) and shall be 1.5 percent (%) minimum and continuous through the shoulders.

### **22.3.3 Gantry Requirements**

The Design-Builder shall provide an overhead structure functionally consistent with the ORT Gantry Schematic.

The Design-Builder shall procure and install equipment mounts as specified below. The ORT gantry shall support flexible placement of equipment mounts. All supports in the vicinity of the equipment shall not interfere with the placement or field of view of the equipment. Supports shall not be placed on the center lines or split lines of the lanes.

Conduit shall not impede access to equipment for installation or maintenance purposes.

The ORT Gantry shall be grounded.

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering traffic – provide a single lane to the ramp split
- C. Exiting traffic – provide two lanes to the split approaching the Riverside Drive intersection.
- D. Complete installation of delineators, with a break for the driveway to the State Police facility, and complete the striping.
- E. Remove the parking on the south side of the toll building.
- F. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

### **Exit 29 Canajoharie**

The Design Builder shall construct an ORT zone to the east of the existing toll booths with 2 lanes and a shoulder for the entering traffic and a single lane with shoulder for exiting traffic, and provide delineators for a Design Speed of 40 MPH – Semi-direct Connecting Ramp.

Prior to the Go Live Date the Design Builder shall:

- A. Remove the parking area on the east side of the existing toll building.
- B. Install cross hatching for the Tandem Lots.
- C. Remove the pavement and regrade and seed the outside of the curve leading to Rte 5S.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Rte 5S as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering traffic – at the east side of the entrance to the tandem truck lot begin taper to two lanes.
- C. Exiting traffic – taper the ramps to one lane prior to entering the toll zone.
- D. Complete installation of delineators and striping.
- E. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

### **Exit 29A Little Falls**

The Design Builder shall construct an ORT zone on ~~Southe~~ither side of the toll plaza with one lane and a shoulder in each direction with delineators for a Design Speed of 40 MPH – Semi-direct Connecting Ramp.

Prior to the Go Live Date the Design Builder shall:

- Retain the park and ride lot and employee parking lot from the north side of the TUB.
- Remove the employee parking lot from the south side of the TUB.

- A. Remove the existing Maintenance Access Drive to the east of the toll plaza.
- B. Improve the radius for the maintenance driveway at the west of the toll plaza.

After the ORT toll system becomes functional Design Builder shall remove the existing toll plaza and connect the ORT Toll Zone to Rte 5/20 interchange as follows:

- A. Restripe the plaza to align the lanes with the appropriate number of toll lanes to manage the peak hour traffic flow for temporary traffic control prior to and during the toll plaza removal.
- B. Entering Traffic
  - The entering lane shall continue from the existing 1 lane at the Rte 394 slip ramp through the toll zone to meet the existing ramp lane after the toll zone.
- C. Exiting Traffic
  - The exit lane shall continue as 1 lane with shoulder after the intersection with Rte 394
- D. Complete installation of delineators.
- E. Remove pavement to provide footprint reduction areas and these areas should be top soiled and seeded.

## 22.5 HIGHWAY REQUIREMENTS AT OPEN ROAD TOLLING GANTRY LOCATIONS:

Requirements of the Highway at the Open Road Tolling Gantry Locations is as follows:

- Treadle Frame shall be installed as per Specification Item 690.6202—25
- The Treadle Frame shall be located under the center of the Mini-Gantry on the exit side only of the units for all Mini-Gantry locations.
- The Design-Builder shall reconstruct the pavement shoulders (both sides) at least within the ORT Toll zone where concrete pavement limits are required at the exits of the Thruway system. The shoulders to be reconstructed shall be full depth asphalt to allow for loops to be cut into the asphalt.
- The Open Road Tolling Mini-Gantries shall be fully completed and conduits (for electricity and communications) from the new Communication Building to the Open Road Tolling Mini-Gantries along with all the mounting hardware, brackets or arms shall be in place so that cameras, antennas, laser scanners and illuminators can be attached by Thruway Authority personnel and adjusted.

Cashless ORT Toll lanes and shoulders shall as a minimum match the maximum number of approach lanes and shoulders entering the Cashless ORT Toll Collection Zone. Ensure the slab containing the concrete treadle section and trench drain shall be a minimum of 22 inch in thickness, heavily reinforced Portland Cement Concrete (PCC) ~~utilizing fiber reinforced polymer (FRP) reinforcing bars so as not to interfere with the Authority's toll collection system.~~

Plotted By: scdusers  
 Design File: scdfiles  
 Plot Date: 3/22/19  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>Thruway Authority</b>	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
	TITLE OF DRAWING INTERCHANGE 23 CONCEPT	DRAWING NUMBER:

Plotted By: scdusers  
 Design File: scdfiles  
 Plot Date: 3/22/19  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
TITLE OF DRAWING INTERCHANGE 24 CONCEPT	DRAWING NUMBER:

Plotted By: scdusers  
 Design File: scdfiles  
 Plot Date: 8/20/19  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>NEW YORK</b> STATE OF OPPORTUNITY.	<b>Thruway Authority</b>	TITLE OF PROJECT	CONTRACT NUMBER:
		CASHLESS TOLLING ON THE NYS THRUWAY	
		LOCATION OF PROJECT	DATE:
		EXITS 16 TO 61	3/22/2019
		TITLE OF DRAWING	DRAWING NUMBER:
		INTERCHANGE 25 CONCEPT	

Plotted By: scduars  
 Design File: scduars  
 Plotted: 3/22/19  
 DRAFTED BY: P. FITZGERALD  
 CHECKED BY: K. CZORA  
 DESIGNED BY: B. LAGRAVE  
 CHECKED BY: K. CZORA  
 DESIGN SUPERVISOR: B. DOHERTY



 <b>Thruway Authority</b> 	TITLE OF PROJECT CASHLESS TOLLING ON THE NYS THRUWAY	CONTRACT NUMBER:
	LOCATION OF PROJECT EXITS 16 TO 61	DATE: 3/22/2019
TITLE OF DRAWING INTERCHANGE 45 CONCEPT		DRAWING NUMBER:

## **ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

### **1. DESCRIPTION:**

- 1.01 This work item shall consist of furnishing and installing a complete front access, full matrix, LED Dynamic Message Sign (DMS) assembly at locations indicated in the contract documents. This item shall include all sign modules, sign housings, controllers, fittings and cabling to make the sign compatible with the control software defined in this document. All other components necessary to support this sign will be covered under separate items.

### **2. MATERIALS:**

#### **2.01 General Requirements**

Unless otherwise specified on the contract plans the DMS equipment shall include, but not limited to, the following components:

- DMS display modules and associated attachment hardware, capable of full matrix alphanumeric and special character messages including displaying message with three (3) lines of characters 18” high and 9.6” average width. Each line shall be able to display 15 characters and spaces.
- DMS controller(s).
- DMS software (where required).
- All required surge suppression, power and data cabling, and miscellaneous ancillaries.
- Sign mounting hardware (size and type to be as approved by the manufacturer).
- Power Supplies

#### **2.02 Sign Requirements**

- A. The complete LED DMS assembly shall conform to the requirements of the current National Electrical Manufacturers Association (NEMA) Standard No. TS-4 - Section 2, Environmental Standards and Test Procedures. The manufacturer shall provide certification for equipment compliance with NEMA environmental standards in accordance with NEMA testing procedures.
- B. Materials not specifically covered in these specifications shall be in accordance with the accepted standards of the NEMA, the Underwriters Laboratories (UL) Inc., the National Electrical Code (NEC), and the American Society for Testing and Materials (ASTM).
- C. Operating range shall be from - 30° F to + 165° F; relative humidity 0% to 95% non-condensing.
- D. For all message boards the use of heaters, fans, and filters shall not be permitted in order to reduce the maintenance requirements for servicing the signs.
- E. All electronic setup and adjustments for the display shall be enabled from the adjacent equipment cabinet.
- F. All materials to be furnished, assembled, fabricated or installed shall be new, corrosion resistant and in accordance with the details as shown on the Plans or as specified in the Contract documents.

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

**2. MATERIALS:** (cont'd)

2.02 **Sign Requirements** (cont'd)

- G. The DMS front face borders shall be constructed with vertically and horizontal channeled trim to provide a high-contrast background. The trim pieces shall be fabricated using aluminum sheeting. The trim shall border the entire DMS display.
- H. All DMS front face trim pieces that are visible shall be powder coated with a textured black Rohm and Haas 31-7091TGIC polyester finish, or approved equal.
- I. Unless otherwise specified by the manufacturer the DMS shall use standard extruded aluminum clamps and bolts which will secure the DMS to the specified support members. In all installed applications the support clips and hardware shall be in accordance with the manufactures standard installation guidelines and shall be supplied by the manufacturer.
- J. For ground-mounted installation, the DMS shall be constructed of such a size, depth and weight to allow installation on breakaway posts.
- K. The sign assembly and mounting hardware shall be designed to meet the loading and fatigue requirements specified in the following documents:  
  
“NYSDOT Design Specification for Overhead Sign Structures Carrying Variable Message Signs” dated October, 1998; and the revisions to this document contained in Engineering Bulletin EB 01-049, “Overhead Sign Structure Interim Design Criteria”, dated 10/01/01; Engineering Instruction EI 99-038 “Design Loads for Permanent Variable Message Signs”, dated 12/31/99; and any other subsequent revisions.
- L. The control cabinet containing the sign controller, communications, and power supplies shall be paid under separate item(s) in this contract. Unless otherwise noted all internal components and mounting hardware shall be paid for under this contract item.

Cabinet foundation, work pads, or buried conduit shall be paid for under various contract items as noted on the plans.

Whenever possible the cabinets shall come pre-wired from the manufacturer to expedite installation and ensure quality control of communications and power component installation.

Internal component hardware (nuts, bolts, screws, standoffs, rivets, fasteners, etc.) shall be fabricated from hot dipped galvanized steel, stainless steel, aluminum, nylon or other durable corrosion-resistant materials suitable for roadway signage applications.

## **ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

### **2. MATERIALS: (cont'd)**

#### **2.03 LED Requirements**

- A. LED's shall be Amber in color with a minimum of 4 LED's per pixel, traceable to the manufacturer, with a typical luminous intensity of 3500 millicandela per LED when driven at 20 mA. The LED's used in the display shall be obtained from batches sorted for luminous output, where the highest luminosity LED shall not be more than fifty percent more luminous than the lowest luminosity LED. The brightness and color of each pixel shall be uniform over the entire face of the sign, within the required cone of vision, at a distance of 100 to 1100 feet, in all lighting conditions. The LEDs shall be protected from degradation due to sunlight and shall be untinted, non- diffused, an aluminum indium gallium phosphide (AlInGaP) amber LED with a peak wavelength 590 +/-5 nanometers.
- B. Unless otherwise shown on the contract plans the LED pixel and module construction technique shall result in a viewing cone of 30 degrees horizontal and 15 degrees vertical.
- C. Each display module shall be completely environmentally sealed. The protective face of the LED module shall be a solar grade polycarbonate material. All masks that are used to enhance the LED contrast or readability shall be UV inhibited.
- D. Each display module shall be based on a single printed circuit board. Designs using multiple levels of control electronics including daughter boards shall not be allowed.
- E. Each module shall be configured via the communication wiring harness and connector without individually addressing each module.
- F. The module shall have IP64 certification for dust and water protection under the International Standard IEC 60529 Edition 2.1.
- G. Each module shall be identical and interchangeable; to be removed and replaced easily using simple hand tools without affecting the operation of the remaining modules. The mounting design shall use mechanical fasteners that are resistant to vibration and vandalism.

#### **2.04 Circuit Board Electronics**

- A. All printed circuit boards shall be FR-4 0.06 in. material, minimum 28 gram copper, double sided with plated holes meeting environmental requirements with moisture proofing conformal coating.
- B. The DMS back plate shall include a NEMA rated distribution cabinet where all sign power and communication is to be terminated onto separate terminal blocks. One terminal block shall be for incoming DC power and the other shall be for incoming DMS signal cabling or a communications line. The distribution cabinet shall be located on the sign panel such that it is closest to the controller cabinet.

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

**2. MATERIALS:** (cont'd)

2.05 **Power Requirements**

A. AC Option: The DMS system power supply shall operate from a 120/240 VAC, 60Hz, single-phase power source, including neutral and earth ground. All cabinet and sign components including display modules shall operate from a 12 VDC power supply. The power supplies shall be rated to supply the required amperage for all DC powered installed equipment and with all LED modules set at full brightness plus twenty-five percent.

B. SOLAR/DC Option: The DMS system power supply shall operate from a 12VDC system. The system shall consist of photovoltaic solar panels, battery storage, and a multipoint power tracking charger to regulate solar-to-battery charging. All cabinet and sign components including display modules shall operate from this 12 VDC power supply. Batteries shall be housed in a separate 3R cabinet. The battery cabinet shall be paid under a separate item.

1. **Solar Charging Regulator:**

The solar charging regulator shall be of the maximum power point tracking (MPPT) type and shall meet the following requirements:

- Rated Solar Current: 30A (MIN)
- Rated Load Current: 30A (MIN)
- System Voltage: 12V/24V/48V
- Ambient Temperature: -40°F to +113°F
- Storage Temperature: -67°F to +2°F
- Humidity 100% non-condensing
- Peak Efficiency: 99%
- Nominal System DC Voltage: 12, 24, 36 or 48
- Max. Solar Open Circuit DC Voltage 150
- Battery Operating DC Voltage Range: 8-72
- Maximum Self-consumption: 2.7 Watts
- Transient Surge Protection: 4500 Watts/port

## **ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

### **2. MATERIALS:** (cont'd)

#### **2.05 Power Requirements** (cont'd)

2. **Batteries:** All supplied batteries shall be a valve regulated lead Acid AGM (Absorption Glass Mat) type. To ensure adequate capacity a minimum of eight (8) deep cycle batteries shall be used and capable of being wired as a 12 volt system. Each battery must have nominal dimensions equal to or less than 10.25”L x 7”W x 11.25”H and be rated for a minimum of 225 Amp-Hr.

The batteries and solar panels shall be rated to supply the required amperage. The sign shall run continuously with 40% of the pixels on for 144 hours on battery only. The solar panels must supply a minimum total of 720W.

3. **Surge Suppression:** The DMS distribution box shall contain surge suppression for both the DC power and sign communications. The sign power surge suppression shall consist of thermal resettable fuses conforming to SAE specification J53 Type 1. The sign communication shall consist of a surge suppression device capable of withstanding a 10kA peak surge in < 1 nanosecond.

#### **2.06 DMS Controller**

- A. The controller shall capable of providing all the necessary functions to control and monitor the DMS locally and from the Traffic Management Center (TMC). Local control shall be made possible in the field by either an alphanumeric keypad or optional QWERTY keyboard connected to the controller with and LCD display.
- B. The controller shall be mounted in the cabinet as shown in the contract plans or as provided by the manufacturer. The communication signals from sign controller to the DMS shall be RS-232 for distances up to 50 feet and RS-485 for distances up to 4,000 feet. Optional TCP/IP communications will also be an acceptable communications technology.

#### **2.07 Photocell**

Each sign assembly shall include photo cells for automatic pixel brightness adjustment to suit ambient lighting conditions. Brightness shall also be manually settable from the front panel of the controller and remotely from the DMS Central Control System in about 5% increments. Control shall be returnable to automatic from both the sign controller and the central computer.

#### **2.08 Fonts and Messaging**

Message text shall be configurable for variable character height, width, character spacing, and line spacing. The DMS font messaging requirements for this specification shall be capable of displaying the specified number of characters based on a maximum character height of 18 inches. The font style, height, and messages displayed shall conform to all applicable standards as described in the Manual on Uniform Traffic Control Devices, 2009 Edition, Chapter 2L, and all applicable NYSDOT supplements:

- Spacing between characters in a word should be between 25 to 40 percent of the letter height.

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

**2. MATERIALS:** (cont'd)

2.08 **Fonts and Messaging** (cont'd)

- Spacing between words in a message should be between 75 and 100 percent of the letter height.
- Spacing between the message lines should be between 50 and 75 percent of the letter height.
- The minimum letter height should be 18 inches for changeable message signs on roadways with speed limits of 45 mph or higher.
- The minimum letter height should be 12 inches for changeable message signs on roadways with speed limits of less than 45 mph.
- The character display width shall be capable of at least 9.6 inches.

Users shall configure the fonts supported by the sign on an alphanumeric keyboard.

Message text shall be configurable for variable character height, width, character spacing, and line spacing.

2.09 **National Transportation Communications for ITS Protocol (NTCIP)**

The controller shall communicate using the NTCIP standards listed here and all current revisions released at the time of bidding. The manufacturer shall be required to provide the NTCIP test results to verify conformance with the minimum standards as outlined here. Any published amendments to these standards at the time of contract advertisement shall be also be effective on this contract.

The following requirements defines those MIB objects which are expected to be used for the communications to the DMS:

- NTCIP 1103 V03– Transportation Management Protocols NTCIP 2104:2003 v01.11 - Ethernet Subnetwork Profile
- NTCIP 2202: 2001 - Internet (TCP/IP and UDP/IP) Transport Profile

The following table defines those MIB objects which are expected to be used by the DMS:

CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>1201: GLOBAL OBJECT (GO) DEFINITIONS</b>			
<b>2.2 - Configuration</b>			
globalSetIDParameter	NTCIP 1201	optional	Yes
globalMaxModules	NTCIP 1201	mandatory	Yes
globalModuleTable	NTCIP 1201	mandatory	Yes
moduleNumber	NTCIP 1201	mandatory	Yes
moduleDeviceNode	NTCIP 1201	mandatory	Yes
moduleMake	NTCIP 1201	mandatory	Yes
moduleModel	NTCIP 1201	mandatory	Yes
moduleVersion	NTCIP 1201	mandatory	Yes
moduleType	NTCIP 1201	mandatory	Yes

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>2.3 Database Management</b>			
Database Management (ALL)	NTCIP 1201	Optional Group	No
<b>2.4 Time Management</b>			
globalTime	NTCIP 1201	mandatory	Yes
globalDaylightSaving	NTCIP 1201	mandatory	Yes
globalLocalTimeDifferential	NTCIP 1201	mandatory	Yes
maxTimeBaseScheduleEntries	NTCIP 1201	mandatory	Yes
timeBaseScheduleTable	NTCIP 1201	mandatory	Yes
timeBaseScheduleNumber	NTCIP 1201	mandatory	Yes
timeBaseScheduleMonth	NTCIP 1201	mandatory	Yes
timeBaseScheduleDay	NTCIP 1201	mandatory	Yes
timeBaseScheduleDate	NTCIP 1201	mandatory	Yes
timeBaseScheduleDayPlan	NTCIP 1201	mandatory	Yes
maxDayPlans	NTCIP 1201	mandatory	Yes
maxDayPlanEvents	NTCIP 1201	mandatory	Yes
timeBaseDayPlanTable	NTCIP 1201	mandatory	Yes
dayPlanNumber	NTCIP 1201	mandatory	Yes
dayPlanEventNumber	NTCIP 1201	mandatory	Yes
dayPlanHour	NTCIP 1201	mandatory	Yes
dayPlanMinute	NTCIP 1201	mandatory	Yes
dayPlanActionNumberOID	NTCIP 1201	mandatory	Yes
dayPlanStatus	NTCIP 1201	mandatory	Yes
<b>2.7 - PMPP</b>			
maxGroupAddresses	NTCIP 1201	mandatory	Yes
hdlcGroupAddressTable	NTCIP 1201	mandatory	Yes
hdlcGroupAddressIndex	NTCIP 1201	mandatory	Yes
hdlcGroupAddress	NTCIP 1201	mandatory	Yes
<b>1203: OBJECT DEFINITIONS FOR DYNAMIC MESSAGE SIGNS (DMS) MIB</b>			
<b>5.2 - SIGN CONFIGURATION AND CAPABILITY</b>			
dmsSignAccess	NTCIP 1203	mandatory	Yes
dmsSignType	NTCIP 1203	mandatory	Yes
dmsSignHeight	NTCIP 1203	mandatory	Yes
dmsSignWidth	NTCIP 1203	mandatory	Yes
dmsHorizontalBorder	NTCIP 1203	mandatory	Yes
dmsVerticalBorder	NTCIP 1203	mandatory	Yes
dmsLegend	NTCIP 1203	mandatory	Yes
dmsBeaconType	NTCIP 1203	mandatory	Yes
dmsSignTechnology	NTCIP 1203	mandatory	Yes
<b>5.3 - VMS Configuration</b>			
vmsCharacterHeightPixels	NTCIP 1203	mandatory	Yes
vmsCharacterWidthPixels	NTCIP 1203	mandatory	Yes
vmsSignHeightPixels	NTCIP 1203	mandatory	Yes
vmsSignWidthPixels	NTCIP 1203	mandatory	Yes
vmsHorizontalPitch	NTCIP 1203	mandatory	Yes
vmsVerticalPitch	NTCIP 1203	mandatory	Yes
monochromeColor	NTCIP 1203	mandatory	Yes
<b>5.4 - Font Definition</b>			
numFonts	NTCIP 1203	mandatory	Yes
fontTable	NTCIP 1203	mandatory	Yes

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>5.4 - Font Definition (cont'd)</b>			
fontEntry	NTCIP 1203	mandatory	Yes
fontIndex	NTCIP 1203	mandatory	Yes
fontNumber	NTCIP 1203	mandatory	Yes
fontName	NTCIP 1203	mandatory	Yes
fontHeight	NTCIP 1203	mandatory	Yes
fontCharSpacing	NTCIP 1203	mandatory	Yes
fontLineSpacing	NTCIP 1203	mandatory	Yes
fontVersionID	NTCIP 1203	mandatory	Yes
fontStatusID	NTCIP 1203	mandatory	Yes
maxFontCharacters	NTCIP 1203	mandatory	Yes
characterTable	NTCIP 1203	mandatory	Yes
characterNumber	NTCIP 1203	mandatory	Yes
characterWidth	NTCIP 1203	mandatory	Yes
characterBitmap	NTCIP 1203	mandatory	Yes
fontMaxCharacterSize	NTCIP 1203	mandatory	Yes
<b>5.5 - MULTI Configuration</b>			
defaultBackgroundColor	NTCIP 1203	mandatory	Yes
defaultForegroundColor	NTCIP 1203	mandatory	Yes
defaultFlashOn	NTCIP 1203	optional	No
defaultFlashOnActivate	NTCIP 1203	optional	No
defaultFlashOff	NTCIP 1203	optional	No
defaultFlashOffActivate	NTCIP 1203	optional	No
defaultFont	NTCIP 1203	mandatory	Yes
defaultFontActivate	NTCIP 1203	optional	No
defaultJustificationLine	NTCIP 1203	mandatory	Yes
defaultJustificationLineActivate	NTCIP 1203	optional	No
defaultJustificationPage	NTCIP 1203	mandatory	Yes
defaultJustificationPageActivate	NTCIP 1203	optional	No
defaultPageOnTime	NTCIP 1203	mandatory	Yes
defaultPageOnTimeActivate	NTCIP 1203	optional	No
defaultPageOffTime	NTCIP 1203	mandatory	Yes
defaultPageOffTime	NTCIP 1203	optional	No
defaultCharacterSet	NTCIP 1203	mandatory	Yes
defaultBackgroundRGB	NTCIP 1203	optional	No
defaultBackgroundRGBActivate	NTCIP 1203	optional	No
defaultForegroundRGB	NTCIP 1203	optional	No
defaultForegroundRGBActivate	NTCIP 1203	optional	No
defaultCharacterSet	NTCIP 1203	optional	No
dmsColorScheme	NTCIP 1203	optional	No
dmsSupportedMultiTags	NTCIP 1203	mandatory	Yes
dmsMaxNumberPages	NTCIP 1203	mandatory	Yes
dmsMaxMultiStringLength	NTCIP 1203	mandatory	Yes
<b>5.6 Message Objects</b>			
dmsNumPermanentMsg	NTCIP 1203	mandatory	Yes
dmsNumChangeableMsg	NTCIP 1203	mandatory	Yes
dmsMaxChangeableMsg	NTCIP 1203	mandatory	Yes
dmsFreeChangeableMemory	NTCIP 1203	mandatory	Yes
dmsNumVolatileMsg	NTCIP 1203	mandatory	Yes
dmsMaxVolatileMsg	NTCIP 1203	mandatory	Yes

**ITEM 645.4530--25 – DYNAMIC MESSAGE SIGN (DMS) FULL MATRIX, FRONT ACCESS LED**

CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>5.6 Message Objects (cont'd)</b>			
dmsFreeVolatileMemory	NTCIP 1203	mandatory	Yes
dmsMessageTable	NTCIP 1203	mandatory	Yes
dmsMessageEntry	NTCIP 1203	mandatory	Yes
dmsMessageMemoryType	NTCIP 1203	mandatory	Yes
dmsMessageNumber	NTCIP 1203	mandatory	Yes
dmsMessageMultiString	NTCIP 1203	mandatory	Yes
dmsMessageOwner	NTCIP 1203	mandatory	Yes
dmsMessageCRC	NTCIP 1203	mandatory	Yes
dmsMessageBeacon	NTCIP 1203	optional	No
dmsMessagePixelService	NTCIP 1203	optional	No
dmsMessageRunTimePriority	NTCIP 1203	mandatory	Yes
dmsMessageMsgStatus	NTCIP 1203	mandatory	Yes
dmsValidateMessageError	NTCIP 1203	mandatory	Yes
<b>5.7 Sign Control</b>			
dmsControlMode	NTCIP 1203	mandatory	Yes
dmsSWReset	NTCIP 1203	optional	Yes
dmsActivateMessage	NTCIP 1203	mandatory	Yes
dmsMessageTimeRemaining	NTCIP 1203	optional	Yes
dmsMsgTableSource	NTCIP 1203	mandatory	Yes
dmsMsgRequesterID	NTCIP 1203	mandatory	Yes
dmsMsgSourceMode	NTCIP 1203	mandatory	Yes
dmsShortPowerRecoveryMessage	NTCIP 1203	optional	Yes
dmsLongPowerRecoveryMessage	NTCIP 1203	optional	Yes
dmsShortPowerLossTime	NTCIP 1203	optional	Yes
dmsResetMessage	NTCIP 1203	optional	Yes
dmsCommunicationsLossMessage	NTCIP 1203	optional	Yes
dmsTimeCommLoss	NTCIP 1203	optional	Yes
dmsPowerLossMessage	NTCIP 1203	optional	Yes
dmsEndDurationMessage	NTCIP 1203	optional	Yes
dmsMemoryMgmt	NTCIP 1203	mandatory	Yes
dmsActivateMsgError	NTCIP 1203	mandatory	Yes
dmsMultiSyntaxError	NTCIP 1203	mandatory	Yes
dmsMultiSyntaxErrorPosition	NTCIP 1203	mandatory	Yes
dmsMultiOtherErrorDescription	NTCIP 1203	optional	Yes
vmsPixelServiceDuration	NTCIP 1203	optional	No
vmsPixelServiceFrequency	NTCIP 1203	optional	No
vmsPixelServiceTime	NTCIP 1203	optional	No
dmsActivateErrorMsgCode	NTCIP 1203	optional	No
dmsActivateMessageState	NTCIP 1203	optional	No
<b>5.8 – ILLUMINATION BRIGHTNESS</b>			
dmsIllumControl	NTCIP 1203	mandatory	Yes
dmsIllumMaxPhotocellLevel	NTCIP 1203	mandatory	Yes
dmsIllumPhotocellLevelStatus	NTCIP 1203	mandatory	Yes
dmsIllumNumBrightLevels	NTCIP 1203	mandatory	Yes
dmsIllumBrightLevelStatus	NTCIP 1203	mandatory	Yes
dmsIllumManLevel	NTCIP 1203	mandatory	Yes
dmsIllumBrightnessValues	NTCIP 1203	mandatory	Yes
dmsIllumBrightnessValulesError	NTCIP 1203	mandatory	Yes
dmsIllumLightOutputStatus	NTCIP 1203	optional	Yes

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CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>5.9 - SCHEDULING ACTION</b>			
numActionTableEntries	NTCIP 1203	mandatory	Yes
dmsActionTable	NTCIP 1203	mandatory	Yes
dmsActionEntry	NTCIP 1203	mandatory	Yes
dmsActionIndex	NTCIP 1203	mandatory	Yes
dmsActionMsgCode	NTCIP 1203	mandatory	Yes
<b>5.11 - SIGN STATUS</b>			
<b>Core Status</b>			
statMultiFieldRows	NTCIP 1203	mandatory	Yes
statMultiFieldTable	NTCIP 1203	mandatory	Yes
statMultiFieldIndex	NTCIP 1203	mandatory	Yes
statMultiFieldCode	NTCIP 1203	mandatory	Yes
statMultiCurrentFieldValue	NTCIP 1203	mandatory	Yes
dmsCurrentSpeed	NTCIP 1203	optional	No
dmsCurrentSpeedLimit	NTCIP 1203	optional	No
watchdogFailureCount	NTCIP 1203	mandatory	Yes
dmsStatDoorOpen	NTCIP 1203	mandatory	Yes
<b>Controller Status</b>			
shortErrorStatus	NTCIP 1203	mandatory	Yes
controllerErrorStatus	NTCIP 1203	mandatory	Yes
<b>Power Status</b>			
dmsPowerFailureStatusMap	NTCIP 1203	mandatory	Yes
dmsPowerNumRows	NTCIP 1203	mandatory	Yes
dmsPowerStatusTable	NTCIP 1203	mandatory	Yes
dmsPowerIndex	NTCIP 1203	mandatory	Yes
dmsPowerDescription	NTCIP 1203	mandatory	Yes
dmsPowerMfrStatus	NTCIP 1203	mandatory	Yes
dmsPowerStatus	NTCIP 1203	mandatory	Yes
dmsPowerVoltage	NTCIP 1203	mandatory	Yes
dmsPowerType	NTCIP 1203	mandatory	Yes
<b>Climate Controlled Status Data</b>			
dmsClimateCtrlNumRows	NTCIP 1203	optional	No
dmsClimateCtrlStatusMap	NTCIP 1203	optional	No
dmsClimateCtrlStatusTable	NTCIP 1203	optional	No
dmsClimateCtrlIndex	NTCIP 1203	optional	No
dmsClimateCtrlDescription	NTCIP 1203	optional	No
dmsClimateCtrlMfrStatus	NTCIP 1203	optional	No
dmsClimateCtrlErrorStatus	NTCIP 1203	optional	No
dmsClimateCtrlOnStatus	NTCIP 1203	optional	No
dmsClimateCtrlTestActivation	NTCIP 1203	optional	No
dmsClimateCtrlAbortReason	NTCIP 1203	optional	No
dmsClimateCtrlType	NTCIP 1203	optional	No
<b>Pixel Failure Data</b>			
pixelFailureTableNumRows	NTCIP 1203	mandatory	Yes
PixelFailureTable	NTCIP 1203	mandatory	Yes
pixelFailureDetectionType	NTCIP 1203	mandatory	Yes
pixelFailureIndex	NTCIP 1203	mandatory	Yes
pixelFailureXLocation	NTCIP 1203	mandatory	Yes
pixelFailureYLocation	NTCIP 1203	mandatory	Yes
pixelFailureStatus	NTCIP 1203	mandatory	Yes

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CONFORMANCE GROUP OBJECTS	REFERENCE	CONFORMANCE REQUIREMENT	PROJECT REQUIREMENT
<b>5.11 - SIGN STATUS</b>			
<b>Pixel Failure Data (cont'd)</b>			
pixelTestActivation	NTCIP 1203	mandatory	Yes
pixelStatusTable	NTCIP 1203	mandatory	Yes
dmsPixelStatusIndex	NTCIP 1203	mandatory	Yes
dmsPixelStatus	NTCIP 1203	mandatory	Yes
dmsPixelFailureTestRows	NTCIP 1203	mandatory	Yes
dmsPixelFailureMessageRows	NTCIP 1203	mandatory	Yes
<b>Lamp Error Status (ALL)</b>	<b>NTCIP 1203</b>	<b>Optional Group</b>	<b>No</b>
<b>Drum Status Data (ALL)</b>	<b>NTCIP 1203</b>	<b>Optional Group</b>	<b>No</b>
<b>Light Sensor Status Data</b>			
dmsLightSensorStatusMap	NTCIP 1203	mandatory	Yes
dmsLightSensorNumRows	NTCIP 1203	mandatory	Yes
dmsLightSensorStatusTable	NTCIP 1203	mandatory	Yes
<b>CONFORMANCE GROUP OBJECTS</b>			
<b>REFERENCE</b>			
<b>CONFORMANCE REQUIREMENT</b>			
<b>PROJECT REQUIREMENT</b>			
<b>5.11 - SIGN STATUS</b>			
<b>Light Sensor Status Data (cont'd)</b>			
dmsLightSensorIndex	NTCIP 1203	mandatory	Yes
dmsLightSensorDescription	NTCIP 1203	mandatory	Yes
dmsLightSensorCurrentReading	NTCIP 1203	mandatory	Yes
dmsLightSensorStatus	NTCIP 1203	mandatory	Yes
<b>Humidity Data (ALL)</b>	<b>NTCIP 1203</b>	<b>Optional Group</b>	<b>No</b>
<b>Temperature Sensor Data</b>			
dmsTempSensorStatusMap	NTCIP 1203	mandatory	Yes
dmsTempSensorNumRows	NTCIP 1203	mandatory	Yes
dmsTempSensorStatusTable	NTCIP 1203	mandatory	Yes
dmsTempSensorIndex	NTCIP 1203	mandatory	Yes
dmsTempSensorDescription	NTCIP 1203	mandatory	Yes
dmsTempSensorCurrentReading	NTCIP 1203	mandatory	Yes
dmsTempSensorHighWarningTemperature	NTCIP 1203	mandatory	Yes
dmsTempSensorHighCriticalTemperature	NTCIP 1203	mandatory	Yes
dmsTempSensorLowCriticalTemperature	NTCIP 1203	mandatory	Yes
dmsTempSensorStatus	NTCIP 1203	mandatory	Yes
dmsTempSensorHighestCriticalTempThreshold	NTCIP 1203	mandatory	Yes
dmsTempSensorLowestCriticalTempThreshold	NTCIP 1203	mandatory	Yes
<b>Power Status Objects</b>			
signVolts	NTCIP 1203	mandatory	Yes
lineVolts	NTCIP 1203	mandatory	Yes
powerSource	NTCIP 1203	mandatory	Yes
<b>Temperature Status</b>	<b>NTCIP 1203</b>	<b>Optional Group</b>	<b>Yes</b>
<b>5.12 – GRAPHIC DEFINITION</b>			
<b>Graphic Definition Objects (ALL)</b>	<b>NTCIP 1203</b>	<b>Optional Group</b>	<b>No</b>

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**2. MATERIALS:** (cont'd)

2.10 **Documentation**

Full documentation of proposed sign equipment, specifications and assembly details, including posts and equipment cabinet, shall be provided to the Engineer for approval.

Software shall be supplied with full documentation, including a CD-ROM containing ASCII versions of the following Management Information Base (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 shall be provided. The filename of this file shall be identical to the standard MIB Module, except that it shall have the extension “.man”.
- A MIB Module in ASN.1 format containing any and all manufacturer-specific (or agency-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.

2.11 **Intellectual Property Rights**

The manufacturer shall allow the use of any and all of this documentation by any party authorized by the Procuring Agency for systems integration purposes at any time initially or in the future, regardless of what parties are involved in the systems integration effort.

2.12 **Central Software**

Unless otherwise specified in the contract plans, the Contractor shall supply DMS central control software necessary to interface sign functions remotely from the TMC. All control software shall be delivered on CD-ROM and installed on the DMS computer and workstations as directed by the TMC manager. The TMC should be contacted for specifics of the communications protocols and software in place.

The software shall be of a client-server design, in which users can connect to, configure, monitor, and control signs from workstations in the TMC and also from workstations connected to the DMS computer by a TCP/IP 100-BaseT network. Some workstations may use dial-up telephone lines or other low-speed connections to reach the network via the LAN server. The DMS computer shall communicate with the signs via either multipoint EIA-232 communication channels or over TCP/IP Ethernet protocol. The DMS central software shall support at least 30 users and workstations, and 100 signs.

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**2. MATERIALS:** (cont'd)

2.12 **Central Software** (cont'd)

The software shall provide the following capabilities to users at the workstations and DMS computer:

1. See a list of messages stored in the sign or on the sign controller with an indication of which is currently being displayed on the monitor screen exactly as it appears to motorist.
2. Cause a different message to be displayed.
3. Upload and download new message files between the sign controllers and the DMS computer.
4. Automatically detect malfunctions, including loss of communication or power, and errors.
5. Create and edit fonts and messages and storing them on the DMS computer's disk drive for subsequent downloading to one or more signs.
6. Create an activity log for all signs.
7. Allow existing, or future, NTCIP based signs to be incorporated, configured, controlled, and monitored.
8. On screen notification/alarm of cabinet door open, malfunctions, errors, and out of range environmental conditions.

**3. CONSTRUCTION DETAILS:**

3.01 The DMS will be installed on either new or existing sign posts or overhead structures as shown in the contract documents. Posts, post foundations, and other supporting structures shall be paid for under other contract items as shown in the plans.

3.02 **Installation Certification**

All controller(s), LED display modules, and mounting hardware shall be installed in accordance with manufacturer's instructions and recommendations. To ensure the sign was installed properly the Contractor shall submit to the Engineer documentation which that states either a) the manufacturer, or the manufacturer's authorized supplier, verifies that the Contractor has been trained on the installation, operation, testing and maintenance of the equipment or b) provides documentation from the manufacturer that the installation has been inspected and approved by the manufacturer or authorized representative.

3.03 **Testing**

**Requirements Test Plan:**

The manufacturer shall provide a test plan, 30-days prior to each test, for review and approval by the Engineer, for each of the three types of acceptance testing required: Factory Acceptance Testing, Stand-alone Acceptance Testing, and System Acceptance Testing.

**3. CONSTRUCTION DETAILS:**

3.03 **Testing** (cont'd)

**Requirements Test Plan:** (cont'd)

The test plans shall clearly identify each function and element being tested, the setup conditions, the steps to be followed during the test, and the anticipated test results. The test plan shall exercise all required functions and capabilities under this item.

The following is a typical, but non-exhaustive list of the type of requirements that the test plan shall verify:

- Downloading, uploading, displaying, entering, editing, and deleting sign messages and fonts.
- Displaying of all characters, all messages, and all symbols on the sign.
- Switching between several different messages and flashing a part of a message.
- Recovery from simulated communications errors, simulated watchdog timer errors, and simulated sign controller errors.
- Demonstration of the operation of the thermostatically controlled fans, automatic LED temperature shutdown and dimming, and environmental warnings.
- Demonstration of automatic restart after a simulated short-term and simulated long-term power failure.
- Demonstration of the operation of the variation of the LED intensity based on various levels of ambient light.

**Test Equipment:**

The test plan shall identify all equipment required to perform the tests. This equipment shall be provided by the Contractor for the duration of the testing program. As a minimum, functional testing equipment shall include the latest version of the Device Tester for NTCIP, software by Intelligent Devices Inc, or approved equal.

**Test Performance:**

The test shall be coordinated with NYSTA at least three (3) weeks prior to the actual date. The Contractor shall conduct all tests, in the presence of the Engineer and/or up to two (2) other representatives. The Engineer may waive the right to witness certain tests. The utilized software shall be in recording/capturing mode while performing the test procedures.

**Test Reports:**

The Contractor shall maintain a complete record of each test performed including the results of the test and a record of who witnessed the test. At the completion of each test, the test documentation shall be completed and provided to the Engineer for review. This documentation shall be the basis for acceptance or rejection by the Engineer. All test reports shall be signed by the Contractor's authorized testing representative.

**3. CONSTRUCTION DETAILS:**

3.03 **Testing** (cont'd)

**Test Failure:**

The unit shall be corrected or another unit substituted in its place and the test successfully repeated. The substitute unit shall have passed all other tests successfully. If any DMS equipment or software/firmware modifications are necessary as a result of any test or demonstration failure, full retesting for compliance with these specifications may be required and a test report shall be prepared and delivered to the Engineer prior to retesting of the equipment. The report shall describe the nature of the failure and corrective action taken. If a failure pattern, as defined by the Engineer, develops, the Engineer may direct that design and construction modifications be made to all units without additional cost to the State, other involved agencies, or extension of the contract period.

**Test Specifics:**

1. **On-Site Stand-Alone and System Performance Test:**

The Contractor shall conduct approved stand-alone tests of the equipment installed in the field and at the TMC. The tests shall, as a minimum, exercise all stand-alone (non- network) functional operations of the field equipment, including NTCIP compliance, and TMC equipment and software with all the equipment installed per the plans as directed by the Engineer. Approved data forms shall be completed and turned over to the Engineer as the basis for review and rejection or acceptance.

Each unit of equipment shall be operated long enough to permit equipment temperature stabilization, and to check and record an adequate number of performance characteristics to ensure compliance with the requirements of this specification. The test shall, as a minimum, exercise all the input and output functions of the unit and demonstrate all operational features.

Following successful completion of the On-Site Stand-Alone tests the entire complement of subsystems and equipment shall be integrated into one system. Interface tests shall then be performed to verify the transfer of information between field equipment elements and the TMC.

System performance testing shall exercise all functional operations of each unit of field equipment from the TMC, and demonstrate compliance with all contract requirements. The tests shall include multiple combinations of functions including infrequent combinations, input validation, and stress testing. Compliance with all performance requirements shall be demonstrated. Where there are multiple units of the same item of equipment used, compliance with performance parameter requirements may be demonstrated on sample units with approval of the Engineer.

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**3. CONSTRUCTION DETAILS:**

3.03 **Testing** (cont'd)

**Test Specifics:** (cont'd)

2. **90-Day Operational Test:**

Following successful completion of the system performance tests, a 90-calendar day test shall be performed. The test shall start at the same time for all system elements unless a waiver is received from the Engineer.

The purpose of the Operational Tests is to demonstrate the reliability of system equipment for a 90 day period. In the event of a failure of any contractor supplied components, or of any existing system elements that may be affected, that portion of the system shall be subjected to an additional 30 day test period. Failure shall be defined as any interruption of operation that can be contributed to the DMS components. If a failure occurs, the test shall be stopped until the failure has been resolved. If the same failure occurs three (3) times, the failure shall be resolved and the 90-day test shall begin anew.

In the event that greater than 20% of similar equipment items malfunction during the test period, the Engineer may declare a system defect and require replacement of all items of that equipment. When a system defect is declared, the 90 day test period shall be restarted for the affected equipment after replacement.

During the Operational Test period the Contractor shall provide support for all installed equipment including problem troubleshooting and replacement of items not operating as specified. The Contractor shall maintain detailed daily records in the form of a maintenance and activity log. The log shall include the identity of equipment on which work is performed, the cost of equipment malfunction, if any, a description of the work performed, materials or special equipment used and the time required to complete the activity. The log shall contain the current test status of all equipment items. The maintenance and activity log shall be available to the Engineer upon request.

The final acceptance shall be based on the satisfactory completion of all 90-Day tests.

3.04 **Training Requirements**

**Contractor Training:**

Prior to the installation of any specified equipment, the Contractor's personnel shall have received training from the supplier on installation, operations, testing and maintenance of all equipment. No equipment will be accepted without detailed documentation from the equipment supplier certifying that the training has taken place.

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**3. CONSTRUCTION DETAILS:**

3.04 **Training Requirements** (cont'd)

NYSTA Training:

Unless otherwise specified on the contract plans, the contractor and/or DMS manufacture shall be responsible for providing a one (1) day training seminar in the operations and maintenance of the DMS for NYSTA management, engineering, operations, and maintenance personnel. The contractor shall contact the Engineer to verify the requirements and number of personnel scheduled for training. Training sessions shall be conducted at the TMC and in the field, consisting of both classroom and “hands-on” training using installed system equipment. Training shall not exceed 8 hours with a maximum of twelve students. The Contractor shall submit two copies of the course outline, training materials, and instructors’ qualifications to the Engineer for approval 30 calendar days prior to the anticipated start of training. Following approval of the material the Contractor shall submit enough copies of the course material for use by the NYSTA during the training program.

The costs for instructors, course materials, handouts, etc. shall be included in the costs of this item. No separate payment for training will be made to the Contractor.

**4. METHOD OF MEASUREMENT:**

4.01 The DMS will be measured for payment as each unit installed, tested, and made fully operational.

**5. BASIS OF PAYMENT:**

5.01 The unit price bid for each DMS shall include the cost of furnishing all labor, materials, tools, software, equipment and incidentals as necessary to complete the work. This includes hardware necessary for mounting the DMS to the support structure.

Progress payment will be made as follows:

Fifty percent (50%) of the bid price of each item will be paid when it is installed.

Forty percent (40%) of the bid price will be paid upon satisfactory completion of the On-Site Stand-Alone and System Performance Test.

Ten percent (10%) of the bid price will be paid upon satisfactory completion of the 90 Day Operational Test.