

# EXHIBIT D

## Technical and System Specifications

### REAL-TIME DISPLAY ASSEMBLY

#### 1. GENERAL

The work includes specifications for installing and integrating real-time displays.

A complete and fully functioning Real-Time Display system includes:

- a) LCD display unit assemblies installed on standalone structures and bus shelters
- b) Equipment (e.g., 4G modems) installed in cabinets and junction boxes mounted on standalone structures and bus shelters
- c) Cabling
- d) Splicing
- e) Licenses
- f) Operating manuals/system documentation
- g) Training
- h) Testing and Integration

The Real-Time Display System shall enable communications between the field display units and remote servers operated by NVTA, which will include streaming of data feeds from remote servers to each field display unit over new 4G wireless connections.

#### 2. MATERIALS

##### 2.1.A General

The Contractor shall furnish and install, where shown on the Plans, a fully functional and operational Real-Time Display System fully inter-operable with NVTA's existing real-time arrival system.

The Contractor is required to supply the necessary real-time display assemblies and units required for testing purposes to demonstrate that the system performs as specified.

The Contractor shall conduct testing in the presence of the ENGINEER, or Engineer designated representative, as described below under "System Operation" during the signal test period. The Contractor shall give the ENGINEER a minimum of two working days' notice prior to performing the tests.

##### 2.1.B LCD Display Assembly

The LCD display assembly shall consist of the following:

- Display Monitor and Controller
- Display Enclosure (environmentally rated)
- 4G Modem
- Equipment mounting assembly

For the real-time display that will be installed in a standalone configuration, the assembly includes the mounting structure consisting of poles, frames, base plates and equipment mounting for the real-time display unit.

Separate measurement and payment will not be made for work required under this Section. All costs in connection with the work specified herein will be considered to be included with the related item of work in the Bid Schedule of the Bid Form, or incidental to the Work.

In order to minimize time for field configuring and troubleshooting communications equipment after the Real-Time Display is installed, the Contractor should set up a testbed for each sign prior to the deployment of any real-time signs. All communications equipment and configurations should be set up and tested as if it were in the field (per the post installation test), including remote check-in. Contractor should run the testbed with test scripts and under different scenarios, including power failure, and communications failure, and recovery and troubleshooting procedures.

### **2.1.C References**

- A. Regional Transit Wayfinding Guidelines and Standards, Version 6.0 – August 1, 2019
- B. The applicable date of reference standards shall be understood to be the date of the Invitation to Bid.
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM B123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
  - 2. ASTM B153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
- D. National Fire Protection Association (NFPA):
  - 1. NFPA 70 National Electrical Code (NEC).
- E. Society For Protective Coatings (SSPC):
  - 1. SSPC SP6/NACE No. 3 Commercial Blast Cleaning

### **2.1.D Submittals**

- A. Shop Drawings: Contractor shall provide shop drawings that show fabrication and installation details including mounting devices.
  - 1. Show mounting heights, locations of supports, and accessories.
  - 2. Wiring Diagrams: Power, control, and data (communications) wiring.
- B. Manufacturer Information:
  - 1. Provide overview literature describing manufacturer's overall scope of products and manufacturing capabilities.
  - 2. Provide URL for manufacturer's web site; website must provide access to technical data, images and general product information.
  - 3. Provide manufacturer's toll-free telephone number for product support.
  - 4. Provide complete list of materials proposed for use, including manufacturer's catalog number and description for each product in typewritten form. Obtain Engineer's approval of materials before proceeding with fabrication.
- C. Calculations: Submit structural calculations including wind and vibration loadings prepared by a professional Engineer registered in California with a record of successful experience providing engineering services for installations similar in design and scope to the work of this Section. Include structural calculations for anchorage.
- D.

### **2.1.E Quality Assurance**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Fabricator Qualifications
  - 1. Minimum 5 years' experience in the fabrication of monitors of similar size and capabilities.
  - 2. Upon Engineer's request, provide reference list and photos of at least 10 public or commercial projects currently using similar monitors made by the fabricator.
- C. Powder-Coating Applicator Qualifications: A firm experienced in successfully applying powder coatings of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

### **2.1.F Delivery, Storage and Handling**

- A. Deliver, store, and handle materials in accordance with the manufacturer's instructions. Store in dry, secure location, protected against direct sunlight and excessive heat.

### **2.1.G Products**

- A. Real-Time Information Display assemblies shall be able to receive and display location-specific real-time information regarding transit arrivals from NVTA using 4G wireless connections. Contractor shall coordinate with NVTA on the procurement of the 4G modems including setting up the accounts, configuration and testing.
- B. Display Controller: The controller shall be a personal computer (PC) which shall include a standard web browser such as Internet Explorer. In lieu of a separate PC, the controller may be integrated with the monitor as a single unit subject to the approval of the Engineer.
- C. Enclosure: The display enclosure shall be selected for the specific locations in accordance with these technical specifications and as noted on the Plans. The screen and controller shall be contained in a single stainless steel housing and anti-glare reflective protection for the screen. Where screen is recessed in wall panel, controller may be in a separate housing providing the same rating as the screen.

The housing enclosure shall meet the following minimum specifications:

- 1. Integrated 120V power source for both screen and sign controller. If power source is not within 5 feet of the display and sign controller, an in-line cut-off (disconnect) switch shall be furnished and installed.
- 2. Stainless steel shall conform to material requirements specified in Section 05 70 00, Decorative Metal.
- 3. The screen and sign controller enclosures shall be IP65-rated for exterior installations and IP 54-rated for interior installations except as otherwise approved by the Engineer.
- 4. If necessary, outdoor rated enclosures shall have Air Conditioning (AC) units to maintain the proper operating temperature recommended by the manufacturer of the real-time display sign and controller, except as otherwise approved by the Engineer.

## **2.1.H Enclosure Mounting and Accessories**

- A. Brackets, Anchors, and Inserts: Fabricate from stainless steel to suit location and mounting conditions. Where exposed to view, stainless steel shall be Type 314 with brushed finish.

## **2.1.I Electrical**

- A. Contractor shall furnish and install conduit, wiring, and other electrical components as necessary to provide power and communications connections for complete and functioning real-time display system.

## **2.1.J Fabrication**

- A. General: Provide assemblies of configurations indicated.
  - 1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
  - 2. Mill joints to tight, hairline fit. Form joints exposed to exclude water penetration.
  - 3. Form joints to eliminate light leaks. Provide gasketing and seals as required to ensure weather-tight assembly.
  - 4. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
- B. Shop assemble units and apply finishes and graphics in accordance with the Contract Plans, manufacturer's standards and approved shop drawings.

## **2.1.K Steel Finishes**

- A. Galvanizing: Hot-dip galvanized products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A123.
  - 1. Hot-dip galvanized steel and iron hardware indicated to be galvanized to comply with ASTM A153.
  - 2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
- B. Powder-Coat Finish on Non-galvanized Ferrous Metal: Prepare, treat, and coat metal to comply with resin manufacturer's written instructions and as follows:
  - 1. Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils or resin manufacturer's recommended thickness, whichever is greater.
- C. Powder-Coat Finish on Galvanized Metal: Prepare, treat, and coat metal to comply with resin manufacturer's written instructions and as follows:
  - 1. Prepare galvanized metal by thoroughly removing grease, dirt, oil, flux, and other foreign matter.

