MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
INTELLIGENT TRANSPORTATION SYSTEMS CABINET AND CABINET EQUIPMENT

a. Description. This work consists of one or more of the following:

1. Furnishing and installing an ITS cabinet in a ground mounted or pole mounted configuration.

2. Adjust the location of existing equipment including but not limited to, electrical equipment, communication equipment, surge protection equipment, ITS equipment, and shelving components, so that additional equipment fit in the cabinet.

Furnish, assemble, fabricate, or install materials that are new, corrosion resistant, and in accordance with the details shown on the plans and in the special provision.

Furnish, install, and integrate grounding and bonding of the ITS cabinet as specified in 20SP-826A - Grounding, Bonding, Lightning Protection and Surge Protection for Electrical System Equipment as well as the details shown on the plans.

b. Materials.

1. General. Furnish all pole mounted, ground mounted, environmental, and small ITS cabinets to meet these general requirements unless specifically identified as not applicable in the sections below.

A. Construct all cabinets from 1/8 inch 5052 aluminum. Furnish a cabinet with a white polyester powder coat finish.

B. Furnish sunshields on all four sides and the top of each cabinet, except no shield is required on any side used to mount the cabinet, any side with an air conditioner, or any side with a panelboard. Ensure the sunshields are of the same material as the cabinet walls and have the same finish. An approved equal heat-resistant coating may be used in lieu of sunshields.

C. Furnish an engraved plaque on the front door, displaying the cabinet identification (ID) shown on the plans. Ensure characters are at least 4 inches high with a minimum stroke width of 0.4 inches unless smaller characters are required to fit the ID on one line. Furnish a plaque made of multilayered plastic with a black surface over a white interior; the engraving will reveal the white interior.

D. Shelving.

(1) Furnish a vented sliding rack mount shelf for a technician's laptop computer that occupies no more than one rack unit (RU) of rack space.

(2) Furnish a full-depth shelf for uninterruptible power supply (UPS) batteries near the base of the cabinet. Ensure the battery shelf can hold 150 pounds.

E. Furnish a rack-mounted cabinet monitoring system that uses simple network management protocol (SNMP) traps to alert the traffic management center/transportation operations center (TMC/TOC) of alarm conditions including high temperature and open doors. The device reports cabinet temperature, humidity, and door status to a central computer that issues SNMP queries or runs a web browser. Ensure the ability to remotely configure the monitor is password protected. The device has an Ethernet port, temperature and humidity sensors, and sensors for each cabinet door. It occupies no more than one RU of rack space.

F. Before procuring the cabinet, furnish shop drawings, layout drawings, catalog cuts, and schematics per the Special Provision for Basic Methods and Materials for Intelligent Transportation Systems Work. With the shop drawings, furnish dimensioned layout drawings or rack elevations showing the proposed location of all equipment for each cabinet that demonstrate that all the equipment will fit and that all controls, connections, and other service points are readily accessible for field technicians. Demonstrate that incoming conductors reach surge suppressors upon cabinet entry. Uniformly lay out and construct all cabinets with like equipment. Submit a single drawing for all like cabinets.

G. Internal Cabinet Lighting.

(1) Furnish two LED light strips providing a minimum combined output of 250 Lumens to provide illumination of the entire cabinet over a minimum -29 ºF to 140 ºF ambient temperature range. Locate the two LED light strips near the ceiling of the cabinet to provide illumination for the entire cabinet interior. Ensure LED light strips can be easily removed and replaced without interference from other devices mounted in the cabinet.

(2) Furnish door switches made of durable materials and mount in a manner that will withstand repeated use. Furnish a connection to the door switches that will turn the cabinet lights on when the door remains open. When the doors are closed, the door switch should turn the lights off.

H. Welding.

(1) Continuously weld all external welds.

(2) Use the TIG welding method for all external welds.

(3) Use the gas metal arc (MIG) or TIG welding method for all internal welds.

I. Lifting Eyes and Mounting Brackets.

(1) Furnish two removable lifting eyes, each rated to 1,000 pounds, on either side of the top of the cabinet.

(2) Each eye must have a minimum internal diameter of 3/4 inch.

J. Doors.

(1) Ensure front and rear access doors are of same metal grade and finish as the cabinet body.

(2) Hinges are to be approximately 1/8 inch stainless steel piano hinge or continuous door length stainless steel hinges to furnish a rigid and strong door construction.

(3) Ensure hinge pin stops are welded on top and bottom to prevent tampering.

(4) Mount hinges on internal side of door, so that hinges cannot be removed without first opening the door.

(5) Two-position door must stop to allow the door to remain open at 90 degree and 120 or 180 degree positions.

(6) The doorstop is to be mounted to the top or bottom of the door.

(7) Ensure a 3-point locking/latching mechanism secures each door.

(a) Furnish three latch points - center, top, and bottom of each door.

(b) Ensure that the latch points do not move until the cabinet door is unlocked.

(c) Use stainless steel locking bars for the top and bottom latch points to prevent manual prying.

(d) Furnish nylon rollers on the top and bottom locking bar ends.

(e) Furnish a locking mechanism as detailed in the Special Provision for ITS Cabinet Locking Mechanism.

(f) Door handle and locking mechanism may be separate.

(g) Furnish locking eyes on handle and door, for each door such that a padlock may be installed.

K. Air Intake/Ventilation and Insulation.

(1) Furnish a louvered air intake vent near the bottom of each door capable of deflecting water and directing incoming air downward towards the bottom of the cabinet.

(2) Furnish a reusable-washable filter to be placed inside the internal panel.

(3) Furnish R-4 insulation on interior sides, top, and both doors.

(4) Furnish dual, independently wired, 100 cfm fans that are controlled by

independent adjustable thermostats. Furnish continuous/heavy duty fans that use ball or roller bearings.

(5) Furnish thermostats for fan control that are accessible without the removal of equipment or racks.

L. Equipment Racks. Furnish one *Electronic Industries Alliance (EIA)-310* compliant 19 inch equipment rack with an adjustable 4-post design. Holes in the 19 inch rail should be drilled and tapped for 10-32 or 12-24 threads. Furnish all cage nuts and screws required for mounting equipment to the rack.

2. Electrical Specifications. Furnish all pole mounted, ground mounted, environmental, and small ITS cabinets to meet these electrical requirements unless specifically identified as not applicable in the sections below.

A. Power Distribution/Service Panel.

(1) Power service to the ITS cabinet from the main disconnect will be 120/240 VAC single phase, three wire plus ground (2 lines, neutral, and equipment ground). Ensure if the feeder cable size from the main disconnect is larger than accepted by the main breaker, then terminal blocks are provided inside the power distribution panelboard enclosure. Ensure terminal block amperage rating matches the over current protection rating in the main disconnect.

Ensure the power service feed is protected by a surge suppression system. See the 20SP-826A - Grounding, Bonding, Lightning Protection and Surge Protection for Electrical System Equipment for details.

(2) Install an external power distribution panelboard on the side of the cabinet. Never locate the panelboard on either door, or on the pole side of the pole-mounted version of this cabinet. Furnish conduit or plastic slotted wiring duct for the feeder cable as it traverses through the cabinet into the external power distribution panelboard. Contain the main feeder cable within this flexible conduit from the ITS cabinet entry point to the panelboard enclosure entry point in the sidewall of the ITS cabinet.

(a) Furnish *UL*-listed lighting and appliance panelboard per *NEMA PB 1*, circuit breaker type, with grounding bus bar, isolated neutral bar bus, panelboard, and bolt-on, copper bus structure compatible with the service voltage. Furnish circuit breaker provisions sufficient to accommodate cabinet loads, plus an additional two single-pole spaces, and one two-pole space. Ensure that panelboard is *UL*-labeled as service entrance rated by the panelboard manufacturer.

(b) Furnish a *NEMA 3R* surface-mounted panelboard enclosure. Furnish enclosure with hinge cover and hasp for a padlock. The padlock will be provided by the Engineer, for each enclosure.

(c) Mount panelboard to the side of the ITS cabinet with a minimum of three 3/8-inch stainless steel hex-head cap screws, flat and lock washers, and hex nuts. Do not locate the panelboard in a way that interferes with the free movement of any doors.

(d) Neatly apply a clean 1/4 inch bead of urethane or 100 percent silicone caulk along top and side edges (no caulk on bottom edge). Ensure no smears or spatter remain on panelboard or ITS cabinet. Select urethane caulk color to match ITS cabinet finish.

(e) Furnish two wire channels between panelboard and ITS cabinet using 1.5 inch (minimum) close nipples, each equipped with bonding bushings at each end. Use of chase nipples is prohibited.

(3) Circuit Breakers.

(a) Main Circuit Breaker. Molded-case, thermal-magnetic with series trip and short circuit rating compatible with available fault current; minimum rating: 22 Kilo-Amperes Interrupting Capacity (KAIC) at 120/240 VAC. Mount circuit breaker as a back-fed main breaker and furnished with *UL*-listed supplemental restraint provided by the panel manufacturer. Supply a 240 Volt (V), 60 Ampere (A) (2-pole) main breaker for sites with a dynamic message sign (DMS) or a 240V, 30A (2-pole), main breaker for sites without a DMS. Supply a 240V, 60A (2-pole) main breaker for sites with an environmentally controlled cabinet.

(b) Surge Protection Breaker. Furnish an additional 240V, 2-pole breaker for connection to the cabinet surge suppression system. Supply this breaker with the same amperage and capacity rating as the main circuit breaker.

(c) Branch Circuit Breakers. Molded-case, thermal-magnetic with series trip and short circuit rating compatible with available fault current; minimum rating: 22 KAIC at 120/240 VAC. Use a 240V, 40A (2-pole) bolt-on type branch circuit breaker for power distribution to the DMS (if present). Use a 120V, 20A bolt-on type branch circuit for the UPS which supplies cabinet electronics. Use a 120V, 15A bolt-on type branch circuit breaker for the convenience outlet, internal fans, and cabinet lighting. For environmentally enclosed ITS cabinets, as defined below, use an additional 120V, 30A bolt-on type branch circuit breaker for an air conditioner.

B. Electrical Outlets.

(1) Furnish one “fed-spec” labeled *NEMA 5-15R* (15A) duplex ground fault interrupter (GFI) receptacle on the 15A circuit. Label this receptacle “Convenience Outlet.” Install in the interior of the ITS cabinet to be readily accessible to maintenance personnel.

(2) Furnish one standard “fed-spec” labeled *NEMA 5-20R* (20A) single outlet on the 20A circuit for exclusive use of cabinet equipment. Label this “Cabinet Equipment” Outlet color: orange or red.

C. Auxiliary Power Connection.

(1) Furnish a generator interlock and breaker in the main distribution panel enclosure. The generator breaker will be 240V, 20A (2-pole), and not capable of being turned to the “on” position while the main breaker is in the “on” position by way of an

interlock system.

(2) Furnish a clear label with instructions on how to use the interlock.

(3) In cabinets with a 40A DMS circuit install a label that says “Turn 40A DMS breaker to the “off” position for panel operation with a generator”.

3. Ground-Mounted Cabinet.

A. Furnish ground-mounted cabinets with dimensions nominally 66 inches high by 24 inches wide by 30 inches deep.

B. Design the cabinet foundation per the details on the plans. If the plans do not contain details, design the cabinet foundation per Traffic Signal Detail SIG-045 Series.

4. Environmentally Controlled Cabinet.

A. Furnish a cabinet meeting the requirements of a ground-mounted cabinet with the following modifications:

(1) Omit intake and exhaust vents, except those connected to the air conditioner. Omit internal fans.

(2) Serve each air conditioner with dedicated branch circuit and equip each air conditioner with an anti-cycle relay to delay response to a thermostat signal for heating or cooling by 0.5 to 1.0 minutes, and to delay operation of the air conditioner after power interruptions. Factory-installed anti-cycle relay is preferred.

(3) Furnish a thermostat-controlled cabinet heater that will keep the temperature above 40 ºF. Furnish an adjustable thermostat that includes the range of 32 to 60 ºF. Thermostats must not have the ability to set a temperature above 70 ºF.

(4) Insulate the cabinet on all four sides, and top with a double layer of polyethylene air-bubble sheet, laminated on both sides with aluminum foil. Use aluminum tape on edges of the insulation for protection from damage and to improve adhesion to the surface. Use insulation that has a thermal resistance of greater than R-7, a vapor resistance permeability of 0.006 or better, and a *National Fire Protection Association (NFPA) Class A, Uniform Building Code (UBC) Class 1* fire resistance or better.

(5) Furnish sealed entry for cables through the side of the cabinet as the project requires. This may include, but is not limited to waveguide, outdoor Ethernet cables, or composite cables.

(6) Furnish a connection and proper receptacles to accommodate a portable AC generator for backup power during outages.

B. Mount an air conditioner on the cabinet, on the sidewall. Use the opposite sidewall as the electrical panelboard, or mount below the panelboard enclosure. Furnish an air conditioner that uses a closed loop cooling system that does not exchange air with the outside with the following features:

(1) Dimensions that do not exceed the dimensions of the sidewall. Ensure the unit does not add more than 14 inches to the cabinet width.

(2) Minimum cooling capacity of 6000 BTU/hour (BTU/h).

(3) Hot gas bypass valve to regulate cooling and prevent evaporator coil freezing during periods of low heat load and low ambient air temperature.

(4) Solid-state electronic noise suppressor to minimize electromagnetic interference/radio frequency interference (EMI/RFI).

(5) Thermostat that is adjustable in the range of 70 ºF to 140 ºF to activate cooling. Unit turn-off is adjustable and set to 7 ºF below the turn-on temperature. Mount the unit such that setting changes can be made from one of the door openings.

5. Pole-Mounted Cabinet.

A. Furnish pole-mounted cabinets with dimensions nominally 46 inches high by 24 inches wide by 20 inches deep.

B. Furnish mounting hardware appropriate for the pole or structure supporting the cabinet.

6. Small Cabinet. Furnish a cabinet meeting the requirements of a pole-mounted cabinet with the following modifications:

A. Furnish a cabinet with dimensions of nominally 36 inches high by 24 inches wide by 16 inches deep.

B. Omit the rear door and replace with a solid panel, designed to be mounted with the back against a wall or pole.

C. Replace the four-post equipment rack with a two-post rack, with the post oriented at the front of the cabinet.

7. Cabinet Modification. Furnish the necessary material including, but not limited to; screws, bolts, nuts, washers, and cable ties to relocate the existing equipment and their wiring in the ITS cabinet to make space for additional equipment to be installed.

c. Construction.

1. Install cabinet following the requirements of the 20SP-826A - Grounding, Bonding, Lightning Protection and Surge Protection for Electrical System Equipment.

2. Install pole mounted ITS cabinets on the opposite side of the pole as oncoming traffic flow. Install mounting hardware to not conflict or restrict any access plates or openings on the pole.

3. Configure the cabinet monitor to issue SNMP traps to a central computer when a cabinet door is open and when the temperature in the cabinet exceeds 120 ºF.

4. Testing. Configure all equipment per 20SP-826H - System Integration and Testing.

5. Warranties. Furnish warranty and other applicable documents from the manufacturer, and a copy of the invoice showing the date of shipment, to the Engineer prior to final written acceptance. Ensure all warranties are transferred to MDOT upon written final acceptance.

A. Furnish cabinet and electrical panelboard with a standard manufacturer's warranty. The cabinet and electrical panelboard must carry a warranty (parts, software, and labor) of 1.5 years from the date of shipment with at least 1 year of warranty remaining at the start of burn-in.

B. Furnish cabinet LED lighting with a standard manufacturer's warranty. The LED lighting must carry a warranty (parts, software, and labor) of 5 years from the date of shipment with at least 4 years of warranty remaining at the start of burn-in.

C. Furnish air conditioner and heater with a standard manufacturer's warranty. The air conditioner and heater must carry a warranty (parts, software, and labor) of 3 years from the date of shipment with at least 2 years of warranty remaining at the start of burn-in.

D. Furnish cabinet monitoring system with a standard manufacturer's warranty. The cabinet monitoring system must carry a warranty (parts, software, and labor) of 1 year from the date of shipment with at least 6 months of warranty remaining at the start of burn-in.

6. Cabinet Modification.

A. Adjust the location of the existing ITS equipment, inside the ITS cabinet, as necessary to facilitate the installation of additional ITS equipment as specified on the plans. The work includes removing and reinstalling mounting hardware as necessary to complete the relocation of the existing ITS equipment

B. Reroute existing cabling inside the ITS cabinet to complete the relocation of the existing ITS equipment. The work includes cutting the existing cable

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	**Pay Unit**
ITS Cabinet, (type)	Each
Cabinet Modification	Each

1. **ITS Cabinet, Ground Mtd** includes furnishing and installing an ITS cabinet in a ground mounted configuration which included but not limited to foundation, pads, all conduit material, four-post equipment rack, double door entry, air ventilation intakes, insolation, electrical service panel components, general electrical outlets, and other requirements stated in this specification

2. **ITS Cabinet, Environmental** includes furnishing and installing an ITS cabinet in a

ground mounted configuration which included but not limited to air condition equipment and enclosure, enhanced insolation, generator electrical equipment, foundation, pads, all conduit material, four-post equipment rack, double door entry, electrical service panel components, general electrical outlets, and other requirements stated in this specification

3. **ITS Cabinet, Pole Mtd** includes furnishing and installing an ITS cabinet in a pole mounted configuration which included but not limited to all mounting brackets, conduit sweeps, four-post equipment rack, double entry door, air ventilation intakes, insolation electrical service panel components, general electrical outlets, and other requirements stated in this specification.

4. **ITS Cabinet, Small** includes furnishing and installing an ITS cabinet in a pole mounted configuration which included but not limited to all mounting brackets, conduit sweeps, two-post equipment rack, single entry door, air ventilation intakes, insolation, electrical service panel components, general electrical outlets, and other requirements stated in this specification.

5. **Cabinet Modification** includes adjusting the location of existing equipment including but not limited to electrical equipment, communication equipment, surge protection equipment, ITS equipment, and shelving components, so that additional equipment fit in the cabinet.