



Florida Department of Transportation

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GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JARED W. PERDUE, P.E.
SECRETARY

August 28, 2025

Daniel Holt, PE, PTOE
Director, Project Delivery
Director, Technical Services
FHWA
400 West Washington Street, Suite 4200
Orlando, FL 32801

Re: State Specifications Office
Section: 990
Proposed Specification: **9900300 Temporary Traffic Control Device Materials**

Dear Mr. Holt:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

The changes are proposed by Ronald Meyer to update requirements to better meet stakeholder needs, reflect current technologies and practices, correct minor typos, and incorporate lessons learned during product evaluations at the FDOT Traffic Engineering Research Lab.

Please review and transmit your comments, if any, within two weeks (10 business days). Comments should be sent via email daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at (850) 414-4130.

Sincerely,

Signature on File

Daniel Strickland, P.E.
State Specifications Engineer

DS/jb

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

TEMPORARY TRAFFIC CONTROL DEVICE MATERIALS (REV 8-26-25)

ARTICLE 990-3 is deleted and the following substituted:

990-3 Portable Devices (Arrow Boards, Changeable Message Signs, Regulatory Signs, Radar Speed Display Units, and Truck Mounted Changeable Message Signs), Automated Flagger Assistance Devices).

990-3.1 General: All portable devices shall meet the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product must submit the following:

1. Certification showing that the product meets the requirements of this Section.
2. Drawings of the device along with technical information necessary for proper application, field assembly, and installation.

Portable devices shall meet the following requirements:

~~31. Ensure that all~~ All assembly hardware less than 5/8 inch in diameter, including nuts, bolts, external screws, and locking washers ~~shall be~~ are Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws, and studs shall meet ASTM F593. Nuts shall meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter shall be galvanized. Bolts, studs, and threaded rod shall meet ASTM A307. Structural bolts shall meet ASTM F3125, Grade A325.

~~42. All e~~ Electronic assemblies shall meet the environmental requirements of NEMA TS 4.

~~53.~~ The controller and associated on-board circuitry shall not be affected by mobile radio, or any other radio transmissions.

~~64.~~ An operator's manual shall be furnished with each unit.

~~75.~~ All portable devices shall be permanently marked with manufacturer's name or trademark, model/part number, and date of manufacture or serial number.

~~86.~~ Portable devices and trailers shall be delineated on a permanent basis by affixing retroreflective sheeting in a continuous line on the face of the trailer as seen by oncoming road users.

990-3.1.1 Electrical Systems: Meet the following:

1. Batteries shall be protected from overcharging and over-discharging.
2. An external battery charge level indicator shall be provided.
3. Automatic recharging of batteries shall be provided using a charge controller that includes charging status and battery charge level indicators.
4. An AC/DC battery charger unit shall be provided.
5. Batteries, charge controllers, and power panels shall be protected from the elements and vandalism.

990-3.1.1.1 Solar Power Systems: Solar power systems shall meet the following:

1. Provide automatic recharging of power supply batteries to normal operating levels with meters showing charge.
2. Solar array recovery time for arrow boards and regulatory signs shall be accomplished in a maximum of three hours.

3. Arrow boards and changeable message signs shall be designed to provide 180 days of continuous operation with minimum onsite maintenance.

990-3.1.1.2 Battery Life: Electrical system batteries shall be designed to provide 21 days of continuous operation without sunlight with a minimum of onsite maintenance for arrow boards and changeable message signs, or 10 days of continuous operation without sunlight with a minimum of onsite maintenance for regulatory signs and radar speed display units, or 2 days of continuous operation without sunlight with a minimum of onsite maintenance for Automated Flagger Assistance Devices signs.

990-3.1.2 Display Panel and Housing:

1. The display housing assembly shall be weather-tight.
2. Except for Automated Flagger Assistance Devices, the display assembly shall be equipped with an automatic dimming operational mode capable of a minimum of 50% dimming and a separate manual dimmer switch
3. The display panel background and frame for the display assembly shall be painted flat black and shall meet Federal Specification TT-E-489.
4. The display panel for arrow boards and changeable message signs, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the panel to the ground, ~~in accordance with the MUTCD~~. The display panel for radar speed display units, when raised in the upright position, will have a minimum height of 5 feet from the bottom of the panel to the ground.
5. The regulatory speed sign panel for regulatory signs and radar speed display units, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the regulatory sign panel to the ground.
6. The unit shall have an accessible mechanism to easily raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.
7. The display panel for changeable message signs shall have a safety system to protect against the panel falling from the trailer to the roadway should the panel separate from the lift system.

990-3.1.3 Controller: The Controller shall meet the following:

1. Controller and control panel shall be housed in a weather, dust, and vandal resistant lockable cabinet.
2. For changeable message signs and arrow boards ensure that the sign control software provides an on-site graphical representation that visibly depicts the message displayed on the sign face.
3. For changeable message signs, if remote communication is included, ensure that the sign controller is addressable through the Ethernet communications network using software that complies with the National Transportation Communications for ITS Protocol (NTCIP) 1101 base standard, including all amendments as published at the time of contract letting, the NTCIP Simple Transportation Management Framework, and conforms to Compliance Level 1. Ensure that the software implements all mandatory objects in the ~~document~~, ~~supplemental requirement SR-700-4.1.1-01, FDOT~~ Dynamic Message Sign NTCIP Requirements, as published on the FDOT State Traffic Engineering and Operations Office web site at the time of contract letting. Ensure that the sign complies with the NTCIP 1102v01.15, 2101 v01.19, 2103v02.07, 2201v01.15, 2202 v01.05, and 2301v02.19 standards. Ensure that the

sign complies with NTCIP 1103v02.17, section 3. Ensure that additional objects implemented by the software do not interfere with the standard operation of mandatory objects.

990-3.1.4 Support Chassis: The support chassis shall meet the following:

1. The support chassis shall be self-contained and self-supporting without the use of additional equipment or tools.

2. Both trailer and truck-mounted units are allowed for arrow boards and changeable message signs. Trailer mounted units are required for regulatory signs and radar speed display units. Automated Flagger Assistance Devices may be trailer or non-trailer units.

a. Trailer mounted unit:

1. The sign, power supply unit, and all support systems shall be mounted on a wheeled trailer.

2. The trailer shall be equipped with Class A lights, using a plug adapter.

3. The trailer shall be equipped with adjustable outrigger leveling pads, one on each of the four frame corners.

4. The trailer shall be designed to be set up at the site with its own chassis and outriggers, without being hitched to a vehicle.

5. The trailer shall be equipped with fenders over the tires.

6. The trailer shall meet all equipment specifications set forth in Chapter 316 of the Florida Statutes, and by such rule, regulation, or code that may be adopted by the Department of Highway Safety and Motor Vehicles.

990-3.2 Portable Arrow Board:

990-3.2.1 Arrow Board Matrix:

1. The minimum legibility distance for various traffic conditions are based on the decision-sight distance concept. The minimum legibility distance is the distance at which a driver can comprehend the arrow board message on a sunny day or a clear night. The arrow board size that is needed to meet the legibility distance is listed as follows:

Table 990-1			
Type	Minimum Size	Minimum Number of Elements	Minimum Legibility Distance
B	30 by 60 inches	13	3/4 mile
C	48 by 96 inches	15	1 mile

Type B arrow boards may be used on low to intermediate speed (0 mph to 50 mph) facilities or for maintenance or moving operations on any speed facility. Type C arrow boards shall be used for all other operations on high-speed (50 mph and greater) facilities and may be substituted for Type B arrow boards on any speed facility.

~~2. Devices shall meet all arrow board displays identified in the MUTCD.~~

~~3.2.~~ The element lens should be 5-3/4 inches in diameter. Smaller element lens diameters are permissible only if they provide an equivalent or greater brightness indication and meet the legibility criteria in 990-3.2.1(a).

~~4. The color of the light emitted shall be in accordance with the MUTCD.~~

~~5.3.~~ There shall be a 360 degree hood for close-up glare reduction.

~~64.~~ For solar powered arrow boards the bulbs shall provide a 350 candle power intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

~~7. The flashing rate of the element shall not be less than 25 flashes or more than 40 flashes per minute as required in the MUTCD.~~

~~8. The minimum element "on time" shall be 50% for the flashing arrow and 25% for the sequential chevron.~~

990-3.3 Portable Changeable Message Sign:

990-3.3.1 Message Matrix:

1. Message matrix panel shall be a maximum height of 7 feet by a maximum width of 146 inches.

2. The matrix must be capable of displaying three lines of 8 characters using an 18 inch or 12 inch font. PCMS with a minimum font size of 18 inches shall be used on any speed facility. PCMS with a minimum font size of 12 inches may be used on facilities with speed limits of 45 mph or less.

3. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS (Standard Highway Signs) companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

4. LED modules used to form the message matrix panel shall be interchangeable.

990-3.3.2 Operation and Performance:

1. The message shall be displayed in upper case except when lower case is project specific and is allowed by the MUTCD.

2. The message matrix panel shall be visible from one-half mile.

3. The 18 inch letter height message shall be legible from 650 feet for nighttime conditions and 800 feet for normal daylight conditions.

4. The 12 inch letter height message shall be legible from 650 feet for nighttime conditions and 650 feet for normal daylight conditions.

5. Under variable light level conditions the sign shall automatically adjust its light source to maintain legibility.

6. The message panel shall have adjustable display rates, so that the entire message can be read at least twice at the posted speed.

7. The control panel shall have the capability to store a minimum 50 pre-programmed messages.

8. The controller in the control panel shall be able to remember messages during non-powered conditions.

9. The controller shall allow the operator to generate additional messages on site via the keyboard.

10. All messages shall be flashed or sequenced. In the sequence mode, the controller shall have the capability to sequence three line messages during one cycle.

990-3.4 Portable Regulatory Signs:

990-3.4.1 Sign Panel Assembly: The sign panel assembly shall consist of a 24 inches by 30 inches "SPEED LIMIT XX" sign panel and a "WHEN FLASHING" sign panel, intended to notify oncoming traffic the speed limit where workers are present. The sign panel assembly shall meet the following minimum physical requirements:

1. The sign panel shall fold down and be pinned in place for towing. Maximum travel height shall be 80 inches.

2. Construct the sign panel and light housing to allow the unit to be operated in the displayed position at speeds of 30 mph. Design the sign panel assembly to withstand transport speeds of 65 mph.

3. Construct the sign panel such that, when in the raised position, the sign panel will have a height of 7 feet from the bottom of the lowest panel to the ground, ~~in accordance with the MUTCD.~~

4. Provide the unit with a mechanism to raise and lower the sign panel. Provide the unit with a device to lock the sign panel in the raised and lowered position.

990-3.4.2 Flashing Lights: Provide a pair of hooded PAR 46 LED advance warning flashing lamps on each side of the top of the sign panel. These lamps shall be visible day or night at a distance of one mile with a flash rate of approximately 55 flashes per minute.

The lamp lens should be at least 5-3/4 inches in diameter. Smaller diameter lens are permissible if they provide an equivalent or greater brightness indication and meet the legibility criteria above.

~~The color of the light emitted shall be in accordance with the MUTCD.~~ For solar powered units, the bulbs shall provide a 350 candlepower intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

990-3.5 Portable Radar Speed Display Unit:

990-3.5.1 Display Unit Panel and Housing: Meet the requirements of 990-3.1.2 and the following physical requirements as a minimum:

1. Provide capability to mount a 24 inch by 30 inch regulatory sign with interchangeable numbers showing the posted speed limit above the message display.

2. Provide legend "YOUR SPEED" either above or below the message display.

990-3.5.2 Message Display: The message display shall meet the following physical requirements as a minimum:

1. Provide a bright LED, two-digit speed display on a flat black background with bright yellow LEDs.

2. Each digit shall contain either a seven-segment layout or matrix-style design. Each digit shall measure a minimum 18 inches in height.

3. Speed display shall be visible from a distance of at least one-half mile and legible from a distance of at least 650 feet under both day and night conditions.

4. Display shall adjust for day and night operation automatically with a photocell.

990-3.5.3 Radar: The radar unit shall not be affected by normal radio transmissions and meet the following physical requirements as a minimum:

1. Approach-Only sensor.

2. Equipped with a low power K-Band transmitter.

3. Part 90 FCC acceptance, 3 amps, 10.8 V_{DC} to 16.6 V_{DC}. Fuse and reverse polarity protected.

4. Range of 1,000 feet for mid-size vehicle, capable of accurately sensing speeds of 10 mph to 99 mph with over speed function that operates when a vehicle approaches over the posted speed limit.

990-3.6 Truck Mounted Changeable Message Sign:

990-3.6.1 General: Truck mounted changeable message signs shall ~~meet the physical display and operational requirements of the MUTCD and~~ be listed on the APL.

1. Sign shall be secured on the vehicle for normal operation.
2. A fault light shall be located on rear of the sign and operate whenever the sign is displaying a message. The light shall flash at the same rate as the message being displayed.
3. An operator's manual shall be furnished with each sign.
4. The manufacturer name, model or part number, and date of manufacture or serial number shall be permanently affixed to the sign housing.

990-3.6.2 Display Panel and Housing:

1. The housing maximum size shall not exceed a width of 96 inches.
2. The housing shall be designed to withstand exposure to the elements and include a locking device to secure the housing from unauthorized entry.
3. Provisions (by convection or fan) shall be made for heat dissipation within the unit.
4. The message matrix panel background and frame for the dynamic message assembly shall be painted flat black, Federal Specification TT-E-489.
5. The face of the display shall be easily opened from the front. Faces that open up shall be locked to stay open far enough to allow for servicing of all message panel components.
6. The face of the sign shall be covered by an impact resistant polycarbonate face that aids against glare and includes an ultraviolet inhibitor to protect from fading and yellowing.
7. The display panel support structure, when raised in the upright position, shall be designed to allow for a minimum height of 7 feet from the bottom of the panel to the ground.
8. The unit shall have a manual and automatic control mechanism to raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.

990-3.6.3 Message Matrix:

1. The matrix shall utilize light emitting diodes (LED).
2. LEDs used shall be amber (590 nm dominant wavelength) and shall meet the visibility requirements of this specification. LEDs shall have a viewing angle no less than 30 degrees. LED intensity shall not fall below 80 percent within 3 years.
3. All display modules shall be identical and interchangeable.
4. The matrix shall be capable of displaying a minimum of two lines of eight characters each, using a 10 inch font ~~that meets the height to width ratio and character spacing requirements in the MUTCD.~~
5. The matrix shall provide variable letter, graphic and symbol sizes from 10 to 36 inches. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

990-3.6.4 Electrical System:

1. The power supply shall be a 12 V_{DC} system designed to operate the sign with a dedicated battery that is charged by the vehicle electrical system, but isolated so it does not drain the vehicle battery.

2. All internal sign components shall be treated with a protective, weather-resistant polyurethane or silicone conformal coating to protect against the adverse effects of humidity and moisture.

990-3.6.5 Sign Controller:

1. The sign controller shall be housed inside the sign and shall be equipped with a security lockout feature to prevent unauthorized use.

2. An external weather-resistant, hand-held control keypad shall be used to display the message on the sign.

3. The sign controller shall have the capability to provide a predetermined or blank default message upon loss of controller function.

990-3.6.6 Operation and Performance:

1. The message shall be displayed in upper case.

2. The message matrix panel shall be visible from one-half mile. With a 10 inch character displayed, the sign shall be legible from a distance of 400 feet in both day and night conditions. Under variable light level conditions, the sign shall automatically adjust its light source to meet the 400 foot visibility requirement.

3. The sign shall have the capability to store a minimum of 40 common messages and graphics of which a minimum of 30 shall be user-programmable messages.

4. All messages shall be capable of being flashed or sequenced. In the sequence mode, the message shall consist of no more than two phases, with each phase consisting of no more than three lines of text. Both message dwell time and message flash rate shall be individually programmable.

990-3.7 Automated Flagger Assistance Devices (AFAD):

990-3.7.1 General: AFAD's shall ~~meet the physical display and operational requirements in the MUTCD and~~ be listed on the APL. Manufacturers seeking evaluation of their product for the APL must include detailed vendor drawings showing typical application of the device in accordance with Standard Plans, Index 102-603. All electronic assemblies shall meet the requirements of NEMA TS 5, Section 4.

990-3.7.2 Stop/Slow Automated Flagger Assistance Devices: Provide a remotely operated Stop/Slow AFAD including a Stop/Slow sign that alternately displays the stop face and the slow face of a Stop/Slow paddle.

When a gate arm is used, ~~ensure that~~ the gate arm shall descend to a down position across the approach lane of traffic when the stop face is displayed and then ascends to an upright position when the slow face is displayed.

~~Ensure the gate arm is fully retroreflectorized on both sides, with vertical alternating red and white stripes at 16 inch intervals measured horizontally in accordance with the MUTCD. When the arm is in the down position blocking the approach lane:~~

~~1. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and,~~

~~2. The end of the arm shall reach at least to the center of the lane being controlled.~~

990-3.7.3 Red/Yellow Lens Automated Flagger Assistance Devices: Provide a remotely operated Red/Yellow Lens AFAD that alternately displays a steadily illuminated

circular red lens and a flashing circular yellow lens to control traffic. Vehicular Traffic Signal Assemblies incorporated into AFADs shall be listed on the APL or meet the requirements of 995-4.

~~Ensure that t~~The Red/Yellow Lens AFAD ~~shall~~ includes a gate arm that descends to a down position across the approach lane of traffic when the steady circular red lens is illuminated and then ascends to an upright position when the flashing circular yellow lens is illuminated.

~~Ensure that the gate arm is fully retroreflectorized on both sides, with vertical alternating red and white stripes at 16 inch intervals measured horizontally in accordance with the MUTCD. When the arm is in the down position blocking the approach lane:~~

- ~~1. The minimum vertical aspect of the arm and sheeting shall be 2 inches; and,~~
- ~~2. The end of the arm shall reach at least to the center of the lane being controlled.~~

~~Do not provide a change interval between the display of the steady circular red indication and the display of the flashing circular yellow indication.~~ Provide a steady illuminated circular yellow indication, with at least a 5 second duration, between the transition from flashing circular yellow indication and the display of the steady circular red indication. The Engineer may approve a different duration, provided it falls within the range recommended by the MUTCD.

ARTICLE 990-7 is deleted and the following substituted:

990-7 Temporary Traffic Control Signals.

990-7.1 General: Temporary traffic control signals shall meet the physical display and operational requirements of conventional traffic signals ~~described in the MUTCD for portable traffic signals~~ and be listed on the APL. Portable Traffic Signal Systems (PTSS) shall meet the requirements of NEMA TS 5 and the following:

1. Use signal heads having three 12 inch vehicular signal indications (Red, Yellow, and Green). Ensure there are two signal heads for each direction of traffic.

2. The traffic signal heads on this device ~~shall will~~ be approved by the Department.

3. Department approved ~~lighting sources will~~ signal modules shall be installed in each section in accordance with the manufacturer's permanent directional markings, that is, an "Up Arrow", the word "UP" or "TOP," for correct indexing and orientation within a signal housing.

4. The masts supporting the traffic signal heads ~~shall will~~ be manufactured with the lowest point of the vehicular signal head as follows:

a. Eight feet above finished grade at the point of their installation for "pedestal" type application or

b. Seventeen to 19 feet above pavement grade at the center of roadway for "overhead" type application.

5. The yellow clearance interval ~~shall will~~ be programmed for 3 seconds or more. Under no condition can the yellow clearance interval be manually controlled. It must be timed internally by the controller as per Department specifications.

6. The green interval ~~must~~ shall display a minimum of 5 seconds before being advanced to the yellow clearance interval.

7. The controller shall ~~will~~ allow for a variable all red clearance interval from 0 seconds to 999 seconds.

8. Portable traffic control signals shall ~~will~~ be either manually controlled or traffic actuated. Indicator lights for monitoring the signal operation of each approach will be supplied and visible from within the work zone area.

9. When the portable traffic control signals are radio actuated the following shall ~~will~~ apply:

a. The transmitter shall ~~will~~ be FCC Type accepted and not exceed 1 watt output per FCC, Part 90.17. The manufacturer must comply with all “Specific limitations” noted in FCC Part 90.17.

b. The Controller shall ~~will~~ force the traffic signal to display red toward the traffic approach in case of radio failure or interference.

10. The trailer and supports shall ~~will~~ be painted construction/maintenance orange enamel in accordance with the MUTCD color.

11. ~~Ensure~~ The APL certification number ~~is~~ shall be engraved or labeled permanently on equipment.

12. ~~Ensure~~ The device ~~has~~ shall have an external, visible, ~~water resistant~~ water-resistant label with the following information: “Certification of this device by the Florida Department of Transportation allows for its use in Construction Zones Only”.

TEMPORARY TRAFFIC CONTROL DEVICE MATERIALS (REV 8-26-25)

ARTICLE 990-3 is deleted and the following substituted:

990-3 Portable Devices (Arrow Boards, Changeable Message Signs, Regulatory Signs, Radar Speed Display Units, and Truck Mounted Changeable Message Signs, Automated Flagger Assistance Devices).

990-3.1 General: All portable devices shall meet the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) and be listed on the Department's Approved Product List (APL). Manufacturers seeking evaluation of their product must submit the following:

1. Certification showing that the product meets the requirements of this Section.
2. Drawings of the device along with technical information necessary for proper application, field assembly, and installation.

Portable devices shall meet the following requirements:

1. All assembly hardware less than 5/8 inch in diameter, including nuts, bolts, external screws, and locking washers shall be Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws, and studs shall meet ASTM F593. Nuts shall meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter shall be galvanized. Bolts, studs, and threaded rod shall meet ASTM A307. Structural bolts shall meet ASTM F3125, Grade A325.

2. Electronic assemblies shall meet the environmental requirements of NEMA TS 4.
3. The controller and associated on-board circuitry shall not be affected by mobile radio, or any other radio transmissions.

4. An operator's manual shall be furnished with each unit.
5. All portable devices shall be permanently marked with manufacturer's name or trademark, model/part number, and date of manufacture or serial number.
6. Portable devices and trailers shall be delineated on a permanent basis by affixing retroreflective sheeting in a continuous line on the face of the trailer as seen by oncoming road users.

990-3.1.1 Electrical Systems: Meet the following:

1. Batteries shall be protected from overcharging and over-discharging.
2. An external battery charge level indicator shall be provided.
3. Automatic recharging of batteries shall be provided using a charge controller that includes charging status and battery charge level indicators.
4. An AC/DC battery charger unit shall be provided.
5. Batteries, charge controllers, and power panels shall be protected from the elements and vandalism.

990-3.1.1.1 Solar Power Systems: Solar power systems shall meet the following:

1. Provide automatic recharging of power supply batteries to normal operating levels with meters showing charge.
2. Solar array recovery time for arrow boards and regulatory signs shall be accomplished in a maximum of three hours.

3. Arrow boards and changeable message signs shall be designed to provide 180 days of continuous operation with minimum onsite maintenance.

990-3.1.1.2 Battery Life: Electrical system batteries shall be designed to provide 21 days of continuous operation without sunlight with a minimum of onsite maintenance for arrow boards and changeable message signs, or 10 days of continuous operation without sunlight with a minimum of onsite maintenance for regulatory signs and radar speed display units, or 2 days of continuous operation without sunlight with a minimum of onsite maintenance for Automated Flagger Assistance Devices signs.

990-3.1.2 Display Panel and Housing:

1. The display housing assembly shall be weather-tight.
2. Except for Automated Flagger Assistance Devices, the display assembly shall be equipped with an automatic dimming operational mode capable of a minimum of 50% dimming and a separate manual dimmer switch
3. The display panel background and frame for the display assembly shall be painted flat black and shall meet Federal Specification TT-E-489.
4. The display panel for arrow boards and changeable message signs, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the panel to the ground. The display panel for radar speed display units, when raised in the upright position, will have a minimum height of 5 feet from the bottom of the panel to the ground.
5. The regulatory speed sign panel for regulatory signs and radar speed display units, when raised in the upright position, shall have a minimum height of 7 feet from the bottom of the regulatory sign panel to the ground.
6. The unit shall have an accessible mechanism to easily raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.
7. The display panel for changeable message signs shall have a safety system to protect against the panel falling from the trailer to the roadway should the panel separate from the lift system.

990-3.1.3 Controller: The Controller shall meet the following:

1. Controller and control panel shall be housed in a weather, dust, and vandal resistant lockable cabinet.
2. For changeable message signs and arrow boards ensure that the sign control software provides an on-site graphical representation that visibly depicts the message displayed on the sign face.
3. For changeable message signs, if remote communication is included, ensure that the sign controller is addressable through the Ethernet communications network using software that complies with the National Transportation Communications for ITS Protocol (NTCIP) 1101 base standard, including all amendments as published at the time of contract letting, the NTCIP Simple Transportation Management Framework, and conforms to Compliance Level 1. Ensure that the software implements all mandatory objects in the document, Dynamic Message Sign NTCIP Requirements, as published on the FDOT State Traffic Engineering and Operations Office web site at the time of contract letting. Ensure that the sign complies with the NTCIP 1102v01.15, 2101 v01.19, 2103v02.07, 2201v01.15, 2202 v01.05, and 2301v02.19 standards. Ensure that the sign complies with NTCIP 1103v02.17, section 3. Ensure that additional objects implemented by the software do not interfere with the standard operation of mandatory objects.

990-3.1.4 Support Chassis: The support chassis shall meet the following:

1. The support chassis shall be self-contained and self-supporting without the use of additional equipment or tools.

2. Both trailer and truck-mounted units are allowed for arrow boards and changeable message signs. Trailer mounted units are required for regulatory signs and radar speed display units. Automated Flagger Assistance Devices may be trailer or non-trailer units.

a. Trailer mounted unit:

1. The sign, power supply unit, and all support systems shall be mounted on a wheeled trailer.

2. The trailer shall be equipped with Class A lights, using a plug adapter.

3. The trailer shall be equipped with adjustable outrigger leveling pads, one on each of the four frame corners.

4. The trailer shall be designed to be set up at the site with its own chassis and outriggers, without being hitched to a vehicle.

5. The trailer shall be equipped with fenders over the tires.

6. The trailer shall meet all equipment specifications set forth in Chapter 316 of the Florida Statutes, and by such rule, regulation, or code that may be adopted by the Department of Highway Safety and Motor Vehicles.

990-3.2 Portable Arrow Board:

990-3.2.1 Arrow Board Matrix:

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2. The element lens should be 5-3/4 inches in diameter. Smaller element lens diameters are permissible only if they provide an equivalent or greater brightness indication and meet the legibility criteria in 990-3.2.1(a).

3. There shall be a 360 degree hood for close-up glare reduction.

4. For solar powered arrow boards the bulbs shall provide a 350 candle power intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

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990-3.3.1 Message Matrix:

1. Message matrix panel shall be a maximum height of 7 feet by a maximum width of 146 inches.

2. The matrix must be capable of displaying three lines of 8 characters using an 18 inch or 12 inch font. PCMS with a minimum font size of 18 inches shall be used on any speed facility. PCMS with a minimum font size of 12 inches may be used on facilities with speed limits of 45 mph or less.

3. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS (Standard Highway Signs) companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

4. LED modules used to form the message matrix panel shall be interchangeable.

990-3.3.2 Operation and Performance:

1. The message shall be displayed in upper case except when lower case is project specific and is allowed by the MUTCD.

2. The message matrix panel shall be visible from one-half mile.

3. The 18 inch letter height message shall be legible from 650 feet for nighttime conditions and 800 feet for normal daylight conditions.

4. The 12 inch letter height message shall be legible from 650 feet for nighttime conditions and 650 feet for normal daylight conditions.

5. Under variable light level conditions the sign shall automatically adjust its light source to maintain legibility.

6. The message panel shall have adjustable display rates, so that the entire message can be read at least twice at the posted speed.

7. The control panel shall have the capability to store a minimum 50 pre-programmed messages.

8. The controller in the control panel shall be able to remember messages during non-powered conditions.

9. The controller shall allow the operator to generate additional messages on site via the keyboard.

10. All messages shall be flashed or sequenced. In the sequence mode, the controller shall have the capability to sequence three line messages during one cycle.

990-3.4 Portable Regulatory Signs:

990-3.4.1 Sign Panel Assembly: The sign panel assembly shall consist of a 24 inches by 30 inches “SPEED LIMIT XX” sign panel and a “WHEN FLASHING” sign panel, intended to notify oncoming traffic the speed limit where workers are present. The sign panel assembly shall meet the following minimum physical requirements:

1. The sign panel shall fold down and be pinned in place for towing. Maximum travel height shall be 80 inches.

2. Construct the sign panel and light housing to allow the unit to be operated in the displayed position at speeds of 30 mph. Design the sign panel assembly to withstand transport speeds of 65 mph.

3. Construct the sign panel such that, when in the raised position, the sign panel will have a height of 7 feet from the bottom of the lowest panel to the ground.

4. Provide the unit with a mechanism to raise and lower the sign panel. Provide the unit with a device to lock the sign panel in the raised and lowered position.

990-3.4.2 Flashing Lights: Provide a pair of hooded PAR 46 LED advance warning flashing lamps on each side of the top of the sign panel. These lamps shall be visible day or night at a distance of one mile with a flash rate of approximately 55 flashes per minute.

The lamp lens should be at least 5-3/4 inches in diameter. Smaller diameter lens are permissible if they provide an equivalent or greater brightness indication and meet the legibility criteria above.

For solar powered units, the bulbs shall provide a 350 candlepower intensity for day use and an automatic reduction or dimming capacity for night use. The dimmed night operation shall provide adequate indication without excessive glare.

990-3.5 Portable Radar Speed Display Unit:

990-3.5.1 Display Unit Panel and Housing: Meet the requirements of 990-3.1.2 and the following physical requirements as a minimum:

1. Provide capability to mount a 24 inch by 30 inch regulatory sign with interchangeable numbers showing the posted speed limit above the message display.
2. Provide legend "YOUR SPEED" either above or below the message display.

990-3.5.2 Message Display: The message display shall meet the following physical requirements as a minimum:

1. Provide a bright LED, two-digit speed display on a flat black background with bright yellow LEDs.
2. Each digit shall contain either a seven-segment layout or matrix-style design. Each digit shall measure a minimum 18 inches in height.
3. Speed display shall be visible from a distance of at least one-half mile and legible from a distance of at least 650 feet under both day and night conditions.
4. Display shall adjust for day and night operation automatically with a photocell.

990-3.5.3 Radar: The radar unit shall not be affected by normal radio transmissions and meet the following physical requirements as a minimum:

1. Approach-Only sensor.
2. Equipped with a low power K-Band transmitter.
3. Part 90 FCC acceptance, 3 amps, 10.8 V_{DC} to 16.6 V_{DC}. Fuse and reverse polarity protected.
4. Range of 1,000 feet for mid-size vehicle, capable of accurately sensing speeds of 10 mph to 99 mph with over speed function that operates when a vehicle approaches over the posted speed limit.

990-3.6 Truck Mounted Changeable Message Sign:

990-3.6.1 General: Truck mounted changeable message signs shall be listed on the APL.

1. Sign shall be secured on the vehicle for normal operation.
2. A fault light shall be located on rear of the sign and operate whenever the sign is displaying a message. The light shall flash at the same rate as the message being displayed.
3. An operator's manual shall be furnished with each sign.
4. The manufacturer name, model or part number, and date of manufacture or serial number shall be permanently affixed to the sign housing.

990-3.6.2 Display Panel and Housing:

1. The housing maximum size shall not exceed a width of 96 inches.
2. The housing shall be designed to withstand exposure to the elements and include a locking device to secure the housing from unauthorized entry.
3. Provisions (by convection or fan) shall be made for heat dissipation within the unit.
4. The message matrix panel background and frame for the dynamic message assembly shall be painted flat black, Federal Specification TT-E-489.
5. The face of the display shall be easily opened from the front. Faces that open up shall be locked to stay open far enough to allow for servicing of all message panel components.
6. The face of the sign shall be covered by an impact resistant polycarbonate face that aids against glare and includes an ultraviolet inhibitor to protect from fading and yellowing.
7. The display panel support structure, when raised in the upright position, shall be designed to allow for a minimum height of 7 feet from the bottom of the panel to the ground.
8. The unit shall have a manual and automatic control mechanism to raise and lower the display assembly. A locking device shall also be provided to ensure the display panel will remain in the raised or lowered position.

990-3.6.3 Message Matrix:

1. The matrix shall utilize light emitting diodes (LED).
2. LEDs used shall be amber (590 nm dominant wavelength) and shall meet the visibility requirements of this specification. LEDs shall have a viewing angle no less than 30 degrees. LED intensity shall not fall below 80 percent within 3 years.
3. All display modules shall be identical and interchangeable.
4. The matrix shall be capable of displaying a minimum of two lines of eight characters each, using a 10 inch font.
5. The matrix shall provide variable letter, graphic and symbol sizes from 10 to 36 inches. The matrix must display characters that meet or exceed the numeral and letter sizes prescribed in the MUTCD and SHS companion document. Fonts and graphics must mimic the characteristics of fonts and graphics defined in NEMA TS4, the MUTCD, and SHS.

990-3.6.4 Electrical System:

1. The power supply shall be a 12 V_{DC} system designed to operate the sign with a dedicated battery that is charged by the vehicle electrical system, but isolated so it does not drain the vehicle battery.
2. All internal sign components shall be treated with a protective, weather-resistant polyurethane or silicone conformal coating to protect against the adverse effects of humidity and moisture.

990-3.6.5 Sign Controller:

1. The sign controller shall be housed inside the sign and shall be equipped with a security lockout feature to prevent unauthorized use.
2. An external weather-resistant, hand-held control keypad shall be used to display the message on the sign.
3. The sign controller shall have the capability to provide a predetermined or blank default message upon loss of controller function.

990-3.6.6 Operation and Performance:

1. The message shall be displayed in upper case.
2. The message matrix panel shall be visible from one-half mile. With a 10 inch character displayed, the sign shall be legible from a distance of 400 feet in both day and night conditions. Under variable light level conditions, the sign shall automatically adjust its light source to meet the 400 foot visibility requirement.
3. The sign shall have the capability to store a minimum of 40 common messages and graphics of which a minimum of 30 shall be user-programmable messages.
4. All messages shall be capable of being flashed or sequenced. In the sequence mode, the message shall consist of no more than two phases, with each phase consisting of no more than three lines of text. Both message dwell time and message flash rate shall be individually programmable.

990-3.7 Automated Flagger Assistance Devices (AFAD):

990-3.7.1 General: AFAD's shall be listed on the APL. Manufacturers seeking evaluation of their product for the APL must include detailed vendor drawings showing typical application of the device in accordance with Standard Plans, Index 102-603. All electronic assemblies shall meet the requirements of NEMA TS 5, Section 4.

990-3.7.2 Stop/Slow Automated Flagger Assistance Devices: Provide a remotely operated Stop/Slow AFAD including a Stop/Slow sign that alternately displays the stop face and the slow face of a Stop/Slow paddle.

When a gate arm is used, the gate arm shall descend to a down position across the approach lane of traffic when the stop face is displayed and then ascend to an upright position when the slow face is displayed.

990-3.7.3 Red/Yellow Lens Automated Flagger Assistance Devices: Provide a remotely operated Red/Yellow Lens AFAD that alternately displays a steadily illuminated circular red lens and a flashing circular yellow lens to control traffic. Vehicular Traffic Signal Assemblies incorporated into AFADs shall be listed on the APL or meet the requirements of 995-4.

The Red/Yellow Lens AFAD shall include a gate arm that descends to a down position across the approach lane of traffic when the steady circular red lens is illuminated and then ascends to an upright position when the flashing circular yellow lens is illuminated. Provide a steady illuminated circular yellow indication, with at least a 5 second duration, between the transition from flashing circular yellow indication and the display of the steady circular red indication. The Engineer may approve a different duration, provided it falls within the range recommended by the MUTCD.

ARTICLE 990-7 is deleted and the following substituted:

990-7 Temporary Traffic Control Signals.

990-7.1 General: Temporary traffic control signals shall meet the physical display and operational requirements of conventional traffic signals and be listed on the APL. Portable Traffic Signal Systems (PTSS) shall meet the requirements of NEMA TS 5 and the following:

1. Use signal heads having three 12 inch vehicular signal indications (Red, Yellow, and Green). Ensure there are two signal heads for each direction of traffic.
2. The traffic signal heads on this device shall be approved by the Department.

3. Department approved signal modules shall be installed in each section in accordance with the manufacturer's permanent directional markings, that is, an "Up Arrow", the word "UP" or "TOP," for correct indexing and orientation within a signal housing.

4. The masts supporting the traffic signal heads shall be manufactured with the lowest point of the vehicular signal head as follows:

a. Eight feet above finished grade at the point of their installation for "pedestal" type application or

b. Seventeen to 19 feet above pavement grade at the center of roadway for "overhead" type application.

5. The yellow clearance interval shall be programmed for 3 seconds or more. Under no condition can the yellow clearance interval be manually controlled. It must be timed internally by the controller as per Department specifications.

6. The green interval shall display a minimum of 5 seconds before being advanced to the yellow clearance interval.

7. The controller shall allow for a variable all red clearance interval from 0 seconds to 999 seconds.

8. Portable traffic control signals shall be either manually controlled or traffic actuated. Indicator lights for monitoring the signal operation of each approach will be supplied and visible from within the work zone area.

9. When the portable traffic control signals are radio actuated the following shall apply:

a. The transmitter shall be FCC Type accepted and not exceed 1 watt output per FCC, Part 90.17. The manufacturer must comply with all "Specific limitations" noted in FCC Part 90.17.

b. The Controller shall force the traffic signal to display red toward the traffic approach in case of radio failure or interference.

10. The trailer and supports shall be painted construction/maintenance orange enamel in accordance with the MUTCD color.

11. The APL certification number shall be engraved or labeled permanently on equipment.

12. The device shall have an external, visible, water-resistant label with the following information: "Certification of this device by the Florida Department of Transportation allows for its use in Construction Zones Only".