ORIGINATION FORM
Proposed Revisions to the Specifications
(Please provide all information - incomplete forms will be returned)

Date: 11/8/2018

Office: *Standard Plans*

Originator: Ed Cashman

Specification Section: 700

Telephone: 850 414 4314

Article/Subarticle: 700-3, 700-5, 700-6

email: edward.cashman@dot.state.fl.us

Will the proposed revision require changes to:

Publication	Yes	No	Office Staff Contacted
Standard Plans Index	○	◉	
Traffic Engineering Manual	○	◉	Javier Ponce
FDOT Design Manual	◉	○	Mary Jane Hayden
Construction Project Administration Manual	○	◉	Daniel Strickland
Basis of Estimate/Pay Items	◉	○	Melissa Hollis
Structures Design Guidelines	○	◉	
Approved Product List	○	◉	Paul Gentry
Materials Manual	○	◉	

Will this revision necessitate any of the following:

Design Bulletin ☐ **Construction Bulletin** ☐ **Estimates Bulletin** ☐ **Materials Bulletin** ☐

Are all references to external publications current? **Yes** ◉ **No** ○

If not, what references need to be updated? (Please include changes in the redline document.)

Why does the existing language need to be changed?

Some of the changes are proposed in order to better support the assemblies shown in the Standard Plans. At the same time, there is existing language which is no longer applicable and is proposed for deletion.

Summary of the changes:

Revised installation requirements for some sign types and rearranged some of the sub-articles.

Are these changes applicable to all Department jobs? **Yes** ◉ **No** ○
If not, what are the restrictions?

Contact the State Specifications Office for assistance in completing this form.
Dan Hurtado 850-414-4130 dan.hurtado@dot.state.fl.us Debbie Toole 850-414-4114 deborah.toole@dot.state.fl.us
Myndi Craig 850-414-4101 myndi.craig@dot.state.fl.us Rebecca Frimmel 850-414-4155 rebecca.frimmel@dot.state.fl.us

Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

MIKE DEW
SECRETARY

M E M O R A N D U M

DATE: November 29, 2018

TO: Specification Review Distribution List

FROM: Dan Hurtado, P.E., State Specifications Engineer

SUBJECT: Proposed Specification: **7000302 Highway Signing.**

In accordance with Specification Development Procedures, we are sending you a copy of a proposed specification change.

This change was proposed by Ed Cashman to better support the assemblies shown in the Standard Plans.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or online at http://www2.dot.state.fl.us/ProgramManagement/Development/IndustryReview.aspx . Comments received after **December 27, 2018,** may not be considered. Your input is encouraged.

DH/rf
Attachment

HIGHWAY SIGNING
(REV 11-9-18)

SUBARTICLE 700-3.2.2.1 is expanded by the following:

700-3.2.2.1 General: Ensure highlighted signs meet the design and functional requirements specified in this Section and Section 2A of the MUTCD. Use LEDs to highlight the sign's shape, color, or message.

Stop, Do Not Enter, Yield, and Wrong Way signs that are highlighted with LEDs must use red LEDs. All other signs must use LEDs which resemble the color of the sign background color.

For roadside sign assemblies, provide support structure in accordance with 646-2.

SUBARTICLE 700-3.2 is expanded by the following:

700-3.2.8 Warranty:

700-3.2.8.1 Internally Illuminated Signs: Ensure that internally illuminated signs have a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

700-3.2.8.2 Highlighted Signs: Ensure that highlighted signs have a manufacturer's warranty covering defects for three years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.

SUBARTICLES 700-3.3.5 through 700-3.5 are deleted and the following substituted:

~~**700-3.3.5 Warranty:**~~

~~**700-3.3.5.1 Internally Illuminated Signs:** Ensure that internally illuminated signs have a manufacturer's warranty covering defects for five years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.~~

~~**700-3.3.5.2 Highlighted Signs:** Ensure that highlighted signs have a manufacturer's warranty covering defects for three years from the date of final acceptance by the Engineer in accordance with 5-11 and Section 608.~~

700-3.4 Installation of Highlighted Signs: For roadside sign assemblies, construct foundation and install support structure in accordance with 646-3 and the Standard Plans, Index 700-120. Install highlighted sign equipment in accordance with the manufacturer's instructions.

700-3.54 Method of Measurement: The Contract unit price per each for internally illuminated signs, furnished and installed, will include furnishing the sign panels, housing, hardware, electrical connection, and labor necessary for a complete and accepted installation. When the internally illuminated sign is ground mounted, the Contract price will include the support structure and foundation. All other mounting will include the hardware necessary to complete the attachment to the support structure; the span wire, monotube, or mast arm structure will be paid separately.

The Contract unit price per each for highlighted signs, furnished and installed, will include furnishing the sign panels, cabinet, support structure, foundation, hardware, solar panel, and labor necessary for a complete and accepted installation.

700-3.~~5~~6 Basis of Payment: Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 700- 5- Internally Illuminated Signs, per each.
Item No. 700- 6- Highlighted Signs, per assembly.

ATICLE 700-5 is deleted and the following substituted:

700-5 Electronic Display Sign.

700-5.1 Description: All electronic display signs (EDS) must meet the physical display and operational requirements for warning, guide or regulatory signs described in the MUTCD and the SHS.

EDS are specialized electronic signs that include dynamic display components. The term EDS refers to a general category of electronically enhanced signs that includes electronic warning signs (EWS), electronic guide signs (EGS), electronic regulatory signs (ERS), electronic speed feedback signs (ESFS), and blank-out signs (BOS).

700-5.2 Material: EWS, EGS, ERS, and ESFS must allow attachment to vertical and horizontal support structures as part of a single or double sign post configuration. Bolts must be used for load bearing attachments.

For roadside sign assemblies, provide support structure in accordance with 646-2.

700-5.2.1 Requirements Common to all EDS: All EDS must be designed to withstand the loads defined in the Department's Structures Manual without deformation or damage. EDS, other than BOS, must provide an option to include flashing beacons. Printed circuit boards shall be protected with conformal coating. Housings that contain electronics shall be constructed of aluminum alloy sheet a minimum of .090 inches thick. Welding used during the construction of EDS must be accordance with Section 965.

700-5.2.1.1 General: ~~EDS, other than BOS, shall include a static sign panel with an integrated dynamic display.~~ Signs included on the APL will be designated with a size and type category and may be listed with restrictions, such as "requires District Traffic Operations Engineer approval", "school zones only", or "low speed only".

700-5.2.1.2 Electronic Display Sign with Static Sign Panel: EDS that include both a static sign panel and dynamic display may be a modular system comprised of a static sign panel with an attached electronic display. Static sign panels shall meet the Department's requirements for highway signing found in this Section.

700-5.2.2 Electronic Display: Electronic displays shall appear completely blank (dark) when not energized. No phantom characters or graphics will be allowed under any ambient light conditions.

700-5.2.2.1 Housing: The housing must protect and seal the dynamic display and other internal electronics. Any polycarbonate material used on the sign face must be a minimum 90% UV opaque and resistant to fading and yellowing. The housing shall be NEMA 3R rated and prevent unauthorized access. The housing shall include weather tight cable entry or connection points for any required power or data connections.

700-5.2.2.2 Cabinet: Any equipment cabinets provided with the EDS must be listed on the APL.

700-5.2.2.3 Optical, Electrical, and Mechanical Specifications for Display Modules: Ensure that all LEDs operate within the LED manufacturer's recommendations for typical forward voltage, peak pulsed forward current, and other ratings. Component ratings shall not be exceeded under any operating conditions.

700-5.2.2.4 LED and Pixel Specifications: Ensure that all LEDs used in the display have a wavelength output that varies no more than plus or minus two nanometers from the specified peak wavelength. Ensure that the display and LED pixel cone of vision is a minimum of 15 degrees (centered around the optical axis, or zero point, of the pixel). The cone perimeter is defined by the point where light output intensity is 50% of the intensity measured at the zero point of the pixel. For all colors other than white, ensure that the sign display produces an overall luminous intensity of at least 9200 candelas per square meter when operating at 100% intensity. For white or full color matrix displays ensure that the sign display produces white with an overall luminous intensity of at least 12,400 candelas per square meter when operating at 100% intensity. Submit documentation that indicates the LED brightness and color bins that are used in each pixel. Ensure that LEDs are individually mounted on a PCB, and are able to be removed and replaced using conventional electronic repair methods. Encapsulated LEDs within a pixel are not allowed. ERS LEDs must be arranged and powered in a manner that maintains a discernible message in the event of a single LED or pixel failure.

700-5.2.2.5 Character Size, Fonts, and Graphics: The minimum numeral and letter size of the electronic display must meet or exceed the numeral and letter sizes prescribed in the MUTCD and the SHS. Fonts and graphics must mimic the characteristics of fonts and graphics defined in the MUTCD and SHS.

700-5.2.3 Electronic Display Controller: Any electronic display controller required for the operation of the EDS shall be housed within the sign and be equipped with a security lockout feature to prevent unauthorized use. The controller shall have the capability to provide a stipulated default message upon loss of controller function. A blank message is acceptable.

700-5.2.3.1 Communication: The electronic display controller shall possess a minimum of one serial interface with the ability to connect to a laptop computer. The serial data interface shall support multiple data rates from 9600 bps to 115200 bps.

700-5.2.3.2 Configuration and Management: Ensure that the sign is provided with computer software from its manufacturer that allows a user to program, operate, exercise, diagnose, and read current status of all sign features and functions using a laptop.

700-5.2.4 Operation and Performance: Ensure that the EDS is visible from a distance of at least 1/4 mile and legible from a distance of 400 feet for applications on roads with a speed limit less than 45 mph and visible from a distance of at least 1/2 mile and legible from a distance of at least 650 feet for roads with speed limits 45 mph or higher. In both cases, the requirements must be met under both day and night conditions.

The electronic display shall automatically adjust brightness for day and night operation. The EDS must be equipped with a light sensor that accurately measures ambient light level conditions at the sign location. The EDS must automatically adjust LED intensity based on the ambient light conditions in small enough increments that the sign's brightness changes smoothly, with no perceivable brightness change between adjacent levels. Stray headlights shining on the photoelectric sensor at night must not cause LED brightness changes.

Flashing messages must not exceed 150 flashes per minute.

700-5.2.5 Mechanical Specifications: EDS mounting provisions and mounting hardware must accommodate sign weight and wind loading requirements of the Department's Structures Manual. BOS must be designed to accommodate overhead attachment using a tri-stud signal hanger. Multiple tri-stud attachment points may be used to meet weight and wind loading requirements. Tri-stud attachment points must be weather-tight and structurally reinforced.

700-5.2.5.1 Fasteners and Attachment Hardware: Ensure that all assembly hardware, including nuts, bolts, external screws and locking washers less than 5/8 inch in diameter, are Type 304 or 316 passivated stainless steel. Stainless steel bolts, screws and studs must meet ASTM F593. Nuts must meet ASTM F594. All assembly hardware greater than or equal to 5/8 inch in diameter must be galvanized. Bolts, studs, and threaded rod must meet ASTM A307. Structural bolts must meet ASTM F3125, Grade A325.

700-5.2.6 Electrical Specifications: All power inputs must be fuse and reverse polarity protected. All EDS must be able to recover from power loss and return to their operational state without user intervention.

700-5.2.6.1 Solar Power: Solar powered signs must be capable of fully autonomous operation 24 hours per day, 365 days per year. Batteries must be a standard 12 volt deep cycle battery suitable for the application and operating environment. Flooded lead-acid batteries are prohibited.

Batteries must be capable of providing 10 days of continuous operation without sunlight. Charging system must use a solar charge controller with temperature compensation. The system must provide for automatic battery charging, overcharge protection, and have indications that display current status and faults.

700-5.2.6.2 AC Power: Fluctuations in line voltage must have no visible effect on the appearance of the display.

700-5.2.7 Electronic Warning Signs (EWS): The EWS must be designed to alert road users to conditions that might call for a reduction of speed or an action, in the interest of safety and efficient traffic operations. EWS must include a secure wireless connection to communicate with a nearby laptop.

700-5.2.7.1 EWS Foreground/Background Colors: If a black background is used on the changeable electronic display, the color used for the legend must match the background color that would be used on a standard sign for that type of legend, in accordance with the MUTCD. Black EWS display backgrounds must be flat black (FED-STD-595-37038) with a reflectance value not exceeding 25%. EWS must utilize yellow LEDs with a peak wavelength of either 585 or 590 nanometers. EWS must have a minimum one inch contrasting margin around illuminated characters or graphics.

700-5.2.7.2 Speed Detector: EWS that detect or display the speed of approaching vehicles must be programmable for the posted speed limit and the maximum speed to display. When the detected speed exceeds the maximum programmed speed (high speed cut-off) threshold, the display must automatically blank. Alternately, the display may show an alert message such as "SLOW DOWN" when speeds above the maximum programmed speed threshold are detected.

The EWS must detect when the posted speed is exceeded by one mph and then activate the alert. When the alert is activated, the display shall be able to flash. When no advancing traffic is detected, the display must be blank. The speed detector must not activate alerts for vehicles outside the display cone of vision.

The speed detector must meet the requirements of FCC Title 47, Part 90 and not require an FCC operating license. The speed detector must operate on 10.8 to 16.6 V_{DC} and draw less than three amperes. The EWS must monitor and display the speed of approaching traffic only. The EWS detector must be able to accurately detect and determine the speed of approaching vehicles. The EWS must be capable of measuring and displaying speeds of approaching traffic only between 10 and 99 mph with an accuracy of plus or minus one mph, 1,000 feet in advance of the sign.

700-5.2.8 Electronic Guide Signs (EGS): Meet the requirements of electronic warning sign (EWS) with the following exceptions: Use a white legend and green background in accordance with the MUTCD. EGSs must utilize white LEDs.

700-5.2.9 Electronic Regulatory Signs (ERS): The ERS must be designed to give notice of traffic laws or regulations, such as the posted speed limit. ERS used for variable speed limit (VSL) applications must be able to display speed limits from 5-70 mph in five mph increments and mimic the physical appearance of a static regulatory speed limit sign as shown in the MUTCD and SHS. ERS for VSL applications shall use black characters on a white background. ERS for VSL applications must log the time and date of any speed limit change to internal non-volatile memory. The log must be able to record a minimum of 1,000 events in a first-in, first-out fashion.

700-5.2.9.1 Foreground/Background Colors and Display Types: Display modules for all ERS must have a minimum two inch contrasting margin around digits, text, or graphics. ~~Type 1~~ ERS must utilize LED technology for the dynamic display. ~~Type 2 ERS must utilize scrolling film technology for the dynamic display.~~

~~**700-5.2.9.2 LED and Pixel Specifications for Type 1 ERS:** Type 1 ERS must meet the LED and pixel specifications defined in 700-5.2.2.4.~~

~~**700-5.2.9.3 Scrolling Film Mechanism for Type 2 ERS:** The dynamic display for Type 2 ERS must utilize a scrolling film module comprised of a transparent film with black characters meeting the size and shape requirements shown in the MUTCD and SHS. The transparent film and characters must move in front of a background panel covered with reflective sheeting identical to that used on the static sign panel. The transparent film must be constructed of material that will not yellow, fade, deform, or otherwise deteriorate over the lifetime of the sign.~~

~~**700-5.2.9.4 ERS Character Size and Font:** Fonts and graphics for Type 1 ERS must mimic the characteristics of fonts and graphics defined in the MUTCD and SHS. Fonts and graphics for Type 2 ERS must exactly match the characteristics of fonts and graphics defined in the MUTCD and SHS.~~

700-5.2.9.~~5~~2 Variable Speed Limit (VSL) ERS Controller Communications: ERS for variable speed applications must be equipped with a sign controller that includes a minimum of one Ethernet 10/100 Base TX 8P8C port.

700-5.2.9.~~6~~3 Configuration and Management Requirements for VSL ERS: Ensure that ERS for VSL applications can be managed remotely from a TMC or managed locally using a laptop computer. Ensure that the TMC or a laptop computer can be used to remotely reset VSL sign controllers. Ensure that ERS for VSL applications log and report status, errors, and failures, including data transmission errors, receipt of invalid data, communication failure recoveries, alternating current power failures, power recoveries, display errors, fan and airflow status, temperature status, power supply status, and information on the operational status of the temperature, photocell, airflow, humidity, and LED power supply sensors.

Ensure that the sign controller is addressable through an Ethernet communication network using software that complies with the NTCIP requirements published online by the Department's Transportation Traffic Engineering Research Laboratory (TERL) at: http://www.fdot.gov/traffic/ . Ensure that the sign implements any NTCIP standards required to achieve interoperability and interchangeability. Ensure that any additional objects implemented by the software do not interfere with the standard operation of any mandatory objects. ERS must be compatible with the Department's SunGuide® software.

700-5.2.9.~~7~~4 ERS Battery Backup System: AC powered signs must include a battery backup system that maintains full operation of the sign for a minimum of two hours in the event of utility power loss. Operation on battery backup can have no visible effect on the appearance of the display.

700-5.2.~~10~~5 Blank-Out Signs (BOS): EDSs designed for BOS applications must have a black exterior finish (FED-STD-595-37038) with a reflectance value not exceeding 25%. Overhead BOS must include a visor.

700-5.2.~~11~~6 Electronic Speed Feedback Signs (ESFS): The ESFS must be designed to alert road users of their speed as they approach the sign.

700-5.2.~~11~~6.1 ESFS Background/Foreground Colors: The ESFS display background must be flat black (FED-STD-595-37038) with a reflectance value not exceeding 25%. ESFS must utilize amber LEDs with a peak wavelength of 590 nanometers. ESFS shall have a minimum one inch contrasting margin around illuminated characters or graphics.

700-5.2.~~11~~6.2 Speed Detector: The ESFS must be programmable for the posted speed limit and the maximum speed to display**.** When the detected speed exceeds the maximum programmed speed (high speed cut-off) threshold, the display must automatically blank. Alternately, the display may show an alert message such as "SLOW DOWN" when speeds above the maximum programmed speed threshold are detected. The ESFS must detect when the posted speed is exceeded by one mph and then activate the alert. When the alert is activated, the display must flash at a rate of 50 to 60 cycles per minute. When no advancing traffic is detected, the display must be blank. The speed detector must not activate alerts or display speeds for vehicles outside the display's cone of vision. The ESFS must meet the requirements of FCC Part 90 and not require an FCC operating license. The speed detector must operate on 10.8 to 16.6 V_{DC}. The ESFS must be capable of measuring speeds of approaching traffic between 10 and 99 mph with an accuracy of plus or minus one mph, 1,000 feet in advance of the sign.

700-5.2.~~12~~7 Environmental Requirements: The EDS assembly must operate properly during and after being subjected to the environmental testing procedures described in NEMA TS 4-2016, Section 2. Fog, frost, or condensation must not form within the dynamic portion of the sign. Electronics must meet FCC Title 47, Subpart B Section 15.

700-5.2.~~13~~8 Warranty: Ensure that the EDS systems and equipment furnished have a manufacturer's warranty covering defects in assembly, fabrication, and materials for a minimum of three years.

700-5.3 Installation: For roadside sign assemblies, construct foundation and ~~I~~install ~~equipment~~ support structure in accordance with 646-3 and the Standard Plans, Index 700-120. ~~and~~Install electronic display sign equipment in accordance with the manufacturer's instructions.

700-5.4 Method of Measurement: The Contract unit price per assembly for electronic display sign, furnished and installed, will include the static sign panels, electronic display,

support structure, foundation, housing, cabinet, controller, speed detector, hardware, electrical connection, and labor necessary for a complete and accepted installation. When the electronic display sign is ground mounted, the Contract price will include the support structure and foundation. All other mounting will include the hardware necessary to complete the attachment to the support structure; the span wire, monotube, or mast arm structure will be paid separately.

When a solar panel is specified in the Contract Documents, the Contract unit price will include the solar panel and batteries.

700-5.5 Basis of Payment: Price and payment will be full compensation for all work specified in this Section.

Payment will be made under:

Item No. 700- 11- Electronic Display Sign, per assembly.

SUBARTICLE 700-6.3 is deleted and the following substituted:

700-6.3 Installation: Install equipment in accordance with ~~the Standard Plans, Index 700-120 and~~ the manufacturer's instructions.

Payment will be made under:

Item No. 700- 12- Sign Beacon, per assembly.