Florida Department of Transportation

RON DESANTIS
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JARED W. PERDUE, P.E.
SECRETARY

September 11, 2026

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: 995
Proposed Specification: **9950209 Traffic Control Signal and Device Materials**
Associated Specifications: **7000101 Highway Signing**

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 correct duplicated text and clarify technical requirements.
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/am
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

TRAFFIC CONTROL SIGNAL AND DEVICE MATERIALS
(REV 6-10-26)

SUBARTICLE 995-2.9 is deleted and the following substituted:

995-2.9 Vehicle Presence Detection System Performance Requirements: Presence detectors shall provide a minimum detection accuracy of 98% and shall meet the requirements for Modes of Operation in NEMA TS2. Advance presence detectors shall meet detection accuracy requirements when located at variable distances in advance of the stop line, including 300 feet. Presence detectors at intersections shall place a call whenever a vehicle occupies the detector, including cases when a vehicle passes the stop line and reverses.

995-2.9.1 Vehicle Presence Detection Accuracy: To verify conformance with the accuracy requirements in this Section and as a precondition for listing on the APL, sample data collected from the vehicle detection system will be compared against ground truth data collected during the same time by human observation or by another method approved by the FDOT Traffic Engineering Research Laboratory (TERL). Ensure sample data is collected over several time periods under a variety of traffic conditions. Weight each data sample to represent the predominant conditions over the course of a 24-hour period. Samples will consist of 15- and 30-minute data sets collected at various times of the day. Representative data periods and their assigned weights are provided in Table 995-2.

Table 995-2
Data Collection Periods

Period	Intended To Represent	Duration	Weight
Early morning (predawn) [EM]	12:30 a.m. – 6:30 a.m.	15 minutes	24
Dawn [DA]	15 minutes before sunrise to 15 minutes after sunrise	30 minutes	2
AM Peak [AMP]	7:00 a.m. – 8:00 a.m.	15 minutes	4
Late AM Off-Peak [LAOP]	8:00 a.m. – 12:00 p.m.	15 minutes	16
Noon [NO]	12:00 p.m. – 1:00 p.m.	15 minutes	4
Afternoon Off-Peak [AOP]	1:00 p.m. – 5:00 p.m.	15 minutes	16
PM Peak [PMP]	5:00 p.m. – 6:00 p.m.	15 minutes	4
Dusk [DU]	15 minutes before sunset to 15 minutes after sunset	30 minutes	2
Night [NI]	6:30 p.m. – 12:30 a.m.	15 minutes	24
Total Sum of Weights			96

For example, the sample gathered for the Late AM Off-Peak period is intended to represent typical traffic conditions between 8:00 a.m. and 12:00 p.m. Since the sample period's duration is 15 minutes and the actual period of time represented is 4 hours, the multiplication factor or weight assigned is 16, the number of 15-minute intervals in a 4 hour period. Specific

times used to capture data for DA shall be adjusted as needed to capture 30 minutes of data that includes darkness, dawn, and daylight. Times for DU shall be adjusted as needed to capture 30 minutes of data that includes daylight, dusk, and darkness.

995-2.9.2 Calculation of Vehicle Presence Detection Accuracy: Determine individual lane presence detection accuracy per period by subtracting cumulative error time from the total time monitored, divided by total time, expressed as a percentage.

Within the equation in 995-2.9.2.1, "EM" represents the early morning period. The variable "i" represents a detector or detection zone and could vary from 1,…, N, where "N" is the total number of detectors observed. Substitute other detector numbers and periods as necessary to determine accuracy for all detectors during each period (i.e., dawn, AM peak, late AM off peak, etc.).

Variables used in the following equations are identified as follows:

PA = Presence detection accuracy

TT = Total time

CET = Cumulative Error Time (duration of all false and missed calls)

N=Total number of detectors observed

995-2.9.2.1 Early Morning Vehicle Presence Detection Accuracy for a Single Detector Expressed as a Percentage:

$$PA_{EM,det_i} = \frac{TT_{EM,det_i} - CET_{EM,det_i}}{TT_{EM,det_i}} \; x100$$

where:

PA_{EM,det_i} = Presence detection accuracy of detector *i* during the early morning period.

TT_{EM,det_i} = Total time that detector *i* was monitored (for instance, the 15-minute minimum duration specified in Table 995-2 for the early morning period).

CET_{EM,det_i} = Cumulative time that detector *i* was in an error state (indicating a detection with no vehicle present or not indicating a detection when vehicle present) during the monitoring period using human observation or another method approved by the Engineer.

The period accuracy will be the arithmetic mean of all individual detector accuracies.

In the equation in 995-2.9.2.2, "EM" represents the early morning period and "*N"* is the total number of detectors tested. Substitute other periods as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.9.2.2 Early Morning Vehicle Presence Detection Accuracy for All Detectors Expressed as a Percentage:

$$PA_{EM} = \left(\frac{\sum_{i=1}^{N} PA_{EM,\mathrm{det}_i}}{N} \right)$$

Where:

PA_{EM} = Average accuracy of all detectors during the early morning.

$PA_{EM,\det_i}$ = Accuracy of detector *i* during early morning.

Calculate the roadway segment accuracy over all periods using the equation in 995-2.9.2.3.

995-2.9.2.3 Total Vehicle Presence Detection Accuracy for All Detectors Expressed as a Percentage:

$$PA_{Total} = \frac{[PA_{EM}x24 + PA_{DA}x2 + PA_{AMP}x4 + PA_{LAOP}x16 + PA_{NO}x4 + PA_{AOP}x16 + PA_{PMP}x4 + PA_{DU}x2 + PA_{NI}x24]}{96}$$

Where:

PA_{Total} =Accuracy for all detectors for all periods

PA_{EM} = Accuracy of all detectors during early morning traffic conditions

PA_{DA} = Accuracy of all detectors during dawn traffic conditions

PA_{AMP} = Accuracy of all detectors during AM peak traffic conditions

PA_{LAOP} = Accuracy of all detectors during late AM off-peak traffic conditions

PA_{NO} = Accuracy of all detectors during noon traffic conditions

PA_{AOP} = Accuracy of all detectors during afternoon off-peak traffic conditions

PA_{PMP} = Accuracy of all detectors during PM peak traffic conditions

PA_{DU} = Accuracy of all detectors during dusk traffic conditions

PA_{NI} = Accuracy of all detectors during night traffic conditions

SUBARTICLE 995-2.10 is deleted and the following substituted:

995-2.10 Traffic Data Detection System Acceptance Requirements: Traffic data detection systems must be capable of collecting data including traffic volume, speed, and occupancy.

995-2.10.1 Data Accuracy: The vehicle detection system shall be capable of meeting the minimum total roadway segment accuracy levels of 95% for volume, 90% for occupancy, and 90% for speed for all lanes, up to the maximum number of lanes that the device can monitor as specified by the manufacturer.

To verify conformance with the accuracy requirements in this Section and as a precondition for listing on the APL, sample data collected from the vehicle detection system will be compared against ground truth data collected during the same time by human observation or by another method approved by the TERL. Sample data shall be collected over several time

periods under a variety of traffic conditions. Weight each data sample to represent the predominant conditions over the course of a 24-hour period. Samples shall consist of 15- and 30-minute data sets collected at various times of the day. Representative data periods and their assigned weights are provided in Table 995-2.

995-2.10.2 Calculation of Volume Accuracy: Determine individual lane volume accuracy per period by subtracting from 100 percent the absolute difference of the total volume measured by the detector and the ground truth volume measurement, divided by the ground truth volume measurement, expressed as a percentage.

In the equation in 995-2.10.2.1, "EM" represents the early morning period. The subscript "*i"* represents a lane at the detection zone on the roadway segment and could vary from 1,…, N, where "N" is the maximum number of lanes being detected. Substitute other lane numbers and periods as necessary to determine the accuracy for each lane during each period (i.e., dawn, AM peak, late AM off-peak, etc.).

Variables and subscripts used in the equations below are identified as follows:

VT = Total volume
VD = Vehicle detection data (in this case, count data)
GT = Ground truth measurement
VA = Volume accuracy

995-2.10.2.1 Early Morning Volume Accuracy for a Lane Expressed as a Percentage:

$$VA_{EM,\ln_i} = 100 - \frac{\left|VT_{EM,VD,\ln_i} - VT_{EM,GT,\ln_i}\right|}{VT_{EM,GT,\ln_i}} x100$$

Where:

VA_{EM,ln_i} = Volume accuracy for early morning traffic conditions in the i^{th} lane.

VT_{EM,VD,ln_i} = Total volume for the 15-minute early morning period using the vehicle detector in the i^{th} lane.

VT_{EM,GT,ln_i} = Total volume for the 15-minute early morning period in the i^{th} lane using human observation or another method approved by the Engineer.

The period volume accuracy will be the arithmetic mean of the lane volume accuracy over all lanes.

In the equation in 995-2.10.2.2, "EM" represents the early morning period and "*N"* is the total number of lanes of detection on the roadway segment under test. Substitute other periods as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.2.2 Early Morning Volume Accuracy Expressed as a Percentage:

$$VA_{EM} = \left(\frac{\sum_{i=1}^{N} VA_{EM,\ln_i}}{N} \right)$$

Where:

VA_{EM} = Average volume accuracy for early morning traffic conditions for all lanes.

VA_{EM,ln_i} = Volume accuracy for early morning traffic conditions in the i th lane.

Calculate the total volume accuracy over all periods using the equation in 995-2.10.2.3.

995-2.10.2.3 Total Volume Accuracy Expressed as a Percentage:

$$VA_{Total} = \frac{\left[VA_{EM}x24 + VA_{DA}x2 + VA_{AMP}x4 + VA_{LAOP}x16 + VA_{NO}x4 + VA_{AOP}x16 + VA_{PMP}x4 + VA_{DU}x2 + VA_{NI}x24\right]}{96}$$

Where:

VA_{Total} = Volume accuracy for all lanes for all periods
VA_{EM} = Volume accuracy for early morning traffic conditions
VA_{DA} = Volume accuracy for dawn traffic conditions
VA_{AMP} = Volume accuracy for AM peak traffic conditions
VA_{LAOP} = Volume accuracy for late AM off-peak traffic conditions
VA_{NO} = Volume accuracy for noon traffic conditions
VA_{AOP} = Volume accuracy for afternoon off-peak traffic conditions
VA_{PMP} = Volume accuracy for PM peak traffic conditions
VA_{DU} = Volume accuracy for dusk traffic conditions
VA_{NI} = Volume accuracy for night traffic conditions

995-2.10.3 Calculation of Speed Accuracy: For computing the accuracy of the detector speed measurement, the average speed readings obtained from the detection system are compared to ground truth values.

The equation in 995-2.10.3.1 represents the ground truth average speed computation procedure for a particular lane during a specific time period. The equation in 995-2.10.3.2 represents the average speed computation procedure for a particular lane during a specific time period using data gathered from the detection system.

In the equations in 995-2.10.3.1 and 995-2.10.3.2, the time period described is the early morning period, represented by "EM", and the subscript "k" represents a vehicle traveling on the roadway and could vary from 1,…, K, where "K" is the total number of vehicles in lane i during the time period under consideration. The subscript "i" represents a lane in a roadway and could vary from 1,…, N, where "N" is the total number of lanes of detection on the roadway segment. Substitute other lanes and periods as necessary and compute the accuracy for each lane for all time periods.

Variables and subscripts used in the equations below are identified as follows:

SA = Speed accuracy
S = Speed of an individual vehicle
K = Total number of vehicles in lane during time period
veh = Vehicle

995-2.10.3.1 Early Morning Average Ground Truth Speed:

$$S_{Avg,EM,GT,\ln_i} = \frac{1}{K}\sum_{k=1}^{K} S_{EM,GT,\ln_i,veh_k}$$

Where:

SA_{Avg,EM,GT,ln_i} represents the average ground truth vehicle speed for the i^{th} lane during the early morning period.

S_{EM,GT,ln_i,veh_k} represents the ground truth speed for the k^{th} vehicle in the i^{th} lane during the early morning period using human observation or another method approved by the Engineer.

995-2.10.3.2 Early Morning Average Vehicle Detector Speed:

$$S_{Avg,EM,VD,\ln_i} = \frac{1}{K}\sum_{k=1}^{K} S_{EM,VD,\ln_i,veh_k}$$

Where:

S_{Avg,EM,VD,ln_i} represents the average speed recorded by the vehicle detector for the ith lane during the early morning period.

S_{EM,VD,ln_i,veh_k} represents the speed for the k th vehicle in the i th lane during the early morning period using the vehicle detector.

Determine lane speed accuracy per period by subtracting from 100 percent the absolute difference of the average lane speed measured by the detector and the average lane ground truth speed, divided by the average lane ground truth speed, expressed as a percent.

In the equation in 995-2.10.3.3, "EM" represents the early morning period. The subscript "*i*" represents a lane of detection on a roadway and could vary from 1,…,N, where "N" is the total number of lanes of detection on the roadway segment. Substitute other lanes as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.3.3 Early Morning Lane Speed Accuracy Expressed as a Percentage:

$$SA_{Avg,EM,\ln_i} = 100 - \frac{\left|S_{Avg,EM,VD,\ln_i} - S_{Avg,EM,GT,\ln_i}\right|}{S_{Avg,EM,GT,\ln_i}} \times 100$$

Where:

SA_{Avg,EM,ln_i} represents the average speed accuracy during early morning traffic conditions for all vehicles that traveled in lane i of the roadway segment.

The period speed accuracy will be the arithmetic mean of the lane speed accuracy, computed using the equation in 995-2.10.3.3, over all lanes.

In the equation in 995-2.10.3.4, "EM" represents the early morning period. The subscript "i" represents a lane of detection on a roadway and could vary from 1,…, N, where "N" is the maximum number of lanes on the roadway segment. Substitute data as

necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.3.4 Early Morning Speed Accuracy Expressed as a Percentage:

$$SA_{EM} = \left(\frac{\sum_{i=1}^{N} SA_{Avg,EM,\ln_i}}{N} \right)$$

Where:

SA_{EM} represents the average speed accuracy during early morning traffic conditions for all lanes of detection on the roadway segment.

Calculate detector speed accuracy for the roadway segment over all periods using the equation in 995-2.10.3.5.

995-2.10.3.5 Total Roadway Segment Accuracy Expressed as a Percentage:

$$SA_{Total} = \frac{[SA_{EM}x24 + SA_{DA}x2 + SA_{AMP}x4 + SA_{LAOP}x16 + SA_{NO}x4 + SA_{AOP}x16 + SA_{PMP}x4 + SA_{DU}x2 + SA_{NI}x24]}{96}$$

Where:

SA_{Total} = Speed accuracy for all lanes for all periods
SA_{EM} = Speed accuracy for early morning traffic conditions
SA_{DA} = Speed accuracy for dawn traffic conditions
SA_{AMP} = Speed accuracy for AM peak traffic conditions
SA_{LAOP} = Speed accuracy for late AM off-peak traffic conditions
SA_{NO} = Speed accuracy for noon traffic conditions
SA_{AOP} = Speed accuracy for afternoon off-peak traffic conditions
SA_{PMP} = Speed accuracy for PM peak traffic conditions
SA_{DU} = Speed accuracy for dusk traffic conditions
SA_{NI} = Speed accuracy for night traffic conditions

SUBARTICLE 995-4.2.6 is deleted and the following substituted:

995-4.2.6 Plastic Signal Housings and Visors: Construct signal housing assembly, door, and visors of UV stabilized plastic with a minimum thickness of 0.1 inch, plus or minus, 0.01 inch, with the following physical properties:

Table 995-4 Plastic Signal Housings and Visors		
Test	Minimum Requirement	Method
Specific Gravity	1.17	ASTM D792
Vicat Softening Temp.	305-325°F (152 – 163°C)	ASTM D1525
Brittleness Temp.	Below -200°F (-129°C)	ASTM D746
Flammability	Self-extinguishing	ASTM D635
Tensile Strength	Yield, 8500 psi (58 MPa)	ASTM D638
Elongation at yield	5.5 - 8.5%	ASTM D638
Shear Strength	Yield, 5500 psi (38 MPa)	ASTM D732
Izod impact strength	15ft-lb/in (800 J/m)	ASTM D256
Fatigue strength	950 psi (6.5MPa) at 2.5 mm cycles	ASTM D671
~~Fatigue strength~~	~~950 psi (6.5MPa) at 2.5 mm cycles~~	~~ASTM D671~~

SUBARTICLE 995-7.1 is deleted and the following substituted:

995-7.1 General: Fastening hardware such as bolts, nuts, washers, set screws, studs, ~~u~~U-bolts, cable and cable swags, must be provided by the mounting assembly manufacturer, must be SAE Type 316 or 304 stainless steel. Hardware (studs, bolts and ~~u~~U-bolts) must be a minimum of 5/16 inch diameter unless otherwise specified in this Section. SAE Grade 8 bolts and nuts are also acceptable. Metallic mounting assemblies must meet ASTM B117 for corrosion resistance.

Connections that provide an entrance to the interior of a traffic device must be weather-resistant.

All assemblies must be constructed to support the weight of any combination of signal indications with all accessories such as back plates and visors.

Connections between signal, disconnect and disconnect hanging hardware must be of the tri-stud design unless otherwise specified in this Section. Tri-stud washers must be a minimum 0.090 inch thick unless otherwise specified in this Section.

Connections must be designed to mate with a standard traffic signal's 2-inch I.D. opening and must be capable of providing positive positioning and alignment of the traffic device. Connection type may be a 72-tooth serrated edge or other connection type as long as all other specifications are met. For 72-tooth serrated edge connections, the teeth must be clean, sharp, and at least 1/8 inch wide and 3/64 inch deep. All connection types must be weather resistant.

All mounting assemblies must be capable of providing adjustment in multiple directions for proper alignment of the attached traffic device and to prevent rotation around the vertical axis or misalignment after installation.

Use studs that are either cast directly into the aluminum during the casting process or tapped and locked with a locking material. In each case, a pull-out force must be provided. Messenger wire clamps must be extruded aluminum six inches long or cast U-bolt type.

Torque specifications must be included for all fastening hardware with the assembly installation instructions.

SUBARTICLE 995-9.2 is deleted and the following substituted:

995-9.2 Standard Pedestrian Pushbutton Detector: Pushbuttons must be raised from or flush with their housings and be a minimum of 2 inches in ~~the smallest dimension~~diameter. The pushbutton must require no more than 5 pounds of force to activate. The detector must be weather-tight and tamper resistant.

SUBARTICLE 995-9.4.4 is deleted and the following substituted:

995-9.4.4 Electrical Requirements: Passive Detectors shall operate using a nominal input voltage of 120 V_{AC} ~~and operate with an input voltage ranging from 89 to 135 V_{AC}~~.

SUBARTICLE 995-9.5 is deleted and the following substituted:

995-9.5 Electrical Requirements: ~~All wiring must meet applicable NEC requirements.~~ If a system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

SUBARTICLE 995-11.5 is deleted and the following substituted:

995-11.5 Intelligent Transportation System Cabinets: The cabinet shell must conform to NEMA 3R requirements, be constructed of unpainted sheet aluminum alloy 5052-H32 with a minimum thickness of 0.125 inch and have a smooth, uniform natural aluminum finish without rivet holes, visible scratches or gouges on the outer surface. Other finishes are acceptable if approved.

The exterior dimensions for cabinets are listed below.

Table 995-7
Exterior Cabinet Dimensions in Inches

Cabinet Type	Height	Width	Depth
340	66” - 68”	44” - 46”	26” - 28”
336	36” - 39”	24” - 26”	20’ - 22”
336S	46” - 48”	24” - 26”	22” - 24”
334	66” - 68”	24” - 26”	30” - 32”
332D	66” - 68”	48” - 50”	30” - 32”
P44	55” - 59”	44” - 46”	26” - 29”

The cabinet must be weather resistant and constructed with a crowned top to prevent standing water. All exterior cabinet welds must be gas tungsten arc (TIG) welds and all interior cabinet welds must be gas metal arc (MIG) or TIG welds. All exterior cabinet and door seams must be continuously welded and smooth and all inside and outside edges of the cabinet must be free of burrs, rounded and smoothed for safety. All welds must be neatly formed and free of cracks, blow holes and other irregularities. Use ER5356 aluminum alloy bare welding

electrodes conforming to AWS A5.10 requirements for welding on aluminum. Procedures, welders and welding operators must conform to AWS requirements as contained in AWS B3.0 and C5.6 for aluminum.

The cabinet must have a lifting eye plate on both sides of the top of the cabinet for lifting and positioning it. Each lifting eye must be secured with a minimum of two bolts to the cabinet body and have a lift point opening diameter of 0.75 inch and capable of supporting a weight load of 1,000 pounds. All external bolt heads must be tamperproof.

Ground-mount cabinets must include a removable base plate and two aluminum plates, welded inside, for anchoring the cabinet. Fabricate the plates from aluminum alloy 5052-H32 a minimum of 4 inches wide by 0.125 inch thick.

995-11.5.1 Doors: Provide cabinets with front and rear doors, each equipped with a lock and handle. Doors must be full size, matching the height and width dimensions of the cabinet enclosure, with no fewer than three Type 4 or larger stainless steel hinges or; alternately, one full-length "piano" hinge. Hinges must be constructed of 14 gauge stainless steel with stainless steel hinge pins that are spot-welded at the top. Mount the hinges so that they cannot be removed from the door or cabinet without first opening the door. Brace the door and hinges to withstand 100 pounds per vertical foot of door height load applied to the outer edge of the door when standing open. Ensure there is no permanent deformation or impairment of any part of the door or cabinet body when the load is removed.

Door opening must provide a flange that allows the door gasket to mate with a flat surface. Include a gasket made of closed-cell material resistant to UV, weathering, elevated temperatures, and permanent deformation that is permanently bonded to the inside of each door forming a weather-tight seal when the door is closed.

995-11.5.2 Latches: Provide all cabinets with a three-point draw roller latching system for the doors. The latching system must have the following latching points.

1. Center of the cabinet (lock).
2. Top of the cabinet – controlled by the door handle.
3. Bottom of the cabinet – controlled by the door handle.

The latching points on the top and bottom of the cabinet must remain in the locked position until the main cabinet door lock is unlocked. The locking mechanism must be equipped with nylon rollers to secure the top and bottom of the door.

Provide the cabinet with a door stop that retains the main door open in a 90 degree and 120 degree position.

995-11.5.3 Rails: Provide the cabinet with four cabinet rails that form a cage for mounting miscellaneous wiring panels and various mounting brackets. Use rails constructed of either 0.1345 inch thick plated steel or 0.105 inch thick stainless steel that extend the length of the cabinet's sides, starting from the bottom of the enclosure. Rails must be keyhole designed with slots 2 inches on center with a top opening of 5/8 inch in diameter to allow the insertion of a 5/8 inch by 1 inch carriage bolt. Rails must be 1-1/2 to 2 inches wide by 1/2 inch deep, drilled and tapped for 10-32 screws or rack screws with EIA universal spacing. Do not use unistruts or other rail types.

995-11.5.4 Racks: The cabinet must include a standard 19-inch EIA/TIA equipment rack centered in the cabinet for mounting devices to be installed inside. Clearance in the rack between the rails must be 17-3/4 inches.

995-11.5.5 Shelf: Provide a level, rollout internal shelf with a minimum work area measuring 10 inches by 10 inches. The shelf must be capable of sustaining a constant 20 pound load and the shelf position must be adjustable.

995-11.5.6 Sunshield: Sunshields must be mounted with tamper resistant hardware to standoffs that provide an air gap of at least one inch between the exterior cabinet walls and the sunshields. Sunshield standoffs located on the roof of the cabinet must be welded to the cabinet body. Construct sunshields of 0.125 inch thick 5052-H32 aluminum sheet with corners that are rounded and smoothed for safety.

995-11.5.7 Ventilation: Provide ventilation through the use of a louvered vent at the bottom of the door. Vent depth must not exceed 0.25 inch. Provide an air filter a minimum of 192 square inches and 1 inch thick behind the vent. The filter must be removable and held firmly in place so that all intake air is filtered.

Provide a bottom trough and a spring-loaded upper clamp to hold the filter in place. The bottom trough must drain any accumulated moisture to the outside of the field cabinet.

ITS field cabinets must have dual thermostatically controlled fans, with one thermostat per fan, rated for continuous duty with a service life of at least 3 years. Mount thermostats on the inside top of the cabinet. Thermostats must be user adjustable to allow temperature settings ranging from a minimum of 70°F to a maximum of 140°F and capable of activating the fans within plus or minus 5 degrees of the set temperature. Use UL listed exhaust fans having a minimum air flow rating of 100 cubic feet per minute. Electric fan motors must have ball or roller bearings. Vent the exhaust air from openings in the roof of the field cabinet.

995-11.5.8 Electrical Requirements: SPD's must be accessible from the front of any panel used in the cabinet. Connect the SPD for the cabinet's main AC power input on the load side of the cabinet circuit breaker. All wiring must be laced. All conductors must be stranded copper.

995-11.5.8.1 Service Panel Assembly: Provide a service panel assembly to function as the entry point for AC power to the cabinet and the location for power filtering, transient suppression and equipment grounding. Provide branch circuits, SPDs, and grounding as required for the load served by the cabinet, including ventilation fans, internal lights, electrical receptacles, etc.

995-11.5.8.2 Terminal Blocks: Terminate electrical inputs and outputs on terminal blocks. The voltage and current rating of the terminal block must be greater than the voltage and current rating of the wire fastened to it.

Terminate conductors on terminal blocks using insulated terminal lugs large enough to accommodate the conductor to be terminated. When two or more conductors are terminated on field wiring terminal block screws, use a terminal ring lug for termination of those conductors. Number all terminal block circuits and cover the blocks with a clear insulating material to prevent inadvertent contact.

995-11.5.8.3 Ground BusBar: Fabricate ground busbars of copper or aluminum alloy material compatible with copper wire and provide at least two positions where a No. 2 AWG stranded copper wire can be attached.

Mount the ground busbar on the side of the cabinet wall adjacent to the service panel assembly for the connection of AC neutral wires and chassis ground wires. If more than one ground busbar is used in a cabinet, use a minimum of a No. 10 AWG copper wire

to interconnect them. Connect the equipment rack to the ground busbar in the cabinet to maintain electrical continuity throughout the cabinet.

Follow the PANI recommendations of USDA-RUS-1751 for connections to the ground busbar. Producer (P) or electrical power and sources of stroke current connections shall be on the left end of the busbar. Absorbing (A) or grounding wires shall be connected immediately right of the P connections. Non-isolated (N) connections such as doors and vents shall be connected to the right of the A connections. Isolated (I) equipment grounds from equipment in the cabinet shall be connected on the right end of the busbar.

995-11.5.8.4 Power Distribution Assembly: Furnish a power distribution assembly that fits in the EIA 19-inch rack and provides for protection and distribution of 120 V_{AC} power.

995-11.5.8.5 Interior Lighting: Provide one or more light fixtures that illuminate the entire interior of the cabinet. All light fixtures must automatically turn on when the main cabinet door is opened and turn off when the door is closed.

995-11.5.9 Adapter Bracket: Provide an adapter bracket for pole mounted cabinets that is slotted or otherwise designed to allow banding straps to be installed to avoid pole handholes.

SUBARTICLE 995-12.1 is deleted and the following substituted:

995-12.1 General: Traffic controller accessories must meet the industry standards in Table 995-8 as well as the environmental requirements of those standards.

Table 995-8
Traffic Controller Accessory Standards

Device	Standard
~~Conflict Monitor~~	~~NEMA TS1-1989, Section 6~~
Malfunction Management Unit	NEMA TS2-2021, Section 4
Power Supply	NEMA TS2-2021, Section 5.3.5
Load Switch	NEMA TS2-2021, Section 6.2
Flasher	NEMA TS2-2021, Section 6.3
Bus Interface Unit	NEMA TS2-2021, Section 8
Model 206L Power Supply Unit	CALTRANS TEES, 2020, 3.4
Model 208 Monitor Unit	CALTRANS TEES, 2020, 3.5
Model 210 Monitor Unit	CALTRANS TEES, 2020, 3.6
Power Distribution Assembly	CALTRANS TEES, 2020, 6.4.3
Input File	CALTRANS TEES, 2020, 6.4.4

SUBARTICLE 995-14.2 is deleted and the following substituted:

995-14.2 Housing: The sign housing must be constructed of continuous 5052 or 6063-T5 aluminum. All housing, corners, and door seams must be continuously welded. All exterior surfaces of the assembly must be powder-coat painted in accordance with Military Standard MIL-PRF-24712A or AAMA-2603-02. Finish must meet the requirements of ASTM D3359,

ASTM D3363, and ASTM D522. Sign housings with any interior airspace must consist of a box type enclosure and separate hinged door assembly. The sign housing must include provisions to prevent water from entering the sign housing. Drain holes in the sign larger than 0.125 inch must be covered by a screen.

Signs must have removable sign faces. The sign face must be secured by a method that holds the sign face securely in place. Slide-in grooves are allowed to secure the sign face if the sign is edge lit.

The sign face must be a translucent lens constructed of 0.125-inch thick high impact strength polycarbonate or acrylic meeting UL48. Background must be retroreflective sheeting coated with a transparent, pressure-sensitive adhesive film. ~~Color must meet the criteria as detailed in Section 994.~~ Retroreflective sheeting must meet the requirements of Section 994 and be listed on the APL.

If a door opens upward, it must have a bracket on each side to secure the door in the open position during maintenance. Doors must be permanently and continuously sealed with a foam gasket listed to UL157 to prevent the entry of water into the sign housing. Each door must be secured from opening by stainless steel rotary action draw latches as follows:

Street name signs of 5 feet up to 7 feet in width must have a minimum of three latches for each sign door.

Street name signs over 7 feet up to 9 feet in width must have a minimum of four latches for each door.

The rotary action draw latch must be captive and will not become detached or allow the door to open when the sign housing is torqued or twisted.

The sign assembly must be designed and constructed to withstand 150 mph wind loads meeting the requirements of the Department's Structures Manual.

SUBARTICLE 995-16.4 is deleted and the following substituted:

995-16.4 Characters, Fonts, and Color: The signs must be capable of displaying American Standard Code for Information Interchange (ASCII) characters 32 through 126, including all uppercase and lowercase letters, and digits 0 through 9, at any location in the message line. Submit a list of the character fonts to the Engineer for approval.

All signs must be loaded (as a factory default) with a font in accordance with or that resembles the standard font set described in NEMA TS 4, Section 5.6. For signs with a pixel pitch of 35 mm or less, the sign must be loaded (as a factory default) with a font set that resembles the FHWA Series E2000 standard font.

DMS fonts must have character dimensions that meet the MUTCD, Section 2L.04, paragraph 08.

Full-color signs must display the colors prescribed in the MUTCD, Section ~~1A.12~~1D.05.

SUBARTICLE 995-16.8.2 is deleted and the following substituted:

995-16.8.2 Sign Controller: The sign controller must monitor the sign in accordance with NEMA TS 4, Section 9. The sign must monitor the status of any photocells,

LED power supplies, humidity, and airflow sensors. Sign controllers must use fiber optic cables for data connections between the sign housing and ground-level cabinet.

~~The sign controller must meet the requirements of NEMA TS 4, Sections 8.3 and 8.4.~~ The sign controller must be capable of displaying a self-updating time and date message on the sign. Sign controllers within ground cabinets must be rack-mountable, designed for a standard Electronic Industries Alliance (EIA) EIA-310 19 inch rack, and includes a keypad and display.

SUBARTICLE 995-16.8.5 is deleted and the following substituted:

995-16.8.5 Sign Controller Communication Interfaces: ~~The sign controller must have communication interfaces in accordance with NEMA TS 4, Section 8.3.2.~~ Ensure that EIA-232 serial interfaces support the following:

Table 995-10 Communication Interface Requirements	
Data Bits	7 or 8 bits
Parity	Even, Odd, or None
Number Stop Bits	1 or 2 bit

The sign controller must have a 10/100 Base TX 8P8C port or a 100 Base FX port Ethernet interface.

The TMC or a laptop computer must be able to remotely reset the sign controller.

SUBARTICLE 995-16.10 is deleted and the following substituted:

995-16.10 TMC Communication Specification for all DMS: The sign controller must be addressable by the TMC through the Ethernet communications network using software that complies with the 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. The software must implement all mandatory objects in the document, Dynamic Message Sign NTCIP Requirements, as published on the Department's State Traffic Engineering and Operations Office web site at the following URL: https://www.fdot.gov/traffic/Traf-Sys/Product-Specifications.shtm.

The sign must comply with the NTCIP 1102v01.15, 2101v01.19, 2201v01.15, 2202v01.05, and 2301v02.19 Standards. ~~The sign must comply with NTCIP 1103v02.17, Section 3.~~

Ensure that the controller's internal time clock can be configured to synchronize to a time server using the network time protocol (NTP). NTP synchronization frequency must be user-configurable and permit polling intervals from once per minute to once per week in one-minute increments. The controller must allow the user to define the NTP server by IP address.

SUBARTICLE 995-17.1 is deleted and the following substituted:

995-17.1 General: 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.

The term EDS refers to a general category of electronically enhanced signs ~~that includes electronic road signs (ERS)~~ with warning, regulatory, or guide legends~~;, including electronic speed feedback signs (ESFS); and blank-out signs (BOS)~~.

EDS 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.

SUBARTICLE 995-17.2.11 is deleted and the following substituted:

995-17.2.11 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.~~

SUBARTICLE 995-17.4 is deleted and the following substituted:

995-17.4 ~~Electronic Regulatory~~Variable Speed Limit Signs: Display modules for ~~ERS~~variable speed limit signs (VSLS) must have a minimum two-inch contrasting margin around digits, text, or graphics. ~~ERS~~VSLS must utilize LED technology for the dynamic display.

995-17.4.1 ~~ERS~~VSLS Battery Backup System: AC powered signs must include a battery backup system that maintains full operation of the sign for a minimum of 2 hours in the event of utility power loss. Operation on battery backup can have no visible effect on the appearance of the display.

995-17.4.2 ~~Variable Speed Limit Signs~~VSLS Legend: ~~Variable speed limit signs (~~VSLS~~)~~ must be able to display speed limits from 5-70 mph in 5 mph increments and mimic the physical appearance of a static regulatory speed limit sign as shown in the MUTCD and SHS. VSLS 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.

995-17.4.2.1 VSLS Controller Communications: VSLS must be equipped with a sign controller that includes a minimum of one Ethernet 10/100 Base TX 8P8C port.

995-17.4.2.2 Configuration and Management Requirements for VSLS: VSLS must support remote management from a TMC and local management using a laptop computer. Remote and local computers must be able to reset VSLS sign controller. VSLS must log and report status, errors, and failures, including data transmission errors, receipt of invalid data, communication failure recoveries, 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.

The sign controller must be addressable through an Ethernet communication network using software that complies with the NTCIP requirements published online by the TERL at: https://www.fdot.gov/traffic/. The sign must implement any NTCIP standards required to achieve interoperability and interchangeability. Any additional objects implemented by the software must not interfere with the standard operation of any mandatory objects. VSLS must be compatible with the Department's SunGuide® software.

SUBARTICLE 995-17.6 is deleted and the following substituted:

995-17.6 Electronic Speed Feedback Signs: The ESFS display background must be flat black (FED-STD-595-37038) with a reflectance value not exceeding 25%. ESFS shall have a minimum one-inch contrasting margin around illuminated characters ~~or graphics~~. Solar powered systems shall be designed to operate for a minimum of 10,000 activations per day and provide 10 days of operation without solar charging.

995-17.6.1 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. When no advancing traffic is detected, the display must be blank. The speed detector must not 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.

TRAFFIC CONTROL SIGNAL AND DEVICE MATERIALS
(REV 6-10-26)

SUBARTICLE 995-2.9 is deleted and the following substituted:

995-2.9 Vehicle Presence Detection System Performance Requirements: Presence detectors shall provide a minimum detection accuracy of 98% and shall meet the requirements for Modes of Operation in NEMA TS2. Advance presence detectors shall meet detection accuracy requirements when located at variable distances in advance of the stop line, including 300 feet. Presence detectors at intersections shall place a call whenever a vehicle occupies the detector, including cases when a vehicle passes the stop line and reverses.

995-2.9.1 Vehicle Presence Detection Accuracy: To verify conformance with the accuracy requirements in this Section and as a precondition for listing on the APL, sample data collected from the vehicle detection system will be compared against ground truth data collected during the same time by human observation or by another method approved by the FDOT Traffic Engineering Research Laboratory (TERL). Ensure sample data is collected over several time periods under a variety of traffic conditions. Weight each data sample to represent the predominant conditions over the course of a 24-hour period. Samples will consist of 15- and 30-minute data sets collected at various times of the day. Representative data periods and their assigned weights are provided in Table 995-2.

Table 995-2
Data Collection Periods

Period	Intended To Represent	Duration	Weight
Early morning (predawn) [EM]	12:30 a.m. – 6:30 a.m.	15 minutes	24
Dawn [DA]	15 minutes before sunrise to 15 minutes after sunrise	30 minutes	2
AM Peak [AMP]	7:00 a.m. – 8:00 a.m.	15 minutes	4
Late AM Off-Peak [LAOP]	8:00 a.m. – 12:00 p.m.	15 minutes	16
Noon [NO]	12:00 p.m. – 1:00 p.m.	15 minutes	4
Afternoon Off-Peak [AOP]	1:00 p.m. – 5:00 p.m.	15 minutes	16
PM Peak [PMP]	5:00 p.m. – 6:00 p.m.	15 minutes	4
Dusk [DU]	15 minutes before sunset to 15 minutes after sunset	30 minutes	2
Night [NI]	6:30 p.m. – 12:30 a.m.	15 minutes	24
Total Sum of Weights			96

For example, the sample gathered for the Late AM Off-Peak period is intended to represent typical traffic conditions between 8:00 a.m. and 12:00 p.m. Since the sample period's duration is 15 minutes and the actual period of time represented is 4 hours, the multiplication factor or weight assigned is 16, the number of 15-minute intervals in a 4 hour period. Specific times used to capture data for DA shall be adjusted as needed to capture 30 minutes of data that

includes darkness, dawn, and daylight. Times for DU shall be adjusted as needed to capture 30 minutes of data that includes daylight, dusk, and darkness.

995-2.9.2 Calculation of Vehicle Presence Detection Accuracy: Determine individual lane presence detection accuracy per period by subtracting cumulative error time from the total time monitored, divided by total time, expressed as a percentage.

Within the equation in 995-2.9.2.1, "EM" represents the early morning period. The variable "i" represents a detector or detection zone and could vary from 1,…, N, where "N" is the total number of detectors observed. Substitute other detector numbers and periods as necessary to determine accuracy for all detectors during each period (i.e., dawn, AM peak, late AM off peak, etc.).

Variables used in the following equations are identified as follows:

PA = Presence detection accuracy

TT = Total time

CET = Cumulative Error Time (duration of all false and missed calls)

N=Total number of detectors observed

995-2.9.2.1 Early Morning Vehicle Presence Detection Accuracy for a Single Detector Expressed as a Percentage:

$$PA_{EM,det_i} = \frac{TT_{EM,det_i} - CET_{EM,det_i}}{TT_{EM,det_i}} \; x100$$

where:

$PA_{EM,\det_i}$ = Presence detection accuracy of detector *i* during the early morning period.

$TT_{EM,\det_i}$ = Total time that detector *i* was monitored (for instance, the 15-minute minimum duration specified in Table 995-2 for the early morning period).

$CET_{EM,\det_i}$ = Cumulative time that detector *i* was in an error state (indicating a detection with no vehicle present or not indicating a detection when vehicle present) during the monitoring period using human observation or another method approved by the Engineer.

The period accuracy will be the arithmetic mean of all individual detector accuracies.

In the equation in 995-2.9.2.2, "EM" represents the early morning period and "*N"* is the total number of detectors tested. Substitute other periods as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.9.2.2 Early Morning Vehicle Presence Detection Accuracy for All Detectors Expressed as a Percentage:

$$PA_{EM} = \left(\frac{\sum_{i=1}^{N} PA_{EM,\det_i}}{N} \right)$$

Where:

PA_{EM} = Average accuracy of all detectors during the early morning.

$PA_{EM,\det_i}$ = Accuracy of detector *i* during early morning.

Calculate the roadway segment accuracy over all periods using the equation in 995-2.9.2.3.

995-2.9.2.3 Total Vehicle Presence Detection Accuracy for All Detectors Expressed as a Percentage:

$$PA_{Total} = \frac{\left[PA_{EM}x24 + PA_{DA}x2 + PA_{AMP}x4 + PA_{LAOP}x16 + PA_{NO}x4 + PA_{AOP}x16 + PA_{PMP}x4 + PA_{DU}x2 + PA_{NI}x24\right]}{96}$$

Where:

PA_{Total} =Accuracy for all detectors for all periods

PA_{EM} = Accuracy of all detectors during early morning traffic conditions

PA_{DA} = Accuracy of all detectors during dawn traffic conditions

PA_{AMP} = Accuracy of all detectors during AM peak traffic conditions

PA_{LAOP} = Accuracy of all detectors during late AM off-peak traffic conditions

PA_{NO} = Accuracy of all detectors during noon traffic conditions

PA_{AOP} = Accuracy of all detectors during afternoon off-peak traffic conditions

PA_{PMP} = Accuracy of all detectors during PM peak traffic conditions

PA_{DU} = Accuracy of all detectors during dusk traffic conditions

PA_{NI} = Accuracy of all detectors during night traffic conditions

SUBARTICLE 995-2.10 is deleted and the following substituted:

995-2.10 Traffic Data Detection System Acceptance Requirements: Traffic data detection systems must be capable of collecting data including traffic volume, speed, and occupancy.

995-2.10.1 Data Accuracy: The vehicle detection system shall be capable of meeting the minimum total roadway segment accuracy levels of 95% for volume, 90% for occupancy, and 90% for speed for all lanes, up to the maximum number of lanes that the device can monitor as specified by the manufacturer.

To verify conformance with the accuracy requirements in this Section and as a precondition for listing on the APL, sample data collected from the vehicle detection system will be compared against ground truth data collected during the same time by human observation or by another method approved by the TERL. Sample data shall be collected over several time periods under a variety of traffic conditions. Weight each data sample to represent the

predominant conditions over the course of a 24-hour period. Samples shall consist of 15- and 30-minute data sets collected at various times of the day. Representative data periods and their assigned weights are provided in Table 995-2.

995-2.10.2 Calculation of Volume Accuracy: Determine individual lane volume accuracy per period by subtracting from 100 percent the absolute difference of the total volume measured by the detector and the ground truth volume measurement, divided by the ground truth volume measurement, expressed as a percentage.

In the equation in 995-2.10.2.1, "EM" represents the early morning period. The subscript "*i"* represents a lane at the detection zone on the roadway segment and could vary from 1,…, N, where "N" is the maximum number of lanes being detected. Substitute other lane numbers and periods as necessary to determine the accuracy for each lane during each period (i.e., dawn, AM peak, late AM off-peak, etc.).

Variables and subscripts used in the equations below are identified as follows:

VT = Total volume
VD = Vehicle detection data (in this case, count data)
GT = Ground truth measurement
VA = Volume accuracy

995-2.10.2.1 Early Morning Volume Accuracy for a Lane Expressed as a Percentage:

$$VA_{EM,\ln_i} = 100 - \frac{\left|VT_{EM,VD,\ln_i} - VT_{EM,GT,\ln_i}\right|}{VT_{EM,GT,\ln_i}} x100$$

Where:

VA_{EM,ln_i} = Volume accuracy for early morning traffic conditions in the i^{th} lane.

VT_{EM,VD,ln_i} = Total volume for the 15-minute early morning period using the vehicle detector in the i^{th} lane.

VT_{EM,GT,ln_i} = Total volume for the 15-minute early morning period in the i^{th} lane using human observation or another method approved by the Engineer.

The period volume accuracy will be the arithmetic mean of the lane volume accuracy over all lanes.

In the equation in 995-2.10.2.2, "EM" represents the early morning period and "*N"* is the total number of lanes of detection on the roadway segment under test. Substitute other periods as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.2.2 Early Morning Volume Accuracy Expressed as a Percentage:

$$VA_{EM} = \left(\frac{\sum_{i=1}^{N} VA_{EM,\ln_i}}{N} \right)$$

Where:

VA_{EM} = Average volume accuracy for early morning traffic conditions for all lanes.

VA_{EM,ln_i} = Volume accuracy for early morning traffic conditions in the i th lane.

Calculate the total volume accuracy over all periods using the equation in 995-2.10.2.3.

995-2.10.2.3 Total Volume Accuracy Expressed as a Percentage:

$$VA_{Total} = \frac{\left[VA_{EM}x24 + VA_{DA}x2 + VA_{AMP}x4 + VA_{LAOP}x16 + VA_{NO}x4 + VA_{AOP}x16 + VA_{PMP}x4 + VA_{DU}x2 + VA_{NI}x24\right]}{96}$$

Where:

VA_{Total} = Volume accuracy for all lanes for all periods
VA_{EM} = Volume accuracy for early morning traffic conditions
VA_{DA} = Volume accuracy for dawn traffic conditions
VA_{AMP} = Volume accuracy for AM peak traffic conditions
VA_{LAOP} = Volume accuracy for late AM off-peak traffic conditions
VA_{NO} = Volume accuracy for noon traffic conditions
VA_{AOP} = Volume accuracy for afternoon off-peak traffic conditions
VA_{PMP} = Volume accuracy for PM peak traffic conditions
VA_{DU} = Volume accuracy for dusk traffic conditions
VA_{NI} = Volume accuracy for night traffic conditions

995-2.10.3 Calculation of Speed Accuracy: For computing the accuracy of the detector speed measurement, the average speed readings obtained from the detection system are compared to ground truth values.

The equation in 995-2.10.3.1 represents the ground truth average speed computation procedure for a particular lane during a specific time period. The equation in 995-2.10.3.2 represents the average speed computation procedure for a particular lane during a specific time period using data gathered from the detection system.

In the equations in 995-2.10.3.1 and 995-2.10.3.2, the time period described is the early morning period, represented by "EM", and the subscript "k" represents a vehicle traveling on the roadway and could vary from 1,…, K, where "K" is the total number of vehicles in lane i during the time period under consideration. The subscript "i" represents a lane in a roadway and could vary from 1,…, N, where "N" is the total number of lanes of detection on the roadway segment. Substitute other lanes and periods as necessary and compute the accuracy for each lane for all time periods.

Variables and subscripts used in the equations below are identified as follows:

SA = Speed accuracy
S = Speed of an individual vehicle
K = Total number of vehicles in lane during time period
veh = Vehicle

995-2.10.3.1 Early Morning Average Ground Truth Speed:

$$S_{Avg,EM,GT,\ln_i} = \frac{1}{K}\sum_{k=1}^{K} S_{EM,GT,\ln_i,veh_k}$$

Where:

SA_{Avg,EM,GT,ln_i} represents the average ground truth vehicle speed for the i^{th} lane during the early morning period.

S_{EM,GT,ln_i,veh_k} represents the ground truth speed for the k^{th} vehicle in the i^{th} lane during the early morning period using human observation or another method approved by the Engineer.

995-2.10.3.2 Early Morning Average Vehicle Detector Speed:

$$S_{Avg,EM,VD,\ln_i} = \frac{1}{K}\sum_{k=1}^{K} S_{EM,VD,\ln_i,veh_k}$$

Where:

S_{Avg,EM,VD,ln_i} represents the average speed recorded by the vehicle detector for the ith lane during the early morning period.

S_{EM,VD,ln_i,veh_k} represents the speed for the k th vehicle in the i th lane during the early morning period using the vehicle detector.

Determine lane speed accuracy per period by subtracting from 100 percent the absolute difference of the average lane speed measured by the detector and the average lane ground truth speed, divided by the average lane ground truth speed, expressed as a percent.

In the equation in 995-2.10.3.3, "EM" represents the early morning period. The subscript "*i*" represents a lane of detection on a roadway and could vary from 1,…,N, where "N" is the total number of lanes of detection on the roadway segment. Substitute other lanes as necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.3.3 Early Morning Lane Speed Accuracy Expressed as a Percentage:

$$SA_{Avg,EM,\ln_i} = 100 - \frac{\left|S_{Avg,EM,VD,\ln_i} - S_{Avg,EM,GT,\ln_i}\right|}{S_{Avg,EM,GT,\ln_i}} \times 100$$

Where:

SA_{Avg,EM,ln_i} represents the average speed accuracy during early morning traffic conditions for all vehicles that traveled in lane i of the roadway segment.

The period speed accuracy will be the arithmetic mean of the lane speed accuracy, computed using the equation in 995-2.10.3.3, over all lanes.

In the equation in 995-2.10.3.4, "EM" represents the early morning period. The subscript "i" represents a lane of detection on a roadway and could vary from 1,…, N, where "N" is the maximum number of lanes on the roadway segment. Substitute data as

necessary to determine the accuracy for each period (i.e., dawn, AM peak, late AM off-peak, etc.).

995-2.10.3.4 Early Morning Speed Accuracy Expressed as a Percentage:

$$SA_{EM} = \left(\frac{\sum_{i=1}^{N} SA_{Avg,EM,\ln_i}}{N} \right)$$

Where:

SA_{EM} represents the average speed accuracy during early morning traffic conditions for all lanes of detection on the roadway segment.

Calculate detector speed accuracy for the roadway segment over all periods using the equation in 995-2.10.3.5.

995-2.10.3.5 Total Roadway Segment Accuracy Expressed as a Percentage:

$$SA_{Total} = \frac{[SA_{EM}x24 + SA_{DA}x2 + SA_{AMP}x4 + SA_{LAOP}x16 + SA_{NO}x4 + SA_{AOP}x16 + SA_{PMP}x4 + SA_{DU}x2 + SA_{NI}x24]}{96}$$

Where:

SA_{Total} = Speed accuracy for all lanes for all periods
SA_{EM} = Speed accuracy for early morning traffic conditions
SA_{DA} = Speed accuracy for dawn traffic conditions
SA_{AMP} = Speed accuracy for AM peak traffic conditions
SA_{LAOP} = Speed accuracy for late AM off-peak traffic conditions
SA_{NO} = Speed accuracy for noon traffic conditions
SA_{AOP} = Speed accuracy for afternoon off-peak traffic conditions
SA_{PMP} = Speed accuracy for PM peak traffic conditions
SA_{DU} = Speed accuracy for dusk traffic conditions
SA_{NI} = Speed accuracy for night traffic conditions

SUBARTICLE 995-4.2.6 is deleted and the following substituted:

995-4.2.6 Plastic Signal Housings and Visors: Construct signal housing assembly, door, and visors of UV stabilized plastic with a minimum thickness of 0.1 inch, plus or minus, 0.01 inch, with the following physical properties:

Table 995-4 Plastic Signal Housings and Visors		
Test	Minimum Requirement	Method
Specific Gravity	1.17	ASTM D792
Vicat Softening Temp.	305-325°F (152 – 163°C)	ASTM D1525
Brittleness Temp.	Below -200°F (-129°C)	ASTM D746
Flammability	Self-extinguishing	ASTM D635
Tensile Strength	Yield, 8500 psi (58 MPa)	ASTM D638
Elongation at yield	5.5 - 8.5%	ASTM D638
Shear Strength	Yield, 5500 psi (38 MPa)	ASTM D732
Izod impact strength	15ft-lb/in (800 J/m)	ASTM D256
Fatigue strength	950 psi (6.5MPa) at 2.5 mm cycles	ASTM D671

SUBARTICLE 995-7.1 is deleted and the following substituted:

995-7.1 General: Fastening hardware such as bolts, nuts, washers, set screws, studs, U-bolts, cable and cable swags, must be provided by the mounting assembly manufacturer, must be SAE Type 316 or 304 stainless steel. Hardware (studs, bolts and U-bolts) must be a minimum of 5/16 inch diameter unless otherwise specified in this Section. SAE Grade 8 bolts and nuts are also acceptable. Metallic mounting assemblies must meet ASTM B117 for corrosion resistance.

Connections that provide an entrance to the interior of a traffic device must be weather-resistant.

All assemblies must be constructed to support the weight of any combination of signal indications with all accessories such as back plates and visors.

Connections between signal, disconnect and disconnect hanging hardware must be of the tri-stud design unless otherwise specified in this Section. Tri-stud washers must be a minimum 0.090 inch thick unless otherwise specified in this Section.

Connections must be designed to mate with a standard traffic signal's 2-inch I.D. opening and must be capable of providing positive positioning and alignment of the traffic device. Connection type may be a 72-tooth serrated edge or other connection type as long as all other specifications are met. For 72-tooth serrated edge connections, the teeth must be clean, sharp, and at least 1/8 inch wide and 3/64 inch deep. All connection types must be weather resistant.

All mounting assemblies must be capable of providing adjustment in multiple directions for proper alignment of the attached traffic device and to prevent rotation around the vertical axis or misalignment after installation.

Use studs that are either cast directly into the aluminum during the casting process or tapped and locked with a locking material. In each case, a pull-out force must be provided. Messenger wire clamps must be extruded aluminum six inches long or cast U-bolt type.

Torque specifications must be included for all fastening hardware with the assembly installation instructions.

SUBARTICLE 995-9.2 is deleted and the following substituted:

995-9.2 Standard Pedestrian Pushbutton Detector: Pushbuttons must be raised from or flush with their housings and be a minimum of 2 inches in diameter. The pushbutton must require no more than 5 pounds of force to activate. The detector must be weather-tight and tamper resistant.

SUBARTICLE 995-9.4.4 is deleted and the following substituted:

995-9.4.4 Electrical Requirements: Passive Detectors shall operate using a nominal input voltage of 120 V_{AC}.

SUBARTICLE 995-9.5 is deleted and the following substituted:

995-9.5 Electrical Requirements: If a system device requires operating voltages other than 120 V_{AC}, supply a voltage converter.

SUBARTICLE 995-11.5 is deleted and the following substituted:

995-11.5 Intelligent Transportation System Cabinets: The cabinet shell must conform to NEMA 3R requirements, be constructed of unpainted sheet aluminum alloy 5052-H32 with a minimum thickness of 0.125 inch and have a smooth, uniform natural aluminum finish without rivet holes, visible scratches or gouges on the outer surface. Other finishes are acceptable if approved.

The exterior dimensions for cabinets are listed below.

Table 995-7
Exterior Cabinet Dimensions in Inches

Cabinet Type	Height	Width	Depth
340	66” - 68”	44” - 46”	26” - 28”
336	36” - 39”	24” - 26”	20’ - 22”
336S	46” - 48”	24” - 26”	22” - 24”
334	66” - 68”	24” - 26”	30” - 32”
332D	66” - 68”	48” - 50”	30” - 32”
P44	55” - 59”	44” - 46”	26” - 29”

The cabinet must be weather resistant and constructed with a crowned top to prevent standing water. All exterior cabinet welds must be gas tungsten arc (TIG) welds and all interior cabinet welds must be gas metal arc (MIG) or TIG welds. All exterior cabinet and door seams must be continuously welded and smooth and all inside and outside edges of the cabinet must be free of burrs, rounded and smoothed for safety. All welds must be neatly formed and free of cracks, blow holes and other irregularities. Use ER5356 aluminum alloy bare welding electrodes conforming to AWS A5.10 requirements for welding on aluminum. Procedures,

welders and welding operators must conform to AWS requirements as contained in AWS B3.0 and C5.6 for aluminum.

The cabinet must have a lifting eye plate on both sides of the top of the cabinet for lifting and positioning it. Each lifting eye must be secured with a minimum of two bolts to the cabinet body and have a lift point opening diameter of 0.75 inch and capable of supporting a weight load of 1,000 pounds. All external bolt heads must be tamperproof.

Ground-mount cabinets must include a removable base plate and two aluminum plates, welded inside, for anchoring the cabinet. Fabricate the plates from aluminum alloy 5052-H32 a minimum of 4 inches wide by 0.125 inch thick.

995-11.5.1 Doors: Provide cabinets with front and rear doors, each equipped with a lock and handle. Doors must be full size, matching the height and width dimensions of the cabinet enclosure, with no fewer than three Type 4 or larger stainless steel hinges or; alternately, one full-length "piano" hinge. Hinges must be constructed of 14 gauge stainless steel with stainless steel hinge pins that are spot-welded at the top. Mount the hinges so that they cannot be removed from the door or cabinet without first opening the door. Brace the door and hinges to withstand 100 pounds per vertical foot of door height load applied to the outer edge of the door when standing open. Ensure there is no permanent deformation or impairment of any part of the door or cabinet body when the load is removed.

Door opening must provide a flange that allows the door gasket to mate with a flat surface. Include a gasket made of closed-cell material resistant to UV, weathering, elevated temperatures, and permanent deformation that is permanently bonded to the inside of each door forming a weather-tight seal when the door is closed.

995-11.5.2 Latches: Provide all cabinets with a three-point draw roller latching system for the doors. The latching system must have the following latching points.

1. Center of the cabinet (lock).
2. Top of the cabinet – controlled by the door handle.
3. Bottom of the cabinet – controlled by the door handle.

The latching points on the top and bottom of the cabinet must remain in the locked position until the main cabinet door lock is unlocked. The locking mechanism must be equipped with nylon rollers to secure the top and bottom of the door.

Provide the cabinet with a door stop that retains the main door open in a 90 degree and 120 degree position.

995-11.5.3 Rails: Provide the cabinet with four cabinet rails that form a cage for mounting miscellaneous wiring panels and various mounting brackets. Use rails constructed of either 0.1345 inch thick plated steel or 0.105 inch thick stainless steel that extend the length of the cabinet's sides, starting from the bottom of the enclosure. Rails must be keyhole designed with slots 2 inches on center with a top opening of 5/8 inch in diameter to allow the insertion of a 5/8 inch by 1 inch carriage bolt. Rails must be 1-1/2 to 2 inches wide by 1/2 inch deep, drilled and tapped for 10-32 screws or rack screws with EIA universal spacing. Do not use unistruts or other rail types.

995-11.5.4 Racks: The cabinet must include a standard 19-inch EIA/TIA equipment rack centered in the cabinet for mounting devices to be installed inside. Clearance in the rack between the rails must be 17-3/4 inches.

995-11.5.5 Shelf: Provide a level, rollout internal shelf with a minimum work area measuring 10 inches by 10 inches. The shelf must be capable of sustaining a constant 20 pound load and the shelf position must be adjustable.

995-11.5.6 Sunshield: Sunshields must be mounted with tamper resistant hardware to standoffs that provide an air gap of at least one inch between the exterior cabinet walls and the sunshields. Sunshield standoffs located on the roof of the cabinet must be welded to the cabinet body. Construct sunshields of 0.125 inch thick 5052-H32 aluminum sheet with corners that are rounded and smoothed for safety.

995-11.5.7 Ventilation: Provide ventilation through the use of a louvered vent at the bottom of the door. Vent depth must not exceed 0.25 inch. Provide an air filter a minimum of 192 square inches and 1 inch thick behind the vent. The filter must be removable and held firmly in place so that all intake air is filtered.

Provide a bottom trough and a spring-loaded upper clamp to hold the filter in place. The bottom trough must drain any accumulated moisture to the outside of the field cabinet.

ITS field cabinets must have dual thermostatically controlled fans, with one thermostat per fan, rated for continuous duty with a service life of at least 3 years. Mount thermostats on the inside top of the cabinet. Thermostats must be user adjustable to allow temperature settings ranging from a minimum of 70°F to a maximum of 140°F and capable of activating the fans within plus or minus 5 degrees of the set temperature. Use UL listed exhaust fans having a minimum air flow rating of 100 cubic feet per minute. Electric fan motors must have ball or roller bearings. Vent the exhaust air from openings in the roof of the field cabinet.

995-11.5.8 Electrical Requirements: SPD's must be accessible from the front of any panel used in the cabinet. Connect the SPD for the cabinet's main AC power input on the load side of the cabinet circuit breaker. All wiring must be laced. All conductors must be stranded copper.

995-11.5.8.1 Service Panel Assembly: Provide a service panel assembly to function as the entry point for AC power to the cabinet and the location for power filtering, transient suppression and equipment grounding. Provide branch circuits, SPDs, and grounding as required for the load served by the cabinet, including ventilation fans, internal lights, electrical receptacles, etc.

995-11.5.8.2 Terminal Blocks: Terminate electrical inputs and outputs on terminal blocks. The voltage and current rating of the terminal block must be greater than the voltage and current rating of the wire fastened to it.

Terminate conductors on terminal blocks using insulated terminal lugs large enough to accommodate the conductor to be terminated. When two or more conductors are terminated on field wiring terminal block screws, use a terminal ring lug for termination of those conductors. Number all terminal block circuits and cover the blocks with a clear insulating material to prevent inadvertent contact.

995-11.5.8.3 Ground BusBar: Fabricate ground busbars of copper or aluminum alloy material compatible with copper wire and provide at least two positions where a No. 2 AWG stranded copper wire can be attached.

Mount the ground busbar on the side of the cabinet wall adjacent to the service panel assembly for the connection of AC neutral wires and chassis ground wires. If more than one ground busbar is used in a cabinet, use a minimum of a No. 10 AWG copper wire to interconnect them. Connect the equipment rack to the ground busbar in the cabinet to maintain electrical continuity throughout the cabinet.

Follow the PANI recommendations of USDA-RUS-1751 for connections to the ground busbar. Producer (P) or electrical power and sources of stroke current

connections shall be on the left end of the busbar. Absorbing (A) or grounding wires shall be connected immediately right of the P connections. Non-isolated (N) connections such as doors and vents shall be connected to the right of the A connections. Isolated (I) equipment grounds from equipment in the cabinet shall be connected on the right end of the busbar.

995-11.5.8.4 Power Distribution Assembly: Furnish a power distribution assembly that fits in the EIA 19-inch rack and provides for protection and distribution of 120 V_{AC} power.

995-11.5.8.5 Interior Lighting: Provide one or more light fixtures that illuminate the entire interior of the cabinet. All light fixtures must automatically turn on when the main cabinet door is opened and turn off when the door is closed.

995-11.5.9 Adapter Bracket: Provide an adapter bracket for pole mounted cabinets that is slotted or otherwise designed to allow banding straps to be installed to avoid pole handholes.

SUBARTICLE 995-12.1 is deleted and the following substituted:

995-12.1 General: Traffic controller accessories must meet the industry standards in Table 995-8 as well as the environmental requirements of those standards.

Table 995-8
Traffic Controller Accessory Standards

Device	Standard
Malfunction Management Unit	NEMA TS2-2021, Section 4
Power Supply	NEMA TS2-2021, Section 5.3.5
Load Switch	NEMA TS2-2021, Section 6.2
Flasher	NEMA TS2-2021, Section 6.3
Bus Interface Unit	NEMA TS2-2021, Section 8
Model 206L Power Supply Unit	CALTRANS TEES, 2020, 3.4
Model 208 Monitor Unit	CALTRANS TEES, 2020, 3.5
Model 210 Monitor Unit	CALTRANS TEES, 2020, 3.6
Power Distribution Assembly	CALTRANS TEES, 2020, 6.4.3
Input File	CALTRANS TEES, 2020, 6.4.4

SUBARTICLE 995-14.2 is deleted and the following substituted:

995-14.2 Housing: The sign housing must be constructed of continuous 5052 or 6063-T5 aluminum. All housing, corners, and door seams must be continuously welded. All exterior surfaces of the assembly must be powder-coat painted in accordance with Military Standard MIL-PRF-24712A or AAMA-2603-02. Finish must meet the requirements of ASTM D3359, ASTM D3363, and ASTM D522. Sign housings with any interior airspace must consist of a box type enclosure and separate hinged door assembly. The sign housing must include provisions to prevent water from entering the sign housing. Drain holes in the sign larger than 0.125 inch must be covered by a screen.

Signs must have removable sign faces. The sign face must be secured by a method that holds the sign face securely in place. Slide-in grooves are allowed to secure the sign face if the sign is edge lit.

The sign face must be a translucent lens constructed of 0.125-inch thick high impact strength polycarbonate or acrylic meeting UL48. Background must be retroreflective sheeting coated with a transparent, pressure-sensitive adhesive film. Retroreflective sheeting must meet the requirements of Section 994 and be listed on the APL.

If a door opens upward, it must have a bracket on each side to secure the door in the open position during maintenance. Doors must be permanently and continuously sealed with a foam gasket listed to UL157 to prevent the entry of water into the sign housing. Each door must be secured from opening by stainless steel rotary action draw latches as follows:

Street name signs of 5 feet up to 7 feet in width must have a minimum of three latches for each sign door.

Street name signs over 7 feet up to 9 feet in width must have a minimum of four latches for each door.

The rotary action draw latch must be captive and will not become detached or allow the door to open when the sign housing is torqued or twisted.

The sign assembly must be designed and constructed to withstand 150 mph wind loads meeting the requirements of the Department's Structures Manual.

SUBARTICLE 995-16.4 is deleted and the following substituted:

995-16.4 Characters, Fonts, and Color: The signs must be capable of displaying American Standard Code for Information Interchange (ASCII) characters 32 through 126, including all uppercase and lowercase letters, and digits 0 through 9, at any location in the message line. Submit a list of the character fonts to the Engineer for approval.

All signs must be loaded (as a factory default) with a font in accordance with or that resembles the standard font set described in NEMA TS 4, Section 5.6. For signs with a pixel pitch of 35 mm or less, the sign must be loaded (as a factory default) with a font set that resembles the FHWA Series E2000 standard font.

DMS fonts must have character dimensions that meet the MUTCD, Section 2L.04, paragraph 08.

Full-color signs must display the colors prescribed in the MUTCD, Section 1D.05.

SUBARTICLE 995-16.8.2 is deleted and the following substituted:

995-16.8.2 Sign Controller: The sign controller must monitor the sign in accordance with NEMA TS 4, Section 9. The sign must monitor the status of any photocells, LED power supplies, humidity, and airflow sensors. Sign controllers must use fiber optic cables for data connections between the sign housing and ground-level cabinet.

The sign controller must be capable of displaying a self-updating time and date message on the sign. Sign controllers within ground cabinets must be rack-mountable, designed for a standard Electronic Industries Alliance (EIA) EIA-310 19 inch rack, and includes a keypad and display.

SUBARTICLE 995-16.8.5 is deleted and the following substituted:

995-16.8.5 Sign Controller Communication Interfaces: Ensure that EIA-232 serial interfaces support the following:

Table 995-10 Communication Interface Requirements	
Data Bits	7 or 8 bits
Parity	Even, Odd, or None
Number Stop Bits	1 or 2 bit

The sign controller must have a 10/100 Base TX 8P8C port or a 100 Base FX port Ethernet interface.

The TMC or a laptop computer must be able to remotely reset the sign controller.

SUBARTICLE 995-16.10 is deleted and the following substituted:

995-16.10 TMC Communication Specification for all DMS: The sign controller must be addressable by the TMC through the Ethernet communications network using software that complies with the 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. The software must implement all mandatory objects in the document, Dynamic Message Sign NTCIP Requirements, as published on the Department's State Traffic Engineering and Operations Office web site at the following URL: https://www.fdot.gov/traffic/Traf-Sys/Product-Specifications.shtm.

The sign must comply with the NTCIP 1102v01.15, 2101v01.19, 2201v01.15, 2202v01.05, and 2301v02.19 Standards.

Ensure that the controller's internal time clock can be configured to synchronize to a time server using the network time protocol (NTP). NTP synchronization frequency must be user-configurable and permit polling intervals from once per minute to once per week in one-minute increments. The controller must allow the user to define the NTP server by IP address.

SUBARTICLE 995-17.1 is deleted and the following substituted:

995-17.1 General: 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.

The term EDS refers to a general category of electronically enhanced signs with warning, regulatory, or guide legends.

EDS 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.

SUBARTICLE 995-17.2.11 is deleted and the following substituted:

995-17.2.11 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.

SUBARTICLE 995-17.4 is deleted and the following substituted:

995-17.4 Variable Speed Limit Signs: Display modules for variable speed limit signs (VSLS) must have a minimum two-inch contrasting margin around digits, text, or graphics. VSLS must utilize LED technology for the dynamic display.

995-17.4.1 VSLS Battery Backup System: AC powered signs must include a battery backup system that maintains full operation of the sign for a minimum of 2 hours in the event of utility power loss. Operation on battery backup can have no visible effect on the appearance of the display.

995-17.4.2 VSLS Legend: VSLS must be able to display speed limits from 5-70 mph in 5 mph increments and mimic the physical appearance of a static regulatory speed limit sign as shown in the MUTCD and SHS. VSLS 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.

995-17.4.2.1 VSLS Controller Communications: VSLS must be equipped with a sign controller that includes a minimum of one Ethernet 10/100 Base TX 8P8C port.

995-17.4.2.2 Configuration and Management Requirements for VSLS: VSLS must support remote management from a TMC and local management using a laptop computer. Remote and local computers must be able to reset VSLS sign controller. VSLS must log and report status, errors, and failures, including data transmission errors, receipt of invalid data, communication failure recoveries, 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.

The sign controller must be addressable through an Ethernet communication network using software that complies with the NTCIP requirements published online by the TERL at: https://www.fdot.gov/traffic/. The sign must implement any NTCIP standards required to achieve interoperability and interchangeability. Any additional objects implemented by the software must not interfere with the standard operation of any mandatory objects. VSLS must be compatible with the Department's SunGuide® software.

SUBARTICLE 995-17.6 is deleted and the following substituted:

995-17.6 Electronic Speed Feedback Signs: The ESFS display background must be flat black (FED-STD-595-37038) with a reflectance value not exceeding 25%. ESFS shall have a minimum one-inch contrasting margin around illuminated characters. Solar powered systems shall be designed to operate for a minimum of 10,000 activations per day and provide 10 days of operation without solar charging.

995-17.6.1 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. When no advancing traffic is detected, the display must be blank. The speed detector must not 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.