FLORIDA DEPARTMENT OF TRANSPORTATION

FDOT MODIFICATIONS TO STANDARD SPECIFICATIONS FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINAIRES AND TRAFFIC SIGNALS (LTS-5)

FDOT STRUCTURES MANUAL
VOLUME 9
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Structures Design
Florida's Transportation Engineers

Table of Contents

1 INTRODUCTION

1.1 SCOPE

Add the following:

Conform to the date specific AASHTO Publications listed in ***Structures Manual Introduction*** I.6 References.

2 GENERAL FEATURES OF DESIGN

2.4 Functional Requirements

2.4.2 Structural Supports for Signs and Traffic Signals

C 2.4.2
Add the following:
For additional design information, refer to ***Plans Preparation Manual*** Chapters 7 and 29***.***

2.4.2.2 Size, Height and Location of Signs (Rev. 01/10)

Add the following:

Span type overhead sign structures in urban locations shall be designed either for the actual signs shown on the signing plans or for a minimum sign area of 120 sq. ft. (12 ft. W x 10 ft. H) per lane, whichever is the greater. If the signing plans require signs for only one traffic direction, the minimum sign area per lane requirement applies to the traffic lanes in this direction only.

Cantilever type overhead sign structures in urban locations shall be designed either for the actual signs shown on the signing plans or for a minimum sign area of 80 sq. ft. (8 ft. W x 10 ft. H) located at the end of the cantilever, whichever provides the more stringent load or stress at the location under consideration.

Figures 1 and 2 show how to apply the above minimum sign areas for span type overhead sign structures in urban locations.

C 2.4.2.2
Add the following:
Minimum sign areas for overhead variable message sign supports are normally not required.

Overhead signs in rural locations should be designed for the actual sign shown on the signing plans.

Figure 1 Example: actual signs

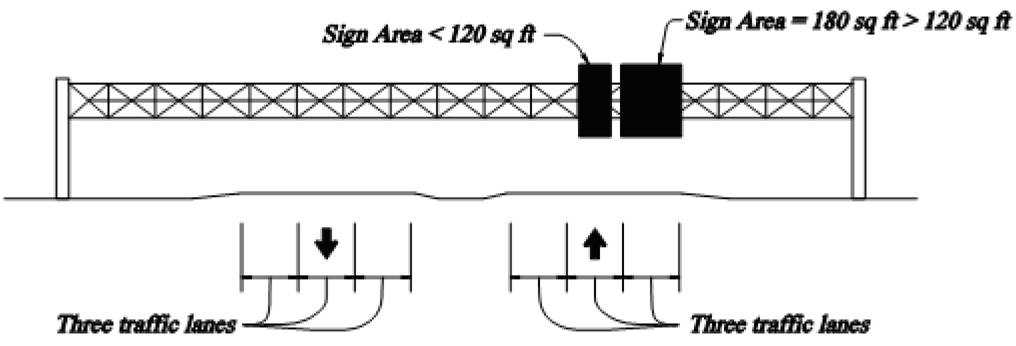
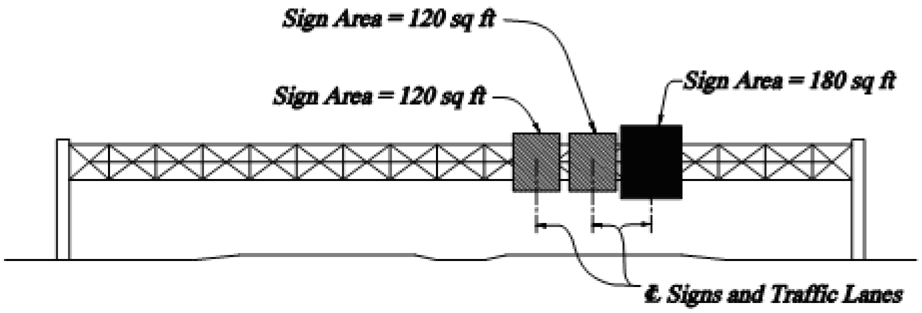


Figure 2 Example: signs used in design



2.4.2.4 Variable Message Signs (Rev. 01/10)

Replace the first sentence with the following:

Cantilevered and noncantilevered support structures for variable message signs (VMS) shall be designed for fatigue in accordance with Section 11, "Fatigue Design."

3 LOADS

3.8 Wind Load (Rev. 01/10)

Delete the last paragraph and add the following:

The use of Appendix C is only permitted for the evaluation of existing structures.

3.8.2 Basic Wind Speed (Rev. 01/10)

Delete the entire paragraph including Figure 3-2, and add the following:

The wind loads shall be based on the wind speeds (mph) shown in FDOT SDG Table 2.4.1-2

3.8.3 Importance Factor

Add the following Wind Importance Factor to Table 3-2:

Recurrence Interval Years	V = 85-100 mph	V > 100 mph	Alaska
1.5	0.45	0.2	---

Delete Table 3-3 and add the following FDOT Table 3-3:

FDOT Table 3-3 Minimum Design Life

Design Life	Structure Type
50-year	Overhead sign structures
	Luminaire support structures >50' in height.
	Mast Arms
	Monotubes
	Steel Strain Poles
	ITS Camera Poles
25-year	Luminaire support structures ≤ 50' in height.
	Concrete Strain Poles
10-year	Roadside sign structures
1.5-year	Temporary construction signs

A 1.5-year design life (Ir = 0.2) for temporary construction signs shall only be used with a 150 mph design wind speed.

C 3.8

FDOT ***Plans Preparation Manual***, Volume 1, Section 25.4.27 defines the structures where evaluation is necessary.

C 3.8.2

Add the following:

FDOT SDG Table 2.4.1-2 was derived from the ASCE 7-05 wind speed map.

C 3.8.3

Add the following:

A 1.5-year design life has been added for temporary construction signs. The importance factor is calculated based on "Wind Speed for Design of Temporary Structures" by D.W. Boggs and J.A. Peterka, Structures Congress, 1992, Compact Papers, ASCE, 1992.

Florida has traditionally designed Luminaire support structures, 50 feet in height and less, and strain poles for a 25 year design life.

Concrete strain poles are designed for zero tension stress, therefore a twenty-five year design life is appropriate.

3.8.6 Drag Coefficients C_d (Rev. 01/10)

Replace the coefficient of drag for Traffic Signals in Table 3-6 with the following:

Traffic Signals - no ability to swing - 1.2

Traffic Signals - installed with the ability to swing on span wire systems under full wind load - 0.7

C 3.8.6

Add the following to note 2 at the bottom of Table 3-6:

A drag coefficient for traffic signal installed with the ability to swing has been established through research (Cook 2007). On span wire systems where signal and signs are allowed to swing, varying C_d as a function of swing angle is allowed (Hoit and Cook 1997).

3.8.7 Lift Coefficient for Traffic Signals C_l (Rev. 01/10)

New Section, add the following:

For traffic signals installed with the ability to swing on span wire systems under full design wind speed (Group II loading), use a coefficient of lift C_l equal to 0.4. To compute the lift pressure, use Eq. 3-1 substituting C_l for C_d. Using a reduced signal area based on the swing angle, compute the lift force and apply in a vertical direction opposite dead load.

C 3.8.7

Add the following:

A lift coefficient of 0.4 on traffic signals installed on span wire systems has been established through research (Cook 2007). On span wire systems where signal and signs are allowed to swing, varying C_l as a function of swing angle is allowed (Hoit and Cook 1997).

3.9 Design Wind Loads On Structures (Rev. 01/10)

3.9.1 Load Application

Add the following:

When the full design wind speed is used for Group II loading on span wire systems, use a reduced signal and sign area based on the following swing angles:

Wind Speed	Swing Angle
110 mph	45 degrees
130 mph	55 degrees
150 mph	60 degrees

C 3.9.1

Add the following:

Swing angles for traffic signals and signs installed on span wire systems have been established through research (Cook 2007).

3.10 References (Rev. 01/10)

Add the following:

Cook, R.A. (2007). ***Development of Hurricane Resistant Cable Supported Traffic Signals*** (FDOT Report# BD545 RPWO #57). Gainesville, Florida: University of Florida.

Hoit, M.I., Cook, R.A. (1997). ***Computer Aided Design Program for Signal Pole and Span Wire Assemblies With Two Point Connection System*** (FDOT Report# 0510653). Gainesville, Florida: University of Florida.

5 STEEL DESIGN

5.15 Welded Connections

5.15.1 Circumferential Welded Splices

Delete the last sentence and add the following:

On steel sign and signal structures, no circumferential welds are permitted on the uprights or arms with the exceptions of the base plate socket weld, the flange plate connections on tubular truss members, and the mitered arm-to-upright angle weld on monotubes.

5.16 Bolted Connections

Add the following:

Design all pole to arm connections on Mast Arm structures as "through bolted". Tapped connections are not permitted.

5.17 ANCHOR BOLTS

Add the following:

All sign, signal, and lighting structures designed for a minimum service life of 50 years (wind speed based on a 50-year mean recurrence interval) shall use a minimum of six, Grade 55, ASTM F1554 anchor bolts at the pole to foundation connection.

5.17.1 Types

Delete c) and add the following:

Both Adhesive anchors and Dywidag bars are not permitted.

5.17.6 Additional Considerations (Rev. 01/10)

5.17.6.4 Bending Stress in Anchor Bolts

Change "should" to "shall" in the first sentence.

5.17.6.5 Use of Grout (Rev. 01/10)

Add the following:

Grout pads underneath the baseplates in double-nut moment joints of miscellaneous highway structures (i.e. mast arms, overhead sign structures, high mast lights, steel strain poles and monotube structures) are not required.

C 5.17.6.5

Add the following:

Inspections have shown that a poorly functioning grout pad is worse than no grout pad at all. For poles without a grout pad beneath the base plate, the double-nut moment joint requires adequate tensioning of the anchor bolts. It is critical that the nuts beneath the base plate, typically referred to as leveling nuts, are firmly tightened and locked to prevent loosening. This locking mechanism is accomplished through the turn of the nut method specified in FDOT Specification 649 or a properly place grout pad.

11 FATIGUE DESIGN

11.1 Scope (Rev. 01/10)

Add the following:

When using FDOT Design Standards for overhead tri-chord trusses with flat panel signs and Mast Arms with traffic signals, analysis using Section 11 is not required.

C 11.1

Add the following:

There have been no reports of significant damage to Mast Arm signal structures and overhead tri-chord sign trusses designed and built using FDOT Design Standards.

13 FOUNDATION DESIGN

13.6 Drilled Shafts

Add the following:

Drilled shafts are the preferred foundation type on high mast light poles, span overhead signs, mast arms, monotubes, and steel strain poles.

13.6.1 Geotechnical Design

13.6.1.1 Embedment

Add the following:

Use a safety factor against overturning of 2 when using the Broms method.

13.6.1 Structural Design

Add the following:

Reinforce drilled shaft foundations with a minimum of 1% steel. In drilled shafts for overhead sign and signal structures, place #5 stirrups at 4 inch spacing in the top two feet of shaft.

13.6.1.1 Details

Replace the second sentence with the following:

A minimum concrete cover of 6 inches over steel reinforcement is required.

Add the following:

A minimum main reinforcement clear spacing of six inches is required for proper concrete consolidation.

13.10 Embedment of Lightly Loaded Small Poles and Posts

Add the following:

When using the Broms method for ground sign foundation design, use a safety factor against overturning of 1.3. When using the Broms method for direct burial concrete pole foundation design, use a safe factor against overturning of 1.5.

APPENDIX C (Rev. 01/10)

C.1 Alternate Method

Add the following:

When evaluating existing structures in accordance with ***PPM*** 25.4.27, an allowable overstress of 1.4 is allowed for Group II loading.

C C.1
By allowing an overstress factor of 1.4, consistent with in previous editions of LTS, properly designed existing structures will be allowed to remain in place in accordance with the ***PPM****.*

C.2 Wind Load

Delete the 2nd and 3rd sentence and add the following:

The design wind pressures shall be computed using the wind pressure formula, Eq. C-1, with the appropriate wind speed shown in FDOT Table C.2-1, Wind Speed by County.

FDOT Table C.2-1 Wind Speed by County

County (Dist)	10 year	25 year	50 year	County (Dist)	10 year	25 year	50 year
Alachua (2)	60	80	90	Lee (1)	80	90	100
Baker (2)	60	80	90	Leon (3)	60	70	80
Bay (3)	70	80	90	Levy (2)	70	80	90
Bradford (2)	60	80	90	Liberty (3)	60	80	90
Brevard (5)	80	90	100	Madison (2)	60	70	80
Broward (4)	90	100	110	Manatee (1)	80	90	100
Calhoun (3)	60	80	90	Marion (5)	60	80	90
Charlotte (1)	80	90	100	Martin (4)	80	90	100
Citrus (7)	70	80	90	Miami-Dade (6)	90	100	110
Clay (2)	60	80	90	Monroe (6)	90	100	110
Collier (1)	80	90	100	Nassau (2)	70	80	90
Columbia (2)	60	70	80	Okaloosa (3)	70	90	100
DeSoto (1)	70	80	90	Okeechobee (1)	70	80	90
Dixie (2)	70	80	90	Orange (5)	70	80	90
Duval (2)	70	80	90	Osceola (5)	70	80	90
Escambia (3)	70	90	100	Palm Beach (4)	80	100	110
Flagler (5)	70	80	90	Pasco (7)	70	90	100
Franklin (3)	70	90	100	Pinellas (7)	70	90	100
Gadsden (3)	60	70	80	Polk (1)	70	80	90
Gilchrist (2)	60	80	90	Putnam (2)	60	80	90
Glades (1)	70	80	90	St. Johns (2)	70	80	90
Gulf (3)	70	90	100	St. Lucie (4)	80	90	100
Hamilton (2)	60	70	80	Santa Rosa (3)	70	90	100
Hardee (1)	70	80	90	Sarasota (1)	80	90	100
Hendry (1)	70	80	90	Seminole (5)	70	80	90
Hernando (7)	70	90	100	Sumter (5)	60	80	90
Highlands (1)	70	80	90	Suwannee (2)	60	70	80
Hillsborough (7)	70	80	90	Taylor (2)	70	80	90
Holmes (3)	60	70	80	Union (2)	60	80	90
Indian River (4)	80	90	100	Volusia (5)	80	90	100
Jackson (3)	60	70	80	Wakulla (3)	70	80	90
Jefferson (3)	60	70	80	Walton (3)	70	80	90
Lafayette (2)	60	80	90	Washington (3)	60	80	90
Lake (5)	60	80	90				

VOLUME 9 - REVISION HISTORY

2.4.2.2 .... Added commentary.

2.4.2.4 .... Added section.

3.8 .... Added provision for the use of Appendix C for the evaluation of existing structures; added commentary C 3.8.

3.8.2 .... Removed wind speed table and added reference to SDG Table 2.4.1-2.

3.8.6 .... Added Section and Commentary.

3.8.7 .... Added Section and Commentary.

3.9 .... Added Section and Commentary.

3.10 .... Added Section.

5.17.6 .... Deleted Section 5.17.6.1 and commentary C 5.17.6.1.

5.17.6.5 .... Deleted requirement for grout pads.

11.1 .... Revised Section and Commentary.

Appendix C ...... Added Appendix C, Section C.1 and Commentary C C.1, Section C.2, and FDOT Table C.2-1.