Session 17

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FL. Dept. of Transportation

Adoption of 2001 AASHTO Standard Specifications for Structural Support for Highway Signs, Luminairies and Traffic Signals

Topic Description

FDOT is in the process to bring all Luminaires, Traffic Signals and Signs Indexes up to AASHTO 2001 compliance. This presentation is an effort to keep the industry informed.

Speaker Biography

Ms White is a Structure Design Engineer working for FDOT Structures Design Office. She has worked for FDOT for over 9 years. Her working experience includes Thomas Drive in house design project, load rating, standard index development, QPL evaluations and computer design program development.

Ms White's specialty is Computational Engineering Mechanics. She is one of the team members in charge of the adoption of 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and traffic Signals (LTS-4). The efforts involve Standard Index evaluations and modifications, Specification, Plans Preparation Manual, TRNS*PORT and QPL evaluation criteria updates, as well as existing FDOT design programs improvements.

Adoption of 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals

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Structures Design Office
Tallahassee
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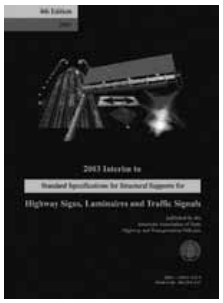
Future of FDOT Lighting, Traffic Signal, and Sign Structures

FDOT to adopt 2001 AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 4th Edition (LTS-4) and all Interims.



LTS-4 Major Changes

Wind speed equations

$$P_{1994} = 0.00256 \cdot C_h (1.3 \cdot V)^2 \cdot C_d$$ (fastest mile)

$$P_{2001} = 0.00256 \cdot K_z \cdot G \cdot V^2 \cdot I_r \cdot C_d$$ (3 sec gust)

Gust Effect Factor G = 1.14

Saffir-Simpson Hurricane Scale					
Category	One	Two	Three	Four	Five
Sustained Winds (60 sec) *(Weather Service)*	74-95 mph	96-110 mph	111-130 mph	131-155 mph	greater than 155 mph
3 second Gust *(used in Design)*	90-119 mph	120-139 mph	140-164 mph	165-194 mph	greater than 194 mph

AASHTO 2001 Design Code			
3 Second Gust Design Wind Speed			**Design Importance Factor and Structure Types**
150 mph (Cat Three)	130 mph (Cat Two)	110 mph (Cat One)	*1.00 Importance Factor- 50 Year Recurrence Interval* High Mast Light Poles, Overhead Sign Structures, Mast Arms
134 mph (Cat Two)	116 mph (Cat One)	98 mph (Cat One)	*0.80 Importance Factor - 25 Year Recurrence Interval* Strain Poles, Aluminum Light Poles
110 mph (Cat One)	96 mph (Cat One)	81 mph (Tropical Storm)	*0.54 Importance Factor - 10 Year Recurrence Interval* Single and Multiple Column Ground Signs

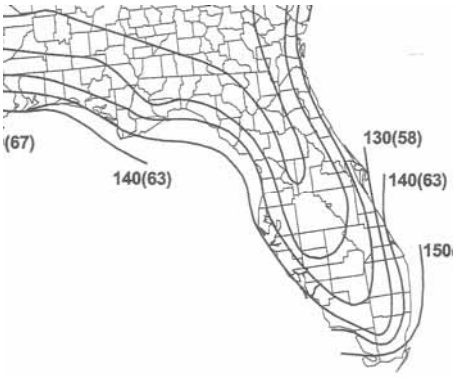
LTS-4 and FDOT

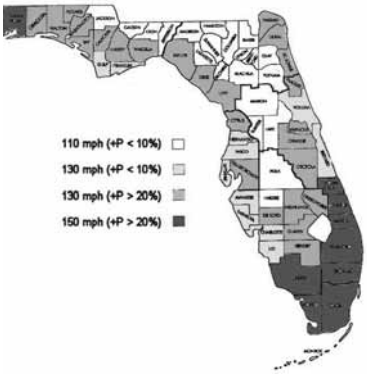
In lieu of LTS-4 wind speed map (Figure 3-2), FDOT will use a simplified county wind speed table (based on wind speed map in the current ASCE 7)

LTS-4 and FDOT

Wind Speed Maps

ASCE 7-02 *vs.* FDOT





FDOT Design Wind Speed By County

110mph Zones: Alachua (2), Baker (2), Bradford (2), Clay (2), Columbia (2), Gadsden (3), Gilchrist (2), Hamilton (2), Hardee (1), Jackson (3), Jefferson (3), Lafayette (2), Lake (5), Leon (3), Madison (2), Marion (5), Polk (1), Putnam (2), Sumter (5), Suwannee (2), and Union (2).

130mph Zones: Bay (3), Brevard (5), Calhoun (3), Charlotte (1), Citrus (7), DeSoto (1), Dixie (2), Duval (2), Flagler (5), Franklin (3), Glades (1), Gulf (3), Hendry (1), Hernando (7), Highlands (1), Hillsborough (7), Lee (1), Levy (2), Liberty (3), Manatee (1), Nassau (2), Okaloosa (3),,Okeechobee (1), Orange (5), Osceola (5), Pasco (7), Pinellas (7), St. Johns (2), Sarasota (1) Seminole (5), Taylor (2), Volusia (5), Wakulla (3), Walton (3), and Washington (3).

150mph Zones: Broward (4), Collier (1), Escambia (3), Holmes (3), Indian River (4), Martin (4), Miami-Dade (6), Monroe (6), Palm Beach (4), St. Lucie (4), and Santa Rosa (3)

LTS-4 Major Changes

- Height and Exposure Factor K_z
  - height ≤ 16 feet K_z=0.87 (LTS-4)
  - height ≤ 14 feet C_h=0.80 (LTS-3)
- Allowable Overstress Group II Load (DL+W)
  - 1.33 (LTS-4)
  - 1.40 (LTS-3)
- Many changes in equation format

FDOT Lighting, Traffic Signal, and Sign Structures

- 50 Year Recurrence Interval
  - Overhead Sign Structures (Span and Cantilever)
  - High Mast Light Poles (> 50 feet)
  - Mast Arms and Monotubes
- 25 Year Recurrence Interval
  - Aluminum Light Poles (≤ 50 feet)
  - Span Wire Signal Structures (Steel and Concrete Poles)
- 10 Year Recurrence Interval
  - Ground Signs (single and multi-post)

LTS-4 and FDOT

LTS-4, Section 11: Fatigue Design will not be implemented by FDOT until further studies are conducted

FDOT Policy Updates

- **Design Standards**
- **Computer Programs**
  - Cantilever Overhead Sign Structures, Span Overhead Sign Structures, High Mast Light Poles, Mast Arms, Atlas, Strain and Multiple Column Ground Signs.
  - Drilled Shaft and Spread Footing Design for Sign and Signal Structures.
- **Qualified Products List**
  - Mast Arms, Aluminum Light Poles, Steel Strain Pole, Concrete Strain Pole, Single Column Ground Signs

FDOT Policy Updates (Cont.)

- **Specifications**
- **Plans Preparation Manual, Ch. 7 & 29**
  - Design Wind Speed by County
  - Design Axial, Shear and Moments (except Concrete Strain Poles)
  - Instructions to Designer (except Single Column Ground Signs)
  - Design Criteria
- **TRNS*PORT (Basis of Estimate)**
  - Aluminum Light Poles

Overhead Sign Structures
Span and Cantilever - 50 Year

LTS-4 updates for:

- *FDOT Design Program*
- *Design Standard*

High Mast Light Poles (> 50 feet)
50 Year

LTS-4 updates for:

- *Mathcad Program*
- *Future Design Standard*

Mast Arms, Monotubes - 50 Year

LTS-4 updates for:

- *Mast Arm Program*
- *Design Standard*
- *QPL approvals*
- *PPM Updates*

Concrete Strain Poles - 25 Year

LTS-4 updates for:

- *Design Standard*
- *Computer Programs*
  - ✓*Atlas*
  - ✓*Strain (Mathcad)*
- *QPL approvals*

Span Wire Performance Parametric Study

Span Length (ft)	Wind Speed (mph)	Signal Spacing (ft)	5.00% Initial Sag		3.00% Initial Sag	
			Max. No. Signals	Max Tension (kip)	Max. No. Signals	Max Tension (kip)
150	150	12	4	7.547	2	6.907
150	150	9	4	7.646	2	6.919
150	150	6	4	7.735	2	6.929
150	110	12	13	7.469	7	7.786
150	110	9	11	8.011	6	7.443
150	110	6	9	7.613	6	7.621
100	150	12	5	7.401	3	7.342
100	150	9	5	7.727	3	7.449
100	150	6	5	8.017	3	7.545
100	110	12	9	5.192	9	6.788
100	110	9	12	6.433	10	8.074
100	110	6	12	7.93	7	7.595

Note: Analyses are based on 2001 AASHTO. Signals have 3 Sections that are one directional and with Back Plate. Signals are allowed to swing. Span Wires are 7/16 in in diameter with a design capacity of 8.0 kips. Kz is 0.945.

Steel Strain Poles - 25 Year

LTS-4 updates for:

- *Design Standard*
- *Computer Programs*
  - ✓*Strain (Mathcad)*
- *QPL approvals*
- *PPM Moment table*

STEEL STRAIN POLE ALLOWABLE MOMENT CAPACITY AT POLE BASE (kip*ft)

Pole Thickness	Pole Type						
	NS-IV Φ 14in	NS-V Φ 16in	NS-VI Φ 18in	NS-VII Φ 21in	NS-VIII Φ 23in	NS-IX Φ 25in	NS-X Φ 27in
0.239 in	100	132	167	216	252	290	331
0.313 in	------	171	218	298	358	416	472

Note: Test runs show that for the case of the Steel Strain Pole, Axial or Shear portions of the Combined Stress Ratio (CSR) are not significant enough to be comparable with the CSR from Bending.

Aluminum Light Poles (≤ 50 feet) 25 Year

LTS-4 updates for:

- *Design Standard*
- *QPL approvals*
- *PPM Axial, Shear and Moment tables.*
- *TRNS*PORT*

Ground Signs:
Single and Multiple Column - 10 Year

LTS-4 updates for:

- *Design Standard*
- *QPL approvals*

Single Column Ground Sign Index

WIND SPEED = 150 MPH

TOTAL PANEL AREA (SF) \ 'H' (FT)	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0
3			1			2							
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	Post Size Diameter (IN)	Post Size Wall (IN)
0	2.0	1/8
1	2.5	1/8
2	3.0	1/8
3	3.5	3/16
4	4.0	1/4
5	4.5	1/4
6	5.0	1/4
7	6.0	1/4

Thank You

- Contact Information

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