

Chapter 29

Structural Supports for Signs, Luminaires, and Traffic Signals

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Chapter 29

Structural Supports for Signs, Luminaires, and Traffic Signals

29.1 General

The design criteria for the structural design of all sign, signal, and lighting structures shall be in accordance with AASHTO's *2001 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals*, as modified by the *FDOT Structures Manual, Volume 9*.

Include structural details in the Plans for all sign, signal, and lighting structures. Use the *Design Standards* for sign, signal and lighting structures unless site conditions or other considerations require a custom design.

The following sign and signal structure limits apply:

1. Overhead sign span length: 250 feet
2. Overhead sign cantilever length: 50 feet
3. Mast Arm cantilever length: 78 feet
4. Signal cable span length: 250 feet

These limits were chosen based on past practice and practical experience.

A Design Variation is required when sign or signal structure limits are exceeded. The design variation documentation shall include the type of structure, height, length, discussion of alternatives, and costs.

29.2 Sign Structures

29.2.1 General

FDOT assigns identification numbers to overhead sign structures. See the *Structures Detailing Manual, Chapter 2*, for instructions.

The rectangular unidirectional slipbase sign support systems in **Index No. 11200** and **Index No. 11860** can be used as a single-post or double-post sign support system where both posts are within a 7-foot span. Single post installations may use any post up to a mass of 45 lb/ft. Two-post systems with both posts within a 7-foot span must use posts with a mass of 18 lb/ft or less. Larger posts with masses up to 45 lb/ft may also be used as dual post systems but the posts must be more than 7 feet apart. In no case, however, should the total mass of all the sign posts above the slip-plane and below the hinge be greater than 600 pounds.

29.2.2 Standard Single Column Ground Signs

Refer to *Design Standards, Index No. 11860*.

29.2.3 Standard Multipost Ground Signs

Refer to *Design Standards, Index No. 11200* and *FDOT Multi-Post2001 Sign Program and (old) FDOT Multi-Post Program*.

29.2.4 Standard Span Overhead Sign Structures

The EOR is responsible for the design of all overhead sign structures whether ground mounted or supported on a structure (including bridge structures), unless otherwise directed by the Department. This responsibility is for the entire sign structure, including the supports and foundations, as well as all details necessary to fabricate and erect the sign structures. The EOR is also responsible for the shop drawing review in accordance with **Chapter 28** when sign structure shop drawings are required by the Contract Documents.

In general, however, the designer may refer to the *Design Standards, Index No. 11320*, the *FDOT Span Overhead Sign Program* and the “*Span Sign Structure Data Table*” cell from the FDOT CADD Menu.

29.2.5 Standard Cantilever Overhead Sign Structures

The EOR is responsible for the design of all cantilevered overhead sign structures whether ground mounted or supported on a structure (including bridge structures), unless otherwise directed by the Department. This responsibility is for the entire sign structure, including the supports and foundations, as well as all details necessary to fabricate and erect the sign

structures. The EOR is also responsible for the shop drawing review in accordance with **Chapter 28** when sign structure shop drawings are required by the Contract Documents.

In general, the designer may refer to the **Design Standards, Index No. 11310**, the **FDOT Cantilever Overhead Sign Program** and the **“Cantilever Sign Structure Data Table”** cell from the FDOT CADD Menu.

29.2.6 Custom Designs

If a custom design is required, include, a brief written justification with the 30% plans submittal.

The EOR is responsible for the design of the attachment system for signs mounted on bridge structures.

For sign structures mounted on bridge structures, include their plans in the structures plans. Otherwise, include design details in the signing plans.

29.2.7 Dynamic Message Sign (DMS) Structures

Attach DMS signs to overhead sign structures with vertical members only. No horizontal members are allowed in DMS sign connections.

29.3 Lighting Structures

29.3.1 General

Luminaire Structures may be Standard Aluminum Light Poles, Standard High-Mast Lighting or Custom Designs.

29.3.2 Standard Aluminum Light Poles

Standard, QPL listed, aluminum light poles must comply with the detail requirements shown in the *Design Standards, Index No. 17515*.

For additional design information, see *Chapter 7* of this volume.

Selection Procedure

1. Determine the height difference between the top of foundation and the top of roadway used to set the fixture mounting height, round as necessary.
 - a. Determine the design mounting height (40, 45, or 50 feet) and fixture arm length (8, 10, 12, or 15 feet) required.

- b. The wind height at fixture equals the design mounting height for poles not on fill. For poles on fill, determine the height of the roadway above the surrounding terrain. The wind height at fixture will equal the design mounting height plus the fill height, rounded up to the next highest 5-foot increment.
- c. Determine the pole design variables for each light pole.

Design

1. Fixture Arm Length of 8-feet, 10-feet, 12-feet or 15-feet. Single arm only.
 - a. Design Mounting Height of 40-feet, 45-feet or 50-feet. (May differ from Fixture Mounting Height, see Selection Procedure item 2).
 - b. 25-feet maximum height above adjoining ground surface.
 - c. Design weight of luminaire assumed to be 51 lbs.
 - d. Equivalent projected area of luminaire for design is 1.5 square feet.
2. No bridge or wall mounting permitted.
3. Maximum fill slope at the pole of one vertical to four horizontal. Steeper slopes can be accommodated provided the face of the slope on a horizontal projection from the foundation base is no closer than it would be if a 1:4 slope were projected from the top of the foundation.
4. Unique site circumstances where poorer soil conditions are encountered than shown on **Index No. 17515** may require the foundation variables to be modified from those shown. If custom designs are required, the Geotechnical Engineer will provide the soil information to be used by the EOR during the design phase of the project.
5. Use an Importance Factor (I_r) = 0.80 (25-year recurrence interval).

For additional design information, see **Chapter 7** of this volume.

29.3.3 Standard High-Mast Lighting

Refer to **Design Standards, No. 17502**.

29.3.4 Custom Designs

When custom aluminum light poles are required, or otherwise specifically designated in the contract documents, the EOR is responsible for the structural design of the roadway light poles, foundations, and the review of the Shop Drawings.

29.4 Traffic Signal Structures

29.4.1 General

Mast Arm Assemblies may be Standard Mast Arm Signal Structures, Standard Mast Arms for Site-Specific Loadings, or Custom Designs.

29.4.2 Mast Arm Signal Structures

For signals, design all mast arm assemblies with backplates unless the Maintaining Agency for a County has a written policy that prohibits the use of backplates in that County. The prohibiting policy must be on file with the Department's District Office in which the County is located, and the policy must be included in the Scope of Services of both the Signal and Structures Design Engineers.

Design and detail mast arm assemblies using one of the following three methodologies:

1. Standard Mast Arm Assemblies: Mast arms that utilize all pre-approved components listed on the Department's Qualified Products List (QPL) and that have been pre-designed for the selected Load Trees shown in **Figure 29.2**.
2. Standard Mast Arm Assemblies for Site-Specific Loadings: Mast arms for unique loadings but which utilize all pre-approved QPL components.
3. Custom Mast Arm Designs: Special Mast arms for unique loadings and/or geometric constraints that contain any component (arm or pole) that is outside the range of those listed on the QPL.
4. For additional design information, see **Chapter 7** of this volume.

29.4.2.1 Standard Mast Arm Assemblies

Refer to **Design Standards, Index Nos. 17743** and **17745**, the **FDOT MastArm Program**, and the **"Standard Mast Arm Assemblies Data Table"** cell from the FDOT CADD Menu. Standard mast arm assemblies must comply with all the requirements and design criteria shown on **Index Nos. 17743** and **17745**.

Standard Mast Arm assemblies are limited to 110, 130 or 150 mph design wind speeds with one of the load tree configurations shown in **Figure 29.2**, and either single arm, single arm with luminaire, or double arms with arm orientations of 90° or 270° only.

Foundations and base plates for standard mast arm assemblies are pre-designed based on the following soil criteria:

- Classification: Cohesionless (Fine Sand)
- Friction Angle: 30 Degrees
- Unit Weight: 50 lbs./cubic foot (assumed submerged)

When the designer considers soil types at the specific site location to be of lesser strength properties than shown above, an analysis is required. Auger borings, SPT borings, or CPT soundings may be used as needed to verify the assumed soil properties, and at sites confirmed to be uniform, a single boring or sounding may cover several foundations. Borings in the area that were performed for other purposes may be used to confirm the assumed soil properties. Unique site circumstances may require the foundation variables to be modified from those shown on **Index 17743**. Accomplish this by completing the "Special Drilled Shaft Data" in the "Standard Mast Arm Assemblies Data Table". The Geotechnical Engineer must justify the differing foundation criteria to the District Structures Design Engineer during the design phase of the project.

To use standard mast arm assemblies:

1. Confirm that the information furnished by the signal designer in the "Mast Arm Tabulation Sheet" meets the geometric and load tree limitations shown in **Figure 29.2**.
2. Follow the procedure described in the design examples in **Volume 2, Chapter 24**, complete the necessary information required in the "Standard Mast Arm Assemblies Data Table" and include in the Traffic Plans.

29.4.2.2 Standard Mast Arm Assemblies for Site-Specific Loadings

The **FDOT Mast Arm Program** will select component parts from those shown on **Index No. 17743** for site specific load configurations differing from those shown in **Figure 29.2**.

In order to be eligible for utilization of QPL component parts, the mast arm assemblies must utilize only arms and poles from the components listed in the tables on **Index No. 17743**. As for standard mast arm assemblies, the foundation design is included with the pole selection and needs no further information.

Design and detail standard mast arm assemblies utilizing QPL component parts in the plans in the same manner as for standard mast arm assemblies by use of the "**Standard Mast Arm Assemblies Data Table**" cell. Similarly, because all QPL component parts are used, shop drawings are not required.

29.4.2.3 Custom Mast Arm Designs

The **FDOT Mast Arm Program** will provide the necessary variables to be shown in the "**Special Mast Arm Assemblies Data Table**" cell from the FDOT CADD Menu.

Show special mast arm assemblies and foundations in the plans. Refer to **Index No. 17745**. Require shop drawings for all special mast arm assemblies.

Figure 29.1 Flowchart for Designing and Detailing Mast Arm Assemblies

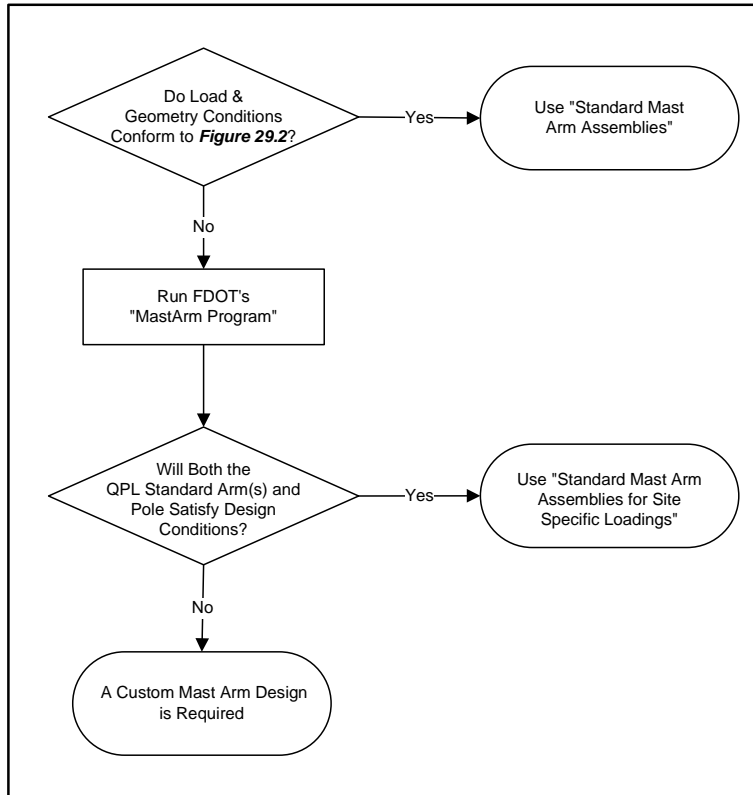
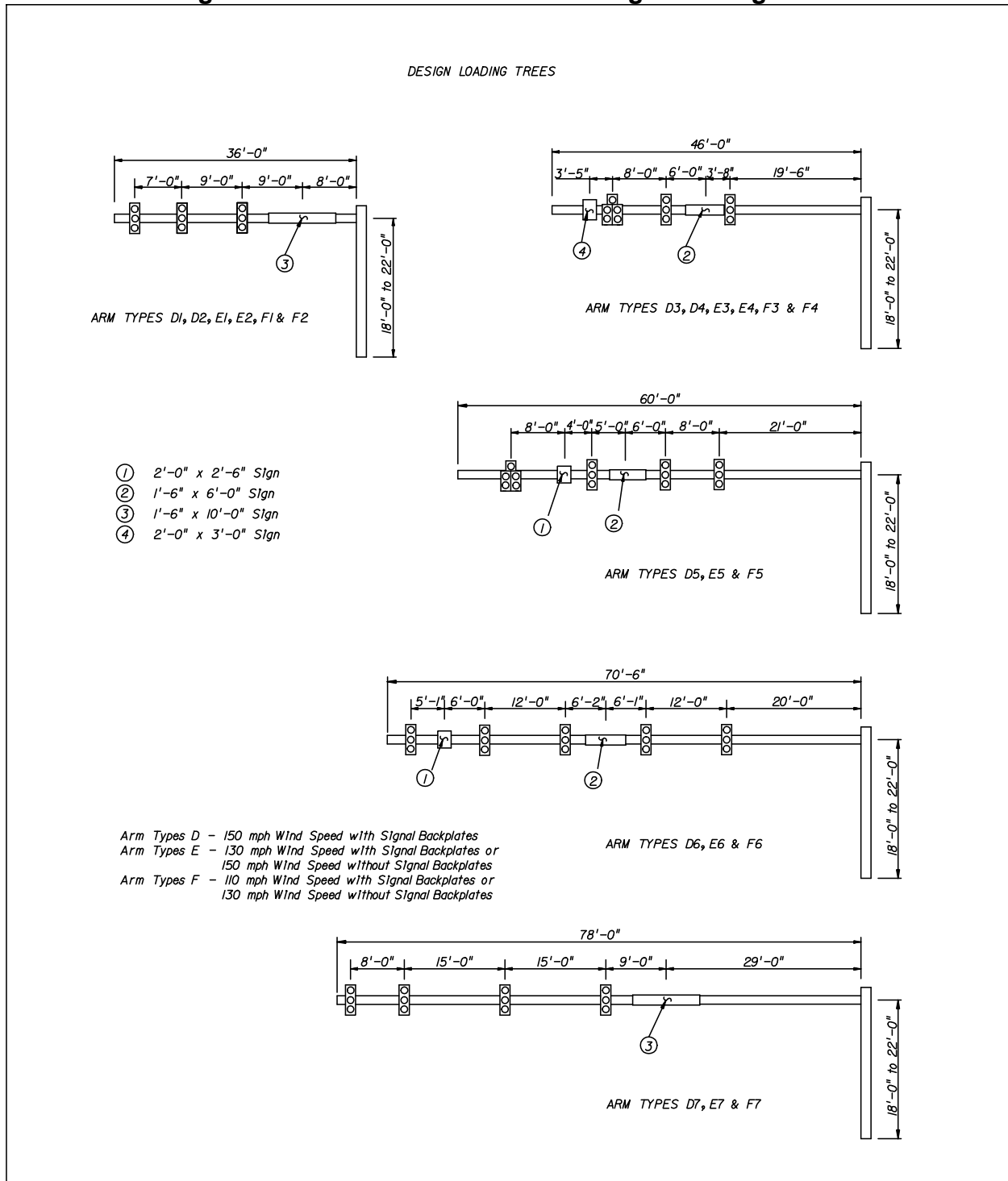


Figure 29.2 Standard Mast Arm Design Loading Trees



29.4.3 Standard Span Wire with Concrete Strain Poles

Refer to *Design Standards, Index No. 17725*, the *FDOT Strain Pole Program*, and the *University of Florida Bridge Software Institute ATLAS Program*.

29.4.4 Standard Span Wire with Steel Strain Poles

Refer to *Design Standards, Index No. 17723*, the *FDOT Strain Pole Program*, and the *University of Florida Bridge Software Institute ATLAS Program*.

29.4.5 Custom Designs

When custom traffic signal structures are required, or otherwise specifically designated in the contract documents, the EOR is responsible for the structural design, foundations, and review of the Shop Drawings.

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