Chapter 29

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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***, with current addenda and the ***FDOT Structures Manual Volume 9***.

Use standard sign structures unless site conditions or other considerations require a custom design.

For overhead sign structures, mast arm signal structures and steel strain poles; indicate in the Plans whether a grout pad is or is not to be installed.

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.

29.2.2 Standard Single Column Ground Signs

Refer to ***Design Standards, Index Nos. 11860 thru 11865***.

29.2.3 Standard Multipost Ground Signs

Refer to ***Design Standards, Index No. 11200*** and ***FDOT Multi-Post Sign 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 Nos. 11310 and 11320***.

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, however, the designer may refer to the ***Design Standards, Index Nos. 11310 and 11320***.

29.2.6 Custom Designs

The Structures Engineer of Record is responsible for the design of the attachment system for signs mounted on bridge structures.

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

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

29.3 Luminaire 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 on ***Index No. 17515*** of the ***Design Standards***.

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

Selection Procedure

1. Use an Importance Factor (I_r) = 0.80 (25-year recurrence interval.)
2. 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.

Limitations

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 special designs are required, the Geotechnical Engineer will provide the soil information to be used by the District Structures Design Engineer during the design phase of the project.

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

29.3.3 Standard High-Mast Lighting

Refer to ***Design Standards, No. 17520***.

29.3.4 Custom Designs

When special aluminum light poles are required, or otherwise specifically designated in the contract documents, the Contractor's Specialty Engineer is responsible for the structural design of the roadway light poles and foundations and the EOR is responsible for 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 Standard Mast Arm Signal Structures

Design the arm to pole connections on mast arm structures as “through-bolted” (tapped connections are not permitted).

Regardless of the design wind speed for the pole and arm, base the torsional resistance of foundations for all mast arm Assemblies on a service wind speed of 85 mph with a safety factor of 1.0.

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 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.

The standard mast arm assemblies must comply with all the requirements and design criteria shown on ***Index Nos. 17743*** and ***17745*** of the ***Design Standards***, and the “Standard Mast Arm Assemblies Data Table”.

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 conservative soil criteria:

Classification: Cohesionless (Fine Sand)

Friction Angle: 30 Degrees

Unit Weight: 50 lbs./cubic foot (assumed saturated)

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 uniform sites, 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.

29.4.3 Standard Mast Arms for Site-Specific Loadings

The Department's mast arm computer 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". Similarly, because all QPL component parts are used, shop drawings are not required.

29.4.4 Custom Designs

The Department's mast arm Computer Program will provide the necessary variables to be shown in the “Special Mast Arm Assemblies Data Table”.

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

29.4.5 Anchor Bolt Installation on Existing Foundations

Ensure that anchors used in the installation of a traffic signal mast arm on an existing foundation conform to ***Structures Design Guidelines 1.6 – Adhesive Anchor Systems*** and ***Sections 416 & 937*** of the ***Standard Specifications***.

Verify that the foundation and strength of the anchors are adequate for mast arm applied loads.

Verify the existing condition of the drilled shaft.

Anchors may be offset from center but all anchors must be within the foundation reinforcing cage. Note the desired offset in the plans.

Figure 29.1 Flowchart for Designing and Detailing Mast Arm Assemblies

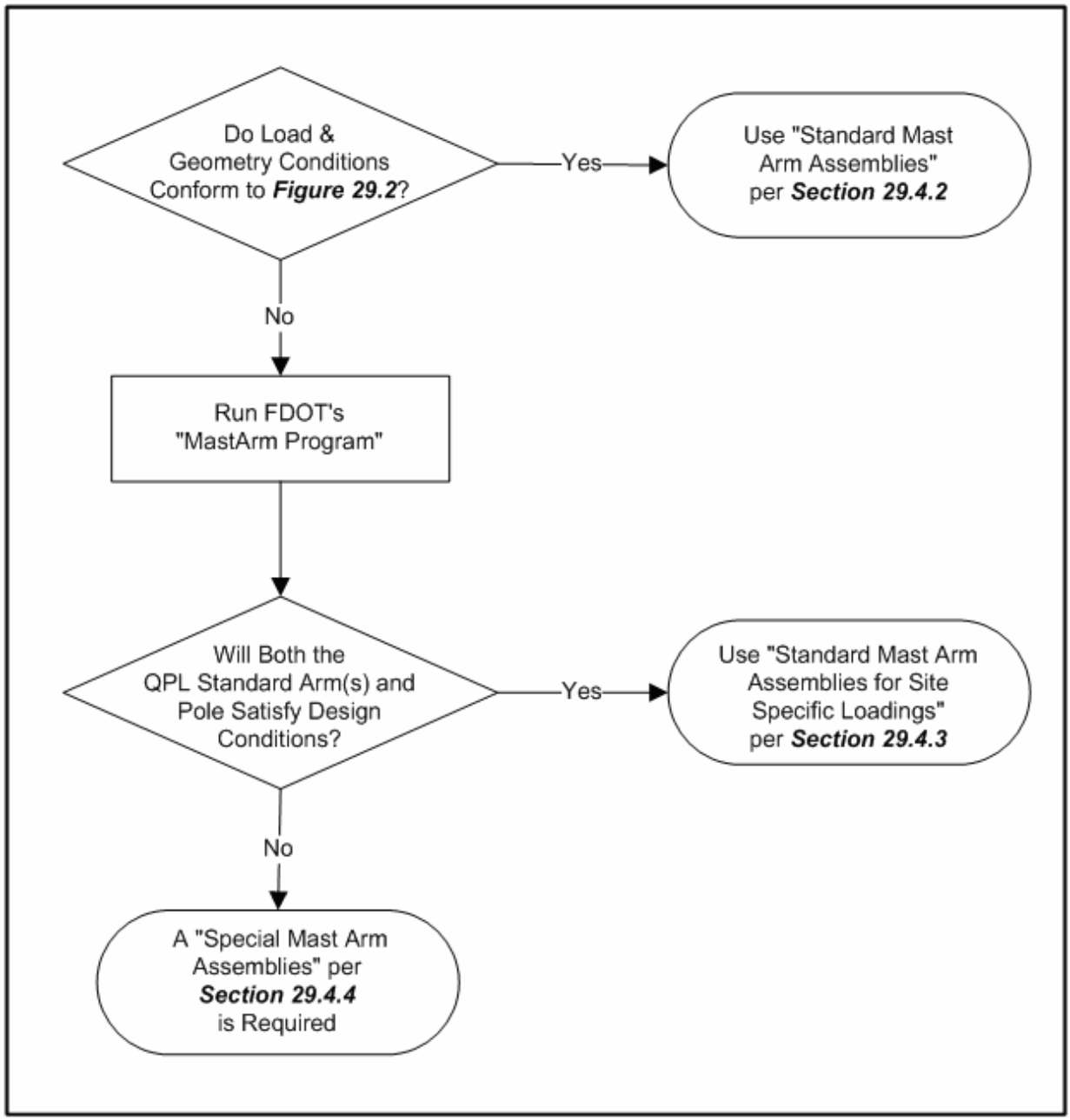
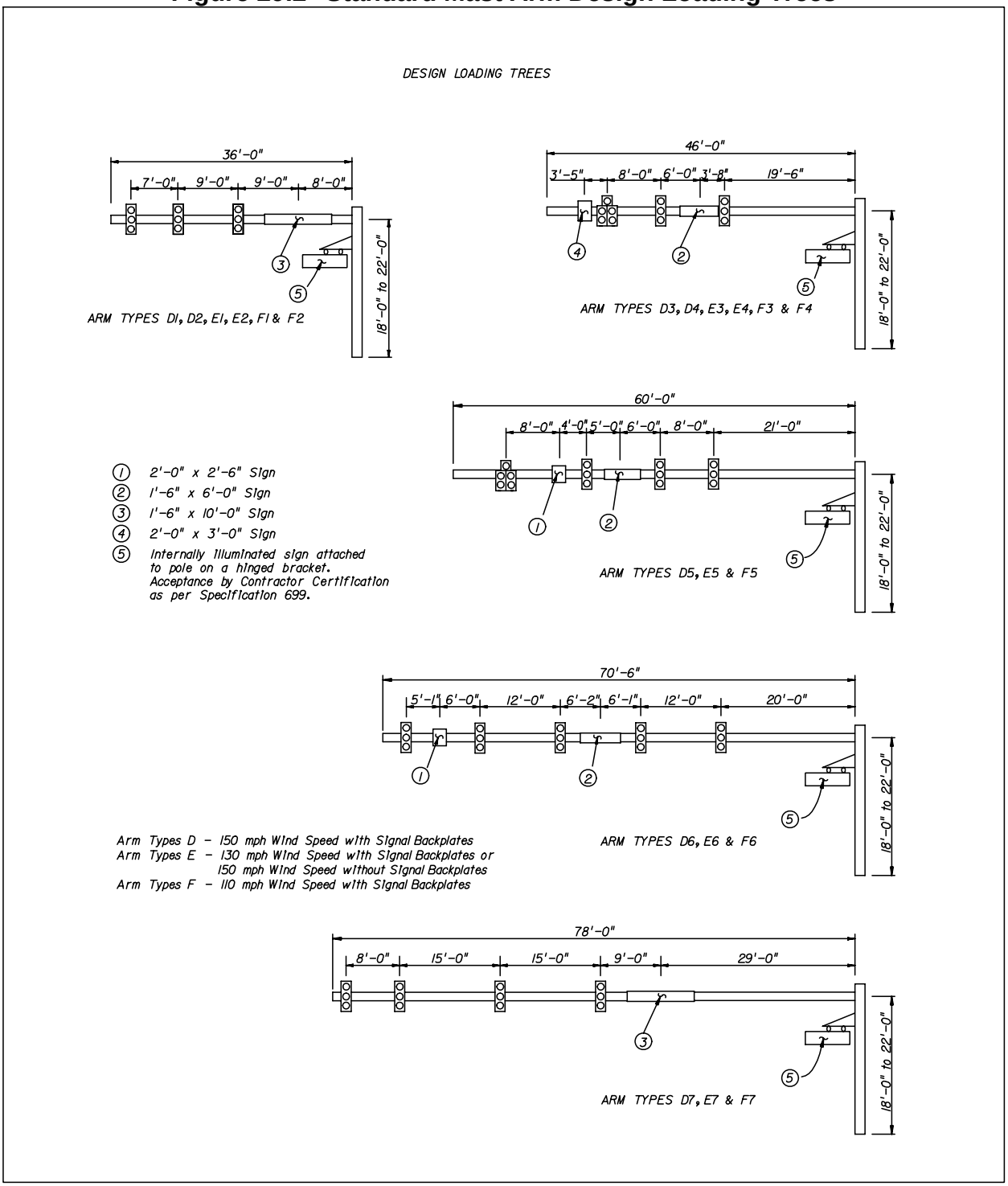


Figure 29.2 Standard Mast Arm Design Loading Trees



29.4.6 Standard Span Wire with Concrete Strain Poles

Refer to Design Standards, Index No. 17725.

29.4.7 Standard Span Wire with Steel Strain Poles

Refer to Design Standards, Index No. 17723.