261 Structural Supports for Signs, Signals, Lighting, and ITS

261.1 General

The criteria for the structural design of sign, signal, lighting, and ITS support structures (aka Ancillary Structures) must be in accordance with AASHTO's ***LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals***, as modified by the ***Structures Manual, Volume 3***. Include structural details in the Plans for all sign, signal and lighting structures. Use the ***Standard Plans*** for sign, signal and lighting support structures, unless site conditions or other considerations require a custom design.

When a custom support structure is required, or otherwise specifically designated in the contract documents, the Engineer of Record (EOR) is responsible for the structural design including foundations and the review of the Shop Drawings. Details for supports attached to bridge structures must be coordinated with the bridge structural engineer and included in the plans. See ***Structures Design Guidelines***, ***Section 1.9*** for details and restrictions related to making attachments to bridges.

Sign and signal structure span length are limited to the following:

- ***Standard Plans, Index 700-041***, Span Sign Structure: 220 feet
- ***Index 700-040***, Cantilever Sign Structure: 50 feet
- ***Indexes 700-040*** and ***700-041***, Cantilever & Span Sign Structure Truss Depth: 9.5 feet
- ***Indexes 649-030*** and ***649-031***, Standard Mast Arm Assemblies: 78 feet
- ***Indexes 649-010*** or ***641-010,*** Steel or Concrete Strain Pole with Signal Cable: 250 feet

These limits were chosen based on past practice and practical experience. See the ***Standard Plans Instructions*** (***SPI***) to obtain the applicable ***Standard Plans*** and additional information on sign and signal structures.

See ***FDOT Modifications to LRFD Specifications For Structural Supports For Highway Signs, Luminaires And Traffic Signals (LRFDLTS-1), Structures Manual Volume 3***, Section 2.6 for limitations on the use of bridge mounted signs.

261.2 Sign Support Structures

Use the applicable ***Standard Plans*** for the following sign support structures:

- ***Index 700-010*** Single Column Ground Signs
- ***Index 700-011*** Single Column Cantilever Ground Mounted Sign
- ***Index 700-012*** Single Post Bridge Mounted Sign Support
- ***Index 700-013*** Single Post Median Barrier Mounted Sign Support
- ***Index 700-020*** Multi-Column Ground Sign
- ***Index 700-040*** Cantilever Sign Structures (Overhead)
- ***Index 700-041*** Span Sign Structures (Overhead)

Refer to the corresponding ***Standard Plans Instruction*** (***SPI)*** for design information.

For ***Standard Plans, Index 700-010*** Single Column Ground Signs, the contactor selects the appropriate pole size using the sign dimensions given in the plans and the four-step process given the standard.

Where the distance between the curb and the sidewalk restricts the use of ***Standard Plans, Index 700-020***; ***Index 700-011*** may be used.

The EOR is responsible for the design of all multi-column ground signs and overhead sign structures (including bridge mounted signs). 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 ***FDM 267*** when sign structure shop drawings are required by the Contract Documents.

FDOT assigns identification numbers to overhead sign structures. See the ***Structures Detailing Manual, Chapter 2***, for instructions. If a custom sign support structure is required, include a brief written justification with the 30% plans submittal.

Modification for Non-Conventional Projects:
Delete the sentence above and replace with the following: If a custom design is required, include a brief written justification with the 90% component plans submittal.

261.3 Lighting Support Structures

Use the applicable ***Standard Plans*** for the following lighting support structures:

- ***Index 715-010*** High Mast Lighting,
- ***Index 715-002*** Standard Aluminum Lighting.

Refer to the corresponding ***SPI*** for design information.

261.4 Traffic Signal Support Structures

Use the applicable ***Standard Plans*** for the following traffic signal support structures:

- ***Index 649-010*** Steel Strain Poles,
- ***Index 641-010*** Concrete Poles,
- ***Indexes 649-030*** and ***649-031*** Mast Arm Assemblies.

Refer to the corresponding ***SPI*** for design information.

See ***FDM 232*** for determining which locations require mast arms.

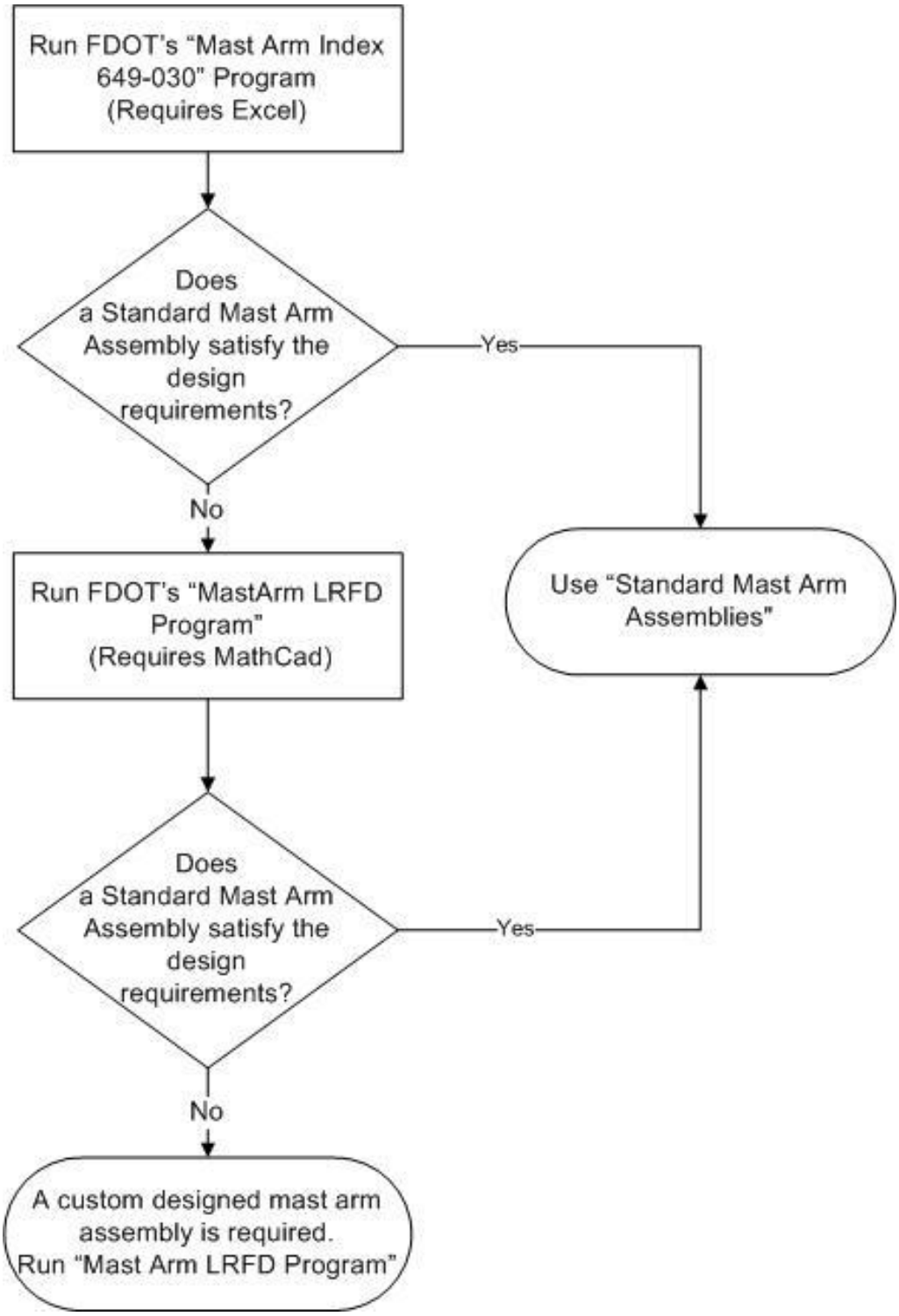
Design all structures assuming traffic signal assemblies have backplates in accordance with ***FDM 232.1.5***

Span wire systems have two strain pole options, rectangular prestressed concrete and round steel. Round steel poles are typically used on longer spans where prestressed concrete poles have exceeded their capacity.

For attaching Free-Swinging, Internally-Illuminated Street Sign Assemblies, see ***Standard Plans*** ***Index 700-050***.

Mast Arm Assemblies may be Standard Mast Arm Signal Structures, Standard Mast Arms for Site-Specific Loadings or Custom Designs. Use the Flowchart in ***Figure 261.4.1*** to determine which type of Mast Arm design is suitable for the particular application. See ***Standard Plans***, ***Indexes 649-030*** and ***649-031,*** and their ***SPI***.

Figure 261.4.1 Flowchart for Designing Mast Arm Assemblies



261.5 ITS Support Structures

Use the applicable ***Standard Plans*** for the following ITS support structures:

- ***Index 649-020*** Steel CCTV Poles,
- ***Index 641-020*** Concrete CCTV Poles,
- ***Indexes 700-040*** and ***700-041*** Cantilever and Span Sign Supports to support Dynamic Message Signs (DMS). For additional DMS details, see ***Standard Plans***, ***Index 700-090*** Dynamic Message Sign Walk-In.

Refer to the corresponding ***SPI*** for design information.

Refer to the ***Structures Manual, Volume 3*** for Dynamic Message Sign Structure design requirements.

261.6 Foundations

Unique site circumstances may require the foundation variables to be modified from the foundations shown in the ***Standard Plans***. If custom designs are required, the Geotechnical Engineer must provide the soil information to be used by the Structures Design Engineer during the design phase of the project.

The foundation design and drawings where special foundations are required are the responsibility of the Structures' EOR. The Geotechnical Engineer must provide the EOR the following soils information (this information may be derived from the borings of other nearby structures or from roadway borings):

(1) Soil Type

(2) Effective Unit Weight of the Soil

(3) Seasonal High Water Table Elevation

(4) Effective Friction Angle of the Soil (if applicable)

(5) Cohesion Value (if applicable)

(6) Coefficient of Horizontal Subgrade Reaction

(7) Factored Bearing Resistance (if applicable)

Include the above soils information in the plans. Additionally, Soil Boring Data Sheets must be included in the plans, except for strain poles. This will provide the Contractor with

the conditions for which the foundations were designed as compared to actual on-site conditions and establish criteria for any future analysis of the foundations.

261.7 Evaluating Existing Sign, Signal, Lighting and ITS Support Structures

For the purposes of this section, existing sign, signal, lighting and ITS support structures are referred to as Ancillary Structures and are classified into one of the following categories:

Category 1: Existing Ancillary Structures without Proposed Additional Loading –

Existing support structures left in place or existing support structures modified with equivalent (or smaller) components.

Category 2: Existing Ancillary Structures with Proposed Additional Loading or Relocated Ancillary Structures –

Existing support structures modified with additional components, existing support structures modified with larger components, existing support structures whose proposed attachments produce loads on any component greater than the design loading and/or existing support structures relocated to another location.

Additionally, there are two types of evaluations that are conducted on ancillary structures as follows:

Condition Evaluation:

A physical and functional assessment based on inspection data that includes damage, deterioration, or other potential defects that may cause a reduction in service life or design capacity.

Analytical Evaluation:

A structural capacity analysis ranging from the review of structural plans, design calculations and shop drawings (if available) to a detailed structural analysis. Contact the District Structures Design Office for guidance on the extent of analysis required and for guidance on analyzing existing ancillary structures without plans, shop drawings, foundation depths, or design calculations.

Submit an Ancillary Structures Evaluation as required by the District Structures Design Office (DSDO). The report is to contain the following information:

(1) Listing of ancillary structures within the project including the proposed disposition (remain in place, relocated, replaced)

(2) Condition Evaluation for ancillary structures within the project

(3) Analytical Evaluation of ancillary structures within the project that are proposed with additional loading and/or relocated

Recommendations in the Ancillary Structures Evaluation require concurrence from the District Structures Maintenance Engineer.

261.7.1 Category 1 Analytical Evaluation

If a detailed Analytical Evaluation is required, evaluate the as-built capacity (no allowances for future loads) in accordance with the ***Structures Manual*, Volume 3, Section 18.2**. Report the Demand/Capacity (D/C) ratios, Combined Stress Ratios (CSRs), and Combined Force Interactions (CFIs). If all D/C ratios, CSRs, and CFIs are ≤ 1.05, the structure meets FDOT structural requirements for existing structures. If certain D/C ratios or CSRs are > 1.05, strengthening or replacement is required unless a Design Variation is approved.

Category 1 ancillary structures typically do not require analysis for fatigue (welds) or foundations; however, welding details and foundations should be checked in the Analytical Evaluation in situations where there is evidence of distress, instability, or the capacity of the structure is in doubt.

261.7.2 Category 2 Analytical Evaluation

Provide a detailed Analytical Evaluation of the existing structure with proposed additional loading with new structure criteria in accordance with the ***Structures Manual* Volume 3**, **Section 18.3**. Report the D/C ratios, CSRs, and CFIs. If all D/C ratios, CSRs, and CFIs are ≤ 1.05, the structure meets FDOT structural requirements for new structures. If certain D/C ratios, CSRs, or CFIs are > 1.05, strengthening or replacement is required unless a Design Variation or Design Exception is approved as described below.

An approved Design Variation is required if the proposed structure fails to meet the structure requirements in the ***Structures Manual* Volume 3**, **Section 18.3** but does meet the criteria in ***Structures Manual Volume 3*, *Section 18.2***. An approved Design Exception is required if the proposed structure fails to meet the requirements in the

Structures Manual ***Volume 3, Sections 18.2*** and ***18.3***. Details listed in the ***Structures Manual*** ***Volume 3, Section 18.1*** are exempt from this requirement.