Structures Detailing Manual

July 2007

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I - Introduction

I.1 Purpose

The ***Structures Detailing Manual (SDM)*** provides guidance for drafting and detailing criteria and methods used in preparing Florida Department of Transportation (FDOT) contract plans for structural elements or systems. These elements or systems include bridges, overhead sign structures, earth retaining structures and miscellaneous highway structures.

I.2 Authority

Section 334.044(2), Florida Statutes.

I.3 Scope

Use of this manual is required when performing design, analysis or detailing of structures for FDOT projects.

I.4 Format

A. The ***SDM*** is presented in both 8 1/2-inch x 11-inch and 11-inch x 17-inch formats consisting of text, figures, charts, graphs, tables and Example drawings (***SDME*** Ex-_). This manual provides standard engineering criteria and guidelines to be used in the development of engineering drawings of structures for which the Structures Design Office (SDO) has responsibility.

B. The manual is intended to be used in conjunction with the ***Structures Design Guidelines***, Standard Drawings, ***Plans Preparation Manual***, Volumes I & II, and the ***CADD Production Criteria Handbook***.

C. The ***SDM*** is written primarily in the active voice to designers and detailers of bridges and structures for the Florida Department of Transportation.

I.5 Distribution

The ***SDM*** is furnished via the SDO web page at no charge. The user must regularly check for additions, modifications and bulletins.

I.6 Manual Registration

No registration is required.

I.7 Administrative Management

Administrative Management of the SDM is a cooperative effort of SDO staff and the nine voting members of the Technical Advisory Group (TAG).

I.7.1 The Technical Advisory Group (TAG)

The TAG provides overall guidance and direction for the SDM and has the final word on all proposed modifications. The State Structures Design Engineer (SSDE) and the eight District Structures Design Engineers (DSDE) comprise the TAG. In matters of technical direction or administrative policy, when unanimity cannot be obtained, each DSDE has one vote, the SSDE has two votes, and the majority rules.

I.7.2 SDO Staff

The SDO staff is comprised of Assistant State Structures Design Engineers and Senior Structures Design Engineers selected by the SSDE.

I.8 Modifications

A. Modifications may be the result of changes in FDOT specifications, FDOT organization, Federal Highway Administration (FHWA) regulations, and AASHTO requirements; or occur from recent experience gained during construction, through maintenance, and as a result of research. Manual users are encouraged to suggest modifications and improvements such as design procedures, text clarity, technical data, or commentary.

B. Address questions regarding this manual and any proposed modifications to:

Structures Design Office
Mail Station 33
605 Suwannee Street
Tallahassee, Florida 32399-0450
Tel.: (850) 414-4255
http://www.dot.state.fl.us/structures/

I.8.1 Adoption of Revisions

SDM revisions are issued by the SDO as ***Temporary Design Bulletins (TDB's)*** or Permanent Revisions following a formal adoption process.

I.8.2 Temporary Design Bulletins (07/05)

A. ***TDB's*** supersede the current ***SDM***, are mandatory, and will be issued when the SSDE deems a change essential to production or structural integrity issues and in need of immediate implementation. ***TDB's*** may address issues in plans production, safety, structural design methodology, critical code changes, or new specification requirements.

B. ***TDB's*** indicate their effective date of issuance and are numbered sequentially with reference to both the ***SDM*** version number and year of issuance. (i.e., Temporary Design Bulletin No. C03-2 would be the second Bulletin issued in 2003 for SDM.)

C. ***TDB's*** are effective for up to 360 calendar days unless superseded by subsequent ***TDB's*** or Permanent Revisions to the ***SDM***. ***TDB's*** automatically become proposed Permanent Revisions unless withdrawn from consideration by the SSDE.

D. TDBs may be proposed by any DSDE, DSME or PE in the SDO for consideration by the SSDE. The author must research all affected FDOT policies, criteria and specifications. Proposed TDBs must be submitted to one of the Assistant SSDEs for review, comment and concurrence. If the Assistant SSDE concurs with the proposal, it will be sent to the SSDE for consideration, final approval and publication on the SDO's website.

E. TDBs that significantly affect other offices must be composed with the assistance of the affected office. TDBs that significantly affect construction will be issued as a Joint Bulletin with the State Construction Office (coordinate with the State Construction Office on the proper Construction Bulletin number).

F. Proposed TDBs must be formatted to include Requirements, Commentary, Background, Implementation and Contact sections.

1.) Requirements: This section codifies exceptions, revisions and/or additions to policies or criteria as specified in current adopted specifications (i.e. Structures Manual, AASHTO LRFD Bridge Design Specification, etc.). Requirements must reference the specific section) in the Structures Manual or other documents where they are to be incorporated. Revisions to the Department's Standard Specifications will be handled through the Specifications Office.

2.) Commentary: This section provides the essential technical support behind the new Requirements). It includes references to the literature, both pro and con, that influenced

the decision. This section is intended be brief and will be published along with the Requirements in the identified documents). If the Requirements are being added to the SDG, the Commentary is added in italics at the end of the amended section.

3.) Background: This section discusses the circumstances that prompted the TDB. It should not duplicate the Commentary but simply facilitate the readers understanding of situations that occurred and the SDO's response to them. It is also appropriate to make recommendations on policy, criteria and/or specification additions and revisions to other offices in this section.

4.) Implementation: This section specifies the timeline upon which the requirements are to be implemented. Factors to be considered in the implementation plan include funding sources to implement changes to existing design and construction contracts, effect on adopted work program, etc. Implementation plans typically include effective, publishing and letting dates for the Requirements.

5.) Contact: Although the SSDE is the responsible author of all TDBs, this section lists the TDB's champion. This section lists the bulletin's key contact name, title, work telephone number and email address.

I.8.3 Permanent Revisions

A. Permanent Revisions to the ***SDM*** are made annually or "as-needed." The following steps are required for adoption of a revision.

1.) SDO Staff will assess proposed revisions and develop the initial draft for the SSDE's approval.

2.) The SDO Staff will conduct the necessary research, coordinate proposed modifications with all other affected offices and, if proposed modifications are appropriate, prepare complete, written modifications. The SSDE's approval signifies the SDO's position on the proposed modifications.

3.) Proposed modifications will be transmitted to TAG members and others, allowing for no less than two weeks review time before the next scheduled TAG meeting. Other parties include, but are not limited to: State Construction Office, State Maintenance Office, State Materials Office, State Roadway Design Office, Organization, Forms and Procedures Office, and FHWA.

4.) DSDE members of TAG will coordinate proposed modifications with all other appropriate offices at the district level.

5.) Each TAG member will review proposed modifications prior to the meeting where they will be brought forward for discussion. The SDO will review all modification comments received from other FDOT/FHWA offices in preparation for presentation at the meeting.

6.) Additional review comments received by the SDO and/or DSDO's during the review process will be presented for discussion and resolution.

7.) Immediately after the TAG meeting, each proposed modification will be returned to the SDO with one of the following recommendations:
   a. Recommended for adoption as presented.
   b. Recommended for adoption with resolution of specific changes.
   c. Not recommended for adoption.

8.) Within two weeks after the TAG meeting, the SDO Staff will resolve each recommended modification and assembled modifications will be provided to the SSDE for final approval.

9.) Once approved by the SSDE, the ***SDM*** revision modifications will be assigned to the SDO's Design Technology Group Leader for final editing.

10.) Unless otherwise agreed, the new ***SDM*** version modifications will be available from the SDO web site within 4 weeks after receipt of approved modifications from the SSDE.

1- Drafting and Printing Standards

1.1 General

This chapter contains general detailing standards and requirements along with details for various bridge components. The instructions are also applicable to most other highway related structures such as retaining walls, pile-supported roadways, etc. Refer to the ***CADD Production Criteria Handbook (CPCH)*** for specific instructions related to computer aided drafting.

1.2 Drafting Requirements

See the ***Plans Preparation Manual*** and the ***CPCH*** for additional drafting requirements.

1.3 FDOT Design Standards (07/06)

A. The current FDOT Design Standards comprise the best practices of the FDOT in design code compliance, pay item consistency, and Specification coordination.

B. In structures and wall plans, reference the applicable FDOT Design Standards by general description and index number. Place the reference on the primary drawings depicting the component. In many instances, several plan references are appropriate (e.g. beam index number references on framing plan and cross section sheets.) Provide at least one index number for each Design Standard used. Note Interim Design Standards and Design Standards Modifications on the project Key Sheet (see ***PPM Vol.II***, Section 3.8.)

C. Some Design Standards for structural components, e.g. prestressed beams, approach slabs, bearing pads, etc., require supplemental tables, notes and or graphics to be completed and included in the plans by the designer. Select the appropriate tables, notes and or graphics using the FDOT 2004 SiteMenu software within Microstation. For the latest version of the CADD cell library, go to: http://www.dot.state.fl.us/ecso/downloads/software/.

D. For the Design Standards, see the Roadway Design Office's web site at http://www.dot.state.fl.us/rddesign/DesignStandards/Standards.htm

Commentary: Since all former Structures Standard Drawings are now contained in the Design Standards, specific references are necessary to clarify the Designer's intent to the Contractor.

1.4 Drafting Techniques

A. To produce the clearest and highest quality drafting techniques with lines and lettering of consistent quality, FDOT requires the use of a CADD system.

B. Differentiate outline and dimension line weights.

C. The relative line weight and the chosen lettering should provide perfect legibility when reproduced by normal printing procedures.

D. For additional drafting techniques, refer to the ***CPCH***.

1.5 Existing Plans

Existing structures plans may be incorporated into new Contract Plans. When available, existing plans may be obtained from the District, or from the Plans Retention Section, Central Office. Plans must be legible and reproducible.

1.6 Quality Assurance

Chapter 18 of the ***Plans Preparation Manual*** - ***Volume I*** explains the processes for Quality Assurance and Quality Control. Chapter 20, "Plans Processing and Revisions", ***Plans Preparation Manual*** - ***Volume I***, discusses acceptable printing methods, paper size, and quality of the media and print.

2 – Detailing Instructions

2.1 Detailing (01/05)

After receiving all pertinent data, the detailer's work may be divided into the following steps:

1.) Design Study: Carefully study the design notes and materials received from the designer and develop a good understanding of the design as well as the probable systematic construction of the structure. Carry out all instructions given in the engineering notes. Review discrepancies with the designer.

2.) Computer Programs: When using FDOT programs (Reinforcing Bar Lists, etc.), use the forms and user's manuals provided by the Structures Design Office as listed on the Structures Design Office's web site. http://www.dot.state.fl.us/structures

3.) Planning: Plan the drawings by determining which details and information need to be placed on each sheet, the scale to be used, the number of sheets required and the sequence of the sheets. See Chapter 4.

4.) Preparation: When necessary, prepare sketches and computations to accurately draw and place details and other information on the drawings. Keep this information for future reference.

5.) Checking: Accurate drawing development requires the conscientious and cooperative efforts of the designer, detailer and checker. It is most important to find errors and mistakes before the job is advertised. Errors discovered after construction has commenced may involve extra work orders, considerable revision, added construction cost, errors and omissions recovery action and time or salary expense to the Engineer of Record and the Department. The constructability of all plan details (i.e. reinforcing cages, concrete placement allowances) is the responsibility of the Engineer-of-Record. Both the detailer and checker are obligated to produce error free drawings. It is the checker's function to check each detail for neatness, correctness, completeness, clarity and compatibility with other components; however, the detailer should not neglect his responsibility by expecting the checker to complete the drawing during the checking process. It is the duty of the detailer to thoroughly back-check all corrections. Checking is an important part of the work and sufficient time should be taken to check and back-check the drawings. This task should not be performed hastily, even on a rush job. This applies especially to CADD files. Return prints to the checker, whose final responsibility is to assure that all corrections have been made. After the drawings have been completed, give prints and pertinent data to the checkers for a comprehensive check of all dimensions, stations, elevations, sections and details. When the checking has been completed and the marked-up check prints indicating corrections, deletions or additions have been returned, verify that CADD files match check sets. The Engineer of Record is ultimately responsible for the drawing.

6.) Making Corrections: After verifying the corrections and changes, make the indicated changes to the original drawing or to the CADD drawing file (if applicable) and add the initials and date in the title block. After making changes, mark "Changes Made" on the check prints. Initial and date the prints.

2.2 Structures Identification Numbers

A. FDOT assigns identification numbers to bridges, overhead signs, and high-mast light poles.

B. Early in the design, the Structures Design Engineer (State or District) will obtain identification numbers from the District Structures Maintenance Engineer (Refer to Maintenance Office).

C. New numbers will be assigned to all new and replacement bridges. Widened bridges generally retain their existing numbers. If the widening joins existing structures, the District Structures Maintenance Engineer will decide which bridge number to retain.

D. Show the bridge number on the lower right side above the Title Block of all sheets.

2.3 Bridge Lengths and Horizontal Control

A. A bridge's length is the distance measured along the stationing line between begin and end of bridge (front faces of end bent backwall or, approach slabs for end bents with no back wall.) (See ***SDME EX-7***.)

B. Horizontal Control Lines (See **SDME EX-7**.)
   1.) Alignment Line: Show the alignment control line that applies within the limits of the bridge.
   2.) Station Line: This is the line from which basic distances, lines and angles are referenced for locating bridge components in the field. This line is usually the same line as the Alignment Line. Use the centerline of construction., Base Line Survey, Profile Grade Line or Baseline to show the stations along the project. Refer to this as the "Station Line."

2.4 Financial Project Number and Federal-Aid Project Number

A. Show the Financial Project ID Numbers in the Title Block on all bridge plan including existing plans if included.

B. Do not show Federal-Aid Project Numbers (F.A.P. No.) on the bridge plans.

2.5 Initial Block

At any stage of plans submittal, include the initials or name of the person performing each function and the date completed for each sheet. If a function is not applicable, place a dash through the name and date block.

2.6 Title Block

In upper case letters, include the following information in the title block, of each plan sheet:

1.) Sheet title.

2.) Project Name (a project description and bridge location).

3.) Sheet Number.

4.) Initials (Detailers' and Designers').

5.) EOR (Consultant or FDOT logo with Engineer of Record's name, address and PE License number.)

6.) Financial Project ID Number.

7.) County.

8.) Road number.

2.7 Orthographic Projection

A. Use orthographic projection (a multi view system using as many dimensioned views as necessary) to show an object's features.

B. Use perspective and isometric views to clarify complicated details.

2.8 Views

A. Before starting a drawing, study the bridge or component and determine the views and sections required to describe it fully and to the best advantage. Plan the layout and detail accordingly, allowing sufficient space for dimensions and notes.

B. Generally, all details throughout the bridge plans shall be oriented consistently. Show layouts with stationing increasing from left to right. Detail End Bent 1 looking back station; detail all other substructure elements looking ahead station. Detail superstructure sections looking ahead station.

C. Cross-reference all sections or notes on a drawing.

D. Use a planned system to arrange details on a sheet. Do not randomly place views and sections on the drawing. Avoid crowding details on a sheet.

2.9 Scales

Select a scale large enough to clearly show required details when printed to 11-inch x 17-inch size with a minimum of 5/8-inch left and right margins. Do not indicate scale on the drawings. The following scales are recommended:

A. Plan and Elevation: Depending on the size of the bridge and/or how congested the sheet will be, use 1"= 10' through 1"= 50'.

B. Foundation Layout: 1"= 10' or to fit the sheet (longitudinal and lateral scales may be different and piling may be exaggerated in size for clarity).

C. Substructures
1.) Plan and Elevation views 3/8"= 1'- 0"
2.) Sections and Details 3/4"= 1'-0" or larger

D. Superstructure
1.) Plan View 1/4"= 1'- 0"
2.) Cross Sections 3/8"= 1'-0"
3.) Details 3/4"= 1'- 0" or larger.

2.10 Strength and Contrast of Lines

A. Contrast between various line weights should be in the width of the line and not in the intensity. Verify that all lines are legible on prints.

B. Vary the line weight to accentuate important features. Use consistent line weights for similar purposes. (See the ***CPCH***)

2.11 Dimensioning

2.11.1 General

A. A dimension is a linear measurement used to describe an object's size.

B. A value is a quantity used to express a magnitude. An integer used to quantify a number of items such as bars, spacing, bolts, holes, etc. (e.g., 10 spaces @ 4", 10 ~ Bars 4A).

C. A unit is a precise quantity in terms of a reference for measurement.

D. Lineal dimension: Use a value in conjunction with a unit of measurement (e.g., 5'-6 1/4").

E. Elevation: The unit for elevations is feet (ft). The unit is understood and should not be shown. Show value to three decimal places (e.g., 25.384).

F. Angle: Show angles to needed accuracy up to the nearest second.

G. Size: When showing size, show all units. Use industry standards such as ASTM or show the manufacturer's size when applicable.
1.) For solid shapes such as bars - 3" x 3" x 5'-0"
2.) For W-Shapes - W 30 x 90
3.) For Channels - C 10 x 15.3
4.) For Angles - L 4" x 4" x 1/4"
5.) For Structural Tees - WT 16.5 x 59

2.11.2 Dimensions and Text

A. Dimensions are displayed by associating Values and Units. Show dimensions clearly, accurately and tied to a control line. Not all dimensions shown on a drawing are for construction purposes; many are engineering dimensions given for convenient reference and checking.

B. Dimensions should be kept outside the views (between Extension Lines), but occasionally may be placed inside views or at the end of a leader line.

C. Dimension lines should be spaced about 3/4-inch from the object when plotted.

D. Parallel dimension lines should be spaced 3/8-inch minimum when plotted.

E. Compressed dimensions, due to limited space, may be shown without sacrificing legibility.

F. Show dimensions in units of feet and inches. Show dimensions of 12-inches or more in feet, inches and fractions of an inch. Show dimension greater than 1-inch but less than 12-inches in inches and fractions of an inch. Show dimensions less than one inch in fractions of an inch. Some exceptions to this rule are component or member designations (i.e., 24" Square Piling, Existing 36" Steel Beam, etc.) and elevations.

G. Dimensions are to be read from the following directions:
   1.) Place numerals on horizontal dimension lines so that they can be read from the bottom of the drawing.
   2.) Place numerals on vertical dimension lines so that they can be read from the right side of the drawing.
   3.) Place numerals on inclined dimension lines so that they can be read horizontally by rotating the sheet through the smallest possible angle.

H. Show all dimension numerals parallel to the dimension line.

I. When dimension numerals occupy more space than provided by the dimension line, show on extension lines or by leader lines to the dimension line.

J. Ensure the sum of string dimensions equals the total overall dimension.

K. When it is necessary to include a dimension between certain points in a detail, small circles may be used to emphasize the extremities of the line being measured.

L. Terminate dimension lines with arrowheads. Arrowheads should be a uniform size on the drawing.

M. Place extension lines beyond the point of the arrowhead and with a gap from the object.

N. Show leader lines with straight lines or continuous curves.

O. Mark centerlines with the centerline symbol. Do not use a centerline as a dimension line, though it may serve as an extension line.

P. Double arrowheads on a dimension line are used on partial views, in congested areas, or when it is not necessary to show the dimension line to its termination. Note dimension numerals on the line along with a description of the magnitude or boundaries in parenthesis.

Q. Label radii, surface finishes, and angles as required.

R. Show angles and bearings without hyphens.

S. For non-level surfaces with extremities not specifically defined by vertical dimensions, note to slope "down" a specific vertical dimension over a defined horizontal length or at a uniform rate.

T. For non-plumb surfaces with extremities not specifically defined by horizontal and vertical dimensions, note to bevel at a uniform rate with the bevel symbol. For the batter of non-plumb piling, note to batter with the bevel symbol or the amount of batter noted and connected to piling by leader lines with the direction of pile batter clearly shown on the drawings.

U. When dimensions are shown by methods other than described above, the unit should be provided. In this event, dimensions are defined as text (i.e., titles, sub-titles, headings, labels, notes, and free standing texts). For free standing texts, the unit may be spelled out to add clarity. If the dimensional text used to describe the size of an object is placed at the end of a leader line pointing directly to the object, show the units.

2.11.3 Accuracy

A. Show dimensions in feet, inches and fraction of an inch and elevations in decimal of a foot.

B. Dimension concrete to the nearest 1/8-inch.

C. Dimension structural steel to the nearest 1/16-inch.

D. Dimension reinforcing steel partial to nearest 1/4-inch; overall dimension to the nearest inch.

E. Show stations to the nearest 0.01 foot.

F. Show layout dimensions (dimensions along tangents, etc.) to the nearest 1/16-inch.

G. Show foundation layout dimensions to the nearest 1/8-inch or 0.01 foot stationing.

H. Show dead load and live load deflections to the nearest 1/16-inch.

I. Show elevations to the nearest 0.001 foot, except pile cut off elevations to the nearest 0.1-foot and water elevations to nearest 0.01 foot..

J. Show skew angles and bearings to the nearest second. Example: 69^{o} 38' 32", N 69^{o} 38' 32" E

K. Show other angles given such that dependent dimensions meet the above criteria to the nearest second.

L. Show spacing of reinforcing steel to the nearest 1/16-inch.

M. Show manufactured items to industry standards.

2.12 Symbols and Patterns

A. To simplify the construction and clarity of details, patterns may be used to represent certain materials.

B. Use only enough material indication to clarify details.

C. Verify legibility when the drawings are reproduced to 11-inch x 17-inch print size.

D. Common symbols and patterns are included in the FDOT CADD Load.

E. Use the following symbologies for material surface and outline treatment:
1.) New Construction - Solid Lines.
2.) Existing Construction - Dashed Lines.
3.) Plan surface or section area to be removed - Hatched or shaded Area.
4.) Construction Joint - Dashed line.
5.) Chamfers - Show all chamfers larger than 3/4-inch (showing a 3/4-inch chamfer is optional).
6.) Axis of symmetry - Alternated long dash/short dash lines.

2.13 Architectural Treatment

A. Do not use architectural treatments such as shades and shadows on bridge drawings.

B. Keep required pictorial views with shades and shadows separate from the bridge details.

2.14 Skew Angle and Complementary Skew Angle

A. A skew angle is the acute angle measured between a line perpendicular to the longitudinal line and the skew line itself.

B. The skew angle referred to by computer geometry programs may actually be complementary to the plan skew angle. The sum of the skew angle and the complementary skew angle is 90 degrees.

2.15 Section Cut Line and Identification

A. A section cut line is an imaginary line extending between right angles at the location of the section. Use section arrows to indicate the direction of the section view.

B. Place the identification letters of the section on the interior side of the cut line. For sections located on another sheet, provide cross-reference notes on both sheets.

2.16 Enlarged Details

When an enlarged detail of a certain area in a view is required, place a circle or an ellipse large enough to encompass the area that is to be shown in the enlarged detail. Annotate the circle/ellipse with a leader line and a label such as: See Detail "A, Sheet _". Entitle the enlarged

detail: DETAIL "A". If the Detail is located on another sheet, provide cross-reference notes on both sheets.

2.17 Using Standard Abbreviations

A. Do not use abbreviations when the meaning may be in doubt.

B. Avoid abbreviations in titles, subtitles, and notes.

C. For Standard Abbreviations, see Design Standard 001.

D. Use periods after all abbreviations other than those on Design Standard No. 001 noted above.

E. Define abbreviations in the General Notes.

2.18 Arrows

A. Place North Arrows on drawings to aid in orientating the drawings to the actual site and bridge (or structure) location and orientation.

B. Use the North Arrow on all sheets requiring directional orientation.

C. Directional Arrow for Water Flow - Use an arrow to indicate direction of stream and/or tidal flow of water.

D. Direction of Stationing - Use an arrow to indicate the direction of stationing on plan views, superstructures, substructures etc., as well as orientation references of details and sections. Refer to Article 2.8 of this Section regarding plan orientation.

3 – General Notes

3.1 General Notes (07/06)

A. Prepare a complete set of General Notes for each project. See **SDMEx-1 and SDMEx-2**.

B. As the first item under General Notes, list the version of the Structures Manual and any subsequent Structures Office Temporary Design Bulletins used as the basis for the design of the plans.

C. On projects that require two different construction methods (e.g., prestressed concrete beams and steel girders), show separate General Notes for each method of construction and identify the method to which they apply.

D. Organize notes under headings for Concrete Notes, Steel Notes, etc.

E. Include all General Notes and Pay Item Notes on the General Notes sheet. Notes for a specific element may be shown on the first sheet showing that element.

F. Do not use General Notes to repeat or modify requirements in the Standard Specifications.

G. If modifications to the Specifications are required, prepare Technical Special Provisions.

3.2 Drawing Revisions (07/07)

A. When changes are required prior to contract award, follow procedures outlined in Chapter 20 of the ***Plans Preparation Manual - Volume I***.

B. Erasure of data is allowed only when a revision is made prior to bid opening.

C. When changes are required after the contract award, follow the procedures outlined in Chapter 4 of the ***Preparation and Documentation Manual*** and comply with the following:
   1.) In the revision block, place the revision date, initials, and a brief description of the revision.
   2.) Place a unique symbol (i.e., a numbered triangle) beside both the revised data and the revision date.
   3.) Do not delete details on the plans. Circle or “Cloud” the revision and strike-through any incorrect data. If the drawing does not have sufficient space for the revision, add a new sheet to the plans.
   4.) See **SDMEx-14**.

3.3 Quantity Calculation (07/04)

A. The Basis of Estimates Handbook describes the method of measurement, basis of payment and required rounding accuracy for frequently used items.

B. Show all quantities on the Computation Book Forms. Include pay item number, description, units and dimensions used if applicable.

C. Show quantity breakdown for individual components by construction phase, such as end bents, diaphragms, deck, traffic barriers, expansion joints, bearings, reinforcing steel, etc. in the estimated quantity blocks located on corresponding plan detail sheets.

D. Show quantities on plan detail sheets to additional decimal place of accuracy.

E. Complete each quantity block and deliver all calculations with the design notes.

F. See ***SDME EX-8***.

3.4 Summary of Bridge Pay Items (07/04)

A. The estimated bridge quantities are given in the "Summary of Bridge Pay Items" sheet. Include this sheet immediately following the first plan sheet. The item numbers, descriptions, units, quantities, and totals will be verified before entry into the computer. Include a separate quantity column for each bridge in the project.

B. Submit quantity booklets and a summary of the estimated bridge quantities with the final submittal package. Refer to the Department's Basis of Estimates Handbook for guidance in preparing the quantity booklets and the summary of quantities. This handbook is available at www.dot.state.fl.us/estimates.

C. Input estimated bridge quantities (for each bridge) into the Department's computerized Cost Estimating System (TRNS*PORT) and check the printout.

D. Place quantity calculations for retaining walls, critical temporary walls, and sound barriers in the Roadway Computation Book. Include pay items in the Roadway portion of TRNS*PORT.

3.5 Typical Bid Item Notes

A. Include in the Bid Item Notes information required to define, show limits of quantities or otherwise offer explanation to the list of Bridge Pay Items. All bid items should be shown in one location; not scattered throughout the plans. Examples are:
   1.) For Traffic Control Bid Item Notes, see Roadway Plans.
   2.) Bid on only one of the alternates designed.
      AA - Bulb-Tee Superstructure.
      AB - Steel Girder Superstructure.
   3.) Bid Item No. 400-7 includes __ sq. yards of Approach Slab Grooving.
   4.) For limits of removal of existing structures (Item Number 110-3), see Sheet No. XX-XX.

B. For additional pay item notes, see **SDMEx-1**.
   * List sheets as needed.

4 – Composition of Plan Set

4.1 Sheet Numbers for Bridges and Walls (07/05)

A. Bridge plans are usually a component set of plans and includes walls. Projects with minor bridge work may include these features on sheets in the roadway plan set or detailed on roadway sheets. When prepared as a component set of plans, assemble the drawings as a separate plans set complete with a key sheet and all bridge and wall sheets, including the existing bridge plans. Number the sheets consecutively with the sheet numbers prefixed by the letter and letter/number combinations “B” for common sheets, “B1” for the first bridge, “B2” for the second bridge, “B3” for the third bridge, etc., “BW” sheets, if necessary, for all walls, and ending with the existing bridge plans, “B1E”, “B2E”, “B3E”, etc., if necessary.

B. Start the sheet numbering with the Key Sheet numbered “B-1”. Continue to use the “B” prefix for all sheets with common details to all the bridges including Structures Standard Drawings. Begin the sheet numbering for the first sheet of the first bridge with “B1-1”. Continue to use the “B1” prefix for all sheets with details pertaining to the first bridge (“B1-2”, “B1-3”, etc.). Number the second series of sheets for the next bridge, if included, “B2-1”, “B2-2”, “B2-3”, etc., continuing to use the “B2” prefix for all sheets of the second bridge. Continue incrementing sheet prefix numbers, “B3-1”, “B4-1”, etc., for each additional bridge included in the plans. To further divide bridge sheets on complex bridge projects, use a Drawing Number box in the upper right hand corner of the sheet (see Section 4.5).

C. After all the bridge plans, place all the wall drawings (including cast-in-place retaining walls, proprietary wall control plans, temporary walls, and sound barriers) using a “BW” sheet prefix. To further divide wall sheets by wall number or type, use a Drawing Number box in the upper right hand corner of the sheet (see Section 4.5). At the end of the plan set, place all existing bridge sheets in one PDF file, using the sheet prefix B1E for the first bridge (number sheets sequentially “B1E-1”, “B1E-2”, etc.) and, if necessary, “B2E” for the second bridge, etc.

D. Number other miscellaneous structures (signs, signals, lighting, etc) for the appropriate component set (see PPM Volume II, Chapter 2) but place the drawing files in the Structures folder (see CADD Production Criteria Handbook, Chapter 18).

E. The preferred sheet order along with the file naming conventions and other CADD requirements are shown in the CADD Production Criteria Handbook, Chapter 18. All the sheets given in the Table may not be required in a given set of plans, while, in others, additional sheets may be necessary. The sheet order should correspond to the work sequence.

4.2 Sheet Titles

If more than one sheet is required for a particular sheet type, add sheet numbers in the Sheet Title Block; ex: “General Notes (1 of 2)”, “General Notes (2 of 2)”.

4.3 Sheet References for Multiple Bridges and/or Structures

The drawings for a specific bridge may refer to other drawings with sheet numbers beginning with the same prefix letter and number or with the letter "B". Do not use reference from one bridge to plan sheets for another bridge (i.e. “B1-XX” sheets should not reference “B2-XX” sheets).

4.4 Sheet Numbers on Projects with Alternate Structure Types

On projects with alternate structure types, designate each alternate for each bridge with a unique number following the "B" prefix (e.g. "B1" and "B2" for bridge 1 alternates; "B3" and "B4" for bridge 2 alternates, etc.). Since the sheet number will no longer correspond to the bridge number, cross reference each alternate with the bridge number in the List of Drawings.

4.5 Construction Sequence

A. Construction sequence drawings for phased construction or bridge replacement supplement but do not replace Traffic Control Plans.

B. Show systematic construction stages including:
   1.) Construction Joints.
   2.) Critical temporary walls (MSE or sheet pile.)
   3.) Temporary traffic barriers.
   4.) Removal of existing structures.

4.6 Optional Drawing Number Box

When developing complex bridges or multiple wall systems, place an additional Drawing number box on the plans to separate components and help in the development of cross references. Drawing letter/number combinations are assigned at the discretion of the designer and should include prefix combinations that correspond to the details on the drawing. When used, place the drawing number box in the top right hand corner of the sheet. The information in the Drawing Number box is only used for cross referencing and plan preparation; no data from the box will used in the electronic Delivery process. For drawing letter/number combination suggestions, see the CADD Production Criteria Handbook, Chapter 18. Optional Drawing Number Box is required on all bascule bridges or bridges with multiple wall types. For projects with alternate designs, follow the Drawing Number with the alternate designation (e.g. Drawing No.: 45, Alt. B).

5 – Plan and Elevation

5.1 General

A. This drawing is the general layout of the bridge in plan and elevation views.

B. See **SDMEx-7**.

5.2 Scales

A. Draw Plan and Elevation views to the same vertical and horizontal scale if possible. In some cases a larger vertical scale larger than horizontal is required. More than one sheet may be required.

B. Do not indicate the scale on the drawing.

C. Select scales selected providing 100% drawing legibility when reproduced to 11-inch x 17-inch prints. See the ***CPCH*** for additional information. See Chapter 2 for recommended scales.

5.3 Plan and Elevation Drawing

Show the following items:

A. The bridge in both plan and elevation views entitled with "PLAN" and "ELEVATION". This is mandatory for 30% and subsequent submittals.

B. The elevation (vertical) scale.

C. All vertical and horizontal geometry including:
   1.) Horizontal alignment. (Horizontal curve data or Bearing of tangents.)
   2.) Vertical Curve Data.
   3.) Profile grade lines.
      a. When the bridge is on a tangent grade, show the grade and station and elevation of the nearest P.I. or P.V.I.
      b. When the bridge is on a vertical curve, use a profile grade diagram showing as a minimum the percent slopes, the station and elevation of the P.I., the length of the vertical curve, the location of the Bridge and a reference to the horizontal control line to which it applies See Chapter 2.

D. Location of profile grade line and roadway alignment.

E. Stations at begin and end of bridge and approach slabs. Stations at centerlines of bents or piers. Stations at intersections of centerlines of roads. Stations on lower roadway, stream, railroad or other physical feature at the location on the structure plan along the stationing line for the structure.

F. Span lengths and overall length of bridge.

G. North Arrow, direction of flow for water crossing and direction of stationing.

H. Skew angle at bents and intersecting base lines.

I. Roadway width, barrier width, shoulder width, median width, sidewalk width, out-to-out width, width of widening and width of removal (including removal of slope protection).

J. Critical locations and dimensions of horizontal and vertical clearances.

K. Location of expansion and fixed bearings.

L. Traffic data (for each facility, if grade separation): design speed, present and design year (+20), percentage of trucks and direction of traffic.

M. Boring Locations.

N. Utilities, sanitary and storm sewers, telephones, etc.

O. Right-of-way lines (roadway, railroad, etc.)

P. Limits of slope pavements, sand cement riprap or rubble riprap.

Q. Edge of shoulder.
R. Embankment slope.
S. Toe of slope.
T. Berm width.
U. Existing ground and finished ground profiles.
V. Low, mean and high water elevations as appropriate.
W. Guardrail in Plan and Elevation views.
X. Bridge-mounted Lighting, Signs and Signals.
Y. Distance to milepost from intersection of railroads.
z. Existing bridge numbers.

6 – Bridge Hydraulics

6.1 Purpose (07/04)

A. This drawing shows all pertinent hydraulic information necessary for the layout of a bridge at the location of a given water crossing.

B. This drawing, prepared by the District Drainage Engineer or a Consulting Drainage Engineer, should be included in the PD&E documents or must be in the 30% Plans submittal. This drawing must be included in the final bridge plans.

C. For a typical drawing, see ***Plans Preparations Manual Exhibit BHB-1***.

6.2 General Requirements and Design Procedures

For General Requirements and Design Procedures involving the Bridge Hydraulics Recommendation Sheet, permits and other hydraulic considerations and requirements, see Chapter 27 of the ***Plans Preparation Manual*** and the ***FDOT Drainage Manual***.

7 – Core Borings

7.1 General

A. This drawing, prepared by the District Geotechnical Engineer or a Consulting Geotechnical Firm, is a graphic portrayal of the subsurface conditions at the project site.

B. The information presented on this drawing and in the Geotechnical Report is used to arrive at a proper foundation design.

7.2 Scales

A. Draw the boring layout plan and boring logs in elevation to a scale large enough to legibly show the data and permit reasonable determination and interpretation of soil strata variations.

B. The vertical scale of the boring logs must be large enough to permit inclusion of all relevant boring data and need not be the same scale as the boring layout.

C. Selected scales must provide 100% legibility when reproduced to 11-inch x 17-inch prints.

7.3 Check Items

The following data should appear on the drawing:

A. Plan View (Boring Layout):
1.) Station Line (show station values at 100-foot increments).
2.) Station Line label (Base Line Survey, Center Line Construction, etc.)
3.) North Arrow.
4.) Begin and end bridge stations and labels.
5.) Boring locations referenced to station line by station and offset.
6.) Boring labels.

B. Elevation View (Boring Logs):
1.) Elevation reference (vertical scale) on both left and right side of sheet (borings must be plotted in reference to elevation, not depth below ground surface).
2.) Boring plots, labels, stations, offsets. (Use the soil-type symbols specified in the current ***Soils and Foundations Handbook)***
3.) Ground surface elevation.
4.) Ground/surface water level and date recorded (note elevation of artesian head if encountered).
5.) Strata description including Unified Classification Symbols.
6.) Standard Penetration Test (SPT) N-values.
7.) Rock Core Locations, % recoveries, RQD.
8.) Undisturbed soil sampling locations.
9.) Lab test results.
10.) Insitu test locations (vane shear test, dilatometer test, pressure meter test, etc.) and corresponding test results.
11.) Note unusual circumstances such as: sudden drop of split spoon, loss of circulation, etc.

C. Other:
1.) Soil Legend.
2.) Rig Type.
3.) SPT Hammer Type.(Safety Hammer or Automatic Hammer.)
4.) Environmental Classification (superstructure, substructure).
5.) Financial Project ID.
6.) Completed Title Block.

7.4 Title Block

A. The title of this drawing is "REPORT OF CORE BORINGS".

B. Show the names of the drillers who performed the borings, and the responsible Geotechnical Engineer.

8 – Foundation Layout

8.1 General

A. This drawing shows a plan view of all spread footings, piling or drilled shafts and provides all information necessary for locating their positions in the field.

B. More than one sheet may be required.

C. See **SDMEx-8 *&* SDMEx-9**.

8.2 Scales and Dimensions

A. See Chapter 2 for recommended scales and accuracy. Do not indicate the scale on the drawing. Select scales to provide 100% drawing legibility when reproduced to 11-inch x 17-inch prints. See the ***CPCH*** for additional information.

B. Reduce scales for the distances and exaggerate pile or shaft sizes when necessary for clarity (Refer to Section 2.9).

8.3 Orientation of Details

If the "Foundation Layout" details are to occupy one drawing, proportion to the sheet. Use the same orientation as is shown on the "Plan and Elevation" sheets.

8.4 Layout Details

Include the following:

A. Station line at the scale required for clarity (show north arrow).

B. A plan of the substructure foundations.

C. All horizontal curve data (or reference if shown elsewhere) including bearings of tangents.

D. Show all substructures stations on the Station Line. The substructure station is the intersection of the stationing line and the substructure centerline or begin/end of bridge.

E. Show on the station line, the angle between intersecting reference lines.
   1.) For bridges with straight (tangent) alignment, show the complementary skew angle.
   2.) For bridges with a single horizontal curve, show the angle between the substructure centerline and the tangent to the station line.
   3.) For bridges with multiple horizontal curves, horizontal curves and tangents, spiral curves or other complex alignments, use coordinates to locate working (control) points for the substructure along the centerline of intermediate supports (piers or bents) or Begin/End Bridge. Tie coordinates to the Florida State Plane Coordinate System.

F. Show the distance between the working (control) point and adjacent pile clusters, the center of footings, drilled shafts, or individual piles. In addition:
   1.) Other foundation units may be dimensioned from above or adjacent foundations.
   2.) Dimension pile spacing within a cluster or concrete boundaries for footings.
   3.) Show the Direction of Stationing adjacent to the station line preferably at the extreme ahead or back station.
   4.) Show all overhead and underground utilities and existing foundations in the vicinity and offset dimensions if applicable.

8.5 Numbering Foundation Units

A. Number piles in each bent or pier sequentially, beginning with "1" from left to right when facing in the Direction of Stationing, then from extreme back station to extreme ahead station in the Direction of Stationing.

B. For each pile cluster, number piles sequentially.

C. Number the drilled shafts and piles in individual spread footings as described above.

D. See ***FDOT Manual for Bridge and other Structures Inspection and Reporting Procedures***, Procedure No. 850-010-030.

8.6 Piling, Drilled Shafts and Spread Footings

A. Show the following information:
   1.) Sizes - The size of the foundation unit.
   2.) Batter - The amount and direction of battered piling.
   3.) Test - The size, number, length and location of test piles or other foundation type.
   4.) Scour Notes.
   5.) Pile or Drilled Shaft Installation Tables. See **SDMEx-8 *&* SDMEx-9**.
      a. Maximum Load - The design pile/shaft load or design footing pressure.
      b. Summary of Pile Lengths - If pile lengths are authorized.
      c. Pile cut-off elevations - Elevation of pile head.
      d. Minimum Tip Elevations - Minimum elevation of pile tip.
      e. Drilled Shafts - Head and tip elevations.

B. See ***SDG 3.5*** for additional Pile instructions and Plan Notes.

C. See ***SDG 3.6*** for additional Drill Shaft instructions and Plan Notes.

8.7 Title Block

The sheet title is "FOUNDATION LAYOUT".

9 – Finish Grade Layout

9.1 General

A. This drawing is a typical section and schematic plan view of the superstructure that shows finish grade elevations.

B. For spans of equal length, only one schematic plan view need be shown.

C. See **SDMEx 15 & SDMEx-16**.

9.2 Finish Grade Elevations (01/07)

Finish grade elevations are riding surface elevations on the bridge. Show these elevations (to three decimal places) along: centerline of beams or girders, longitudinal construction joints, Profile Grade Line, gutter lines and outside coping lines at their intersections with the following lines: Begin/end bridge, begin/end approach slab, centerline of intermediate substructure components, intermediate diaphragms, transverse construction joints, mid-span, and other equally spaced intermediate locations (T-lines) so that a linear interpolation midway between elevations does not deviate from the theoretical elevation by more than 0.005'.

9.3 Layout Line

The layout line for the superstructure schematic plan view is the horizontal control line (See ***SDM Chapter 2***) from which all the basic distances, lines and angles are referenced for locating the finish grade elevation points. Show the location of the Profile Grade Line and offset distance from the Station Line, when appropriate (this is normally the case for twin bridges).

9.4 Centerlines (or Control Lines)

Show and label the following lines:

A. Begin/End bridge and begin/end approach slabs.

B. Centerline of piers or intermediate bents.

C. Centerline of all beams/girders and intermediate diaphragms.

D. Centerline of roadway, median, etc.

E. Gutter Lines.

F. Coping Lines.

G. Construction Joints.

H. Midspan and T-Lines (label numerically starting with 1.)

9.5 Title Block

A. The sheet title is "Finish Grade Elevations".

10 – Framing Plan

10.1 General

A. This drawing shows a single, concise graphical representation (except for phased construction) of the geometry necessary for location and detailing beam or girder framing.

B. Show sufficient information to permit verification or determination of all calculated, detailed dimensional or noted information on the drawings related to beam or girder layout, as well as other work related to or dependent upon the layout.

10.2 Required Information

For all steel box and plate girder bridges with either straight or curved girders and for all prestressed concrete beam bridges with either curved or trapezoidal spans, provide a framing plan showing the following information:

A. Span lengths along the Station Line.

B. The distances between girders (centerlines or extensions) measured between the begin or end bridge line and centerline of intermediate substructure components.

C. For straight girders or beams supporting curved bridge decks, the chord lengths between the points established in "B" above.

D. The distances (when appropriate) from the station line to adjacent girders measured along the lines established in "B" above.

E. The distances between diaphragms measured along the centerline of beams or girders.

F. Lateral bracing and vertical stiffeners, when applicable.

G. Angles between the station line and begin/end bridge line and centerline of intermediate substructure components.

H. Angles between centerline of beams or girders and begin or end bridge line and centerline of intermediate substructure components.

I. All dimensions to the nearest 1/8-inch and all angles to the nearest second.

J. The identification of beams/girders on the Framing Plan consistent with detail sheets.

K. Girder radius of curvature, if necessary.

L. North arrow.

M. Direction of stationing adjacent to the station line, if necessary.

11 – Slope Protection

11.1 General

This chapter provides bridge designer with the necessary information to develop plan details for appropriate slope protection. See **SDMEx3, SDMEx-4 and SDMEx-5**. In most cases the standard details depicted for slope protection, with minor modifications will be suitable. In some cases, typically in tidal areas or when severe scour conditions exist, special designs and details may be required.

11.2 Responsibility

A. Determine Begin and End Bridge stations and select the appropriate type, slope rate and extent of slope protection for highway and railroad grade separations.

B. For water crossings, consult the Drainage Engineer for minimum Begin and End Bridge stations and for type, slope rate and minimum extent of slope protection. Discuss any alteration to the recommended end location and protection design with the Drainage Engineer.

11.3 Grade Separations

A. For grade separation bridges, design slope pavement on 1:2 slopes with provisions to extend erosion protection to a minimum of four feet outside the superstructure coping. Extend slope protection in the median of dual bridges the entire width between bridges when the median width (distance between copings) is forty feet or less at rural locations or fifty feet or less at urban locations.

B. To protect railroad track embankments, use sand-cement riprap instead of slope pavement.

11.4 Water Crossings

A. The Drainage (Hydraulic) Engineer will determine the design and extent of the slope protection in accordance with the ***FDOT Drainage Manual*** and other applicable guidelines such as ***HEC-18***. The slope protection for spill-through abutments (End Bents) adjacent to water will usually be rubble riprap. Sand-cement riprap is usually limited to bridges over streams or canals with extremely low, non-erodible flow velocities under all flood conditions. A 1:2 slope is the steepest desirable slope rate.

B. Bulkhead abutments can be protected by sheet piling or precast panels with toe protection provided by rubble riprap. Rubble riprap might also be recommended above the bulkhead or at its ends. Never design the protection to be extended less than four feet outside the superstructure coping.

C. Extend the slope protection in the median between dual bridges to include:

1.) The entire median width for rural area bridges with a separated median width of forty feet or less.

2.) The entire median width for urban area bridges with a separated median width of fifty feet or less.

3.) The entire width for urban area bridges inaccessible due to physical barriers or when access is severely limited due to design features or vehicular movement that will impede the ability to maintain the facility.

12 - Fender Systems…See SDG 3.14 Fender Systems.

July 2006 - All information is now in Structures Design Guidelines

13 – Concrete Components

13.1 General

A. Concrete components for bridges are custom constructed either in place at the bridge site or at a precast facility and require clear, complete and fully detailed plans.

B. The concrete outlines, reinforcing steel, prestressing strands and/or post-tensioning tendons must be easily distinguishable. This can be accomplished by using different line weights on the drawings. The preferred method is to use line weights in the following descending order. (See ***CPCH***)
   1.) Use heavier line weights for the concrete outlines.
   2.) Use lighter line weights for dimension lines.
   3.) Differentiate line weights for reinforcing steel, prestressing strands and/or post-tensioning tendons.

C. When detailing concrete components, show plan and elevation views along with sections and any details necessary for construction.

13.2 Items Embedded in Concrete Components

Show the vertical and horizontal locations of reinforcing steel, prestressing strands and/or post-tensioning tendons. Normally, the spacing, location and limits of reinforcing steel can be clearly shown with a few bars. Determine when and where to show required reinforcing steel without cluttering up the drawing.

13.3 Reinforcing Steel

A. Detail reinforcing bars in plan, elevation and sections to clearly indicate the size, location and spacing of individual bars. Show the number of reinforcing bars in plan or elevation views.

B. Usually, in plan or elevation views, only the first bar and the last bar of a series of bars need be drawn, and the number and spacing indicated between. Show all bars in section views.

C. Show the number of bars, followed by a tilde, the bar size, the bar mark and the spacing. For example, 12 ~ 8 A1 @ 6" means 12 bars, Size #8, Mark A1 at 6 inch spacing. The symbol "@" is optional for the word "at".

13.3.1 Maximum Bar Spacing

A. For maximum bar spacing for shrinkage and temperature, see ***LRFD,*** Section 5.10.8.

B. #4 bars are the smallest reinforcing steel size used in cast-in-place components for bridges.

C. For horizontal reinforcing steel in walls, the distance from the top of footing to the first bar in the stem is a maximum of one half the spacing of the bars immediately above it.

D. Bar spaces, plus cover to centerline of bars must equal the concrete dimension of the member. Use the following procedure to detail multiple bars equally spaced where the number of spaces times the nominal spacing does not exactly equal the overall concrete dimension:

14 Bars @ 5"± = 6'-0" or 13 sp @ 5" ± = 6'-0"

This means 13 equal spaces. The symbol "@" means "at", and the symbol "±" means "approximately."

13.3.2 Minimum Bar Spacing

A. For minimum bar spacing, see ***LRFD***, Section 5.10.3.

B. When multiple bars are lapped at the same location, the spacing between laps must be equal that for parallel bars.

C. Avoid using bundled bars. If bundled bars are required, they must meet AASHTO requirements.

13.3.3 Minimum Concrete Cover

See the ***SDG*** for minimum concrete cover requirements.

13.3.4 Fit and Clearance

A. Check reinforcing fit and clearance by calculations and with large scale drawings. Skews tend to aggravate problems of reinforcing fit. Consider tolerances normally allowed for cutting, bending and locating reinforcing. Refer to ***CRSI Manual of Standard Practice*** for industry fabrication tolerances.

B. Some common areas of interference are:
   1.) Between slab reinforcing and supporting element reinforcing, such as girder stirrups and monolithic end bent or intermediate bent.
   2.) Vertical column bars projecting through pier cap reinforcing.
   3.) Areas near expansion devices.
   4.) Anchor bolts for girders.
   5.) At anchorages for post-tensioning systems.
   6.) Between prestressing (pretensioned or post-tensioned) steel and reinforcing steel stirrups, ties, etc.
   7.) Between column bars to be lapped with footing dowels.
   8.) Drilled shaft steel projecting through footing steel.
   9.) Bars with large radii spaced close together or where fabrication tolerances exceed placement tolerances.
   10.) Bars greater than size #11 where fabrication tolerances are increased.

13.3.5 Bar Splicing

A. Detail splices for main reinforcement bars of different sizes. Other bars may be shown as "continuous" without showing splice locations because splices are detailed on the Reinforcing Bar List. Indicate splice locations as required (i.e., phase construction, construction joints, etc.). Detail locations and splice lengths for main reinforcing. Use mechanical splices or other positive connections for bars larger than #11.

B. For tension splices, the smaller bar governs the length of a lap splice between bars of different sizes.

C. For compression splices, the larger of the splice length of the smaller bar or the development length of the larger bar, governs.

D. Wherever practical, stagger main reinforcing bars with so that only one-third are spliced at the same location. Exceptions include:
   1.) Phased construction.
   2.) Flat slab construction.
   3.) Compression zones.
   4.) Bases of stems of cantilevered retaining walls.

13.3.6 Dowels

Obtain the embedment length from the Designer and show on the plans. Use standard hook bends when bent bars are used and depth of embedment permits. Show bent bars used for footing dowels resting on the bottom reinforcing steel mat in the footing.

13.3.7 Bars in Section

A. Draw sections at a scale adequate to clearly show reinforcing details.

B. For stirrups and other bars not shown end-on, represent bars with single, unbroken lines at less than 1/2"=1'-0" and double, unbroken lines at 1/2" scale or larger.

C. Draw tie and stirrup hooks to scale. Dimensions are not necessary, unless it is a non-standard bar bend.

D. Use small circles to represent bars shown end-on. Circles may be left open or shown solid (filled). Use the chosen symbol consistently throughout the drawings. Show bars as filled circles when holes are also shown.

E. Indicate bars shown end-on by circles or arrowheads pointing to the bar.

F. For complex reinforcing patterns, cut sections at specific locations along a member rather than showing a typical section.

G. Show corner bars enclosed by stirrups or ties at the corner of the bend.

13.3.8 Reinforcing Steel Diagrams

A. Dimension all bars "out-to-out".

B. Round the overall length of each individual bar to the next inch.

C. Show all straight bar dimensions rounded to the nearest inch.

13.3.9 Hook Bars

When the required concrete cover cannot be maintained with normal orientation of the hook, add the following note to the plans: "Rotate bar as necessary to maintain required cover."

13.3.10 Maximum Reinforcing Bar Lengths (07/05)

#3 Bars and larger: 60 feet.

13.3.11 Bridge Decks

Detail beam supported bridge decks with straight top and bottom reinforcing steel bars. Use of truss bars is prohibited.

13.3.12 Cast-in-Place Concrete

For cast-in-place concrete, use the smallest practical bar size in order to minimize stress concentrations, increase bonding strength, decrease corrosion potential, and comply with AASHTO crack control criteria. Do not use bars smaller than #4.

13.3.13 Reinforcing Bar Lists (07/07)

A. Using FDOT "Rebar Program", generate a reinforcing bar list for each structure. Provide a labeled tabulation for every reinforced component, (i.e., bents, piers, deck, rails, etc.) Each bar designation must be unique for a component but may be repeated for separate components. Designate bars "A1", "A2", "B1" etc. Show a separate reinforcing bar list on the plans for each component and construction phase on a project.

B. Separate reinforcing for sub-components into a logical sequence similar to the order in which they will be constructed. Identical components should be grouped together. The following list should be used as a guide of the minimum breakdown of sub-components.

Substructure

Footing

Column/Pier

Bent Cap

End Bent

Superstructure

End Diaphragms

Intermediate Diaphragms

Deck

Approach Slabs

Walls

Footing

Wall/Cap

Deadman Anchor

13.3.14 Standard Bar Bending Details

Include Design Standard 21300, Standard Bar Bending Details.

13.4 Construction Joints in Concrete Deck Slabs

A. Locate transverse construction joints as follows:
   1.) For continuous flat slab superstructures, show construction joints at most one-quarter and/or three-quarter points in the spans. Space joints at not less than 20 feet or more than 80 feet.
   2.) For simply supported girders with deck slabs continuous over bents or piers, include the alternate details showing construction joints.

B. For deck slabs on continuous girders, use construction joints to divide the spans into units of positive moment area and negative moment area (over intermediate substructures).

C. Provide additional construction joints to limit the volume of cast concrete. Show the concrete pouring sequence on the units with numbers in circles.

D. Sequence pours to reduce the potential for tension in the slab due to girder deflection from subsequent pours in adjacent spans.

13.5 Reinforcing Steel Splices and Terminations in Deck Slabs

A. Deck concrete is placed in a sequence of units, and reinforcement spliced as necessary. See ***SDME EX-13 & EX-14.***

B. Show splices of longitudinal reinforcing in continuous flat slab spans either staggered or located in compression zones.

13.6 Placing Deck Slab Concrete

A. For flat slab and girder type superstructures, include the following notes:
   1.) Do not place a unit adjacent to a unit that is not a minimum of 72 hours old.
   2.) After placement of the first unit, begin succeeding placements at the end away from and proceed toward the previously placed unit.
   3.) Units with identical labels may be placed individually or simultaneously.

B. For continuous superstructures, include the following note near the slab casting sequence diagram: "A revised casting sequence may be submitted for approval. Submit structural analysis and its effect on the Camber Diagram."

13.7 Stay-in-Place Metal Forms

Incorporate stay-in-place metal forms in the design and details unless prohibited by the ***SDG***. Superstructure form details must be generic because the actual form material (depth, pitch, thickness, etc.) cannot be predetermined.

13.8 Sizing Caps for Intermediate Bents

When sizing caps for pile-supported bents, consider the allowable tolerance for driving the piles.

13.9 Crash Wall

Bents or Piers adjacent to railroad tracks with horizontal clearance less than 25 feet, require crash walls. For additional information, see Chapter 6 of the ***Plans Preparation Manual - Volume I.***

13.10 Open Drains/Deck Drains

A. Open deck drains must not discharge directly on the supporting beams, substructure embankments at end bents and other areas (water or land) not permitted. Show pipes drained to a location recommended by the State/District Drainage Engineer.

B. Locate required deck drain near pier supports and, when practical, use a single drain; sized to drain the entire span. Provide a connection with the drain that accommodates differential movement between the superstructure and substructure.

H. Additional reinforcement is required in the bridge deck at drain locations. Detail additional reinforcing around drains. The reinforcing requirement is dependent on the drain size and beam spacing.

C. Detail the drain system utilizing scuppers with removable grate, welded steel plates and bars with anchors.

E. Use PVC, Schedule 80 UV-Resistant or fiberglass pipe, encased in the pier concrete. Provide clean-outs.

F. A note allowing specific alternate ferrous castings may be included.

13.11 Prestressed Beam Bearings (01/07)

A. See ***Design Standards*** Index Nos. 20500, 20501 (Bearing Plates - AASHTO & Florida Bulb-T Beams), and 20502 (Bearing Plates - Florida U-Beams). See ***Volume* 3, *Instructions for Design Standards*** for example drawings and general instructions.

B. For beam grades 2% or less, require the beam seats to be finished parallel to the bottom of the beam.

C. For beam grades greater than 2%, require the beam seats to be finished level and use beveled bearing plates to prevent the beams from sliding.

13.12 Approach Slab (01/07)

A. Include reinforced concrete approach slab details with the structures plans. Use ***Design Standards*** 20900 or 20910 if suitable with the corresponding Data Tables provided on the Microstation Sitemenu. If a ***Design Standard*** cannot be used, prepare the necessary drawings for submittal with the bridge plans.

B. Urban roadway approaches usually have a 6-inch raised sidewalk. If the raised sidewalk is not continued across the bridge, when possible, transition the raised sidewalk to the bridge sidewalk over the length of the approach slab. Design and detail the transition to prohibit low spots or ponding and to redirect or collect runoff from the bridge and approach slab into suitable roadway or drainage structures.

13.13 Concrete Surface Finishes

A. See SDMEx-6 for depiction of areas that are to receive a "Class 5 Applied Finish Coating". This is a concrete texture coating utilized as a final concrete finish. Show appropriate notes in the General Notes and the corresponding sketches on the General Notes drawing. Conventional cast-in-place retaining walls will generally require a "Class 5 Applied Finish Coating". In most cases, precast portions of proprietary retaining walls do not require a Class 5 Applied Finish Coating.

B. When existing bridges are widened, specify a "Class 5 Applied Finish Coating" on the existing substructures along with the widened portions of the structure where applicable. Use Pay Item 400-143, Concrete Surface Cleaning and Coating.

14 – Structural Steel

14.1 General Detailing (01/05)

14.1.1 Design Drawings

A. See **Structures Preferred Details** for suggested details. Refer to these details and use them as a guide in the preparation of specific details. The designer may select structural members other than those shown.

B. Refer to the AASHTO/NSBA Steel Collaboration Document ***G 1.2-2003 Design Drawing Presentation Guidelines***. http://www.steelbridge.org/

14.1.2 Shop Drawings

Refer to AASHTO/NSBA Steel Bridge Collaboration Document ***G 1.1-2000, Shop Drawing Review/Approval Guidelines*** and ***G 1.3-2002, Shop Detail Drawing Presentation Guidelines***. http://www.steelbridge.org/

14.2 Connections

For welded steel girders, designers and detailers must account for fatigue problems caused by secondary members and displacement induced stresses in connections to the main girders. These problems exist because most bridges are essentially linear and are designed for in-plane loading and deflection of the main girders and diaphragms. Although interaction between longitudinal girders and diaphragms does not alter in-plane behavior enough to economically justify space frame analysis for these effects, it is of paramount importance that the designer and detailer consider the distortions resulting from such interaction. See **Structures Preferred Details** for additional information.

14.3 Welds (07/04)

A. Even the best welds may have imperfections such as porosity, slag inclusions, cold laps and other comparable conditions that cannot be eliminated. These imperfections are assumed to be unavoidable and have been considered in the allowable stress range for the weld.

B. Avoid using details that cause stress concentrations in the weld and a decrease in the basic allowable stress range.

C. It is the designer's responsibility to design the connections; however the detailer should be familiar with Table 6.6.1.2.3-1 and Figure 6.6.1.2.3-1 in the ***AASHTO-LRFD Specifications***. This table indicates that welds cause reductions in allowable fatigue strength and the reductions are governed by the magnitude of discontinuities in the welds.

D. Avoid the following Category E weld types:
   1.) Intersecting welds: Do not use this type detail.
   2.) Longitudinal weld terminations: Plates on cover-plated beams should terminate at the ends of beams. Welds should be continuous. When attachments require longitudinal welds on beams or girders, refer to the ***AASHTO-LRFD Specifications***.

E. Any detail can be used provided it is properly accounted for in the design and details. The simplest detail consistent with the stress requirements will generally be the most desirable from the standpoint of design, fabrication and economics.

F. Show a field weld symbol where the stud shear connectors are applied.

14.4 Stay-in-Place Metal Forms

Incorporate stay-in-place metal forms in the design and details except when prohibited by the *S**tructures Design Guidelines***. Form details must be generic because the actual form material (depth, pitch, thickness, etc.) cannot be predetermined. See **Structures Preferred Details** for

suggested details. To avoid conflicts with the top flange lateral bracing system, take special care for forms inside box girders.

15 – Fences and Sound Barriers

15.1 Fences (07/05)

15.1.1 General

A. Show the limits of fencing in the plans if they are not from begin of approach slab at Begin Bridge to end of approach slab at End Bridge.

B. Show estimated quantities for bridge fencing with estimated quantities for Traffic Railing and/or concrete parapets in the superstructure details sheets.

C. Determine if bridge fencing requires grounding. If required, provide details in the superstructure sheets.

15.1.2 Chain Link Fabric and Tension Wire Types

A. Specify the type of chain link fabric and tension wire required for bridge fencing in the General Notes. See Design Standards Index Nos. 810 through 812, Bridge Fencing for options.

B. When PVC coated chain link fabric is specified, provide the following information in the General Notes:
   1.) A note specifying the color of the PVC coating for chain link fabric.
   2.) A note to paint the fence framework to match the color of the PVC chain link fabric.
   3.) A note for preparation of galvanized steel for painting.
   4.) A note to coat tension wire and fence fittings to match the color of the PVC chain link fabric.

15.1.3 Expansion Rails and Assemblies

Evaluate the expansion joints movements of the bridge. Expansion rails are required for concrete parapet installations at expansion joints where the total movement exceeds 1-inch. If the total movement at an individual expansion joint is 6-inches or less, the bridge fence will span the joint without using an expansion assembly. If the total movement at an individual expansion joint exceeds 6-inches, an Expansion Assembly must be installed at that location. Provide locations for expansion joints requiring expansion rails or expansion assemblies in the superstructure layout sheets. See Design Standards Index Nos. 810 through 812, Bridge Fencing for details.

15.2 Traffic Railing / Sound Barriers

15.2.1 General

For Bridge Decks up to a maximum thickness of 9-inches, the two Bars 5S1 (See Design Standard 5210) placed in the Bridge Deck may substitute for the longitudinal deck steel located within the limits of Bars 5V, provided that the total area of longitudinal deck steel beneath the barrier, as required by calculation, is not reduced. Show these bars on the Superstructure Sheets with the deck steel.

15.2.2 Form Liners

A. Form liners providing a textured finish are permitted on the outside face of Traffic Railing /Sound Barrier with the following provisions:
   1.) The maximum amplitude of the form liner on the lower 32-inches section shall be limited to 1-inch depth
   2.) Any form liner used above 32-inches, must provide a thickened concrete section to maintain 2-inch cover.
   3.) Provide full details of this thickened section and the form liner in the plans.

B. Form liners on the inside face of Traffic Railing /Sound Barrier are not recommended.

15.2.3 End Treatment Options

A. Use one of the following options:

1). When the Sound Barrier terminates on the bridge, the End Taper shall be located at an open joint. When the Sound Barrier terminates on the Approach Slab, the End Taper shall terminate at Begin or End Approach Slab in the Design Standard Index No. 5210.
2.) Apply 8'-0" Traffic Railing / Sound Barrier End Taper (see Index No. 5210) adjacent to 12-inch Traffic Railing / Sound Barrier End Taper. Attach guardrail as shown on Index No. 5210. Use trench footing for 14'-0" Traffic Railing/Sound Barrier (see Index No. 5215) as the foundation for the 8'-0" Traffic Railing/Sound Barrier End Taper.
3.) Apply 8'-0" Traffic Railing/Sound Barrier End Taper (see Index No. 5210) adjacent to full height 14'-0" Traffic Railing/Sound Barrier. Attach guardrail as shown on Index No. 5210. Use trench footing for 14'-0" Traffic Railing/Sound Barrier (see Index No. 5215) as the foundation for the 8'-0" Traffic Railing/Sound Barrier End Taper.
4.) Taper 14'-0" Traffic Railing/Sound Barrier back until it is outside the clear zone. Taper rate varies based on both design speed and highway application (i.e., Interstate, urban or rural installations). See Design Standards and Plans Preparation Manual for applicable taper rates. 14'-0" Traffic Railing/Sound Barrier may be full height or tapered.
5.) Apply a wide crash cushion at the end of the 14'-0" Traffic Railing/Sound Barrier. 14'-0" Traffic Railing/Sound Barrier may be full height or tapered. Ensure the traffic face of the crash cushion is offset at least 24-inches from vertical face of Sound Barrier. See Design Standards for crash cushion options.

B. Show details of selected End Treatment in the Plan Sheets.

15.3 Precast Sound Barriers

15.3.1 General

A. The precast Sound Barriers Standard Index Nos. 5200 through 5206 depict 5 Pile/Post Connection Options, based on either 10'-0", or 20'-0" post spacing and are applicable for sites with soil SPT N values between 10 and 40.

B. Specify, on the Key Sheet Index No. 5203 for flush panels or Index No. 5204 for recessed panels, as required.

C. Allow all pile/post connection options shown in, Index No. 5205, except for Option D (Sheet No. 5 of 7), which may be excluded when project aesthetics requirements dictate.

D. A cell is available on the Structures Sitemenu for the summary of project aesthetic requirements, wall quantities, limits of anti-graffiti coating, and applicable proprietary panel/system options.

15.3.2 Soil Conditions

A. For project sites where soil N values are less than 10, specific designs are required.

B. If muck/organic soils are encountered, removal or soil improvement methods may be necessary. The limits of muck/organic soils should be shown in the plans with specified removal/improvement methods and method of payment.

C. For project sites where rock/very strong soils are encountered at shallow depths (N values greater than 40), specific designs are required.

15.3.3 Soil Survey

A. Maximum preferred boring spacing is 200 ft. and minimum boring depth is the lesser of 2.0 times the design wall height for that location or 30'-0".

B. Consider soil borings as structural borings that include SPT performed at a maximum of 36-inch intervals along the depth of the borings.

15.3.4 Utilities

A. Consider spread footings at locations where auger cast piles are not practical due to overhead/underground utilities.

B. Provide project specific foundation designs as necessary.

15.3.5 Wall Layout

During design, field stake wall alignment at 20'-0" spacing to locate potential conflicts.

15.3.6 Drainage Holes

A. Locate wall drain holes based on site requirements.

B. Show drain holes locations and types in the Wall Control Drawings. See Index No. 5204 for details.

15.3.7 Fire Access Holes

Locate fire access holes at hydrants and at other locations based on project requirements.

15.3.8 Anti-Graffiti Coating

A. Contact the FDOT Project Manager to determine where anti-graffiti coating is required.

B. For wall areas not receiving anti-graffiti coating specify a Class 5 Applied Finish applied in accordance with Specification Section 400. Specify Class 5 Finish color to match the anti-graffiti coating system unless otherwise directed by FDOT.

C. Tabulate limits of the anti-graffiti coating in the Wall Control Drawings.

D. Specify sacrificial or non-sacrificial coating systems as directed by FDOT District Maintenance. (See Pay Items)

15.3.9 Wall Textures

A. For recessed panels, textures may be specified for either the back or front face of wall. For flush panels, specify textures for the front face only. Specify a broom finish for the back face.

B. All textures shown on Index No. 5201, except Type "H", may be used for either the back face or front face of the wall. Type "H" Texture is limited to front face only.

C. Textures on the front face are formed while textures on the back face are rolled or pressed; therefore random pattern types are more suitable on the back face.

15.3.10 Graphics

A. When formed wall graphics are required, show the locations in the Wall Control Drawings.

B. See the Structures Sitemenu for graphics options.

C. Create other graphics as project requirements dictate. General considerations in creating graphics are as follows:
   1.) Detail wall graphics in the plans.
   2.) Keep wall graphics simple.
   3.) Wall graphics should be as large as possible (approximately 8 ft. in height).
   4.) Consider input from local communities when determining graphics.

15.3.11 Vehicle Impact Loads

A. The wall system shown on Index 5200 has been designed for wind loads only, with no provisions for vehicle impact loads. See Plans Preparation Manual - Volume I (current version).

B. Locate walls outside clear recovery zone or set back 5'-0" from front face of crash-tested barrier.

C. Guardrails and delineators may be required at the back-face of wall along local streets.

15.3.12 Proprietary Options

A. Any of the approved proprietary sound barrier panels or proprietary systems (panels and foundations) listed on the Qualified Products List may be allowed as alternates to the Precast Standard, provided the proprietary panel/system option meets the project's aesthetic requirements as shown in the Wall Control Drawings.

B. List all applicable proprietary panel/systems in the Wall Control Drawings based on project requirements.