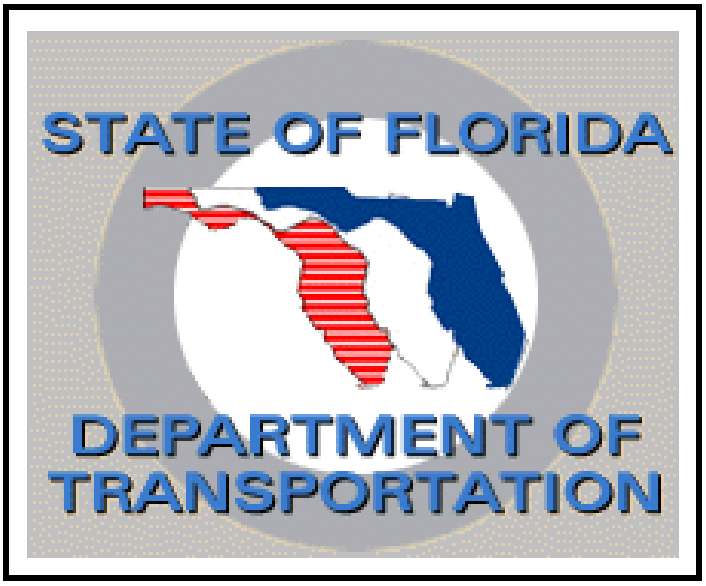
DETAILING MANUAL
FOR
LOAD AND RESISTANCE FACTOR DESIGN

Topic No.: 625-020-200-d
Effective: January 1, 1999



Published by:

STRUCTURES DESIGN OFFICE
Mail Station 33
605 Suwannee Street
Tallahassee, FL 32399-0450

DETAILING MANUAL

Topic No.: 625-020-200-d
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Please return to:

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PREFACE

Throughout this Manual, reference is made to CADD prepared drawings. The Department requires all drawings to be prepared by a CADD System for all projects. Therefore, consultants should carefully check the written contract agreement for specific requirements on this issue. CADD drawings submitted to the Department must be in MicroStation "*.dgn" format.

This Manual is intended to supplement, complement and be used in conjunction with the Roadway Design Office's Plan Preparation Manual - Metric (Topic No.: 625-000-005) and Structures Design Office's: Structures Design Guidelines (Topic No.: 625-020-150), the CADD Manual and the Standard Drawings (Topic No.: 625-020-300). All Structures' documentation can be obtained from the Structures Design Office's web site on the Internet, www.dot.state.fl.us/structures

DETAILING MANUAL

INTRODUCTION

I.1 PURPOSE

The Detailing Manual sets forth the basic drafting and detailing criteria and methods to be used in preparing contract plans for structural elements and/or systems that are included as part of the construction work in Florida Department of Transportation projects. Such elements and/or systems include, but are not necessarily limited to, bridges, overhead sign structures, earth retaining structures and miscellaneous roadway appurtenances.

I.2 AUTHORITY

Section 334.044(2), Florida Statutes.

I.3 SCOPE

This manual is required to be used by anyone performing structural design or analysis for the Florida Department of Transportation.

I.4 GENERAL

The Detailing Manual is presented in 8½ x 11 format consisting of text, figures, charts, graphs and tables as necessary to provide engineering standards criteria and guidelines to be used in the development of engineering drawings of structures for which the Structures Design Office (SDO) has responsibility. The manual is intended to be used in conjunction with the Structures Design Guidelines (Topic No. 625-020-150),the Standard Drawings (Topic No. 625-020-300), the Roadway Design Plans Preparation Manual Volumes 1 & 2 (Topic No. 625-000-005) and CADD Manual.

I.5 DISTRIBUTION

The Detailing Manual is available from the following address:

Structures Design Office
Mail Station 33
605 Suwannee Street
Tallahassee, Florida 32399-0450
Tel.: (850) 414-4255
E-mail: strucdes@tfn.net

This Detailing Manual is furnished to Department of Transportation personnel at no charge upon request. Generally, for registrants external to the Department, first-time acquisition of the manual and subsequent, total re-prints must be obtained by purchase at the above address. At the discretion of the SDO, minor, intermediate modifications to the manual, in the form of individual pages to be inserted in a previous edition, either may be sent to all registered users free of charge or, for registrants external to the Department, may be obtained by purchase.

I.6 MANUAL REGISTRATION

Each copy of the manual and intermediate modifications thereto includes a registration page. This page must be completed by the authorized, registered user and returned to the address indicated on the page in order for the registrant to be assured of obtaining notification of future editions of the manual and/or any intermediate modifications.

I.7 ADMINISTRATIVE MANAGEMENT

Administrative Management of the Detailing Manual occurs through the cooperative effort of nine voting members of the Technical Advisory Group (TAG). The TAG provides overall guidance and direction for the Detailing Manual and has the final word on all proposed modifications. The TAG comprises the State Structures Design Engineer (SSDE) and the eight District Structures Design Engineers (DSDE). In matters of technical direction or administrative policy, when unanimity cannot be obtained, each DSDE has one (1) vote, the SSDE has two (2) votes, and the majority rules.

I.8 SUGGESTED MODIFICATIONS AND IMPROVEMENTS

All manual users are encouraged to suggest modifications and improvements to the Detailing Manual. The vast majority of modifications to the manual that become necessary are the direct result of changes in specifications, FDOT organization, Federal Highway Administration (FHWA) regulations and AASHTO requirements or as a result of recent experiences in construction, maintenance and research. Many other improvements to the manual, however, have been suggested by users. This has been particularly true with suggestions to improve the clarity of the text and to include examples, sketches and details that cover drafting needs not previously addressed in the manual. Suggestions to modify and improve the Detailing Manual should be transmitted in writing to the State Structures Design Engineer at the address included in Section I.5 above.

I.9 ADOPTION OF REVISIONS

Revisions to the Detailing Manual occur either as Temporary Bulletins issued by the SSDE or as Permanent Revisions according to a formal adoption process. Temporary Bulletins provide the SDO with the flexibility to address in an efficient and responsive manner any

mandatory modification or any modification considered by the SSDE to be essential either to production or to structural integrity issues. Temporary Bulletins are active for the limited time period of 360 days after the date of issuance after which time they automatically terminate. At any time during their life, Temporary Bulletins may be proposed by the SDO as Permanent Revisions to the Detailing manual.

I.9.1 Temporary Bulletins

A Temporary Bulletin is a revision to the Detailing Manual that is deemed by the SSDE to be mandatory and in need of immediate implementation. The conditions that dictate the implementation of a Temporary Bulletin may comprise issues in such bridge detailing area due to critical code changes or new specification requirements.

Temporary Bulletins supercede the requirements of the current version of the Detailing Manual to which they apply and may be issued by the SDO at any time. Temporary Bulletins must reference the particular portion or portions of the Detailing Manual that will be affected. Temporary Bulletins are not official or effective until signed by the State Structures Design Engineer.

Temporary Bulletins are effective for a period not to exceeding 360 calendar days. They become null and void after the 360-day, by issuance of subsequent Permanent Revisions to the Detailing Manual, or when superceded by a subsequent Temporary Bulletin. Temporary Bulletins automatically become proposed Permanent Revisions unless with draw from consideration by the SSDE.

Bulletins will indicate their effective date of issuance, will include the reference Topic Number, be numbered sequentially with reference to both the Detailing Manual version number and their year of issuance, and be issued on color-coded paper. For example, Temporary Bulletin No. D99-1 would be the first Temporary Bulletin issued in 1999 for the Detailing Manual Topic Number 625-020-200-**d**.

I.9.2 Permanent Revisions

Permanent Revisions to the manual are made on an "as-needed" basis but not less frequently than once yearly. If an individual revision, or an accumulation of several revisions, is considered by the SDO to be substantive, a complete reprinting of the manual will occur. Otherwise, color-coded pages for insertion into the most recently printed manual will be published. The following steps are required for adoption of a revision to the manual.

A. Revision Assessment

Proposed revisions to the manual, either developed internally by the Department or in response to external suggestions or requirements, will be assessed by SDO Staff for inclusion in the manual. The SDO Staff has the responsibility of developing the initial draft of all proposed Detailing manual modifications for the SSDE's approval.

B. Revision Research and Proposal

The SDO Staff will conduct the necessary research, coordinate the proposed modification with all other affected offices and, if the proposed modification is deemed appropriate, prepare a complete, written modification with any needed commentary. The SSDE's approval signifies the SDO's position on the proposed modifications.

C. Revision Distribution to TAG and Other Review Offices

The proposed, completed modification and all other similar, proposed modifications will be collected by the SDO and mailed to each TAG member such that the revision package will be received by the TAG members not less than two (2) weeks prior to the next scheduled TAG meeting. The DSDE members of TAG are responsible for coordinating the proposed modifications with other all other appropriate offices at the district level.

Concurrent with the distribution to TAG, the assembled, proposed modifications will be transmitted by the SDO to all other appropriate FDOT/FHWA offices affected by the SDG, which offices shall be given the same two (2) weeks to reply to the proposed modifications. These offices include, but are not necessarily limited to: Office of Construction, State Maintenance Office, State Materials Office, State Roadway Design Office, Organization and Procedures, and FHWA.

D. Revision Review by TAG and SDO

The proposed modifications will be reviewed by each TAG member prior to the meeting. Similarly, the SDO will review all modification comments received from other FDOT/FHWA offices in preparation for presentation at the meeting.

Each proposed modification will be brought forward for discussion at the TAG meeting. Also, any additional review comments received by the SDO and/or DSDO's during the review process will be presented for discussion and resolution.

E. TAG Adoption Recommendation

Immediately after the TAG meeting, each proposed modification will be returned to the SDO with one of the following three recommendations:

1. Recommended for adoption as presented.

2. Recommended for adoption with resolution of specific changes.

3 . Not recommended for adoption.

F. Revision Recommendations to SSDE

Within two (2) weeks after the TAG meeting, each modification recommended for adoption by the TAG shall have all TAG comments resolved by the SDO Staff, and the assembled modifications shall be provided to the SSDE for final approval.

G. Revision Adoption and Implementation

Once approved by the SSDE, the Detailing manual revision modifications will be assigned to the Design Technology Group Leader for final editing.

H. Official Distribution of Revisions as New Detailing Manual Version

Within four (4) weeks after receipt of the approved modifications from the SSDE, or when otherwise agreed upon, the SDO shall print and distribute the Detailing Manual version modifications. This process includes coordinating with the Organization and Procedures Office for updating of the Standard Operating System and any electronic media prior to hardcopy distribution of the Detailing Manual.

I.10 TRAINING

No specific training is made available for the requirements of this manual.

I.11 FORMS

No forms are required by this manual.

DETAILING MANUAL

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DETAILING MANUAL

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Chapter 1

DRAFTING AND PRINTING STANDARDS

1.1 Purpose

This chapter contains general detailing standards and requirements along with details for various bridge components. The instructions are also applicable in a general sense to other highway related structures such as retaining walls, pile-supported roadways, etc. The Structures Computer Aided Drafting and Design (CADD) System's CADD Manual should be used for specific instructions related to the computer aided drafting.

1.2 Drafting Materials

See the Plans Preparation Manual (Topic No.: 625-000-005) for drafting material requirements. The Title Block shall comply with the title block shown in Figure 2-1.

1.3 Ordering Information

Design Programs and Standard Drawings: See the Structures Design Office's web site on the Internet, www.dot.state.fl.us/structures

1.4 Dimensioning

1.4.1 Definitions

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

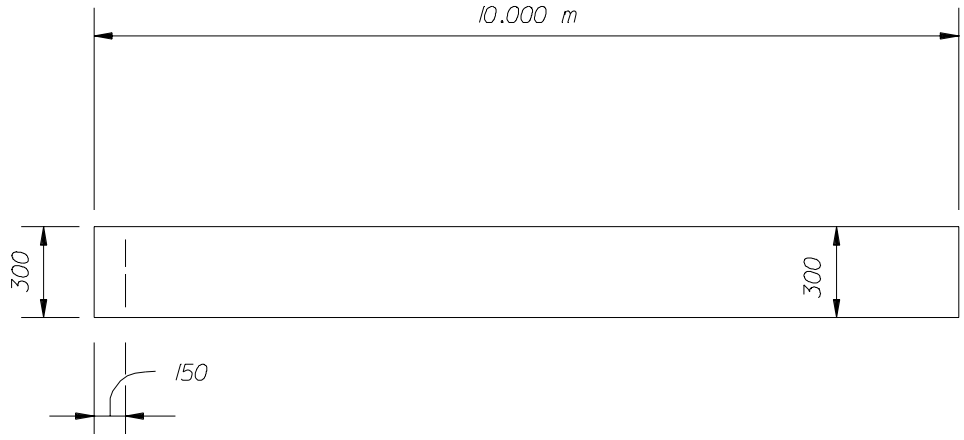
A Value is a quantity used to express a magnitude.

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

Dimensions are displayed by associating Values and Units. Dimensions shall be shown in millimeters (mm) or meters (m). Dimensions less than one meter shall be detailed in millimeters without the "mm" designation.

1.4.2 Dimensions and Text

Dimensions are preferably kept outside the views (between Extension Lines), but occasionally may be placed inside the views, or at the end of a leader line, as shown below:

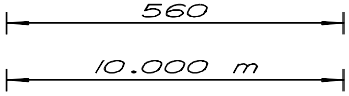


In general, when dimensions are shown by methods other than described above, the unit should be provided also. In this event dimensions are defined as Text. Examples of Text are: titles, sub-titles, headings, labels, notes, and free standing texts. In the case of free standing texts, the unit may be 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, the unit mm or m shall be shown. If two or more dimensions share the same unit, the unit shall be shown only once after the last dimension sharing the unit. For example, the object is a bar 5 millimeters thick by 10 millimeters wide by 1.500 meters long, the dimensional Text shall be: 5 x 10 mm x 1.500 m. And, if the object is a round hole with a diameter of 5 millimeters, the object shall be described as: 5 mm round hole, or 5 mm dia., or 5 mm Φ.

1.4.3 Application of Dimensions to Plans

When showing dimensions, the following format shall be used:

Measurement	Example	Comment
Value	10	This number is an integer. Use it to quantify number of items such as: bars, spacings, bolts, holes, etc.
		(when showing bars)
		(when showing spaces)

Lineal dimension	10.000 m	This number is used in conjunction with a unit of measurement; however, when less than 1.000 m, the dimension shall be given in millimeters (without showing the unit).
		(when showing millimeters) (when showing meters)
Area	10.00 m^2 200 mm^2	Areas shall be shown in square meters or millimeters. The unit shall be shown, and shall agree with a pay item unit and/or industry standard.
Volume	10.00 m^3	Volumes shall be shown in cubic meters (show units). The accuracy of the shown value shall be consistent with the accuracy of the pay item. Sub-quantities (quantity's breakdown) shall be shown to an additional decimal place.
Elevation	EL. 10.000	The unit for elevations is meters(m). The unit is understood and therefore should not be shown. Value shall be shown to three decimal places.
Angle	45^0 15' 30"	Angles shall be shown to needed accuracy up-to-the nearest second.
Size	25 x 25 mm	When showing size, show the unit once (if common). However, industry standards such as those published by ASTM or a manufacturer shall be implemented where applicable.
□	75 x 75 mm x 15.000 m	(when showing solid shape)
I	W 760 x 134	(when showing W-shape)
[	C 250 x 23	(when showing Channel)
L	L 102 x 102 x 6.4	(when showing Angle shape)
T	WT 420 x 88	(when showing Structural Tee)

1.5 Drafting Techniques

Drafting techniques used shall be the clearest and highest quality possible. A CADD System is required. The lines and lettering must be of consistent quality. Different thicknesses between outlines and dimension lines must be maintained. However, the relative line thickness or heaviness and the lettering chosen should be such that perfect legibility can be easily obtained when reproducing by normal printing procedures. For additional drafting techniques, refer to the Structures CADD Manual.

1.6 Existing Plans

Plans of existing Structures may be incorporated into new Contract Plans. These may be obtained from the District, or from the Plans Retention Section in the Central Office. Plans must be legible and reproducible.

1.7 Quality Assurance

Chapter 18 of the Plans Preparation Manual explains the processes for Quality Assurance and Quality control. Chapter 20, “Plans Processing and Revisions”, Plans Preparation Manual, discusses acceptable printing methods, paper size, and quality of the media and print.

Chapter 2

DETAILING INSTRUCTIONS

2.1 Detailing

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

Step-1 Design Study: The detailer should carefully study the design notes and material received from the designer. The detailer should have a good understanding of the design as well as the probable step-by-step construction of the structure. The detailer should carry out all instructions given in the engineering notes. However, he should bring to the designer's attention any item that is not clear or that he considers worthy of discussion.

Step-2 Computer Programs: If the detailer is using FDOT programs (for reinforcing bar lists, etc.) he should use the forms and user's manuals provided by the Structures Design Office as listed on the Structures Design Office's web site on the Internet, www.dot.state.fl.us/structures

Step-3 Planning the Drawings: The detailer should plan the drawings by determining what 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. Chapter 4 discusses the preferred order of drawings in the bridge plans.

Step-4 Preparation of the Drawings: The detailer will, when necessary, prepare sketches and computations to accurately draw and place details and other information on the drawings. This information should be kept for future reference.

Step-5 Checking: The Engineer of Record is ultimately responsible for the drawing. After the drawings have been completed by the detailer, prints are given to the checkers along with all pertinent data necessary to perform a comprehensive check. All dimensions, stations, elevations, sections and details are to be checked for accuracy. When the checking has been completed, the marked-up check prints indicating possible corrections, deletions or additions are returned to the detailer. CADD files shall match check sets and be kept up-to-date with checks. Developing drawings without errors 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. It is the obligation of both the detailer and checker to produce drawings that are error free. It is the checker's function to check each and every 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. Prints shall be returned to the checker, whose final responsibility is to assure that all corrections have been made.

Step-6 Making Corrections: After the detailer has verified the corrections and changes indicated on the check prints, he should 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 the changes are made the check prints shall be marked "changes made" and the detailer shall initial and date the prints.

2.2 Bridge Numbers

Early in the design, bridge numbers shall be obtained by the Structures Design Engineer (State or District) from the District Structures and Facilities Engineer (Refer to Maintenance Office).

New bridge numbers will be assigned to bridges that are replacing existing ones and to all new bridges. In general, bridges that are to be widened shall retain their existing numbers. If the widening joins existing structures, the District Structures and Facilities Engineer will decide as to which existing number shall be retained. The bridge number(s) shall be prominently shown in the title block of the Plan and Elevation sheet(s) as well as on the Plan View of the Bridge and on the lower right side above the Title Block of all sheet (See Figure 2-1).

2.3 Bridge Length, Bridge Classifications and Horizontal Control Lines

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 backwall, See Figure 2-2).

b. FDOT classifications of bridges over water are based on vertical clearance as follows:
   1. Low level - less than 6.0 m.
   2. Medium level - 6.0 m or greater but less than 14.0 m.
   3. High level - 14.0 m or greater.

The vertical clearance of bridges over water is the minimum distance between the underside of the superstructure and the normal high water for navigable water crossings or the mean high water for coastal crossings (See Figure 2-2). When applicable, the vertical clearance for a structure over navigable waters shall be measured at the face of the fender system. See Section 2.10.1 of the Plans Preparation Manual - Metric. The vertical clearance for bridges over roads or railroads is the minimum distance between the underside of the superstructure and road or railroad below (See Figure 2-2).

c. Horizontal Control Lines

1. Alignment Line
   The alignment control line that applies within the limits of the bridge shall be shown and labeled consistent with the Roadway Plans.
2. Stationing Line
   The line used, either ℄ Construction, Base Line Survey, Profile Grade Line or Baseline shall be the line showing the stationing and will be referred to in subsequent articles as the "Stationing Line." This is the line from which all basic distances, lines and angles are referenced for the purpose of locating the bridge components in the field. This line is usually the same line as the Alignment Line.

2.4 Financial Project Number and Federal-Aid Project Number

a. The Financial Project Number shall be located at the Project No. of the Title Block (see Figure 2-1).

b. The Federal-Aid Project Number (F.A.P. No.) shall not be shown in the bridge plans.

2.5 Initial Block

At any stage of plans submittal, initials of the person performing each function shall be indicated in the Initial Block along with the date completed. The name and date blocks shall be completely filled out on each sheet. The name blocks may contain either names or initials. If a function is not applicable, a dash shall be placed thru the name and date block (See Figure 2-1).

2.6 Title Block and Sheet-Title

In the title block (bottom of the sheet) a description of the project and/or bridge location shall be shown, identically, on each sheet in the plans in upper case letters (See Figure 2-1). The sheet title shall be shown in the title block and shall indicate the information shown on the sheet.

2.7 Orthographic Projection

In general, the system of Orthographic Projection, a multi view system using as many dimensioned views as necessary, shall be used to show an object's features to describe it fully.

Perspective and isometric views should be used in certain cases to clarify a complicated detail.

2.8 Views

Before starting a drawing, the detailer should study the bridge or part thereof that is to be shown and determine the views and sections required to describe it fully and to the best advantage. He should then plan the layout and detail accordingly, allowing sufficient space for dimensions and notes.

Generally, all details throughout the bridge plans shall be oriented consistently. Layouts shall generally be made with stationing increasing from left to right. End Bent Number 1 shall be detailed looking back station; all other substructure elements shall be detailed looking ahead station. Superstructure sections shall always be detailed looking ahead station.

Cross-reference all sections or notes on a drawing.

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

In preparing a drawing, select a scale large enough to show the required details clearly keeping in mind that the drawing will be reproduced to 279 x 432 mm size with a minimum of 20 mm left margin. 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 1:100 thru 1:400.

b. Foundation Layout: 1:100 or to fit the sheet (longitudinal and lateral scales may be different and piling may be exaggerated in size for clarity). The important thing is that the foundation locations be correctly shown, i.e., in any substructure unit, the relationship between piles or footings and the Stationing Line shall be drawn to scale.

c. Substructures
   1. Plan and Elevation views 1:30
   2. Sections and Details 1:15 or larger

d. Superstructure
   1. Plan View 1:50
   2. Cross Sections 1:30
   3. Details 1:15 or larger

2.10 Strength and Contrast of Lines

Contrast between various line weights should be in the width of the line and not in the intensity. Make all lines so that legible prints can be made.

The line weight should be varied to accentuate the important features. Consistent line weight should be used for similar purposes to provide clarity and to ease reading of the drawings (See the CADD Manual).

2.11 Dimensions

The drawings for Highway Bridges are a combination of Engineering and Construction Drawings from which the bridge must be built. Dimensioning is one of the most important features of these drawings; therefore, it is imperative that all dimensions are shown 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.

Sometimes it is necessary to clearly indicate a dimension between certain points in a detail. An example of this is shown in Figure 2-3. Small circles may be used, when required, to emphasize the extremities of the line being measured.

The following guidelines shall be used for dimensioning:

a. Centerlines shall be shown and marked ℄.

b. Do not use a centerline as a dimension line, though it may serve as an extension line.

c. Dimension lines are terminated by arrowheads which determine the extent of the dimensions. Arrowheads should be of a uniform size on a drawing. The width of the arrowheads should be about 1/3 their length.

d. Dimension lines should be about 20 mm from the object when plotted.

e. Parallel dimension lines should be spaced 10 mm minimum when plotted.

f. Extension lines shall extend beyond the point of the arrowhead and have a gap from the object as shown in Figure 2-4.

g. Leader lines shall be either straight lines or continuous curves terminated with arrowheads.

h. Dimensions of 1 000 mm or more shall be given in meters (m) and decimals thereof, and dimensions less than 1 000 mm in millimeters (mm), except that computer program output such as the Reinforcing Bar List will list dimension in meters throughout.

i. Compressed dimensions, due to limited space, may be shown in any of the various ways indicated in Figure 2-5. Legibility should never be sacrificed by crowding dimensions into small spaces.

j. Radii may be shown as indicated in Figure 2-6.

k. Finish marks may be shown as indicated in Figure 2-7.

l. Angles may be shown in various ways as indicated in Figure 2-8.

m. Angles and Bearings shall be shown without hyphens as shown below:
13° 21’ 75° 00’ 13" N 18° 13’ 25" E S 41° 21’ 14" W

n. Directions from which the dimensions on a drawing are to be read are as shown in Figure 2-9, and as follows:
   1. The numerals that are placed on a horizontal dimension line are to be read from the bottom of the drawing.
   2. The numerals that are placed on a vertical dimension line are to be read from the right side of the drawing.
   3. The numerals that are placed on an inclined dimension line shall be so placed that they can be read horizontally by rotating the sheet through the smallest possible angle.
   4. All dimension numerals shall be shown parallel to the dimension line.
   5. Dimension numerals that occupy more space than provided by the dimension line shall be either shown on extension lines or by leader lines to the dimension line as shown in Figures 2-3 & 2-4.

o. The sum of string dimensions shall equal the total overall dimension. Refer to Figure 2-10.

p. Double arrowheads on a dimension line are used on partial views, in congested areas, or when it is not necessary to show the line to its termination. Figure 2-11 shows a dimension line with two arrowheads at one end, indicating that the dimension numerals shall be noted on the line along with a description of the magnitude or boundaries in parenthesis.

q. Non-level surfaces with extremities not specifically defined by vertical dimensions shall be noted to slope "down" a specific vertical dimension over a defined horizontal length or at a uniform rate as shown in Figure 2-12.

r. Non-plumb surfaces with extremities not specifically defined by horizontal and vertical dimensions shall be noted to bevel at a uniform rate as shown on the bevel symbol (See Figure 2-12). Similarly, the batter of non-plumb piling shall either be noted to batter with the bevel symbol or the amount of batter noted and connected to the piling by leader lines and the direction of pile batter clearly shown on the drawings.

2.12 Accuracy of Dimensions and Elevations

Dimensions shall be given in meters to three decimal places if larger than 999 mm. Elevations shall be given in meters and decimals always. The minimum degree of accuracy used on the drawings shall be as follows:

a. Concrete dimensions to the nearest 1 mm.

b. Structural steel dimensions to the nearest 1 mm.

c. Reinforcing steel partial dimensions to nearest 5 mm; overall dimension to the nearest 5 mm.

d. Stations to the nearest 0.001 m.

e. Layout dimensions (dimensions along tangents, etc.) to the nearest 1 mm.

f. Foundation layout dimensions to the nearest 5 mm.

g. Dead load and live load deflections to the nearest 1 mm.

h. Elevations to the nearest 0.001 m, except pile cut off elevations to the nearest 0.01 m.

i. Skew angles and bearings given to the nearest second.
Example: 69° 38’ 32", N 69° 38’ 32" E

j. Other angles given such that dependent dimensions meet the above criteria.

k. Spacing of reinforcing steel to the nearest 1 mm.

l. Manufactured items to industry standards.

2.13 Symbols

To simplify the construction and clarity of details, symbols may be used representing certain materials. The more common symbols are shown in Figure 2-13, in sectional view. The detailer’s judgement will determine the extent of the symbol indicating the particular material.

Material indication shall be used only when its use will help clarify the details and not create a cluttered appearance when the drawings are reproduced to 279 x 432 mm print size.

Material surface and outline treatment shall conform to the following symbolism:

a. New Construction - Solid Lines.

b. Existing Construction - Dashed Lines.

c. Plan surface or section area to be removed - Hatched or shaded Area.

d. Construction Joint - Dashed line.

e. Chamfers - Show all chamfers larger than 20 mm (showing a 20 mm chamfer is optional).

f. Axis of symmetry - Alternated long dash/short dash lines.

2.14 Architectural Treatment

Do not use architectural treatments on bridge drawings, such as shades and shadows, regardless of their supposed effect. If required, pictorial views with shades and shadows shall be kept separate from the bridge details.

2.15 Definition of Skew Angle and Complementary Skew Angle

A skew angle is defined to be the acute angle measured between a perpendicular to the longitudinal line and the skew line itself (See Figure 2-14).

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

2.16 Section Cut Line and Identification

A section cut line is an imaginary line extending between the right angles at the location of the section. Figure 2-15 shows a part plan view of a superstructure with concrete girders. A section "cut line" is shown extending through the Plan. The arrowheads indicate the direction in which the section is being viewed.

The identification letters of the section are always placed on the interior side of the cut line. In Figure 2-15, the section cut is identified as "A-A" and is shown in Figure 2-16. If the section is located on another sheet, then a cross reference note should be provided on both

sheets.

2.17 Detail Identification

Sometimes, for the sake of clarity, it is advisable to make an enlarged detail of a certain area in a view. Figure 2-17 shows an example. A circle or an ellipse is made large enough to encompass the area that is to be shown in the enlarged detail. The circle/ellipse is referenced with a leader line and labeled such as: See Detail "A". The enlarged detail is identified with the title: DETAIL "A". Each such detail on an individual drawing must have an independent label.

If the Detail is located on another sheet, then cross-reference notes should be provided on both sheets.

2.18 Standard Abbreviations

a. Abbreviations should never be used when the meaning may be in doubt.

b. Abbreviations shall be avoided in titles, subtitles, and notes.

c. For Standard Abbreviations see Roadway and Traffic Design Standards (Topic No.: 625-010-003), Index No. 001.

d. Periods shall be used after all abbreviations other than those of Index No. 001 noted above.

e. Abbreviations used shall be defined in the General Notes.

2.19 Arrows

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

b. Figure 2-18 shows the North Arrow to be used on all sheets requiring directional orientation.

c. Directional Arrow for Water Flow - Any plan showing stream and/or tidal flow of water shall have an arrow indicating direction of the flow as shown in Figure 2-19.

d. Direction of Stationing - Plan views of bridges, superstructures, substructures and components thereof, as well as orientation references of details and sections where necessary, shall have an arrow indicating the direction of stationing. Figure 2-20 shows examples of arrows to be used. Refer to Article

2.8 of this Section regarding plan orientation.

2.20 Designation of Reinforcing Steel

Reinforcing bars shall be called out in plan, elevation and sections to clearly indicate the size, location and spacing of the individual bars. The number of reinforcing bars shall be called out in plan or elevation views.

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. In section views, all bars should be shown.

The number of bars shall be called out, followed by a tilde, the bar size, the bar mark and the spacing.

For example, 12 ~ #25 A1 @ 150 would mean 12 bars, Size #25, Mark A1 at 150 mm spacing. The symbol "@" is optional for the word "at".

2.21 Maximum Bar Spacing

The maximum spacing for bars carrying calculated stress (main reinforcement) shall be 1½ times the thickness of the slab or wall, or 450 mm maximum.

The maximum spacing for temperature reinforcement shall be 450 mm except in beam supported cast-in-place concrete bridge decks and flat slab bridges where the temperature reinforcement shall be spaced at 300 mm maximum spacing. Size #13 bars shall be the minimum size reinforcing steel used in cast-in-place components for bridges.

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

The bar spaces plus clearances to ℄ of bars must total up to the concrete dimension of the member. The following procedure shall be used to detail multiple bars equally spaced where the number of spaces times the nominal spacing does not exactly equal the overall available space:

14 Bars @ 140 $\pm$ = 1.800 m

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

2.22 Minimum Bar Spacing

For minimum bar spacing see AASHTO LRFD Bridge Design Specifications, Section 5.10.3.

When multiple bars are lapped at the same location, the spacing between laps shall be the same as for parallel bars. Wherever possible the use of bundled bars should be avoided; however, if required, bundled bars shall meet the requirements of the AASHTO Specifications.

2.23 Minimum Concrete Cover

The concrete cover (mm) used for design purposes and shown on detailed drawings shall be as shown in Chapter 2 of the Structures Design Guidelines.

2.24 Fit and Clearance

Fit and clearance of reinforcing shall be carefully checked by calculations and large scale drawings. Skews will tend to aggravate problems of reinforcing fit. Tolerances normally allowed for cutting, bending and locating reinforcing shall be taken into consideration, refer to “CRSI-Placing Reinforcing Bars” for Industry Fabrication tolerances.

Some of the common areas of interference are:

a. Between slab reinforcing and reinforcing in supporting elements such as girder stirrups and reinforcing in monolithic end bents or intermediate bents.

b. Vertical column bars projecting through reinforcing in pier caps.

c. The areas near expansion devices.

d. Anchor bolts for girders.

e. At anchorages for post-tensioning systems.

f. Between prestressing (pretensioned or post-tensioned) steel and reinforcing steel stirrups, ties, etc.

g. Between column bars to be lapped with footing dowels.

h. Drilled shaft steel projecting through footing steel.

i. Large radii bars that are spaced close together or where fabrication tolerances exceed placement tolerances.

j. Large diameter bars greater than #36 where fabrication tolerances are

increased.

2.25 Bar Splicing

Splices for main reinforcement bars of different sizes shall be detailed on the plans. Other bars may be shown as "continuous" without showing splice locations because splices are detailed on the Reinforcing Bar List. The designer shall indicate splice locations as required (i.e., phase construction, construction joints, etc.).

For tension splices, the length of a lap splice between bars of different sizes shall be governed by the smaller bar. For compression splices, the larger of the splice length of the smaller bar or the development length of the larger bar shall govern.

Lapped splices shall not be used for bars larger than #36; however, if bars larger than #36 are necessary, mechanical splices or other positive connections shall be used.

The location(s) and splice length(s) of main reinforcing shall be detailed on the plans.

Wherever practical, splices for main reinforcing bars should be staggered and preferably with only one-third spliced at the same location. The exceptions to this criterion include:

- phased construction
- flat slab construction
- compression zones.
- bases of stems of cantilevered retaining walls.

2.26 Dowels

The length of embedment and projection for bars used as dowels shall be determined by the designer and shown on the plans. When bent bars are used and the depth of embedment permits, the bends shall be standard hooks. Bent bars used for footing dowels shall rest on the bottom reinforcing mat in the footing.

2.27 Bars in Section

Figure 2-21 is a section through a hypothetical member showing some accepted methods for detailing reinforcing steel. The following list describes some of the concerns and observations that should be accounted for in detailing reinforcing steel:

a. Sections shall be drawn to a large enough scale to clearly show reinforcing details.

b. Stirrups and other bars not shown end-on shall be drawn as follows: Bars shall be represented by single unbroken lines at less than 1:10 scale and by double

unbroken lines at 1:10 scale or larger (See Figures 2-4 and 2-21).

c. Bends of standard hooks and stirrups generally need not be dimensioned, however, all bends shall be drawn to scale.

d. Bars shown end-on shall be shown as small circles. The circles may be left open or may be shown solid (dot); however, the symbol used shall be consistently applied on the drawing. If bars and holes are to be shown, the bars shall be shown solid.

e. Arrowheads or circles shall be the preferred method of detailing for bars shown end-on. Arrowheads shall point directly to the bar.

f. Sections cut at specific locations along a member will often be preferred over a typical section for complex reinforcing patterns.

g. Corner bars enclosed by stirrups or ties should be shown at the corner of the bend (See Figure 2-21).

2.28 Dimensions of Reinforcing Steel

All bars shall be dimensioned from out-to-out. All straight or bent bars partial dimensions shall be given to the nearest 5 mm. The overall length of each individual bar shall be rounded to the nearest 5 mm.

All straight bar dimensions shall be given and rounded to the nearest 5 mm.

2.29 Note Pertaining to Hook Bars

When the required concrete cover to a hooked bar cannot be maintained with normal orientation of the hook, the following note shall be added to the plans: "Bar __ shall be tilted to obtain required cover."

2.30 Reinforcing Bar Lengths (Maximum)

#16	Bars and larger:	18.30 m
#13	Bars:	12.20 m

2.31 Bridge Deck Reinforcing Steel

The design of the beam supported bridge decks shall utilize straight top and bottom reinforcing steel bars. Truss bars shall not be used.

2.32 Cast-in-Place Concrete

For Cast-in-place concrete in order to minimize stress concentrations, increase bonding strength, decrease corrosion potential, and comply with AASHTO crack control criteria, the smallest practical bar size shall be used. Do not use bars smaller than #13.

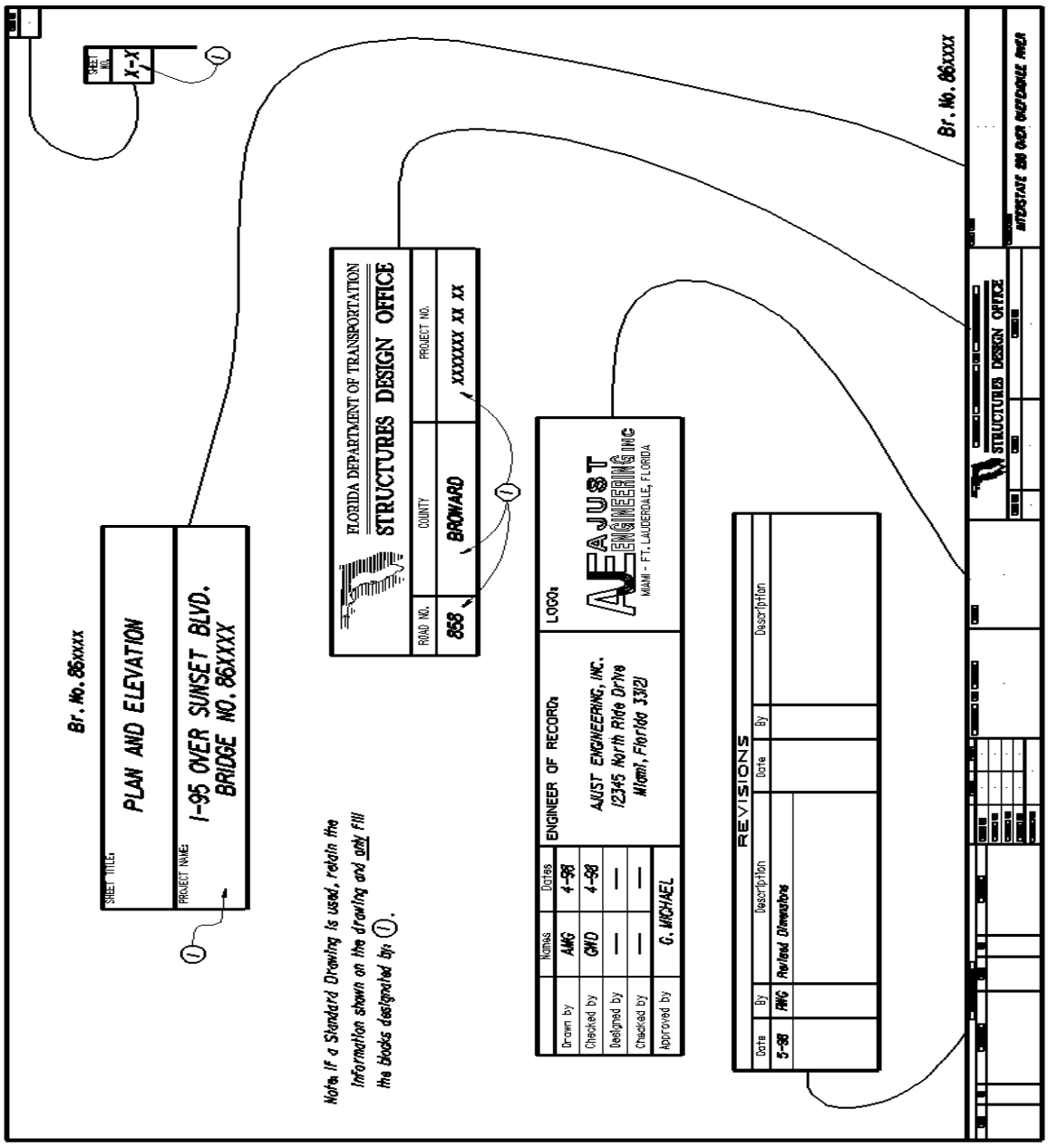


Figure 2-1 Border with Title Block Instructions

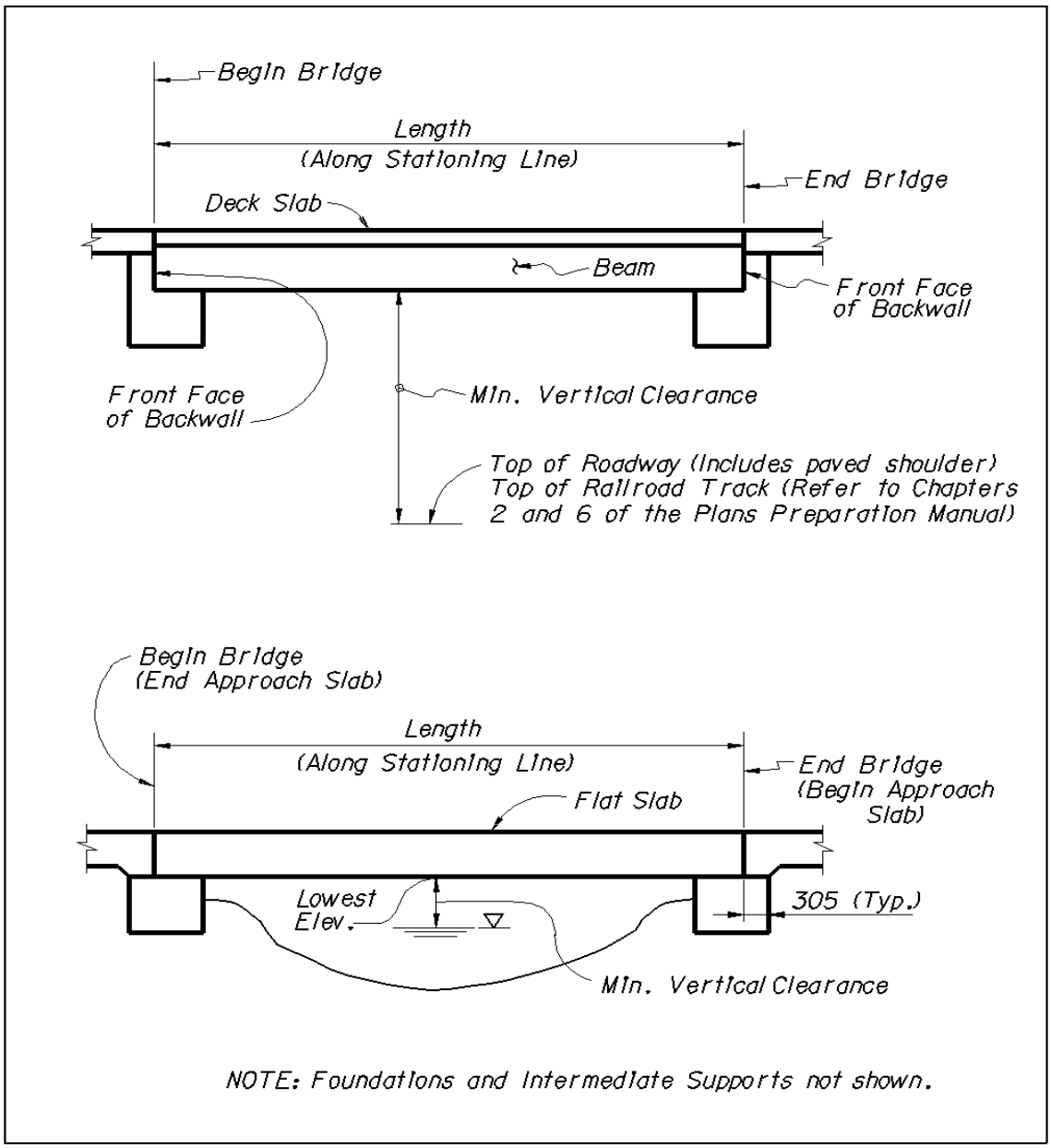


Figure 2-2 Minimum Bridge Vertical Clearance

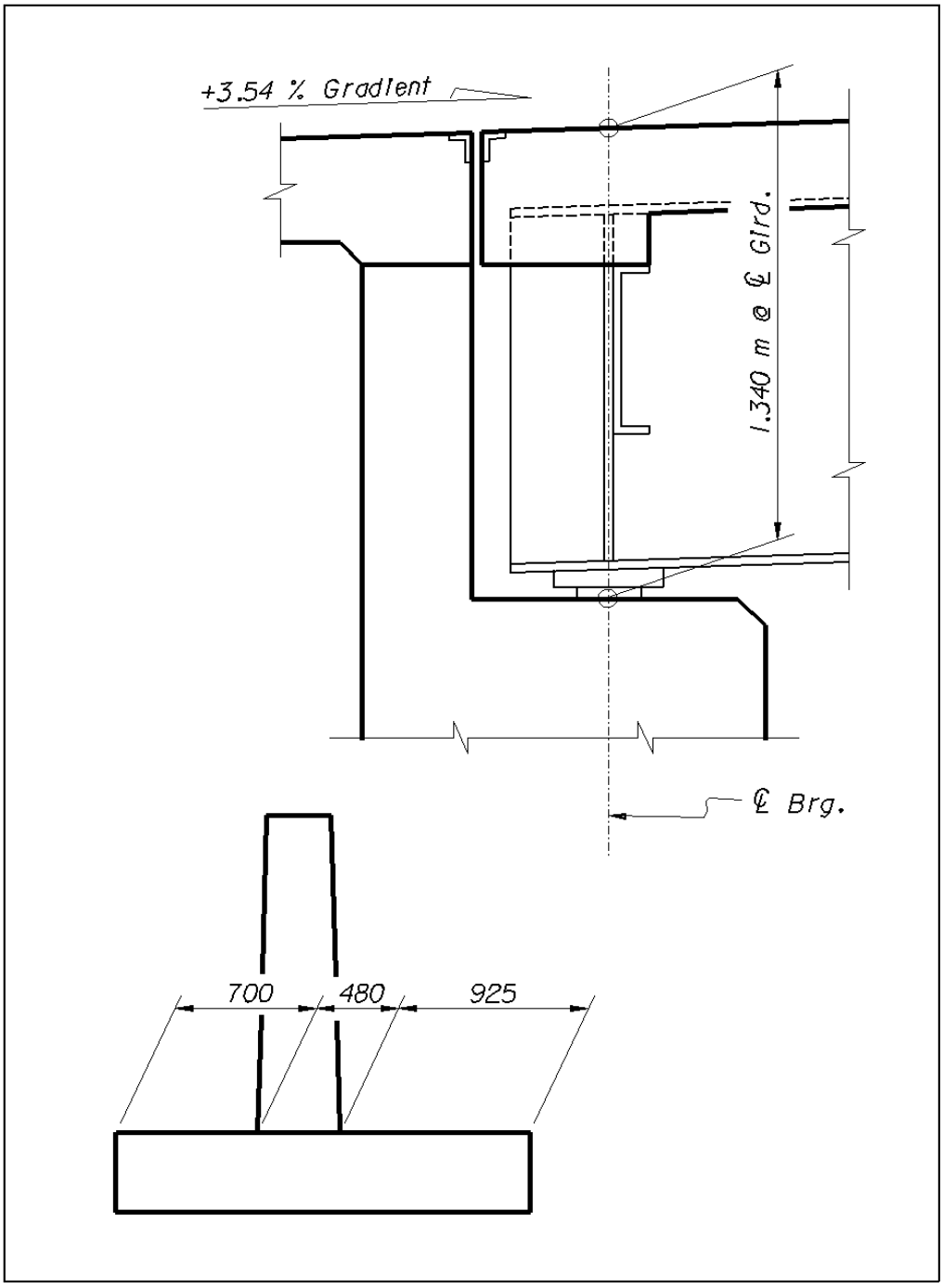
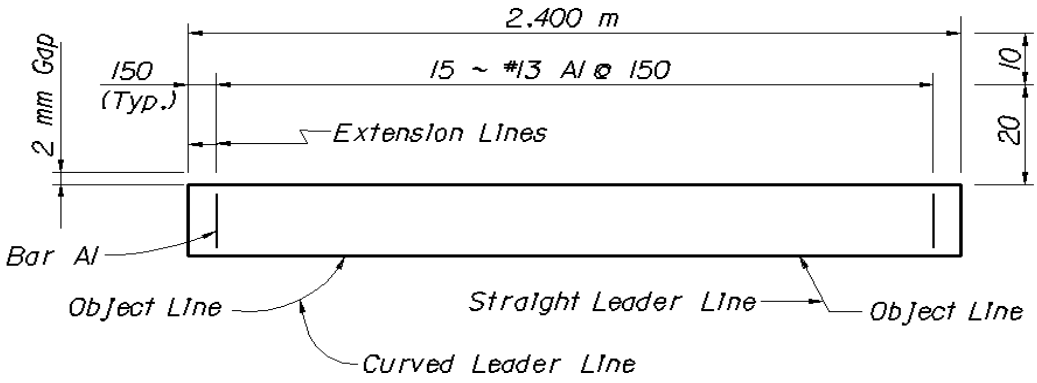
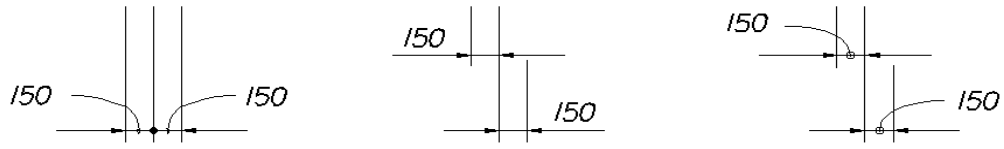


Figure 2-3 Dimensions at ℄ Girder, Bearing, etc.



EXAMPLE OF EXTENSION LINES

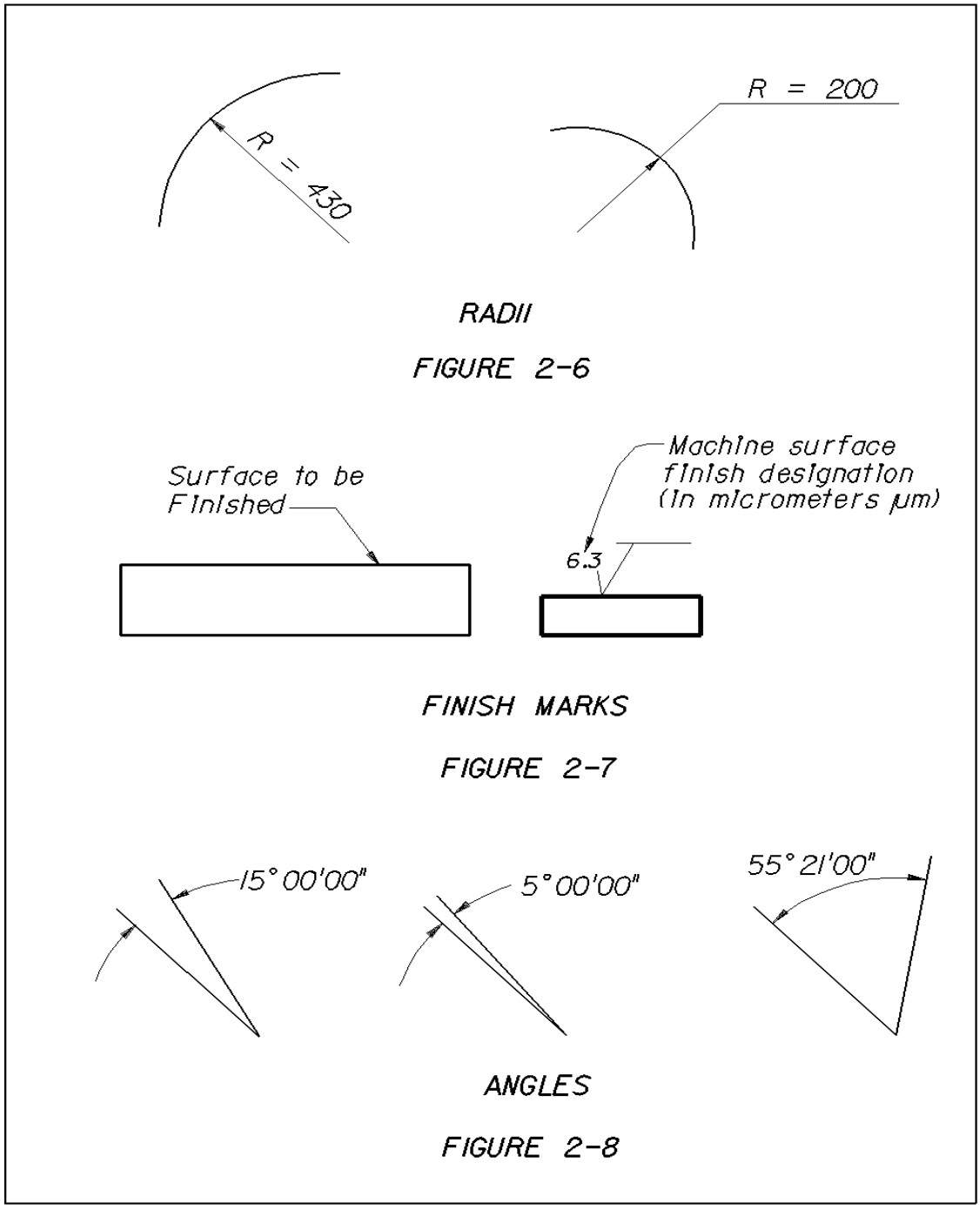
FIGURE 2-4



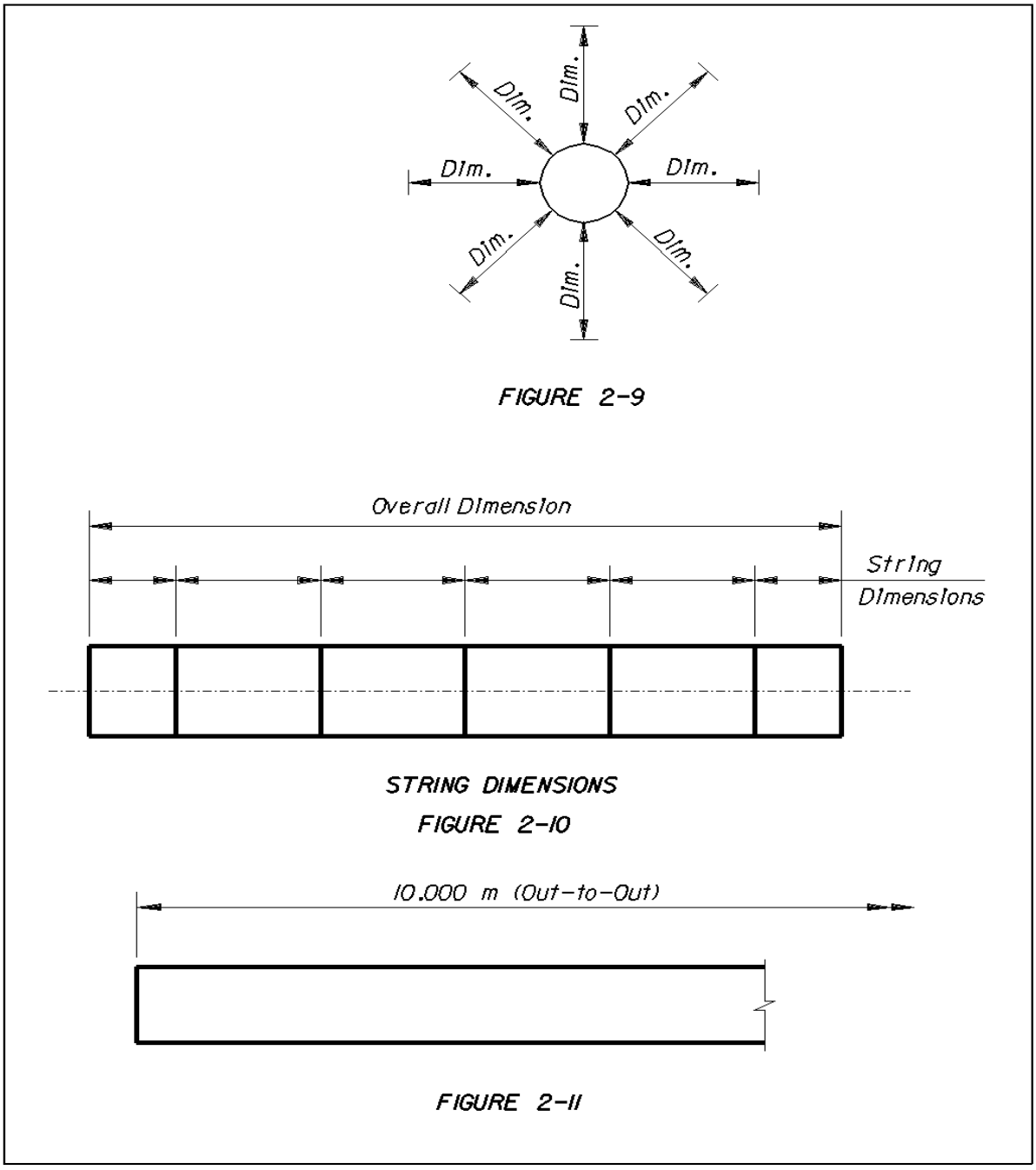
COMPRESSED DIMENSIONS

FIGURE 2-5

Figures 2-4 thru 2-5 Extension Lines



Figures 2-6 thru 2-8 Radii Labeling



Figures 2-9 thru 2-11 Dimensioning

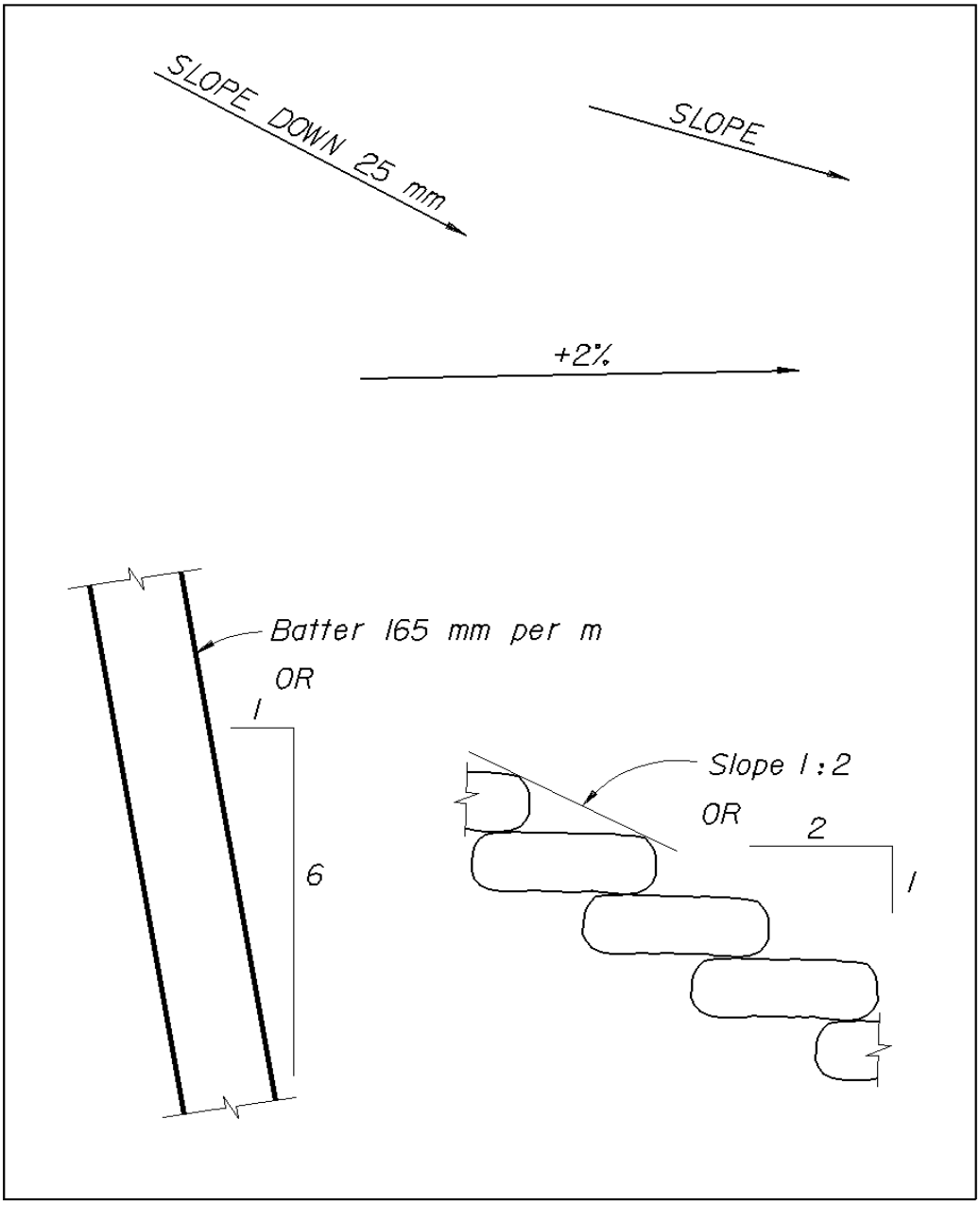


Figure 2-12 Slope Dimensioning

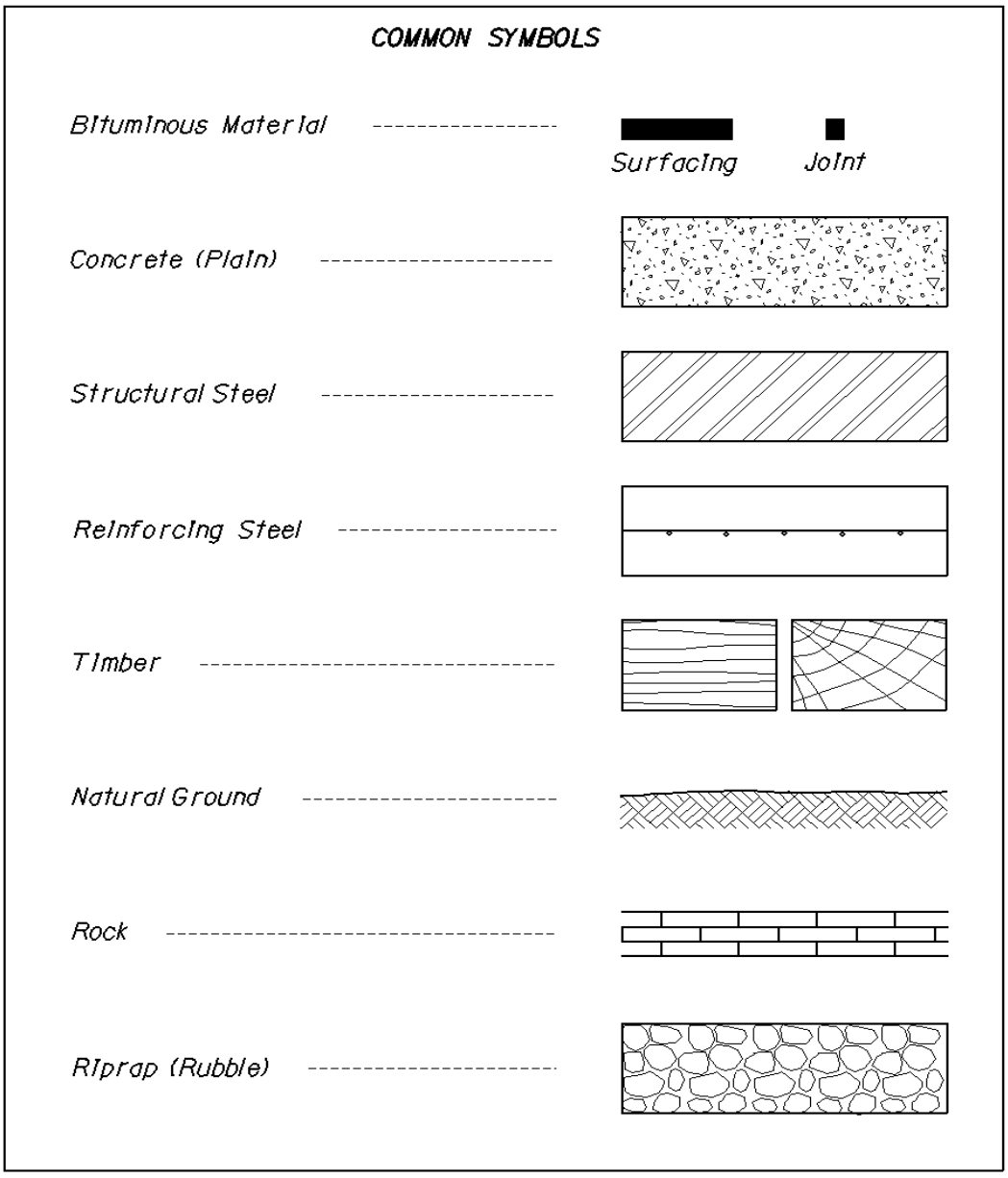
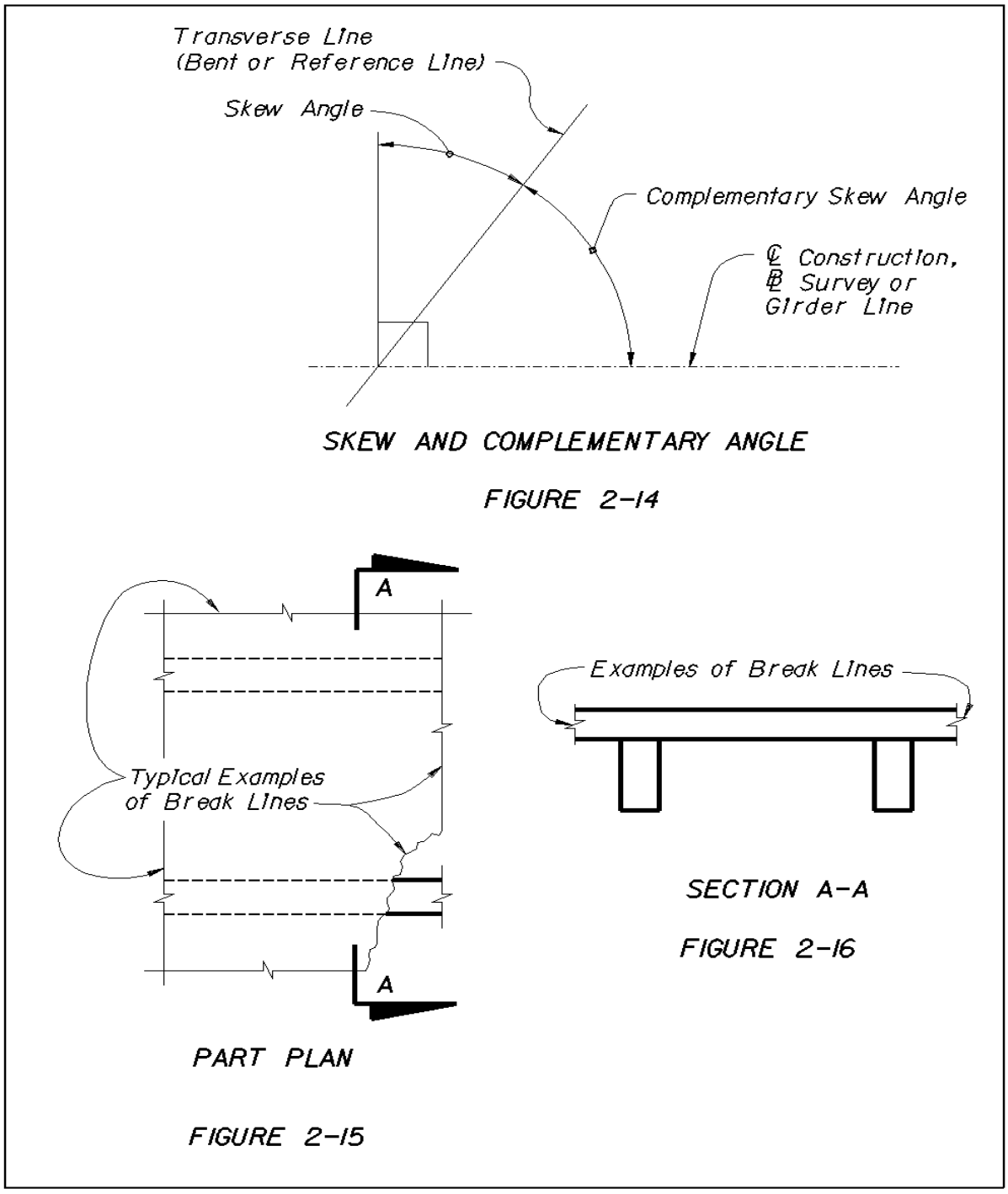
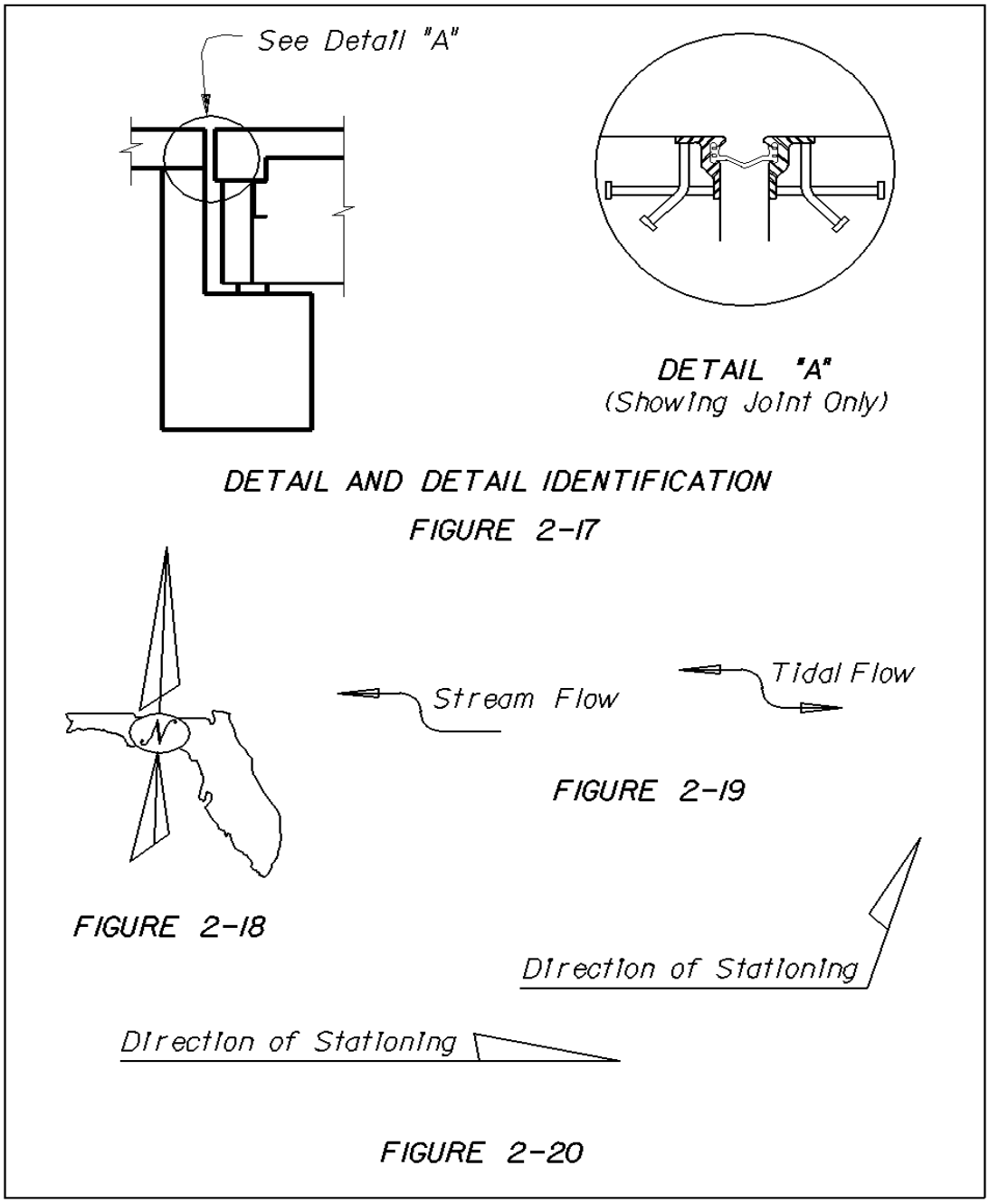


Figure 2-13 Symbols



Figures 2-14 thru 2-16 Angles and Break Lines



Figures 2-17 thru 2-20 Details and Directional Arrows

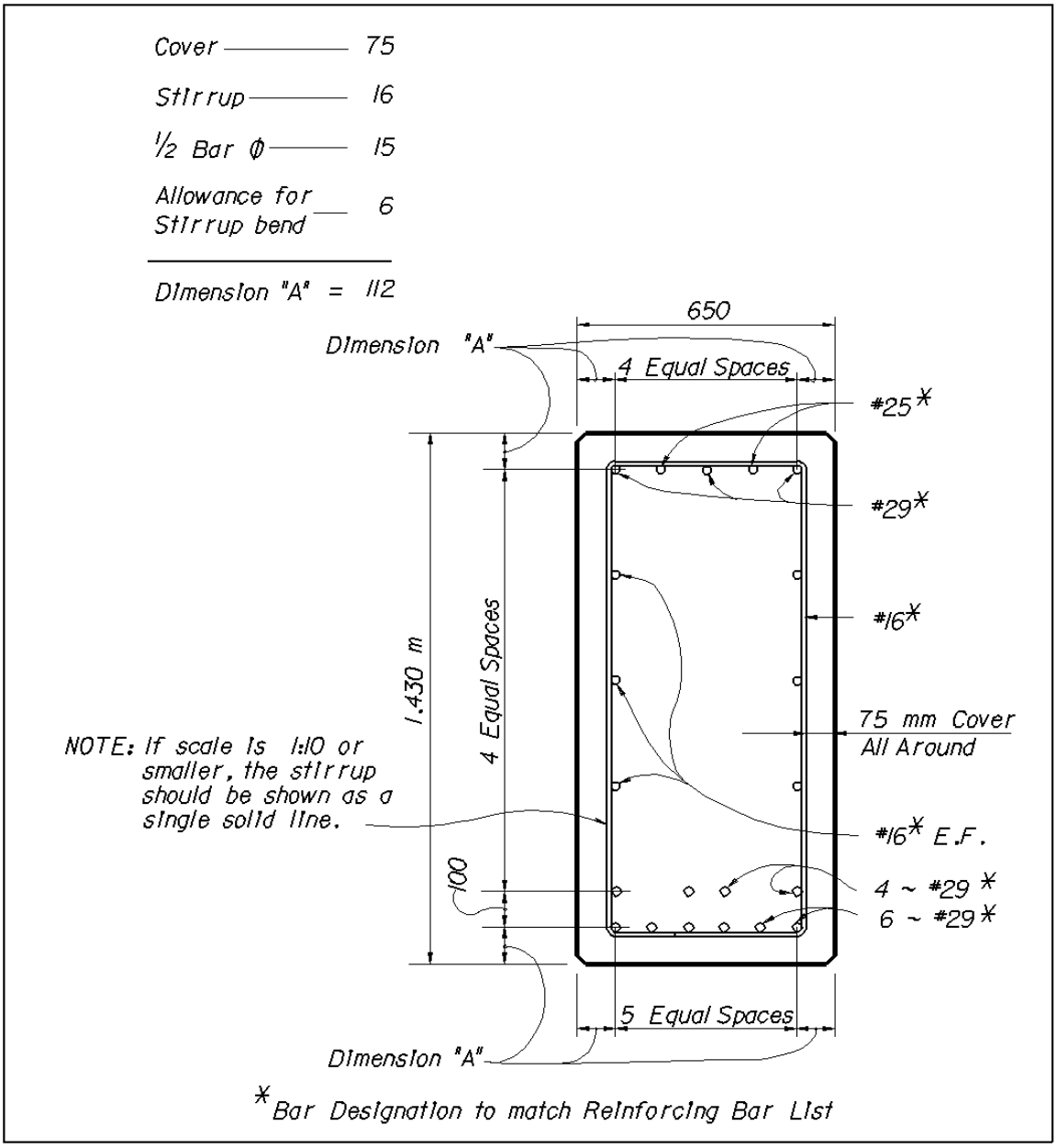


Figure 2-21 Stirrup Bar Detail

Chapter 3

GENERAL NOTES, REVISIONS, QUANTITIES, MISCELLANEOUS SHEETS

3.1 General Notes

The Designer shall prepare a complete set of General Notes for each project (See Section 3.2). The Designer should add or delete or modify General Notes, as required, to those shown below. Only those notes and data which are applicable to the project shall be used. On projects that require two different construction methods (i.e., prestressed concrete beams and steel girders) separate General Notes shall be shown for each method of construction. General Notes shall clearly identify the method of construction to which they apply.

The General Notes for all bridges shall include all design information that is required to load rate the bridge and to permit analysis of the bridge and its components after construction.

All General Notes and Pay Item Notes shall be included on the General Notes sheet. Notes for a particular element may be shown on the first sheet showing that element. Do not use General Notes to repeat or modify requirements in the Standard Specifications. If modifications to the Specifications are required, Technical Special Provisions should be prepared.

3.2 Typical General Notes

The following notes, when applicable, are required to supplement the Standard Specifications. The notes shall be placed under the heading "General Notes".

Notes numbered 1 thru 12 shall be included in the plans for all bridges, notes 13 thru 35 shall be included where applicable, notes 36 thru 47 apply to segmental concrete bridges, and notes 48 thru 54 apply to temporary MSE walls. The Designer should keep in mind that additional notes, not in this list, may be necessary.

List of Notes:

1. GENERAL SPECIFICATIONS: Florida Department of Transportation Standard Specifications for Road and Bridge Construction (199x edition) and Supplements thereto. (Also, list Special Provisions if applicable)

2. DESIGN SPECIFICATIONS: American Association of State Highway and Transportation Officials (AASHTO), LRFD Bridge Design Specifications (199x edition) and applicable Interims thru 199x. Guide (AASHTO) Specifications (*). FDOT Structures Design Guidelines (199x edition).

* List applicable Guide Specifications.

3. DESIGN METHOD: Load and Resistance Factor Design Method (LRFD) except that (*) have been designed for Service Load or Strength Design Methods.
   * List applicable items, such as: prestressed components, bascule spans, etc.

4. DESIGN LOADING: HL-93 Loading.

5. FUTURE WEARING SURFACE: Design includes allowance for 0.720 kN/m^2.

6. EARTHQUAKE: Seismic acceleration coefficient of x.xx

7. CONCRETE:

Class	Minimum 28-day Compressive Strength (MPa)	Location
II *	f'_c= **	***
III	f'_c= **	***
IV ****	f'_c= **	***
V *****	f'_c= **	***
VI	f'_c= **	***

Show all concrete classes used, and where appropriate show the following:

* : (Bridge Deck), if applicable
** : Strength Value such as: 21, 23, 31, 35, 38, 41, 45, 59 etc.
*** : Specific Location such as: Bridge Deck, piles, etc.
**** : (Drilled Shaft)
***** : (Special), if applicable

8. REINFORCING STEEL: All reinforcing steel shall be ASTM A615M-96a, Grade 420.

9. ENVIRONMENT: Superstructure: *
   Substructure: *
   * Show Environmental Classification of the Superstructure and Substructure for the specific site.

10. CONCRETE COVER: Concrete cover shown in the plans does not include reinforcement placement and fabrication tolerances unless shown as "minimum

cover". See FDOT Standard Specifications for allowable reinforcement placement tolerances.

11. CONCRETE SURFACE FINISH: A Class 5 finish coating (see detail sheet xx), shall be applied to the following exposed concrete surfaces: (*).
The sidewalk shall be built in accordance with Section 400 of the Specifications except that the sidewalk shall be finished as per Section 522-7.
* List applicable surfaces. Also, provide detail showing applicable surfaces. Show Anti-Graffiti Coating details when necessary.

12. DIMENSIONS: All dimensions are in millimeters (mm) except as noted.

13. DISTRIBUTION VALUES:

	Interior Beams	Exterior Beams
Live Load (**/beam)	*	*
Traffic Railing (N/m)	*	*
Raised Sidewalk (N/m)	*	*
Raised Median (N/m)	*	*
Pedestrian/Bicycle Railing (N/m)	*	*
Wearing Surface (N/m)	*	*
Utilities (N/m)	*	*
Stay-in-Place Metal Forms (N/m)	*	*

* Show Loads
** Axle, wheel or lane

14. STAY-IN-PLACE METAL FORMS: Design includes allowance for 0.960 kN/m^2 over the projected plan area of the metal forms for the unit weight of metal forms and concrete required to fill the form flutes.

15. STAY-IN-PLACE FORMS: Metal forms are permitted.

16. SCREEDING DECK SLABS: The riding surface of the bridge deck shall be screeded to the Finish Grade Elevations which already include allowance for permanent camber.

17. ANCHOR BOLTS: Anchor bolts shall be in accordance with ASTM A307. The anchor bolts, nuts and washers shall be hot-dip galvanized in accordance with the Specifications.

18. VESSEL IMPACT CRITERIA: The Structure has been designed for the following Equivalent Static Forces applied at Mean High Water elevation. Transverse and Longitudinal Forces have not been applied simultaneously.

Distance from ℄ Channel (m)	Equivalent Static Force (kN)	
0 - *	*	Transversely
	*	Longitudinally
> *	*	Transversely
	*	Longitudinally

* Show Distances and Forces, or show specific Piers and Forces.

19. SCOUR: Scour has been considered in the design of the (*) with scour elevations based on (**). The scour elevations are shown in the "Installation Data Table". Under no circumstances shall the final installations be made to tip elevations above the shown minimum tip Elevation.
* Show foundation type: Piles or Drilled Shafts
** Show design Flood or Hurricane Category.

20. PILE FOUNDATIONS: (Foundation Layout Sheet)

All piles shall be installed according to the Pile Data Table (Show a Pile Data Table similar to that shown as Table 4.3 in the Structures Design Guidelines).

21. DRILLED SHAFT FOUNDATIONS: (Foundation Layout Sheet)

All drilled shafts shall be installed according to the Drilled Shaft Table (Show a Drilled Shaft Data Table similar to that shown as Table 4.4 in the Structures Design Guidelines).

22. SPREAD FOOTINGS: See FDOT Specifications and plans.

23. FENDER PILES: See FDOT Specifications and plans.

24. AESTHETICS: This structure has been designed to conform with Aesthetics Level (**). Therefore, any redesign or value engineering proposals shall not adversely impact the following attributes of the design:
a) *
b) *
c) * ...
* List items: Box Girders, Hammerhead Pier, etc.
** 2 or 3

25. STRUCTURAL STEEL: All structural steel shall be in accordance with ASTM A709M, Grade (*), except that stiffeners, diaphragms and lateral bracing may be Grade (*), unless shown otherwise.
* Show Grade. Modify note as needed.

26. CHARPY V-NOTCH: All ASTM A709M structural steel as designated on the plans shall receive Charpy V-Notch testing in accordance with ASTM A709M - 97b and Supplemental Requirement S83 or S84 as noted below:
    1. Redundant Members, as designated on the plans, shall be tested in accordance with Table S1.2 (Zone 1) of ASTM A709M-97b(S83).
    2. Non-Redundant Members, as designated on the plans, shall be tested in accordance with Table S1.3 (Zone 1) of ASTM A709M-97b(S84).

    All other structures steel shall meet the Charpy V-Notch test requirements specified in Section 962, Table A, of FDOT Standard Specifications.

27. STEEL FABRICATION: Structural steel girders and girder framing shall be fabricated by a shop that has the AISC Quality Certification for Major Steel Bridge. Fabrication and non-destructive testing shall be performed in accordance with the current applicable edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code. Welding procedures shall be submitted and approved prior to welding on the project.

28. FRACTURE CRITICAL MEMBERS: Structural components designated on the plans or in special provisions as “fracture critical” shall conform to the provisions of Chapter 12 of the current ANSI/AASHTO/AWS D1.5 Bridge Welding Code. See sheets (*) for designation of fracture critical members.
    * Show applicable sheet number.

29. ANCILLARY COMPONENTS: All following members are classified as Ancillary members in accordance with the current edition of the ANSI/AASHTO/AWS D1.5 Bridge Welding Code.
    1. *
    2. *
    3. * .....
    * List Components

30. FIELD CONNECTIONS: All field connections shall be made with (*) diameter high strength friction type bolts in accordance with ASTM A325M unless otherwise noted.
    * Show appropriate bolt diameters: M22, M24, etc.

31. PAINTING: All structural steel shall be painted with self-curing inorganic zinc coating system in accordance with section 561 of the Specifications. A three (3) coat system is required regardless of environmental classification.

32. LADDERS AND PLATFORMS: Structural Steel for Ladders and Platforms shall conform with ASTM A36M and shall be Hot-Dip galvanized in accordance with ASTM A123. Welding shall conform to ANSI/AASHTO/AWS D1.1.

33. UTILITIES: The utilities shown in the Bridge Plans are at approximate locations. For additional information, refer to the Utilities Plans.

34. PENETRANT SEALERS: Existing riding surface of the superstructure shall be sealed after grooving. (*)
    * If the bridge deck is in an Extremely Aggressive environment and the cover does not meet the cover requirement.)

35. MECHANICAL/ELECTRICAL: See Mechanical/Electrical Drawings.

36. COMPUTER PROGRAMS:
    (Describe computer programs used for time-dependent analysis of segmental bridges)

37. CONSTRUCTION LIVE LOADS:

Erection Gantry	x xxx	kN
Form Traveler	x xxx	kN
Uniform	x xxx	kN/m^2

    For sequence of construction, see sheet xx.

38. LIVE LOAD FOR TRANSVERSE AND LONGITUDINAL DESIGN:
    (Describe briefly live load used and analysis method such as: finite element or frame model)

39. WIND LOAD:
    (Describe if other than AASHTO or Guidelines)

40. THERMAL LOADS:

Longitudinal Design:			
Normal Mean Temperature		xx	^0C
Thermal Coefficient		x.xxx xxx	$/^0C$
Temperature Range for Design of Structure:			
Rise		xx	^0C
Fall		xx	^0C
Temperature Range for sizing Bearings and Joints:			
Rise		xx	^0C
Fall		xx	^0C
Differential Temperature:			
+ Nonlinear Gradient with	T1 =	xx	^0C
	T2 =	xx	^0C
	T3 =	xx	^0C
- Nonlinear Gradient with	T1 =	xx	^0C
	T2 =	xx	^0C
	T3 =	xx	^0C

41. THERMAL GRADIENT (TG) FOR TRANSVERSE DESIGN: (Describe temperature condition if considered)
Thermal Gradient Combinations:
(service combination only)

DL	+	(+TG)
DL	+	(-TG)
LL+I	+	(+0.5TG)
LL+I	+	(-0.5TG)

42. MATERIAL PROPERTIES:
Concrete:
(Base on use of Florida limerock)

f'_c	=	xx	MPa
E_c	=	xx xxx	MPa

Prestressing Steel:
Strands ~ ASTM A416, Grade 1860, low relaxation

Modulus of elasticity	xxx xxx	MPa
Maximum jacking stress	x xxx	MPa
Maximum anchoring stress at end of seating zone	x xxx	MPa
Maximum anchoring stress at anchor	x xxx	MPa
Anchor set	xx	mm
Friction coefficient (specify type of duct)	0.xx	
Wobble coefficient:		
External tendons	0.0	
Internal tendons	x xxx	(1/mm)
Strand Diameter	xx	mm

Bars ~ ASTM A722, Grade 1035, Type x

Modulus of elasticity	xxx xxx	MPa
Maximum jacking stress	xxx	MPa
Maximum anchoring stress	xxx	MPa
Anchor set	x	mm

43. DESIGN METHOD ~ STRESSES/LOADS:

Component:	Design Method:
Precast Superstructure	Service / Strength check
Precast Substructure	Strength / Service check
Cast-in-place Superstructure	Strength

44. ALLOWABLE STRESSES:
Prestressed concrete (Superstructure):
Temporary stresses before losses due to creep and shrinkage at time of transfer:

	Without TG		with TG	
Compression	xx	MPa		
Tension:				
Longitudinal	xx	MPa	xx	MPa
Transverse	xx	MPa		
Stresses at service level after all losses:				
Compression	xx	MPa		
Tension in precompressed tensile zone:				
Longitudinal	xx	MPa	xx	MPa
Transverse	xx	MPa		
Principal tension in other areas	xx	MPa		
Construction stresses:				
Compression	xx	MPa		

Tension, (See Table 8-1, AASHTO "Guide Specifications for Design and Construction of Segmental Concrete Bridges")
Compression, (Min. Required on joint during epoxy curing):
xxx MPa

45. SEGMENT CASTING AND ERECTION:
Type x joints between precast/cast-in-place segments.
Min. concrete strength prior to lifting segments or lowering support forms:
xx MPa
Min. concrete strength before transverse post-tensioning:
xx MPa
Min. age of segments at erection: xx days
Min. concrete strength prior to post-tensioning:
Precast elements xx MPa
Cast-in-place closure pours xx MPa
Min. concrete strength before moving form traveler:
xx MPa

46. MISCELLANEOUS: For handling, storage, shop drawings, inspection, payment, etc., see Special Provisions.

47. VALUE ENGINEERING: Value Engineering (*) be permitted on this project.
* Show applicable term: Will or will not.

48. The overall factor of safety shall be at least $F_s = 1.5$.

49. The reduction factor for construction site damage shall not be less than $F_c = 1.5$.

50. The reduction factor for durability shall not be less than $F_d = 1.25$.

51. The allowable reinforcement tension, T_a, shall not exceed one half the facing connection strength at 20 mm movement.

52. The value of limit state tensile load, T1, shall preclude brittle or ductile failure of the geogrid within the design life based on stress rupture testing of the geogrid product. The testing and data extrapolation shall be in accordance with ASTM D-2837 or GRI GM-5; results shall be submitted with the design calculations.

53. Note to designer: For steel sheet piling walls the section modulus and grade of steel must be shown for both cold and hot rolled sections.

54. Note to designer: If "Critical Temporary Walls" are required, consult Chapter 5 of the Structures Design Guidelines.

3.3 Drawing Revisions

If changes are required, the appropriate procedures shown in the Plans Preparation Manual - Metric and Construction Project Administration Manual (Topic No.: 700-000-000) shall be used.

When changes to the plans are required after the letting, the procedure followed in making the changes shall also conform to the following:

Do not delete details on the plans. Data to be revised shall be circled (clouded) and the revised data added. If the drawing does not have sufficient space available to add the revision, a new sheet with the revision shown thereon shall be added to the plans. Show the date of revision and a brief description in the revision block of the revised and/or added drawings (see Figure 3-1). For each drawing revision process, a unique symbol (for example a triangle) shall be placed beside both the revised data and the revision date. This will help locating revisions that occurred at different dates.

3.4 Quantity Calculation

The Basis of Estimates Handbook describes the method of measurement, basis of payment and required rounding accuracy for frequently used items. All quantities except reinforcing steel shall be calculated on "Design Computations" sheets. Calculations shall include item number, description, dimensions used and units.

Reinforcing steel shall be tabulated for the purpose of dimensioning and estimating reinforcing quantities.

Final quantities of individual components such as End Bents, Superstructure, etc. shall be listed in estimated quantity blocks located on corresponding plan detail sheets. Each quantity block shall be completed and all calculations turned in with the design notes. For assistance

in computing the volume of concrete in build-ups over prestressed concrete beams see Figure 3-2. Figure 3-3 tabulates the rounding accuracy of the most frequently used quantities of materials. Detail sheets shall have a quantity breakdown as shown in Figure 3-4.

3.5 Summary of Bridge Pay Items

The estimated bridge quantities are given on a computer printout sheet as shown in Figures 3-5 and 3-6 for single and multiple bridge projects, respectively. This sheet, titled Summary of Bridge Pay Items, shall be included in the set of plans as appropriate, immediately following the first sheet. The item numbers, descriptions, units, quantities, and totals shall be verified by the District Structures Design Office prior to entry into the computer. For projects with more than one bridge, each bridge shall have its own quantity column listed by bridge numbers.

The Engineer of Record shall submit quantity booklets and a summary of the estimated bridge quantities with the final submittal package. The Engineer of Record shall refer to the Department's Basis of Estimates Handbook for guidance in preparing the quantity booklets and the summary of quantities. This manual may be purchased from the Department of Transportation, Maps and Publications Sales, Mail Station 12, 605 Suwannee Street, Tallahassee, Florida 32399-0450. Current publication prices can be found on FDOT's web site, www.dot.state.fl.us/publcat/manuals/pub-list.htm

The Department or the consultant will enter a summary of estimated bridge quantities (for each bridge) into the computerized Cost/Contract Estimating System (CES), which is the Department's program for estimating construction costs for projects, and check the printout.

3.6 Typical Bid Item Notes

Notes required to define, show limits of quantities or otherwise offer explanation to the list of Bridge Pay Items shall be included in the Bid Item Notes, which are generally located on the General Notes sheet. Examples are:

a. For summary of Bridge Pay Items see print of Cost/Contract Estimating System (CES) output (or Summary of Pay Items).

b. Payment for incidental items not specifically covered in the Individual Bid Items shall be included in the Contract Unit Price for the Bid Items.

c. For Maintenance of Traffic Bid Item Notes, see Roadway Plans.

d. The Contractor shall bid on only one of the alternates designed.
AA - Bulb-Tee Superstructure.
AB - Steel Girder Superstructure.

e. Bid Item No. 2400-7 includes Approach Slab Grooving.

f. Item Number 2110-3 includes removal of approximately __ m^2 (plan area) of existing structure(s).

g. See additional pay item notes on sheet *
* List sheets as needed.

3.7 Reinforcing Bar List Sheet

The Reinforcing Bar List Sheet shall tabulate all of the bars detailed on the individual, non-standard detail sheets.

Every substructure and superstructure component shall be titled with the required bars tabulated under an appropriate heading such as End Bent, Intermediate Bent, Pier, Superstructure, etc. Each bar detailed for a given bridge component shall have a unique bar mark; however, the same bar mark may be used to designate bars used in other components where such bar tabulations are listed under a separate heading on the Reinforcing Bar List sheet. See Figure 3-7 Reinforcing Bar List Sheet. For additional information refer to the User's Manual for Bar Reinforcing Steel Program.

3.8 Standard Bar Bending Details Sheet

The Standard Bar Bending Details sheet shall be included in every plan assembly of the detailed structure and referred to for bent bar shapes and dimensions. All necessary spaces for dimensioning each bar shall be completely filled in on the table of the Reinforcing Bar List Sheet.

Refer to the Standard Drawings, Index No. 1300 (Standard Bar Bending Details) for this sheet. If special bends are required, they may be added to the sheet; however, the Index Number and initials in the standard drawing shall be deleted. See Index No. I-001 (Preface) for additional instructions.

3.9 Bridge Permits

For bridges over a navigable waterway under the jurisdiction of the U.S. Coast Guard, permit application sketches are required. See Chapter 27 of the Plans Preparation Manual.

3.10 Key Sheet

Key Sheet: When let to contract with Roadway Plans, bridge plans do not require a Key Sheet; however, when the bridge contract is to be let alone, a Key Sheet as described in the Plans Preparation Manual (PPM) is required. The Key Sheet is the first sheet of the plans and contains general information concerning the project and the plans themselves (see Exhibit KS-1 in Appendix C of the PPM).

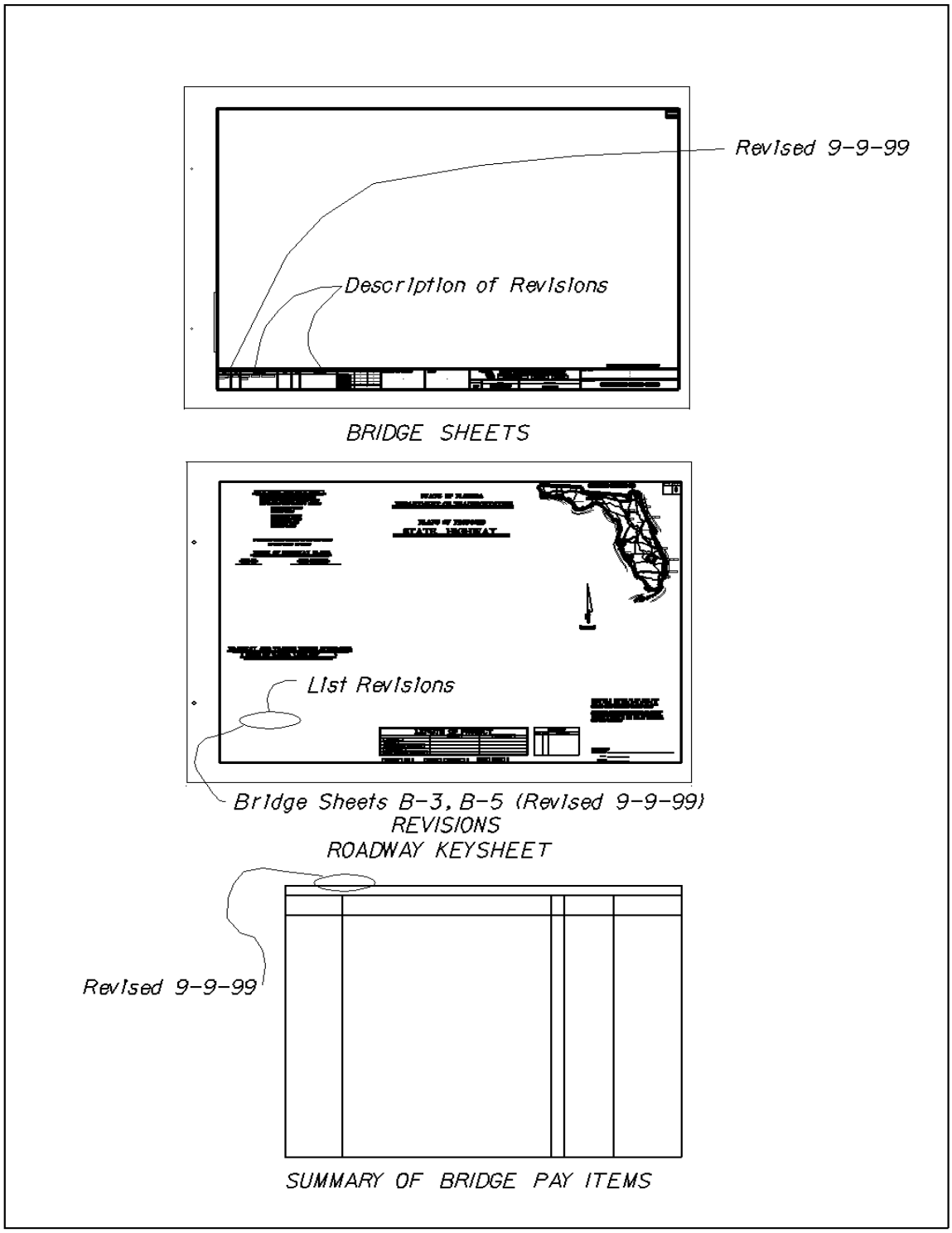


Figure 3-1 Revision Locations

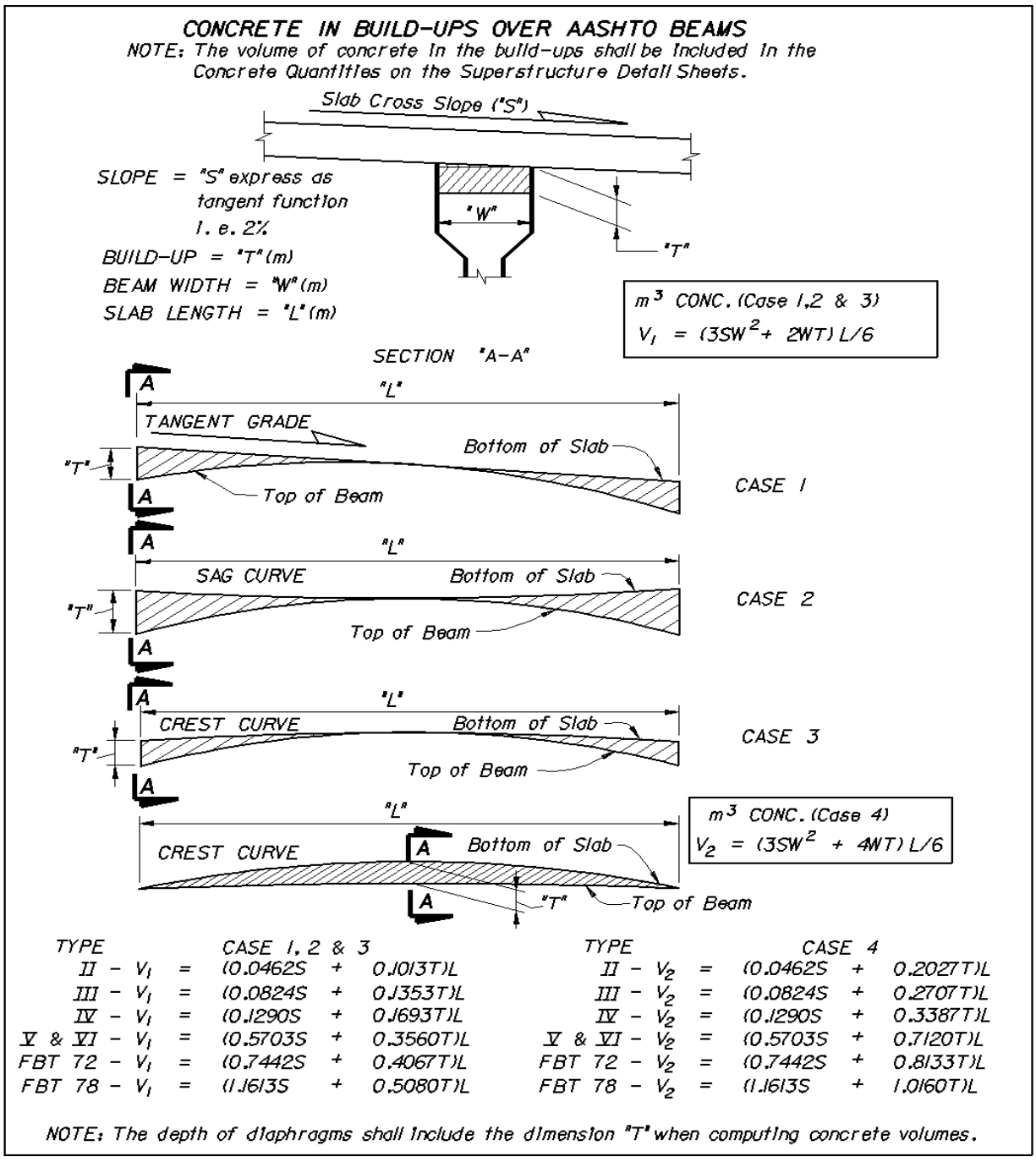


Figure 3-2 Concrete Build-Ups

ROUNDING ACCURACY ON INDIVIDUAL SHEETS

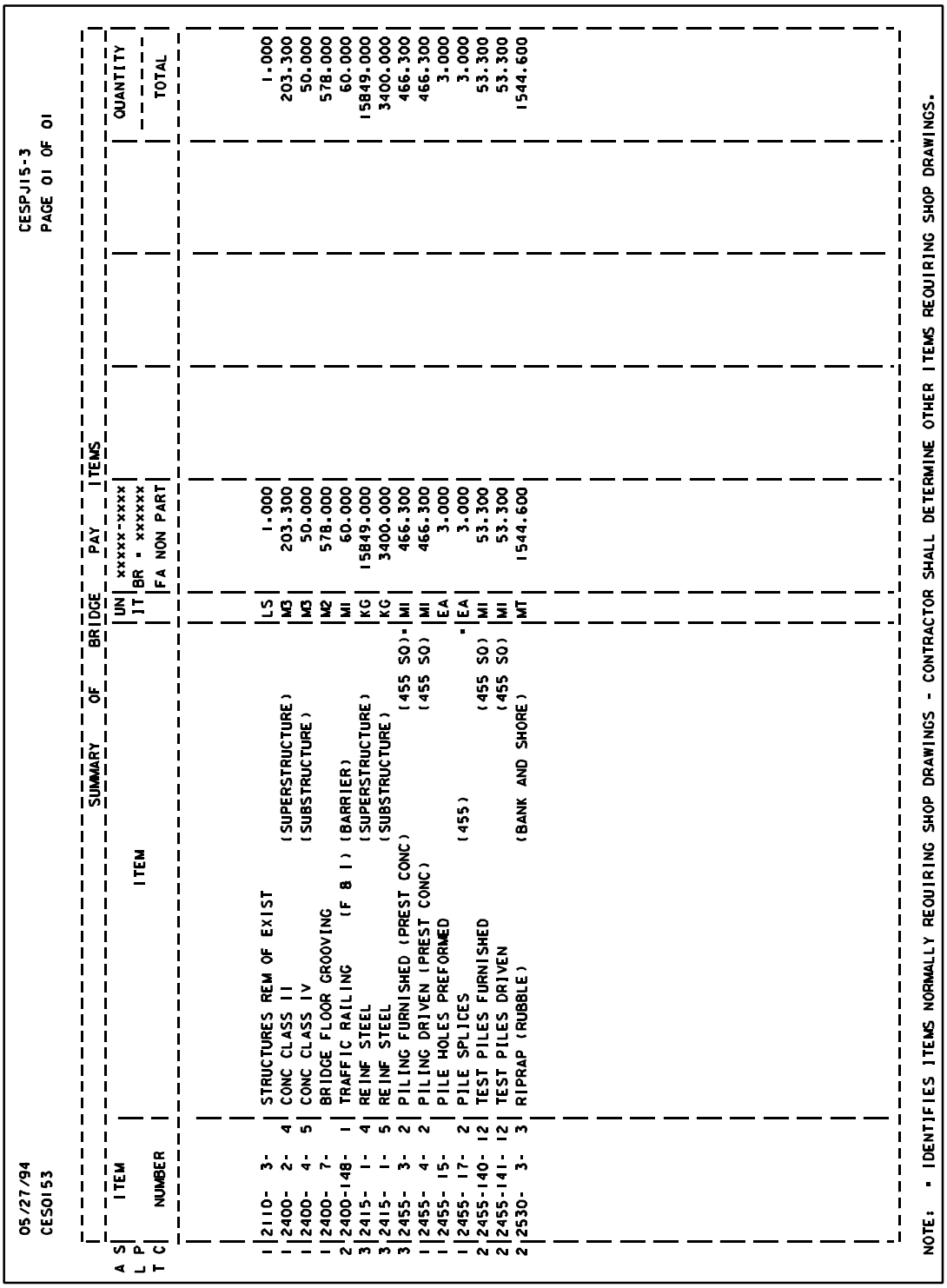
ITEM DESCRIPTION	UNIT	ROUNDOFF
Concrete	m^3	0.01
Reinforcing Steel	kg	1
Structural Steel and Components (Ladders, Expansion Joints, etc.)	kg	1
Prestressed Components (Beams, slabs, Double-Tees, etc.)	m	0.001
Handrails and Traffic Barriers	m	0.01
Treated Structural Timber	m^3	0.01

Figure 3-3 Rounding Accuracy

ESTIMATED QUANTITIES				
ITEM		UNIT	QUANTITY	
			END BENT 2 LT.	END BENT 1 RT.
Class II Concrete (Substructure)	Cap	m^3	27.09	27.09
	Walls		25.60	25.16
	Pedestals		0.67	0.68
	Wingposts		4.49	4.49
	Total		57.85	57.42
Reinforcing Steel (Substructures)		kg	31.50	31.50
Prestressed Concrete Piles (455 mm Sq.)		m	*	

*** See Summary of Bridge Pay Items**

Figure 3-4 Quantity Block



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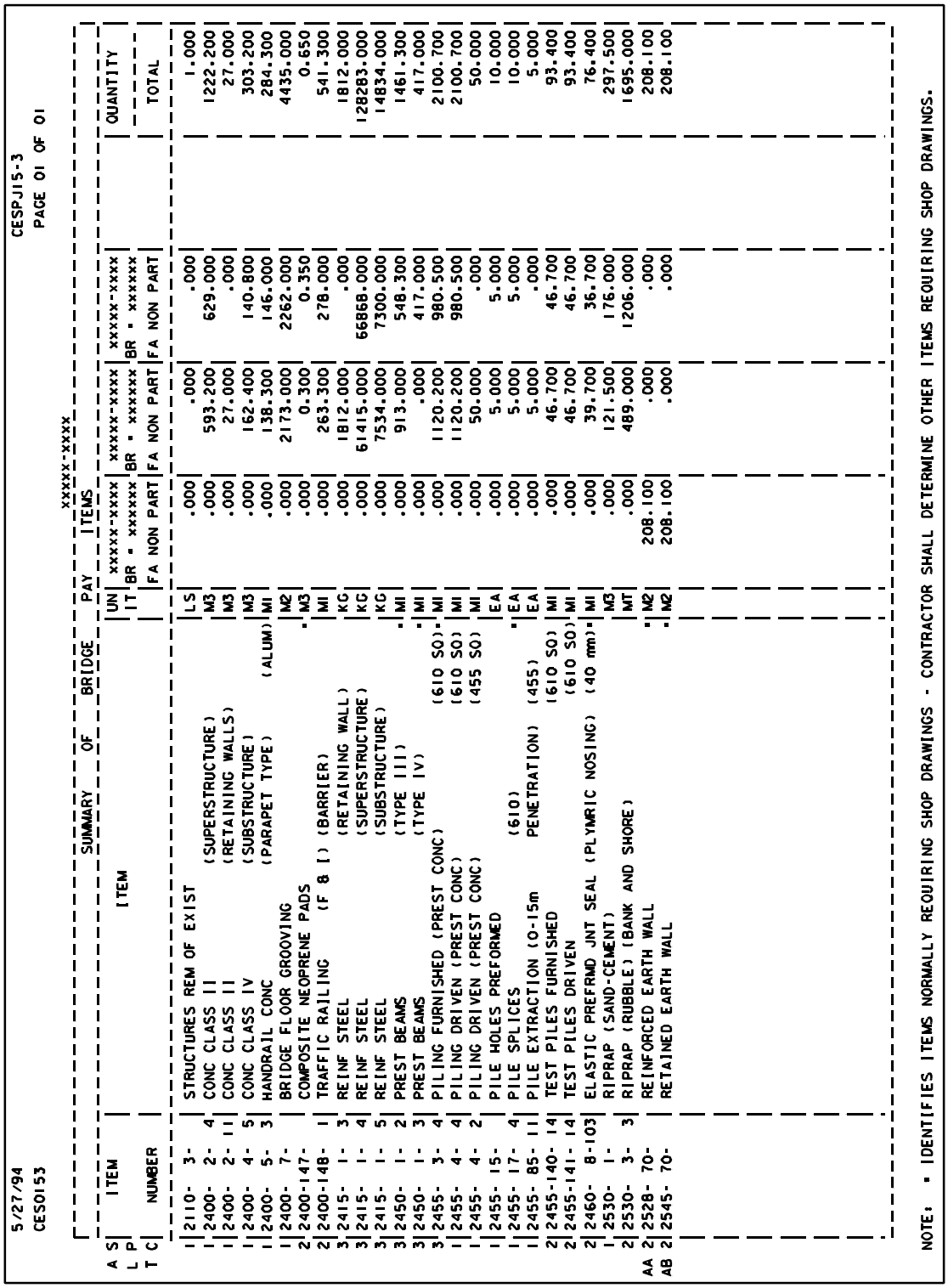
SUMMARY OF BRIDGE PAY ITEMS

A S L P T C	ITEM NUMBER	ITEM	UN IT	xxxxx-xxxx BR - xxxxxx FA NON PART	QUANTITY TOTAL
1	2110- 3-	STRUCTURES REM OF EXIST	LS	1.000	1.000
1	2400- 2- 4	CONC CLASS II (SUPERSTRUCTURE)	M3	203.300	203.300
1	2400- 4- 5	CONC CLASS IV (SUBSTRUCTURE)	M3	50.000	50.000
1	2400- 7-	BRIDGE FLOOR GROOVING	M2	578.000	578.000
2	2400-148- 1	TRAFFIC RAILING (F 8 1) (BARRIER)	MI	60.000	60.000
3	2415- 1- 4	REINF STEEL (SUPERSTRUCTURE)	KG	15849.000	15849.000
3	2415- 1- 5	REINF STEEL (SUBSTRUCTURE)	KG	3400.000	3400.000
3	2455- 3- 2	PILING FURNISHED (PREST CONC) (455 SO)*	MI	466.300	466.300
1	2455- 4- 2	PILING DRIVEN (PREST CONC) (455 SO)	MI	466.300	466.300
1	2455- 15-	PILE HOLES PREFORMED	EA	3.000	3.000
1	2455- 17- 2	PILE SPLICES (455) *	EA	3.000	3.000
2	2455-140- 12	TEST PILES FURNISHED (455 SO)	MI	53.300	53.300
2	2455-141- 12	TEST PILES DRIVEN (455 SO)	MI	53.300	53.300
2	2530- 3- 3	RIPRAP (RUBBLE) (BANK AND SHORE)	MT	1544.600	1544.600

NOTE: * IDENTIFIES ITEMS NORMALLY REQUIRING SHOP DRAWINGS - CONTRACTOR SHALL DETERMINE OTHER ITEMS REQUIRING SHOP DRAWINGS.

Figure 3-5 Summary of Pay Items



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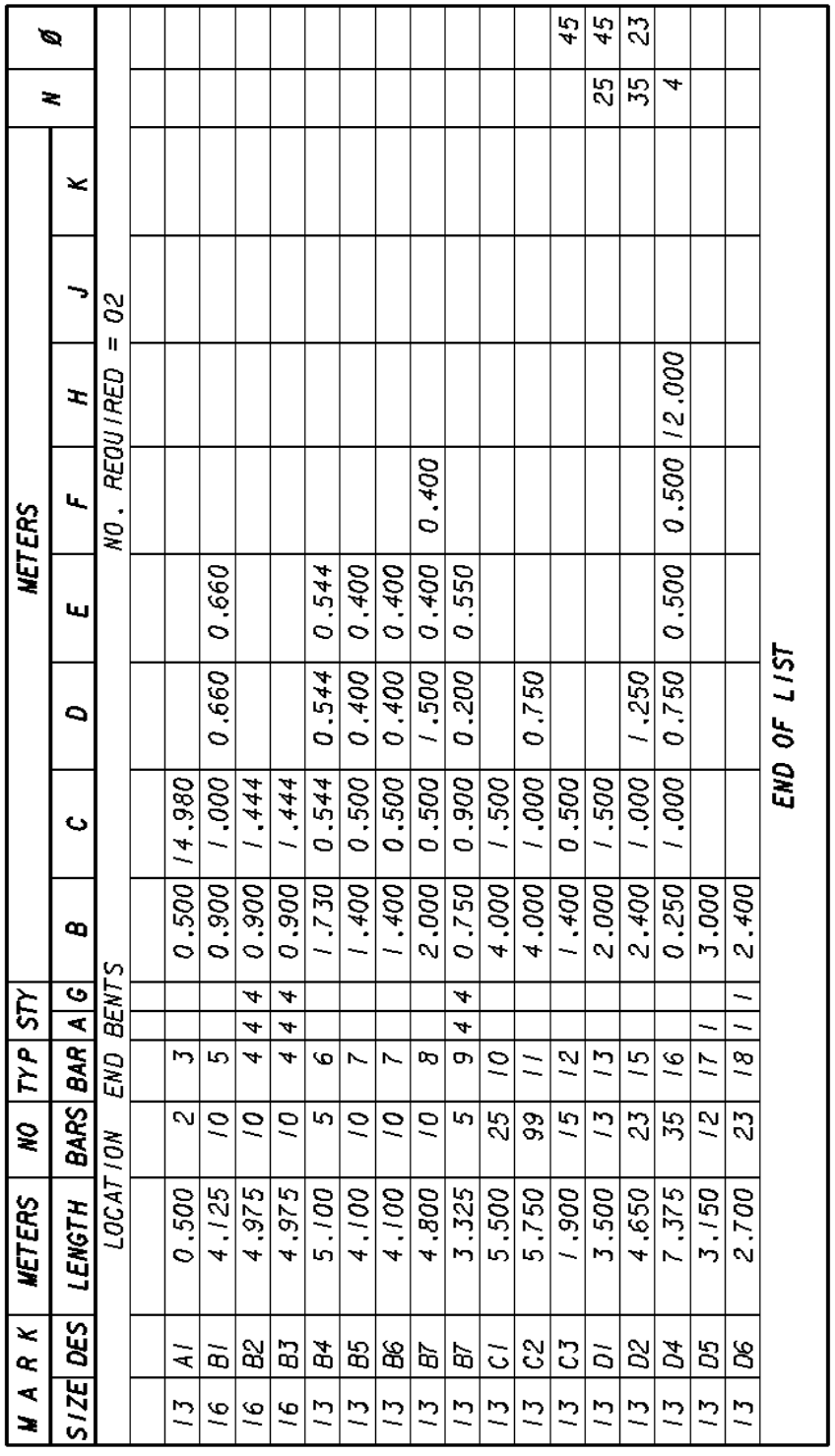
SUMMARY OF BRIDGE PAY ITEMS xxxxx-xxxx

ASLPTC	ITEM NUMBER	ITEM	UNIT	xxxxx-xxxx BR - xxxxxx FA NON PART	xxxxx-xxxx BR - xxxxxx FA NON PART	xxxxx-xxxx BR - xxxxxx FA NON PART	QUANTITY TOTAL
1	2110- 3-	STRUCTURES REM OF EXIST	LS	.000	.000	.000	1.000
1	2400- 2- 4	CONC CLASS II (SUPERSTRUCTURE)	M3	.000	593.200	629.000	1222.200
1	2400- 2- 11	CONC CLASS II (RETAINING WALLS)	M3	.000	27.000	.000	27.000
1	2400- 4- 5	CONC CLASS IV (SUBSTRUCTURE)	M3	.000	162.400	140.800	303.200
1	2400- 5- 3	HANDRAIL CONC (PARAPET TYPE) (ALUM)	MI	.000	138.300	146.000	284.300
1	2400- 7-	BRIDGE FLOOR GROOVING	M2	.000	2173.000	2262.000	4435.000
2	2400-147-	COMPOSITE NEOPRENE PADS	M3	.000	0.300	0.350	0.650
2	2400-148- 1	TRAFFIC RAILING (F 8 I) (BARRIER)	MI	.000	263.300	278.000	541.300
3	2415- 1- 3	REINF STEEL (RETAINING WALL)	KG	.000	1812.000	.000	1812.000
3	2415- 1- 4	REINF STEEL (SUPERSTRUCTURE)	KG	.000	61415.000	66868.000	128283.000
3	2415- 1- 5	REINF STEEL (SUBSTRUCTURE)	KG	.000	7534.000	7300.000	14834.000
3	2450- 1- 2	PREST BEAMS (TYPE III)	MI	.000	913.000	548.300	1461.300
3	2450- 1- 3	PREST BEAMS (TYPE IV)	MI	.000	.000	417.000	417.000
3	2455- 3- 4	PILING FURNISHED (PREST CONC) (610 SQ)	MI	.000	1120.200	980.500	2100.700
1	2455- 4- 4	PILING DRIVEN (PREST CONC) (610 SQ)	MI	.000	1120.200	980.500	2100.700
1	2455- 4- 2	PILING DRIVEN (PREST CONC) (455 SQ)	MI	.000	50.000	.000	50.000
1	2455- 15-	PILE HOLES PREFORMED	EA	.000	5.000	5.000	10.000
1	2455- 17- 4	PILE SPLICES (610)	EA	.000	5.000	5.000	10.000
1	2455- 85- 11	PILE EXTRACTION (0-15m PENETRATION) (455)	EA	.000	5.000	.000	5.000
2	2455-140- 14	TEST PILES FURNISHED (610 SQ)	MI	.000	46.700	46.700	93.400
2	2455-141- 14	TEST PILES DRIVEN (610 SQ)	MI	.000	46.700	46.700	93.400
2	2460- 8-103	ELASTIC PREFRMD JNT SEAL (PLYMRIC NOSING) (40 mm)	MI	.000	39.700	36.700	76.400
1	2530- 1-	RIPRAP (SAND-CEMENT)	M3	.000	121.500	176.000	297.500
2	2530- 3- 3	RIPRAP (RUBBLE) (BANK AND SHORE)	MT	.000	489.000	1206.000	1695.000
AA 2	2528- 70-	REINFORCED EARTH WALL	M2	208.100	.000	.000	208.100
AB 2	2545- 70-	RETAINED EARTH WALL	M2	208.100	.000	.000	208.100

NOTE: * IDENTIFIES ITEMS NORMALLY REQUIRING SHOP DRAWINGS - CONTRACTOR SHALL DETERMINE OTHER ITEMS REQUIRING SHOP DRAWINGS.

Figure 3-6 Summary of Pay Items



MARK		METERS	NO	TYP	STY	METERS								N	Ø
SIZE	DES	LENGTH	BARS	BAR	A G	B	C	D	E	F	H	J	K		
LOCATION END BENTS										NO. REQUIRED = 02					
13	A1	0.500	2	3		0.500	14.980								
16	B1	4.125	10	5		0.900	1.000	0.660	0.660						
16	B2	4.975	10	4	4 4	0.900	1.444								
16	B3	4.975	10	4	4 4	0.900	1.444								
13	B4	5.100	5	6		1.730	0.544	0.544	0.544						
13	B5	4.100	10	7		1.400	0.500	0.400	0.400						
13	B6	4.100	10	7		1.400	0.500	0.400	0.400						
13	B7	4.800	10	8		2.000	0.500	1.500	0.400	0.400					
13	B7	3.325	5	9	4 4	0.750	0.900	0.200	0.550						
13	C1	5.500	25	10		4.000	1.500								
13	C2	5.750	99	11		4.000	1.000	0.750							
13	C3	1.900	15	12		1.400	0.500								45
13	D1	3.500	13	13		2.000	1.500							25	45
13	D2	4.650	23	15		2.400	1.000	1.250						35	23
13	D4	7.375	35	16		0.250	1.000	0.750	0.500	0.500	12.000			4	
13	D5	3.150	12	17	1	3.000									
13	D6	2.700	23	18	1 1	2.400									
END OF LIST															

Figure 3-7 Reinforcing Bar List

Chapter 4

COMPOSITION OF BRIDGE PLAN SET

4.1 Plans Sheets

The preferred order of Bridge Plans Sheets in the contract set is shown below. All the sheets shown may not be required in any given set of bridge plans, while, in others, additional sheets may be necessary. Generally, the order of listing sheets (except as shown) shall parallel the sequence of work performed in constructing the bridge.

4.1.1 Single Bridges (one Bridge site)

Sheet No.	Title
B-1	Key Sheet (Applies only when Bridge plans are let to contract without Roadway Plans). The Index of Bridge Sheets shall be placed on this sheet unless space is not available. A description of information required is provided in Chapter 3.
B-1 or B-2 (When a Key Sheet is required)	General Notes, Index of Bridge Sheets, Bid Item Notes and if space is available provide a sketch showing areas to receive Class 5 surface finish and slope protection details. If more than one sheet is required for the above, number sheets in numerical order.
B-	Standard Drawings (piling, traffic barrier, bearing pads, etc.)
B-	Plan and Elevation includes item(s) in B-2 above if space is available. See Chapter 5 for specific requirements.
B-	Bridge Hydraulic Recommendations Sheet (See Chapter 6)
B-	Construction Sequence (Phase Construction or Replacement)
B-	Report of Core Borings (See Chapter 7)
B-	Foundation Layout (Piles, Drilled Shafts or Spread Footings) (See Chapter 8)
B-	End Bent Details
B-	Intermediate Bents or Piers
B-	Finish Grade Elevations (See Chapter 9)
B-	Superstructure Sheets
B-	Framing Plan (for steel or concrete, beam or girder Bridges) (See Chapter 10)
B-	Miscellaneous Details
B-	Beam Sheets (concrete or steel, beam or girder)

B-	Reinforcing Bar List
B-	Approach Slabs
B-	Detour Bridge Plan and Elevation
B-	Detour Bridge Details
W-	Retaining Wall Sheets (including control plans and proprietary designs if required) - Where retaining walls or bulkheads are required to retain bridge approach embankments, these plans shall be included as part of the bridge plan submittal. When retaining walls or bulkheads are primarily associated with roadway embankments, these plans shall be submitted with the roadway plans.
TW-	Critical Temporary Wall
LT-	Load test sheets for load testing of piles & drilled shafts
EB-	Existing Bridge Sheets (if needed)

4.1.2 Multiple Bridges (more than one Bridge site)

Sheet No.	Title
A-1	Key Sheet (See Single Bridges)
A-1 or A-2 (When a Key Sheet is required)	Index of Bridge Sheets for all Bridges in the contract and Bridge Location Map if space is available a sketch showing areas to receive Class 5 surface finish and slope protection details. If more than one sheet is required for the above, number sheets in numerical order.
A-	Standard Drawings
A-	* Details common to more than one bridge.
B-1	* General Notes and Bid Item Notes for the first Bridge in the contract.
B-	Plan and Elevation includes items in B-1 above, if space is available. See Chapter 5 for specific requirements.

(Remainder of Sheets follow Single Bridges List)

C-1	* General Notes and Bid Item Notes for the second Bridge in the contract.
C-	Plan and Elevation include items in C-1 above, if space is available. See Chapter 5 for specific requirements.
W-,TW-,LT-, & EB-	sheets should be placed after all bridges.

* On multiple Bridge projects where the Bridges are the same type construction, only one set of General Notes is required. When projects require different construction methods (example, prestressed concrete beams and steel girders) separate General Notes shall be shown for each method of construction.

4.2 Sheet Numbers

All sheet numbers shall be prefixed with a letter, with sequential letters used for multiple bridge projects, except do not use the letters "I", "L", "O", "S", "T", or "U". Furthermore, the letter "A" is reserved for Standard Drawings and common details for multiple bridge projects.

4.3 Standard Drawings

Standard Drawings are drawings prepared by the Department depicting common structural elements. Refer to the Structures Design Office book of Standard Drawings for available standards.

4.4 Consultant's Logo

The logo of the design engineer's firm (who may also be the Engineer of Record) shall be shown on each sheet in the space provided in the title block along the bottom of the sheet (See Figure 2-1).

4.5 Existing Bridges

a. The plans for existing bridges (to be widened, repaired, etc.) shall be included in the construction plans in accordance with this Chapter. These existing drawings shall be titled "EXISTING PLANS" and the sheet numbers prefixed with the letters "EB".

b. The Construction Plans shall clearly explain which portions of the existing bridges are to be incorporated in the new construction and which portions are to be removed. Required removal depth not conforming with the FDOT Standard Specifications for Road and Bridge Construction (latest edition) shall be shown.

c. An outline (in plan view) of the existing bridge shall be shown in the Plan and Elevation sheet. The areas to be removed shall be shown hatched as described in the symbolism descriptions in Chapter 2.

4.6 Sheet References for Multiple Bridges

The drawings for a specific bridge may make reference to other drawings with sheet numbers beginning with the same prefix letter or with the letter "A". Reference to sheets for other bridges is not permitted.

4.7 Approach Slab

Reinforced concrete approach slabs shall be utilized on the roadway approach to the bridge. The bridge designer is responsible for providing the detail sheets which are to be included with the bridge plans (effective letting date - July 1999). Standard Drawing Index No. S-900 shall be utilized if suitable; however, if the Standard Drawing cannot be used, the bridge designer shall prepare the necessary drawing(s) for submittal with the bridge plans.

Roadway approaches to bridges located in urban sections typically comprise a 150 mm raised sidewalk. When possible, the raised sidewalk shall be transitioned to the bridge sidewalk over the length of the approach slab. The transition shall be designed and detailed to prohibit low spots or “ponding” by use of special profiles or other means to redirect or collect runoff from the bridge and approach slab into suitable roadway or drainage structures.

4.8 Sequence of Construction Sheet

Required for phase construction or Bridge replacement to supplement not replace Maintenance of Traffics plans. Show step by step construction to include but not limited to the following:

a. Construction Joints.
b. Critrical temporary MSE walls.
c. Bearier walls
d. Removal of existing structures.

Chapter 5

PLAN AND ELEVATION

5.1 Purpose

This drawing is the general layout of the bridge in plan and elevation views (See Figures 5-1 and 5-2).

5.2 Scales

The Plan and Elevation views shall be drawn preferably to the same vertical and horizontal scale; however, in some cases a vertical scale larger than the horizontal scale might be necessary. More than one sheet may be required. For recommended scales see Chapter 2; however, do not indicate the scale used on the drawing. In any event, the scales selected shall permit 100% legibility of the drawing when reproduced to 279 x 432 mm size prints. See Structures CADD User's Manual for additional information.

5.3 Plan and Elevation Drawing

The following is a list of items that shall be shown, when appropriate, on the Plan and Elevation drawing:

a. All vertical and horizontal geometry including:
   1. Horizontal and vertical curve data
   2. Profile grade lines: See Figures 5-3 and 5-4 for establishing profile grade elevation:
      (a) When the bridge is on a straight 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 plan geometrical control line to which it applies (See Chapter 2).

b. Span length(s) and overall length of bridge.

c. North Arrow (See Figure 2-18), direction of flow for water crossing (See Figure 2-19) and direction of stationing (See Figure 2-20).

d. Skew angle at bents and intersecting base lines.

e. 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), as appropriate.

f. Slope of embankment.

g. Berm width.
h. Limits of slope pavements, sand cement riprap or rubble riprap.
i. Location of the profile grade line and roadway alignment.
j. Location of expansion and fixed bearings.
k. Traffic data (for each facility, if grade separation): design speed, present and design year (+20), percentage of trucks and direction of traffic.
l. Bearing of bridge (N or S and E or W).
m. Labels: "PLAN" and "ELEVATION".
n. Elevation view graphic scale on side of drawing (vertical scale only).
o. Edge of shoulder.
p. Toe of slope.
q. 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.
r. Distance to mile post from intersection of railroads.
s. Utilities, sanitary and storm sewers, telephones, etc.
t. Existing ground and finished ground profiles.
u. Right-of-way lines (roadway, railroad, etc.) if pertinent.
v. Guardrail in Plan and Elevation views and across the median between the ends of end bent wing posts on dual bridges.
w. Bridge - mounted Lighting, Signs and Signals.
x. Boring locations.
y. Low, mean and high water elevations as appropriate.
z. Critical locations and dimensions of horizontal and vertical clearances.
aa. Properly completed title block and initial block (this requirement is mandatory for 30% plan and subsequent submittals).

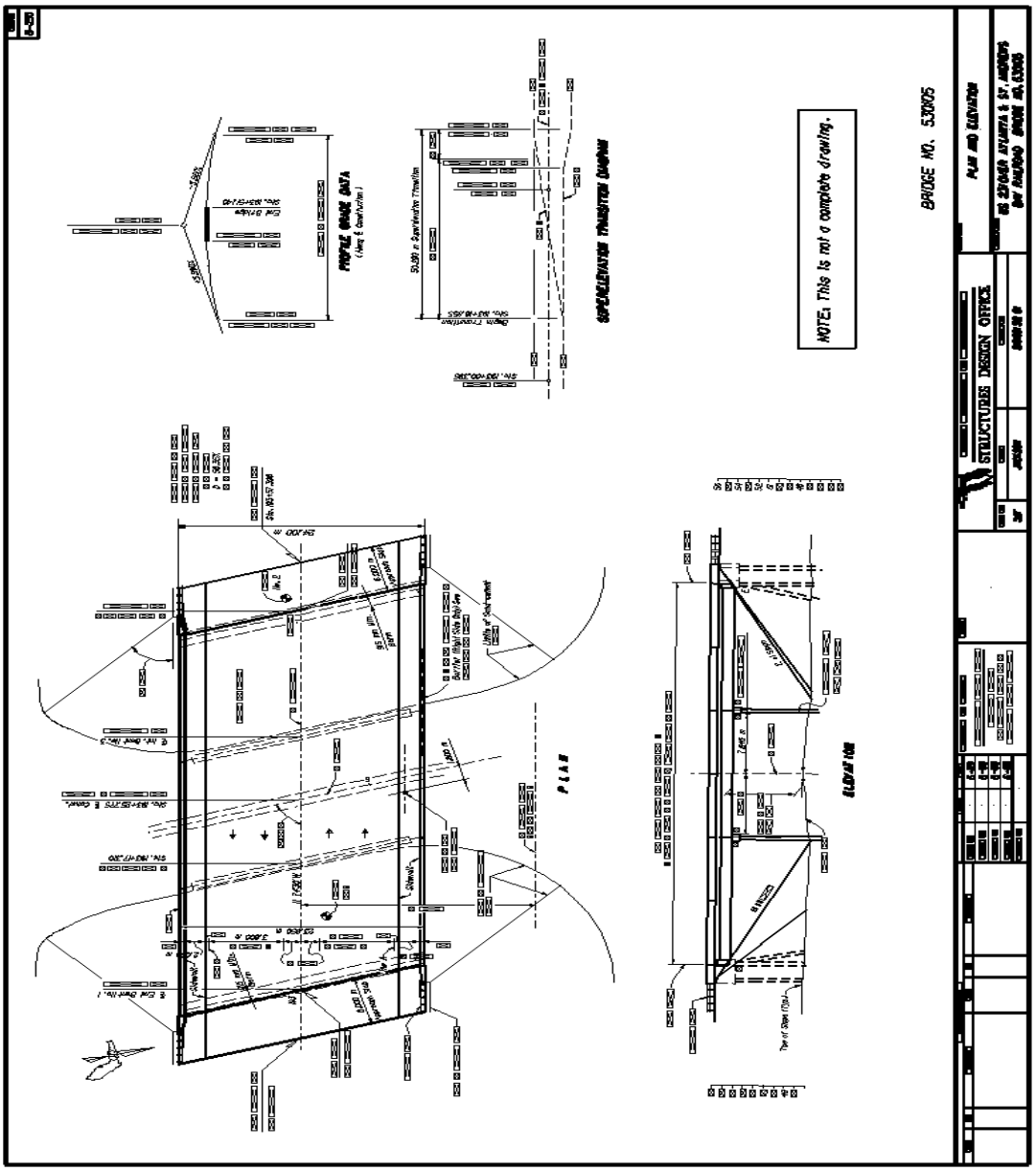


Figure 5-1 Plan and Elevations

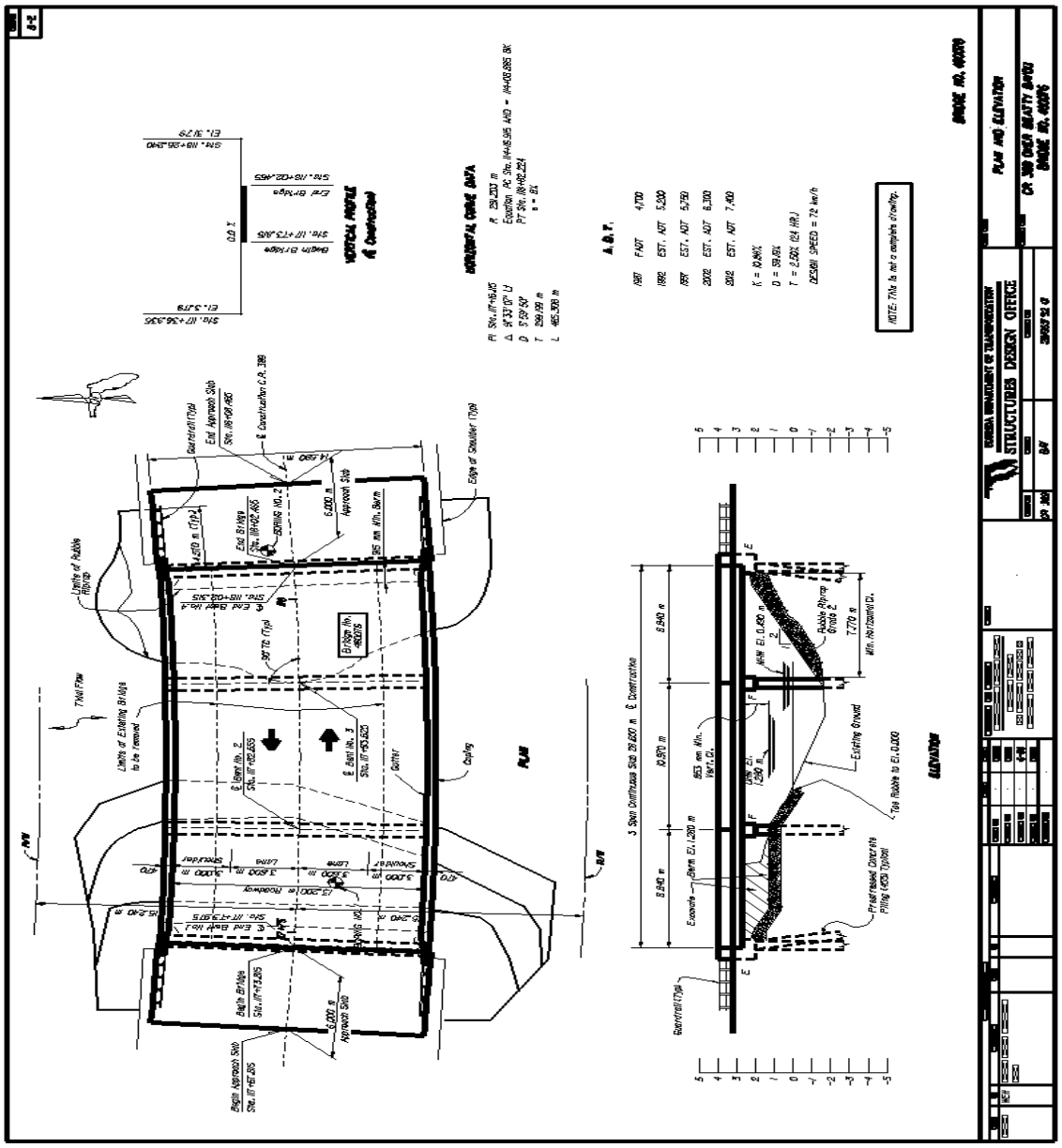


Figure 5-2 Plan and Elevations

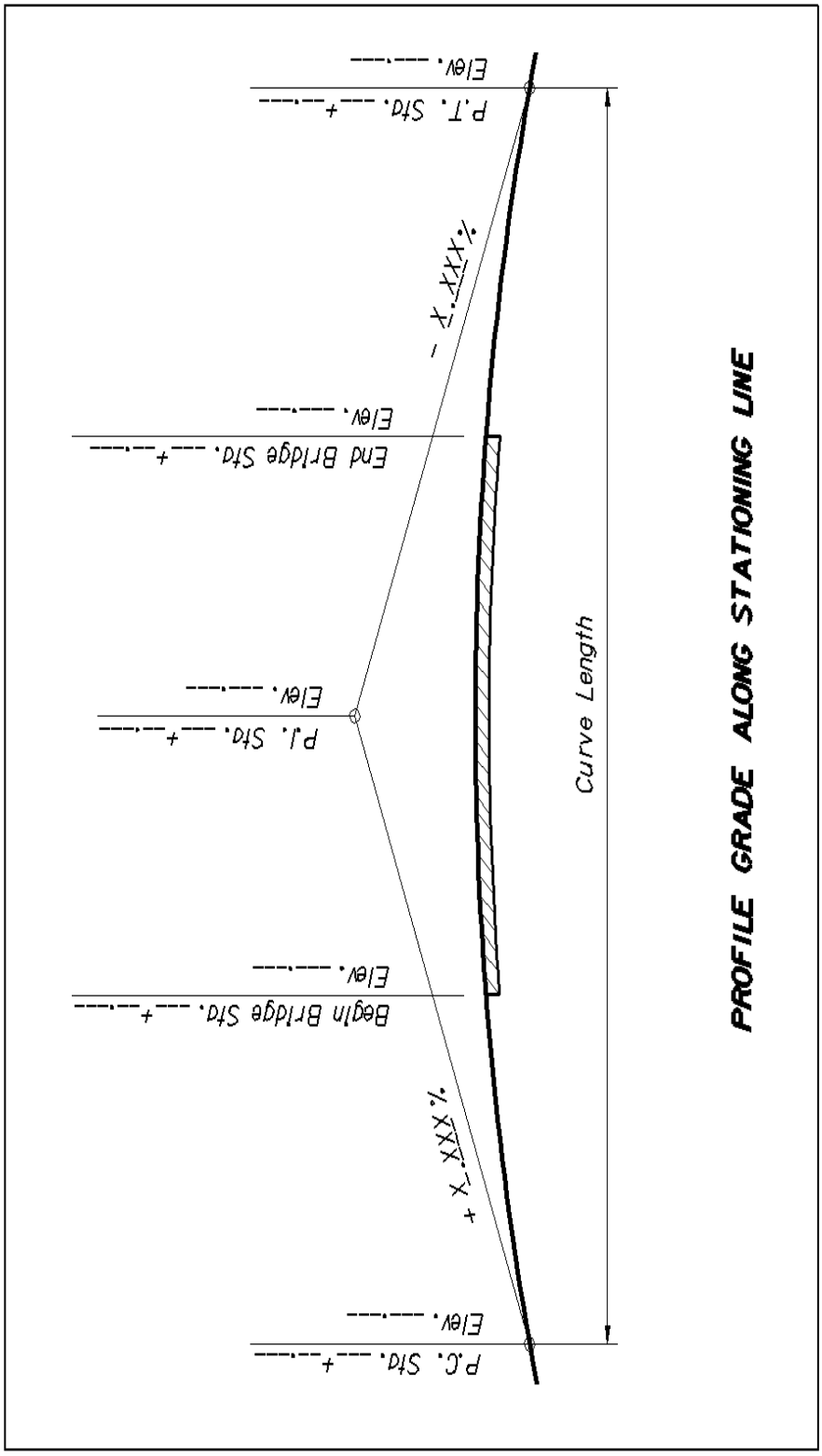
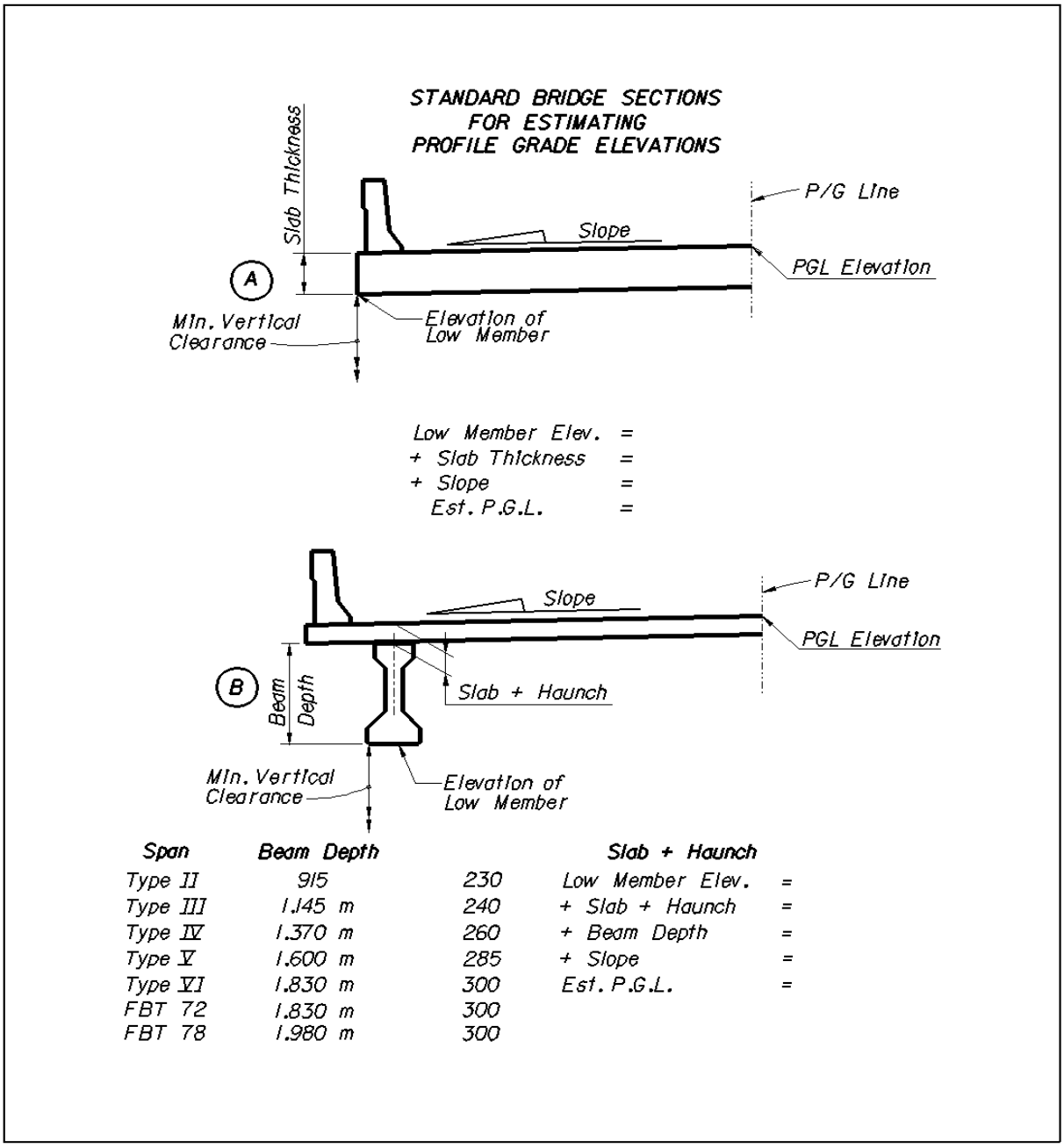


Figure 5-3 Profile Grade



Span	Beam Depth		Slab + Haunch	
Type II	915	230	Low Member Elev.	=
Type III	1.145 m	240	+ Slab + Haunch	=
Type IV	1.370 m	260	+ Beam Depth	=
Type V	1.600 m	285	+ Slope	=
Type VI	1.830 m	300	Est. P.G.L.	=
FBT 72	1.830 m	300		
FBT 78	1.980 m	300		

Figure 5-4 Standard Bridge Sections

Chapter 6

BRIDGE HYDRAULIC INFORMATION, BRIDGE HYDRAULIC RECOMMENDATION SHEET (BHRS)

6.1 Purpose

This drawing shows all pertinent hydraulic information necessary for the layout of a bridge at the location of a given water crossing(s). This drawing, which is prepared by the District Drainage Engineer or a Consulting Drainage Engineer, preferably should be included in the PD&E documents. If not included in the PD&E documents it must be included in the 30% Plans submittal. For a typical drawing see Exhibit BHD-1 in the Plans Preparation Manual.

6.2 General Requirements and Design Procedures

For General Requirements and Design Procedures involving the BHRS, permits and other hydraulic considerations and requirements, see Chapter 27 of the Plans Preparation Manual and the FDOT Drainage Manual (Topic No.: 625-040-001).

Chapter 7

REPORT OF CORE BORINGS FOR STRUCTURES

7.1 Purpose

This drawing is a graphic portrayal of the geological conditions at the site of the bridge or structure. The drawing is prepared by the District Geotechnical Engineer or by a Consulting Geotechnical Firm. The information presented on this drawing and in the Foundation Recommendation Report is used to arrive at a proper foundation design (See Figures 7-1 and 7-2).

7.2 Scales

The drawing shall be prepared with the boring layout plan and boring logs in elevation both drawn to scale. The plan layout scale shall be sufficiently large to enable the necessary boring log data to be legibly shown and permit reasonable determination and interpretation of the soil strata variations.

The vertical scale of the boring logs shall be sufficiently large to permit inclusion of all relevant boring data (See Figure 7-2) and need not be the same scale as that of the plan layout.

In any event, the scales selected shall permit 100% legibility of the drawing when reproduced to 279 x 432 mm size prints.

7.3 Check Items

Listed below are items that should appear on the drawing:

Plan View (Boring Layout)

a. Stationing Line (show station values).
b. Stationing Line terminology (B.L. Survey, ℄ Construction, etc.)
c. North Arrow.
d. Begin and end bridge stations and labels.
e. Boring locations referenced to Stationing Line by station and offset. Boring labels.

Elevation View (Boring Logs)

f. Elevation reference on both left and right sides of the sheet (borings must be plotted in reference to elevation, not depth below ground surfaces).
g. Boring plots, labels, stations, offsets.
h. Ground surface elevation.
i. Ground/surface water level and date recorded (note artesian head if encountered).
j. Strata description including Unified Classification Symbols.

k. Standard Penetration N-values.
l. Rock Core Locations, % recoveries, RQD.
m. Undisturbed soil sampling locations.
n. Lab test results.
o. Insitu test locations (vane shear test, dilatometer test, pressuremeter test, etc.) and corresponding test results.
p. Note unusual circumstances such as: sudden drop of split spoon, loss of circulation, etc.

Other

q. Soil Legend.
r. Rig Type.
s. Environmental Classification (superstructure, substructure).
t. Financial Project Number.
u. Completed Title Block.
v. Hammer Type

7.4 Title Block

This drawing is titled "REPORT OF CORE BORINGS".

The names of the driller who produced the borings, the Geotechnical Engineer and the District Materials Engineer shall be placed in their proper location.

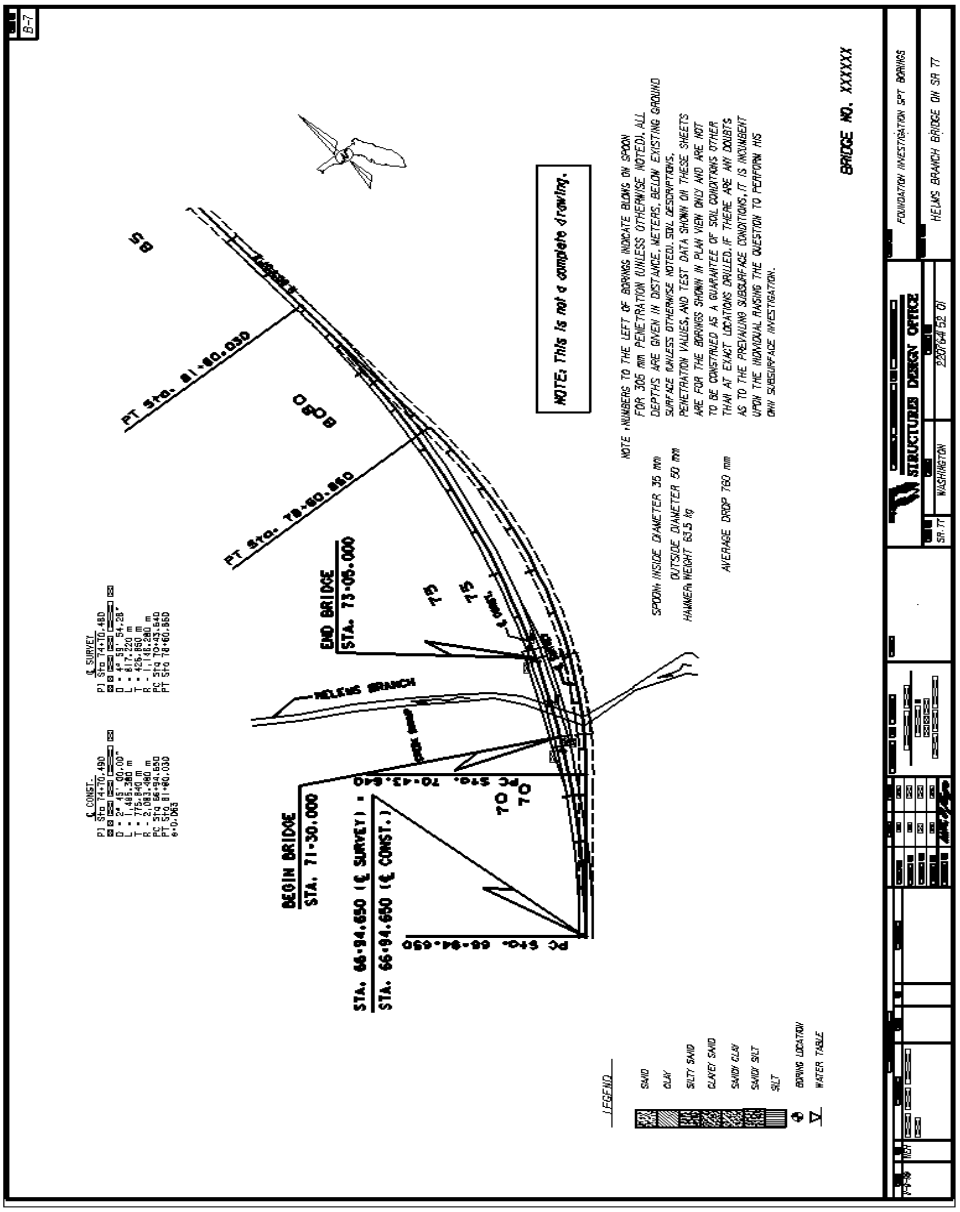


Figure 7-1 SPT Boring

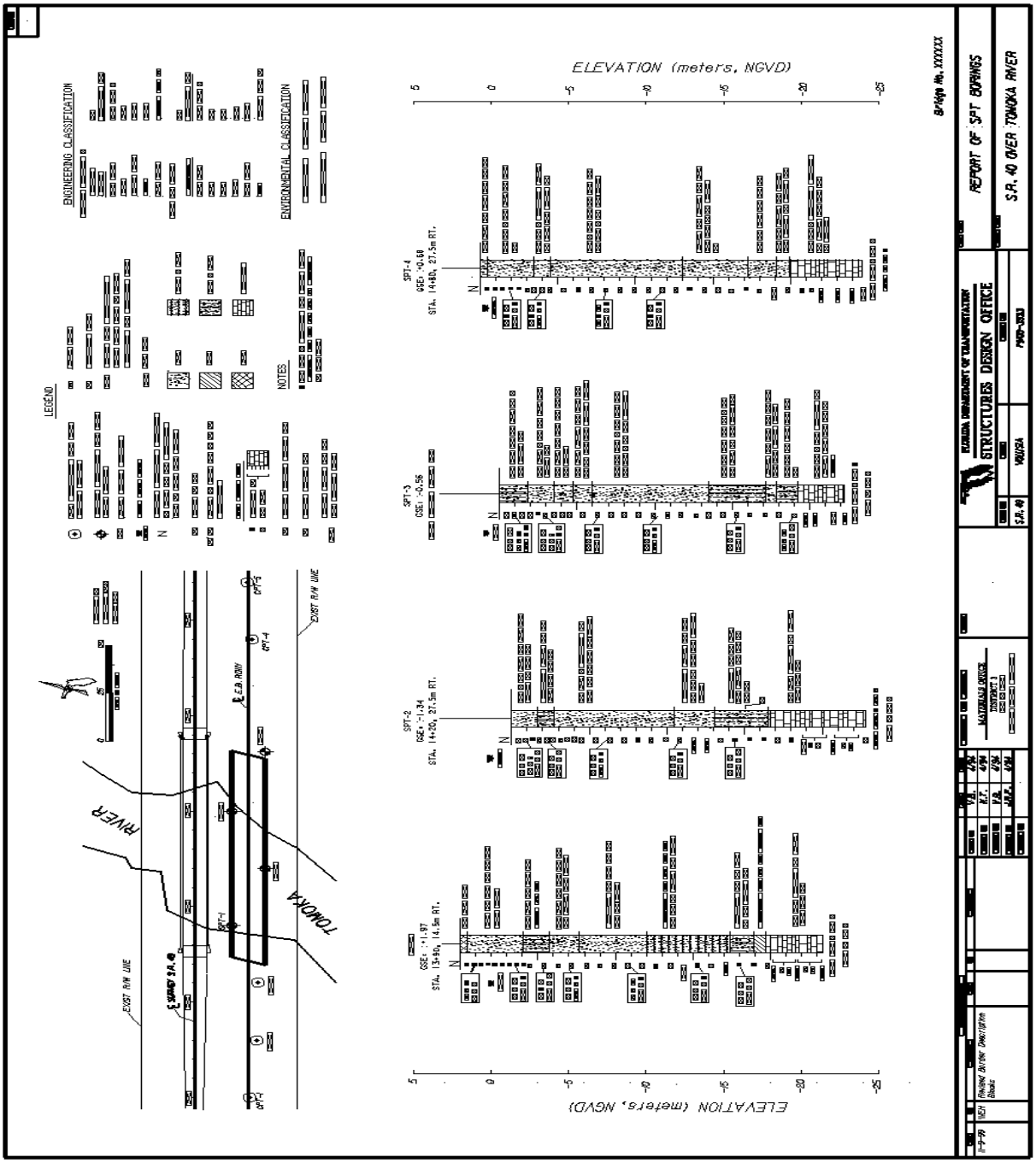


Figure 7-2 Boring Strata

Chapter 8

FOUNDATION LAYOUT

8.1 Purpose

This drawing shall show a plan view of all spread footings, piling or drilled shafts and shall provide all information necessary for locating their positions in the field (See Figure 8-1).

8.2 Scales and Dimensions

See Chapter 2 for recommended scales; however, do not indicate the scales used. In any event, the scales selected shall permit 100% legibility of the drawing when reproduced to 279 x 432 mm size prints.

Scales for the distances may be reduced when deemed necessary and the size of piles and drilled shafts may be exaggerated for clarity (Refer to Section 2.9).

All stations on the Foundation Layout shall be given in meters to three decimal places and all dimensions on the drawing shall be in meters and decimals thereof to the nearest 5 mm. Dimensions less than one meter shall be shown in millimeters.

8.3 Orientation of Details

If the "Foundation Layout" details are to occupy one drawing, they are to be proportioned to the sheet.

If this layout is combined with the “Finish Grade Elevations” details (see Chapter 9), it should occupy the bottom half of the drawing.

The orientation shall be identical to that shown on the "Plan and Elevation" sheet.

8.4 Layout Details

This sheet shall show but not be limited to the following:

a. The Stationing Line which shall be drawn to the scale required for clarity (show north arrow).
b. A plan of the substructure foundations.
c. All horizontal curve data (or reference to it if shown elsewhere) including bearings of tangents.

d. The station of all substructures shall be shown on the Stationing Line. The substructure station shall be the intersection of the stationing line and the substructure centerline or begin/end of bridge. These lines might require extension for intersection.
e. Show on the Stationing Line the angle between the above lines.
    1. For bridges on straight (tangent) alignment, the angle shown shall be the complementary skew angle (See Figure 2-15).
    2. For bridges on a single horizontal curve, the angle shown shall be the angle between the substructure centerline and the tangent to the stationing line.
    3. For bridges on multiple horizontal curves, horizontal curve and tangent, spiral curves or with other complex alignments, use coordinates to locate working points (controls) within the substructure along the ℄ of intermediate supports (piers or bents) or begin or end bridge. The coordinates shall tie into the Florida State Plane Coordinate System (See Figure 8-2).
f. The distance between the working point and adjacent pile clusters, center of footings, drilled shafts, or individual piles shall be shown. In addition:
    1. Other foundation units for a substructure may be dimensioned from the above or adjacent foundations.
    2. Pile spacing within a cluster or concrete boundaries for footings shall be dimensioned.
g. Show the Direction of Stationing adjacent to the Stationing Line preferably at the extreme ahead or back station limit of the layout (See Figure 2-21).
h. Show all overhead and underground utilities and existing foundations in vicinity and offset dimensions if applicable.

8.5 Numbering Foundation Units

The piles in each bent or pier shall be numbered sequentially, beginning with “1". The piles shall be numbered first from left to right when facing in the Direction of Stationing then from most back station to most ahead stationing in the Direction of Stationing. At each pile cluster the piles shall be numbered sequentially. Drilled shafts and individual spread footings shall be numbered as above (See Figures 8-1 thru 8-4).

Reference DOT Procedure No. 850-010-030, Volume 1 - Manual for Bridge and other Structures Inspection and Reporting Procedures.

8.6 Piling, Drilled Shafts and Spread Footings

The following information shall be shown on the drawing as applicable:

a. Sizes - The size of the foundation unit.
b. Maximum Load - The design pile/shaft load or design footing pressure.

c. Batter - The amount and direction of battered piling.
d. Test - The size, number, length and location of test piles or other foundation type.
e. Summary of Pile Lengths - If pile lengths are authorized.
f. Pile cut-off elevations - Elevation of pile head.
g. Pile Tip Elevations - Minimum elevation of pile tip.
h. Drilled Shafts - Head and tip elevations.
i. Scour Notes.
j. Show Pile or Drilled shaft Installation Table accordance with Chapter 4 of the Structures Design Guidelines.

8.7 Drilled Shaft Details

Figures 8-5 thru 8-9 show typical reinforcing steel and problem areas in detailing drilled shafts.

8.8 Sub-Title

The drawing title is "FOUNDATION LAYOUT" and shall be so indicated on the drawing.

If other details are combined on this drawing, they shall be so indicated. Example: If the "Finish Grade Elevations" are placed on the drawing with the "Foundation Layout", the title of the drawing would be "FINISH GRADE ELEVATIONS" - "FOUNDATION LAYOUT".

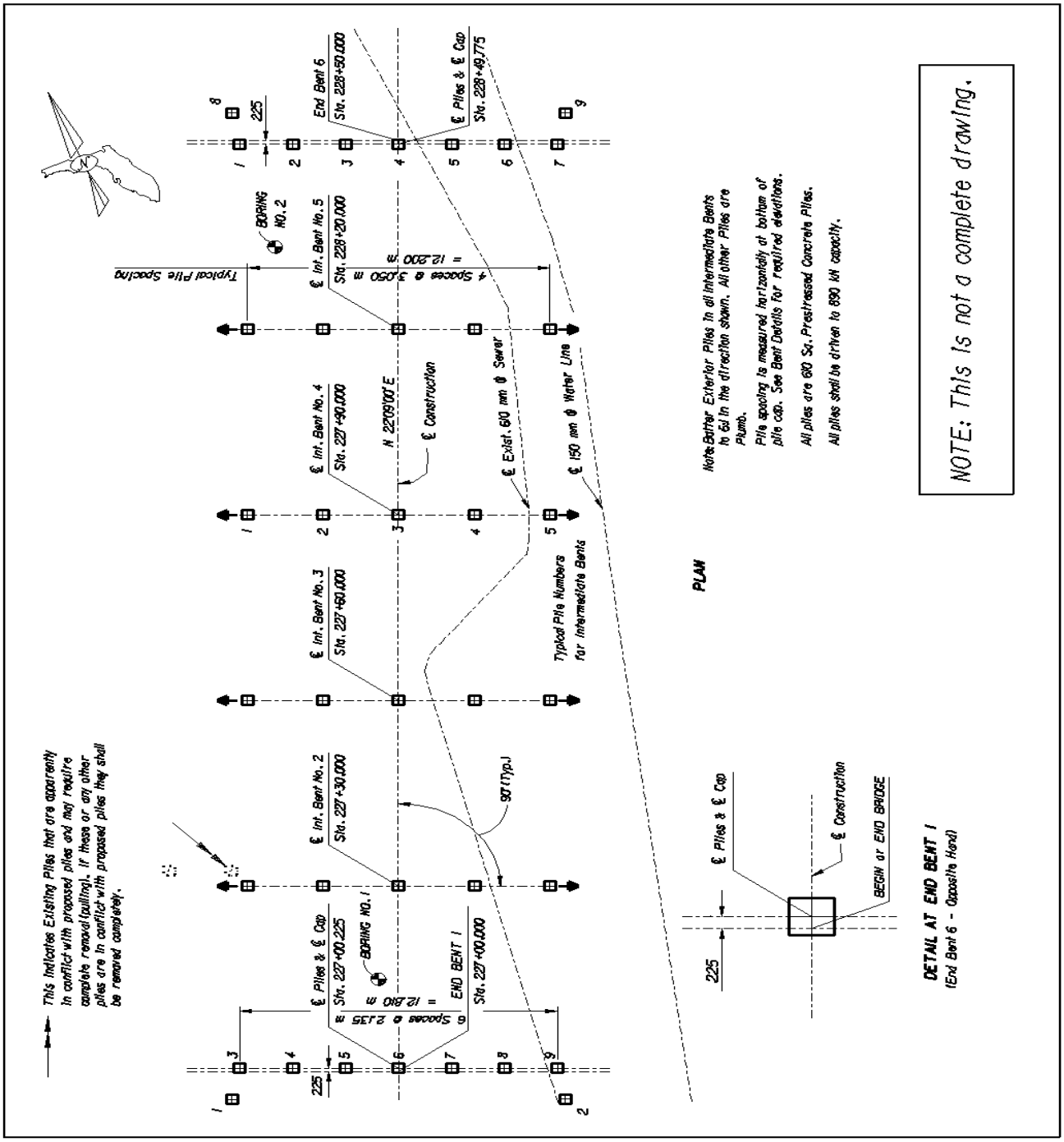


Figure 8-1 Foundation Plan

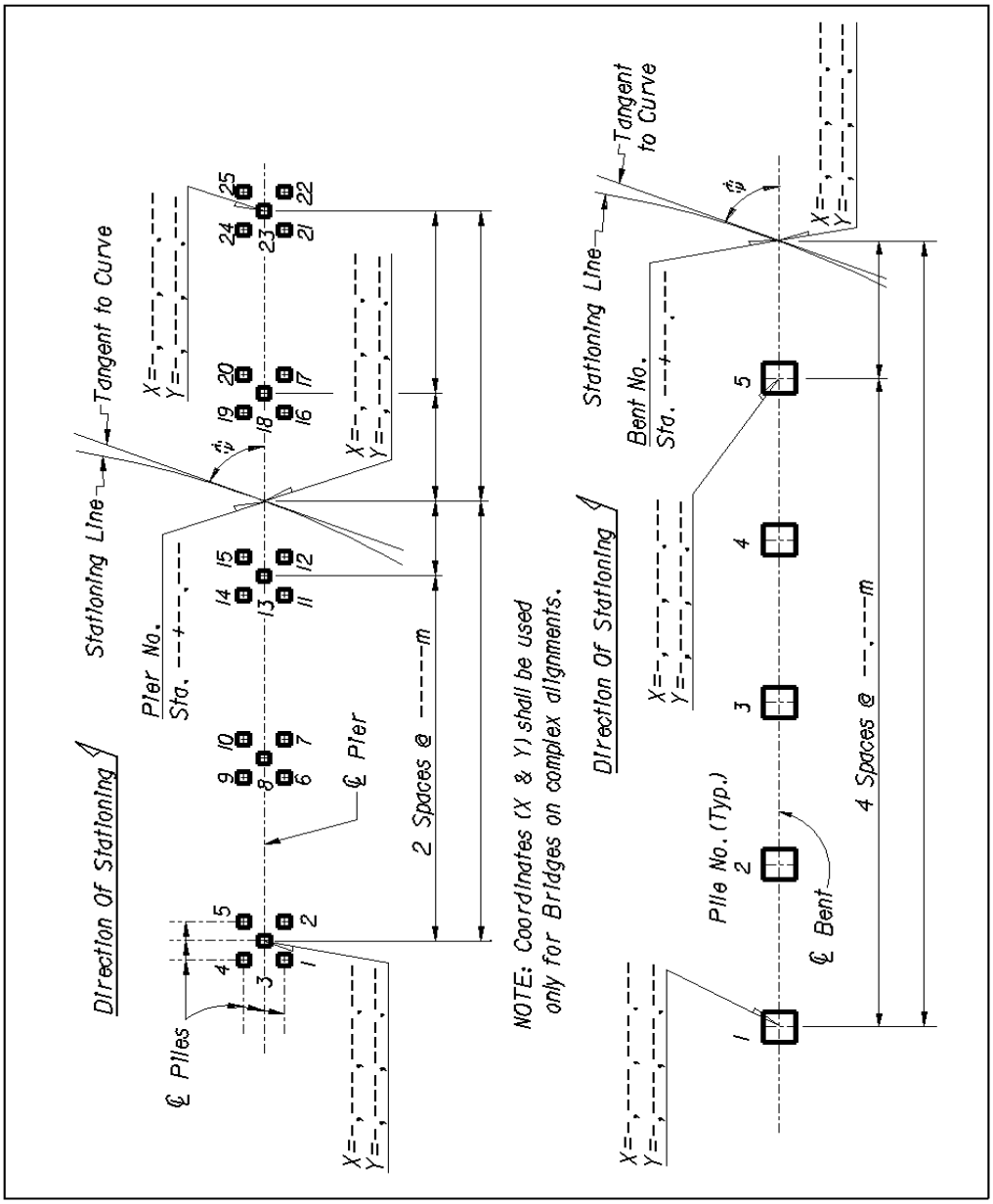


Figure 8-2 Pile Layout

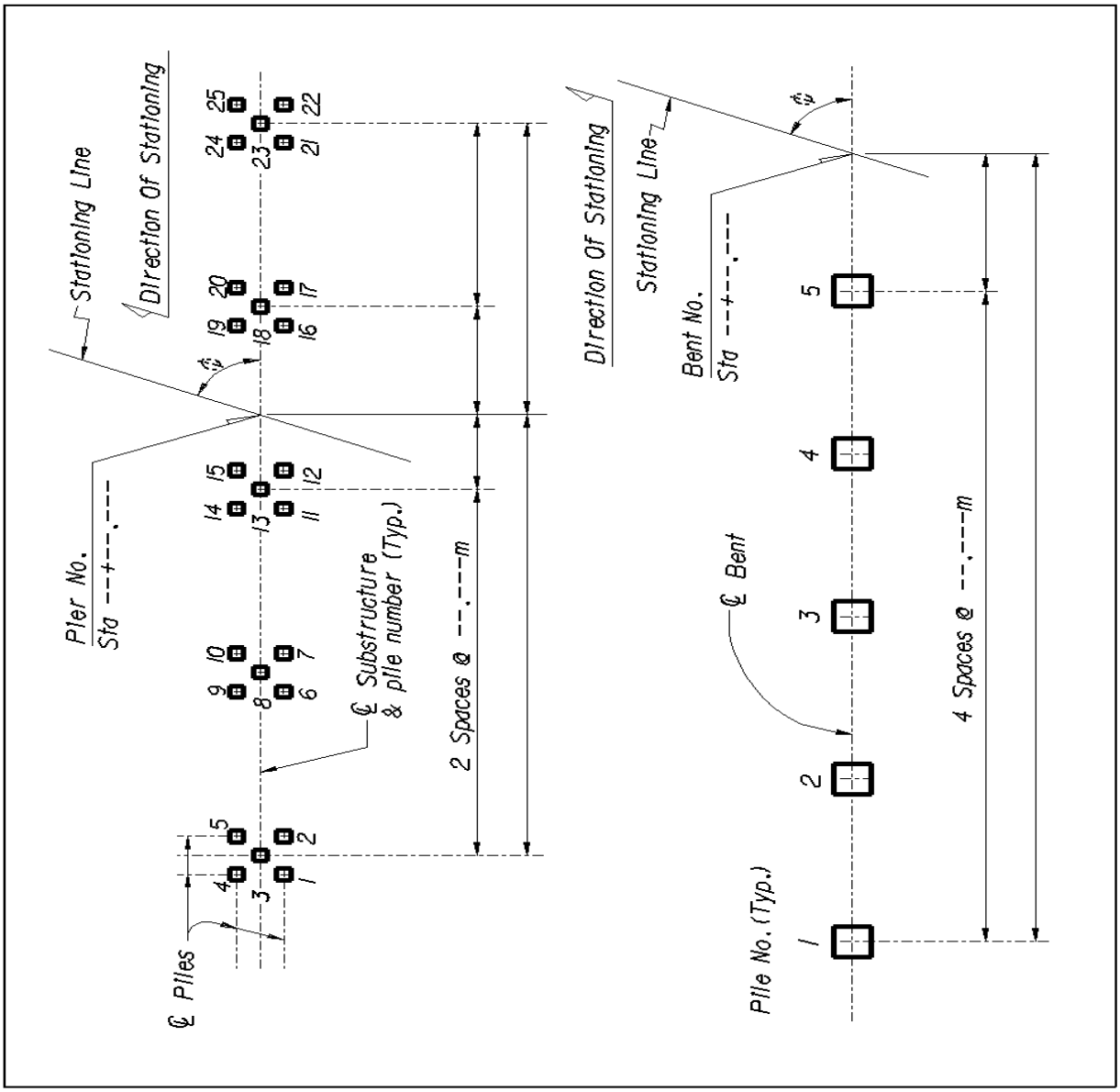


Figure 8-3 Pile Layout

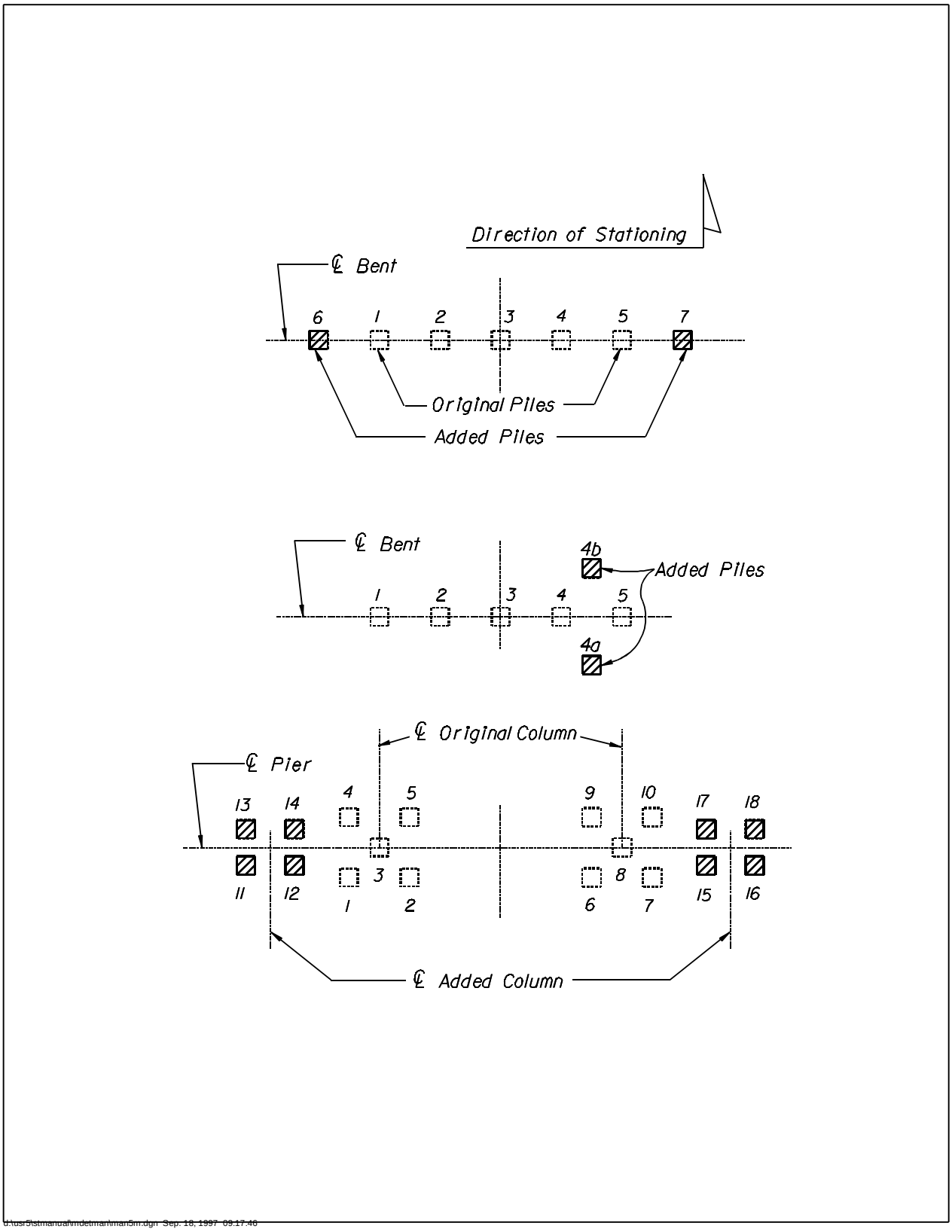


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Figure 8-4 Pile Layout

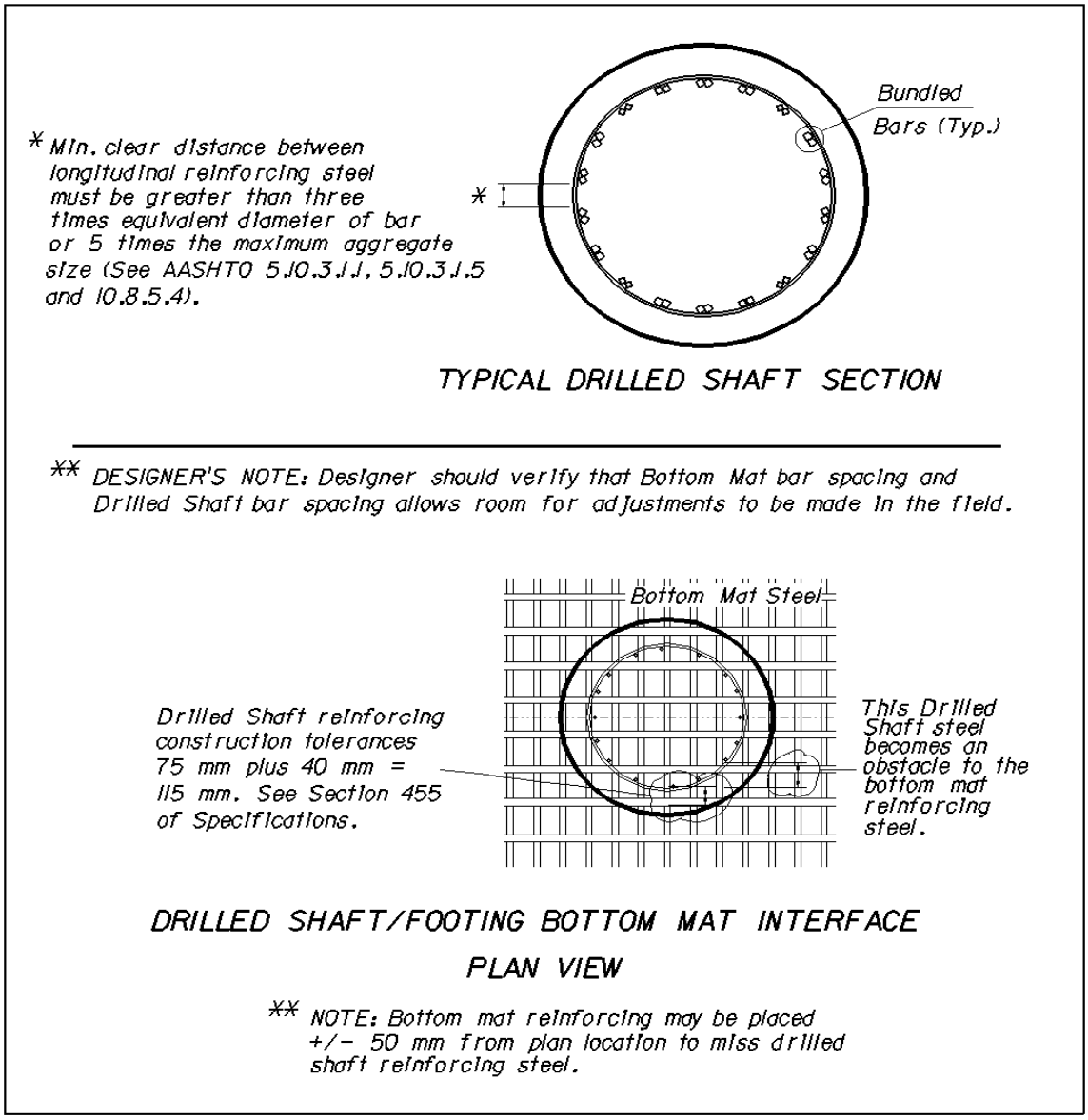


Figure 8-5 Drilled Shaft Details

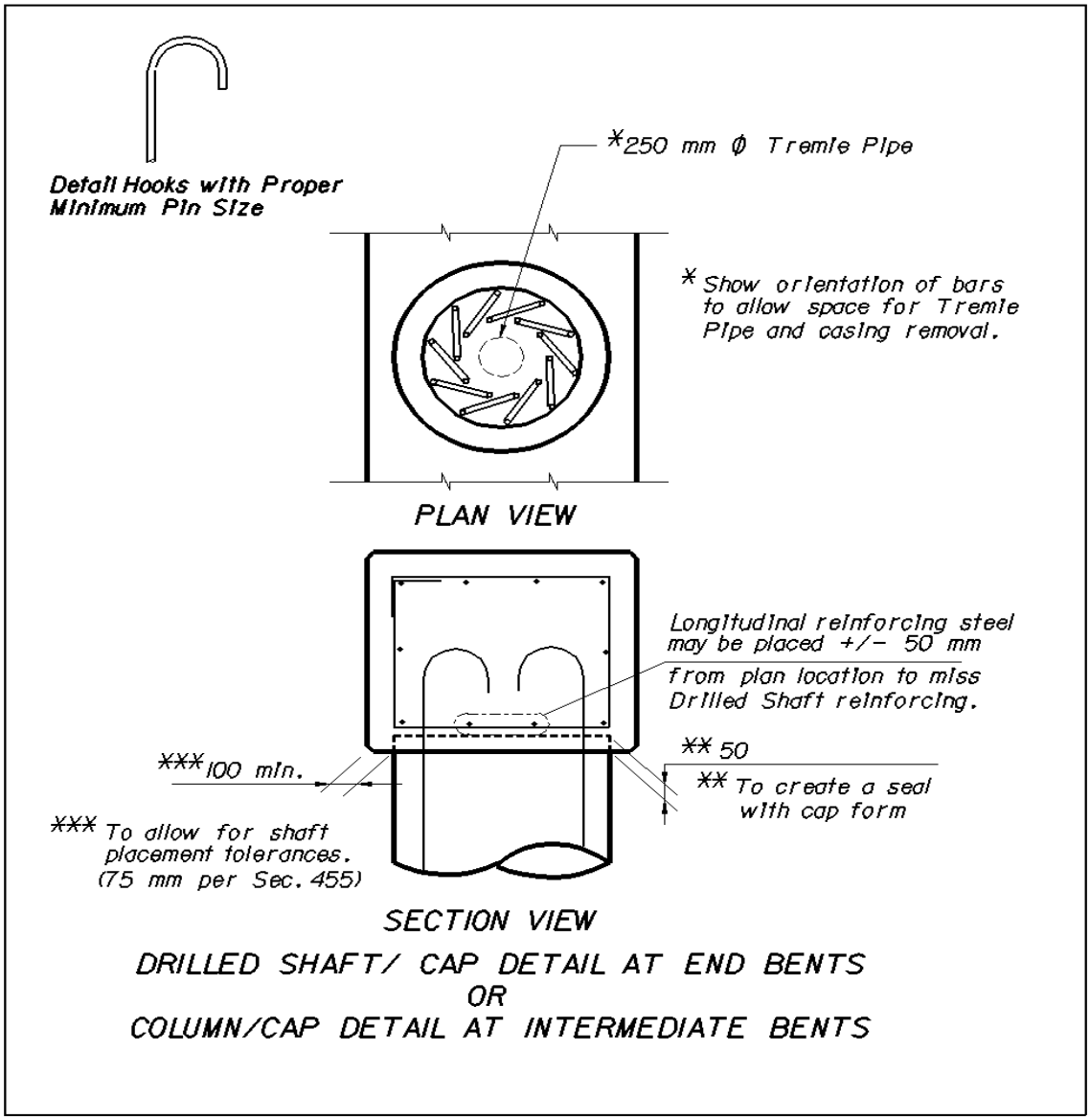


Figure 8-6 Drilled Shaft at Bents

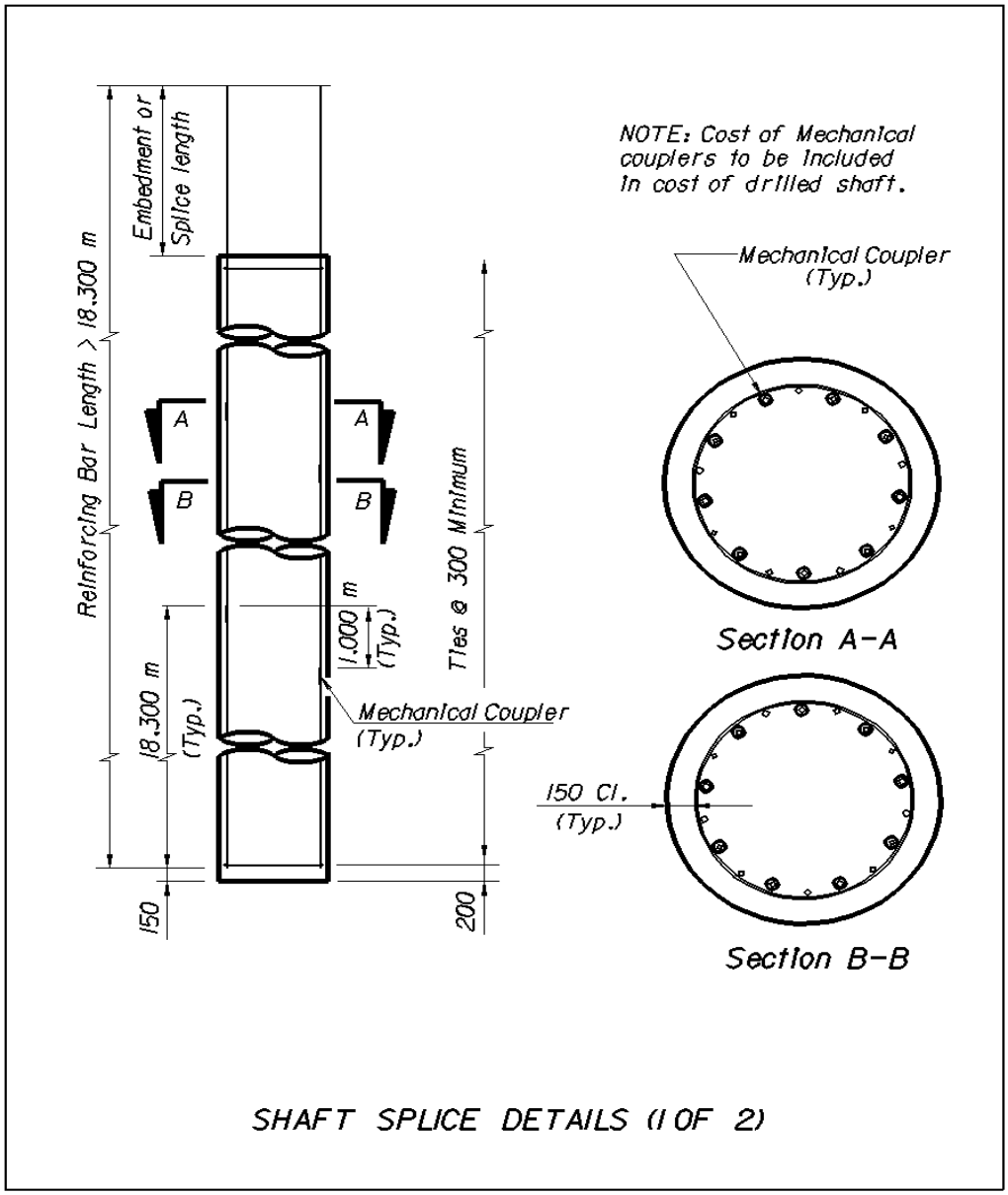


Figure 8-7 Shaft Splice Details

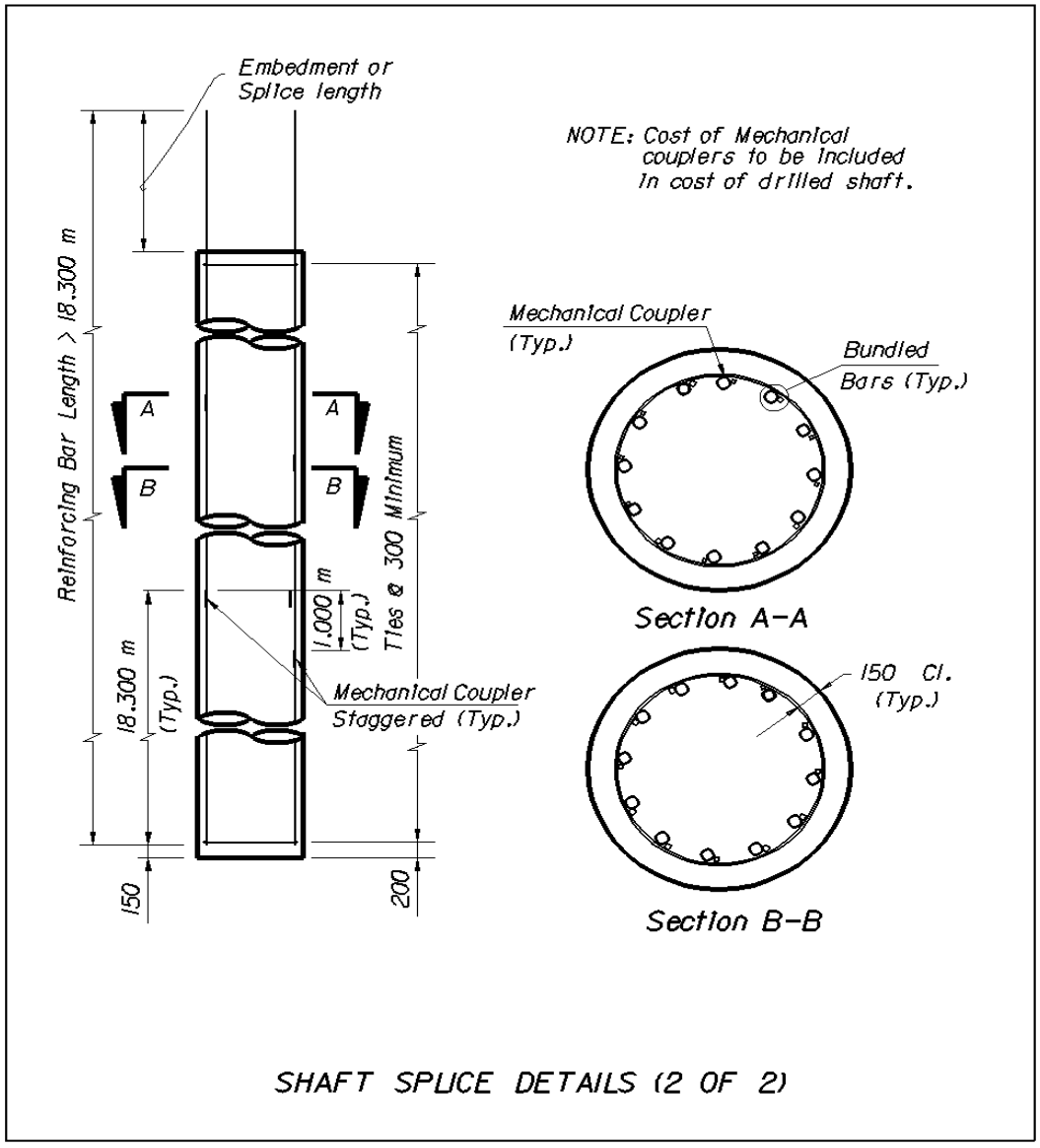


Figure 8-8 Shaft Splice Details

DESIGNERS NOTE:

In general, mono-shaft column details should be discouraged on projects where placement of the column is critical; i.e., if column placement effects the bridge superstructure. When it is determined that mono-shafts must be used, then Technical Special Provisions should be written to reduce the construction tolerances giving in Section 455 of Specifications and should require rigid placement templates to assure proper shaft placement. Construction placement tolerances for shaft placement and reinforcement placement allowed by Specifications is 75 mm + 40 mm = 115 mm.

Figure 8-9 Designer's Note

Chapter 9

FINISH GRADE ELEVATIONS

9.1 Purpose

This drawing is a section and plan of the superstructure showing finish grade elevations for construction of the superstructure.

9.2 Finish Grade Elevations

Finish grade elevations are elevations of the riding surface of the bridge. These elevations shall be shown along centerlines of beams or girders, longitudinal construction joints, Profile Grade Line, gutter lines and outside coping lines at their intersections with the following lines (See Figure 9-1):

> Begin/End bridge, centerlines of intermediate substructures, intermediate diaphragms, transverse construction joints, midspans, and at other regularly spaced intermediate locations such that a straight line interpolation midway between given elevations does not deviate from the theoretical elevation by more than 2 mm.

Finish grade elevations shall be given in meters to three (3) decimal places and shall be spaced as stated above.

9.3 Layout Line

The layout line for the superstructure plan sheet shall be the horizontal control line (see Chapter 2 "Stationing Line") from which all the basic distances, lines and angles are referenced for the purpose of locating the finish grade elevation points. The location of the Profile Grade Line and offset distance from the Stationing Line, when appropriate (this is normally the case for twin bridges), shall be shown.

9.4 Stationing

Stations shall be shown on the Stationing Line where it intersects the beginning or end of bridge lines and the centerlines of intermediate substructures. Stations shall be given to three decimal places. The direction of stationing shall be shown adjacent to the Stationing Line at the extreme back or ahead station limit of the layout (See Figure 2-21).

9.5 Centerlines (or Control Lines)

The following lines shall be shown and labeled:

a. Begin/End bridge.
b. Centerlines of piers or intermediate bents.
c. Centerlines of all beams/girders and intermediate diaphragms.
d. Centerline of roadway, median, etc., where required.
e. Gutter Lines.
f. Coping Lines.
g. Construction Joints.
h. Midspans.

9.6 Combining Details

The details for the Finish Grade Elevations and the Foundation Layout may be placed on the same sheet for short span bridges if practical.

When the Finish Grade Elevations are combined with other details, the former shall preferably occupy the top half of the sheet.

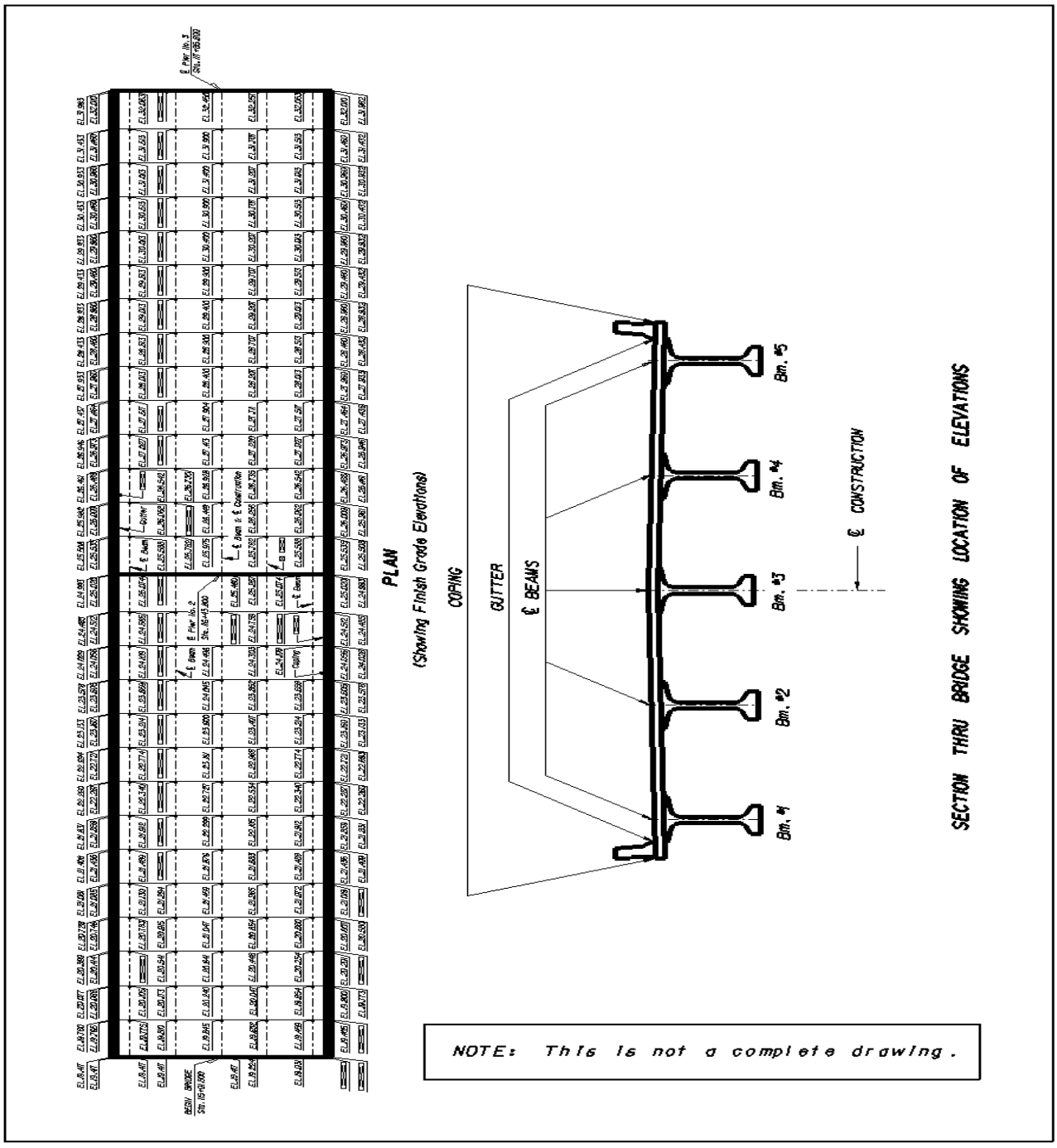


Figure 9-1 Construction Data Sheet

Chapter 10

FRAMING PLAN

10.1 Purpose

This drawing is prepared to show a single, concise graphical representation of all the geometric control necessary for the location and detailing of beam or girder framing. Sufficient information must be shown to permit the verification or determination of all calculated, detailed dimensional or noted information on the drawings related to the 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, a framing plan shall be provided showing the following information:

a. Span lengths along the Stationing Line.
b. The distances between girders (centerlines or extensions) measured along the beginning/end of bridge lines and centerline of intermediate substructures.
c. For straight girders/beams supporting curved bridge decks, the chord lengths between the points established in "b" above.
d. The distances (when appropriate) from the Stationing Line to the adjacent girders measured along the lines established in "b" above.
e. The distances between diaphragms measured along the centerline of beams or girders.
f. The lateral bracing and vertical stiffeners, when applicable.
g. Angles between the Stationing Line and begin/end bridge lines and centerlines of intermediate substructures.
h. Angles between centerline of girders/beams and begin/end bridge lines and centerlines of intermediate substructures.
i. All dimensions to the nearest 1 mm and all angles to the nearest second.
j. The identification of girders/beams on the Framing Plan consistent with the detail sheet(s).
k. Girder radius of curvature.
l. North arrow, if necessary.
m. Direction of stationing adjacent to the Stationing Line, if necessary. For examples of Framing Plans See Figures 10-1 and 10-2.

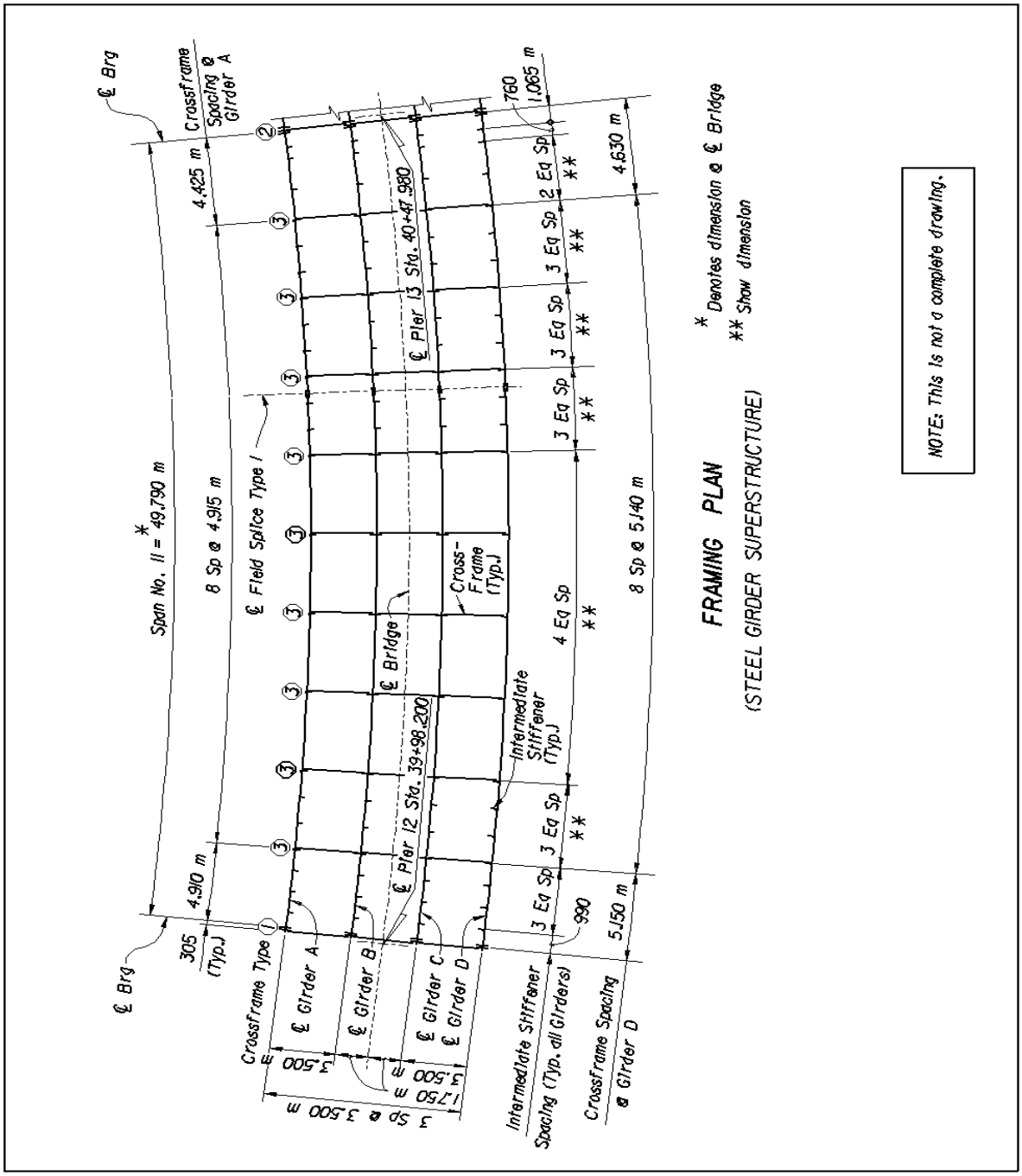


Figure 10-1 Steel Girders Framing Plan

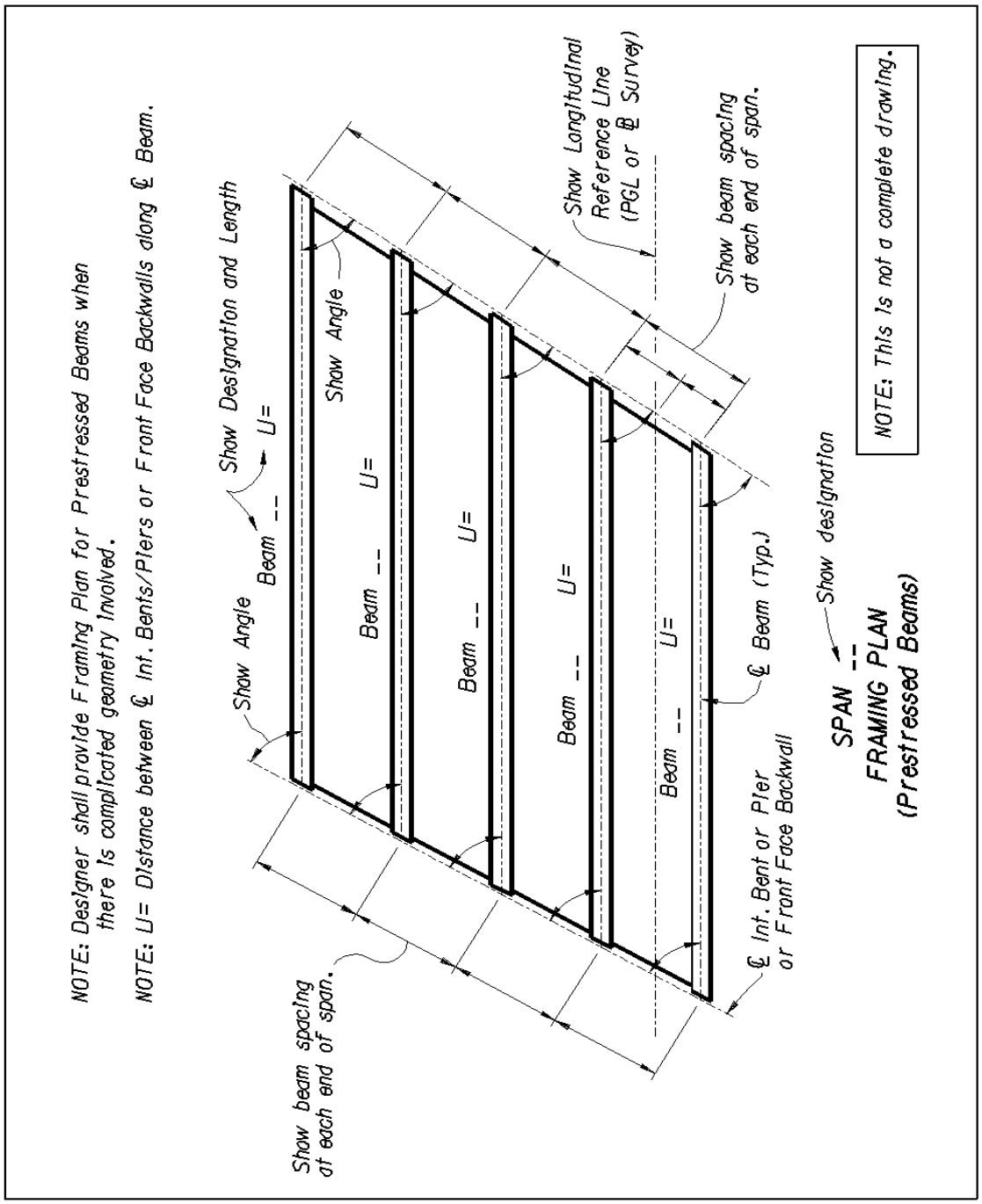


Figure 10-2 Prestressed Beam Framing Plan

Chapter 11

DETAILING FOR CONCRETE COVER AND SURFACE FINISHES

11.1 Concrete Cover

The requirements for concrete cover for reinforcing steel are shown in Table 2.2 of the Structures Design Guidelines.

See Figure 11-1 of this manual for sample details showing concrete cover requirements.

11.2 Concrete Surface Finishes

Figure 11-2 depicts the areas that shall receive a "Class 5 Applied Finish Coating". This is a concrete texture coating that is utilized as a final concrete finish. The appropriate notes are required to be in the General Notes or shown with the corresponding sketches. Conventional cast-in-place retaining walls will generally require a "Class 5 Applied Finish Coating". Precast portions of proprietary retaining walls have their own finish and do not require additional finish.

When existing bridges are widened, the existing substructures shall receive a "Class 5 Applied Finish Coating" along with the widened portions of the structure where applicable. A separate bid item "Cleaning and Coating Concrete Surfaces", Bid Item No. 2400-143, has been reserved for this additional quantity of "Class 5 Applied Finish Coating".

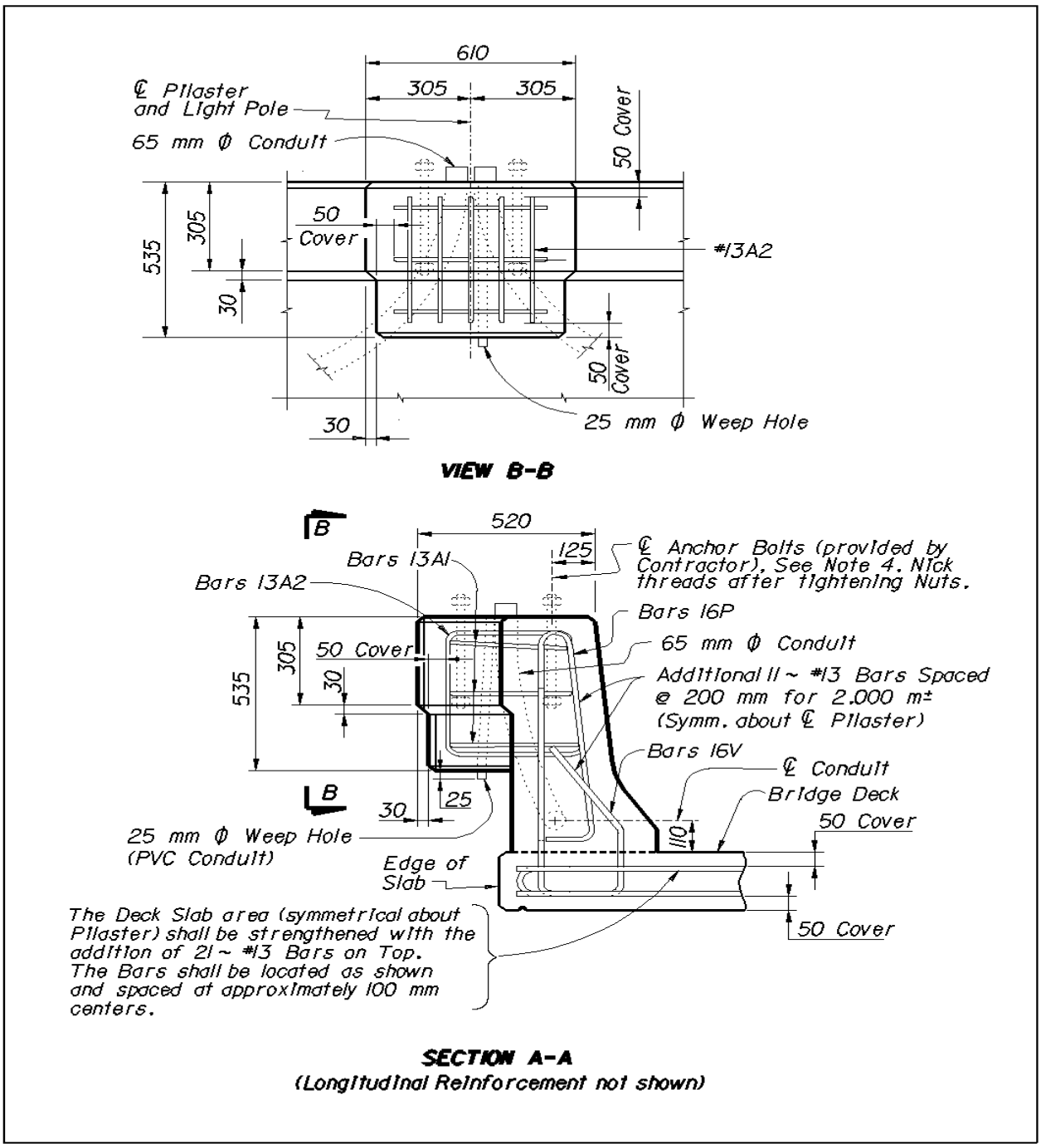


Figure 11-1 Light Pilaster

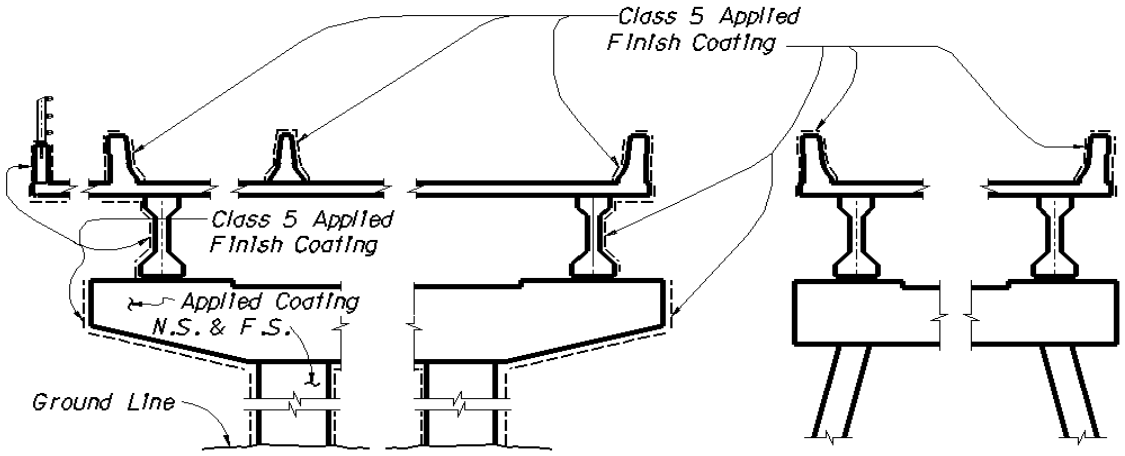
CONCRETE FINISHES

GRADE SEPARATION STRUCTURES

NOTE 1: All exposed surfaces as seen in Elevation, see detail below, and the following: exposed surfaces of end bent wingwalls and all exposed surfaces of piers above ground line except tops of caps shall receive a "Class 5 Applied Finish Coating".

WATERWAY CROSSINGS AND RAILROAD SEPARATION STRUCTURES

NOTE 2: All exposed surfaces (top, inside and outside) of end bent wingwalls, traffic railing barrier, median barrier and deck slab coping, see detail below, shall receive a "Class 5 Applied Finish Coating".



GRADE SEPARATION STRUCTURES

WATERWAY CROSSINGS AND R.R. SEPARATION STRUCTURES

NOTE 3: Exposed surfaces of C.I.P. retaining walls shall receive a "Class 5 Applied Finish Coating" when called for on the plans.

NOTE 4: It is the intent of the notes above to coat the surfaces seen by the motoring public utilizing the facility. Judgement shall be used in determining surfaces to be coated on Waterway and Railroad Structures in urban areas.

Figure 11-2 Finish Coatings

Chapter 12

SLOPE PROTECTION, SLOPE PAVEMENT AND RIPRAP DETAILS

12.1 Purpose

This chapter provides the bridge designer with the necessary information to develop sufficient plan details for the appropriate slope protection (See Figures 12-1 thru 12-4). In most cases the standard details for slope protection, with minor modifications will be suitable. However in some cases, typically in tidal areas or when severe scour conditions exist, special designs and special details may be required.

12.2 Responsibility

The Bridge Designer shall determine the Begin Bridge and End Bridge stations and select the appropriate type, slope rate and extent of slope protection for highway and railroad grade separations.

For water crossings the Drainage Engineer is responsible for providing minimum Begin Bridge and End Bridge stations and for recommending the type, slope rate and minimum extent of slope protection. The Bridge Designer shall discuss any alteration to the recommended end location and protection design with the Drainage Engineer.

12.3 Grade Separations

The slope protection on grade separation bridges shall be slope pavement constructed on 1:2 slopes that provides erosion protection to a minimum of 1.200 meters outside the superstructure coping. Slope protection in the median of dual bridges shall extend the entire width between bridges when the median width (distance between copings) is 12 meters or less at rural locations or 15 meters or less at urban locations.

Embankments adjacent to railroad tracks shall be protected as above except that sand-cement riprap shall be used instead of slope pavement.

12.4 Water Crossings

The design and extent of the slope protection shall be provided by the Drainage (Hydraulic) Engineer 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 desirable steepest slope rate.

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.

The limits of embankment protection shown on Figures 12-3 are typical. In no case shall the protection be extended to less than 1.2 m outside the superstructure coping.

The slope protection in the median between dual bridges shall be extended to include the following:

a. The entire median width between rural area bridges with a separated median width of 12 meters or less.
b. The entire median width between urban area bridges with a separated median width of 15 meters or less.
c. The entire width between urban area bridges that are 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.

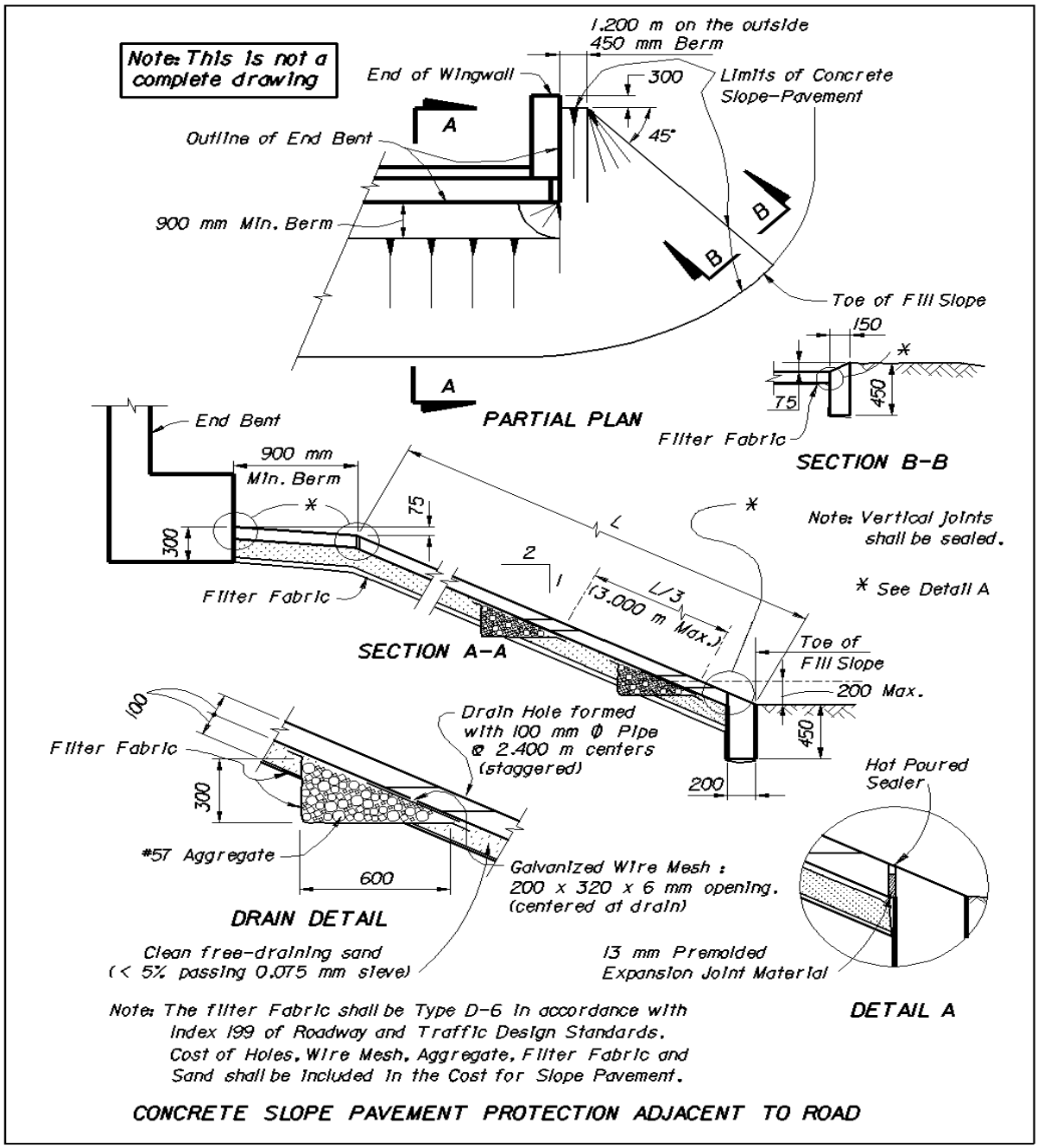


Figure 12-1 Concrete Slope Pavement Protection Adjacent to Road

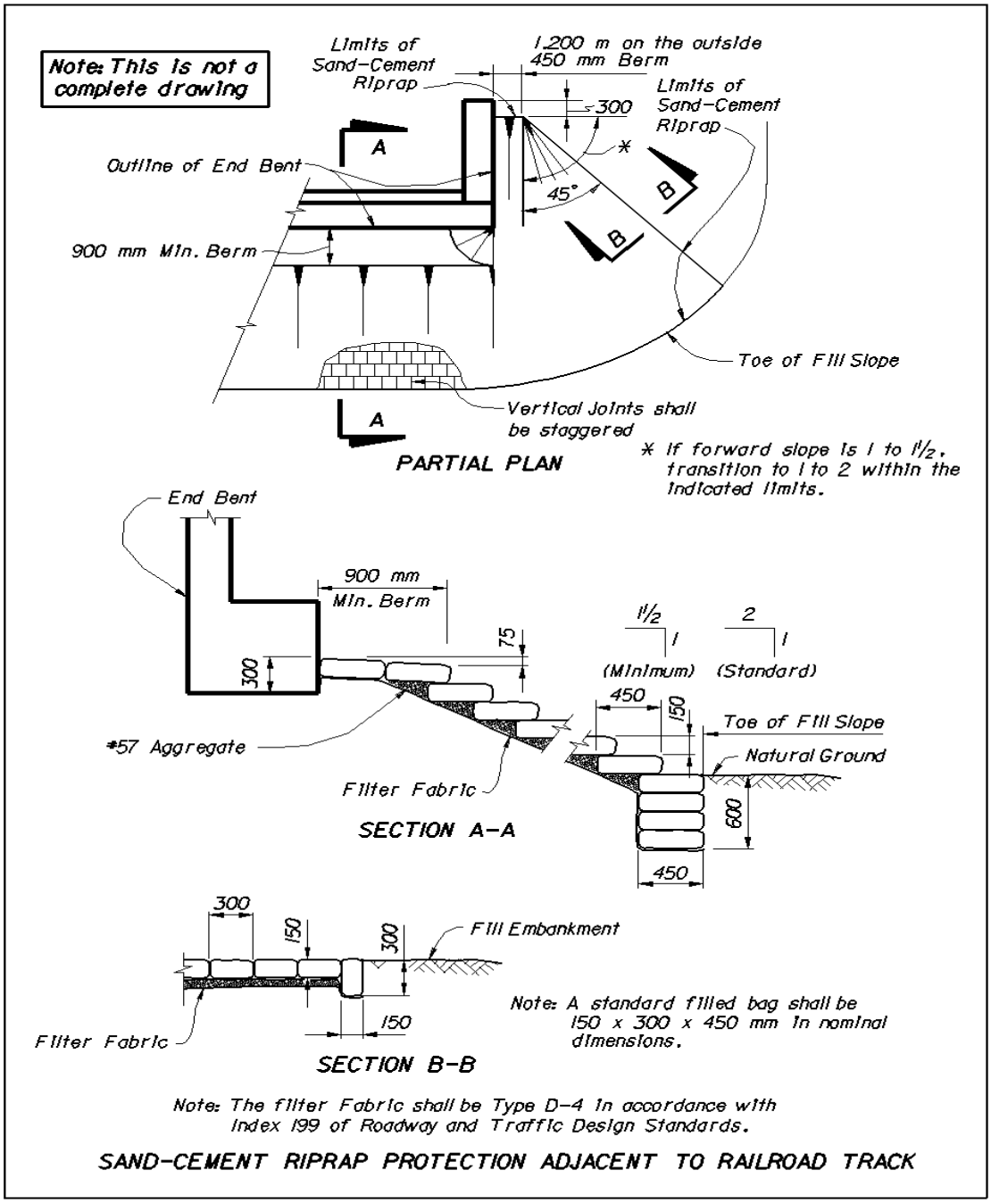


Figure 12-2 Sand - Cement Riprap Protection Adjacent To Railroad Track

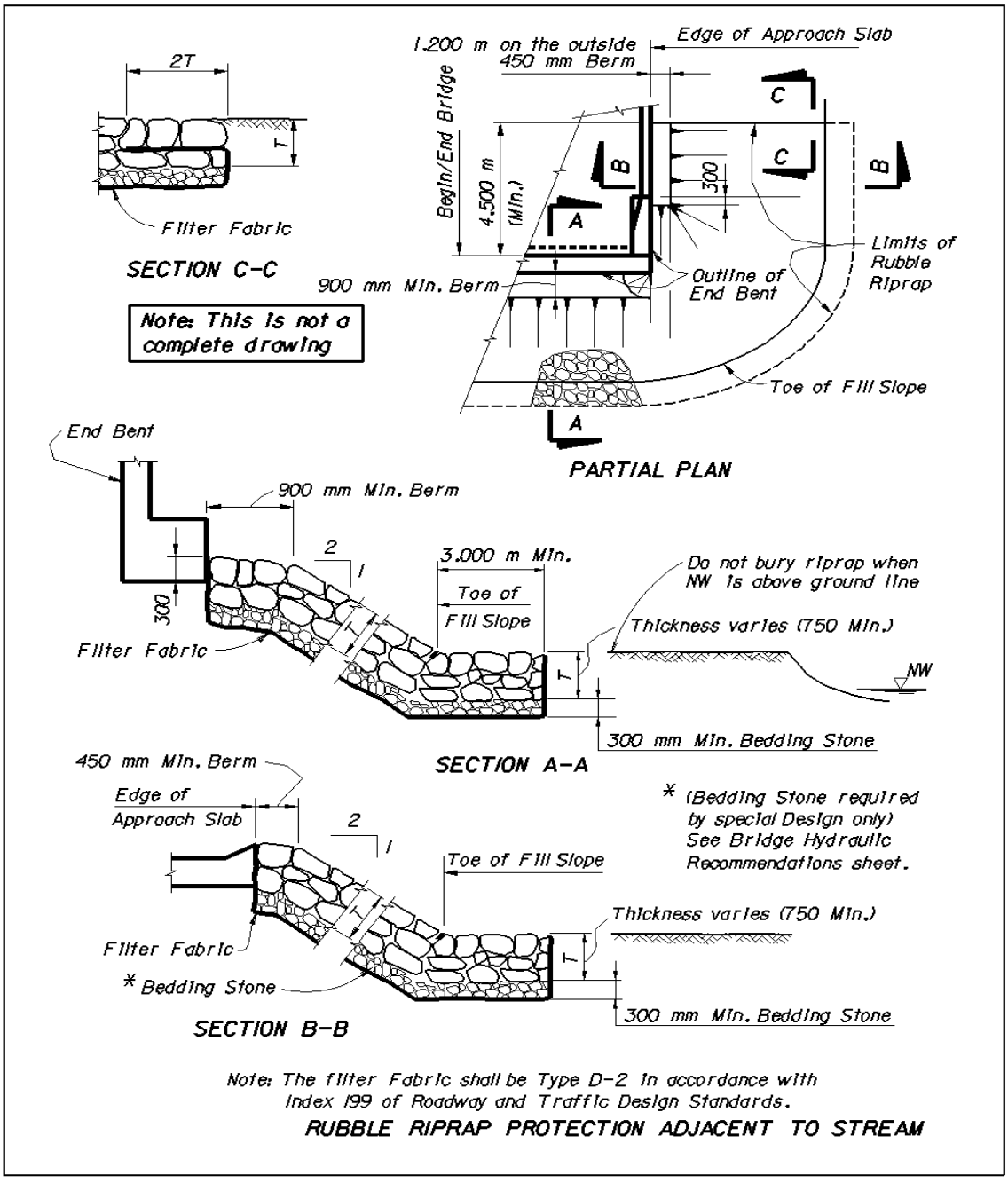


Figure 12-3 Rubble Riprap Protection Adjacent To Stream

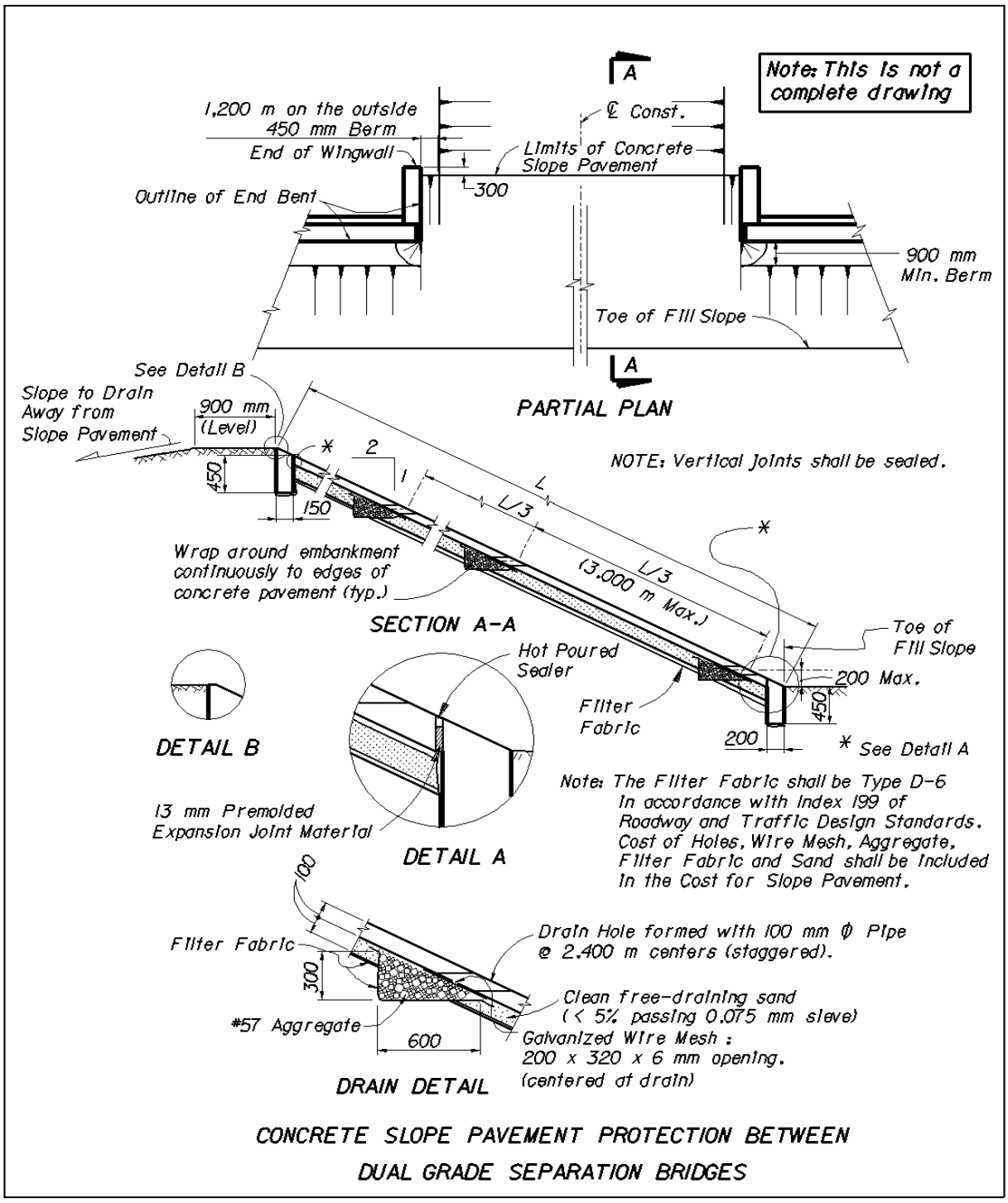


Figure 12-4 Concrete Slope Pavement Protection Between Dual Bridges

Chapter 13

FENDER SYSTEMS

13.1 Purpose

A bridge fender system is a structure located on each side of and parallel to a designated navigable water channel that will provide limited protection to the bridge and the boats passing through the channel.

13.2 Responsibility

The responsibility for determining if a bridge requires a fender system rests with the Department.

13.3 Procedure

In general, a bridge over a navigable waterway that is under the jurisdiction of the U.S. Coast Guard will have a bridge fender system. The exceptions to this are monumental type high level bridges with very long channel spans and where the channel piers are located on dry land or where they are protected by dolphins and/or islands (Examples in Florida: Sunshine Skyway and Dame Point Bridges).

13.4 Fender Construction

In general, 355 mm Square Prestressed Concrete Piles are used to support fender systems. Figure 13-1 shows a plan view of a heavy duty fender system layout and Figure 13-2 shows details that should be utilized on all jobs requiring this type of fender system. The type (heaviness) of fender protection shall match the nature (size, volume, type, etc.) of the vessels utilizing the facility. Light duty protection shall be provided at locations serving small vessels. Figure 13-3 shows additional typical Fender Details. Normally the fender outlines for heavy duty fender protection should commence to flare at the same points directly opposite each other. The minimum dimension from the superstructure coping to the beginning of the fender flare shall be 3.0 m (See Figure 13-1).

At some freshwater sites with light waterborne traffic, dual treated timber piling may be used and the pay item shall be "Treated Timber Piling [Dual Treatment]".

Where requested by the District Structures and Facilities Engineer, ASTM A 709M, Grade 250 steel piling may be used to support the fender system.

13.5 Fender Pile Clusters

Fender pile cluster details shall specify that the pile clusters are to be wrapped with polypropylene impregnated wire rope in accordance with the specifications. See Figure 13-3.

13.6 Conflicts

The designer shall investigate and resolve any conflicts between the proposed fender system and any existing utilities or structures. He/she shall also verify that the fender piles can be installed to the elevations shown (review soil layers piles installed in and resolve as penetration problems such as hard rock).

13.7 Ladders and Platforms Design Requirements

Contact the District Structures and Facilities Engineer before including ladders and platforms in the plans.

Ladders and Platforms, if required by the District Structures and Facilities Engineer, shall be designed and constructed to conform with the current OSHA regulations (See Figures 13-4 and 13-6).

13.8 Pitch of Fixed Ladders

A fixed ladder is a ladder permanently attached to a bridge, building, or equipment. Steel or other accepted metals shall be used to construct ladders for bridge and fender systems.

The preferred pitch of fixed ladders shall be about 75° to 90° with the horizontal. Ladders having a pitch in excess of 90° with the horizontal shall not be permitted. Most ladders designed for access to platforms and Fender Systems will be 90° from the horizontal.

13.9 Clearance of Ladders

The preferred clearance between rungs and obstructions is 305 mm (180 mm minimum).

13.10 Distance Between Ladder Rungs and Cleats

The distance between rungs, cleats, and steps shall not exceed 305 mm and shall be uniform. The rungs shall be at least 405 mm long and so designed that the foot cannot slide off the end. A clear width of at least 380 mm shall be provided each way from the centerline of the ladder in the climbing area except when cages or wells are necessary.

13.11 Ladder Cages

Where landing platforms are provided at intervals of 6.0 meters or less, a cage is not required regardless of the height of the ladder. Wherever possible, ladders to bridge fender systems shall avoid the use of cages by providing platforms and limiting vertical distances between them to 6.0 meters or less.

For ladders requiring cages there shall be at least 2.15 meters (but not more than 2.45 meters) clearance between the bottom of the cage and the top of base platform. The cage shall be built as shown in Figures 13-4 thru 13-6.

13.12 Landing Platforms

Landing platforms shall be spaced at 9.0 meters maximum intervals for caged ladders or 6.0 meters maximum for uncaged ladders. Each ladder section shall be offset from adjacent sections. All landing platforms shall be equipped with standard railings and toe boards so arranged as to give safe access to the ladder. Platforms shall not be less than 760 mm in width and 760 mm in length. The side rails of fixed ladders shall extend at least 1.065 meters above parapets and landings.

13.13 Navigation Lighting Details

Bridges over waterways with no significant nighttime navigation may be exempted from lighting requirements by the proper authorities; however, most bridges over navigable waterways will require some type of lighting. Refer to Code of Federal Regulations (CFR) 33 Part 118 for requirements.

For Navigation Lighting Details see the Bridge Administration Manual (U.S. Coast Guard) CG-424, Appendix 3, A Guide to Bridge Lighting, and SDO's Standard Drawings Indices 510 and 511.

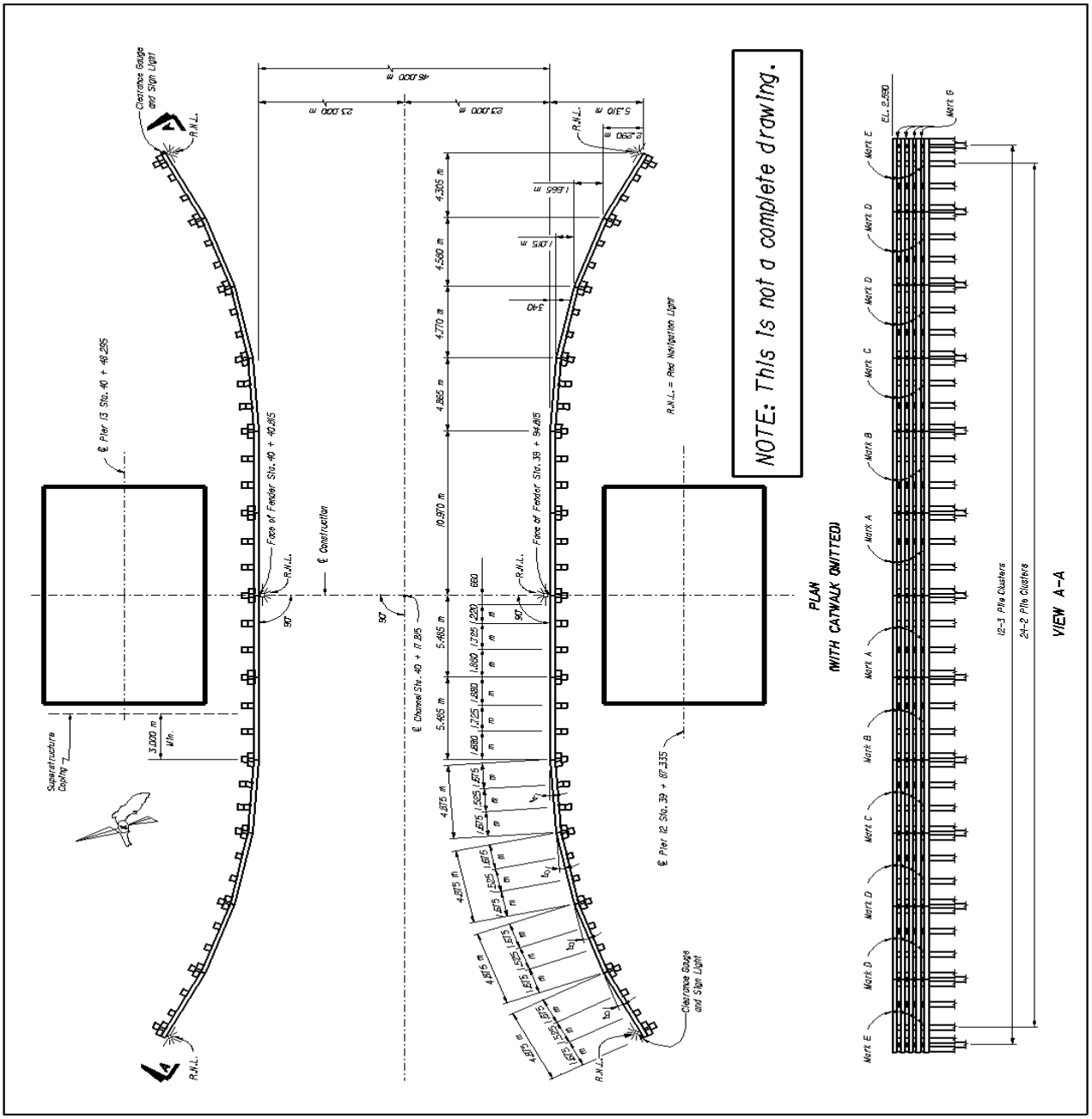


Figure 13-1 Fender Details

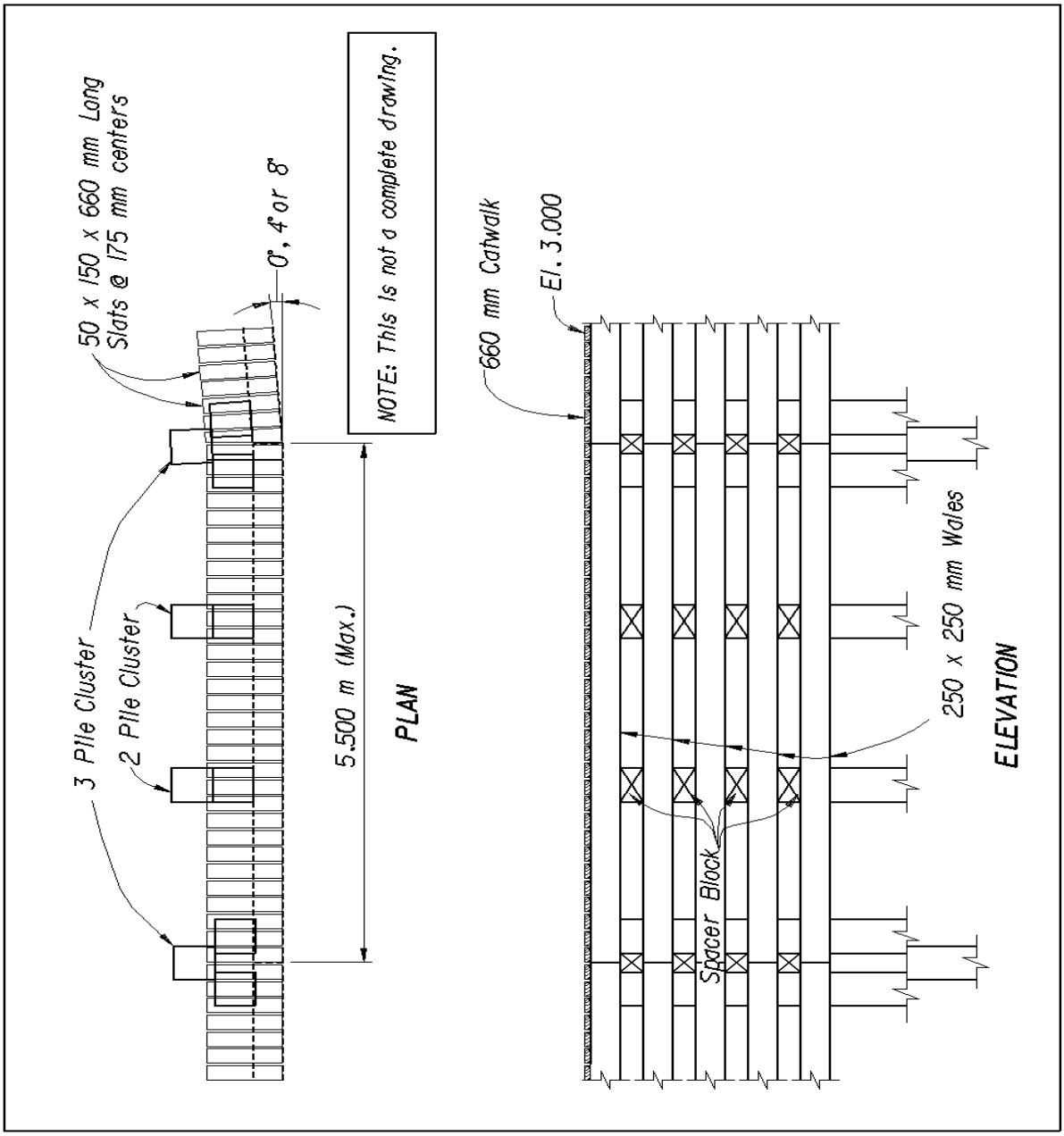


Figure 13-2 Plan and Elevation

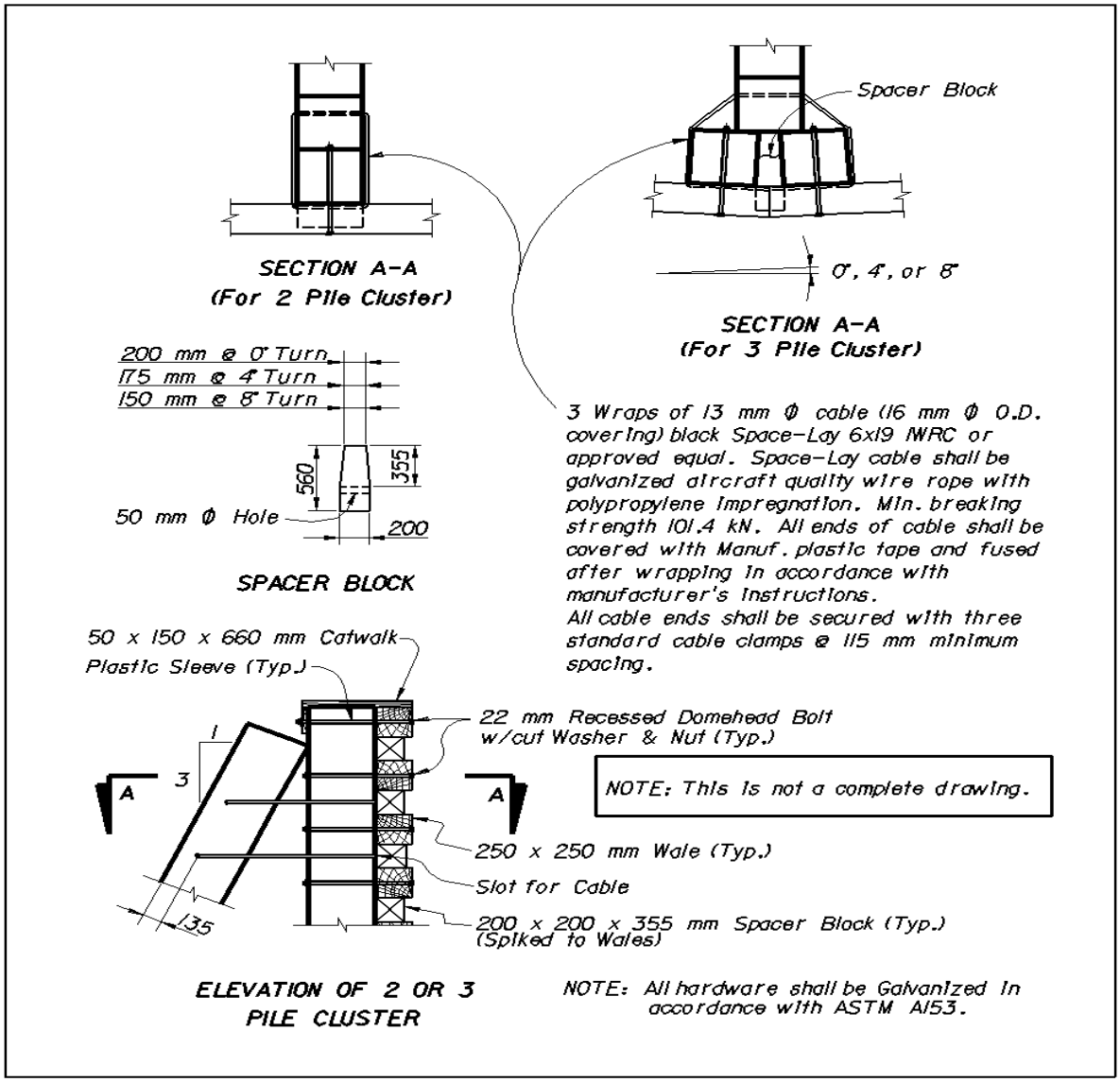


Figure 13-3 Fender Details (Pile Cluster)

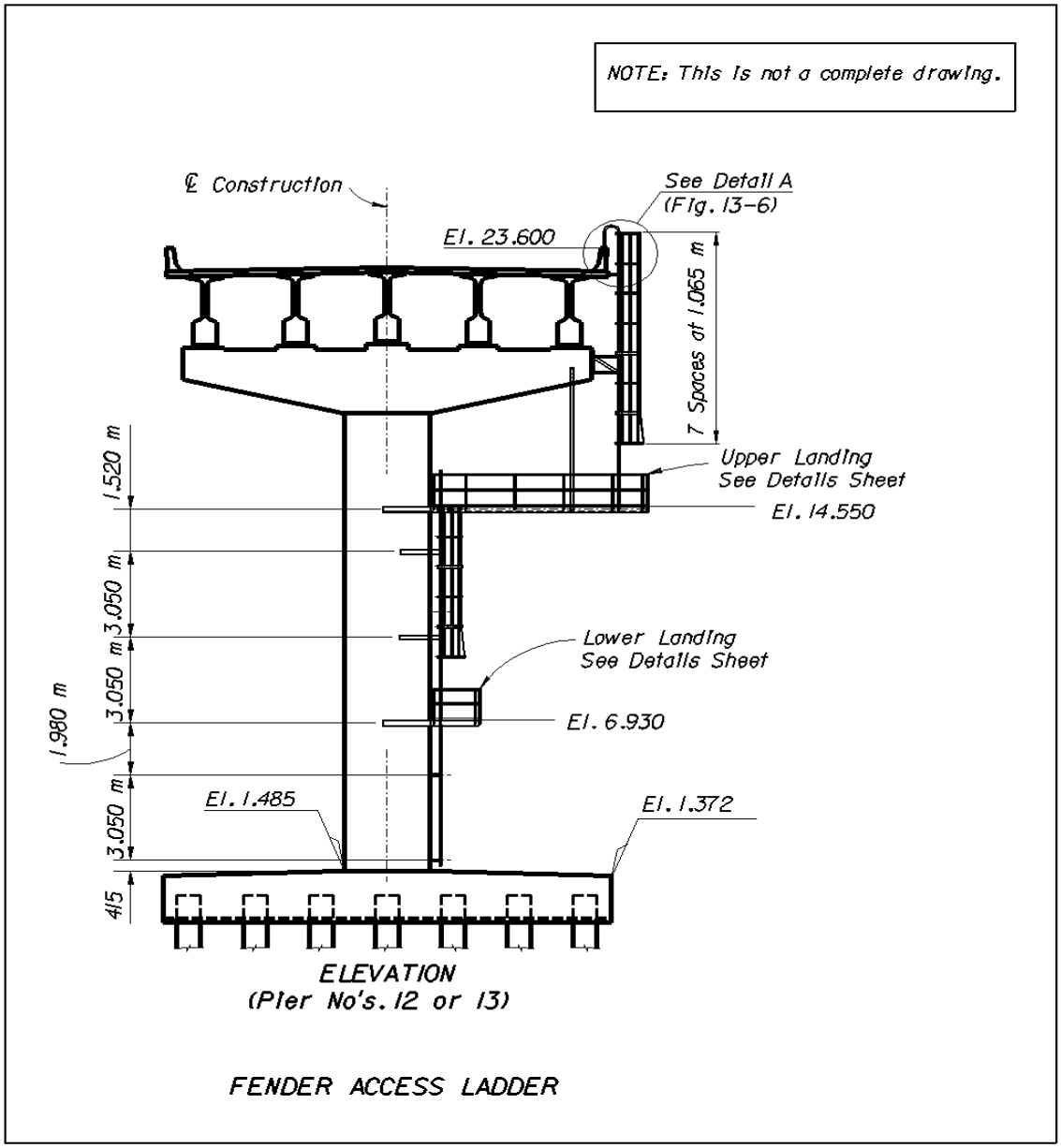


Figure 13-4 Fender Access Ladder (Elevation)

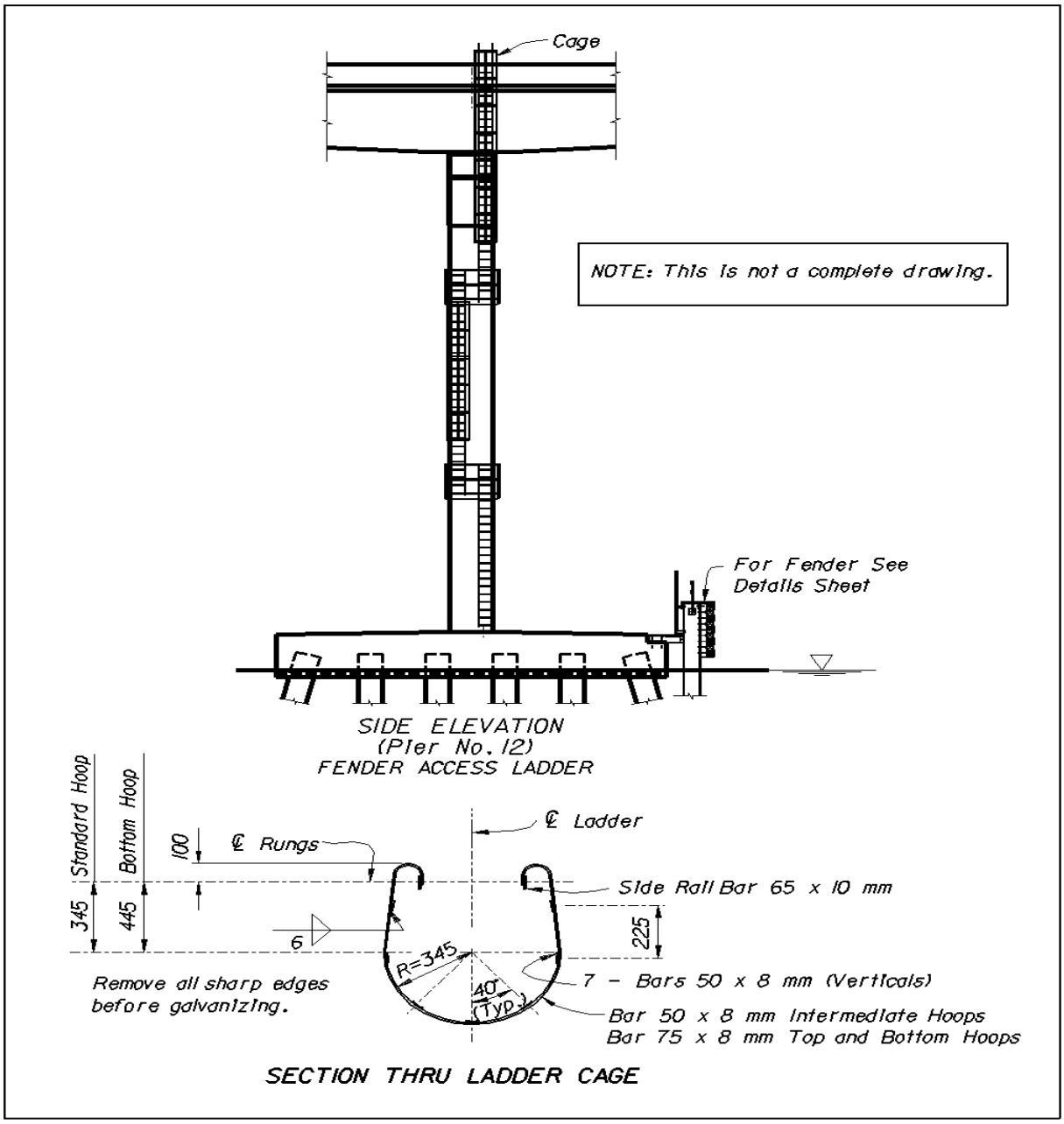


Figure 13-5 Fender Access Ladder (Typical Side Elev.)

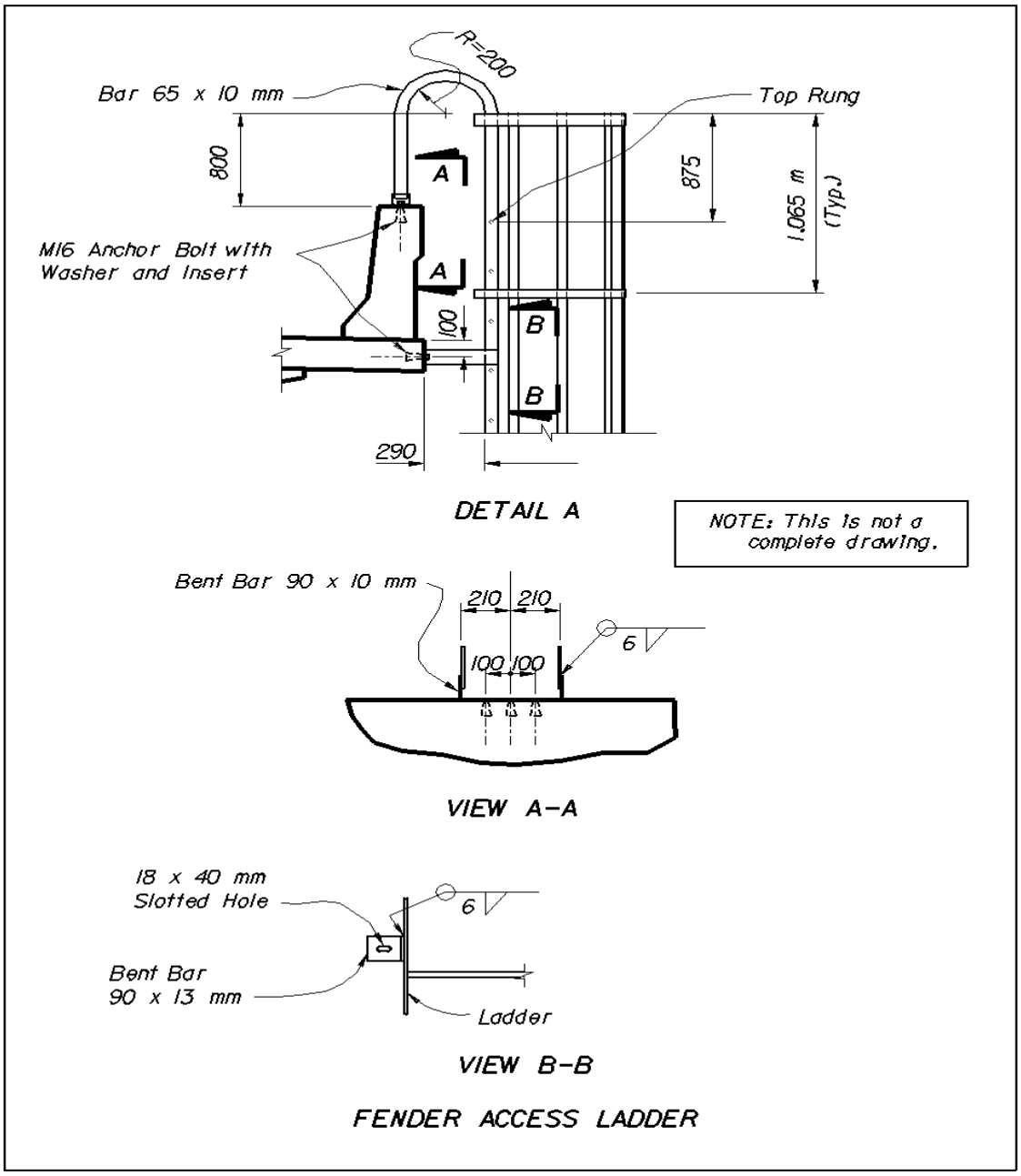


Figure 13-6 Fender Access Ladder Detals

Chapter 14

DETAILS FOR CONCRETE COMPONENTS

14.1 General

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.

The concrete outlines, reinforcing steel, prestressing strands and/or post-tensioning tendons shall be easily distinguishable. This can be accomplished by using different weight lines in the drawings. The preferred method is to use line weights in the following descending order (see CADD Manual):

a. The most weighty line shall be used for the concrete outlines.
b. The least weighty line shall be used for dimension lines.
c. Different line weights between the above shall be used for reinforcing steel, prestressing strands and/or post-tensioning tendons.

Drawings for concrete components shall, with very few exceptions, show plan and elevation views along with sections and details as necessary to show the required construction.

14.2 Items Embedded In Concrete Components

The vertical and horizontal locations of reinforcing steel, prestressing strands and/or post-tensioning tendons shall be shown on the drawings. Normally, the spacing, locations and the limits of reinforcing steel can be clearly shown with a few bars. The detailer shall exercise judgement to determine when and where to show the required reinforcing steel without cluttering up the drawing with a maze of lines.

14.3 Construction Joints In Concrete Deck Slabs

Transverse construction joints shall be located as follows:

a. For continuous flat slab superstructures the drawings shall allow construction joints at most one-quarter and/or three-quarter points in the spans. The joints shall be spaced at not less than 6.0 meters nor more than 25.0 meters (See Figure 14-1).
b. For simply-supported girders with deck slabs continuous over bents or piers the drawings shall include the alternate details shown in Figure 14-2.
c. For deck slabs on continuous girders the spans shall be divided by construction joints into units of positive moment area and negative moment area (over intermediate substructures). Additional construction joints may be provided to limit the volume of concrete to be cast. The concrete placement sequence shall be shown on the units with numbers in circles. The placement sequence

shall be such as to reduce the potential for tension in the slab due to girder deflection from subsequent slab placement in adjacent spans.

14.4 Reinforcing Steel Splices and Terminations In Deck Slabs

When deck concrete is placed in a sequence of units, the splicing procedure shall be as follows (Also, see Section 2.25 "Bar Splicing"):

a. At least one (1) longitudinal deck reinforcing splice shall be placed in a unit located between two previously constructed units.
b. Splices of longitudinal reinforcing in continuous flat slab spans shall be either staggered or located in compression zones.

14.5 Placing Deck Slab Concrete

The following notes shall be placed on the drawings of flat slab and girder type superstructures:

a. No unit shall be placed adjacent to a previously placed unit that is not a minimum of 72 hours old.
b. After placement of the first unit, succeeding placements shall begin at the end away from and proceed toward the previously placed unit.
c. Units with identical labels may be placed individually or simultaneously.
d. For continuous superstructures, the following note shall be placed on the plans near the casting diagram: "The Contractor may submit for approval a revised casting sequence. The submittal shall include structural analysis by the Specialty Engineer reflecting the new casting sequence and its effect on the Camber Diagram. The revision shall be in conformance with Chapter 28 of the Plans Preparation Manual."

14.6 Detailing for Stay-in-Place Metal Forms

Except when prohibited from use by the Specifications, stay-in-place metal forms shall be incorporated in the design and details. Because the actual form material (depth, pitch, thickness, etc.) to be used cannot be predetermined, superstructure details shall include generic form details. Some suggested details are shown in Figure 14-3.

14.7 Sizing Caps for Intermediate Bents

When sizing caps for pile supported bents, the allowable tolerance for driving the piles shall be taken into consideration (See Figure 14-4).

14.8 Crash Wall

Bents or Piers adjacent to railroad tracks with horizontal clearance less than 7.600 meters require crash walls (See Figures 14-5 and 14-6). For additional information sees Chapter 6 of the Plans Preparation Manual.

14.9 Open Drains/Scuppers

a. Open Drains: Open deck drains cannot discharge directly on the supporting beams, substructure embankments at end bents and other areas (water or land) not permitted (See Figure 14-7).

b. Drain Scuppers: If drain scuppers are required, the scuppers shall be located near pier supports and, when practical, a single scupper shall be sized to drain an entire span. The scupper discharge shall be conveyed by pipe to a location recommended by the State/District Drainage Engineer. The pipe shall be PVC, Schedule 80 UV-Resistant or fiberglass, encased in the pier concrete, and shall be provided with cleanouts. Provision for differential movement between the superstructure and the substructure shall be made at the connection with the scupper. The drain system shall be fully detailed on the plans and shall utilize scuppers with removable grate and welded steel plates and bars with anchors. A note allowing specific alternate ferrous castings may be provided. Figure 14-8 shows the minimum additional reinforcement that shall be provided in the bridge deck at scupper locations. It is the EOR's responsibility to show details with additional reinforcing around scuppers. The reinforcing requirement will be dependent of the scupper size and beam spacing.

14.10 Prestressed Beam Bearings

a. Slope $\leq$ 2%: When the slope of the bottom flange of prestressed concrete beams is 2% or less, the beam bearing areas shall be finished parallel to the beam slope and the underside of the beam shall be a flat surface.

b. Slope > 2%: When the slope of the bottom flange of prestressed concrete beams exceeds 2%, the beam bearing areas shall be finished level and the underside of the beam ends shall be notched to prevent the beams from sliding (See Standard Drawings for details)..

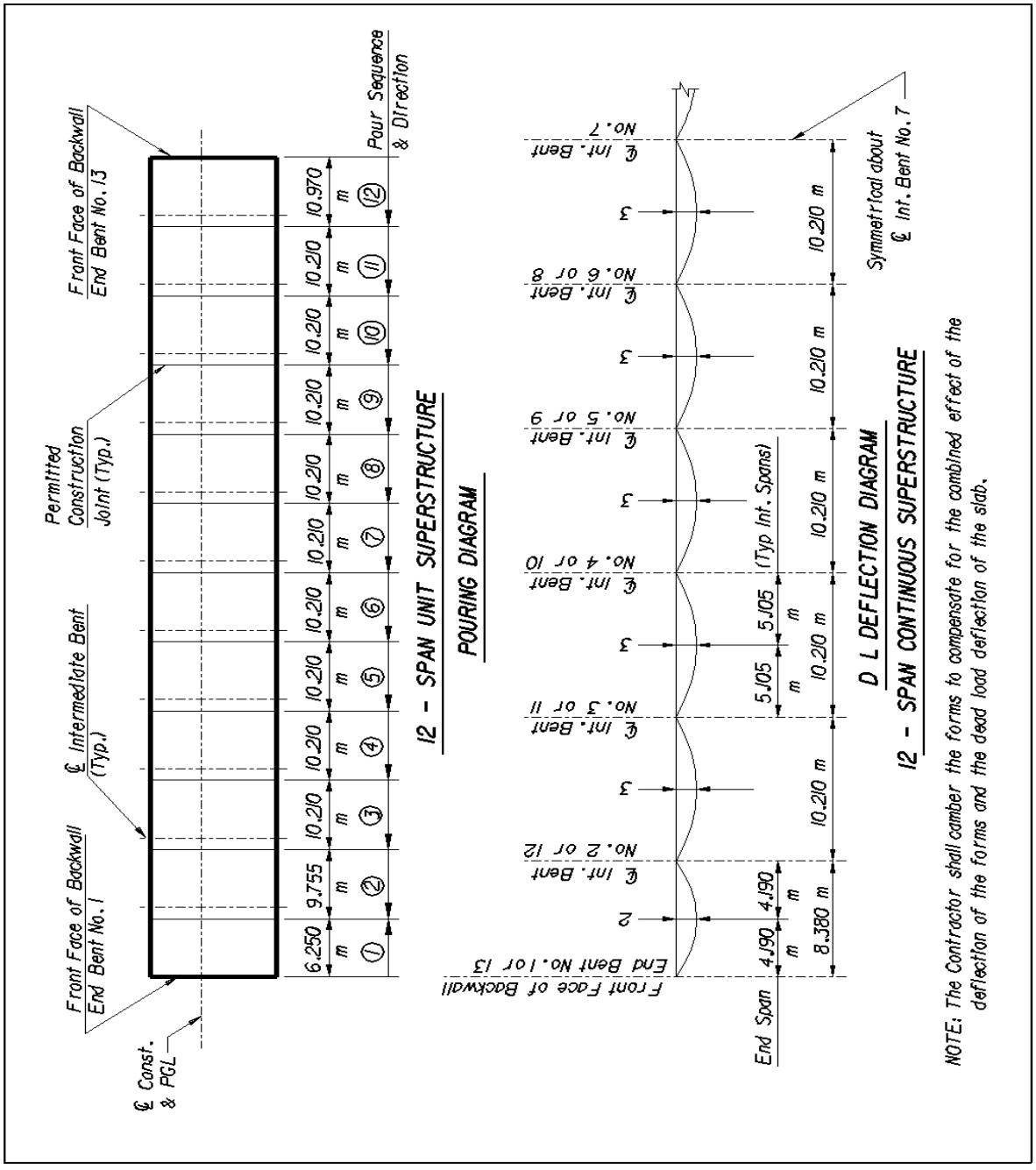


Figure 14-1 Pour and Dead Load Deflection Diagrams Of Superstructure

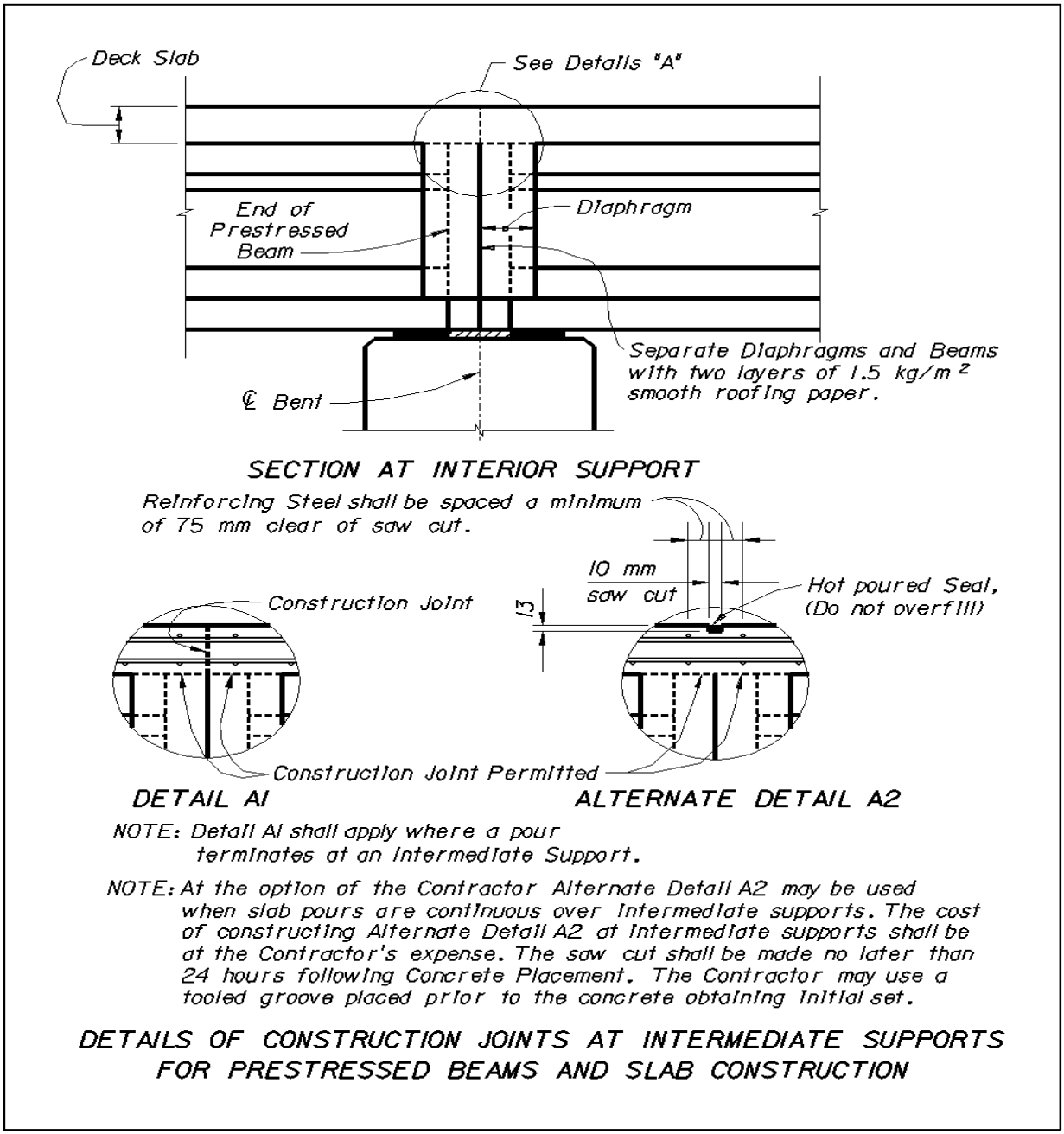


Figure 14-2 Superstructure Construction Joint

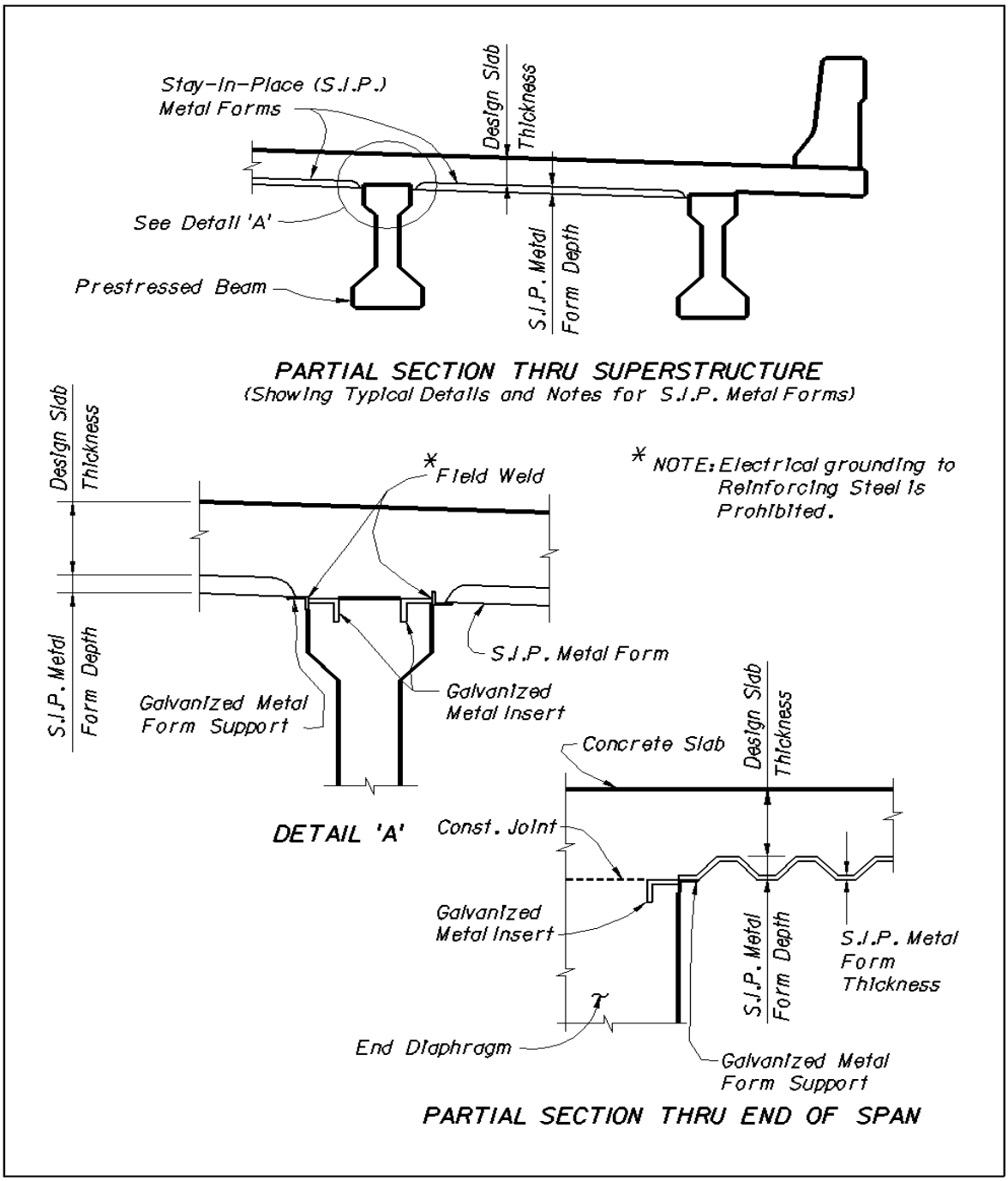


Figure 14-3 Stay-in-Place Metal Form Details

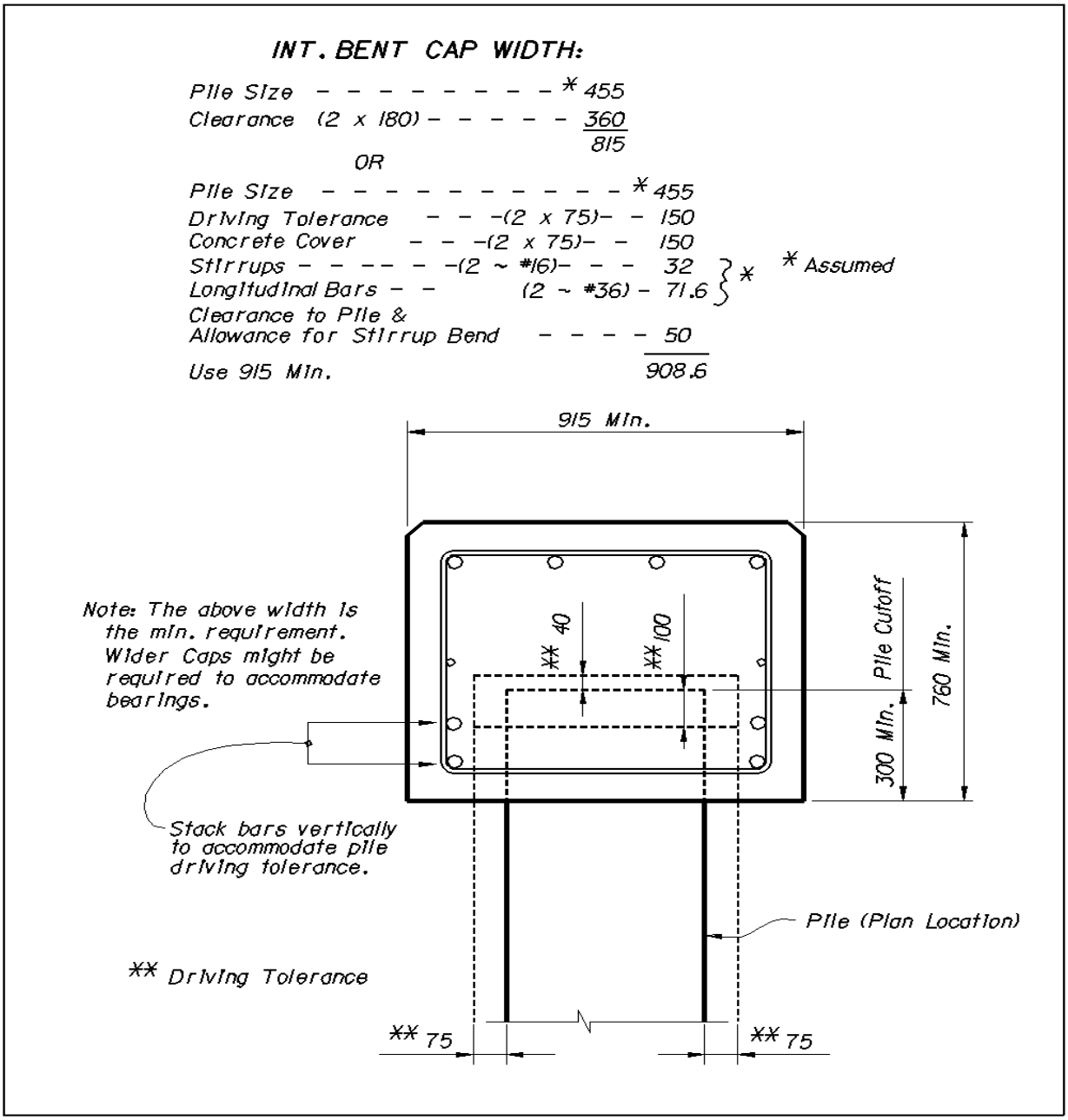


Figure 14-4 Intermediate Bent Cap Width

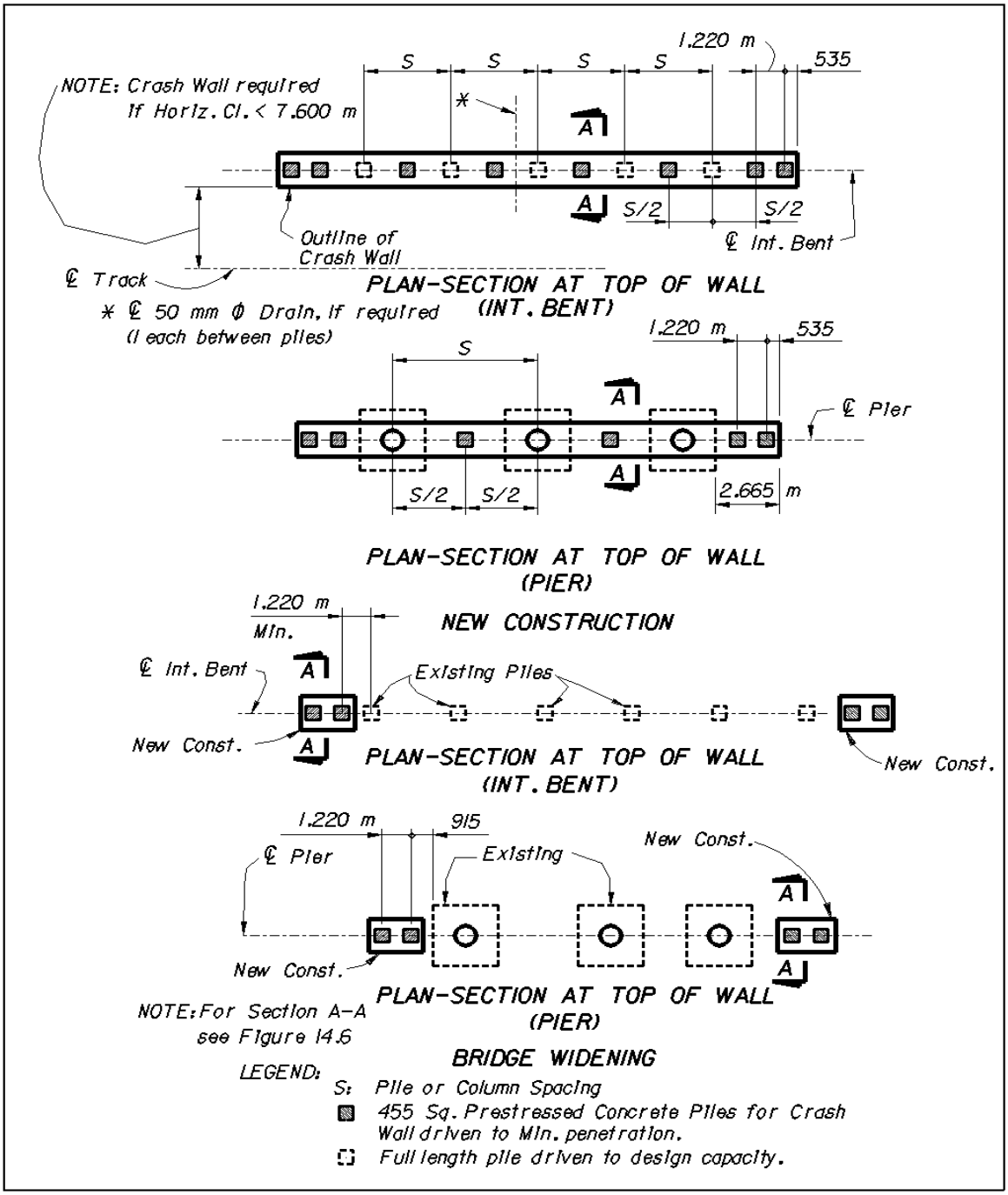


Figure 14-5 Crash Wall Sections for Widenings

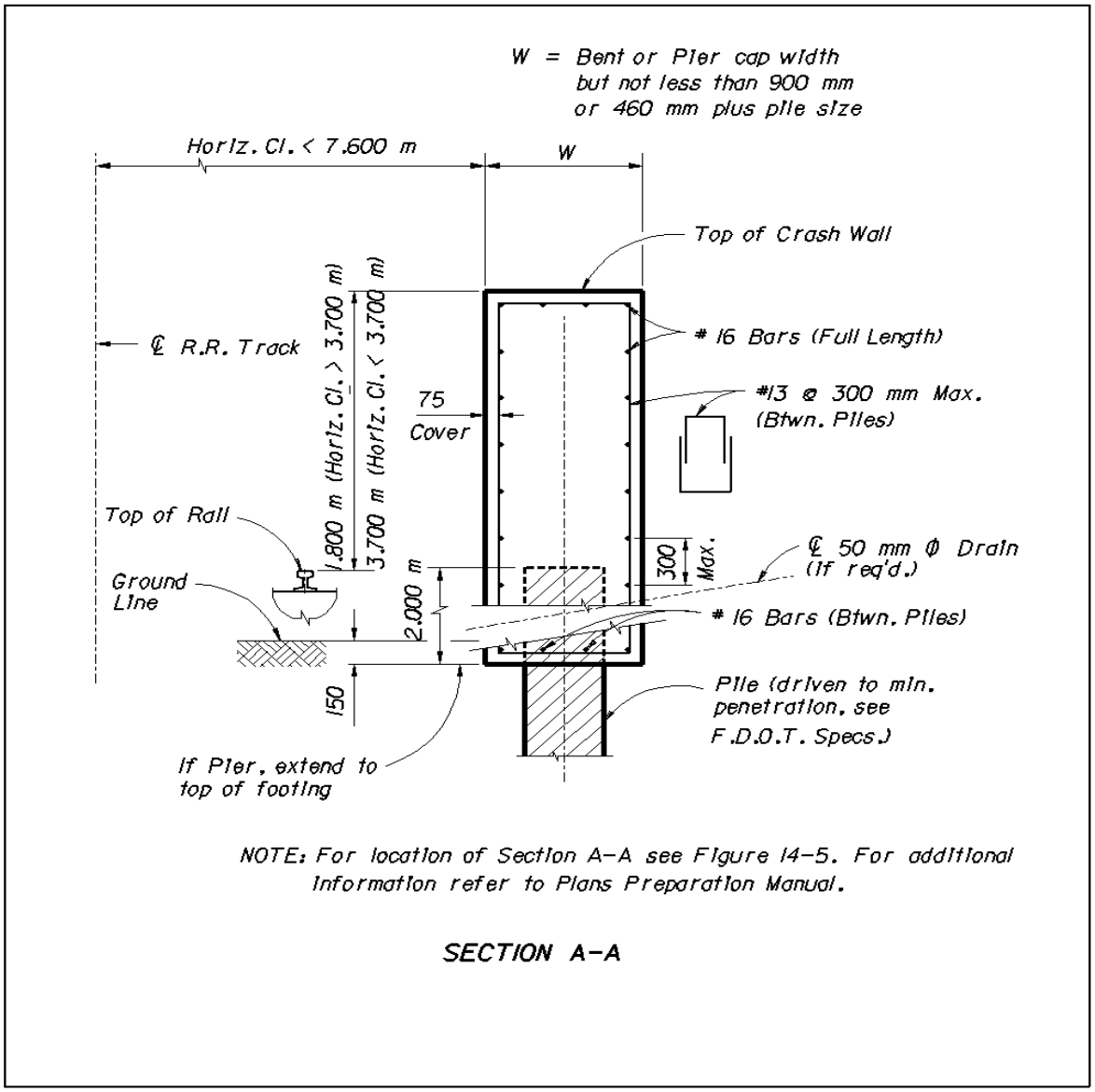


Figure 14-6 Crash Wall Reinforcing Steel Detail

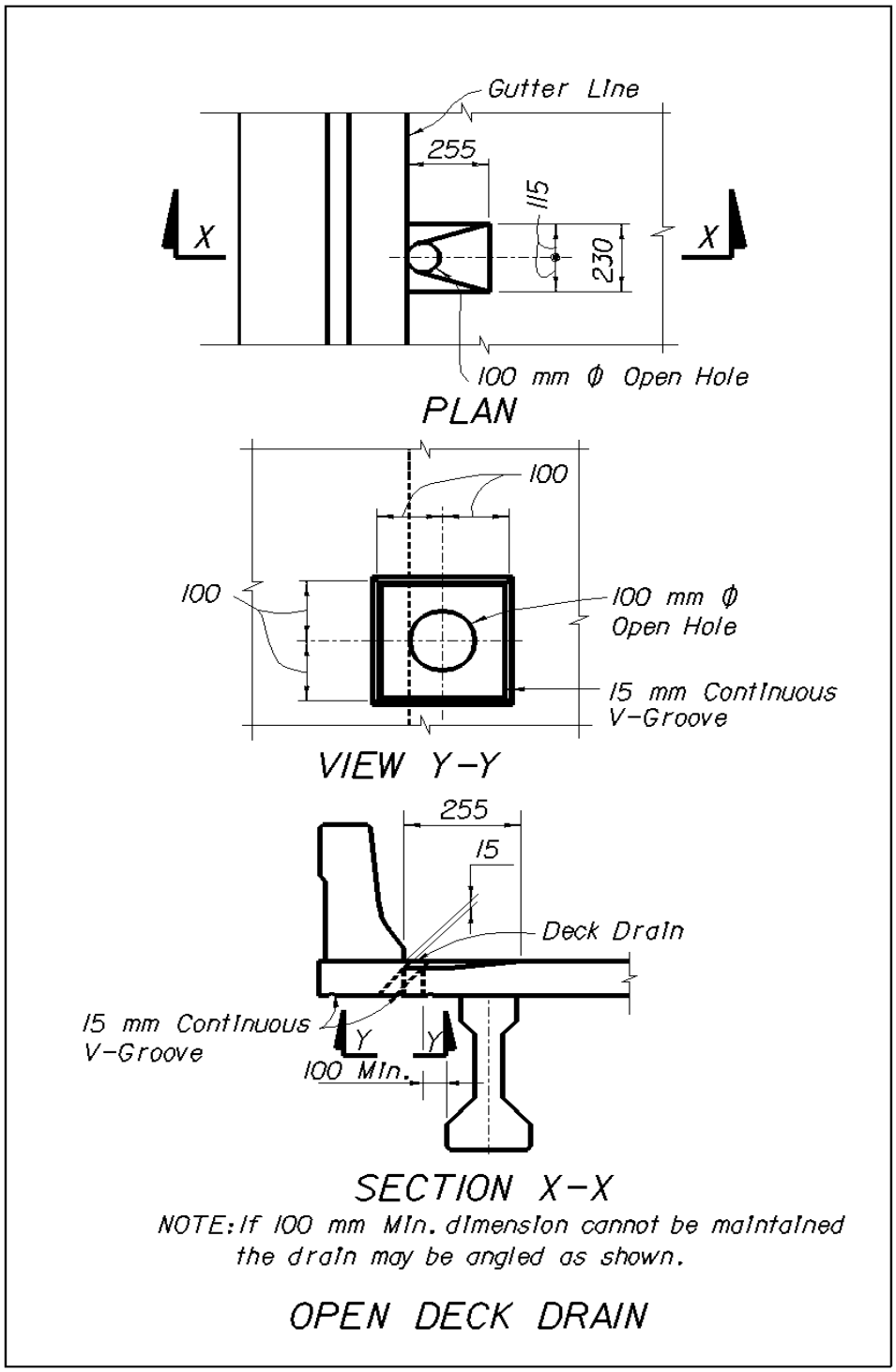


Figure 14-7 Open Deck Drain

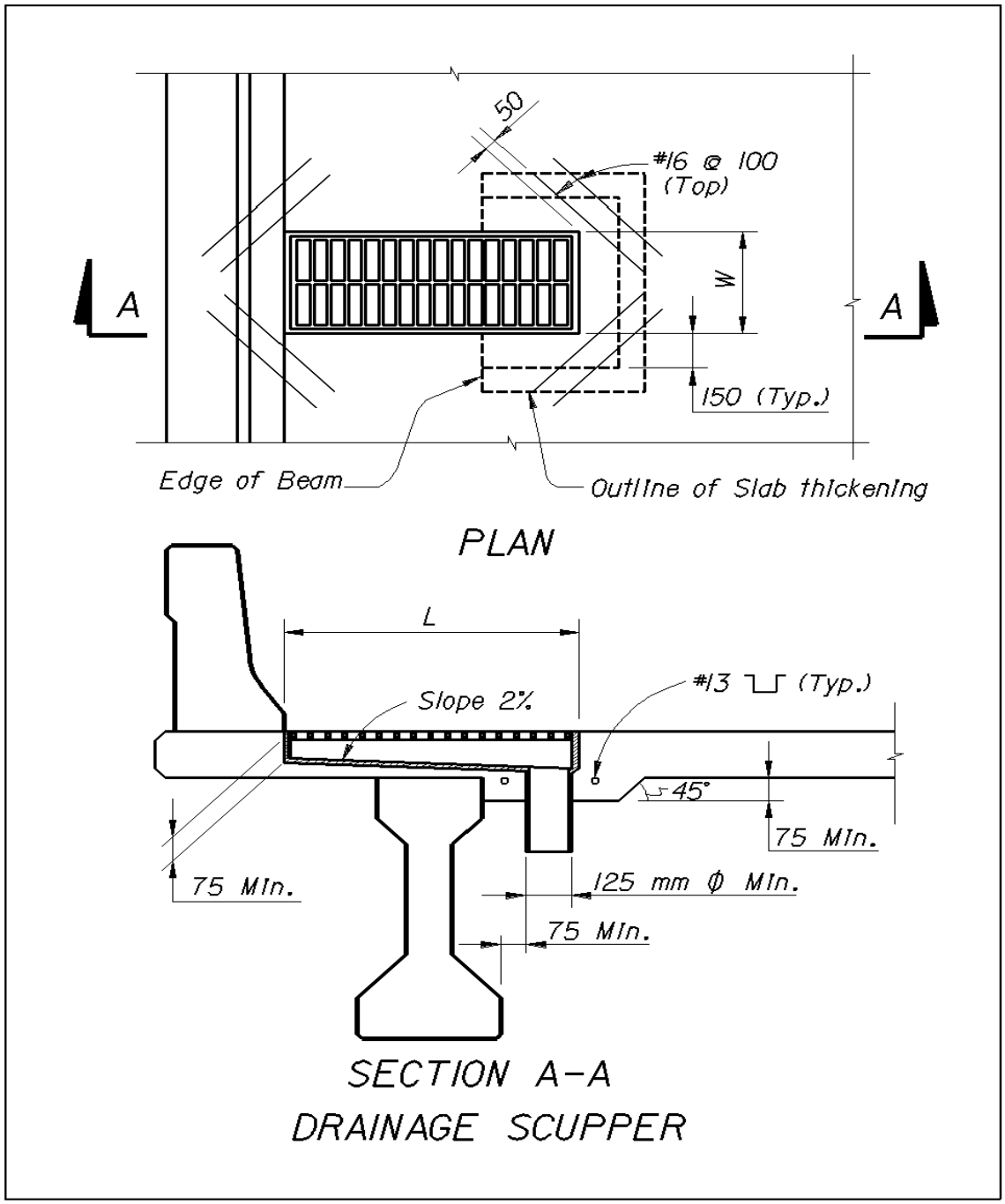


Figure 14-8 Scupper (Plan and Section)

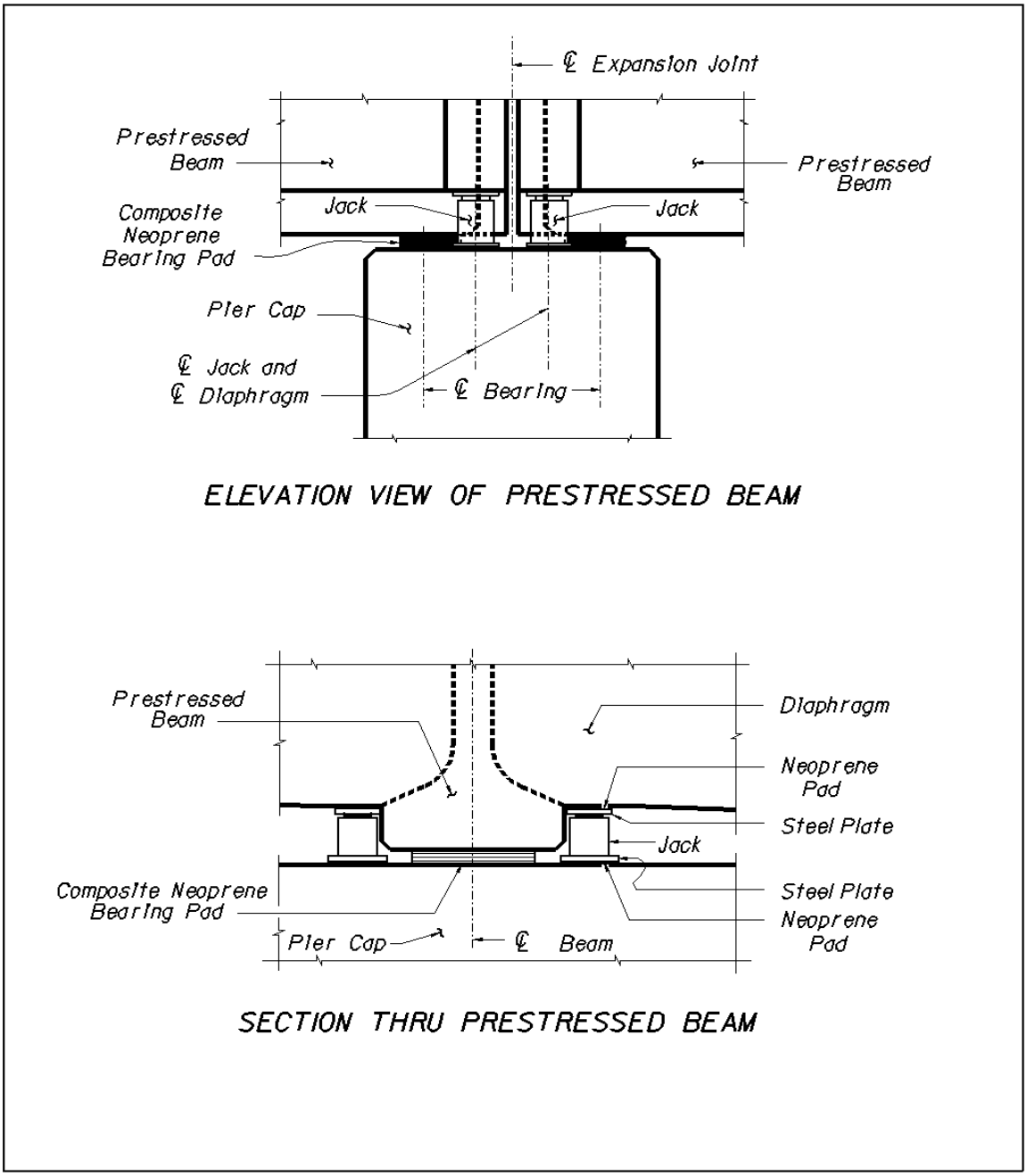


Figure 14- 9 Jack Location Detail

Chapter 15

STRUCTURAL STEEL DETAILS

15.1 Connections

A major problem designers and detailers must account for in welded steel girders is fatigue problems caused by secondary members and displacement induced stresses in the 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. Details that will minimize problems associated with these effects are included in the figures for this chapter.

15.2 Welds

Even the best welds obtainable are far from being perfect. Imperfections such as porosity, slag inclusions, cold laps and other comparable conditions cannot be totally eliminated. These imperfections are assumed to be unavoidable and have been considered in the allowable stress range for the weld.

The designer and detailer should avoid using details that cause stress concentrations in the weld, since such details will cause a decrease in the basic allowable stress range.

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. Examination of this Table and Figures reveal that welds cause reductions in allowable fatigue strength and basically the reductions are governed by the magnitude of discontinuities in the welds. When the following welds are used a Category E (low allowable fatigue strength) design condition results:

a. Intersecting welds: This type detail shall not be used.
b. Longitudinal weld terminations: It is preferred that plates on cover plated beams terminate at the ends of beams and that welds are continuous. The detailer should refer to the above AASHTO-LRFD Specifications when attachments require longitudinal welds on beams or girders.

It is important to realize that 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 economy.

15.3 Heat Curving

Heat curving of structural steel beams and plate girders are permitted. The preferred method of detailing design drawings is to detail components assuming conventional fabrication. However, the Engineer of Record shall determine the effects of heat curving according to AASHTO-LRFD Bridge Construction Specifications Article 11.4.12.2, 1998 Edition and show the dimensions on the overall camber diagram. The Contractor must prepare Shop Drawings to include the effects of heat curving based upon the added camber dimensions shown, when heat curving is used in the girder fabrication. All details, sections, dimensions, connections, bracing, etc. shall be detailed for conventional, non-heat-curved fabrication practices.

15.4 General Detailing

See Figures 15-1 thru 15-6 for suggested details for the fabrication of plate girders. The designer shall 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.

When permitted by AASHTO all bolted connections shall be made with High Strength Steel Bolts. The holes shall be in accordance with Article 6.13.2.4 in the AASHTO-LRFD Specifications.

Figure 15-8 shows anchor bolt details using preformed anchor bolt holes formed with 100 mm Φ corrugated galvanized pipe grouted with non-shrink grout. It is recommended that all anchor bolts be preformed for steel structures to assist in field fit up.

15.5 Detailing for Stay-in-Place Metal Forms

Except when prohibited from use by the Specifications, stay-in-place metal forms shall be incorporated in the design and details. Because the actual form material (depth, pitch, thickness, etc.) to be used cannot be predetermined, superstructure details shall include generic form details. Some suggested details are shown in Figure 15-6. Special care shall be taken for forms inside box girders, to avoid conflicts with the top flange lateral bracing system.

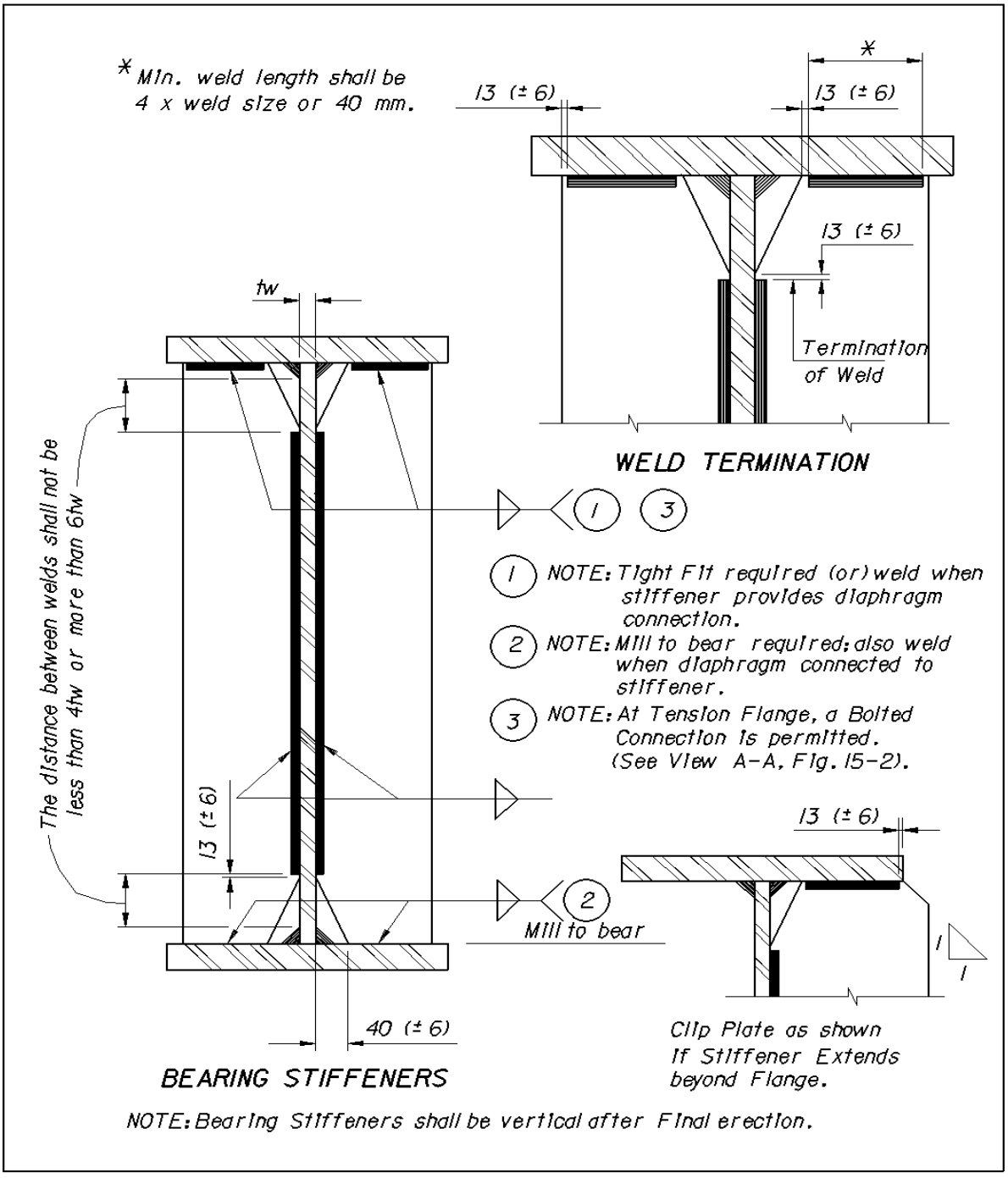


Figure 15-1 Bearing Stiffeners

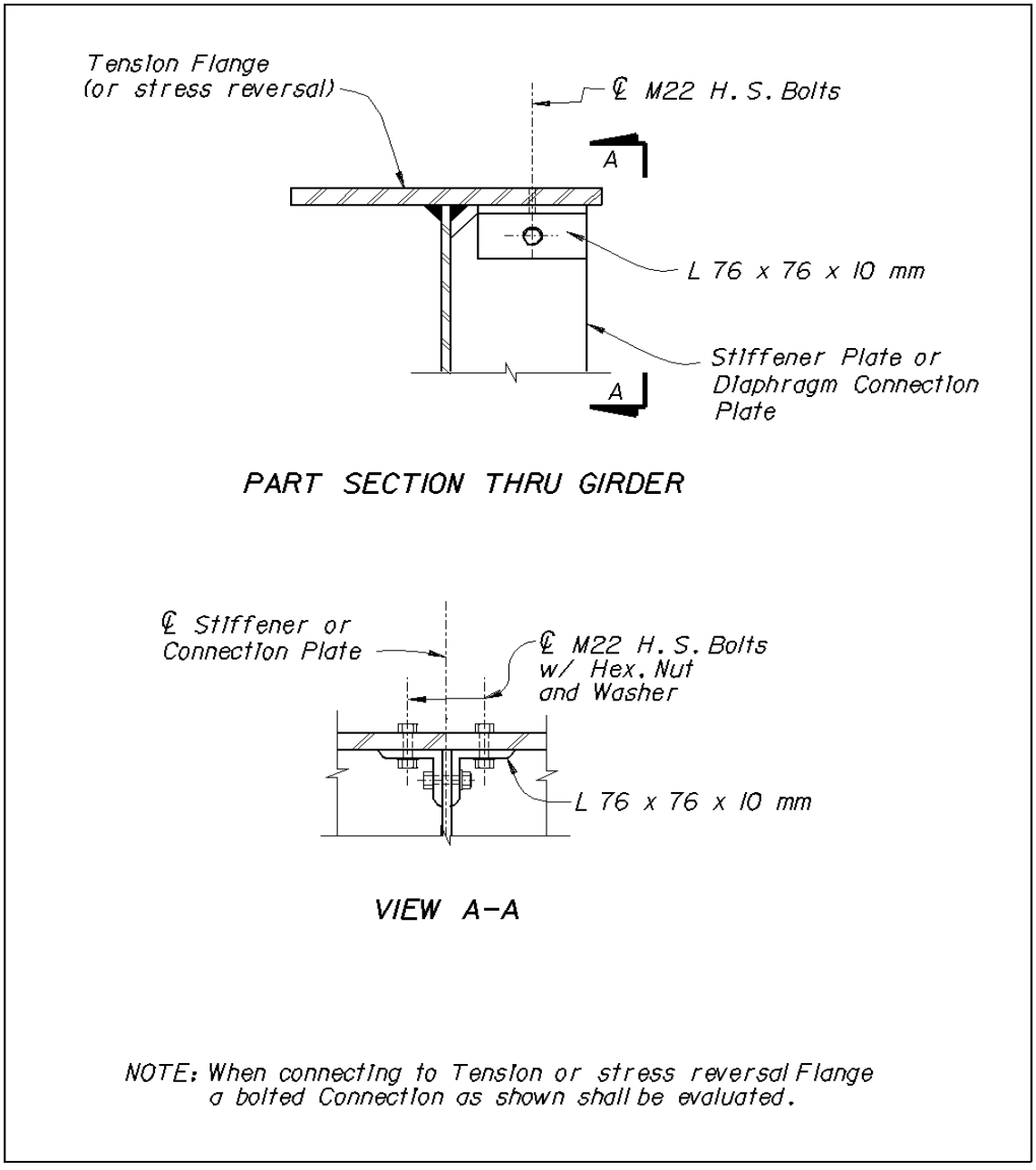


Figure 15-2 Partial Section Thru Girder

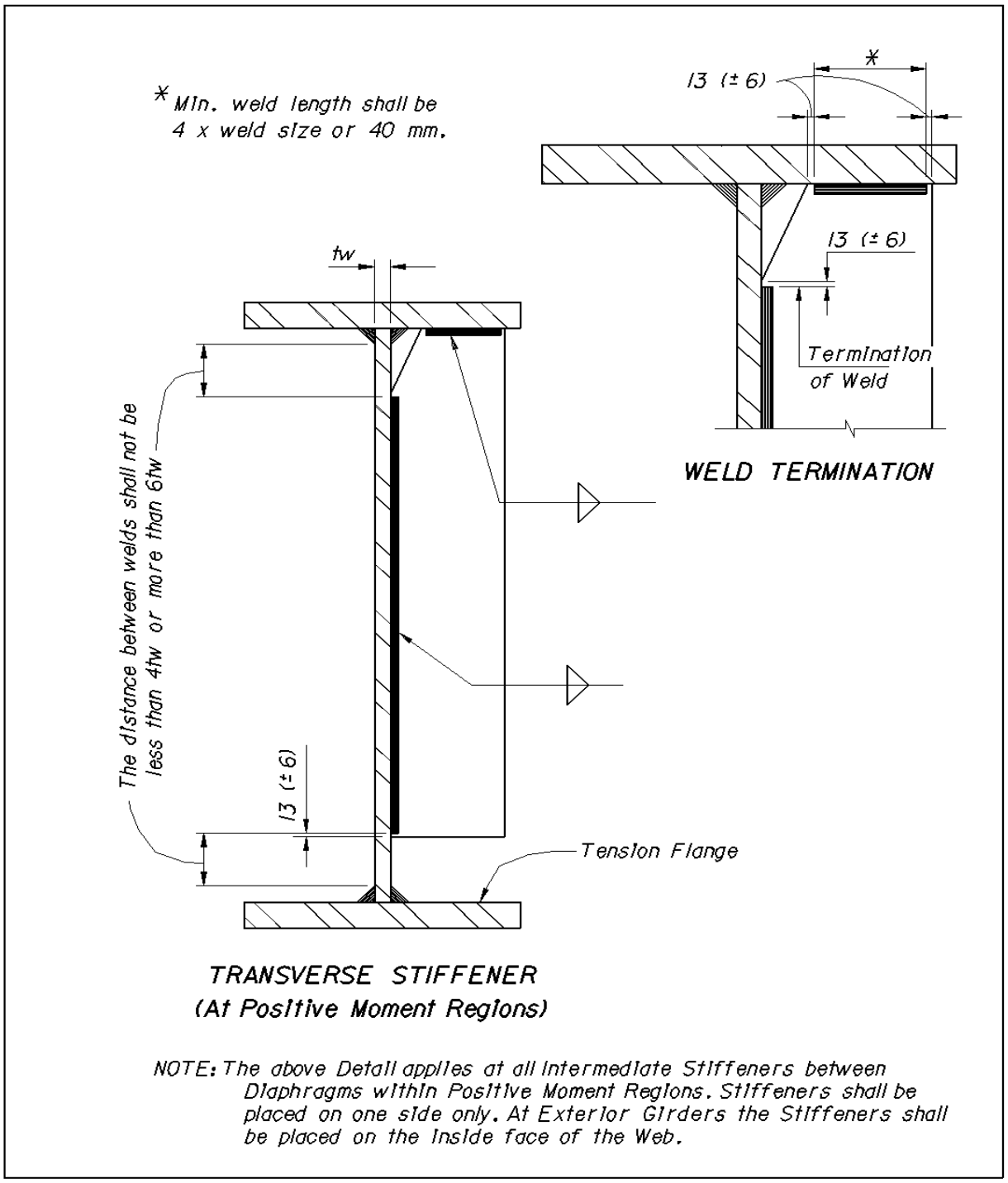


Figure 15-3 Transverse Stiffener (Positive Moment)

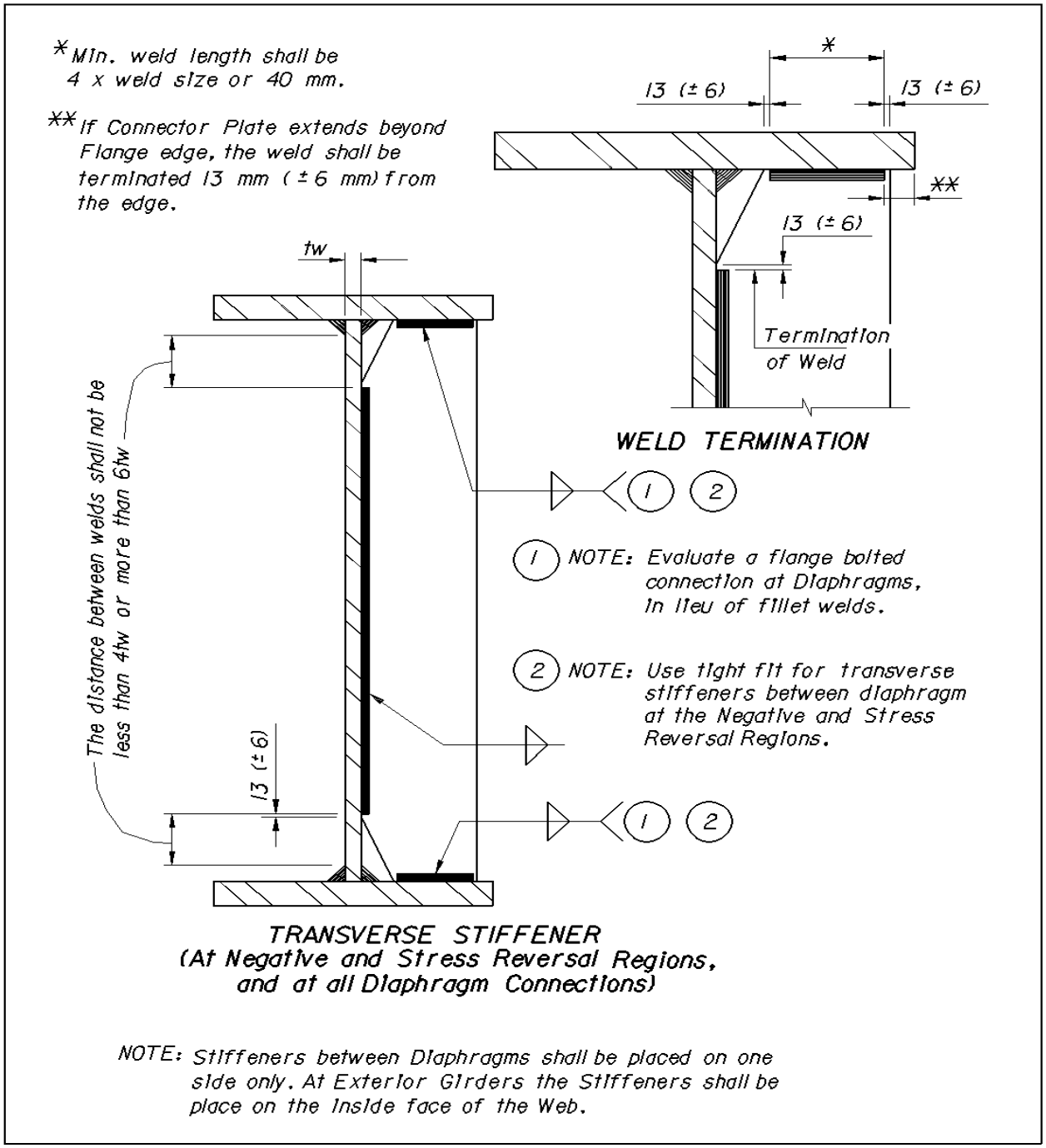


Figure 15-4 Transverse Stiffener

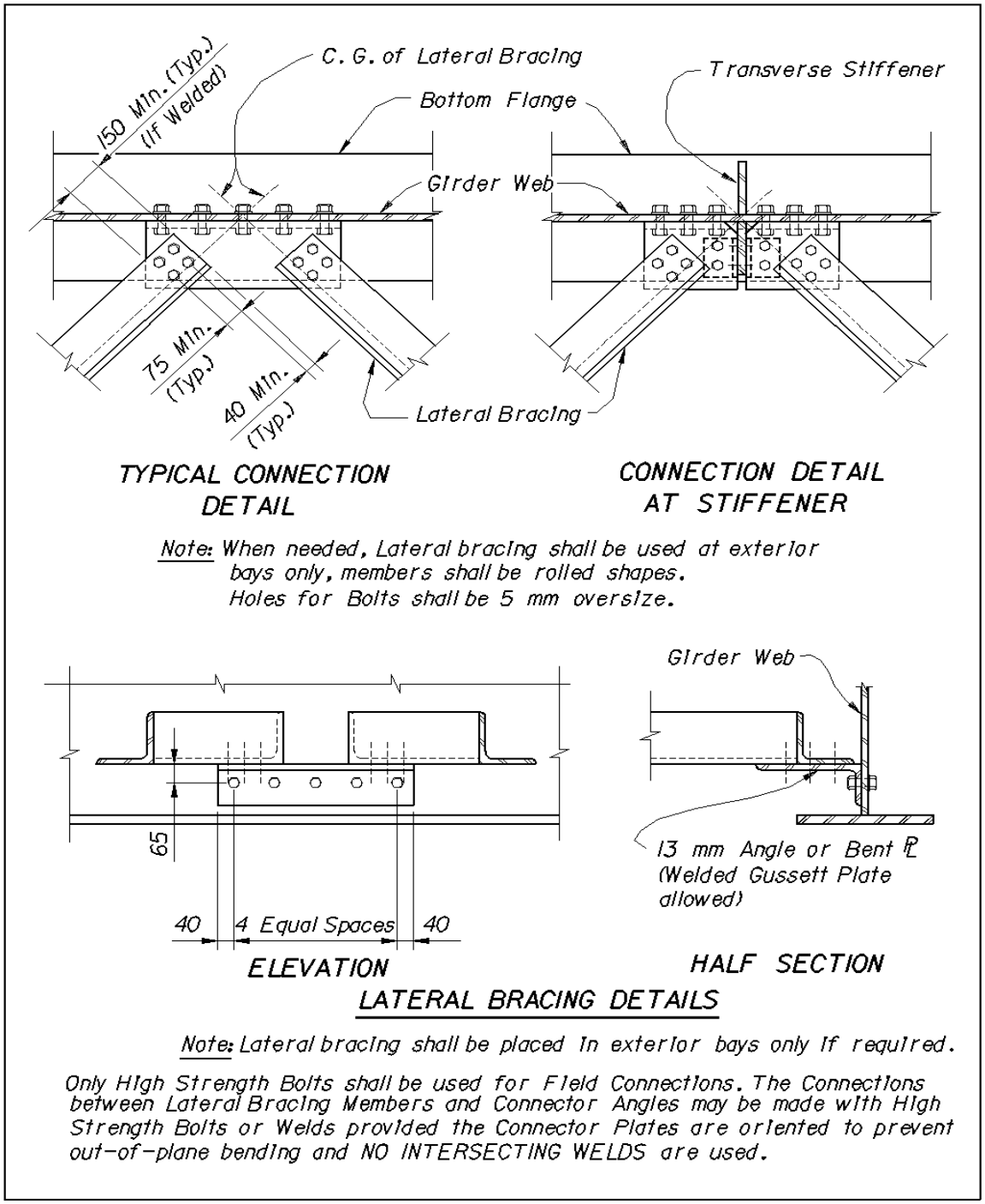


Figure 15-5 Connection and Lateral Bracing Details

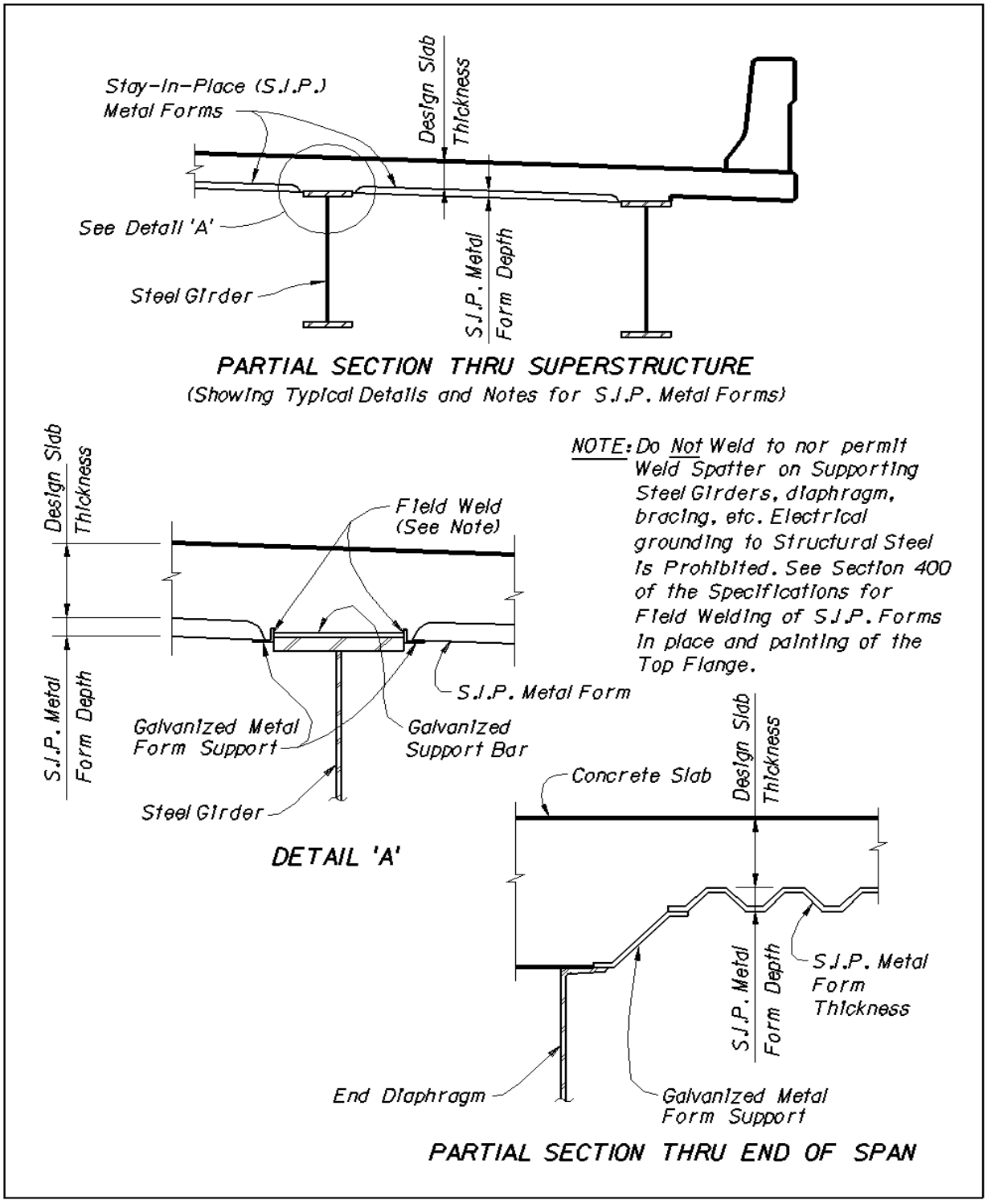


Figure 15-6 Stay-in-Place Metal Forms for Steel Girders

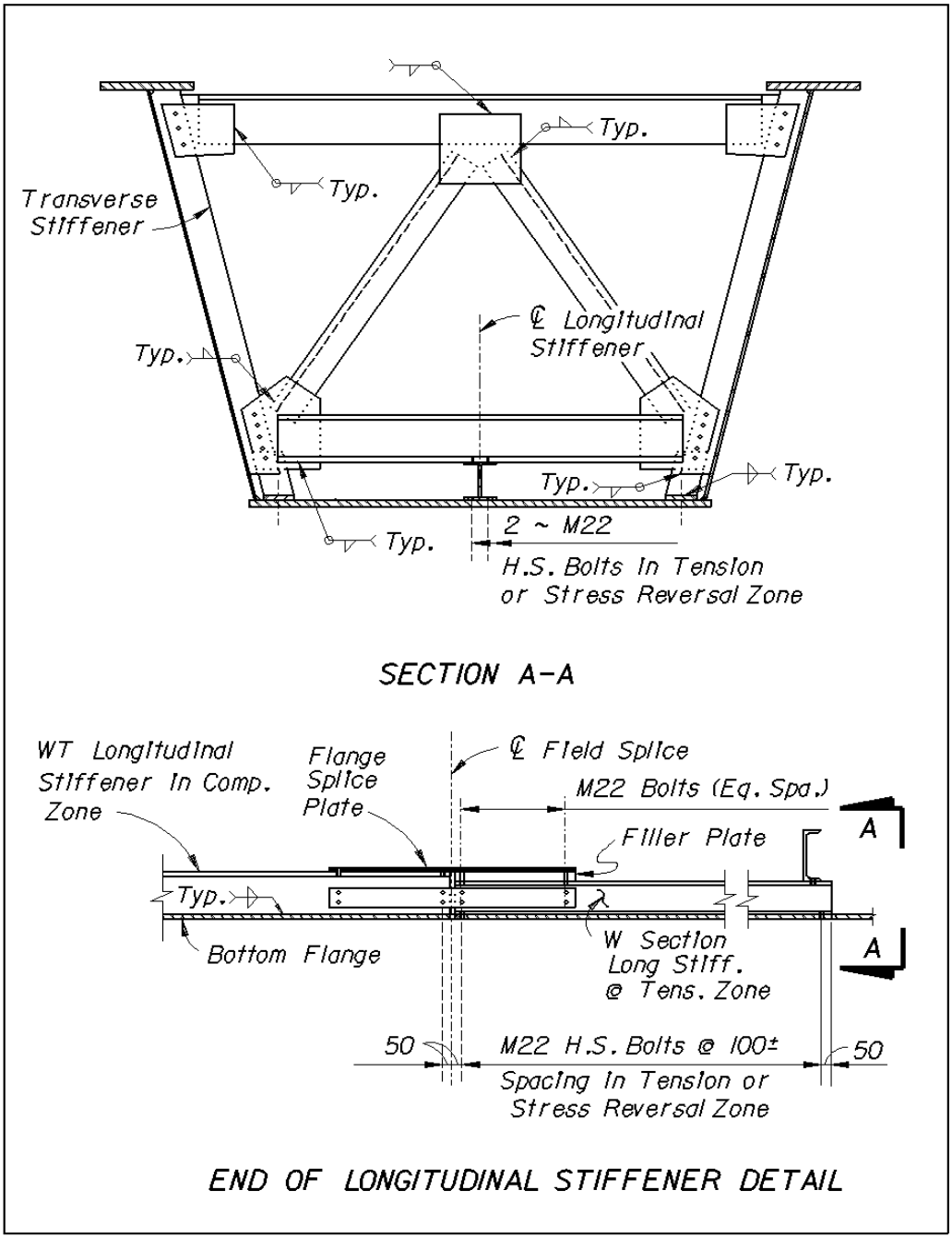


Figure 15-7 Longitudinal and Transverse Stiffener Details

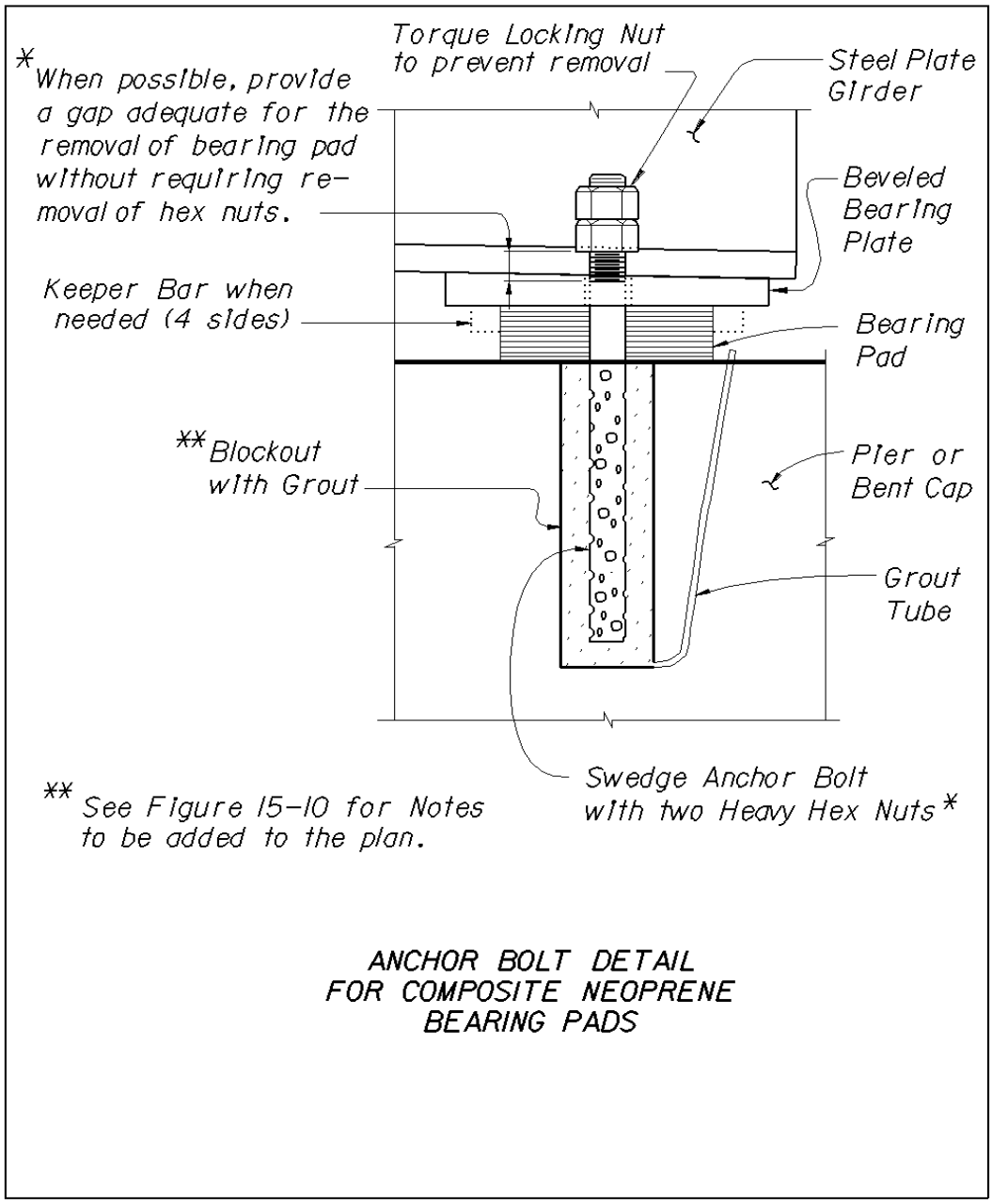


Figure 15-8 Anchor Bolt Detail for Composite Neoprene Bearing Pads

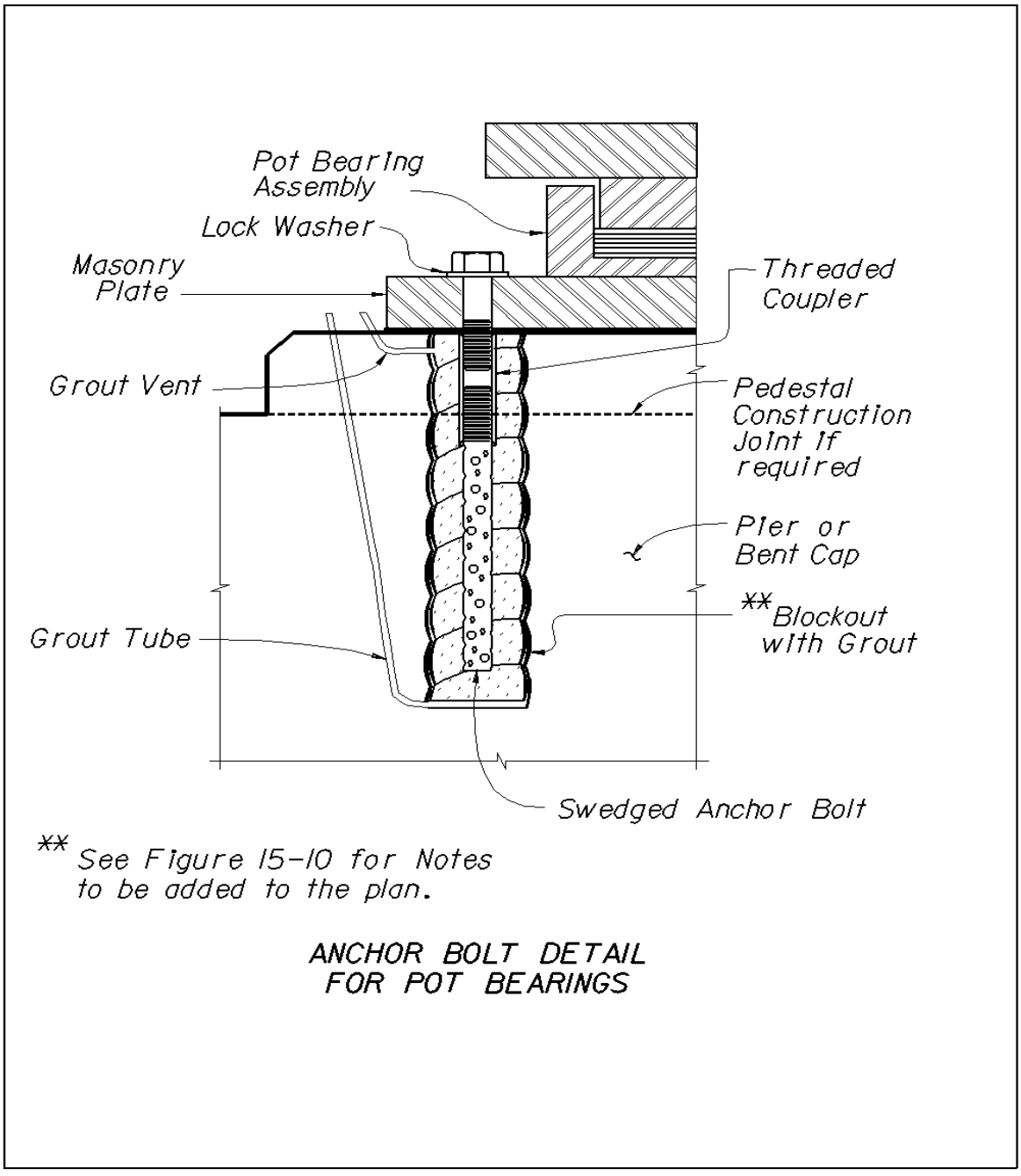


Figure 15-9 Anchor Bolt Detail for Pot Bearings

NOTE:

Blockout hole shall be free of debris prior to grouting. The blockouts shall be grouted with a non-shrink grout conforming to the Specifications and having a minimum strength of 41 MPa.

As required by the design, either a corrugated galvanized metal form that is to remain in place or a smooth removable form shall be used.

Blockout shall have a minimum diameter of 100 mm.

Reinforcing steel in the substructure shall be detailed to clear blockouts.

PLAN NOTES
FOR ANCHOR BOLT DETAILS

Figure 15-10 Designer's Note

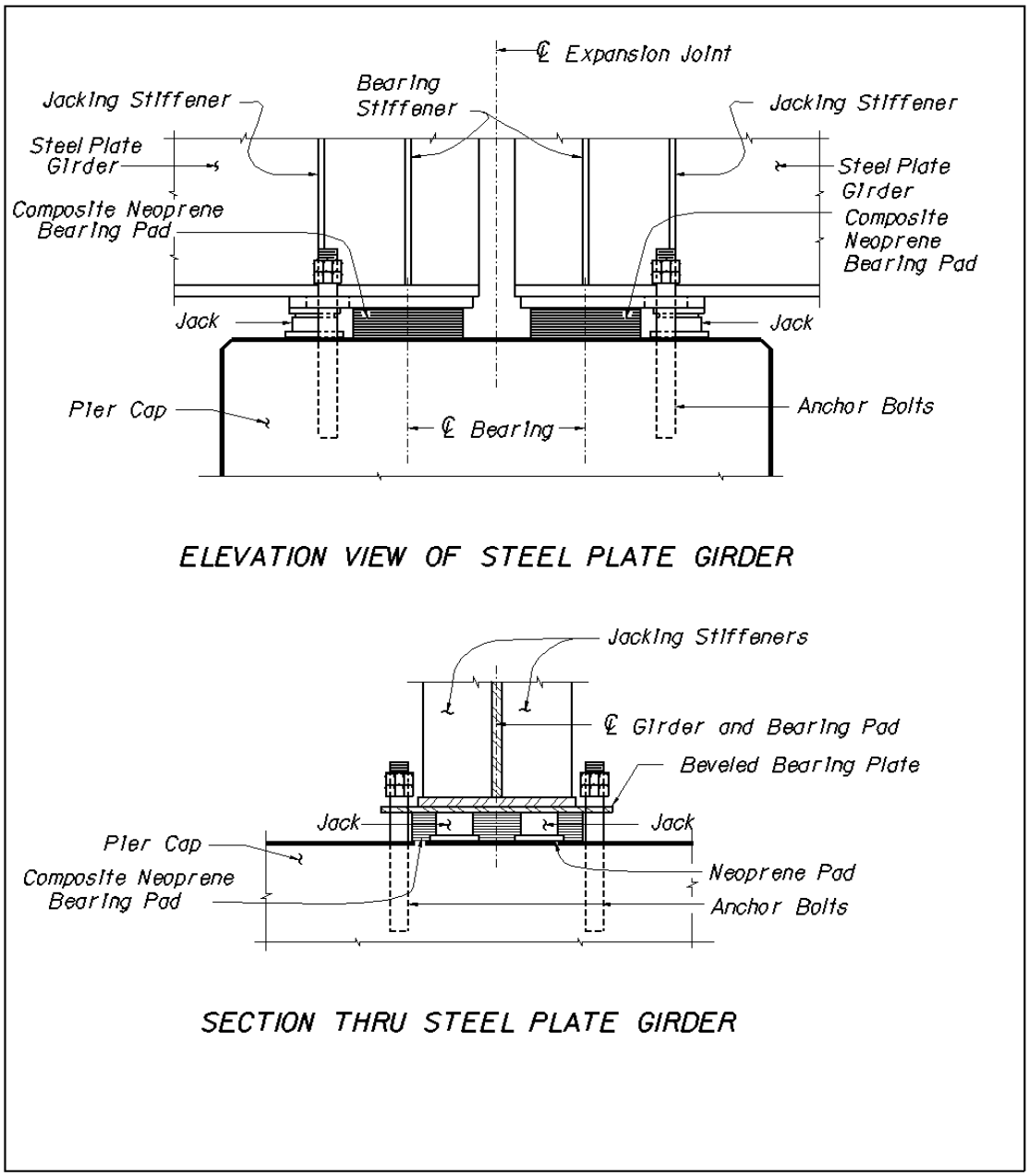


Figure 15-11 Jack Location Detail

DETAILING MANUAL

KEY WORD INDEX

(Note: Chapter Numbers are shown in bold-face type. All page number references for a given word are listed even for the occurrence of strings of sequential pages.)

-Abbreviations-

-A-

-B-

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-D-

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