SECTION 4: DRAFTING PRACTICES

4.1 COMPUTER AIDED DRAFTING (CAD)

4.1.1 DIRECTORY SETUP

Every NT Workstation has been set up with a similar directory diagram. This will enable any user to find information on another workstation efficiently. Every Workstation has their "Projects" and "share" directory shared. This will allow Drafter to share details freely. (See Appendix Figure A4.3.1A for the Directory Diagram)

When copying a file from another workstation, rename the file to avoid multiple copies of one file.

Standard Drawings files can be found in a pdf format on **\\s0442c\inetsrv\techserv\roadway\standards** and in dgn and pdf formats on **f:\\scdata\brdgshar\bridge\standards\drawings**

When a standard drawing is placed on an individual workstation the file extension should be changed to .ref.

4.1.2 CELL LIBRARIES

Each CAD Workstation has a Bridge Section Standard Cell Library plus a personal cell library.

Bridge Section Standard Cell Library

rc = /usr/brucx/mbrcell.cel

Personal Cell Library

rc = /usr/brucx/_____.cel

4.1.3 MENUS

There are several types of menus that will be discussed below. All menus are located in the directory /usr/br/

- Side Bar Menus - Side bar menus are text files that execute commands, as shown in Figure 4.1.3A.
- System Menus – A palate Menu as seen when you enter MicroStation can be created going through the Modify User Interface under utilities. See Figure 4.1.3B for a custom made system menu.
- Function Key Menus - To set a function key menu you must be in a draw in file and go to user - function keys and edit and delete as needed, but remember to save it when finished. Each individual may have their own version of a function key menu.
- metbr.mnu - This Metric menu is the standard specialized menu for bridge. Each individual may modify it to their own special needs.
- brsb2.mnu - This menu is the standard specialized menu for bridge designers. Each individual may copy it, rename it and modify it for their special needs.

4.1.3 MENUS – (continued)

Figure 4.1.3A

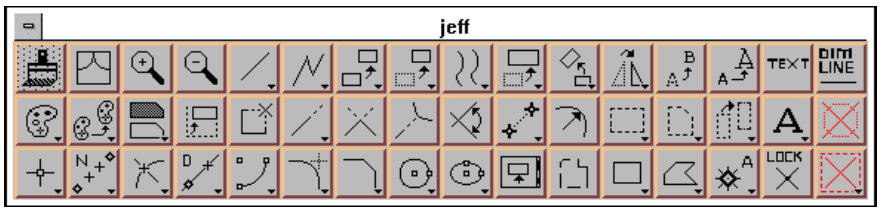


Figure 4.1.3B

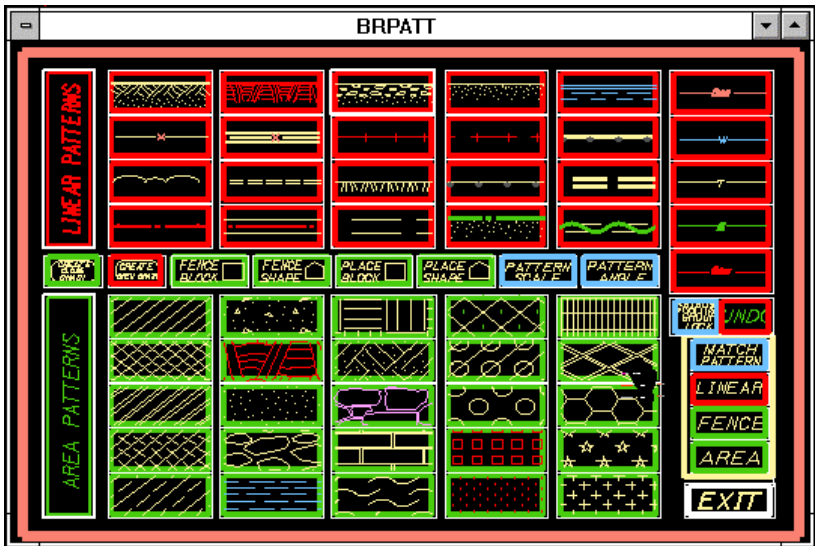


Figure 4.1.4A

4.1.4 TUTORIALS

- AT=WELD - This places welding symbols from the tutorial as selected with desired features.
- AT=BRPATT - This tutorial is for various types of linear and area patterning. See Figure 4.1.4A

4.1.5 SEED FILES

Seed files are the beginning of every file, when creating a new file the system copies your seed file to create a new file. So by having your seed file set up the way you want it, this will save much work later when you are in your drawing file. Example: Having cell library, menus, color table, etc. Standard Bridge Section Seed File name = seedm.dgn (this is for starting a metric CAD file).

4.1.6 SCALES

When selecting a scale, keep in mind that the drawing will be reduced to half size. For any given structure, all plans should, whenever possible, be drawn at the appropriate scale for the same details. Sections and views may be enlarged to show more detail, but the number of different scales used should be kept to a minimum. When scaling CAD details, use Figure 4.1.6A. (An enlarged version is available from Drafters.)

The scale listed under each detail should read **Scale xxx = xxx** where xxx is the appropriate scale factor.

All drawings are drawn full size to a scale of 1:1. Only when they are plotted do they become the specified scale.

Common scales for bridge drawings:

- Plan & Elevation - Use a metric scale and make the plan as large as possible. (Remember to save room for location map in the upper right corner and General Notes if possible).
- Footing Plan - As large as possible
- Deck Plan - Use either a 1/8" = 1'-0" or 1" = 10'-0".
- Deck Section - Use a 3/8" = 1'-0" or larger.
- Bents - The plan and elevation of Bents are drawn to 1/4" = 1'-0" or 3/16" = 1'-0".

Of course, these are suggested guidelines and remember, there are always situations that don't quite fit

DETAIL FACTOR SHEET "METRIC"

Scale factor for sheet

Detail Size	1000	500	250	200	150	100	50	30	25	20	15	10	5	1
1000	1	2	4	5	6.6667	10	20	33.3333	40	50	66.6667	100	200	1000
500	0.5	1	2	2.5	3.3333	5	10	16.6667	20	25	33.3333	50	100	500
B 250	0.25	0.5	1	1.25	1.6667	2.5	5	8.3333	10	12.5	16.6667	25	50	250
o 200	0.2	0.4	0.8	1	1.3333	2	4	6.6667	8	10	13.3333	20	40	200
r 150	0.15	0.3	0.6	0.75	1.0000	1.5	3	5.0	6	7.5	10.0000	15	30	150
d 100	0.1	0.2	0.4	0.5	.6667	1	2	3.3333	4	5	6.6667	10	20	100
e 50	0.05	0.1	0.2	0.25	.3333	0.5	1	1.6667	2	2.5	3.3333	5	10	50
r 30	0.03	0.06	0.12	0.15	.2000	0.3	0.6	1.0	1.2	1.5	2.0000	3	6	30
25	0.025	0.05	0.1	0.125	.1667	0.25	0.5	.8333	1	1.25	1.6667	2.5	5	25
S 20	0.02	0.04	0.08	0.1	.1333	0.2	0.4	.6667	0.8	1	1.3333	2	4	20
i 15	0.015	0.03	0.06	0.075	.1000	0.15	0.3	.50	0.6	0.75	1.0000	1.5	3	15
z 10	0.01	0.02	0.04	0.05	.0667	0.1	0.2	.3333	0.4	0.5	.6667	1	2	10
e 5	0.005	0.01	0.02	0.025	.0333	0.05	0.1	.1667	0.2	0.25	.3333	0.5	1	5
1	0.001	0.002	0.004	0.005	.0067	0.01	0.02	.0333	0.04	0.05	.0667	0.1	0.2	1

Figure 4.1.6A

4.2 DETAILING

4.2.1 TEXT

Since all drafting is now done with the use of computers, use the following:

- General text – 5/32" font 24, wt=2
- Titles – 7/32" font 2, wt=3

There are several menu types for setting text (see Section 4.1.3 for menus). Lettering shall be oriented so as to be read from the bottom or right edge of the sheet. For abbreviations see Appendix Section A4.1.1.

4.2.2 LINE WORK

All line work must be of sufficient size, weight and clarity so that it can be easily read from a print that has been reduced to one-half (1/2) the size of the original drawing. Similar lines denoting a structural outline, a centerline, etc., shall have the same line weight and style.

Line weight shall have appropriate gradations of width to give line contrast as shown in Figure 4.2.2A. Care shall be taken that the thin lines are dense enough to show clearly when reproduced (line weight of wt=0 has a tendency to fade out on half size prints and therefore is suggested not to be used). See Appendix Section A4.1.2 for Standard Symbols.

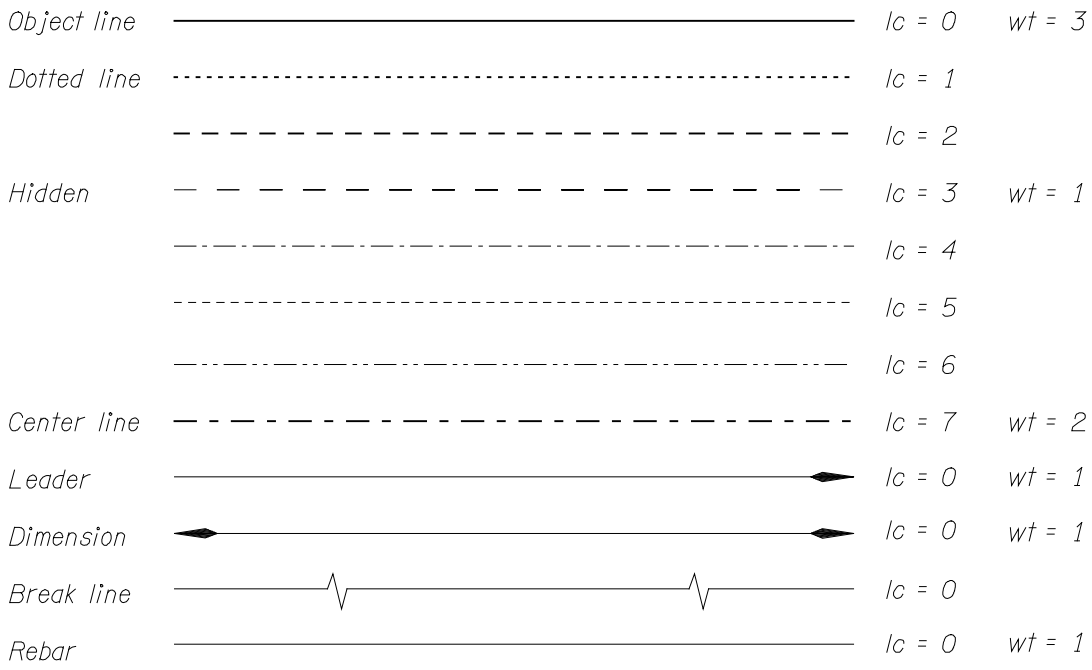


Figure 4.2.2A

4.2.3 DIMENSIONING

Duplication and unnecessary dimensions should be avoided. All dimension figures shall be placed above the dimension line, so that they may be read from the bottom or the right edge of the sheet, as shown in Figure 4.2.3A.

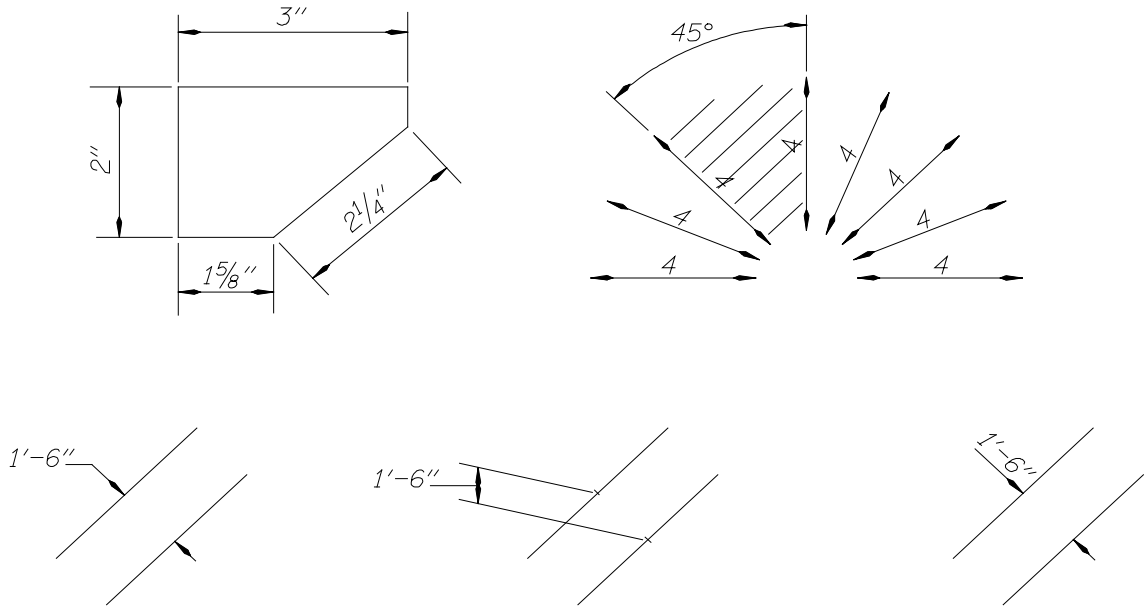


Figure 4.2.3A

In general, the precision of detail dimensions should consider the normal construction tolerances to which it is being constructed. General plan and detail dimensioning precision should not be more than the following:

- Structural Steel to 1/16”
- Welds to 1/16”
- Concrete to 1/8”
- Camber Diagrams to 1/8”
- If a series of dimensions (i.e. beam or rail post spacing) do not add up to the exact overall dimension, use a plus or minus (±) following the series dimension. (i.e. 25 spaces at 9’-3 1/8”± = 231’-7”)

4.2.3 DIMENSIONING – (continued)

Dimensions 12" or more are to be dimensioned in feet and inches, unless the item dimensioned is conventionally designated in inches (for example, 16" dia, pipe or #4 bars at 18" ctrs.).

In dimensions more than 1 ft, fractions less than 1" are to be proceeded by 0 (for example, 3'-0 1/8").

Intersection angle should be dimensioned as the acute angle between centerlines of roadways or between centerline of roadway and centerline of bent. Where the intersection is on a curve, the angle should be measured from the local tangent to the curve at the point of intersection; for intersecting curves, give angle and add the words "tan - tan".

Placement of dimensions outside the view, preferably to the right or below, is desirable. However, in the interest of clarity and simplicity, it may be necessary to place them otherwise. Examples of dimensioning placement are shown in Figure 4.2.3B.

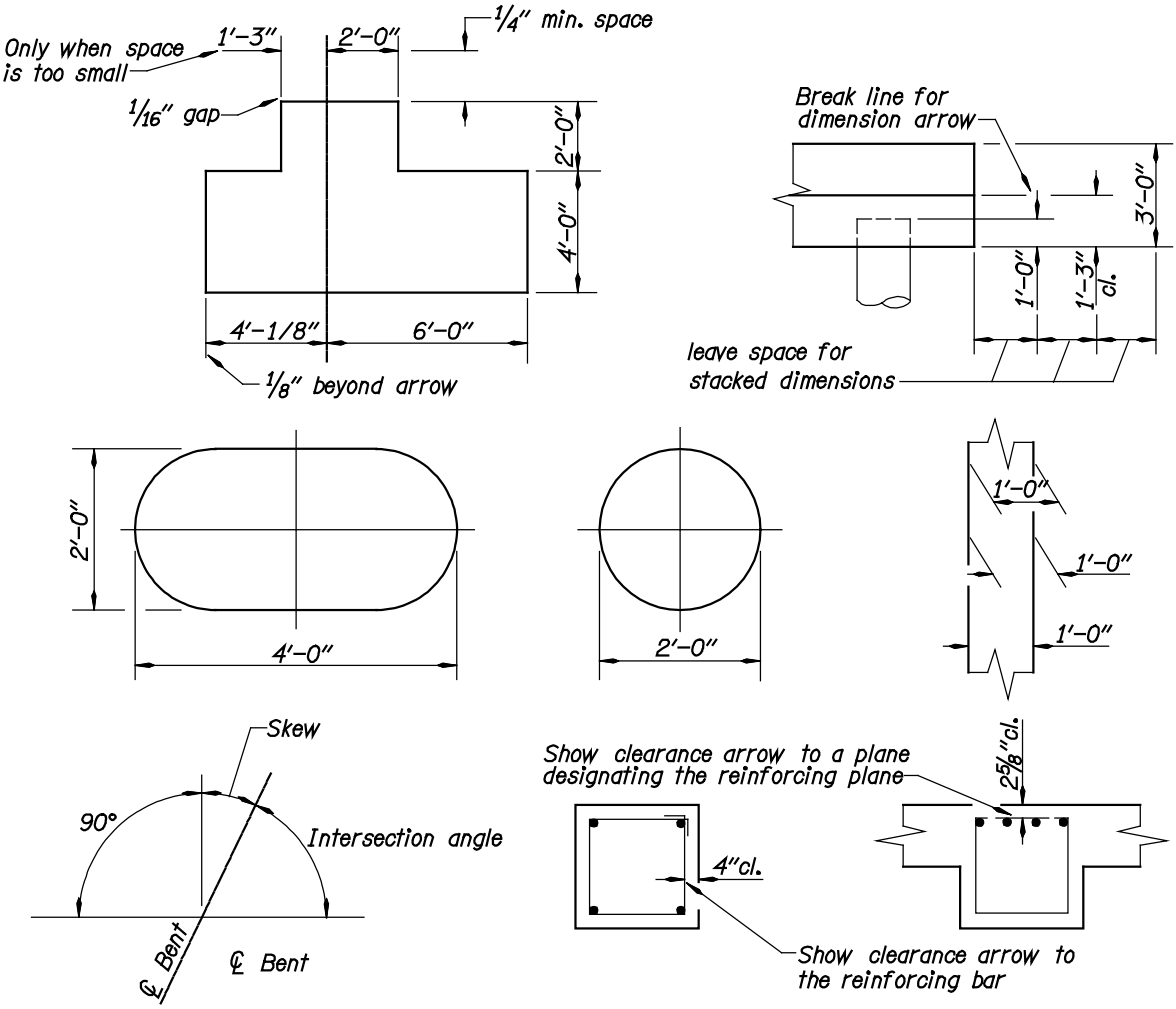
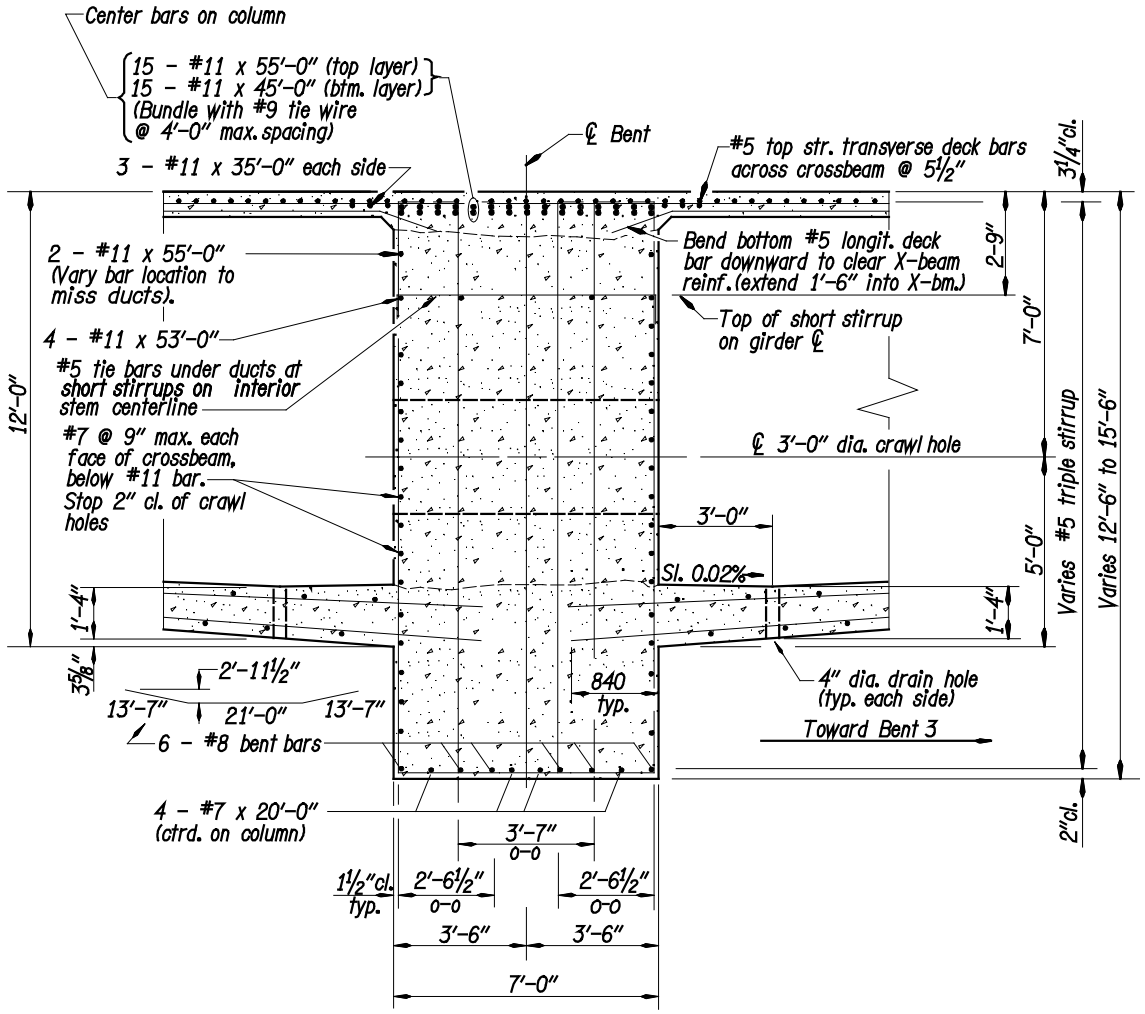


Figure 4.2.3B

4.2.4 CONCRETE

A typical crossbeam section is shown below.



TYPICAL SECTION CROSSBEAM - BENT 2 (BENT 4 SIMILAR)

Figure 4.2.4A

4.2.5 STRUCTURAL STEEL

Generally dimension marks are not used, except for length dimensions, for detailing structural steel shapes, plates and welds. See Figure 4.2.5A for an example. Steel callout examples include:

Plates
PL 1/2 x 12 x 6'-3"
PL 3/4 x 12 x 12

Angles
L 6 x 6 x 1/2 x 16'-6"
2Ls 3 x 3 x 3/8 x 12"

Wide-Flange Sections
W 8 x 24 x 10'-0"

Structural Tubing

TS 4 x 4 x 0.375 x 8'-6"
TS 3 OD x 0.250 x 6'-3"

Fillet Welds

For welding symbols, there is a tutorial called **AT=WELD** for most weld symbols. (See Section 4.1.4 Tutorials) See example of fillet welds in Figure 4.3.4A)

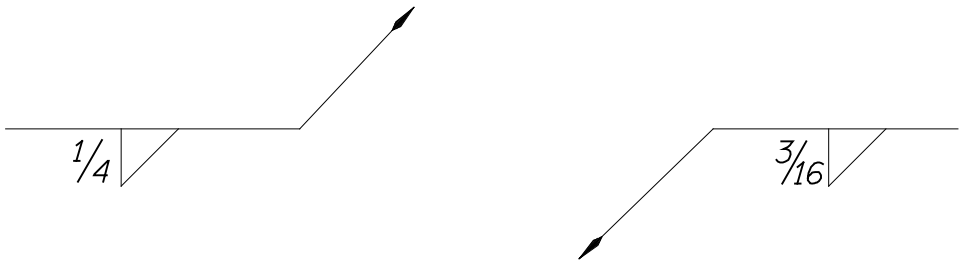


Figure 4.3.4A

4.2.5 STRUCTURAL STEEL – (continued)

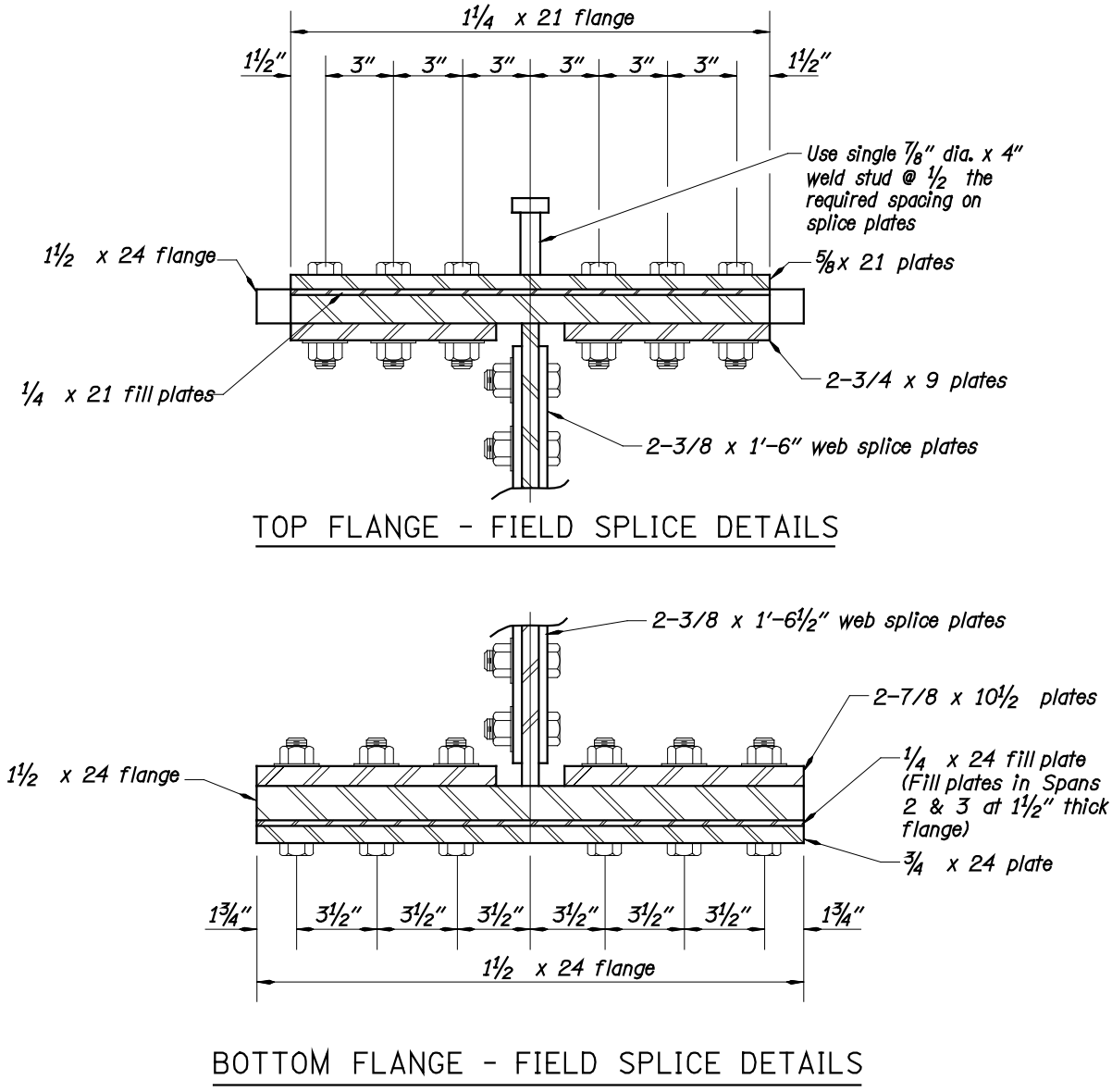


Figure 4.2.5B

4.2.6 REINFORCING STEEL

Labeling reinforcing steel should be simplified as much as possible. Eliminate needless words like "no.", "bars", "ctrs", etc. See example in Figure 4.2.6A.

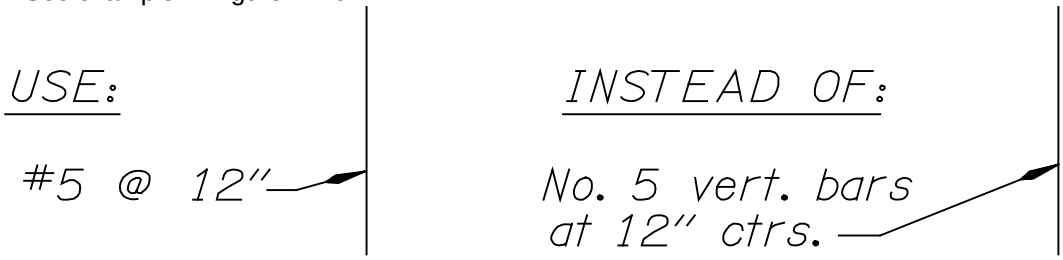


Figure 4.2.6A

4.2.7 BAR LENGTH LABELING

To avoid excessive bar lengths (greater than stock lengths indicated in Section 5.1.10.2) and to avoid splices in the wrong places, main reinforcing steel lengths should be labeled. Sketches may be necessary to show correct bar and splice location. See labeling methods in Figure 4.2.7A.

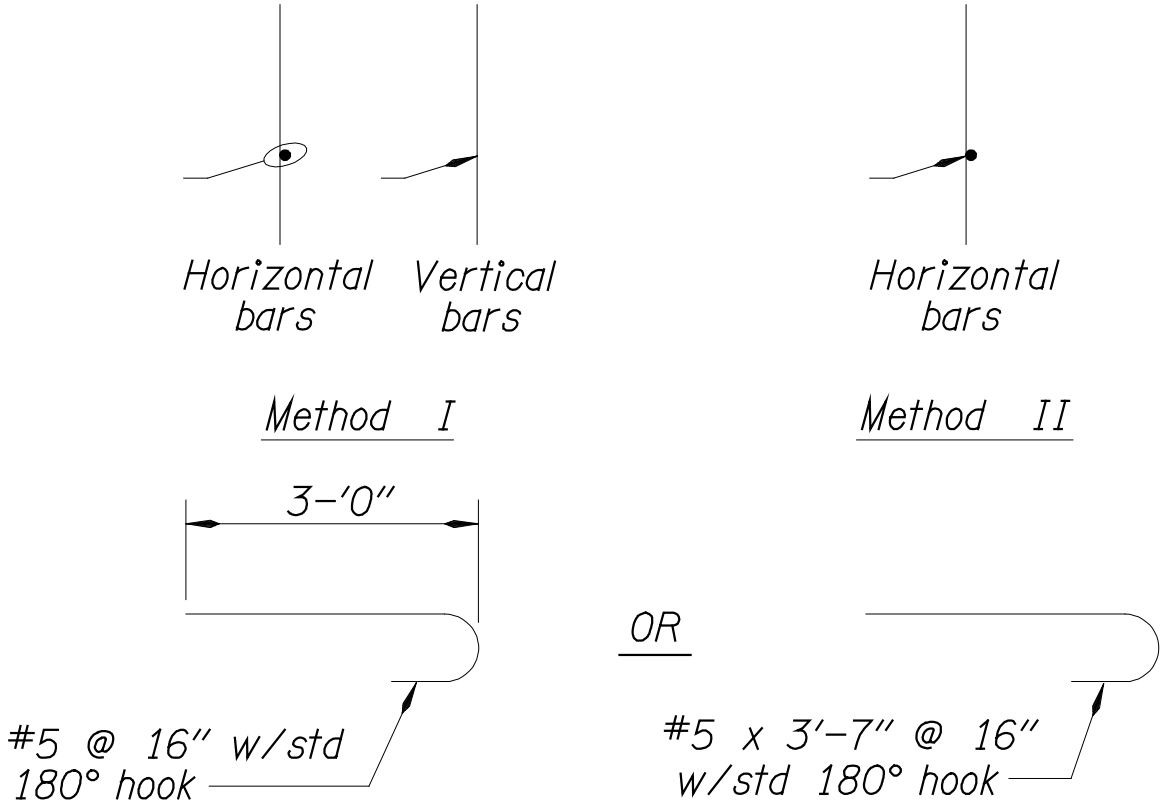
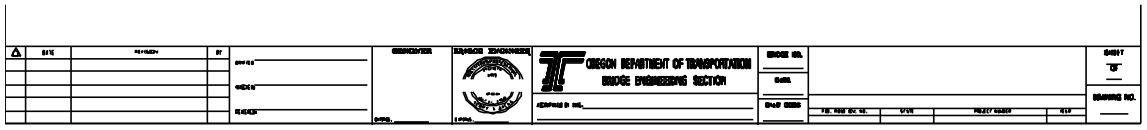


Figure 4.2.7A

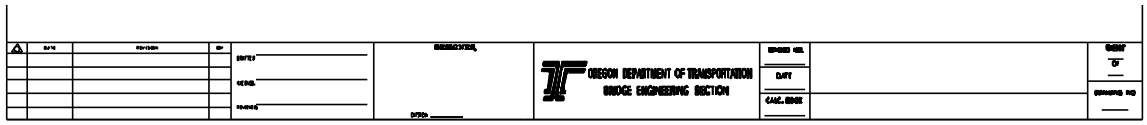
4.3 DRAWING BORDERS

Final drawings shall be plotted on mylar (“D” Size). There are three styles of borders as shown in Figure 4.3A. See Appendix Section A4.1.6 for enlarged examples.

When one of the three borders is selected and placed in a graphics file, a file identification tag is placed vertically at the bottom right corner of the border just inside the cut line. See drawing identification tag in Section 4.3.1 .



TITLE SHEET



DETAIL SHEET

FOUNDATION DATA SHEET

Figure 4.3A

While in a graphics file, all drawings should be placed in an appropriate MPGRID location. See Figure 4.3B for a sample MPGRID layout.

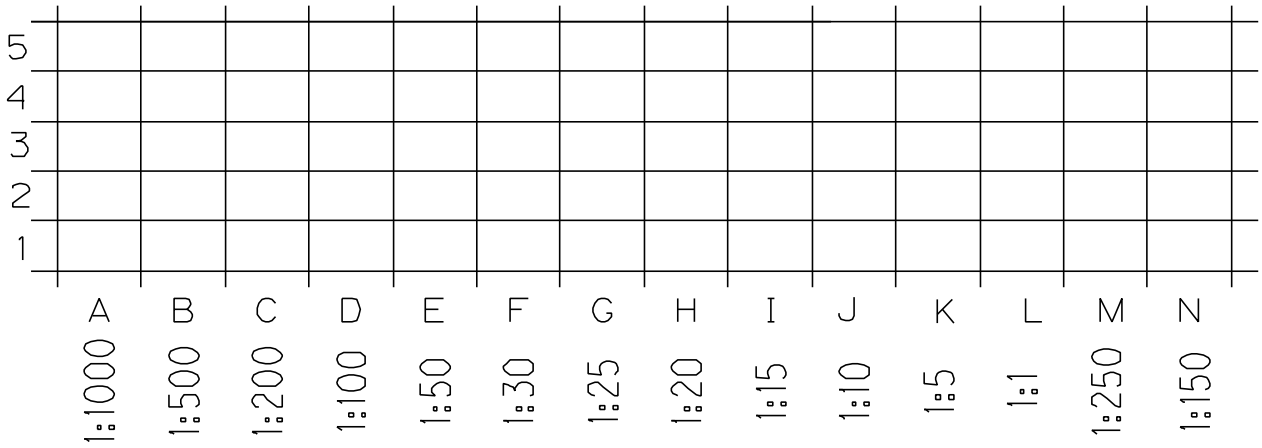


Figure 4.3B

4.3.1 DRAWING IDENTIFICATION TAG

The drawing ID tag runs up the right side of the drawing starting at the bottom corner.

example: Station ID: ##FILE NAME LOCATION WHILE PLOTTING## [View=] [MPGRID=] DATE

Station ID: This is the name associated with the workstation where the current file is created and located.

File name location while plotting: This will plot the current file location during plotting.

View: Placing a descriptive name here will help find specific drawings within the graphics file, some examples are:

Index Sheet	vi=index
Plan and Elevation	vi=plan
Footing Plan	vi=ftg
Deck Plan	vi=dp1
Deck Section	vi=ds
Longitudinal Beam	vi=lbm
Plan and Elevation Bent	vi=bt1
Bent Details	vi=dbt1
Wingwalls	vi=wing
Miscellaneous	vi=misc

MPGRID: This identifies where the file is located within a graphics file.

Date: The date when the plot was made.

See Appendix Figure A4.3.1A for Bridge Directory Diagram, Bridge File Naming Conventions and Owner Identification information.

4.4 TITLE BLOCK INFORMATION

4.4.1 REQUEST FOR DRAWING NUMBERS

Request drawing numbers through the Senior Drafter or the designated person for your crew. This person will have contact with the front office regarding drawing number requests.

Bridge name should reflect the information on the structure data sheet submitted by the designers to the front office.

Drawing numbers for new drawings may be obtained from the front office. All information on the drawing request form should be complete. (Use the electronic form “DwgRqst.xlt”.) Be sure to include the Foundation Data Sheet(s) in the sequence of numbers.

The Drafter should work with the Designer to make sure all areas are covered before requesting drawing numbers.

The final drawing numbers should normally be assigned prior to Roadway Engineering Section's "advance plans", and no later than for the plans-in-hand meeting.

4.4.2 TITLE SHEET

Title block information should be listed as follows: structure name, section name, highway name and milepost, and the county name. See Appendix Section A4.1.6 for example.

The County Bridge No. is placed immediately above the BRIDGE NO. to provide maintenance cross referencing. If the County Bridge No. is not already cross- referenced in the job record or our files, it may be obtained from the Bridge Operations Managing Engineer.

Structures on the State Highway System (Interstate, Primary and Secondary highways) shall be identified in the title block of the title sheet by milepoint (MP) location. The milepoint shall be shown in parenthesis immediately after the highway name to the hundredth of a mile.

For milepoint determination, see Section 2.2.3.7, "Request for Structure Number."

For "Accompanied by", list here the rest of the drawings for this structure (i.e., 37833 through 37846) followed by any Bridge standard drawings which show details common to this structure and other structures which are a part of the same contract and roadway standard drawings to which reference has been made anywhere in the plans for this structure.

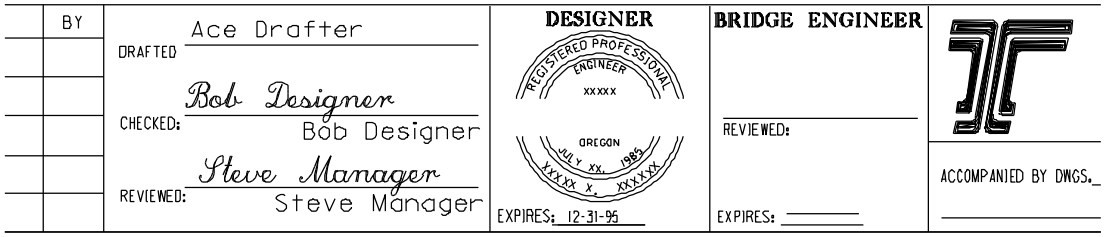


Figure 4.4.2A

4.4.2 TITLE SHEET – (continued)

A list of drawing numbers for the existing structure should be listed just above title inside the border.

Put "Information Only" notation above the title block at the right side of existing drawings.

For "No. of ", the title sheet will be No. 1. The number of sheets will be the title sheet and all of the detail sheets for the structure. Do not include “Accompanied by” standard drawings in the total.

Within the title block, place the Bridge Engineer's and the Managing Engineer's or Design Engineer's registration seal, whoever is the most appropriate. Each registration seal must have an expiration date (which will be added by the Engineer when signature is placed) placed under it within the title block. (See Section 2.1.3.5)

Drafters may print or sign their first and last names.

Checkers and Reviewers sign their names (using full signature) above the dotted line and print their name below (see Figure 4.4.2A and Figure 4.4.2B for the Title Block).

For any project not designed in-house the Bridge Engineer will sign the plans "Reviewed" rather than stamp the plans (see Figure 4.4.2A and Figure 4.4.2B)

4.4.3 DETAIL SHEET

On Detail Sheets, Designers include their registration seal and expiration date if registered. If the Designer is not a Registered Engineer, then the Design Supervisor will place their registration seal. See Appendix Section A4.1.6 for example.

Drafters and Checkers place their names as indicated for the title sheet (see Figure 4.4.2A and Figure 4.4.2B for the Detail Sheet title block).

Normally Standard Drawing project specific fill-in sheets should be detail sheets. Change the border from a Standard Drawing border to a Detail Sheet border.

4.4.4 FOUNDATION DATA SHEET

On Foundation Data Sheets, Foundation Designers shall have their registration seal and expiration date if registered. If the Foundation Designer is not a Registered Engineer, then Foundation Unit Checkers will place their registration seal. See Appendix Section A4.1.6 for example

The Foundation Sheet typically contains:

A Plan view showing the existing and proposed structures with location of subsurface explorations, alignment data, north arrow, scale and other pertinent data.

An elevation or profile view (called Foundation Data) that shows the subsurface explorations at their correct elevations with existing groundline. The subsurface exploration will also show the following:

- Material descriptions
- Standard Penetration Test “N” Values
- Undisturbed samples
- Core Samples with R.Q.D., Hardness, Recovery
- Groundwater levels and date(s)
- Other pertinent information as determined by Foundation designer
- Title block
- Legend of materials
- Standard Designations
- General notes
- Engineer’s stamp and signature

The plan and elevation are drawn to the same horizontal scale, but the elevation view vertical scale is increased (space permitting) to show more detail in the material description, e.g. 1”=20’ (Horiz.) 1”=10’ (Vert.)

Drafters and Checkers place their names as indicated for the Title Sheet (see Figure 4.4.2A and Figure 4.4.2B for the Foundation Data Sheet Title Block).

4.4 TITLE BLOCK INFORMATION – (continued)

EXAMPLE TITLE BLOCKS

1. Revisions
2. Drafted
   Checked
   Reviewed or Designer
   (Reviewer signs here if Designer is registered)
3. Registration Seal
   Designer (if registered) or Reviewer
4. Registration Seal
   Bridge Engineer
5. Accompanied by drawings
6. Bridge Number
7. Date
8. Calculation book
9. Bridge Name
   Section Name
   Highway Name with Milepost
   County Name
10. Drawing Description
11. Federal Road Division Number
    State
    Project Number or state
    Year
12. Sheet xx of xx
13. Bridge Section drawing number
14. Bridge Name
15. Foundation Data
16. County Bridge Number or Existing Bridge Number
17. For Information Only drawings
18. Welds Reviewed by (top left corner)

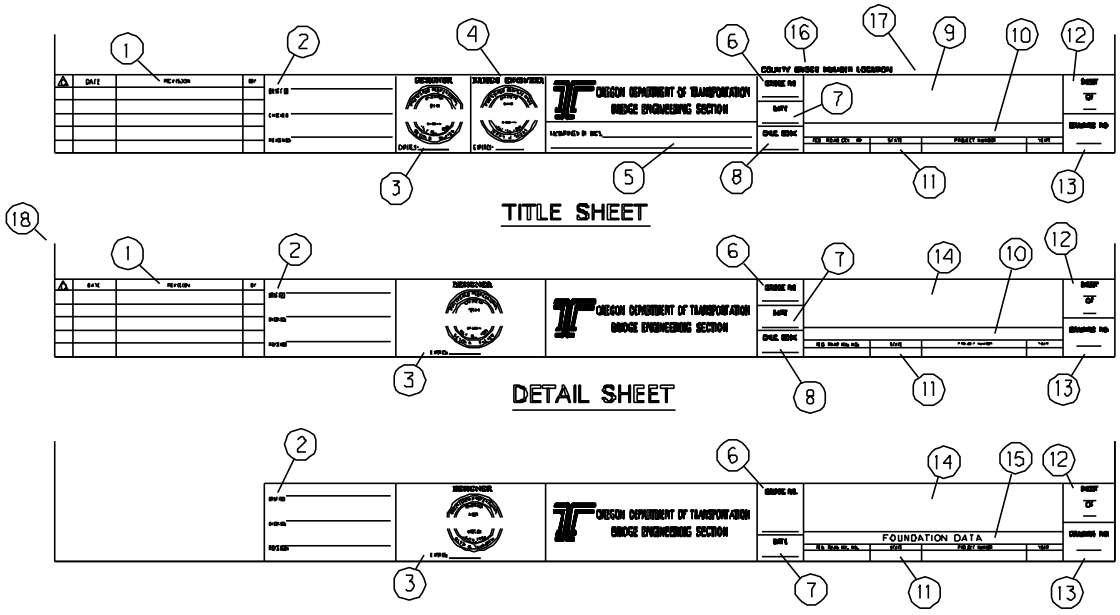


Figure 4.4.2B

4.5 LEAD DRAFTERS DUTIES ON LARGE PROJECTS

Large projects, with multiple or complex structures involving several designers and drafters, can often be completed more efficiently with one Designer and Drafter helping the Design Team Supervisor manage and organize the efforts of the design team. These Lead Designers and Drafters also benefit by gaining experience in project management and coordinating the efforts of other Designers and Drafters.

The following guidelines should be reviewed and agreed to by the designer and drafter.

- Get involved early to be knowledgeable about the overall project and deadline requirements.
- Make early estimates of time and number of sheets required.
- Be available to do TS&L sketches and drawings as needed.
- Coordinate and communicate with other Drafters.
- Monitor drafting progress and request help as needed to meet project deadlines.
- Review drafting for completeness and consistency.
- Maintain a current drawing file of all structures on the project.
- Attend project team meetings along with other Drafters involved.
- Stay informed of project status regarding schedules and deadlines.

4.6 TYPE, SIZE AND LOCATION PLAN & ELEVATION

The Type, Size and Location (TS&L) Plan and Elevation sheet is also used for the Final Plan and Elevation sheet. This information is placed on a title sheet.

4.6.1 PLAN

This is a plan view showing horizontal alignment and all major dimensions of the structure: total length, span lengths, rail pay limits, and numbers with type of construction (e.g., RCBG), bent numbers and stations (normally increasing from left to right), roadway width and out-to-out transverse dimensions. Show retaining walls, wing walls, abutments, existing utilities, right-or-way lines, catch basins, drains and where they drain to, and access manholes for utilities on box girders.

All dimensioning should be referred to the line described by the alignment data (e.g., "L" line or "C" line, etc.). No separate "structure center line" should be used.

North arrows should be shown on the Plan and Elevation Sheet, Foundation Data Sheet, and Footing Plan sheet. (**AC = NPOINT)**

To avoid confusion on multi-span structures, all supports whether they are technically abutments, bents or piers, shall be called "bents" and numbered consecutively.

4.6.1 PLAN – (continued)

Existing bridges or other structures which will be in place during the construction of a structure should be shown and, if necessary, tied down by dimensions. Existing structures and utilities to be moved or relocated should be so noted, and the responsibility for this work should be indicated. Structures which are to be removed or used in the performance of the contract should be shown.

This sheet typically contains the following: (if possible Type, Size and Location information should be on one drawing, but not always possible. Place Staging and Typical Section on second drawing when two drawings are needed)

- Location map (upper right corner)
- Plan (location of existing bridge if applicable) and Elevation
- Typical Section
- Proposed Loading (HL-93)
- Gradeline Diagram
- Vertical Elevation Diagram (including Datum information)
- Staging Details
- Hydraulic Data (if applicable)
- The TS&L Plan and Elevation sheet is normally drawn to a 1"=10' and 1"=20' scale.

4.6.2 LOCATION MAP

A small-scale location map is required to enable prospective bidders to locate the project. The map should be about 6" square (on final mylar) and placed in the upper right-hand corner of the sheet, but it can be placed elsewhere on this sheet if necessary. In cities, the name of the city and the names of important streets should be shown. In rural areas, the section, township and range should be shown and also the direction and distance to the nearest town. For railroad projects, show the section to the nearest 1/16 section. A north arrow should be shown on the location map (See Figure 4.6.2A). The project location should be identified with a bold arrow as shown in Figures 4.6.2B and 4.6.2C.

State, County and City maps may be found on the server \\S0442C\FTP in directory /TDB/TRANDATA/MAPS.

Map files use a .lam extension in file name.

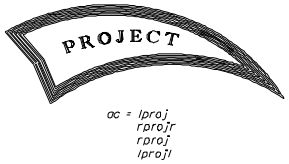


Figure 4.6.2B

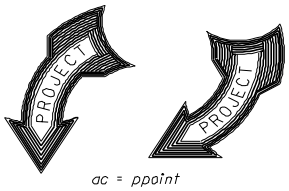


Figure 4.6.2C

4.6.2 LOCATION MAP – (continued)

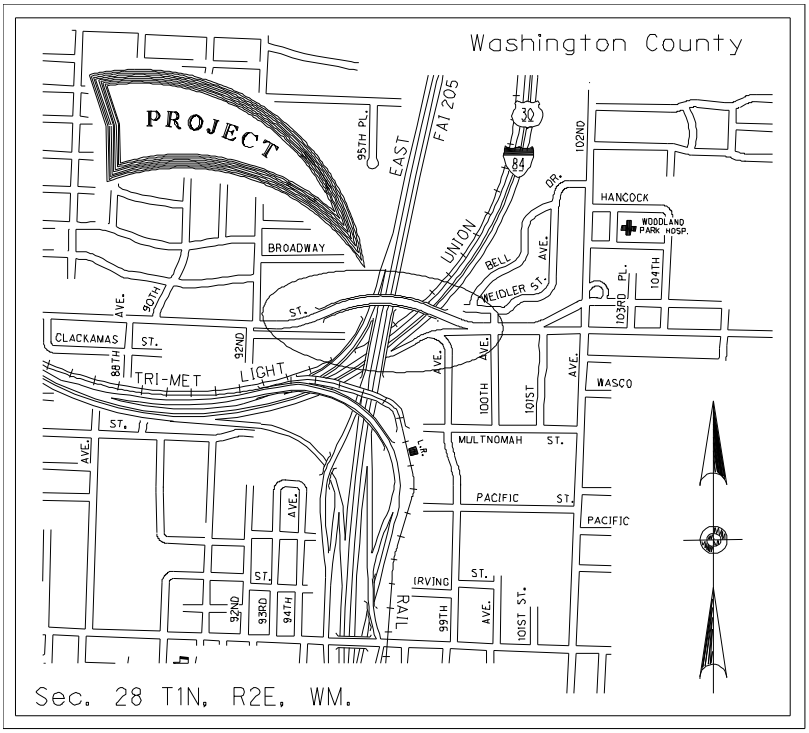


Figure 4.6.2A

4.6.3 CLEARANCE DIAGRAMS

Vertical clearances at the critical points over railroads, streets, roads and/or highways shall be shown. Where construction is to be over traffic and railroad, a construction clearance diagram shall be shown indicating both horizontal and vertical minimum clearances.

The support condition at each end of each span, "fixed", "expansion", "pinned", should be indicated. Show existing and future ground lines at centerline, left and right. Fill areas should be hatched and labeled as fill.

4.7 FINAL PLANS

4.7.1 LAYOUT FOR LARGE PROJECTS

An Index Sheet is usually provided where 30 or more sheets are required for a single structure or where several structures are to be built under the same contract. On this sheet, the structure drawings are listed with their drawing numbers and bridge numbers (if more than one structure) followed by the standard drawings needed for the project. A "title sheet border" should be used for the General Layout and Index sheet.

The Index Sheet should give an overall layout of the entire project with each structure and the accompanied drawings being listed. The sheet number shall be 1 of 1.

The sheet numbers for each structure shall begin with No. 1 for the Title Sheet of that structure. The total number of sheets for each structure shall be listed on the plans for that structure and shall include all of the standard drawings used for that structure. The sheet numbers for each structure shall begin with No. 1 for the Title Sheet of that structure.

When construction requires excavation adjacent to a railroad, a Railroad Shoring Requirement Diagram shall be shown. Limits of excavation and shoring requirements are shown in Section 5.4.8.2.

Details which are repeated several times or which require a note which is larger than can readily be placed close to the item detailed can be called out by a number in a circle. A corresponding number and circle along with the note can then be placed elsewhere on the sheet. Typical Detail references are shown in the Appendix Section A4.7.1.

4.7.2 FINAL PLANS, GENERAL

A set of drawings for a structure should contain all the information necessary for the layout and construction of that structure. Clear and complete plans form the basis for fair bidding. Details not properly covered can lead to high bid prices or extra work orders and price agreements during construction.

The use of notes, such as "Bent 3 similar", may be a good practice to save detailing, but should be used only if strictly true or if any differences are clearly noted.

Before detailing is begun, there should be good communication between the Designer and the Drafter to determine the number of sheets which will be required and what views and details are to be shown on each sheet. Sheets should be laid out to ensure sufficient room for unanticipated details which may be required later. **Take care at this time to ensure the** information is presented in a clear and logical manner.

No Pencil changes should be made to mylars. The only time for pencil changes is when doing As Constructed drawings. This will ensure that the electronic data is current.

4.7.2 FINAL PLANS, GENERAL – (continued)

Detailing practices will be discussed under the following headings:

- Plan and Elevation
- Foundation Data Sheet
- Stage Construction details (when needed)
- Footing Plan
- Deck Plan
- Superstructure Details
- Bent Details
- Miscellaneous Details
- Standard Drawings
- Plans For Information Only
- Revisions

4.7.3 PLAN AND ELEVATION

The Plan and Elevation sheet for the ordinary bridge is also the title sheet. It typically contains:

- Location Map
- Plan
- Elevation
- General Notes (see Appendix A4.7.3)
- Grade Line Diagram
- Hydraulic Data (if applicable)
- Loading Diagram (if applicable)
- Title Block
- Miscellaneous Additional Information

The plan and elevation and footing plan are normally drawn to the same scale and as large as possible.

4.7.3.1 Plan

This is a complete plan view showing horizontal alignment and all major dimensions of the structure: total length, span lengths, rail pay limits, traffic flow direction and numbers with type of construction (e.g., RCBG), bent numbers and stations (increasing from left to right), roadway, lane, shoulder, rail and median widths and out-to-out transverse dimensions. Show retaining walls, wing walls, existing utilities, right-of-way lines, abutments, catch basins, drains.

All dimensioning should be referred to the line described by the alignment data (e.g., "L" line or "C" line, et.). No separate "structure center line" should be used.

North arrow should be shown on the Plan and Elevation Sheet, Foundation Data Sheet, and Footing Plan sheet. (ac=npoint)

To avoid confusion on multi-span structures, all supports, whether there are technically abutments, bents or piers, shall be called "bents" and numbered consecutively.

4.7.3.1 Plan – (continued)

Existing bridges or other structures which will be in place during the construction of a structure should be shown and, if necessary, tied down by dimensions. Existing structures and utilities to be moved or relocated should be so noted, and the responsibility for this work should be indicated. Structures which are to be removed or used in the performance of the contract should be shown.

The location and type of detour structures should be shown as well as any information necessary to determine the responsibility for the construction and removal of these detours.

Space limitations on the title sheet may require that the footing plan and/or the grade line diagrams, General Notes, and other miscellaneous information be located after the Foundation Data Sheet. Do not put it on the Foundation Data Sheet.

Existing utilities, whether relocation necessary, and responsible entity for relocation.

4.7.3.2 Elevation

This is an overall elevation view showing the general appearance, grade and type of structure to be built. Spans and bents should be numbered in agreement with the plan view. The support condition at each end of each span, "fixed", "expansion", "pinned", should be indicated. Show existing and future ground lines at centerline, left and right. Fill areas should be hatched and labeled as fill. Bridge rails, pedestrian rails, special rail end treatment and slope paving, if any, should be called out by drawing number. The type of footings, bottom of footing elevations and type and size of piling, if any, should be indicated. For spread footings, the maximum required soil bearing capacity should be indicated for each footing.

Elevations based on the City of Portland Datum is 1.375 feet above the National Geodetic Vertical Datum (MSL = 0.0) and the Oregon Department of Transportation Datum.

Show an elevation bracketed to the left of the structure such as shown in Figure 4.7.3.2A.

The Datum used to establish the elevations shown on the drawing should be indicated. Normally, this will be the National Geodetic Vertical Datum (MSL = 0.0) or the Oregon Department of Transportation Datum.

If a different datum is used, indicate the relationship between the datum as shown in Figure 4.7.3.2B.

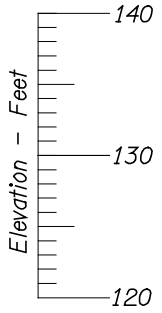


Figure 4.7.3.2A

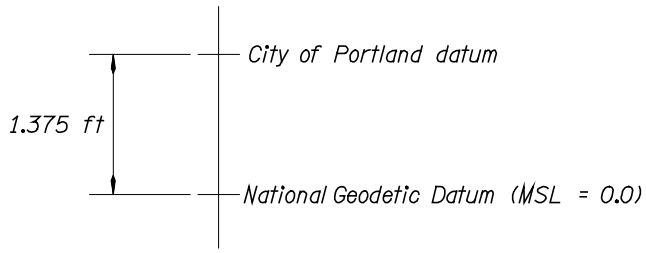


Figure 4.7.3.2B

4.7.3.3 Hydraulic Data

At stream crossings, show normal low water elevation and high water elevation with date of flood. Show low water channel width and channel change on both elevation and plan view. Show footing seals, riprap and navigation lights wherever applicable. Hydraulic data shall be as shown in Figures 4.7.3.3A and 4.7.3.3B for all bridges and for culverts greater than 6 feet in diameter.

STRUCTURES

HYDRAULIC DATA				
ITEMS	(UNITS)	DESIGN FLOOD	BASE FLOOD	ROADWAY OVERTOPPING FLOOD
DISCHARGE	(ft^3/S)			
RECURRENCE INTERVAL	(yrs.)			
H.W. ELEV. AT UPSTREAM FACE OF BRIDGE ALONG EMBANKMENT	(ft)			
BACKWATER	(ft)			

Figure 4.7.3.3A

PIPE ARCHES AND CULVERTS

HYDRAULIC DATA				
ITEMS	(UNITS)	DESIGN FLOOD	BASE FLOOD	MAX. PROBABLE FLOOD
DISCHARGE	(ft^3/S)			
RECURRENCE INTERVAL	(yrs.)			
H.W. ELEV. AT NATURAL CHANNEL, AT CULVERT INLET	(ft)			
HEADWATER ELEV. AT CULVERT INLET	(ft)			
BACKWATER DEPTH AT CULVERT INLET	(ft)			
TAILWATER ELEV. AT CULVERT OUTLET	(ft)			

Figure 4.7.3.3B

4.7.3.4 General Notes

General notes are normally located immediately below the location map. See Appendix Section A4.7.3 for General Notes.

4.7.3.5 Gradeline and Superelevation Diagrams

Show gradeline diagrams for the roadway carried by the structure and for all roads and/or railroads under the structure. The structure gradeline diagram should indicate the location of the structure by a dark heavy line. Roadway cross-slope or superelevation information should also be shown. The geometric controls should match the Roadway Plans.

4.7.3.6 Military Loading

When a structure is designed for military loading, place the military loading diagram shown in Figure 4.7.3.6A on the title sheet. A cell is available for placing this diagram (**AC=ML**).

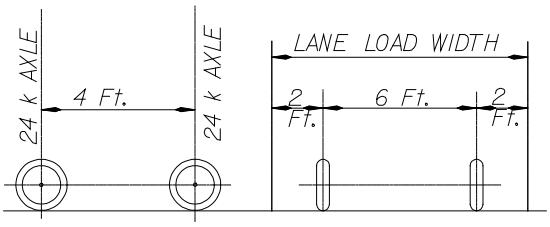


Figure 4.7.3.6A

4.7.3.7 Utilities and Right-of-Way

Show utilities located within the limits of the construction of the structure. Water lines, sewer lines, gas lines, power lines, telephone and telegraph lines are commonly encountered and should be indicated both in their existing and proposed locations. Railroad tracks, existing streets and highways and private roads should be shown. If right-of-way lines are close to the work area, they should be shown along with any temporary or permanent easements. In all cases where the location of utilities is critical, they should be tied by dimension and/or station, and in all cases where utilities are to be moved or salvaged, the responsibility for this work should be indicated. Underground utilities should be shown on the footing plan.

4.7.3.8 Railroad Clearance Diagram

For railroad overcrossing structures, a railroad clearance diagram is required. Where the intersection angle is 90 degrees, this can often be shown on the Elevation View. Otherwise, a separate clearance diagram normal to the centerline of the tracks will be required. Where there will be construction over or adjacent to railroad tracks, show a construction clearance diagram (possibly on the same view as the final clearance diagram). Construction clearance diagrams are also required for railroad shoofly tracks if the clearances provided are less than those required for permanent construction. Construction clearance requirements are shown in Section 5.4.8.2 .

Collision posts or crash walls, if required, should also be detailed on the plans or specified in the Special Provisions. Requirements are referred to in Section 5.4.8.2 .

4.7.3.8 Railroad Clearance Diagram – (continued)

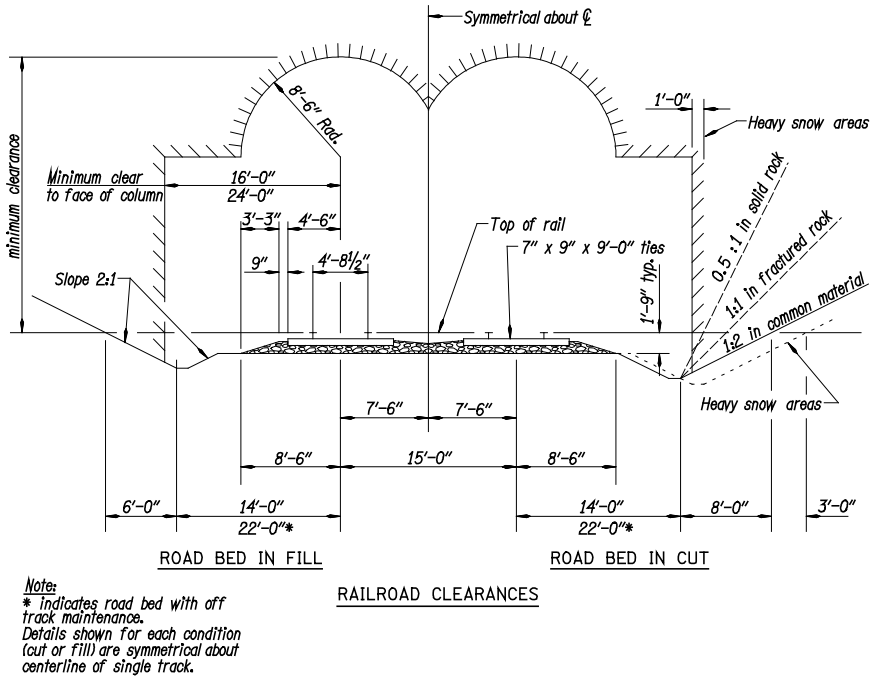


Figure 4.7.3.8A

4.7.3.9 Construction Clearance Diagram

When construction requires excavation adjacent to a railroad, a Railroad Shoring Requirement Diagram shall be shown. Limits of excavation and shoring requirements are referenced in Section 5.4.8.2 .

4.7.4 FOUNDATION DATA SHEET

A Foundation Data Sheet will normally be a part of each set of construction plans. This sheet should usually follow the Plan and Elevation sheet.

4.7.5 FOOTING PLAN

The purpose of the footing plan is to enable the footings to be laid out readily in the field. The intersection station and angle between each bent center line and the alignment center line shall be called out and the distance from the intersection to each footing or pile.

For spread footings, show "Minimum Required Bearing Capacity is __ psf." The value should be the average allowable bearing capacity as stated in the Foundation Report.

All underground utilities as well as existing footings should be shown on the footing plan.

4.7.6 DECK PLAN

If the plan view of the Plan and Elevation sheet is drawn to a scale of 1"=10' or larger, a separate deck plan may not be necessary. When a deck plan is required it should be drawn to a scale of 1/8" = 1'-0". Generally, a full deck plan should be drawn, however, if a structure is symmetrical or has repetitious elements it may be sufficient to draw only half or less of the total superstructure. In this case, the designer and drafter should study together how this can best be done so as to avoid confusion.

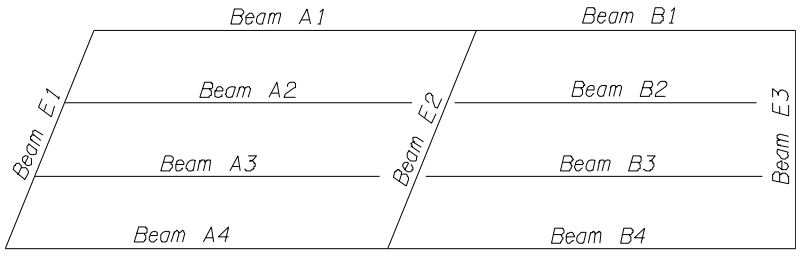


Figure 4.7.6A

Details normally shown on the deck plan include:

- Details which are repeated several times or which require a note which is larger than can readily be placed close to the item detailed can be called out by a number in a circle. A corresponding number and circle along with the note can then be placed elsewhere on the sheet. Typical Detail references are shown in the Appendix Section A4.7.1.

- The designated alignment line ("L" Line, "C" Line, etc.) to which all dimensions are tied. Show the bearing of this line if it is on tangent.

- Out-out widths of the structure.

- Bent centerline stations, numbers, and angles of intersection with the local tangent. The intersection angle should be dimensioned as the acute angle between centerlines of roadways or between centerline of roadway and centerline of bent. Where the intersection is on a curve, the angle should be measured from the local tangent to the curve at the point of intersection. The skew angle, which determines placement of deck steel, should not be dimensioned.

- Span numbers and lengths.

- Deck elevations with a note, "elevations shown are finish grade top of concrete at centerline of bent" (if ACWS is to be placed elevations may be shown 2" below finish grade if so noted).

- Drains, catch basins and drain pipes.

- Rail post spacing, rail splices and locations of preformed expansion joint filler in concrete curbs or parapets and rail pay limits.

- Light posts and electrical conduit and fixtures.

4.7.6 DECK PLAN – (continued)

Details normally shown on the deck plan include: - (continued)

- Deck steel placement if not parallel to bents.
- The location of utility lines carried in the structure, pipe hangers, concrete deck inserts, and the name of the owner, who will furnish the materials, and who will do the work.
- Access manholes, crawl holes and drain holes in diaphragms. Drain holes and access holes in the bottom slabs of box girders. Vent holes in top of stems.
- The centerlines of all longitudinal beams, cross beams and diaphragms. The distances between the centerlines of longitudinal beams along the centerline of the bent are normally shown here. If this proves too involved to do on the deck plan, it can be done on a plan view of the bent, in which case it would appear with the bent details.
- Beams usually identified by a single letter for the beams of one span with subscripts when the beams are not identical. See Figure 4.7.6A
- Lateral bracing for steel structures indicated by a single line. Its size may be called out here.
- The width of the stems of poured-in-place concrete girders. This may be done by a "cut away" view showing the typical dimensions of each type of beam used.
- Protective screening
- Earthquake Restraint
- Expansion joints
- End panels

4.7.7 SUPERSTRUCTURE DETAILS

4.7.7.1 General

The superstructure is that portion of the structure that extends from the bottom of the longitudinal beams upward. Here are a few basic types of superstructure construction:

- Cast-in-Place Concrete
- Slab
- Rigid Frame
- Reinforced concrete deck girder
- Reinforced concrete box girder (RCBG)
- Post-tensioned concrete box girder (RCBG/PT)
- Precast prestressed concrete
- Slab
- Girder
- Box beams
- Integral deck girder
- Channels (tubs)
- Segmental post-tensioned concrete - a structure combining elements of cast-in-place and precast prestressed concrete
- Steel structures
- Multi-beam, composite girder
- Through girder
- Truss
- Arch

Superstructure details for girder type structures consist primarily of longitudinal beam elevation views, superstructure sections, and diaphragm and cross beam details.

4.7.7.2 Superstructure Sections

A "Typical Deck Section" is a transverse cross-section of the superstructure showing the deck, beams and curbs or parapets, if any. Required dimensions include the out-out width of the structure, roadway width, beam spacing, the location of these with respect to the designated alignment centerline and the deck thickness, reinforcement bends and bar spacing.

4.7.7.2 Superstructure Sections – (continued)

The deck section should be drawn to a scale of not less than 3/8" = 1'-0". A separate deck section is required for each type of construction used. Additional sections may be required if the roadway width or number of size of beams changes. Half sections may be used for symmetrical superstructures. On wide superstructures with many identical girders at equal spaces, a portion of the width may be omitted to save space and detailing. The number, size and spacing of deck reinforcing bars should be listed adjacent to the deck section. A note should refer to rail drawing(s) for additional reinforcement at rails.

For conventionally reinforced continuous concrete structures, the location of the main longitudinal bars can be called out by letter on typical sections (or half-sections) of the superstructure at midspan and near interior supports. These bars can then be listed in a table showing the letter designation, number required, size and length, and the distance to some control point. These sections can also be used as typical deck sections (see above). Separate sections of individual girder stems are often shown to call out such details as the shape and dimensions of vertical stirrups and the location of temperature reinforcement.

4.7.7.3 Diaphragm and Cross-Beam Details

Diaphragm beams for concrete girder structures are usually shown in elevation on the typical deck section. Details required include reinforcing bars and the size and location of utility holes. Crawl holes and drain holes through the diaphragm must be shown for box girders. A section through the diaphragm beam showing dimensions and reinforcing bars should be shown on the same sheet.

Cross beams and end beams for concrete structures are normally shown on the bent drawings.

4.7.7.4 Longitudinal Beam Elevation Views

The elevation view of a cast-in-place concrete girder should show the total length, the lengths between centerlines of bents or bearings, the location of diaphragm beams, haunch dimensions (vertical), stirrup spacing, beam end condition and longitudinal reinforcing bar location.

For post-tensioned concrete box girders, a diagram showing the path of the post-tensioning center of gravity is normally placed above the longitudinal beam elevation.

For steel girders, standard precast prestressed concrete girders and the tensioning details of post-tensioned box girders, there are file drawings which can be completed to cover most of the required details. Use these if possible. If not, use them as patterns for the manner of presenting information.

For all structures which make use of prefabricated beams, there shall be a note saying, "All dimensions shown are horizontal and must be corrected for slope." This note appears on the standard steel beam and prestressed girder sheets and need not be repeated.

Plate diaphragms and cross beams for steel structures must be detailed separately.

So far as possible, beam details should be completed on each sheet for the spans shown there. Notes referring to common details which appear on other sheets should be placed immediately above the title block.

Camber diagrams - Required for all structures. A note should be placed by the camber diagram as to the assumptions on which it is based.

4.7.8 BENT DETAILS

4.7.8.1 General

The following information, as applicable, shall be shown for all bents. Where abutments are used it is necessary to show the final ground elevation inside the abutment. This may be shown on a side elevation of the abutment used for other purposes or may be shown on a separate sketch.

4.7.8.2 Plan View

A plan view of a pier, bent or abutment should be shown if it is necessary to tie down the arrangement of beams or to show features at the deck level which influence the details of the substructure. Drains, special reinforcement at joints, et cetera, may be shown in this view. On some bents, a plan at the bearing level is necessary to show the arrangement of bearing devices and anchor bolts.

4.7.8.3 Elevation

An elevation view showing the dimensions and reinforcement of columns, web walls, caps, crossbeams, etc., shall be shown. The location of utility holes should be indicated. The vertical dimensions of the footings or pile caps, and the elevations of the bottoms of the footings or pile caps, should be shown on this view. If the footings or pile caps are sloped, show the elevations at each end.

4.7.8.4 Footing Plan

A footing plan showing the size and reinforcement of footings (and seals) and the size and locations of piles, if any, shall be shown. The location of the footings with respect to the designated alignment line and the intersection angle of the footing centerline with that line shall be shown. Sectional views of columns or shafts with dimensions and reinforcement may be shown in this view or elsewhere on this sheet.

4.7.8.5 Details

Reinforcing and dimensions of cross-beams, caps, wing walls and web walls shall be shown in cross-section views. All reinforcing steel shall be called out by size, length and spacing. Stirrup and hoop details shall be clarified by separate diagrams if necessary.

The following procedures which reduce the amount of detailing may be used if they do not reduce the clarity of the plans. Draw similar bents, footings or cross-beams only once and double dimension or make a table of varying dimensions.

If possible, bent details should be complete on any sheet for the bents shown there. Place notes referring to common details which appear on other sheets immediately above the title block, and reference individual details to their location.

4.7.9 MISCELLANEOUS DETAILS

Each set of drawings shall have included such miscellaneous details as are required for the completion of the project. These would include the following:

- Concrete pour schedules.
- Bearing devices - details of bearing devices shall be shown and their material called out. List the location and number required for each type or size of bearing.
- Steel beam details - framing and bracing, splices, etc.
- Deck joint details - armored corners, paving dams, joint seals, etc.
- Electrical and lighting details.
- Signing support details.
- Pile details - tip reinforcement, encasement, etc.
- Median details - barrier rail, longitudinal joint, etc.
- Shoring plan and Falsework diagram and lighting.
- Surface finish diagram.

4.7.10 PLANS "For Information Only"

When plans of an existing bridge are to be included in a set of contract drawings, the designer or drafter should obtain the full-scale tracings. Place the following tag on each drawing in a manner that can be removed:

These drawings should then be added to the contract tracings. When drawings are placed back into the file, the For Information Only tag should be removed.

4.7.11 REVISIONS

Revisions to drawings shall be noted under the following conditions:

- Final drawings which have been sent to prospective bidders (generally, any time after the Bridge Engineer has signed them) or are a part of a job under contract.
- "As Constructed" prints that are returned at the completion of a project.

Revised final drawings and "As constructed" drawings (2nd and 3rd items above) shall normally have the changed detail lined out, not erased. Where changes are such that they cannot be made feasibly by lining out, the change note shall include ("redrawn") next to the description of the change.

4.7.11 REVISIONS – (continued)

Revisions shall be noted by a number in a triangle next to the change and in the title block.

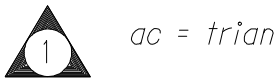


Figure 4.7.11A

Revisions should not be made on final drawings between the latest date that a letter of addendum can be sent out and the bid opening date. This generally means at least 10 days before the bid opening date. Failure to observe this could result in some bidders obtaining revised plans while others did not. After the bid opening, revisions can be made and sent out as a construction change.

Revisions to project will have designer's initials shown, As Constructed changes should have the Drafters initials. See Figure 4.7.11B.

△	DATE	REVISION	BY	
1	8-21-79	Added temporary rail	RLM	DRAFTED
2	8-21-79	change longitudinal joint	RLM	
3	10-2-79	change post dimension	RLM	CHECKED:
4	11-7-80	As Constructed	JLS	
				REVIEWED:

Figure 4.7.11B

When drawings are revised or added to the project plans after advertising or during the contract period, see Section 3.1.2.3.

All "As Constructed" revisions on one sheet should have the same revision number, consecutive with previous revisions on that sheet. If there are no "As Constructed" revisions, add the date and "As Constructed" with no triangle or revision number. The name of the Project Manager shall be shown on the title sheet.

"As Constructed" revisions are made by hand to the original signed mylar and not made to the electronic cad files.

Distribute "As Constructed" drawings as indicated in Section 3.1.10.

4.8 PLOTTING

The following chart shows several types of plotters and media type available:

Server	Printer Name	Media Type	Media Size (inches)
S0442B	Pr+crew #A	Paper	8.5 x 11
S0442B	Pr+crew #B	Paper	11 x 17
pn1	P24	Paper	400 x 24
pn1	P36	Paper	400 x 35
pn1	M36	Mylar	400 x 35

- MBRPLOT - This is an automated plot routine for running multiple plots from different PGRID locations while outside the graphics environment. (See Figure 4.8A)

- IPLOT - This is used while in Graphics file using a fence and the IPLOT tutorial to plot desired drawings.

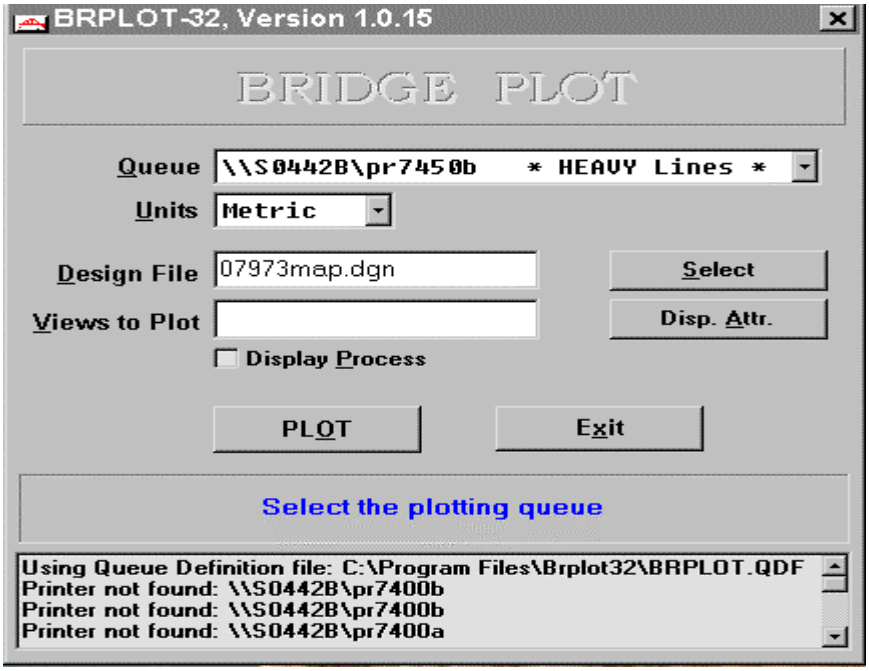


Figure 4.8A

During the design phase of a project there are different requirements as far as what kind of plot is ordered. The following are suggested guidelines.

- Check Prints - Use queue's for plotters located within your crew's room for half size paper prints
- Preliminary Plans - Same as "Check Prints"
- Advanced Plans - Use half size paper prints (sent with Roadway Plans)
- Final Plans - Use queue Mylar for full size mylar prints

4.9 TRANSFER OF ELECTRONIC FILES TO CONSULTANTS

There are several ways to send files outside of ODOT. Using floppy disk, electronic mail (this method is discouraged for large design files) and using the internet.

Using the internet (through FTP ws_ftp32):

1. Using File manager open ftp window. (See Figure 4.9A)

2. Key-in (See Figure 4.9B)
   Profile name = ftp.odot
   Host name = ftp.odot.state.or.us
   Host type = Microsoft NT
   User ID = Anonymous
   Password = Guest

3. Next click on these boxes
   x = Anonymous
   x = Save Password
   = leave this box blank

4. Press Save button to save configuration.

5. Press okay or return key.

6. Once in the FTP.ODOT.STATE.OR.US
   Change directory to /temp and now you are in the directory that is used by consultants to receive electronic data.

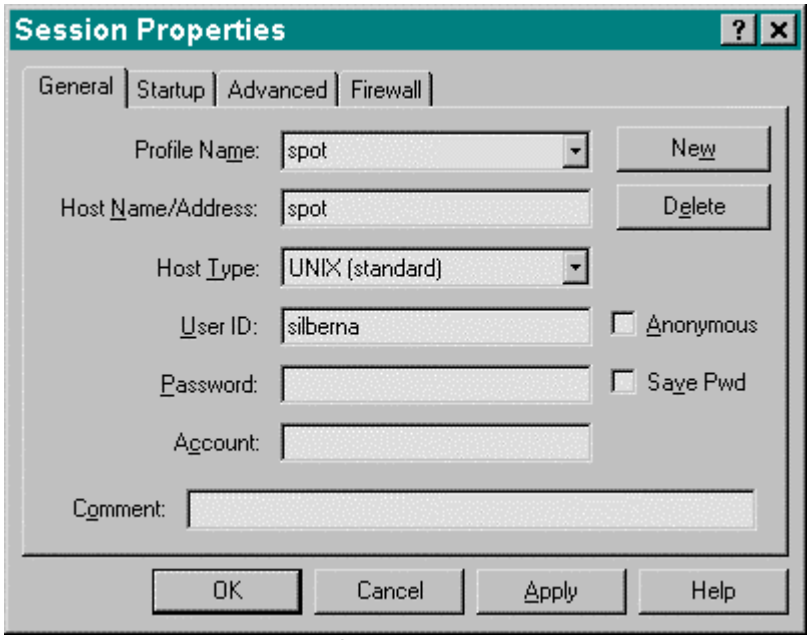


Figure 4.9A

4.9 TRANSFER OF ELECTRONIC FILES TO CONSULTANTS – (continued)

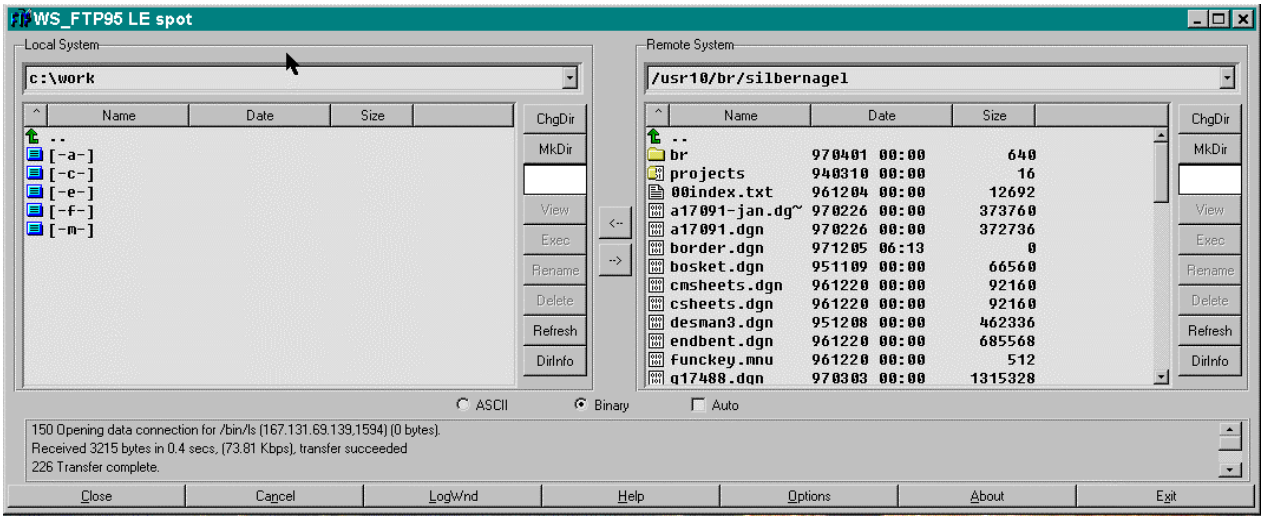


Figure 4.9B

Using the internet (through Connect Network Drive:

1. In “File Manager” go to disk, then to “Connect Network Drive” then select shared directories “S0442C” then “inetsv”**.**

2. Open directory “ftproot”, then temp, then create consultant directory or open existing directory like ABKJ, OBEC …etc.

3. Open drive “C” and tile windows, so both drive are open on the screen.

4. Copy Files from “C drive” to the consultants directory on the internet.

*** Remove files from consultant directory after they have received the files successfully.**

4.10 ARCHIVING CAD FILES

Once a project has been printed on mylar, then the files should reside on your workstation until shortly after the projects has gone to bid before being archived.

Just before archiving your files, there needs to be a scale disclaimer note placed in the file. (**AC=DISNOT**) Remember to save setting around this note, so it only appears when entering the file.

Scale Disclaimer note
These drawings may or may not be drawn
to scale or the scale shown. Therefore
any measurements may not be accurate,
but the dimensions noted on the drawings
are correct.

Files to be archived should be sent to the server (spot) and placed in the archive directory. (Archive directory = spot:/usr/archive/bridge/current date/key number/filename) A key number directory will need to be created under current date (example 19970911) directory, and then place the files in the appropriate directory.

It is the Structural Drafters responsibility to see that key numbers are archived in the proper directory. Remember to do this in a timely manner, so that everyone can find the files they need.

When files are retrieved from Archives directory for another project, remember to rename these files. (filename.ref)

SECTION 4: APPENDIX

A4.1.1 TEXT

Abbreviations:

GENERAL

1. Abbreviations should not be used where the meaning may be in doubt. If there is a possibility of confusion, the term should be spelled out.

2. A period should be placed after all abbreviations, except as listed below.

3. Apostrophes are usually not used. Exceptions: pav't., req'd.

4. Abbreviations for plurals are usually the same as the singular. Exceptions: figs., nos., ctrs., pp.

5. Abbreviations in titles should be avoided if possible.

List of Abbreviations Commonly Used on Bridge Plans

A

additional	add'l.
adjust, adjacent	adj.
alternate	alt.
ahead	ah.
American Society for Testing Materials	ASTM
American Association Of State Highway and Transportation Officials	AASHTO
Anchor Bolt	A.B.
and	&
approximate	approx.
approved	appd
asphalt concrete	AC
Asphalt Concrete Wearing Surface	ACWS
assembly	assy
at	@ (used only to label spacing or pricing, otherwise spell out.)
Avenue	Ave.
average	avg.

B

back	bk.
beam	Bm.
bearing	Brg.
begin vertical curve	BVC
bent	Bt.
between	btwn.
bottom	btm.
bottom of	B.O.
bridge	Br.
building	bldg.

C

cast-in-place	CIP
center, centers	ctr., ctrs.
centerline	CL or L
center of gravity	cg
center of gravity of strands	cgs
center to center	ctr-to-ctr or c-c
centered	ctrd.
clearance, clear	cl.
compression, compressive	comp.
column	col.
concrete	conc.
concrete pavement	PCC pav't.
connection	conn.
construction	const.
continuous	cont.
corrugated metal pipe	CMP
County	Co.
Creek	Cr.
crossbeam	X-Bm.
crossing	Xing
cross section	X-Sect
cubic feet, meters	ft^3 ,m^3
cubic in, millimeters	in^3 ,mm^3
culvert	culv.

D

degrees, angular	^{o} or deg.
degrees, thermal	^{o}C, ^{o}F
diagonal(s)	diag.
diameter	dia. or ø
diaphragm	diaph.
dimension	dim.
District	Dist.
double	dbl.
drawing, drawings	dwg, dwgs
drill and tap	D & T
Drive	Dr.

E

each	ea.
each face	EF
each way	EW
easement	ease.
East	E
edge of pavement	EP
edge of shoulder	ES
electric	elect.
elevation	El.
embankment	emb.
end vertical curve	EVC
Engineer	Engr.
estimate(d)	est.
excavation	exc.
excluding	excl.
expansion	exp.
existing	extg.
exterior	ext.

F

far face	FF
far side	FS
feet, foot	ft.
figure, figures	fig., figs.
flange	flg.
footing	ftg.
forward	fwd.
Freeway	Fwy.

G

galvanized	galv.
galvanized steel pipe	GSP
gauge	ga.
Grade	Gr.
ground	grd.

H

hanger	hgr.
height (retaining wall)	ht.
hexagonal	hex.
high strength	HS
high water	HW
high water mark	HWM
Highway	Hwy.
hook	hk.
horizontal	horiz.
hour(s)	hr.
included, including	incl.
inside diameter	ID
inside face	IF
inside radius	IR
interchange	intchge.
interior	int.
intermediate	interm.

J

joint	jt.
junction	jct.

K

Kilometer	km

L

left	lt.
length of curve	LC
longitudinal	longit.
long	LG
lump sum	L.S.

M

maintenance	maint.
manhole	MH
manufactured	mfd.
manufacturing	mfg.
material	mat'l.
maximum	max.
meter	m
mile	mi.
millimeter	mm
minimum	min.
minute(s)	min.
miscellaneous	misc.

N

National Geodetic Vertical Datum	NGVD
near face	NF
near side	NS
nominal	nom.
North	N
Northbound	NB
number, numbers	No., Nos., #

O

original ground	OG
outside diameter	OD
outside radius	OR
out to out	o-o
overcrossing	O'xing

P

page, pages	p. or pp.
pavement	pav't.
pedestrian	ped.
Plans, Specifications and Estimates	PS&E
plate	PL
point	pt.
point of compound curve	PCC
point of curvature	PC
point of intersection	PI
point of reverse curve	PRC
point of tangency	PT
point on vertical curve	PVC
point from tangent to spiral	PS
point from spiral to circular curve	PSC
point from circular curve to spiral	PCS
point on spiral	POS
point on horizontal curve	POC
point on tangent	POT
polyvinyl chloride	PVC
Portland Cement Concrete	PCC
prestressed	prest.
prestressed concrete pipe	PCP

Q

quantity	qty.

R

radius	R.
railroad	RR
Range	R.
reinforced, reinforcing	reinf.
reinforced concrete	RC
reinforced concrete box beam	RCBB
reinforced concrete box culvert	RCBC
reinforced concrete deck girder	RCDG
reinforced concrete box girder	RCBG
reinforced concrete pipe	RCP
required	req'd.
retaining wall	ret. wall
revised (date)	rev.
right	rt.
right of way	R/W
River	R.
Road	Rd.
roadway	rdwy.

S

seconds (angular)	“
seconds (time)	sec
Section (map location)	Sec.
Section (of drawing)	Sect.
sheet	sht.
shoulder	shld. or sh.
sidewalk	SW or sdwk.
slope	sl.
South	S
Southbound	SB
spaces	spcs
spaced	spcd.
spacing	spcg.
splice	spl.
specification	spec.
square kilometer	km^2
square feet,meter	ft^2,m^2
square inch, milimeter	in^2 ,mm^2
standard	std.
Station	Sta.
stiffener	stiff.
stirrup	stirr.
Street	St.
structure, structural	str.
support	supp.
surface, surfacing	surf.
symmetrical	symm.

T

top & bottom	T & B
tangent	Tan. or T.
telephone	Tel.
temporary	temp.
test hole	T.H.
thick(ness)	thk.
township	T.
top of	T.O.
transportation	trans.
transverse	transv.
typical	typ.

U

ultimate	ult.
undercrossing	U'xing

V

variable, varies	var.
vertical	vert.
vertical curve	VC
volume	vol.

W

wearing surface	WS
weight	wt.
West	W
Willamette Meridian	WM
with	w/
without	w/o

A4.1.6 DRAWING BORDERS

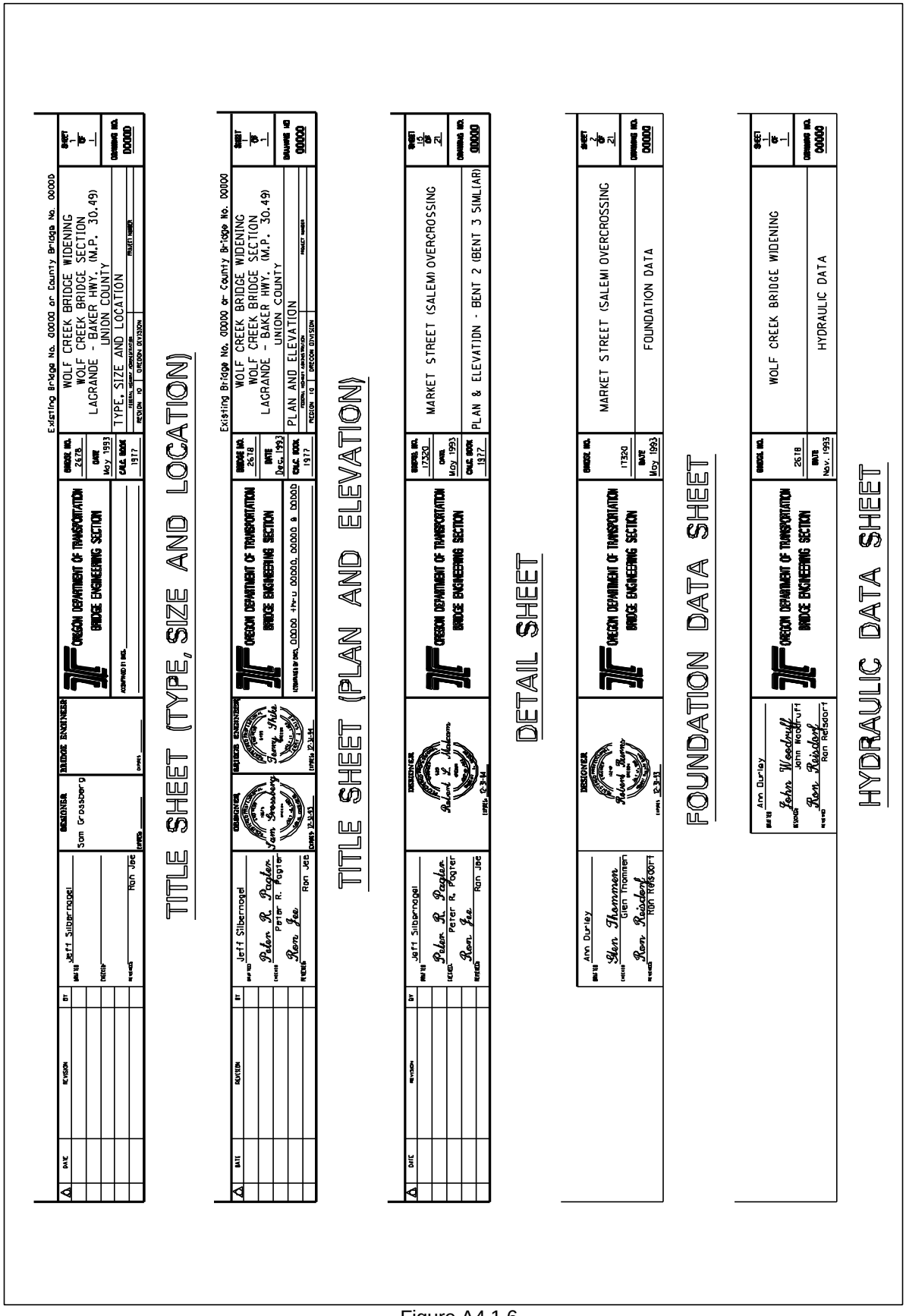


Figure A4.1.6

A4.2.2 LINE WORK

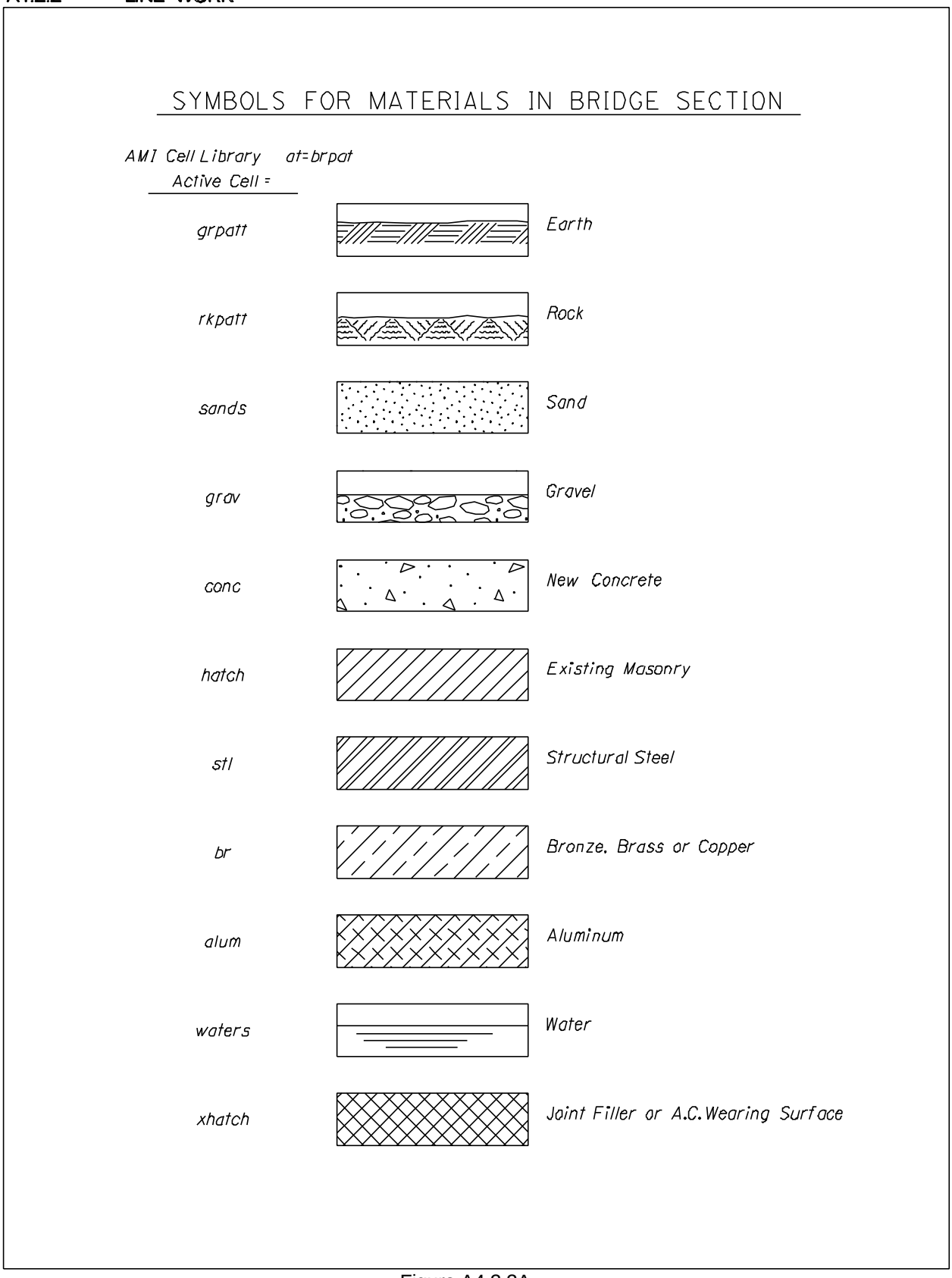


Figure A4.2.2A

A4.2.2 LINE WORK

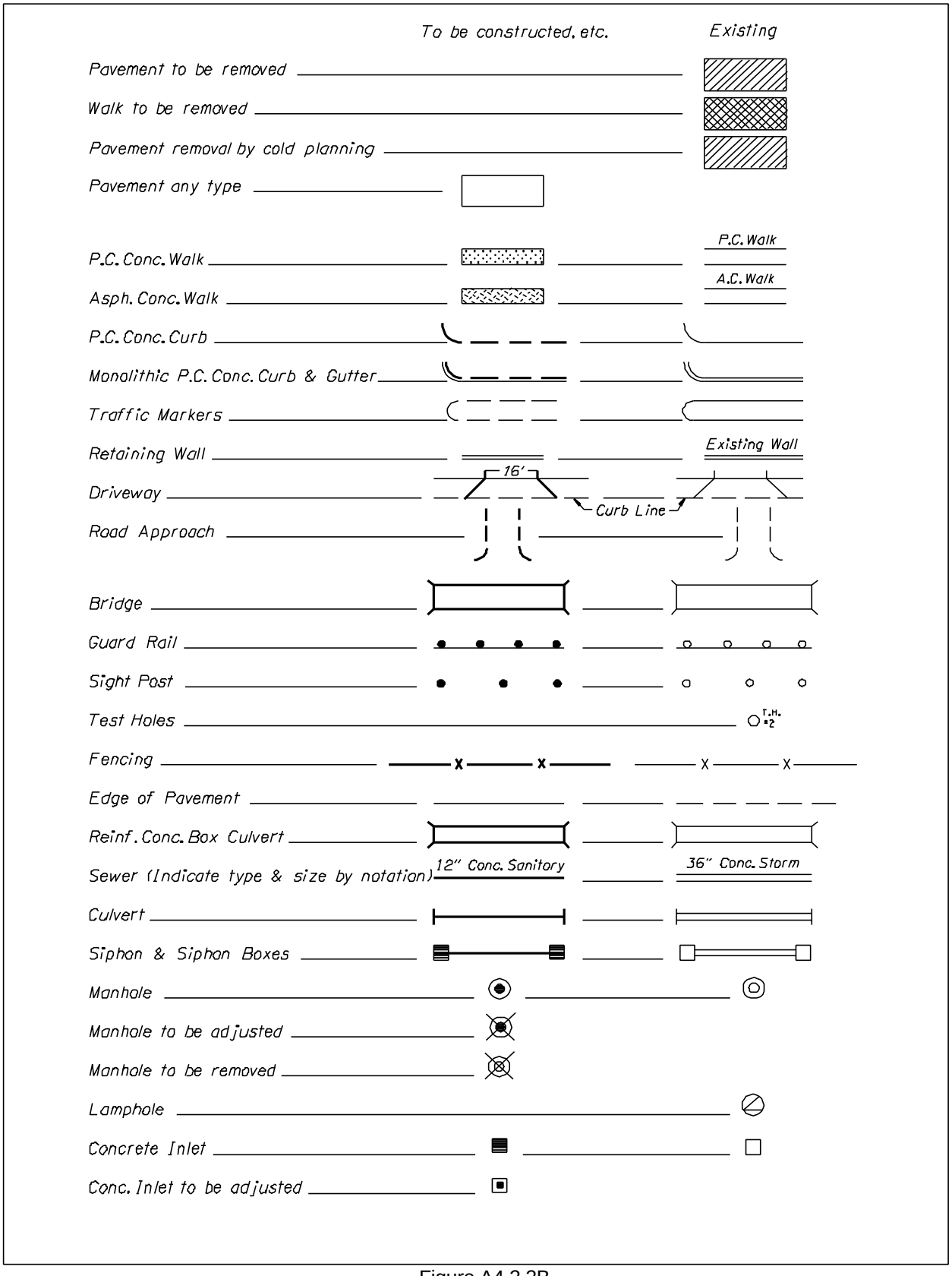


Figure A4.2.2B

A4.2.2 LINE WORK

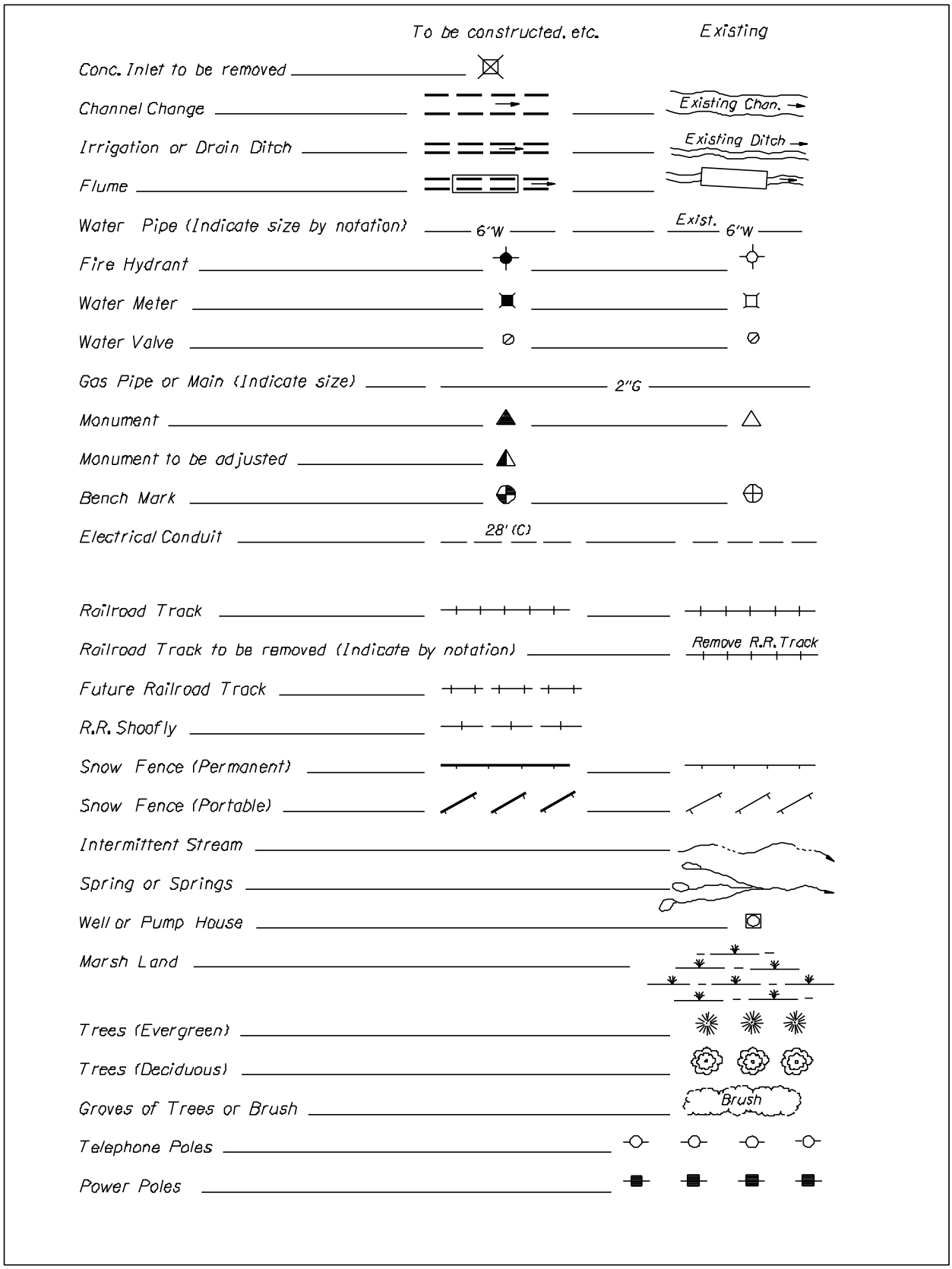


Figure A4.2.2C

A4.2.2 LINE WORK

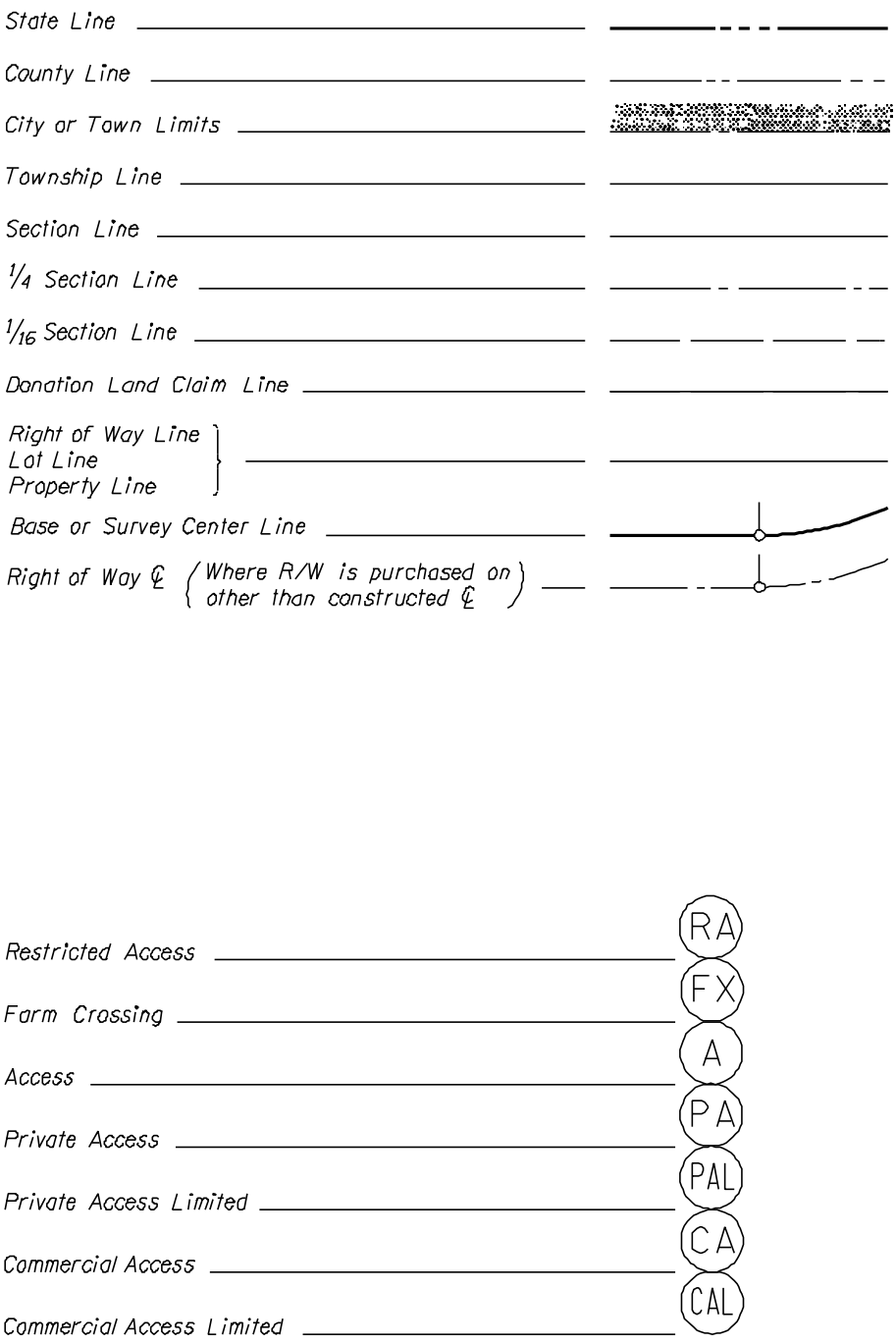


Figure A4.2.2D

A4.3.1 Directory Setup

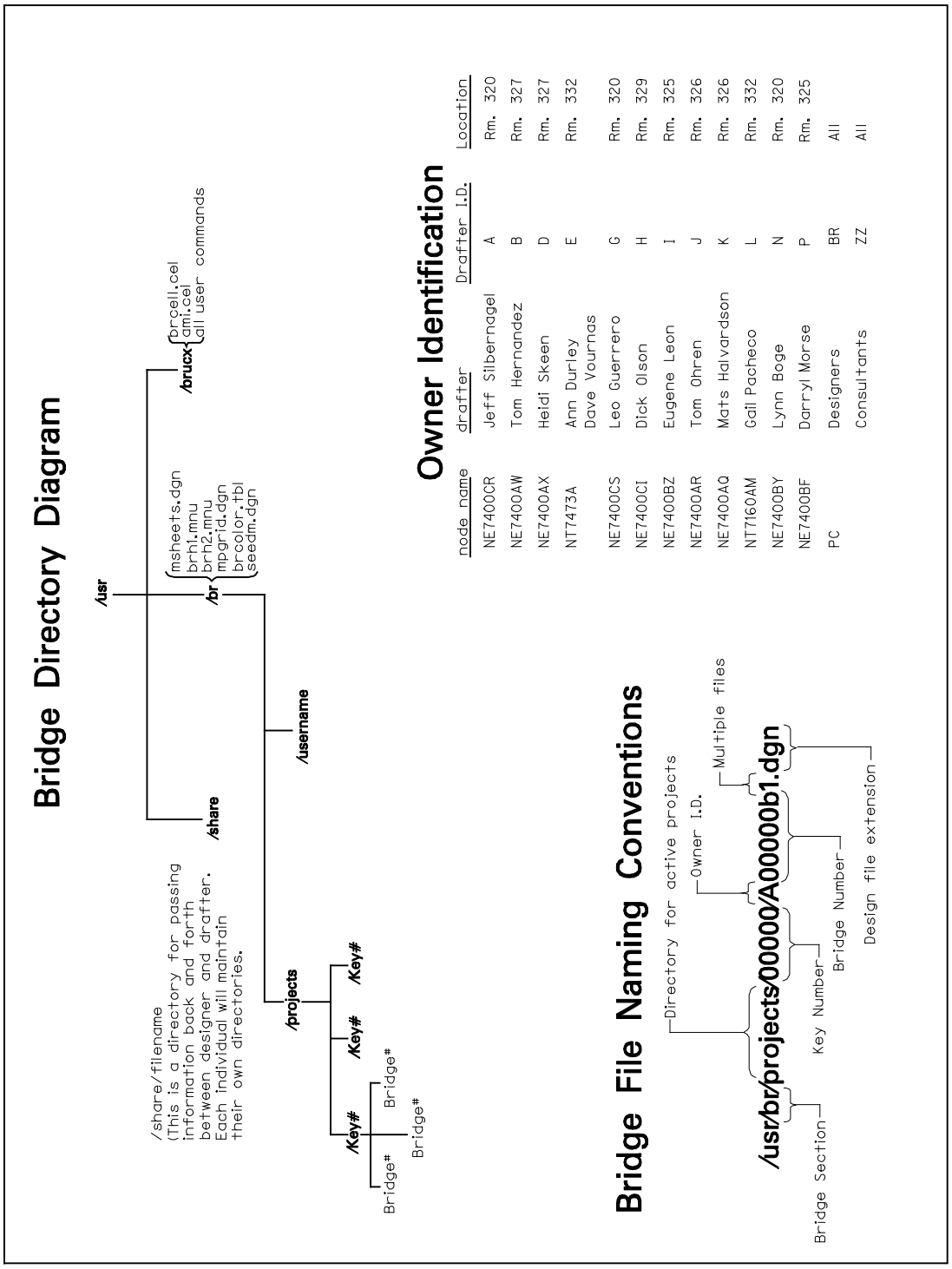


Figure A4.3.1A

A4.7.1 DECK PLAN

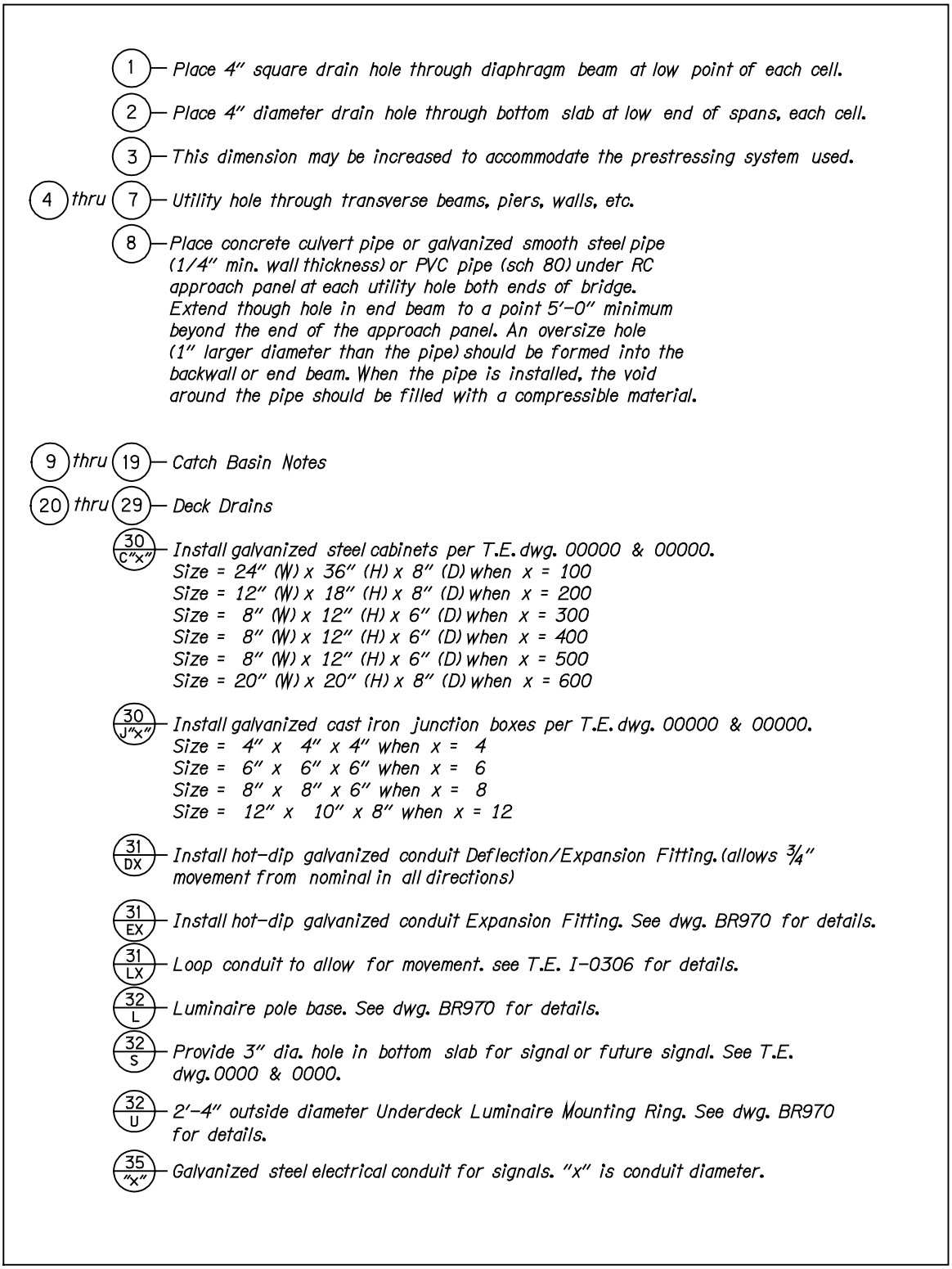


Figure A4.7.1A

A4.7.1 DECK PLAN

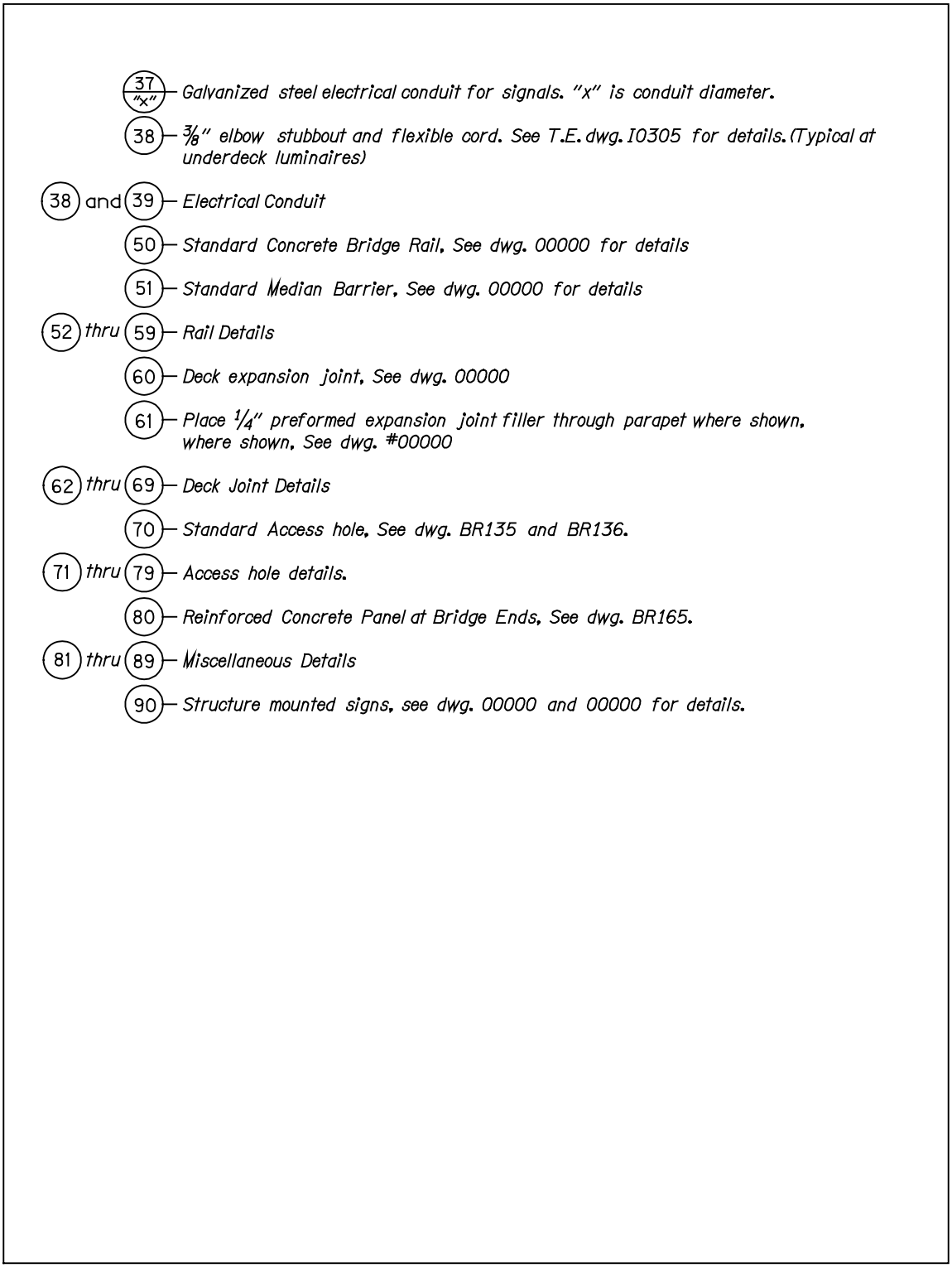


Figure A4.7.1B

A4.7.3 PLAN AND ELEVATION

[Note: The following is only a guide for General Notes. Omit those sections, items and terms in parenthesis that are not applicable, except retain the parenthetical references to ASTM equivalents to AASHTO Specifications.]

General Notes:

Provide all materials and perform all work according to the 2002 Oregon Standard Specifications for Construction.

Bridge(s) are designed for (HL-93) (and military) loading with an allowance of (25psf for present wearing surface) (and) (25psf, 50psf) for future wearing surface.

Concrete deck is designed using the empirical method for isotropic reinforcing of the Ontario Highway Bridge Design Code. [Use for bridges with isotropic decks]

Concrete members (except prestressed members) are designed by Load Factor Design Method. [Use only for load factor designed bridges]

[New Seismic Designs ----- Multi-Span Bridges]:
Seismic design is by single-mode (multi-mode) analysis in accordance with the AASHTO Division I-A, Seismic Design, "Standard Specifications Seismic Design of Highway Bridges". The site peak bedrock acceleration coefficient (A) is ___g and the assumed site coefficient (S) is ____. The Response Modification factors used are: R=___ for column moments, R= 0.8 for abutment connections, and R= 1.0 for other – components.

[New Seismic Designs -----Single-Span Bridges]:
Seismic design is in accordance with the AASHTO Division I-A, Seismic Design, "Standard Specifications Seismic Design of Highway Bridges". The site peak bedrock acceleration coefficient (A) is ___g and the assumed site coefficient (S) is ___.

[Widenings which do not carry the existing structure]:
Seismic design for widening is by single-mode (multi-mode) analysis, with Response Modification Factors, in accordance with the AASHTO Division I-A, Seismic Design, "Standard Specifications for Highway Bridges". Seismic design is based on __ ft of superstructure width and is not designed to carry the seismic load of the existing structure. The site bedrock acceleration coefficient (A) is __g and the assumed site coefficient (S) is __.

[Widenings which do carry the existing structure]:
Seismic design for widening is by single-mode (multi-mode) analysis, with Response Modification Factors, in accordance with the AASHTO Division I-A, Seismic Design, "Standard Specifications for Highway Bridges". The widened structure is designed to resist the full seismic load including the existing structure. The site bedrock acceleration coefficient (A) is __g and the assumed site coefficient (S) is __.

General Notes: - (continued)

[Phase 1 Seismic Retrofit Designs - select appropriate sections:]

Seismic retrofit design to prevent superstructure pull-off is based on a site bedrock acceleration coefficient (A) of ____g and an assumed site coefficient (S) of ____.

[Simple Span Support Connections:]
Longitudinal design forces:
Force to prevent pull-off by single-mode analysis, without substructure stiffness considered, with a maximum response not greater than 2.5 x A.

Transverse design forces:
Force equal to 2.5 x A x supported dead load.

[Continuous Span Series Support Connections:]
Longitudinal design forces:
"Plastic hinging" of columns and forces to prevent pull-off by single-mode analysis, considering substructure stiffness with column capacity limitation (strength), maximum response not greater than 2.5 x A.

Transverse design forces:
"Plastic hinging" of column(s) (and x-beam frame).

[In-Span Hinges:]
Longitudinal design forces:
"Plastic hinging" of columns and forces to prevent pull-off by single-mode analysis, considering substructure stiffness with column capacity limitation (strength), maximum response not greater than 2.5 x A.

Transverse design forces:
Force equal to 2.5 x A x supported dead load.

Cable for seismic restraint devices will be furnished by the Department. See Section 00160.30 of the Special Provisions.

( ) indicates (Options), [ ] indicates [Instructions]

All Bent(s), Provide _____ [insert pile type & grade of steel*] piling (with reinforced tips) driven (open-ended or closed-ended) to an ultimate capacity of _____ kips per pile.

* *example* ==> Pipe Pile ==> 12-3/4 x 0.375, ASTM A252 (Grade 2)(Grade 3)

H-Pile ==> HP 10 x 42, ASTM (A36) (A572)

Pile tip elevation for minimum pile penetration at (All) Bent(s) (___) (is elevation _____ feet) (according to the Pile Penetration Table).

General Notes: - (continued)

[Use one of the following as directed by the Foundation Unit]

Drive (Bent ___), (All) piling to the specified ultimate capacity using driving criteria developed from a Wave Equation Analysis.

Drive(Bent ___), (All) piling to the specified ultimate capacity using driving criteria developed from the ODOT Gates Equation.

Determine (Pile capacities from the results of Capwap Analysis and/or Dynamic Pile Load Tests as specified in the Special Provisions.

(If applicable:)

Support all falsework on driven piling.

NOTE: If project plans have a separate footing plan sheet, place all foundation design notes on the footing plan sheet and reference them in the "General Notes"; "See Footing Plan for foundation design notes."

Provide spiral column reinforcement according to ASTM Specification A706, AASHTO Specifications M31 (ASTM A615) Grade 60, AASHTO M225 (ASTM A496), or AASHTO M32 (ASTM A82).

Provide all (other) reinforcing steel according to ASTM Specification A706, or AASHTO M31 (ASTM A615) Grade 60. (Provide Field bent stirrups according to ASTM Specification A706.) Use the following splice lengths (unless shown otherwise):

Reinforcing Splice Lengths (Class B) Grade 60										
Bar Size	#3	#4	#5	#6	#7	#8	#9	#10	#11	#14 & #18
Uncoated	1’-0”	1’-4”	1’-8”	2’-0”	2’-8”	3’-6”	4’-4”	5’-7”	6’-9”	Not permitted
Coated	1’-5”	1’-10”	2’-4”	2’-10”	3’-9”	4’-11”	6’-1”	7’-10”	9’-6”	Not permitted

Splice reinforcing steel at alternate bars, staggered at least one splice length or as far as possible, unless shown otherwise.

Support the bottom mat reinforcing steel from the forms with precast mortar blocks at 36” maximum centers each way. Support the top mat of reinforcing steel from the bottom mat of reinforcing steel with reinforcing bar supports by Dayton Superior Co. (SBU, BBU, or CHCU) or approved equal at 36” maximum centers.

Epoxy coat reinforcing steel in the upper portion of the deck (and bridge end panel). This includes top longitudinal bars, (and) top transverse bars (including "truss" bars), (bars " ", " " and " ") [(and all bars extending from the Bridge End Panel) into the (sidewalk)(curb)(parapet)].

Epoxy coat reinforcing steel, except prestressing steel, in precast beams (slabs, boxes). [for marine environments]

Epoxy coat reinforcing steel in the upper portion of the prestressed (slab) [or] (box). This includes top longitudinal bars, top transverse stirrup ties and bars extending from the prestressed (slab) [or] (box) into the parapets or curbs.

General Notes: - (continued)

Place bars 2" clear of the nearest face of concrete (unless shown otherwise). The top bends of stirrups extending from beam stems into the top slab may be shop or field bent (unless shown otherwise). The top bends of stirrups extending from prestressed precast units may be shop or field bent (unless shown otherwise).

Do not fabricate reinforcing steel for columns (and walls) until final footing elevations have been determined in the field.

Provide Class ____ - ___ concrete in post-tensioned box girder superstructure (prestressed-precast units) and as shown on detail plans. See dwg. _____.

Provide Class 4350 – 3/4 concrete in deck (except in prestressed or post-tensioned sections).

Provide Class ____ - 1 1/2, 1 or 3/4 concrete in (columns, footings, etc.).

Provide Class 3600 (Seal Concrete) - 1 1/2, 1 or 3/4 concrete in seals.

Provide Class 4350 - 1 1/2, 1 or 3/4 concrete in reinforced concrete end panels.

Provide Class 3600 - 1 1/2, 1 or 3/4 concrete for All (other) concrete.

Provide Class 3600 - 1 1/2, 1, 3/4 or 3/8 concrete in walls with form liners.

Provide Class _____ - _____ concrete in precast prestressed (beams, boxes, slabs) according to detail plans. See dwg. _____. The minimum strength of concrete at transfer of prestress is ____ psi.

Provide prestressing steel according to detail plans.

Epoxy coated prestressing steel. [in marine environments]

Provide structural steel according to (AASHTO) [or] (ASTM) Specifications in accordance with detail plans.

("Galvanize-Control Silicon" – provided silicon content of the base metal in either of the ranges 0 to 0.04 percent, or 0.15 to 0.25 percent.)

Provide (7/8" diameter) high-strength fasteners at structural connections according to AASHTO Specification M164 (ASTM Specification A325) (unless shown otherwise).

Provide (lock-pin and collar) (black) (coated) (mechanically galvanized) (hot dip galvanized), high-strength fasteners (including washers).

Tighten high-strength fasteners using the (lock-pin and collar fastener tightening) (direct tension indicator tightening) (tension control fasteners tightening) (turn-of-nut tightening) method(s).

See the Special Provisions for detailed coating and tightening requirements.

Note: Have Nowzar Ardalan review all of your structural steel and painting General Notes.

General Notes: - (continued)

Provide Douglas Fir (non-laminated) timber conforming to _____ Grade [insert lumber grade] according to WCLIB rules.

Incise and treat sawn members with _____ [insert appropriate treatment from Section 02190] to a minimum retention level of _____ pcf [insert appropriate treatment level] in accordance with AWPA Specification C-2.

Provide all glued laminated timber members according to the requirements of the current American Institute of Timber Construction (AITC) Timber Construction Standards.

Allowable stresses in glued laminated members are per the latest version of AITC Specification 117.

Provide [insert wood species] glued laminated stringers according to combination symbol _____. [insert combination symbol]

Provide [insert wood species] glued laminated deck panels and rail posts according to combination symbol 2. [insert combination symbol]

Mark glued laminated stringers "Top" on the top at both ends.

Incise and treat glued laminated timber members with _____ [insert appropriate material from Section 02190] to a minimum retention level of _____ pcf. [insert appropriate level of retention] Treat laminated members after laminating in accordance with AWPA Specification C-28.

Perform cutting and drilling of timber members before preservative treatment. No field cutting of treated material will be permitted unless absolutely necessary. In the event of injury, drilling or cutting of treated material, field treat according to AWPA Specification M-4.

Provide structural steel, dowels (etc.) according to ASTM Specification _____. [insert Specification number] Provide all bolts, lag nuts and drift pins shall conform to AASHTO Specification M314, Grade 35 (ASTM A307) and/or AASHTO M314 Grade 105 (ASTM A449) as shown on the detail plans. Hot-dip galvanize structural steel, dowels, miscellaneous metal, bolts, lag bolts and drift pins after fabrication.