SECTION 2: DESIGN PHASES AND RESPONSIBILITIES

2.1 DESIGN PHASES AND RESPONSIBILITIES, GENERAL

2.1.1 INTRODUCTION TO STRUCTURE DESIGN

Section 2 explains the functions and responsibilities of the Bridge Structural Designer.

From the first Scoping Trip and/or Meeting to the date contractors submit their bids, the design process is divided into four phases:

- Project Scoping Meetings, Project Team Meetings, Site Inspections, Structure Location information gathered and Job Record Setup. (Job Setup)
- Type, Size, and Location (TS&L Design)
- Final Design.
- Finalize Plans.

Theoretically, the Structural Designer should carry a project from the first Project scoping meeting through the Final design process. Occasionally because of a Bridge Structure Design Team's workload or other reasons, a Structural Designer is asked to do only part of the design process. In some cases, the Designer who completed the TS&L design may not perform the final design. Regardless of who has been previously involved.

> The Structural Designer who completes the final design has the overall responsibility for the finished product.

Therefore, always review data and recommendations. Challenge that which seems questionable or inappropriate.

Another Structural Designer, preferably from another Design Team, checks the final design.

2.1.2 STRUCTURE DESIGN REFERENCES

2.1.2.1 Standard Specifications and Standard Drawing Manuals

- For design of vehicular, pedestrian, and bicycle bridges: Use *LRFD Bridge Design Specifications* or Division I, "Design", and Division I-A, "Seismic Design", *Standard Specifications for Highway Bridges* both published by the American Association of State Highway and Transportation Officials (AASHTO). The *Standard Specifications for Highway Bridges* are scheduled to be phased out sometime in the future and new designs are to be designed by *LRFD Bridge Design Specifications.*

- For design of sign, luminaries, and signal support structures: AASHTO *Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals*. (Copy in each Structural Design Team library.)

- For design of bridges carrying railway traffic: pertinent sections of the *Manual for Railway Engineering* of the American Railway Engineering and Maintenance-of-Way Association (AREMA) (formerly AREA) as modified by the individual requirements of each railroad company *. (Set of volumes in the Bridge Section Library.)

- For design of movable highway bridges: AASHTO *Standard Specifications for Movable Highway Bridges*. (Copy in each Structural Design Team library.)

- For all construction except bridges carrying railways: Standard *Specifications for Highway Constructions* published by ODOT and as modified by the *Supplemental Standard Specifications* and special provisions. (Copy *of the Standard Specifications* issued to each Designer.)

- *Metric Standard Drawings for Design and Construction* published by Oregon Department of Transportation, Standards Engineer. (Copy issued to each Designer and Drafter.)

2.1.2.2 Other Design Specifications, Manuals, and References - See list in Section A2.1.2.2, Section 2 Appendix.

Section 5, "Design and Detailing Practices", includes requirements, comments, and aids which are not considered direct modifications or readily related to the AASHTO provisions.

2.1.3 FOR THE RECORD

2.1.3.1 Communicating with the Outside - In the design phase, except during the contract advertising period, the Structural Designer and Design Team Supervisor may answer inquiries from outside ODOT about non controversial projects. Politically or environmentally sensitive projects are another matter. Refer questions about them, especially those from the press or public, to the Bridge Engineer, or the Project Team Leader.

However, from the advertisement date until the project is awarded, the Construction Project Manager has sole responsibility for answering questions about the project. This insures equitable treatment of prospective bidders and avoids conflicting information about plans, specifications, and bid items. Therefore, avoid conversations with prospective bidders during this period and refer them to the Construction Project Manager listed in the front of the project special provisions.

2.1.3.2 Reminders About Original Documents - As mentioned in Section 1.3.1 "Bridge Engineering Section Files", do not keep original documents in your work area or Job Record Folder. An "original" is paperwork noted with the Bridge Section's red RECEIVED/date stamp. If necessary for further reference, make copies. Always send the original back to the Front Office to be filed.

Also, be cautious about writing notes on original letters and papers, especially those from sources outside ODOT that could end up in litigation.

2.1.3.3 Informal Memos - The Project Discussion Memo Form was originally created to permanently document conversations or interaction between our personnel and the field during project construction. However, Designers and Team Supervisors have found its format useful for recording field trip notes or personal exchanges with other ODOT employees, public agency personnel, or private individuals during the TS&L and final design phases. Project Discussion Memo Forms are found in each Design Team supply of forms or use your PC Template file, "DISMEMO".

Keep a copy of the Project Discussion Memo in the Job Record Folder for reference. Send the original to the Correspondence Folder of the Project Precontract File, by way of your Design Team Supervisor -- and, if you think it is significant enough, the Bridge Engineer. If the matter may affect the project contract or construction, send a copy to the Construction Project Manager. Eventually, a copy should be included in your set of calculations if it relates to a critical design decision.

For other informal memos, an E-mail, an ODOT Speed Memo Form 734-3320 or a commercial-type speed letter is available in your Design Team area or the Front Office.

As with the Project Discussion Memo, a copy of any correspondence pertinent to the project should be sent to the project file for permanent documentation.

2.1.3.4 Template File List – Templates for correspondence and forms for various phases of a project have been developed and are available in the "Word\Template" directory.

2.1.3.4 Bridge Section Template File List

TEMPLATE FILE DIRECTORY AND FILE DESCRIPTION C:\USR\WORD\TEMPLATE	
FILE NAME	NOTES/DESCRIPTION
PRELIMINARY DESIGN	
PrjProspect1.xls	Prospectus Estimate
PRJDATA.DOT	Project Data Sheet Information
STRDATA.DOT	Structure Bridge Number Form
TS&L DESIGN	
ADVANCE PLANS DESIGN	
ADDSHTS.DOT	Added sheets Letter
BIKELTR.DOT	Bikeway Quantities Letter
NOTE2SPC.DOC	Notes to Specwriter Letter
SPLIST96.DOC	Bridge Special Provisions Checklist
PROJBUDG.DOC	Construction Support Budget Worksheet
RETWALLS.DOT	Advance Plans, Retaining Wall Letter
REVDWGS.DOT	Revised Drawings and Changes Letter
POST BID LETTING	
RETRODAT.DOT	Seismic Retrofit Data Sheet
SIGN SUPPORT	Sign Support Inventory Sheet
CONSTRUCTION	
SHOPDRW.DOT	Shop Drawing Submittal Review Form
ASCONST.DOT	As Constructed Distribution Letter
OTHER FORMS	
CBCVRSHT.DOT	Calculation Book Cover Sheet
TRANSMIT.DOT	Transmittal Letter
DISMEMO.DOT	Phone Discussion Memo
Advance Travel Expense	Advance Travel Expense Request Form
AEE Performance Appraisal	AEE Performance Appraisal Form
Archives Requisition	Archives Requisition Form
Development Plan	Employee Development Plan Form
Educational Assistance	Educational Assistance Application Form
Expense Statement	Expense Per Diem Statement Form
Out of State Travel	Out of State Travel Authorization Form
Overtime Work at Home	Overtime Work at Home Form
Personal Car Use	Personal Car Use Authorization Form
Trail Service Evaluation	Trail Service Employee Evaluation Form
Work Schedule Request	Work Schedule Request Form
TREPORT.DOT	Training Report Form

2.1.3.5 Professional Engineer Seal and Title - The seal and signature of the registered Professional Engineer (P.E.) considered by the Bridge Section as responsible for the engineered design will appear on the:

- Project Data Sheet of each set of calculations. See Section 2.1.5.3.
- Title blocks of contract drawings for the structure. See Sections 4.4.2, "Title Sheet", 4.4.3, "Detail Sheet", and 4.4.4, "Foundation Data Sheet".
- Cover sheet of each set of load rating calculations. See Load Rating Procedure handout issued to each Structural Designer by the Load Rating Coordinator of the Bridge Operations Team.

Professional Engineer (PE) seals should not be placed on TS&L drawings. In general, unsigned PE seals should not appear on mylars or documents that are sent to file. Unsigned PE seals may appear on preliminary plans (formerly bridge advance plans), but seals must be either signed or removed before bid documents are printed.

Design Engineers of TE2 or TE3 classifications are required to be registered professional engineers and are considered the responsible registrant for their engineered design work.

Other Design Engineer classifications (TE1 and ATE) should discuss with their supervisor as to whether or not it would be appropriate to delegate to the designer the certifying of the engineering work. The Section encourages these classifications to develop and exercise their professionalism, which includes stamping and signing their work on a voluntary basis. If the Design Team Managing Engineer stamps and signs the plans, the designer signs on the Designed line above their printed name.

Oregon Administrative Rule (OAR) 820-10-620, adopted November 1992, requires the expiration date of your certificate also be included with the seal. Renewals are on a two-year cycle based on last name initials. Current expiration dates are:

A - F: 12/31/2003
G - K: 6/30/2005
L - R: 12/31/2004
S - Z: 6/30/2004

If registered Designers are to sign as authors of letters, they are encouraged to add the abbreviation "P.E." after their typed name.

2.1.3.6 Comments About Drawings - For comments about vicinity map drawings, see Section 2.2.2.2.

The Structural Drafter assigned to a project is responsible for requesting title and detail sheet drawing numbers from the Front Office. For the procedure, refer to Section 4.4.1. A drawing number for the Foundation Data Sheet is also reserved for each structure. (See Section 4.4.4.)

As part of Bridge Section's ongoing overhaul of the structure number system, some existing bridges are receiving new numbers during the job setup. (See Section 2.2.3.7, "Request for Bridge Number".) Because the old bridge number is entered in the Project Control System (PCS) before the Bridge Section begins its job setup, the Project/Program Management Services has asked that the old bridge number be printed above the new number on contract plans. This is to provide a reference to the PCS section name printout, which usually includes the old bridge number. See also Section 4.4, "Title Block Information".

Review plans are any set of prints sent out for comments before the contract plans are advertised for bids. They ordinarily do not include bridge standard drawings. Each print of a set of review plans must have the following stamped or CAD-produced note on it:

REVIEW PLANS

JUNE 16,2003

DO NOT SCALE
DO NOT USE FOR CONSTRUCTION

The descriptive name "final drawings" and "contract drawings" are sometimes used interchangeably. In the strictest sense, contract drawings are considered signed, sealed, and ready for delivery to the prospective bidders.

The assigned Structural Designer is responsible for seeing that the appropriate people sign the contract and standard drawings. Signatures and professional engineer seals are not required for type, size, and location (TS&L) drawings.

Section 1.2.5, "Making Copies and Prints", explains how to order prints of standard, or full size, drawings. Half-size prints are often referred to as reduced prints.

2.1.4 DESIGN COMPUTER SYSTEM AND SOFTWARE

The Bridge Section's computer-aided design and drafting (CADD) system is still under development and subject to changes. Consequently, it is difficult to keep existing manuals updated or produce new ones. For now, you can refer to the following for computer procedures and design program software:

- Bridge Section *Computer Installation and Documentation Manual*, a recent publication issued to each Designer.
- User's Manual for M-Strudl and Cast-Utility, 1993 issued to each Designer.
- *Bridge Computer Manual,* published by Bridge Section 1984 and now out of print. Includes instructions and examples of available design programs. Some Designers of each Design Team have a copy.

Each Design Team also has a member on the Bridge Section Computer Committee available to answer your questions or give assistance.

Periodically, the Computer Committee publishes the *Bridge Computer News* for Bridge Section personnel.

2.1.5 DESIGN CALCULATIONS

2.1.5.1 Importance of Calculations - Designers are responsible for well-organized, legible, neat design calculations properly assembled in a calculation book. Remember:

YOUR CALCULATION BOOK COULD BECOME AN EXHIBIT IN THE COURTROOM!!!

Try to be selective, including only calculations that actually support what the contract plans show. Think about eliminating those calculations that led down the wrong path or were really wasted effort. However, consider carefully the fate of sheets voided by a project "redo". Ask your Design Team Supervisor if you are unsure what to discard.

2.1.5.2 A Set of Calculations - For a structure, the paperwork (usually excluding most correspondence) generated by the TS&L design, final design, and construction stages becomes a "set of calculations". Typically for a bridge, it includes:

- Calculation Book Cover Sheet. (See Word Template file CBCVRSHT.DOT)
- TS&L design calculations.
- Copy of TS&L Estimate. (Section 2.3.8.2)
- Copy of TS&L Narrative. (Section 2.3.8.3)
- Final design calculations, diagrams, sketches.
- Copy of checked Final Estimate. (Section 2.4.3.7)
- Bridge Construction Time Estimate graph. (Section 2.4.6)
- Copy of structure cost data. (Section 3.1.4)
- Copy of design cost data. (Section 3.1.5)
- Checker's calculations and any written comments. (Inclusion with the Designer's calculations is optional. See Section 2.4.9.1.)
- Construction stage calculations such as falsework calculations, alternate design checks, and design corrections or revisions.
- Copies of Project Discussion Memos. (Section 3.1.2.2)

2.1.5.2 A Set of Calculations - (continued)

In the above list, if it does not say “copy”, it means use the original. Many of the listed items are temporarily stored in the Job Record Folder.

A set of calculations for a retaining wall, box culvert, or sign structure may have only a few sheets, but the first page will always be a Calculation Book Cover Sheet. Refer to Section 2.1.6.3 “What Goes in Calculation Books?” for how to handle calculations for a minor assignment.

Calculations for bridge load rating are handled differently from design calculations. Load rating calculations have their own calculation book and number. For details, refer to the Bridge Section’s write-up “Load Rating Procedures” mentioned in Section 2.5.2.

2.1.5.3 Calculation Book Cover Sheet - The first sheet of every set of design calculations is a completed Calculation Book Cover Sheet. (See Word Template file CBCVRSHT.DOT) If a set of calculations needs more than one book, put a Calculation Book Cover Sheet in each book with cross-references to the other books used for the same set.

For bridges, the design standards will normally be the AASHTO *LRFD Bridge Design Specifications or Standard Specifications for Highway Bridges* as modified or supplemented by:

- AASHTO *Interim Specifications*.
- Section 5, “Design and Detailing Practices”, Bridge Section *Office Practice Manual*.

Either the Design Team Managing Engineer or the Design Engineer will stamp and sign the Project Data Sheet, whoever is most appropriate. (See Section 2.1.3.5.)

2.1.5.4 Calculation Sheets - Pads of Standard Bridge Section calculation sheets are stored in the Main File/Supply Room 321.

Fill out <u>all</u> heading blanks completely for each sheet used. You may want to number the sheets of a set with its own sequence of numbers while working on an assignment, but you will probably need to renumber with page numbers in the upper right corners when the set is bound into a calculation book. See Section 2.1.6.5 for final numbering of pages.

To make your calculations understandable to someone else:

- Put them in logical order.
- Show design assumptions and formulas complete with references.
- Reference the source of any numbers taken from other calculations. Do not pull numbers out of a hat!
- State reasons for a design change that deviates from normal procedures of design codes and “ODOT Design Instructions”, and give who approved it.

2.1.5.5 Other Calculation Material - Make sure other material such as computer output, diagrams on graph paper, or completed forms also have the same identifying information as the calculation sheets. Whenever possible, avoid oversize fold out sheets. They can be reduced to book size by using Bridge Section's copying machine for one or two sheets or sending numerous sheets to ODOT's Service Center. The exceptions might be moment and shear diagrams.

2.1.5.6 Temporary Storage of Unbound Calculations - Keep calculation sheets in a loose-leaf binder at your desk until they are bound into a calculation book. Properly identify each binder, and cross-reference if more than one binder is needed for a set of calculations.

2.1.6 CALCULATION BOOKS

2.1.6.1 The Basics - Each calculation book:

- Has its own number.
- Is limited to about 300 pages, which are numbered consecutively.
- Is permanently stored at the Archives Division's State Records Center.

2.1.6.2 Calculation Book Numbers - Calculation book numbers are requested from and assigned by Front Office personnel.

At the time final plans are first distributed for review, the designer will need a calculation book number for the title blocks of the drawings. When the design check is completed, the Checker's book number should also be added to the title blocks unless the Checker's calculations are to be bound with the designer's set of calculations. List only the first book number assigned to the Designer or Checker, even though there is more than one book for a structure.

Although you may expect to use more than one book for a structure or a project with several structures, do not reserve additional book numbers when requesting the first one. Book numbers for a structure or project are <u>not</u> required to run consecutively. Request additional book numbers when needed or when preparing your set or sets of calculations for binding.

2.1.6.3 What Goes in Calculation Books? - Should everything the designer produce go into a calculation book? That's a tough question! Sometimes it's a judgement call.

Some types of assignments do not involve structural design or drawings with calculation book references. These may be difficult to find if buried in a calculation book. Such material should either be:

- Put in a properly identified manila folder and kept at your desk, or
- Put in a calculation book and also listed on a sheet of paper kept at your desk.

Put bridge load rating calculations in separate calculation books according to Bridge Section's write-up "Load Rating Procedures".

If in doubt about which assignments to include in your calculation book, check with your Design Team Supervisor.

WARNING: Storing calculations on floppies and securing them within a calculation book in place of included printout is not recommended. Data stored on disks can become unreliable over a period of time.

2.1.6.4 Table of Contents - Keep the following guidelines in mind:

- If a book has more than one set of calculations,
  - Place, as the first page, a table of contents for the entire book.
  - Use dividers with tabs between sets of calculations.
- If a set of calculations is divided among two or more books, each book should have a copy of the table of contents for the entire set, not just that portion of the set in that book.
- Take time to tie books together by careful cross-referencing.

2.1.6.5 Page Numbering - Number the pages of each calculation book consecutively. (Each Design Team has a sequential numbering stamp.) Do not continue numbering from one book to another even though both books have calculations for the same structure. Always begin a book with "page 1".

2.1.6.6 Examples of Calculation Book Format

(1) Introduction - If this is all very confusing, perhaps the following two examples will answer some questions about assembling calculation books.

(2) Example 1 - *Calculation Book 4000* for Bridges 50000 and 50010 with a total of 290 pages:

- Page 1: Table of Contents for *Book 4000*.
- Divider with tab Br. 50000 (no page number).
- Set of calculations for Br. 50000 beginning with Calculation Book Cover Sheet.
- Divider with tab Br. 50010 (no page number).
- Set of calculations for Br. 50010 beginning with Calculation Book Cover Sheet.
- Checker's set of calculations.
- Page 290: Last sheet of calculations for Br. 50010 and last page of *Book 4000*.

(3) Example 2 - *Calculation Book 4100* with 280 pages and *Calculation Book 4150* with 310 pages for Bridge 50020:

Calculation Book 4100

- Page 1: Table of Contents for *Book 4100* and *Book 4150*.
- Project Data Sheet for Br. 50020 with cross-reference to *Book 4150*.
- First portion of calculations for Br. 50020.
- Page 280: Last sheet of calculations in *Book 4100*.

Calculation Book 4150

- Page 1: Table of Contents for *Book 4100* and *Book 4150*.
- Project Data Sheet for Br. 50020 with cross-reference to *Book 4100*.
- Remainder of calculations for Br. 50020.
- Page 310: Last page of calculations for Br. 50020 and last page of *Book 4150*.

2.1.6.7 Binding and Storing Calculation Books - When no more calculations or related paperwork is anticipated for your structure, usually after completion of the construction stage, your set or sets of design calculations can be bound into a book. Your Design Team Supervisor should review your prepared calculations for organization and completeness.

Send your prepared design calculations to the Front Office to be bound. Unless you request that the bound book be returned to you, it will be sent directly to the Archive Divisions State Records Center after binding. For future reference, you may want to keep at your desk a summary of what is in each of your calculation books. For the procedure to retrieve a stored calculation book see Section 1.3 “Sources of Information”.

Bridge load rating calculation books are stored in the Load Rating Coordinator’s area.

2.1.7 TRACKING DESIGN COSTS

As part of setting up a job, the Bridge Designer estimates the cost to design the structure. (See Section 2.2.3.5, “Completing Bridge Project Prospectus Estimate”.)

After the project contract is awarded, the Structural Designer makes a final accounting of actual design costs by Reporting the Design Cost, using the design cost spreadsheet as detailed in the *Cost Data Preparation Book* in each Design Team library.

During TS&L and final design, you can check on how much design cost allocation has been spent to date by calling up the “Structural Design Cost Data Report”. ODOT Financial Services also tracks estimated design costs and actual activity code costs with its “Active Project Expenditure” printout issued monthly. If your Design Team Supervisor does not receive a copy, the Front Office has one.

2.1.8 MEASURING DESIGN PRODUCTIVITY

NOTE: This section was set up to explain the productivity measurement program as it was originally setup and activated by the Bridge Section. At present, the program is on hold.

2.1.9 SPECIAL CONSIDERATIONS FOR FEDERAL-AID PROJECTS

2.1.9.1 Alternate Designs - Federal Highway Administration (FHWA) policy allows the states to decide if alternate designs for major federally funded bridges are appropriate. If alternate designs are appropriate, consider the following:

- Alternate designs should consider the utilization of competitive materials and structural types.
- Each alternate design shall be prepared using the same design philosophy. (That is, load factor design, finite element, etc.) Also the design/construction requirements for the entire bridge (foundation, substructure, deck) shall be designed with compatible requirements.
- Estimates are to be prepared for all alternate designs during the TS&L design phase.

2.1.9.2 Large or Unusual Structures - FHWA policy requires the following designs to be approved by its Washington D.C. Headquarters:

- Bridges with deck area greater than 125,000 square feet.
- NHS Bridges with a cost greater than $1,000,000.
- Movable bridges.
- Unusual bridges.
- Tunnels.
- Unusual geotechnical features.

An “Unusual bridge” may have:

- Difficult or unique foundation problems.
- New foundation types.
- New or complex designs involving unique design or operational features.
- Bridges with spans exceeding 500 feet or bridges for which the design procedures depart from current acceptable practice.

Examples of unusual bridges include:

- Cable-stayed, suspension, arch, segmental concrete bridges, trusses, and other bridges which deviate from AASHTO *Design Specifications* or *Guide Specifications*.
- Bridges requiring abnormal dynamic analysis for seismic design.
- Bridges that include ultra high-strength concrete or steel.

2.1.9.2 Large or Unusual Structures (continued)

An “unusual geotechnical feature” involves new or complex retaining wall systems or ground improvement systems.

The above information was taken from the December 24, 1990 FHWA Order 5520.1 attached to a cover letter from the Oregon Division Headquarters, Salem, dated June 5, 1991. A copy can be found in the Program Records filing cabinet in the Main Files/Supply Room 321.

A couple of final comments:

- Projects of this nature must get in the pipeline earlier than the usual structure to allow for added review and processing time.
- Include an additional set of plans and other required material in the TS&L and advance submittals to the Oregon Division Headquarters in Salem.

2.1.9.3 Experimental Features Program - An experimental feature is a material, process, method, or equipment item that:

- Has not been sufficiently tested under actual service conditions to be accepted without reservation in normal highway construction, or
- Has been accepted, but needs to be compared with acceptable alternatives for determining relative merits and cost effectiveness.

For full details of the Federal-aid experimental features program directed by the FHWA, refer to Chapter 6, “Construction Projects Incorporating Experimental Features” of the *Federal-Aid Policy Guide*. (A two-volume set is in the Front Office.) Although the experimental features program is normally used in conjunction with Federal-aid projects, the program format has occasionally been followed for projects funded entirely by the State. In some cases, the FHWA has even paid part of the research cost for basically a State-funded experimental program.

The intent of the Federal-aid experimental features program is to allow ODOT time to develop, test, and evaluate specifications for new, innovative, or untried products or processes. It is not to be used to avoid FHWA policy explained in the following Section 2.1.9.4 “Specifying Proprietary Items” which generally prohibits specifying only one brand name for an item.

Sometimes, use of an experimental feature is promoted in the Location Narrative. (See Section 2.2.2.3.) If not, the Structural Designer should anticipate if there is a need for an experimental feature as early as possible in the design process, ideally during the first part of the TS&L design. The ODOT Research Unit is ready to assist in understanding the experimental feature process. You may want to contact a FHWA Specialist at the Oregon Division Headquarters in Salem as a source of information and advice. Once the decision to use an experimental feature is made, developing a work plan is the next challenge.

2.1.9.3 Experimental Features Program (continued)

Producing a successful work plan requires teamwork. A work plan put together without coordinating design and construction activities will undoubtedly result in misunderstandings about who is responsible for what.

If the Bridge Section is to initiate the experimental features program, these guidelines should be followed:

- The ODOT Research Unit will coordinate the work plan process, assist in editing the initial draft, and make the final submittal to the FHWA.
- The Structural Designer produces the initial work plan draft which includes the reasons for using the product or process as well as benefits and how they are to be measured.
- Other ODOT Headquarters Units with particular interest in the experimental feature should be contacted and involved.
- From the beginning, the Region staff should be involved in the work plan development so that no matter when the Construction Project Manager is assigned, he or she has a close source of information. Also, Region specialty units such as geotechnical or maintenance should be included in the work plan review.
- The FHWA Area Engineer and any specialists need to be included in the work plan development and review. This insures the work plan will be accepted during the plans, specifications, and estimate (PS&E) package review.

Normally, the FHWA approves the experimental features work plan as part of the PS&E submittal. If the work plan is sent in after the PS&E deadline, the FHWA must take separate formal approval action, causing further delay of acceptance and implementation.

In Appendix Figure A2.1.9.3A, is an example of a cover letter and guide work plan for an experimental isotropic deck.

2.1.9.4 Specifying Proprietary Items - To encourage competitive prices from manufacturers and suppliers, the FHWA has established a policy for specifying proprietary products or processes for Federal-aid projects. Generally, "proprietary" means:

- Calling out a product on plans or in specifications by brand name.
- Using specifications written around a specific product in such a way as to exclude similar products.

Read carefully the policy as stated by FHWA Memorandum "Proprietary Items in Federal-Aid Contracts" dated September 13, 1990, which is included in the Appendix Section A2.1.9.4. Basically, it says:

- You must use two, preferably three, products when specifying by name brand.
- You can use generic specifications patterned after a specific item if at least two manufacturers can supply the item.

On the other hand, specifying one proprietary item is allowed only:

- If it qualifies for the experimental features program. (Refer to Section 2.1.9.3.)
- If, with written justification from ODOT, the FHWA specifically approves in advance a single product, which is essential because of compatibility with an existing system, or the only suitable product that exists.

Calling out one proprietary item plus adding an "or approved equal" note is definitely not acceptable to FHWA. In fact, avoid using "or approved equal" on any project. If a contractor submits an unknown product, it will cause delays, last minute paperwork, and generally higher costs and aggravation. See Section 2.1.10.1 "Evaluation of Construction/Maintenance Products".

Do not forget the *Qualified Products List* (QPL) as a source of approved products. It is mentioned in Section 2.1.10.1.

2.1.10 OTHER DESIGN CONSIDERATIONS

2.1.10.1 Evaluation of Construction/Maintenance Products - The Materials Unit of the Operations Support Section supervises the evaluation of construction and maintenance products.

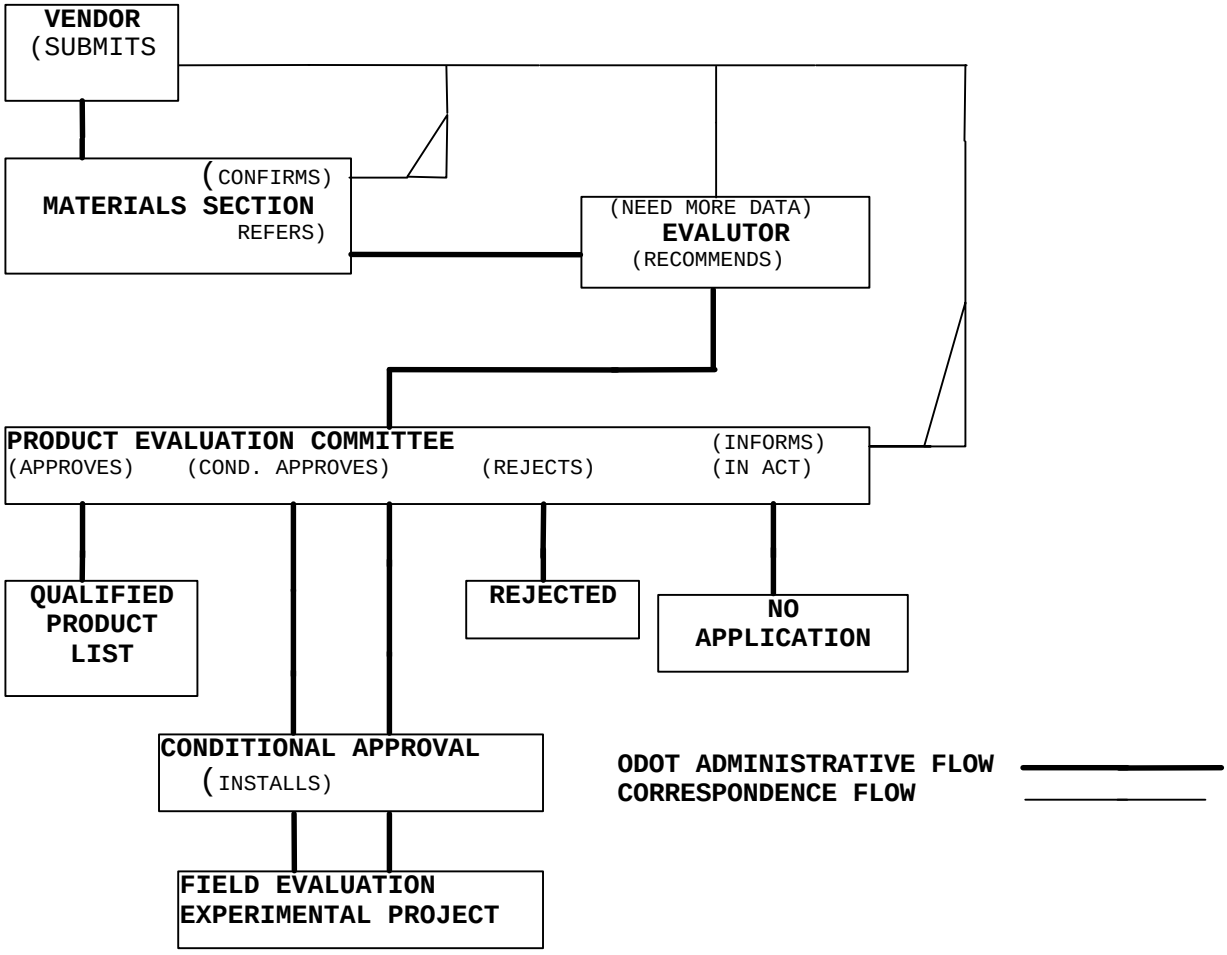
If a product is approved for use, it is included in the *Qualified Products List* (QPL) published every six months by the Materials Unit. The QPL is covered in Section 00160.05 of the ODOT *Standard Specifications for Highway Construction* as modified by the special provisions.

The special provisions of a project will tell which edition of the QPL is in effect for that contract. For the Structural Designer, the QPL is a handy reference, and the latest edition can be found in each Design Team library.

The Material Unit's Product Evaluation Coordinator chairs the Product Evaluation Committee, which makes the final decision on a product's status. ODOT units that serve as product reviewers have a representative on the Committee.

2.1.10.1 Evaluation of Construction/Maintenance Products (continued)

The procedure for evaluating a proposed product is outlined in the following Flowchart.



- The manufacturer or supplier, sometimes referred to as a vendor, submits a completed Preliminary Information for Product Evaluation application to the Materials Unit.
- The Product Evaluation Coordinator sends the product data to the appropriate ODOT unit for review.
- The reviewing unit returns its recommendation to the Coordinator.
- The Product Evaluation Committee takes action on the recommendation.

2.1.10.1 Evaluation of Construction/Maintenance Products - (continued)

A product can be evaluated as an “equal product” or a “new product”:

- Equal products are similar to ones currently used by ODOT and are covered by existing specifications or standards.
- New Products are ones not addressed by current specifications or standards.

After evaluation, a product’s status becomes one of the following:

- Conditional - Equal or new product will be allowed a trial installation on one project only, recommended for a demonstration project, or recommended as an experimental feature. See Section 2.1.9.3 “Experimental Features Program”.
- Qualified - Product is equal to existing approved products or has test results that meet ODOT specifications.
- Rejected - Product does not meet ODOT specifications or has failed performance testing.

Products with Conditional status will have trial installation on projects where they can be monitored during installation and for a limited performance period. The manufacturer or supplier is responsible for locating an active project, either construction or maintenance, for the proposed product. Normally, a product will be considered Conditional first, and then move to Qualified after it establishes a good track record.

Of course, a previously qualified product can fall from grace and become rejected because of unsatisfactory field performance.

Bridge Section’s involvement includes evaluating products related to bridge or other structures work. After receiving product data and a questionnaire (Appendix Figure A2.1.10.1A), the Product Evaluation Specialist selects the appropriate reviewer from the “Bridge Section Specialty List”. The reviewer evaluates the product and returns the evaluation to the Product Evaluation Specialist. The evaluation is then forwarded to the Product Evaluation Committee.

Guidelines for specific concrete related products are located in the Appendix Section A2.1.10.1.

2.1.10.2 County and City Bridges

County and city bridge designs can present some special problems. Finding plans of and information about existing bridges may be the greatest difficulty.

ODOT is responsible for the Oregon Bridge Inspection Program that includes all county and city bridges. Therefore, the Bridge Operations Team and its county and city bridge files, including underwater inspection reports, are good sources of information.

County bridge numbers are one source of confusion. The numbering system used by counties is not uniform. However, for many counties, a typical bridge number would be 25C172.

2.1.10.2 County and City Bridges – (continued)

To add to the county bridge number confusion, the Bridge Section assigns a State bridge number to a county project as a way of keeping track of the project in our present records system. (A new system using Internal File Numbers is being developed.) Therefore, a county bridge may have a county number and a State number or just a State number if the county voluntarily adopts the State number! If a bridge has a county number and State number, both numbers should be on the title and detail sheets of the bridge contract drawings and also in the headings of our paperwork.

Finding which county road or city street a bridge is located on can also be very challenging. Check the General Highway Series County or City Map atlas each Design Team has. Individual maps are available from Reprographics and Map Distribution Unit; these maps are produced by the Transportation Inventory and Mapping Unit. Transportation Development Branch and its personnel are the experts on the complex Federal, State, and county highway systems. They have begun a joint effort with the counties to show county bridge numbers on county maps.

2.1.10.3 Free Bridge Design - ODOT is obligated by State law to provide counties, upon their request, with bridge design and project specifications at no charge to the counties. This obligation is indicated on page 1 of 2, Part 4, "Survey Authority", of the Project Prospectus. (Refer to Section 2.2.2.1.) The Bridge Designers time for "Free County Bridge Design" is charged to the J18 activity code.

Free Bridge Design should be noted on the Job Record Sheet. (See Section 2.2.3.8.)

A county must pay for certain project development items associated with Free Bridge Design such as:

- Hydraulics studies.
- Foundation exploration.
- Field survey work.
- Environmental, right-of-way, and utility work.

About the only difference between a Free Bridge Design and a regular bridge design job is the cost accounting charge. The expenditure account (EA) number for the Time Report will include the activity code J18, for example: C2291419/012-J18.

2.1.10.4 Value Engineering - As defined in the 1970 booklet *Principles of Writing Highway Construction Specifications* (a copy is in the Bridge Section Library), value engineering (VE) is "an organized effort directed to analyzing the function of highway components with the purpose of achieving the required function at the lowest cost." Or more simply, value engineering is a program of systematically studying all operations, design features, paperwork, etc., to see that the person who is paying the bill is getting the best buy possible.

Value engineering can be a difficult concept to grasp, but it is not just cutting costs. "Cost cutting is attacking things, as they are to reduce their cost. Value engineering, on the other hand, takes nothing for granted and attacks everything about a component that will not change the essential characteristics below the required value." Chapter 7 of *Principles of Writing Highway Construction Specifications* makes some other good points about VE.

When applied to construction contracts, value engineering takes the form of a cost-reduction proposal. That is, if the contractor proposes a different way of doing something that retains the original function and also saves money, the contractor and the owner split the savings. ODOT recognizes this possibility in Section 00140.70 "Cost Reduction Proposals" of the *Standard Specifications for Highway Construction*.

For the project development stage, ODOT's value engineering program is managed by the Value Engineering Manager of the Project Services Unit, Engineering Services. Each Region has a Value Engineering Coordinator. Some potential projects for VE study might be:

- Projects substantially exceeding initial cost estimates.
- Major bridges.
- Items requiring difficult construction.
- Items that have grown complex over a long period of time.
- Items that perform a questionable function.

Details of the Value Engineering Program are explained in ODOT Directive HWY RES 5-01 dated September 15, 1991. (A copy is available in the Front Office's ODOT *Policy and Procedures Manual.*)

From time to time, Bridge Section personnel are asked to participate in VE studies. The Value Engineering Manager keeps a list of ODOT employees who have either taken the 40-hour VE course or have on-the-job training.

Although we may not often be called to serve as a VE team member, we can keep the following basic questions in mind during our day-to-day work so we can give the traveling public the greatest value for its money:

- What does the operation or feature accomplish? What is its function?
- What does it cost, and does the cost seem reasonable?
- Is there a way of avoiding or reducing this cost without sacrificing satisfactory operation?

2.1.10.5 Railroad Bridge Design

ODOT is obligated to request that the state be allowed to design structures that carry railroad traffic.

A letter requesting permission to design the railroad structure should be written to the Railroad and Utilities Engineer, who will then write a request letter to the railroad.

The letter should include:

- A statement requesting to design the railroad structure
- A statement about ODOT's past design experience with railroad structures
- An example of a past design
- A description of the proposed structure
- Pertinent project information, such as location maps, x-sections, etc.

An example letter is shown in Figures A2.1.10.5A and A2.1.10.5B.

2.1.11 ORGANIZING FOR LARGE DESIGN PROJECTS

2.1.11.1 Lead Personnel for Large Projects - Large design projects with multiple or complex structures usually involve several Designers and Drafters. Often, these large projects can be done more efficiently if the Design Team Supervisor chooses a Lead Designer and Lead Drafter to help organize and manage the project. As an added benefit, the Lead Designer and Drafter gain valuable experience in project and personnel management.

The following text gives some guidelines for the Design Team Supervisor and Lead Designer. Section 4.2.4.2 discusses guidelines for the Lead Drafter. Before accepting their leadership assignment and beginning project work, the Lead Designer and Drafter should review these guidelines, meet with the Design Team Supervisor to discuss them, and agree as to their responsibilities and duties.

2.1.11.2 Design Team Supervisor's Responsibilities

(1) Beginning of Project - The Design Team Supervisor should:

- Discuss the responsibilities and duties with the potential Lead Designer and Drafter and get their agreement.
- Write a memo to the file designating the Lead Designer and Drafter.
- Discuss structure design and drafting assignments with the Lead Designer and Drafter after the scope of work is determined.
- Schedule a design meeting with the project team Designers and Drafters to review and discuss:
    - Project and design work involved.
    - Design and drafting assignments, and then make assignments.
    - Project schedule and permit deadlines.
    - Design criteria and restrictions.
    - Available design information.
    - Structures types and architectural/aesthetic considerations.
    - Features that require uniformity among two or more structures.

(2) TS&L and Final Design - The Design Team Supervisor should:

- Schedule project team work so all Designers and Drafters are able to work on the project at the same time. If this is not possible, see that those interrupted with other assignments attend all project team meetings to keep abreast of project status and criteria.

2.1.11.2 Design Team Supervisor's Responsibilities (continued)

- Try not to reschedule Designers or Drafters to work other projects after their large project assignment is well underway. Broken assignments result in extra drafting time and inconsistent detailing because the design and drafting stages of individual structures will be out of step with the project as a whole.

- Involve the Lead Drafter early with anticipating the drafting time and number drawings required. Insure that Designers are far enough along in the design process before requesting drafting. All too often, Drafters are asked to proceed with minimal or inadequate data.

- Monitor design and drafting progress, and conduct monthly review/status meetings with Lead Designer and Drafter. Periodically review plans and details. Stay current with project design and detail changes.

- Schedule project team meetings about every two or three weeks or as needed to discuss status and changes. At the meetings, discuss:

    - Status of each structure.

    - Items of interest that have surfaced since the last meeting.

    - Design or drafting problems or inconsistencies. Try to reach consensus. If not, the Design Team Supervisor, Lead Designer, or Lead Drafter will make the decision.

(3) Project Evaluation - After the project has gone to contract, the Design Team Supervisor should:

- Meet with the project team to critique the team's effort and the project in general.

- Obtain comments from project team members about how the project went, areas for improvement, and performance of the Lead Designer and Drafter.

- Meet with the Lead Designer and Drafter to evaluate their performance.

2.1.11.3 Lead Designer's Duties

(1) Beginning of Project - The Lead Designer should:

- Communicate to other Bridge Section and ODOT units as well as outside organizations that he or she will be the design contact person for the project.
- Obtain available design information.
- Coordinate job setup. See Section 2.2.

(2) TS&L and Final Design - The Lead Designer should monitor design and drafting work, which includes:

- Attend Project Team meetings.
- Be aware of the status of design and drafting in relation to lead-time required to meet submittal deadlines and bid-opening dates. (Request help as needed to meet deadlines.)
- Reviewing all structure plans for uniformity of design/drafting practices and detailing.
- Reviewing TS&L and Preliminary Plans for completeness before submittal to Design Team Supervisor.
- Coordinating preparation of the following project submittals:
  - TS&L package and transmittal letter.
  - Preliminary Plans package and transmittal letter.
  - Advance Plans package and transmittal letter.
  - Final contract package and transmittal letter.
- The Lead Designer should maintain project records and update the project team by keeping:
  - A current set of all structure plans.
  - A file of correspondence and decisions that affect design.
  - Design Team Supervisor aware of project status and any changes that develops.
  - Project team members informed, by memos or meetings, of any decisions or changes.

And finally, the Lead Designer should:

- Be available to project team members, especially new Designers, and encourage them to ask questions and share some of their assumptions for design and analysis before they start on a major modeling and design task.
- Stay informed about what is happening with all project structures in order to answer questions from other units in the absence of other team members.

2.2 JOB SETUP

2.2.1 THE PROJECT DEVELOPMENT PIPELINE

2.2.1.1 Project Development Overview - To understand and use the information from preliminary documents, Bridge Section personnel need a basic knowledge of the ODOT project development procedure, which incidentally, has undergone many changes. Although Section 2.2.3, "Bridge Preliminary Design Tasks", has the details, a brief explanation is given here to help you follow the job setup process.

An ODOT project passes through three major stages on the way to the finished product:

- Programming.
- Preliminary Engineering (PE) and right-of-way acquisition.
- Construction

Of primary interest to the Structural Designer is the Preliminary Engineering (PE) with its area of work divided between location and design. The Structural Designer should take an active role in the development of information gathered in the location phase. It is very important that the information gathered in this phase of the project be accurate, and accomplished in a timely manner.

Structural Designers are involved with a project from the very beginning. Each Design Team has been aligned with a specific Region as follows.

- DESIGN CREW 7430 REGION 1(District 2C)and Region 4
- DESIGN CREW 7440 REGION 1(District 2A)and Region 5
- DESIGN CREW 7450 REGION 1(District 2B)and Region 3
- DESIGN CREW 7460 REGION 2

These Regions of responsibilities are somewhat flexible for large projects where one Team may need help, or as the workload dictates moving jobs around to other crews not specifically assigned to that particular Region.

The "Bridge Project Workflow" pictorially outlines Bridge Sections involvement in and contribution to ODOTs project development pipeline.

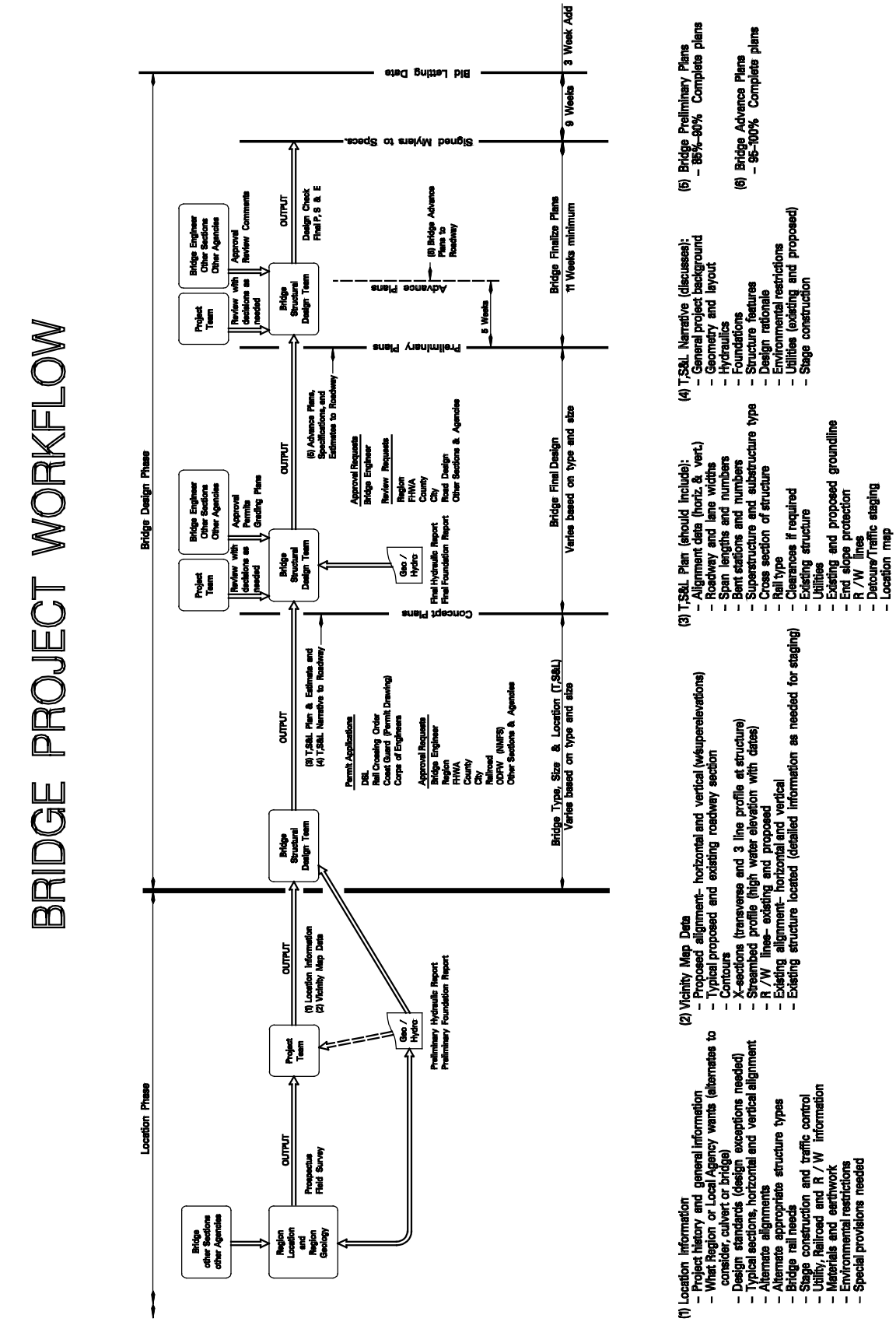


Figure 2.2.1.1A

2.2.1.2 Filing Early Project Information

Information gathered for projects should be kept with the designer or by the supervisor. The Project Precontract File will be set up in the Main Files/Supply Room 321 to receive correspondence and other job-related material after a new structure number has been assigned or an existing structure number has been checked and confirmed according to Section 2.2.3.7, “Request for Bridge Number”. (See also 1.3.1, “Bridge Engineering Section Files”.)

Then the Job Record Folder can be put together (see Section 2.2.3.9), and eventually, the Structural Designer will make copies of relevant material for the Job Record Folder and send the originals back to the Project Precontract File.

The Roadway Engineering Section is now responsible for distributing most of the preliminary field documents received from the Regions. If location information is missing, the Region Design Personnel would be a good place to check for it.

2.2.2 IMPORTANT PRELIMINARY DOCUMENTS

2.2.2.1 Project Prospectus - Initiated by Regions for each project, the Project Prospectus is a key player in the programming stage of project development. It is a four-part form:

- Part 1, "Project Request" (pages 1 and 2 of 2).
- Part 2, "Project Details".
- Part 3, "Project Environmental Classification".
- Part 4, "Survey Authority" (pages 1 and 2 of 2).

Basically, the Project Prospectus tells:

- The overall scope of the project.
- What work needs to be done and recommended solutions to problems.
- Who is going to do the work.
- The estimated costs and what funds are going to pay for them.

The Section 2 Appendix has an example of the Prospectus (Figures A2.2.2.1A through A2.2.2.1F).

On page 1 of 2, Part 1, "Project Request", the summary of project costs is of primary interest. Structure, foundation, and hydraulics design costs from Part 4 are included in the preliminary engineering figure, and the total construction cost of the structures is shown. Also on this page, any existing and proposed bikeway involvement will be noted.

Among other things, Part 2, "Project Details", indicates what permits are required. Estimated construction costs of individual structures are listed.

Sometimes, because a project has a Class 2 "Categorical Exclusion" environmental classification, Part 3 may not be included in the copy of the Project Prospectus found in the Job Record Folder. However, even with a Class 2 project, there may be some relevant comments in Part 3 that could affect the structural design.

Part 4, "Survey Authority", spells out estimated design costs and current authorized cost for each unit involved in the preliminary engineering. "Final Design - Bridge and Foundation" is split out under activity codes J13 and J15. (Here, bridge final design means structure TS&L and final design.) Structure design will have a 7400 organization unit number. "Free Bridge Design" has a J18-activity code. See Section 2.1.10.3, "Free Bridge Design".

The Project Prospectus is a working document that is added to, revised, and re-circulated several times during the location phase of a project. A copy of the initial version comes to the Bridge Section from the Region responsible for the Project. Sometimes, the Hydraulic Unit receives its own copy.

2.2.2.1 Project Prospectus - (continued)

Referring to an existing Bridge Project Prospectus Estimate or completing one if none exists (see Section 2.2.3.5), the Bridge Designer reviews the costs for structure design and construction listed in Parts 1, 2, and 4. If necessary, missing figures are filled in or incorrect ones updated, and a revised copy returned to the Region using on ODOT standard transmittal letter form. Copies also go to the Hydraulics Unit, Foundation Unit, and Precontract File.

Eventually, the Region sends an updated, more complete Prospectus to the Bridge Designer. (In many cases, the Part 4 form will be replaced by a computer printout of the Survey Authority data.) A copy of this version of the Project Prospectus will be put in the Job Record Folder. The original will be sent to the Project Precontract File.

A point to remember: If the Project Prospectus and the schedule are to be accurate and reliable, recommendations for major changes to the Bridge Project Prospect Estimate figures during TS&L and final designs need to be communicated to the Region. (See Section 2.3.4.1, "Review of Job Record Folder and File".)

2.2.2.2 Vicinity Map Information - In the past, Region personnel prepared hand-drawn, full size vicinity map drawings for each proposed bridge, box culvert, retaining wall, or sound wall. But both the way field information is physically gathered and the way Regions have traditionally submitted it to the Bridge Section is changing with the advent of electronically transferred data.

Now, Regions may send vicinity map information in one of the following forms:

- Hand-drawn, standard Full Size mylar film drawings.
- CAD-produced, standard Full Size mylar drawings or paper prints.
- Electronically transferred data that can be used to make CAD-produced paper prints.

Regardless of what the finished product looks like, the same vicinity map information described by the ODOT *Highway Design Manual* is needed. The timeliness of this information is critical to the completion of the *Hydraulics Report* and *Foundation Report* as well as the progress of the TS&L design. Here is a rundown of what should be expected:

- Proposed and existing typical roadway sections.
- Proposed and existing gradelines.
- Streambed profile.
- Horizontal alignment plotted using 1"=50' scale and showing:
  - Proposed and existing horizontal alignment including existing right-of-way lines.
  - Proposed and existing structures.
  - Existing and proposed utilities, pipes, fences, luminaries, etc.
  - Contours
  - Stream/river name and direction of flow.
  - North arrow.

2.2.2.2 Vicinity Map Information - (continued)

- Stream/river high water elevations with dates.

- Project location map (small-scale road map) showing:
  - Project location.
  - Section, Township, and Range.
  - Nearest city, highways, streams, etc.

- Title block showing:
  - Structure name and, if an existing bridge, bridge number
  - Section
  - County
  - Highway (with milepoint for State highways)
  - Project Manager and date

The Roadway Engineering Section should forward all vicinity map material from the Regions to the Bridge Design Unit. In the case of electronic files, the Bridge Design Unit is notified that a Region has the files available to transfer.

Mylar vicinity map drawings received from the Regions are not normally assigned drawing numbers.

The vicinity map material (prints if it is a drawing with a number or the original if it is some other form of information) is placed in the Job Record Folder and eventually becomes a part of the Project Precontract File. Prints or copies are also distributed to the Foundation and Hydraulics Units.

2.2.2.3 Location Narrative - The Location Narrative is a general summary of the important features that are shown in detail by maps and records generated by the location surveys. Written by Region, it may cover, but is not limited to, the following areas:

- Project history and general information.
- Design standards.
- Typical sections, horizontal and vertical alignment.
- Alternate alignments.
- Stage construction and traffic control.
- Utilities and right-of-way.
- Materials and earthwork.
- Structures and drainage.
- Special provisions.
- Experimental features.

Refer to the *Highway Design Manual* for additional comments. Also see Section 2.2.3.6, “Location Narrative Review”.

2.2.2.4 Bridge Project Prospectus Estimate - The Bridge Project Prospectus Estimate is a form which shows very preliminary estimated structure design and construction costs that will be used for the Project Prospectus, Job Record Sheet, and cost accountability during project development. It is periodically reviewed during the design stages and may require updating should major changes occur in the project scope. More is said about the Bridge Project Prospectus Estimate in Section 2.2.3.5. For an example of the form, see the Excel template file PrjProspect.xls.

Copies are given to the Foundation and Hydraulics Units; a copy is included in the Job Record Folder.

2.2.2.5 Hydraulics Report - The Hydraulic Unit includes in its *Hydraulics Report*:

- Introduction with background information describing history of the site.
- Hydrology of the site.
- Existing hydraulic conditions.
- Hydraulic design for the proposed structure.
- Hydraulic Data Sheet which includes for the design and base floods:
    - Discharge.
    - Frequency.
    - Natural high water elevations.
    - Backwater elevations.
    - Amount of bridge backwater.
    - Culvert headwater and tail water elevations.
    - Minimum required waterway opening.
    - Average velocity.
- Potential scour depths and elevations.

For scour prevention, recommendations are given for size, depth, and placement of riprap in front of abutments and around bents in the water.

Use the ODOT *Hydraulics Manual* as a reference for flood design background and terminology.

The Hydraulics Report is an essential tool for design, but its issue date is dependent on timely field input. If it is not available when needed, Hydraulics Unit personnel may be able to provide some preliminary data and assumptions as a beginning step for design.

Copies of the *Hydraulics Report* go to the Job Record Folder and Project Precontract File, and one copy accompanies Federal-aid plans if FHWA approval is needed. The original stays with the Hydraulics Unit.

2.2.2.6 Foundation Report - The *Foundation Report* contains background, drill logs, and photographs from the project site. The Foundation Unit recommends, among other things:

- Types of footings and piles.
- Footing elevations.
- Minimum pile tip elevations.
- Bearing values for spread footing and piles.
- Pile tip reinforcement when required.
- Falsework to be supported on driven piles when appropriate.

The recommendations of the *Foundation Report* are fundamental to design, and its publication depends upon timely submittal of investigation results from the Regions. If the *Report* has not been issued when early foundation design assumptions are being considered, get together with the assigned Foundation Designer to review preliminary data including site inspection photos, if available. Preliminary recommendations may be made after a copy of the Drill Log is received.

Before the *Foundation Report* is officially published, interim foundation material such as drill logs, site photographs, and correspondence are put in a project Foundation Folder that is either filed in the Foundation Unit or are kept at the Foundation Designer's desk. When the *Report* is printed, the original goes with the Foundation Folder to the Project Precontract File. A copy is made for the Job Record Folder. Another copy is sent to FHWA if plans are required for review.

2.2.3 BRIDGE PRELIMINARY DESIGN TASKS

2.2.3.1 Activation of a Project - The Bridge Designer is responsible for providing input to development of a project when:

- A Region requests a Bridge Project Prospectus Estimate or
- A Project Prospectus is forwarded to the Bridge Section from a Region by Program/Project Management Services.

The Preliminary Design Checklist, Word Template file PDTCHK.DOT, is used as a step-by-step guide for setting up a job.

2.2.3.2 Gather Project Information

(1) Hold File – In the past a Preliminary Design Unit gathered information and stored it in this file. Since the Bridge Designer is involved with a project from its beginning, they should now hold this information themselves until a project is far enough along that a Bridge Number can be attained. (See Section 2.2.3.7)

(2) Bridge Log - The ODOT *Bridge Log* is reviewed to identify, within the project limits, bridges and culverts with potential problems that may have been overlooked when the project scope of work was developed such as bridges:

- With roadway widths less than standard for highway ADT.
- With substandard vertical clearances.
- With H15 ratings.
- With 6 inch thick decks.
- With substandard traffic rails.
- Without end panels.
- Constructed of timber.

For small streams, a culvert might be used to replace a bridge. For locations with low deck-to-streambed distance (5 feet or less), a culvert might not be proposed, because it could not provide enough waterway area. (The Hydraulics Unit can do a preliminary review to determine waterway area needed.) Poor foundation material may be another reason for not choosing a culvert.

(3) Straight-line Chart – Produced by Trans. Development / Trans. Inventory & Mapping. Each crew should have a copy in their room and it is available electronically at ftp://ftp.odot.state.or.us/tdb/trandata/maps/slchart.

(4) Contract Drawings - The Structure Number Card File in the Main Files/Supplies Room is used to locate contract drawings of existing structures. Half-size prints are made for reviewing and placed in the Job Record Folder later for the Designer's use.

2.2.3.2 Gather Project Information (continued)

(5) Sufficiency Rating – The Sufficiency rating of existing bridges are checked. (Refer to the *Oregon Coding Guide for the Inventory and Appraisal of Oregon Bridges* for the definition of the sufficiency rating and the formula to compute it.) The Bridge Operations Team maintains the bridge inspection mainframe program which can show the sufficiency rating by accessing the Structure Inventory and Appraisal File.

(6) Load Rating - If available, the load ratings of existing bridges are checked. The Load Rating Coordinator, Bridge Operations Team has a PC listing of available load ratings.

(7) Bridge Seismic Prioritization Program (BSPP) - The Bridge Seismic Prioritization Program was developed to prioritize the seismic risk of bridges statewide. The Seismic Prioritization Coordinator is the Bridge Section's contact person for bridge seismic ratings.

(8) Bridge Maintenance Files - The Bridge Maintenance Files are reviewed, especially the most recent inspection report.

(9) Proposed Bridge Widening – A Bridge widening is carefully considered to see if it would be more appropriate to replace the bridge rather than widen it. This is particularly true for a proposed widening over a stream with a record of serious flooding, approach fill washouts at the site, or bridges with serious seismic deficiencies.

(10) Project Prospectus Revisions - To reflect the Current Bridge Project Prospectus Estimate, structure design and construction costs in Parts 1, and 2 of the Project Prospectus may have to be revised. A copy of the revised Estimate should be sent to Region so that a new Prospectus can be circulated. (See Section 2.2.2.1.)

2.2.3.3 Preliminary Site Inspection - At some time during the location phase, the Bridge Designer should usually make a site inspection. Depending on the site and type of structure that is planned it's a good idea to include or accompany personnel from either the Hydraulics unit or the Foundation Unit or Region Personnel. Photographs of the site are filed in the Job Record folder or placed in the Precontract file.

2.2.3.4 Coordination with Regions - During the location phase, Bridge personnel are normally part of the Project Team and should attend the Project Team meetings to input structure information.

The Bridge Structural Units work with the Foundation and Hydraulics Unit to determine the scope of the Region's foundation exploration and hydraulics studies program for a project. For example, the Structural Unit may develop an approximate TS&L layout so that the Foundation Unit can establish test boring at proposed bent locations.

2.2.3.5 Completing Bridge Project Prospectus Estimate - As mentioned in Section 2.2.2.4, the Bridge Structural Unit is responsible for completing the Bridge Project Prospectus Estimate.

The Excel template file for the Prospectus Estimate is called ProjProspect1.xls, and the following comments point out where some of the needed biographical data can be found:

- Funding - This means the Federal or State category of construction funding noted on page 1 of 2, Part 1 of the Project Prospectus.

- S.R. - See Section 2.2.3.2(5) for finding the sufficiency rating (S.R.) for an existing structure, which may help to determine if the existing structure should be widened or replaced.

- D.S. - Deck-to-streambed (D.S.) distance for an existing stream crossing is listed in the ODOT *Bridge Log* and is used in determining the structure depth of the proposed bridge.

- Key No. - Key Identification Number from the Project Control System is in the upper right corner of the Project Prospectus.

- Hwy No. - State highway number is shown on page 1 of 2, Part 1 of the Project Prospectus. (Do not confuse state highway number with state route number.)

- M.P. - The milepoint locating a structure is usually the midpoint of the structure's length. See Section 2.2.3.7, "Request for Bridge Number", for more on determining milepoints.

The latest tables and charts of design and construction costs distributed periodically by Bridge Section's Cost Data Coordinator can be found in each design team's area in the Bridge Cost Data Instruction Manual. The annual *Structure Cost Data* books are also a source of construction cost information.

Additional expenses for such things as stage construction, work bridges, unusual types of construction, or railroad company involvement need to be anticipated and reflected in the estimate.

Proposed revisions to the Project Prospectus should be forwarded to the Region.

Engineering expenses (that is, ODOT construction contract management costs) are added in after the "Subtotal (Project Prospectus)" is plugged into the construction cost summary on page 1 of 2, Part 1 and at the bottom of Part 2 of the Project Prospectus. Typical percentages for "Engineering and Contingencies" are:

- 30% for box or pipe culverts.
- 40% for all other structures.

Structure design costs are estimated using the guide sheets in the Bridge Cost Data Instruction Manual. The Foundation and Hydraulics Units provide their estimated design costs. These design costs are used for page 1 of 2, Part 4 of the Project Prospectus as explained in Section 2.2.2.1.

2.2.3.5 Completing Bridge Project Prospectus Estimate - (continued)

The Structural Managing Engineer should review bridge Project Prospectus Estimates. After review and signature, copies are sent to:

- Region Federal-Aid Specialist.
- Region Project Development Manager or Engineer.
- Foundation Unit.
- Hydraulics Unit.
- Job Record Folder.

Copies going to Region are attached to an ODOT standard transmittal letterform. Prospectus Estimate originals are kept with the designer until a Precontract file is set up at which time the designer can send them to file.

During the TS&L design, usually after the design concept review, the Bridge Project Prospectus Estimate should be reviewed. If there are significant changes complete a new Estimate Form and revise the Job Record Sheet. See Section 2.3.9, "Processing the TS&L Design Package".

2.2.3.6 Location Narrative Review - Arrival of the project Location Narrative from Roadway Engineering Section generally indicates the completion of the field location work. After reviewing it, the Bridge Designer makes a copy of the Narrative to be put in the Job Record Folder and sends the original to the Project Precontract File.

2.2.3.7 Request for Bridge Number

Once the Project Tracking System forms have been returned with verification of an existing bridge number or assignment of a new number, the Front Office staff will set up a Project Precontract File under that bridge number. (If there is more than one structure in the project, the number of the major structure will be used to identify the file.) The Project Precontract File will have, among other things, a "CORRES. & MISC." folder or folders.

(1) Bridge Numbers and Project Tracking System - After the Location Narrative has arrived and before assembling the Job Record Folder material, request a bridge number from the Front Office staff using the Project Tracking System input forms (word template file **STRDATA.DOT** for structures and **PRJDATA.DOT** for each project).

REQUEST BRIDGE NUMBERS FOR ALL STRUCTURES BOTH NEW AND EXISTING!!!

The Bridge Section Project Tracking System is a database program to store information about structures and their construction history. This information will help you provide accurate data to the system and use the data effectively.

2.2.3.7 Request for Bridge Number - (continued)

(1) Bridge Numbers and Project Tracking System (continued)
The program uses two main files to keep information about structures. The first is a Structure database, which contains information on the structure type and location. The second file is the project database. This file contains information relative to the construction activities that have been performed on the structure. A structure may have several project entries, each with different data. The first would be the initial construction. Others may be related to a widening, a rail retrofit, a seismic retrofit, etc. Each project will likely have different section names and stationing. The PCSKEY number relates structures to projects. A project may have several structures. All of the structures would have individual structure entries, but there would only be one project entry.

Put your name at the top right of the forms. Enter as much information as you know and leave unknown items on the forms blank. Please be careful that what ever you enter is correct and submit them to the Front Office. The data will be entered into the database.

When you receive the Project Tracking System forms back with an assigned bridge number, our Front Office staff will have set up the Precontract Project File (see Section 1.3.1.3(1)). Keep the forms in the Job Record Folder.

After a project goes to contract complete the remaining information on the Project Data Sheet and update all information on the Structure Data Sheet and turn in to the Front Office.

(2) Structure Data Fields:

- **PCSKEY – (**Numeric 6)
  The PCSKEY is a numeric field accepting only positive and negative numbers. The PCSKEY number 0 can not be used. Positive numbers reflect projects that are in the PCS system. Negative numbers are keys that are assigned in the Bridge Section generally when a project is not in the PCS system.

- **DATE** – (MM/DD/YY)
  The current date. For example, 09/06/03.

- **STRUCTURE NAME** – (Character 40)
  The structure name field is self-explanatory. Use name in the Bridge Log if appropriate.

- **NO** – (Character 2) (Character 6)
  The Structure Number is preceded by a two character structure code that is used to recognize structures that are managed. Managed structures are those tracked in the National Bridge Inventory System (NBIS). BR is the prefix for all managed structure types. For non-managed structures the prefix is OT.
  The structure number field is a six-character field.
  THIS INFORMATION WILL BE SUPPLIED BY THE FRONT OFFICE, AND RETURNED TO THE DESIGNER IN A COMPUTERIZED PRINTOUT WITH ALL THE INFORMATION SUPPLIED IN THIS SHEET.

- **OLD STRUCTURE NUMBER** – (Character 6)
  Include OLD STRUCTURE number when appropriate for bridges being replaced.

2.2.3.7 Request for Bridge Number - (continued)

(2) Structure Data Fields: (continued)

- **COUNTY BRIDGE NUMBER** – (Character 10)
  Include County Bridge Number for bridges that have county bridge numbers.

- **OWNER** – (Character 3)
  Use the following codes:
  ST State
  CO County
  CT City
  FOR Forest Service
  BLM Bureau of Land Management
  BIA Bureau of Indian Affairs
  OR Other

- **STRUCTURE TYPE –** (Character 15)
  Select one of the following Structure Types.
  - Managed structure types:
    BRIDGE
    CANTILEVER SIGN
    CULVERT (> 6 feet)
    PED STRUCTURE
    SIGN BRIDGE
    TUNNEL
    OTHER STRUCTURE (managed)

  - Non-managed structure types:
    CULVERT (< 6 feet)
    BUILDING
    GUARDRAIL
    ILLUMINATION
    RETAINING WALL
    SIGNAL
    SIGNING
    SOUNDWALL
    OTHER STRUCTURE (non-managed)

- **DESCRIPTION** – (Character 15)
  Use the following codes for BRIDGE STRUCTURE TYPES:

CIP-ARCH	CIP CONCRETE ARCH
CIP-RF	CAST-IN-PLACE RIGID FRAME
CIP-SLAB	CAST-IN -PLACE SLABS
PS SLAB-12	Reinf. Conc. Slabs Precast
PS SLAB-15	Reinf. Conc. Slabs Precast
PS SLAB-18	Reinf. Conc. Slabs Precast
PS SLAB-21	Reinf. Conc. Slabs Precast
PS SLAB-26	Reinf. Conc. Slabs Precast
RCBG-CIP	RC BOX GIRDER – CONV. REINF.
RCBG-PB-BX42	RC BOX GIRDER - PRECAST- 42”
RCBG-PB-BX48	RC BOX GIRDER - PRECAST- 48”
RCBG-PB-BX33	RC BOX GIRDER - PRECAST- 33”
RCBG-PB-BX36	RC BOX GIRDER - PRECAST- 36”
RCBG-PB-BX39	RC BOX GIRDER - PRECAST- 39”
RCBG-PB-TUB52	RC TUB GIRDER - PRECAST- 52”

2.2.3.7 Request for Bridge Number - (continued)

(2) Structure Data Fields: (continued)

- **DESCRIPTION** – (Character 15) (Continued)

Use the following codes for BRIDGE STRUCTURE TYPES:

RCBG-PB-TUB58	RC TUB GIRDER - PRECAST- 58”
RCBG-PB-TUB64	RC TUB GIRDER - PRECAST- 64”
RCBG-PB-TUB70	RC TUB GIRDER - PRECAST- 70”
RCBG-PB-TUB76	RC TUB GIRDER - PRECAST- 76”
RCBG-PT	RC BOX GIRDER - POST TENSIONED
RCDG-CIP	RC DECK GIRDER-CIP
RCDG-PB-BI51	RC DECK GIRDER -PRECAST- BULB I 51”
RCDG-PB-BI63	RC DECK GIRDER -PRECAST- BULB I 63”
RCDG-PB-BI75	RC DECK GIRDER -PRECAST- BULB I 75”
RCDG-PB-BI84	RC DECK GIRDER -PRECAST- BULB I 84”
RCDG-PB-BI96	RC DECK GIRDER -PRECAST- BULB I 96”
RCDG-PB-BT45	RC DECK GIRDER -PRECAST- BULB T 45”
RCDG-PB-BT48	RC DECK GIRDER -PRECAST- BULB T 48”
RCDG-PB-BT60	RC DECK GIRDER -PRECAST- BULB T 60”
RCDG-PB-BT72	RC DECK GIRDER -PRECAST- BULB T 72”
RCDG-PB-BT84	RC DECK GIRDER -PRECAST- BULB T 84”
RCDG-PB-DK54	RC DECK GIRDER -PRECAST- DECK T 54”
RCDG-PB-DK36	RC DECK GIRDER -PRECAST- DECK T 36”
RCDG-PB-II	RC DECK GIRDER -PRECAST- TYPE II
RCDG-PB-III	RC DECK GIRDER -PRECAST- TYPE III
RCDG-PB-IV	RC DECK GIRDER -PRECAST- TYPE IV
RCDG-PBPTBI84	RC DECK GIRDER -PRECAST- PT-BI 84”
STEEL-ARCH	STEEL ARCH
STEEL-BOX	STEEL BOX GIRDER
STEEL-PLATE	STEEL PLATE GIRDER
STEEL-SUSP	STEEL SUSPENSION
STEEL-TRUSS	STEEL TRUSS
TIMBER	TIMBER BRIDGE

If you have mixed structure types supply information for the main span and indicate other types in the comments section.

Use the following codes for SIGN SUPPORT STRUCTURE TYPES:

SIGN1 (sign bridge, box truss)
SIGN2 (sign bridge, tri-chord truss)
SIGN3 (sign bridge, Vierendeel truss)
SIGN4 (sign bridge, single-plane truss)
SIGN5 (sign bridge, monotube)
SIGN6 (cantilever support, box truss)
SIGN7 (cantilever support, tri-chord truss)
SIGN8 (cantilever support, Vierendeel truss)
SIGN9 (cantilever support, single-plane truss)
SIGN10 (cantilever support, monotube)
SIGN11 (butterfly support, box truss)
SIGN12 (butterfly support, tri-chord truss)
SIGN13 (butterfly support, Vierendeel truss)
SIGN14 (butterfly support, single-plane truss)
SIGN15 (butterfly support, monotube)
SIGN16 (structure mount)

Use the following codes for CULVERT STRUCTURE TYPES:

CU-CMPARCH	CORRAGATED METAL PIPE ARCH
CU-CMPROUND	CORRAGATED METAL PIPE ROUND
CU-PLPIPEARC	STRUCTURE PLATE PIPE ARCH
CU-PLPIPEROU	STRUCTURE PLATE PIPE ROUND
CU-RCBC	REINFORCED CONCRETE BOX CULVERTS

2.2.3.7 Request for Bridge Number - (continued)

(2) Structure Data Fields: (continued)

- **DESCRIPTION** – (Character 15) (Continued)

  Use the following codes for RETAINING WALL STRUCTURE TYPES

RW-BINWALL	BIN-WALL RETAINING WALL
RW-CANT	ODOT STD CONC CANTILIVER RW
RW-CANT-BR705	ODOT STD CONC CANTILEVER RW, DWG BR705
RW-CANT-CIP	CANT. WALL BY OTHERS NOT STANDARD
RW-GABION	GABION RETAINING WALL
RW-GEOTEXTILE	GEOTEXTILE RETAINING WALL
RW-GRAV-BR720	ODOT STD CONC GRAVITY RW, DWG BR720
RW-MSE	MSE RETAINING WALL
RW-OPTIONAL	RETAINING WALL OPTION-DEFINE LATER
RW-SOLDIER PILE	SOLDIER PILE WITH SHOTCRETE RET. WALL
RW-WOOD	WOOD RETAINING WALL
RW-SOILNAIL	SOILNAIL Retaining Wall

  Use the following codes for SOUND WALL STRUCTURE TYPES:

SW-MASONRY	SOUNDWALL MASONRY
SW-OPTIONAL	SOUNDWALL OPTIONAL
SW-PCPANEL	SOUND WALL PRECAST PANEL
SW-TIMBER	SOUNDWALL TIMBER

- **BUILT** – (Numeric 4)
  Enter the year of original construction.

- **STRUCTURE LENGTH** – (Numeric 7)
  The structure length is the overall length of the structure. As defined by FHWA Bridge cost reporting guidelines. See Bridge Cost Data Instruction Manual for further guidelines. The length is not the centerline to centerline of bent distance.

- **RDWY WIDTH** – (Numeric 5)
  The roadway width field is the face of curb to face of curb.

- **NO OF SPANS** – (Numeric 3)
  The number of spans includes main and all approach spans.

- **CONFIG** – (Character 30)
  Enter the span configuration. (for example, 60ft-90ft-60ft).

- **HIGHWAY** – (Character 4) (Character 30) (Character 1)
  The Highway field is represented by two entries. The first is a four character field for the Highway Number. For State Highway numbers see the Bridge Log for reference. Counties may have a four-digit number like 2004. The second field is for the highway name.

- **MP** - (Character 1)(Numeric 6.2)
  The MilePost is identified with two fields. The first is the Milepost sign. This may be a "+" or a "-". The default is a "+", and only where a highway beginning point has been redefined will there be a need for the "-" sign. The milepoint (MP) number of a structure is usually the approximate midpoint of the structure. There are inconsistencies in our data, however, and people in the Transportation Inventory and Mapping Unit who are responsible for the Automated Milepoint Log make the official determination.

2.2.3.7 Request for Bridge Number - (continued)

(2) Structure Data Fields: (continued)

- **NEAR** – (Character 45)
  Enter the closest feature the structure is near.

- **CITY** – (Character 10)
  If the structure is in a city, enter the city name.

- **COUNTY** – (Character 10)
  Enter the county name

- **REGION** – (Numeric 1)
  Enter the region number. Valid region numbers are from 1 to 5.

- **TOWNSHIP, RANGE, SECTION** - Determine the location using your team's county map atlas. Refer to pages 12-17, *Basic Surveying for Highway Workers*, in the Bridge Section Library if you need a refresher course covering township, range, and section.

- **CURRENT/PHASE** – (Character 3)
  The Phase field is used to indicate the progress of the project.

- **CREW, DESIGNER, DRAFTER, CHECKER** – ALL(Character 3)
  Enter the responsible person's initials.

- **COMMENTS** – (3*Character 60)
  Enter any notes for the structure.

(3) Project Data Fields - Most of these fields come from the PCS data. Soma data will not be known until contract work is completed. Fill in only those items you know.

- **PCSKEY – (**Numeric 6)
  The PCSKEY is a numeric field accepting only positive and negative numbers. The PCSKEY number 0 can not be used. Positive numbers reflect projects that are in the PCS system. Negative numbers are keys that are assigned in the Bridge Section generally when a project is not in the PCS system.

- **DATE** – (MM/DD/YY)
  The current date. For example, 09/06/03.

- **SECTION NAME** – (Character 45)
  Enter the Section Name as listed in the PCS Report.

- **STATION** – (Numeric 10.2)
  Enter the station of the structure. If the project has more than one structure, enter the station of the first structure. Stations of other structures may be entered in the comments.

- **DESCRIPTION** – (Character 60)
  Enter a description of the project. For example, "Structure Widening, Seismic Retrofit and Rail Retrofit". This description is for the entire project which may include several structures.

2.2.3.7 Request for Bridge Number - (continued)

(3) Project Data Fields – (Continued)

- **LETTING DATE** – (MM/DD/YY)
  Enter the letting date for the project. For example, 09/06/04. This may be found in the PCS Report and may change. Try to keep as up to date as possible.

- **FAP NUMBER** – (Character 20)
  Enter the Federal-aid Project (FAP) number when available. Refer to Appendix Figure A2.2.3.7A for the elements that make up a typical FAP number. This number should be verified with what appears on the final Bid Tabulations.

- **FUNDING** – (Character 6)
  Enter the funding source. Examples may be I4R, HBR, HBROS, AND FAI-X, UNKNOWN.

- **DESIGN EA** – (Character 16)
  Enter the design EA. This should include the EA, SUBJOB and ACTIVITY. For example, a valid EA could be **C0371482/000-J13.**

  EA SJ ACT

- **DESIGNER, CREW** – (Character 3)(Character 3)
  Enter responsible person's three intials

- **PROJECT MANAGER** – (Character 15)
  Enter the name of the Project Manager.

- **REGION ENGINEER** – (Character 15)
  Enter the name of the Region Engineer.

- **CONTRACT DATE** – (MM/DD/YY)
  Enter the date the contract was entered into. For example, 09/06/03.

- **CONTRACT NUMBER** – (Numeric 5)
  Enter the contract number. For example, 11545

- **CONTRACT EA** – (Character 8)
  Enter the EA. For example, CON000109.

- **CONTRACTOR** – (Character 30)
  Enter the name of the prime contracting company.

- **COMPLETED DATE** – (MM/DD/YY)
  Enter the date project was completed. For example, 09/06/04.

- **ACCEPTED DATE** – (MM/DD/YY)
  Enter the date project was accepted. For example, 09/06/04.

- **COMMENTS** – (3*Character 60)
  Use for notes that may be helpful. A list of all bridges related to the project may be helpful here.

2.2.3.8 Job Record Sheet - The completed Job Record Sheet is a summary of a structure's identifying information and TS&L design data. If a project has more than one structure, a sheet is completed for each one unless minor work is being done to several bridges or a project has several retaining walls.

- The Job Record sheet is now the first sheet of the Cost Estimating Program and is located on the "F" Drive under F:\BRIDGE\BIDCOST\PRJSEED.XLS. Instructions and examples are located in the "Bridge Cost Data Instruction Manual" located in each room.

- At the completion of the TS&L design and the Job Record Sheet, the review signatures at the bottom of the sheet signifies that the TS&L design has been approved and the final design can begin. (Refer to Section 2.3.9, "Processing the TS&L Design Package".)

2.2.3.9 Preparing and Processing Job Record Folder - The Designer shall use the PCS's *Region Project Scheduling Report* and the Project Prospectus to complete the information requested in the upper portion of the Job Record Sheet.

Two important design schedule deadlines are noted on the Job Record Sheet:

- The estimated bid-opening date, sometimes referred to as the project, contract, or bid letting date.

- The estimated Preliminary Plans distribution date.

The bid-opening date is taken from the latest monthly PCS *Advance Scheduling Report* which is sorted by target date (bid-opening date) and State highway number. If the target date is shown as a 3-month quarter, such as JanFebMar 03, the fourth Thursday of the first month is used as the bid-opening date.

For a project with 3-week advertisement period, the Preliminary Plans distribution date is set at 20 weeks before the bid-opening date. (See Section 2.4.1.3, "Final Design Timetable".) For a 4-week advertisement period, 21 weeks would be used, and so forth.

If an ODOT Rail Crossing Order(for railroad structures) or Coast Guard permit application will be required (it should be indicated in the Project Prospectus), the "Permits Required" located further down the form is filled in. See BRIDGE PERMITS MANUAL each crew should have a copy in their room.

After completing the top portion of the Job Record Sheet, print an initial copy of the Job Record Sheet to turn this into the Front Office. The Front office will prepare a Job Record Folder with appropriate project label attached, and return them to the Designer ready to receive copies of job-related paperwork.

The following information should be kept in the Job Record Folder:

- Latest Project Prospectus.

- Copy of latest maintenance inspection report from Bridge Operation Team's files. (See Section 2.2.3.2(8).)

- Half-size prints of contract drawings for existing structures.

2.2.3.9 Preparing and Processing Job Record Folder - (continued)

- Vicinity map information. Copies should have already gone to Hydraulics and Foundation Units according to Section 2.2.2.2.
- Location Narrative.
- Copy of latest Bridge Project Prospectus Estimate.
- Copies of Foundation Report and Hydraulics Report. If the reports are not yet completed whatever information or notes pertaining to the structural design in the Foundation or Hydraulic Unit files can be copied and put in the folder.
- Other preliminary documents.
- Copy of Project Data and Structure Data sheets for Bridge Number request.

Certain blank forms, checklists, and worksheets, depending on type of structure or situation, may be included in the Job Record Folder for the Structural Designer's future use. Most of these forms are available in the template section in each designer's computer:

- Project Personnel References form (Appendix Figure A2.2.3.9A). As much of this form is completed as possible, and it is taped to the inside front cover of the Job Record Folder. The assigned Designer will fill in the rest of the names as they become available.
- Checklist for TS&L Submittal (Appendix Figure 2.3.1.2A).
- Checklist for Final Design (Appendix Figure A2.4.1.2A).
- Bridge Section Notes to Specifications Unit (see the template SPLIST96.DOC and Section 2.1.3.4).
- Project Budget Worksheet, ODOT Form 734-2223 (Section 2.4.7).
- Seismic Design/Retrofit Data Sheet (Section 3.1.6.5).
- Overhead Sign Support Inventory, if applicable (Section 3.1.6.2).

2.3 TYPE, SIZE, AND LOCATION (TS&L) DESIGN

2.3.1 TS&L DESIGN, GENERAL

2.3.1.1 What is a TS&L Design? - The type, size, and location (TS&L) design phase can begin once enough preliminary information is available to layout the structure. The end product of a TS&L design is basically a completed Job Record Sheet accompanied by:

- TS&L Plan and Elevation drawing (Section 2.3.8.1).
- TS&L Estimate of structure construction cost (Section 2.3.8.2).
- TS&L Narrative (Section 2.3.8.3).

Although much of the following discussion deals specifically with bridges, the fundamental procedure applies to smaller, less-complicated structures as well.

Because choices made during the TS&L design will determine both final cost and appearance of a structure, no design step is more important. Failure to make a complete TS&L investigation could mean valuable time and money wasted during final design.

2.3.1.2 TS&L Design Aids - A couple of helpful guides to what needs to be considered and done to complete a TS&L design are:

- Checklist for Type, Size, and Location (TS&L) Submittals (Appendix Figure A2.3.1.2A)

Some other sources that may provide ideas, background information, and guidance along the way are:

- Section 1, "General Provisions", and Section 2, "General Features of Design", AASHTO *Standard Specifications for Highway Bridges* and Section 2 "*General Design and Location Features",* AASHTO LRFD Bridge Design Specifications.
- Section 2.1.9.3, "Experimental Features Program".
- Section 5, "Design and Detailing Practices", of this manual which covers such subjects as bridge rail selection, wingwall location, deck overlay criteria, bridge-widening details, and impact attenuators.
- Annual *Structure Cost Data* books with plan and elevations and bid prices for all types of structures that went to contract during each year. Each Structural Design Team has a complete series.
- Highway video logs. (See Section 2.3.1.4, "TS&L Design Field Trips".)
- Roadway Engineering Section's straightline chart books with contract limits and references to roadway contract drawings for all ODOT projects on State primary and secondary highways.

2.3.1.3 Contact with Roadway Designer - For most assignments, you will be working closely with the Roadway Engineering Section Designer assigned to the project involving your structure. The Roadway Designer receives a variety of important field information, including the location survey data package, and is in active contact with Region personnel responsible for this information. In some cases, the project is designed in the Region and a Region Designer is the Roadway Designer.

Keep in touch with the Roadway Designer throughout the TS&L and final design phases so you both will know about any changes affecting each other's design.

2.3.1.4 TS&L Design Field Trips - A field trip to a proposed or an existing structure site can be a very beneficial design tool. A better understanding of site conditions during the TS&L design could influence important, far-reaching decisions. Site visits done in the company of experienced construction or maintenance personnel may be especially helpful.

For details of arranging a field trip, see Section 1.2.7.

If a field trip is not possible, you may be able to visit the project site by viewing a highway video log taken from a moving vehicle. The Traffic Engineering Section and the Transportation Inventory and Mapping Unit have video log libraries and viewing areas. The video logs cover all State primary and secondary highways.

2.3.2 THINGS TO KEEP IN MIND

2.3.2.1 Structure Appearance and Aesthetics - Keep in mind a bridge's appearance as well as its structural analysis.

Generally for bridges, appearance is best when elements are few and simple. Also try to:

- Keep lines straight and distinct.
- Place joints at offsets or other surface disruptions.
- Consider the effects of light and shadows, particularly on the appearance of concrete structures.
- Keep column sizes and depth-to-span ratios proportional.
- Keep arrangement of girders, crossbeams, and columns orderly and their proportions aesthetically appealing.
- Pay special attention to highly visible features such as large abutments or high retaining walls.

Sometimes aesthetics and environmental considerations may conflict. For example, Oregon Department of Fish and Wildlife restrictions may cause problems with your type of foundation or pier placement. However, if you start the permit application process as early as possible in the design stage, the permitting agency may soften its restrictions if given enough time to consider your point of view.

2.3.2.2 Traffic Handling and Data - Consider the various methods of handling traffic:

- Is the method proposed by the field the most reasonable way to build a project?
- Are there alternate and possibly more satisfactory solutions?

There are four basic methods of handling traffic when replacing a bridge:

- Close the highway while removing and rebuilding the bridge.
- Use the existing roadway and bridge while constructing a parallel bridge on new alignment.
- Construct a temporary detour around existing bridge and replace the bridge on the existing alignment.
- Use stage construction with one or more existing or new lanes carrying traffic while other portions of the existing bridge are being removed and rebuilt.

Often the last method is recommended over the second and third methods without proper investigation. Stage construction may:

- Cause a high number of complaints from the traveling public.
- Mean greater danger for ODOT and contractor personnel as well as to the public.
- Result in construction difficulties and longer construction time.
- Adversely affect the quality of the finished product.

Another traffic handling consideration that should not be overlooked is accommodating pedestrians (including the disabled) and bicycles passing through the work site, especially in urban areas.

Always discuss your traffic handling proposals with Traffic Control Plans personnel of the Roadway Engineering Section. The Traffic Control Plans Engineer as well as the Roadway Designer assigned to the project needs your input and cooperation to produce a coordinated, workable traffic control plan (TCP). Even if no grading work is included in a structure project, a TCP and traffic handling cost estimate still needs to be made.

Average Daily Traffic (ADT) counts for All State primary and secondary highways can be found in the latest annual *Traffic Volume Tables* published by ODOT's Transportation Research Section. Each Design Team has copies or electronically at http:/www.odot.state.or.us/tdb/traffic_monitoring/tvtable.htm.

If specific traffic accident information about a structure site is needed from the Accident Record System, send an Accident Data Request Form (Appendix Figure A2.3.2.2A) to the Accident Data Unit, Transportation Research Section. However, if interpretation or analysis of traffic accident data is required, contact Traffic Engineering Section's Investigation and Research Group. Safety Priority Index System (SPIS) tables are available electronically at http:/intranet.odot.state.or.us/techserv/trafmgt/SMS/SPIS/SPIS.htm.

2.3.2.3 Bikeways - Oregon law requires that reasonable amounts of highway funds be spent for bicycle and pedestrian facilities. That means: consider bikeway staging needs wherever highways, roads, or streets are being constructed, reconstructed, or relocated.

Normally, the Regions determine if a bikeway will be included in a project. Page 1 of 2, Part 1 of the Project Prospectus (Appendix Figure A2.2.2.1A) should show bikeway involvement. Bikeways should also be mentioned in the location narrative. But be aware that they can be overlooked, especially in urban areas!

"Bikeway" is a general term meaning any road or paths open to bicycle travel regardless of whether it is designated for bicycles or to be shared with pedestrians or automobiles. Specific types of bikeways are:

- Bikes lanes or bike paths.
- Shared roadways.
- Shoulder bikeways.
- Sidewalk bikeways.

To work with bikeways, you are going to need:

- *Oregon Bicycle Plan.*
- AASHTO *Guide for the Development of Bicycle Facilities.*

Each Structural Design Team should have copies. Pay particular attention to the following memo reprints in the *Oregon Bicycle Plan*:

- "Appendix G: Separated Bike Paths Criteria/Guidelines"
- "Appendix H: Bike Lane Retrofit Guidelines"
- "Appendix L: Guidelines for Interchange Areas"
- Loose insert: "Bikeway Project Selection Criteria and Rating Sheet" dated January 12, 1993

Also refer to Section 5.1.19, "Bridge Rails", and Section 5.4.8.1 "Roadway Clearances" for guidelines.

For a pedestrian and/or bikeway bridge with a 10 foot or greater traveled way, check with the region in which it is located to determine if it should be designed for a maintenance vehicle or power sweeper. See also the AASHTO "*Guide Specifications for Design of Pedestrian Bridges".*

2.3.2.4 Protection of Recreational/Cultural Resources - Be alert to the effects of construction on:

- Recreational activities, areas, or facilities.
- Cultural resources such as fossils, artifacts, burial grounds, or historical bridges and dwellings.

Refer to Section 00170.50, "Protection of Cultural Resources", ODOT *Standard Specifications for Highway Construction.*

Although normally researched and proposed by ODOT's Environmental Section, protection or consideration of these activities or resources can be initially overlooked. Permit requirements from agencies like the U.S. Army Corps of Engineers or Oregon Department of Fish and Wildlife deal with historical, cultural, and recreational concerns too. Here are some examples of challenges from the past:

- Protection of summertime river rafters passing under a contractor? s work bridge.
- Removal of large amounts of river debris hung up on cofferdams and endangering a collegiate racing crew practicing downstream.
- Saving of old or rare trees near a city bridge construction site in deference to neighborhood sentiment.

2.3.2.5 Right-of-Way - Proposed and existing right-of-way limits and any construction easements should be included with the vicinity map information. (See Section 2.2.2.2.) Ask yourself: Can my structure and the contractor's operations (work bridge, shoring, falsework, etc.) be accommodated within these limits?

For questions about right-of-way data, contact the project's Roadway Designer, who is in touch with the Right-of-Way Description Group and Right-of-Way Services personnel in the Regions. Both the Location Narrative and the Right-of-Way Estimate Report included in the location survey data package discuss right-of-way provisions and concerns.

For the structure project that does not involve roadwork, verify that steps to acquire necessary right-of-way have been initiated.

Anticipate any need for additional right-of-way as early as possible because of the long lead-time required purchasing right-of-way.

2.3.2.6 Utilities - As an early TS&L design task, determine if there are:

- Requirements for carrying existing and future utilities on bridges.
- Requirements for accommodating utilities in the vicinity of box culverts, sound walls, or retaining walls, especially mechanically stabilized earth (MSE) walls. (See *ODOT Retaining Structures Manual.*)

If you are providing for existing or future utilities on a bridge, read Section 5.4.7, "Utilities on Structures".

2.3.2.6 Utilities – (continued)

Generally, utilities refers to power, telephone, TV cable, water or gas lines as well as storm sewers (not connected with highway drainage) and sanitary sewers. For the official version, see Section 00110.20, "Definitions", in the ODOT *Standard Specifications for Highway Construction.*

Part 2 of the Project Prospectus (Appendix Figure A2.2.2.1C) lists utility companies involved in the project. Location of existing or proposed utilities should be included with the vicinity map information. (See Section 2.2.2.2.) The *Utilities Report* and Location Narrative, both included in the location survey data package, will also provide information about:

- Types of utilities with ownership and location noted.
- Conflicts expected.
- Contacts made, discussions, and results.
- Timing requirements.
- Cost of work.

The Region Utility Specialist is responsible for furnishing:

- Location of all utilities.
- Information about utilities on structures such as:
  - Side of bridge preferred for location.
  - Accommodation within or attachment to rail or rail support.
  - Size of hole required if carried through bridge.
  - Type and longitudinal spacing of inserts in bottom of deck.
  - Size of encasement pipe under end panels.
- Any special or unusual conditions such as:
  - Contractor's required cooperation.
  - Utility-Contractor negotiations concerning installations.
  - Timing requirements.
  - Stage construction.
  - Special protection of existing facilities.

Before contacting the Region Utility Specialist directly for needed information or answers to questions, check with the Roadway Designer assigned to the project or the Railroad and Utility Coordinator of Right-of-Way Services. For a general reference, the Bridge Section Library has a copy of the *Railroad and Utility Manual*.

2.3.3 PERMITS--POTENTIAL TROUBLE!

2.3.3.1 Permit Applications - If your bridge is over water or a railroad track, you will probably be involved in the permit application process. Even if no permit is required for a waterway crossing, restrictions or comments from the permitting agency may have to be shown on the contract drawings or stated in the special provisions. Always review Part 2 (Appendix Figure A2.2.2.1C) of the Project Prospectus for early indications of possible permit requirements. And then there is the rare situation of an interstate river crossing into Washington and Idaho. If ODOT is the contracting agency, we may need to apply for permits required by the other state.

2.3.3.2 Three Major Permits - Basically, the Structural Designer is directly involved with supplying information for three types of permit applications:

- U.S. Corps of Engineer/Oregon Division of State Lands (DSL) joint permit application (federal/state waters) submitted by the Permit Liaison of the Roadway Engineering Section.
- U.S. Coast Guard permit application (navigable waters) also submitted by the Permit Liaison.
- Rail Crossing Order (formerly PUC permit) for railroad crossings processed by the Rail Safety Unit of the Transportation Development Branch.

There is a special permit, which does not fit into one of the major permit categories. Before using in-water blasting (for example: keying footings into streambed rock or removing an existing bridge pier), the contractor must have a permit from the Oregon Department of Fish and Wildlife. The contractor will have to submit a Blasting Plan before attaining this permit. Be sure the project special provisions spell out:

- That such a permit is required.
- That adequate lead-time is required to process the application.
- Where contractors can get application information.

Much of the information supplied for permit applications by the Bridge Section is in the form of drawings with specific data shown. TS&L plan-and-elevation drawings and vicinity maps are normally used as a basis for special permit drawings, but they should be stripped of any information not needed to obtain the permit. Keep in mind: the people reviewing the applications are probably not structural designers. They do not have time to sift through many drawing details and dimensions not relevant to the permit approval.

For Federal-aid projects, permits should be in hand 6 to 7 weeks before the bid opening. Usually, FHWA will not usually approve a PS&E submittal without all required permits issued. For other classes of projects, the absolute deadline is the advertisement date or three to four weeks before the letting date.

2.3.3.2 Three Major Permits – (continued)

The need to supply the required permit information as soon and as accurately as possible cannot be overemphasized. Some applications take 6 or more months to get approval. Drawings and any draft special provisions required for Corps of Engineer/DSL permit applications are asked to be submitted to the Permit Liaison, Roadway Engineering Section, 21 to 24 weeks in advance of the project advertisement date. An application returned for missing data can be a scheduling disaster! (See also the third paragraph of Section 2.3.2.1, "Structure Appearance and Aesthetics", for another benefit of early-bird involvement.)

So, if you are involved with one of the major permits just described, you can find a Bridge Section's *Bridge Permits Manual* in your Team library.

2.3.3.3 Other Permits - You should be aware of several other types of permits that may be required for structure projects, even though you may not be directly responsible for furnishing application information:

From ODOT Highway Design Manual:

- Permits issued by canal, diking, and irrigation districts. These are the responsibility of the Region Location Engineer or designated representative of the Region Engineer. The Region Utility Specialist handles canal crossings in coordination with the Railroad and Utility Unit in Salem.

- Floodplain permits issued by cities and counties. Region personnel also secure these permits. (See Chapter 1, ODOT *Hydraulics Manual* for background on floodplains.)

- Utility permits. Issued to utility companies by the Permits Unit of Operations Support Services. The permits allow the installation, relocation, and removal of utilities within the State right-of-way.

- National Pollutant Discharge Elimination System (NPDES) permit. ODOT is required to have an erosion control plan for projects with five or more acres disturbed by construction activity. The project Roadway Designer develops the plan with input from several other ODOT sources including the Hydraulics Units.

2.3.4 BEFORE YOU START

2.3.4.1 Review of Job Record Folder and Files - Thoroughly review:

- Contents of the Job Record Folder. (See Section 2.2.3.9.)
- Project Precontract File, Main Files/Supply Room 321.
- Vicinity map information. (See Section 2.2.2.2.)

An important point to remember:

> Throughout the TS&L and final designs, the Designer is responsible for checking the Project Precontract File for newly added material.

And read again Section 2.1.3.2, “Reminders About Original Documents”.

If available information is insufficient to complete the TS&L design, you may need to draft a request, to be signed by your Design Team Supervisor, for additional data from the Regions or other sources.

If either the Hydraulics Report or Foundation Report has not yet been issued, confer with the Hydraulics or Foundation Designers working with your structure. They can give helpful guidance and usually have field data and site photographs available in their files.

And do not forget the highway video logs if you are involved with an existing structure and cannot take a field trip. (See Section 2.3.1.4, “TS&L Design Field Trip”.)

Keep in mind the estimated design and construction costs should be reviewed anytime during the TS&L stage that changing circumstances cause significant design changes. Refer to Section 2.3.9, “Processing the TS&L Design Package”.

2.3.4.2 Review of Project Design Standards and Geometry - At this point, you may want to brush up on bridge and roadway design standards covered by:

- AASHTO *Standard Specifications for Highway Bridges*
- AASHTO *LRFD Bridge Design Specifications*
- ODOT *Highway Design Manual*

Note that horizontal curves are normally spiraled according to Table 4-7, ODOT *Highway Design Manual.* Spiral details and tables are found in ODOT Technical Bulletin 20 *Standard Highway Spiral*, revised August 1973. Each Structural Designer and Structural Drafter should have one.

2.3.4.2 Review of Project Design Standards and Geometry – (continued)

Project design standards are noted in Part 2, "Project Details", of the Project Prospectus (Appendix Figure A2.2.2.1C).

Design exceptions to current AASHTO standards should be addressed as early in the project development as possible. Approval of a design exception is a joint responsibility of the Region Manager and the Technical Services Managing Engineer. Bridge Section requests for design exceptions are made through the Roadway Engineering Manager. For more details, read Section 5, "Project Exception Process", ODOT *Highway Design Manual*.

Review the project geometry with the Roadway Designer to verify that you have the latest alignment, roadway cross sections, and grades. Some questions to consider:

- Do grades, superelevations, etc., provide enough vertical clearances for the type of structure anticipated?
- Is the choice of bridge width and horizontal and vertical alignment consistent with traffic volume and type of road.
- Structures are more susceptible to roadway surface icing and superelevation rates in excess of 0.08 ft/ft are considered hazardous under those conditions. Use greater rates only if special study has determined that the greater rate is desirable.

2.3.5 FUNDAMENTAL DECISIONS FOR BRIDGE DESIGNS

2.3.5.1 Bridge Length

(1) General - Determine the bridge length by referring to the following as applicable:

- Section 5.1.6.1, "Determining Bridge Length".
- Bridge Standard Drawing BR115, "Standard Slope Paving".
- Following Subsections (2) through (6).

(2) Waterway Openings and Hydraulic Requirements for Stream Crossings - Refer to the *Hydraulics Report* for design recommendations. If it is not available yet, consult with the Hydraulic Designer for preliminary guidance and any field data.

Some helpful guides and references are:

- Chapter 1, "Drainage Guidelines", ODOT *Hydraulics Manual*. A good reference for basic terminology.
- Chapter 3, "Designing Bridges for Scour", FHWA *Evaluating Scour at Bridges*. Available from Hydraulics Unit.
- Section 5.1.1, "Foundation and Hydraulics Considerations".
- Section 5.1.4, "Underwater Construction".

2.3.5.1 Bridge Length – (continued)

With respect to design floods and analysis, the standard design flood for bridges on Interstate Highways is 50-year and for other highways is 50-year or 25-year depending on their traffic volume. Designated floodway projects are designed for 100-year floods, and if any structures, walls, or fills encroach on a floodway area, you will need to contact the Hydraulics Unit for comments and requirements. The criteria for selecting the design flood is included in Chapter 1 of the *Hydraulics Manual*.

All designs are analyzed for 100-year floods with a safety factor of 3:1. However, structural stability must be checked for a 500-year flood with safety factor of 1. The *Hydraulics Report* will give the 100-year and 500-year scour elevation.

The *Hydraulics Report* may recommend a waterway opening capacity of less than a 50/25-year design flood for a local agency bridge. The Hydraulics Unit will have contacted the agency for future plans to raise the road and, if the road will be raised, determined that the hydraulic design is satisfactory and the overtopping flood is less than a 25-year flood.

The waterway opening under a bridge must be capable of passing the design flood with clearance to design high water according to the following:

- Width of waterway opening is measured normal to stream flow. The waterway area is the normal channel area below the design flood high water elevation. Minor channel cleanup and modification is acceptable, but major lowering of the streambed under the bridge to increase the opening is not only ineffective but unacceptable.

- The *Hydraulics Report* will recommend the minimum bottom-of-beam elevation. Normally, a minimum bottom-of-beam clearance of 1 foot is provided above the design flood elevation. The exception would be for county and city bridges whose approaches are overtopped more frequently than once every 10 years. The minimum bottom-of-beam elevation provided for these situations is 1 foot above the 10-year design flood elevation. Large amounts of drift or ice flows may require more clearance. If practical, 1 foot of clearance above the 100-year elevation is provided.

- Under rare circumstances such as a park setting or where other controls on grade lines make it necessary, high water above beam bottoms or over the deck may be allowed.

- Ordinarily, the design flood should not overtop the adjacent roadway. When the roadway over topping flood is less than the design flood, the overtopping flood becomes the design flood.

If there are no future plans to raise a roadway to eliminate overtopping, a combination of bridge waterway opening and overtopping at the low points of adjacent roadway may be an acceptable alternate to accommodating the entire stream flow under the bridge. For Interstate Highways, the minimum overtopping frequency is 50 years.

2.3.5.1 Bridge Length - (continued)

Roadway overtopping at lesser recurrence intervals than the 50/25 years is acceptable and allowable in certain circumstances such as:

- Other roads in the area are overtopped.
- Traffic counts are low.
- Alternate routes are available.
- Road is useable when overtopped (shallow overtopping).
- The required bridge would be excessively long or high and a review is made of the effect of backwater and overflow on adjacent properties and facilities.

(3) Skewed Box Girders - If you are considering skewed box girders, take into account the recommendations of Section 5.6(9.4)3.

(4) Width and Cross Section of Lower Roadway - For horizontal clearances, see Section 5.4.8.1. Choose your back-slopes as follows:

- Use 2:1 end fill slopes for all bridges except for county roads or less-traveled highways.
- Use 1.5:1 end fill slopes for county roads or less-traveled highways based on traffic count and ODOT *Highway Design Manual* Figure 4-1, “Standard Sections for Highways Other Than Freeways”.

(5) Stock Paths at Stream Crossings - Normally, provisions for stock to cross the roadway should be located away from the bridge crossing to prevent pollution of the stream. However, if a stock path running under the bridge parallel to the stream is required, additional bridge length will be needed to accommodate:

- Sufficient horizontal space and vertical clearance to construct a benched section for a path above ordinary high water.
- A fence to keep stock out of the stream.

Stock passes are discussed in Article 6.6.6, “Stock and Equipment Passes”, ODOT *Highway Design Manual*.

(6) Clearances and Cross Sections for Railroad Crossings - See Section 5.4.8.2.

2.3.5.2 Structure Layout: Spans and Proportions

(1) Column Locations - Column locations, which of course affect span lengths, are subject to clearance requirements of Section 5.4.8.1, AASHTO standard clearances, or by hydraulic considerations. After these conditions are met, spans lengths are to be governed by economics and aesthetics. (See Section 2.3.5.3, "Structure Types and Economics", and Section 2.3.2.1, "Structure Appearance and Aesthetics".)

If columns are located in the median of a divided highway and within the clear zone (for definition, see Section 1 Glossary), they must be protected from traffic by:

- An earth mound if the face of the column is from between 50 and 30 feet from the edge of a travel lane or
- A guardrail or concrete barrier if the face of column is less than 30 feet from the edge of a travel lane. However, guardrail cannot be used if the rail face will be closer than 5 feet to the column face.

Check with the Roadway Designer about which barrier will be used. It will affect the bridge's appearance and may influence the type of column selected.

When locating columns and span configurations. You should consider the effects of columns in waterways. The possibility for scour or difficulty in inspecting a column that is in the highest flow area of a river. Instead of placing the column directly in the middle of the river, maybe look at other alternatives.

(2) Structure Depth - Structure depth, also referred to as superstructure depth, is generally controlled by span length and clearance limitations. Keep structure depth, especially for grade separations, to a minimum consistent with good engineering practice.

(3) Beam Spacing - Beam spacing is normally dependent on beam capacity. Generally, beam spacing should not exceed 9 feet. As span length increases, beam spacing should decrease. Deck overhangs should be no more than one-half the beam spacing. Long deck overhangs, even if the deck is post-tensioned transversely, tend to sag over time.

2.3.5.3 Structure Types and Economics

(1) General - Structure type is the most important factor influencing bridge costs. (Substructure considerations are second.) For the following discussion, structure type generally means classification by construction material and method of construction.

As can be determined from the Bridge Section's annual *Structure Cost Data* books, structure types in order of increasing costs are as follows:

Structure Type	Span Range
Precast concrete slabs	up to 70 feet
Precast concrete box beams	up to 120 feet
Cast-in-place concrete slabs	up to 50-66-50 feet
Precast integral deck concrete girder	up to 130 feet
Precast concrete girder	up to 140 feet
Cast-in-place box girder	*
Cast-in-place post-tensioned box girder	*
Steel girder	*
Steel truss	*

*Normally used for longer, multi-span continuous bridges.

Timber bridges up to 30' of length may be considered for special situations. (See Section 5.3.1, 'Timber Bridge Locations".) The cost of a timber bridge may be more than a concrete bridge of the same length.

(2) Precast Concrete Versus Cast-in-Place Concrete - Formwork is the key to concrete structure costs. Use of standard forms or repeated use of specially built forms means lower costs. For smaller bridges in remote areas, precast or shop-fabricated elements usually lead to the most economical solution.

Precast concrete slabs have the following pluses:

- Good for shorter stream crossings, low-volume roads, and remote locations.
- No falsework required in roadway or stream.
- Fast, simple installation, saving construction time.
- Shallow depth providing greater clearance to stream or roadway surfaces below.

However, they have problems with:

- Providing smooth riding surfaces. (AC wearing surface is required to level up except for low-volume roads.)
- Accommodating horizontal curves, gradelines, or superelevations. (Thickness of AC wearing surface to accommodate superelevation can become excessive.)
- Multi-span resistance to longitudinal seismic loads.

2.3.5.3 Structure Types and Economics - (continued)

(2) Precast Concrete Versus Cast-in-Place Concrete - (continued)

Precast concrete box beams, girders, and integral bulb-T beams have most of the same good and bad points that the precast slabs do. They can accommodate longer spans, but they do have deeper depths resulting in less clearance to stream or roadway surfaces below.

In general, cast-in-place concrete spans are a good choice:

- For longer spans.
- Where ability to resist seismic forces is important.
- For accommodating horizontal curves, gradelines, or superelevations.

However, three drawbacks are:

- Falsework is required.
- Falsework in the roadway below a grade crossing creates traffic hazards.
- Settlement of falsework before post-tensioning begins is a potential problem.

(3) Continuous Steel Span Bridges - Steel construction extends the span length range and usually does not require falsework in the roadway or stream. However, steel bridges normally cannot compete in cost with concrete alternates, and paint maintenance is a problem unless weathering steel is used. (See "Weathering Steel Guidelines" in the Bridge Section's *Structural Steel Girder Design and Detailing Guidelines*. Each Design Team has a copy in its library.)

(4) Bridge Widening - Generally, the same type of construction that matches the existing bridge is used for the widened portion. See also Section 2.3.6.5.

2.3.5.4 Substructure Choices

(1) Type of Foundation and Scour Protection - Read the *Foundation Report* (see Section 2.2.2.6) for information and recommendations about type of foundation required, or talk to the Foundation Unit if the *Foundation Report* is not yet available. For stream crossings, the Hydraulics Unit makes its recommendations for scour and riprap protection in the *Hydraulics Report* (see Section 2.2.2.5). Also refer to Sections 5.1.1, "Foundation and Hydraulic Considerations", and 5.1.4, "Underwater Construction", for guidelines about riprap and footing placement.

An important point to remember about scour design is that structural stability is analyzed for a 100-year flood using 3:1 safety factor, but it must also be checked for a 500-year flood with safety factor of 1:1. Chapter 3, "Designing Bridges for Scour" of FHWA's *Evaluating Scour at Bridges* is a helpful reference available from the Hydraulics Unit.

(2) Abutments and Bents - Sections 5.1.6 and 5.1.7 may have some useful information to guide preliminary bent and wingwall layout.

2.3.6 OTHER BRIDGE DESIGN CONSIDERATIONS

2.3.6.1 Bridge Rail - Turn to Section 5.1.19 for discussion about design and selection of bridge rails. If you are working with a grade separation, check out the criteria for using protective screening in Section 5.4.4.6.

2.3.6.2 Bridge End Panels and Supports - Provide reinforced concrete bridge end panels for Interstate and State highway bridges. Counties, cities, or other agencies can choose whether or not to include them in their project contract.

When end panels are required, show the general outline of them on the bridge plans with reference to the panel details shown on Bridge Standard Drawings or detail plans. Include end panel quantities with the bridge quantities.

In regards to end panel supports:

- Detail ledges or other methods of support for all bridges (including those of other agencies), even through end panels are not called for when the bridge is built.
- Provide bridges that have sidewalks with a method of supporting approaching sidewalks at the bridge ends (present or future) if no end panel extends into the walk area.

Refer to Section 5.1.6.13 for more end panel detailing considerations.

2.3.6.3 Slope Paving/Railroad Slope Protection - Generally, where a roadway passes under a bridge, provide slope paving on the bridge end fill according to Bridge Standard Drawing BR115. Also, consider slope paving where a bridge crosses over a sidewalk or park.

For a highway bridge crossing over a railroad, rock slope protection may be required on the end fill slope under the bridge.

2.3.6.4 Corrosion Protection Concerns - Requirements for corrosion protection of reinforcing steel are covered in Section 5.1.23. Weathering steel guidance is included in Bridge Section's *Structural Steel Girder Design and Detailing Guidelines* in each Design Team area.

The Bridge Section's Preservation Team has the overall responsibility for protecting Oregon's bridges (decks, surfaces exposes to salt, etc.) to ensure their anticipated longevity. Make good use of the Team's expertise!

2.3.6.5 Bridge Widening and Deck Overlays - Bridge widening details are found in:

- Section 5.1.7.3 (interior bents).
- Section 5.1.11.2(6) (precast, prestressed beam superstructure.)
- Section 5.1.12.10 (cast-in-place superstructure).

When involved in projects requiring repair or protection of existing decks using asphalt concrete or structural concrete overlays, review Section 5.1.18.5, "Deck Overlays".

2.3.7 WORKING WITH MISCELLANEOUS STRUCTURES

Before researching AASHTO *Standard Specifications for Highway Bridges* and other AASHTO specifications and design publications about structures such as retaining walls, soundwalls, and box culverts, read:

- Section 5.2.3, “Sign, Signal, and Luminaire Supports”.
- Section 5.4.1, “Retaining Walls”.
- Section 5.4.2, “Soundwalls”.
- Section 5.4.3, “Impact Attenuators or Crash Cushions”.
- Section 5.4.5, “Culvert Design”.

2.3.8 TS&L DESIGN END PRODUCTS

2.3.8.1 TS&L Plan and Elevation Drawing - In its final form as part of the approved TS&L design, the TS&L Plan and Elevation drawing is produced on a half size CAD paper print. Drawing numbers and full size mylars are not required.

For the information and details it should include, refer to:

- Checklist for TS&L Submittal, Figure A2.3.1.2A Appendix.
- Section 4.6, “Type, Size, and Location Plan and Elevation”.

After review by your Design Team Supervisor, have two half size CAD prints made: One to go with the TS&L Design submittal (and eventually to the Project Precontract File) and one to keep in the Job Record Folder for reference.

The TS&L Plan and Elevation drawing can be modified to be used with other permit requests, as well. See Bridge Section’s *Bridge Permits Manual*.

2.3.8.2 TS&L Estimate - Before starting the TS&L Estimate, carefully read Sections 2.4.3.1 through 2.4.3.3 about the Final Estimate.

Normally, the TS&L Estimate of structure quantities and costs is based on a rough calculation of quantities. However, if time is short and the structure is ordinary or typical, square-foot costs may be adequate. A bridge with tall end bents would not be considered typical, and would, therefore, require a rough quantity estimate to account for the greater abutment costs.

When preparing the TS&L Estimate use the STRUCTURE BID COST PROGRAM PRJSEED.XLS. It is located on the “F” Drive at F:\BRIDGE\BIDCOST\PRJSEED.XLS. Refer to BRIDGE COST DATA INSTRUCTION MANUAL for further information about the program. Each Design Crew should have a copy of this manual in their room. See the manual for examples of estimate printouts.

2.3.8.2 TS&L Estimate - (continued)

Your TS&L estimate will later be cloned into your Final Estimate and then used to produce your Structure Cost Data Reports (see Section 2.4.3).

To estimate rough quantities for concrete reinforcement, use reinforcement-to-concrete ratios. Determine the ratios from reinforcing steel and concrete quantities and contract prices for similar structures found in one of the annual *Structure Cost Data* books that each Design Team has.

For unit costs the most frequently used bid items will have an average unit cost automatically shown when each item is selected in the cost program. This number is just an average cost and each project is different so pay attention to your particular job. Items with unusually small or large quantities, remote locations, new construction techniques, etc may need adjustment.

You may need to adjust these costs to account for the location of the structure or unusual details or construction methods.

For mobilization, use 10 percent of the base structure cost -- that is, the cost before adding mobilization and engineering/contingencies costs. Note that square-foot costs listed on cost estimating sheets already include 10 percent for mobilization.

For square-foot estimates, allowance for engineering and contingencies is 40 percent of the sum of base structure cost plus mobilization cost. Since 20 percent is used for the Final Estimate, prorate the percentage between 20 and 40 for rough quantity estimates, depending on the accuracy of your quantity figures.

2.3.8.3 TS&L Narrative - A TS&L Narrative is required for each design project except those minor ones such as deck joint rehabilitations, rail retrofits, or projects that will not be distributed for TS&L review. The Design Team Supervisor decides if a TS&L Narrative is not needed.

The purpose of the TS&L Narrative, which is in the form of a Memo to File, is to provide enough background information so that reviewers can effectively evaluate the proposed final design and the concepts it is based on. Summarize this information concisely. Do not include design details. Ordinarily, the Narrative is two or three pages long (see example, Appendix Figure A2.3.8.3A).

The following is a general outline of discussion item suggestions:

- General Background:
  - Project development and justification.
  - Right-of-way restrictions.
  - Permits and restrictions.
  - Utility conflicts or restrictions.
  - Railroad clearances and restrictions.
- Geometry and layout:
  - Roadway width, ADT, grades, and alignment. (If design does not meet current AASHTO standards, note that a design exception has been or will need to be made.)
  - Sidewalks, rails, and protective fencing.
- Hydraulics:
  - Waterway openings, high water elevation, and clearances.
  - Bank or bent protection.
  - Floodway information, when appropriate.

2.3.8.3 TS&L Narrative - (continued)

The following is a general outline of discussion item suggestions: (continued)

- Foundations:
  - Piling, spread footings.
  - Fills, surcharges.
  - Settlement.
  - Lateral earth or seismic loads.
- Structure Features:
  - Span length and span arrangement.
  - Type of superstructure.
  - Type of bents and location.
  - Alternate structure types considered and estimated costs.
  - Stage construction and detour requirements.
- Design concepts - Rationale for decisions about:
  - Building new bridge versus widening existing one.
  - Use of bridge versus culvert.
  - Foundation support assumptions.
  - Assumed pile or bearing capacity loads.
  - Assumed lateral soil pressure against end bent.
  - Seismic load assumptions.

Many bridge replacement projects require a Biological Assessment. To aid in the process, try to address as many of the following subjects as practical.

1) Project timing and chronology.
2) Alignment and size of the new bridge in relation to the existing bridge (i.e., number of spans, length).
3) Quantity of impervious existing bridge surface removed and added by the new bridge.
4) Type of the new deck surface and construction methods.
5) Type of the new bridge railing and construction methods.
6) Proposed treatment of the runoff (i.e., number of scuppers or direct discharge drains on the old bridge vs. number of drains on the new bridge)
7) Number and sizes of the existing bents/footings to be removed within the OHWM and the wetted channel. Discuss the sizes, numbers and removal methods of the existing bents, footings and piles.
8) Number and sizes of bents/footings added for the new bridge, within the OHWM and the wetted channel. Discuss the sizes, numbers and construction methods for the new footing, bents and piles.
9) Type of isolation method used during construction (i.e., coffer dam).
10) For bridges with lead based paints, discuss the method of removal and disposal.
11) If a detour bridge, working bridge, or falsework are required, discuss how many bents and types of temporary supports may be within the OHWM and wetted channel. Discuss the construction and removal methods that might be used.
12) Extent and duration of in-water work (i.e., heavy machinery in wetted channel).
13) Amount or extent of fill and/or rip-rap.
14) Possible staging areas and access.
15) Amount and type of vegetation to be removed (outside and within the OHWM).
16) Amount of wetland impacted.
17) Any planned mitigation.

2.3.8.3 TS&L Narrative - (continued)

Biological Assessment input:: (continued)

Note: Even though the *Hydraulics Report* or *Foundation Report* may not be available at the time the TS&L Narrative is written, always include comments about assumptions made in consultation with the Hydraulics or Foundation Designer. Also, send two copies of the TS&L Narrative rough draft to the Geo/Hydro Section so that the Foundation and Hydraulics Units can review those parts dealing with their concerns. Attach prints of the TS&L Plan and Elevation Drawing for reference.

After the Design Team Supervisor has reviewed the TS&L Narrative rough draft, have it typed, sign it, and have your Supervisor note it. The original will be included in the TS&L design submittal to another Design Team Supervisor for a peer review. Make a copy for your design calculations.

2.3.9 PROCESSING THE TS&L DESIGN PACKAGE

2.3.9.1 Submittal for Approval - After the TS&L Plan and Elevation drawing, Estimate, Narrative, have been completed and reviewed by your Design Team Supervisor, complete the remainder of the Job Record Sheet.

If not already done, look at the estimated structure design cost figure with your Supervisor. If there is a significant change, make a revision on the original Job Record Sheet. The Region should also be contacted if the TS&L Estimate is significantly different than the construction cost shown on the latest Project Prospectus or the latest Bridge Project Prospectus Estimate Sheet.

When you have completed the Job Record Sheet, put it in the Job Record Folder. Temporarily remove and keep at your desk all material not essential to the reviewer. The Job Record Folder should include the following when given to your Supervisor:

- Completed Job Record Sheet.
- Half-size print of TS&L Plan and Elevation drawing.
- Original TS&L Narrative, signed by Designer and noted by Supervisor.
- Original TS&L Estimate.
- Half-size print of vicinity map or electronically transmitted data.
- Copy of Foundation Report.
- Copy of Hydraulics Report.
- Copy of Project Prospectus.
- Copy of Location Narrative.

2.3.9.1 Submittal for Approval - (continued)

Your Design Team Supervisor will forward the Job Record Folder to another Supervisor for review and approval of the TS&L design.

After another Team's Supervisor has approved the TS&L design and signed the Job Record Sheet, the Job Record Folder will be returned to you. Make a copy of the signed Job Record Sheet for the Job Record Folder. Return to the folder all material originally removed. Staple or secure together the following and send them to the Project Precontract File:

- Original Signed Job Record Sheet.
- Half-size print of the TS&L Plan and Elevation drawing.
- Original TS&L Estimate.
- Original TS&L Narrative.

2.3.9.2 Distribution to Outside Reviewers – Plan distribution will be made through Roadway Engineering as part of their "Roadway Concept Plans" distribution. The Bridge Designer will develop the Bridge Distribution list. The distribution is dependent on the type of project and project funding: Federal-aid, State, or city or county. In the letter distribution comments for approval by local agencies, point out that membrane waterproofing and end panels are included on the structure, if applicable. Boilerplate transmittal letters and distribution lists are on the ODOT ftp site, at techserv\roadway\offadmin.

Have your Supervisor review the distribution list. Remember to identify the prints as "Review Plans" with hand or computer-produced stamp. See Section 2.1.3.6.

The process varies slightly for bridge only projects and where the roadway design is done. For Concept Plans/TS&L and Preliminary Plans:

- When Roadway staff located in the field office designs the project, the Bridge Designer will deliver plans and attachments to the Front Office where a person from the 2nd Floor Front Office will pick them up. The Roadway Designer will submit plans and attachments to the Specification Typist.

- When Roadway staff in the Transportation Building design the project, the Bridge Designer will deliver plans and attachments to the Roadway Designer. The Roadway Designer will deliver the complete distribution package to the Specification Typist.

- For TS&L, only plans the Bridge Designer will deliver plans and attachments to the Front Office where a person from the 2nd Floor Front Office will pick them up.

The Bridge Designer normally delivers (via a standard ODOT Transmittal Letter Form) the following information:

- Bridge Distribution List.
- One copy of the Bridge TS&L drawing.
- "x" copies of the TS&L Narrative, with recipient's name on each copy (post-it note)
- "x" copies of the TS&L Estimate, with recipient's name on each copy (post-it note)
- "x" copies of the Foundation Report, with recipient's name on each copy (post-it note)
- "x" copies of the Hydraulics Report, with recipient's name on each copy (post-it note)

2.4 FINAL DESIGN

2.4.1 FINAL DESIGN, GENERAL

2.4.1.1 The Last Phase - The final design phase can begin after receiving the TS&L approval. The final design end product is a:

- Set of checked contract drawings.
- Set of special provisions.
- Checked final estimate of structure quantities and construction costs.
- Construction Schedule

Normally, the Structural Designer assigned to TS&L design continues on to do the final design. However, regardless of who does the TS&L design, it should be emphasized again:

The Designer completing the final design has overall responsibility for the finished product.

Make every effort to meet the project bid opening, or letting, date within the design budget. Pay attention to the progress of your design work and keep track of design costs throughout the assignment so you can make timely adjustments to your work schedule as needed. See Section 2.1.7, "Tracking Design Costs".

2.4.1.2 Guides for Final Design - The Checklist for Final Design (Appendix Figure A2.4.1.2A) provides a quick guide for the specific tasks ahead. Also, look over the resources listed in Section 2.1.2, "Structure Design References".

2.4.1.3 Final Design Timetable - Before starting the final design, you need to be aware of several intermediate deadlines leading up to that all-important one: The bid-opening, or letting, date.

First, here are some important definitions:

- PS&E - The package of plans, specifications, and estimate complete, except for minimal changes, and ready at 7 weeks before bid-opening date to be delivered to the Fiscal Management Unit for final processing. If a project is federally funded or located on the National Highway System, the PS&E is submitted by the Fiscal Management Unit to the FHWA for review.
- Advertisement - The public notice (Notice to Contractors) issued by ODOT inviting bids for construction work to be performed.
- Advertising Period - The number of weeks that copies of the contract plans and special provisions are available to contractors for preparation of bids. The length of advertising period depends upon the size and complexity of the project. Normally, a period of three weeks is allowed for average-size projects and 4 to 6 weeks for large or complex projects.

2.4.1.3 Final Design Timetable – (continued)

- Bid-Opening, or Letting Date - The date that bids submitted to ODOT by contractors are publicly opened and read in the Main Conference Room of the DOT Building in Salem. The opening of bids is usually held the fourth Thursday morning of each month.

For a project with 3-week advertising period, the countdown begins 20 weeks before bid-opening date (or 21 weeks for a 4-week advertisement period, etc.) when the first distribution of plans is made for review. In the Section 2 Appendix, Figure 2.4.1.3A is a table which defines what Bridge Section personnel need to have done in relation to the number of weeks before the bid-opening date.

Plan Distribution	Weeks Remaining
Preliminary Plans & Specs	20
Advance Plans	15
Final Plans & Specs	8
PS&E	7

2.4.2 GETTING STARTED

If you did the TS&L design, you are ready to continue on with the final design. However, if someone else completed the TS&L design, you will want to get together with the TS&L Designer and become familiar with the past history and details of your project as well establish contact with the Hydraulics, Foundation, and Roadway Designers involved.

Also consider reviewing some of the discussion and comments in Section 2.3, particularly:

- Section 2.3.2, “Things to Keep in Mind”
- Section 2.3.3, “Permits--Potential Trouble!”
- Section 2.3.4, “Before You Start”
- Section 2.3.5, “Fundamental Decisions for Bridge Design”
- Section 2.3.6, “Other Bridge Design Considerations”

Check with the Foundation Designer about the status of the Foundation Data Sheet. (See Section 4.7.4.) And as the final design progresses, remember to keep the Foundation Unit personnel informed about changes that affect their design or the Data Sheet.

2.4.3 FINAL ESTIMATE

2.4.3.1 What Will it Cost?

(1) Introduction - The Structural Designer makes the Final Estimate when the structure design is essentially complete and the plans are ready for the first round of reviewers. The Final Estimate Sheet includes bid item work and quantities required to build the structure and their costs.

From the Final Estimate Sheet, the Specifications Unit will list bid items and their quantities in their proper place in the Bid Schedule and the Summary. (As part of the project bidding documents, the Bid Schedule is bound in the back of the special provision's booklet, and the Summary appears on a Roadway Engineering Section drawing near the front of the plans.) The Specifications Unit will also include the bid items quantities and unit prices in the project Engineer's Estimate, the "E" in the Plans, Specifications, and Estimate (PS&E) package. The estimated contract amount shown in the Engineer's Estimate will later be compared to the actual amount bid for the contract.

If your structure involves a bikeway, the ODOT Bikeway/Pedestrian Program Manager will also be interested in some of the quantities from the Final Estimate. Refer to the next Section 2.4.4, "Bikeway/Pedestrian Path Allocation Estimate".

(2) Structure Bid Cost Program - All Estimates will be calculated using the Cost Program PRJSEED.XLS. See "Bridge Cost Data Instruction Manual" for examples and additional information on completing final Structure Estimates.

(3) Listing Bid Items - The bid items of the Final Estimate should be listed in the same numerical order as they appear in the Bid Schedule, Summary, and Engineer's Estimate. The order is dictated by the numbered sections of the ODOT *Standard Specifications for Highway Construction.* Before printing Final Spec Estimate, Sort the Estimate, using the sort function provided under the Utilities button.

If you need to add a Bid Item or change the bid units contact the Bridge Section Cost Data Coordinator.

(4) Substructure and Superstructure Quantities - For a realistic analysis of structural cost factors, quantities are divided into two categories on the Final Estimate Sheet: substructure and superstructure. The limits of substructure and superstructure are defined in the Glossary of Section 1 Appendix.

(5) Combining Quantities - For some projects, a material such as riprap may be used for the construction of a bridge and the roadway and, therefore, appear in both the Roadway Section and Bridge Section estimates. However, if the item common to both estimates is classified as a roadway item according to the *Standard Specifications*, the Specifications Writer will add the bridge quantities to the roadway quantities for the purposes of the Bid Schedule, Summary, and Engineer's Estimate.

To avoid omitting or doubling up quantities of such bid items, check with the Roadway Designer and Specifications Writer to determine what portion of the combined quantities you will be responsible for estimating.

(6) Estimated Unit Prices - Unit prices for most bid items will automatically show up in the unit price column as you select bid items for your project. These are the current average unit price for that bid item. Remember, you may need to adjust these prices for project type, size, and location. If available, compare prices to those of past similar structures in the same area. You can adjust this price accordingly for your specific project.

2.4.3.1 What Will it Cost? - (continued)

(7) Anticipated Items - Anticipated items are those items of work which are anticipated as a possibility or with certainty, but are not included in the construction costs as a bid item or in the engineering costs of construction engineering budget (see Section 2.4.7, "Construction Assistance Estimate"). Although they do not appear on the Final Estimate Sheet, their costs must be estimated and reported on the Bridge Section Notes to Specifications Unit Form mentioned in Section 2.4.5.3, "Processing Special Provisions". After approval by the Region Construction Engineer, the Specifications Writer lists an anticipated item and its cost on the Estimated Construction Authorization form (Appendix Figure A2.4.3.1A) of the Engineer's Estimate.

The Bridge Section does not propose the use of anticipated items very often. Usually, they are in the form of work performed by State or other forces or extra work items. (Extra work is defined in the Glossary of this *Manual* and further explained in Section 00140.60, ODOT *Standard Specifications for Highway Construction*.) Other examples of potential anticipated items are:

- "Railroad Protective Cost" or the amount to be paid to the railway company for furnishing its own flaggers and inspectors during a railroad bridge project.
- Funds for experimental feature programs (Section 2.1.9.3) with in-house reports requiring the researching of data, monitoring construction/maintenance, and tracking/evaluating performance. Examples: soil nail wall and high-early-strength concrete.
- Instrumentation of bridges to collect seismic data or to monitor construction and performance of such things as drilled shafts.
- Consulting services for specialized work.

If, for some reason, Department personnel cannot perform underwater inspection or monitor surcharge settlement, these tasks could possibly become anticipated items.

Do not request the use of anticipated items unless absolutely necessary! Can the work be covered by an existing bid item or included in the construction engineering budget? Discuss it with the Specifications Writer and the Region Construction Engineer.

(8) Unit Bid Items vs. Lump Sum Bid Items

Bid items which are bid on a per unit basis are those that are readily counted or measured; e.g.,Furnish Piles, Reinforced Concrete End Panels, Membrane Waterproofing, etc.

Bid items which are bid on a lump sum basis are those that are not easily counted or measured; e.g., Shoring & Cribbing, Furnish PIle Driving Equipment, Prestressing Steel, Seismic Instrumentation Systems, etc.

2.4.3.1 What Will it Cost? - (continued)

(8) Unit Bid Items vs. Lump Sum Bid Items – (continued)

Depending on the project some bid items can be bid either way. Review the bid units with the Construction office.

1. Lump sum means the work described shall be completed and accepted without measurement unless changes are ordered, in writing, by the Engineer. If estimated quantities of the work to be performed are listed in the special provisions, they are only to provide a basis for adjustment payment. These estimated quantities are approximate only and are made from a reasonable interpretation of the plans and intent. No guarantee is made that the computations based on the details and dimensions shown on the plans or in the specifications will equal these estimated quantities.

2. If no changes are made in the work, no allowance will be made if the quantities based on bidder's or Contractor's computations overrun or under-run the estimated quantities.

3. If changes are ordered, the changes will be measured according to the following to determine the adjustment of payment.

    a. Insignificant Changes - If the work involved in the change is measured on a lump sum basis and its character is not significantly changed, payment for the changed work will be determined:

        - As described in the applicable section of the covering specification, or
        - If not described there, on a theoretical unit price determined by dividing the Contractor's lump sum contract price by the estimated quantity of the item listed in the special provisions, or
        - If neither of the above apply, the Engineer will make a fair and equitable adjustment.

    b. Significant Changes - If the changes made significantly change the character, the unit cost, or the lump sum cost of the work under the contract, whether or not changed by any such changes, an adjustment, excluding loss of anticipated profits, will be made to the contract. The basis for payment and the amount of adjustment shall be agreed upon before performing the work. If the basis and amount can not be agreed upon, the Engineer will make a fair and equitable adjustment, which may increase or decrease the contract price and contract time.

    The term "significant change" shall apply only to the following circumstances:

        - When the character of the work as changed differs materially in kind, nature, or unit cost from that involved or included in the original proposed construction, or
        - When the final quantities of a major item of work, as defined in the following paragraph, is more than 125 percent or less than 75 percent of the original contract quantity. Any allowance for an increase in quantity shall apply only to that portion in excess of 125 percent of the original contract item quantity, or in the case of a decrease below 75 percent, to the actual amount of the work performed.

    A major item of work is any contract item, except lump sum items, having an original contract value greater than 10 percent of the total amount of the contract.

2.4.3.2 Notes About Bid Items and Estimating - Special comments and instructions concerning certain bid items and estimating their quantities.

(1) Riprap Protection - Initially, the Structural Designer calculates the quantities for riprap protection of bridge bents in streams and embankment slopes at bridge ends to be included in the Final Estimate. However, these figures are eventually combined with any roadway riprap quantities and listed in Part 00300, "Roadwork", of the Bid Schedule, Summary, and Engineer's Estimate. Where roadway and bridge riprap protection meet, coordinate your estimating efforts with the Roadway Designer and Specifications Writer to avoid omitting or doubling up of quantities.

(2) Drain Pipe and Drain Material - Although drain pipes and drain material placed behind abutments and retaining walls are shown on the structure plans and accounted for in the Final Estimate, their quantities are included with the "Roadwork" items of the Bid Schedule, Summary, and Engineer's Estimate. Review the roadway plans (including the Pipe Data Sheet) and quantities to ensure they have been included.

(3) Encasement Pipes for Utilities Under End Panels - Pipes used to carry utility lines under bridge end panels (see Section 5.4.7, "Utilities on Structures") are frequently overlooked as an estimate quantity. Even though they are detailed on the bridge plans and listed on the Final Estimate Sheet, they are included with other pipes on the Pipe Data Sheet of the roadway plans. Check with the Roadway Designer to be sure your encasement pipe quantities have been accounted for.

(4) Structure Excavation - See "Excavation Limits in Fill Areas", Appendix Figure A2.4.3.2A.

(5) Driven Pile - Use the graph "Furnish Pile Driving Equipment Cost", Located in the Bridge Cost Data Instruction Manual, for estimating.

For bridges with driven piling, attach a list to the Final Estimate Sheet showing the lengths of piling assumed in estimating the total length. Make the list in the form of a table, which includes location, type, number, and length.

When steel HP tips are required for driving prestressed concrete piles, include the length of the HP tip as part of the length of pile used for the bid item "Furnish Piles". There is no separate payment item for HP tips.

(6) Steel Reinforcement for Concrete - Use the BARLIST computer program for calculating and checking reinforcement quantities whenever practicable. A program write-up is included in the *Bridge Computer Manual*.

For small jobs or parts of larger projects not easily inputted into the computer program, the rebar quantities worksheet can be used. (Each design crew should have a copy in their crew area.)

Consider bars that extend from precast members, cast-in-place decks, and bridge end panels into concrete rails as part of the precast members, decks, and end panels when calculating quantities or determining payment.

To determine bar splice locations and estimate the additional quantities for splices, use the stock bar length given in Section 5.1.10.2.

See also the following Section, "Miscellaneous Metal".

2.4.3.2 Notes About Bid Items and Estimating – (continued)

(7) Miscellaneous Steel - If you are not working with a structural steel bridge, minor metal items such as the following are covered by Section 00530.13, "Miscellaneous Metals", of the special provisions and their weight added to the weight of the steel reinforcement for concrete:

- Anchor bolts for cast-in-place concrete except rail post and guardrail connection anchor bolts.
- Inserts and anchors for cast-in-place concrete.
- Access hole frames and covers.
- Deck drains and steel pipe.

If you are estimating quantities for a structural steel bridge, most of the miscellaneous metal items can be covered under Section 00560.81 of the ODOT *Standard Specifications for Highway Construction*. However, some items might still be included under Section 00530.13, "Miscellaneous Metals", of the special provisions. Spell out in the special provisions what items are covered by which specification's section.

(8) Concrete Bridges - Segregate structural concrete quantities into a bid item for each class of concrete (Class 3600-1-1/2, Class 4350-1, etc.) defined by Section 00540.11 of the ODOT *Standard Specifications for Highway Construction*. Calculate concrete quantities for cast-in-place decks supported on precast concrete or steel beams using the nominal deck thickness shown on the plans. Include additional concrete for deck buildup.

(9) Precast, Prestressed Concrete Members - Precast, prestressed concrete beams and slabs are bid on a lineal foot basis. Each size of precast member is listed as a bid item. For most of the precast, prestressed members, the depth is also included in the item description, for example: 26" Precast Prestressed Slabs. (Select the appropriate bid item from the pick list in the cost estimating program.)

Hardware such as anchor bolts, dowels, and threaded diaphragm rods are paid for as parts of the precast, prestressed concrete member. Therefore, their weight would not be included in the quantities of special provision Section 00530.13, "Miscellaneous Metals".

(10) Structural Steel Bridges - A worksheet for estimating structural steel quantities longhand is available. (Each design crew should have a copy in their crew area.)

(11) Timber Bridges - Estimate timber quantities in units of cubic feet (ft^3).
For finished length, use the shortest commercial length that could be used. No other allowance for waste will be made. Refer to Section 00570.80, "Measurement, General", for other timber estimating guides.

(12) Bridge Rails - Pay limits for the different bridge rails are generally defined on the rail drawings in the ODOT *Manual for Metric Bridge Standard Drawings*. However, the project-specific "Pay Limits for Rail" is shown on the title sheet plan view.

The transition guardrail section from the last rail post on the bridge or end of concrete rail to the approach roadway guardrail is a roadway pay item. (See Section 00810.82 and 00810.90(e), *Standard Specifications for Highway Construction*.

(13) Concrete Barrier - Concrete barrier used as median barrier across a structure is a roadway pay item.

(14) Sign Structures – for sign bridges and cantilever sign structures, use the horizontal span length when entering the "o-o" length in the final estimate.

2.4.3.3 Mobilization, E&C, and Square-Foot Costs

(1) Mobilization Costs – Normally 10 percent.

(2) Engineering and Contingencies (E&C) Costs - As with the TS&L Estimate, engineering and contingencies costs are still lumped together at this point of the estimating process.

Engineering costs are those project costs generated by ODOT Region and Headquarters units as they administer the contract and oversee construction. Contingencies are unforeseen costs due to problems or situations resulting from construction, weather, accidents, etc., and which are not covered by contract pay items. Generally, for a Final Estimate, E&C costs of 20 percent are used for structures.

(3) Square-Foot Costs for Bridges - A quick way to compare or estimate total bridge costs is to use deck area unit costs, that is, dollars per square foot of deck area.

At the lower left bottom of the Estimate Sheet is a place to show the estimated square-foot cost of the bridge. As used in the square-foot cost equation, the term "subtotal" is the total of certain bid items common to most bridges plus mobilization costs. Excluded from the amount is what is called additional items.

Additional items are construction activities or features that may not be used in the construction of the same type of bridge in other situations and locations. Some examples are:

- Bridge removal.
- Bridge end panels.
- Slope paving.
- Riprap.
- Electrical conduit.
- Any unusual or unique item.

By eliminating additional items, we are able to use deck area unit costs to compare "apples with apples" when analyzing estimated or actual bridge costs. The *Cost Data Preparation Book* in each Design Team library further discusses additional items, and the annual *Structure Cost Data* books have actual examples.

In calculating the deck area, use the out-to-out width of deck superstructure and out-to-out of end bents defined by the illustrations in the *Cost Data Preparation Book*.

2.4.3.4 Processing Unchecked Final Estimate - Your Design Team Supervisor reviews the unchecked Final Estimate before outside distribution.

The total cost from the unchecked Final Estimate is given in the transmittal letter for the Bridge Section's Preliminary Plans package distributed 20 weeks before the bid opening, or letting date. A copy of the Estimate Sheet is included with the package sent to the Roadway Engineering Section, and it will be passed on to the project Specifications Writer. Another copy accompanies a set of Advance Plans to the Structural Materials Engineer, Operations Support Section.

Keep the original of the unchecked Final Estimate Sheet in the Job Record Folder. When the checked version is completed, replace the unchecked Final Estimate in the Job Record Folder, with the checked & Signed Final Estimate. The checked Final Estimate will eventually become part of the permanent record of the Project Contract File.

2.4.3.5 Checking Final Estimates - Someone other than the original estimator checks the Final Estimate. As a responsibility of the final design check, the Design Checker is normally assigned to verify the Final Estimate figures. However, regardless of who checks it, the Designer or original estimator is still responsible for the accuracy of the Final Estimate.

Note that, to make checking reinforcing steel quantities easier, the estimate checker should break down the bars into the same sub-groupings used by the Designer or original estimator.

General guidelines for rounding off quantities are as follows. A large project has a cost over $1,000,000. This is just a guide individual projects may have unusually small or large quantities and may not be prudent to round a very small quantity.

	Round Off to Nearest:	
Item	Small Projects	Large Projects
Structure Excavation	10 yd^3	100 yd^3
Steel Reinforcement	100 lb	1,000 lb
Structural Concrete	1 yd^3	10 yd^3
Structural Steel	100 lb	500 lb

A general guide for allowable percentage of difference between estimator and checker quantities is:

Item	Difference
Structure Excavation	10%
Steel Reinforcement	3%
Structural Concrete	3%
Structural Steel	3%

2.4.3.6 Final Estimate Revisions - Make revisions to the original of the checked Final Estimate as follows:

- Highlight the corrected or revised entry on the original estimate. Make changes to estimate and reprint it and have it signed, and send a new revised copy to the specification's writer.

2.4.3.7 Processing Checked Final Estimate - Remember the checked Final Estimate is confidential information--not for public viewing! Keep the original in the Job Record Folder. With the disposition of the Job Record Folder, it will be put in the Project Contract File in a folder labeled "Work Folder Prior to Contract".

Your Design Team Supervisor may want to look over the Estimate one more time after it has been signed by the Checker.

A copy of it accompanies the signed Final Plans sent to the Specifications Unit about 12 weeks before bid-opening, or letting, date. A copy is also sent to the Cost Analysis Unit of Program/Project Management Services at that time.

And finally, make a copy of the checked Final Estimate for your set of calculations.

2.4.4 BIKEWAY/PEDESTRIAN PATH ALLOCATION

2.4.4.1 Who Needs to Know? - As discussed in Section 2.3.2.3, "Bikeways", if a bridge is to carry or cross a bikeway or pedestrian path, a portion of the quantities are allocated to providing for the bicycle/pedestrian facility. After the bid, the Bikeway/Pedestrian Unit calculates the appropriate quantities. If they have questions, they will contact the designer for a cost breakdown.

2.4.4.2 Computing Bikeway Quantities - Include only eligible bikeway/pedestrian path quantities. The following are some guidelines for eligible bikeway/pedestrian path quantities:

- If a bikeway is incorporated with the roadway shoulder, include only quantities for the width greater than required for a standard roadway shoulder. If the standard roadway shoulder is adequate for the bikeway, then no quantities can be allocated as bikeway quantities.
- If a separate pedestrian rail is required in addition to the traffic rail, include the total pedestrian rail quantity.
- If a combination rail, such as pedestrian rail or chain link fencing on top of a concrete Type "F" on sidewalk-mounted parapet rail, is specified instead of a traffic rail, include only the pedestrian rail or chain link portion of the rail quantities.
- Do not include bridge removal or mobilization items.

Quantity units of measurement for eligible bid items should match the units appearing on the Bid Schedule. List lump sum items as percentage of the lump sum. Generally, calculate percentages by multiplying the total quantity of each item by the ratio of the additional width (or length) to the total width (or length) of the bridge.

Some examples of typical items and their quantities are shown below:

Item	Unit	Quantity
Structure Excavation	yd^3	50
Furnish HP14 x 89 Steel Piles	ft	30
Drive HP14 x 89 Steel Piles	Each	4
Reinforcement	Lump Sum	21%
Coated Reinforcement	Lump Sum	15%
Structural Concrete, Class 5000	Lump Sum	17%
Reinforced Concrete Bridge End Panels	ft^2	30
26" Precast Prestressed Slabs	ft	200
Structural Steel	Lump Sum	26%
Compression Joint Seal	Lump Sum	24%
Pedestrian Handrail	Lump Sum	80%

2.4.5 SPECIAL PROVISIONS

2.4.5.1 Where to Begin - After making the Final Estimate, the Structural Designer's next responsibility is to develop complete and correct special provisions for the structure.

Writing special provisions for structures begins with looking through a Proposal/Special Provision Document Assembly Request. This is also available in the word template file directory, and is called SPLIST96.DOT. This Specification Unit multi-page form is a shopping list for special provision preprints--sometimes referred to as "boiler plate specials" because they are pre-approved and ready to use. A supply of Document Assembly Request forms and special provision preprints are kept in the Specification Unit's filing cabinet located in the Roadway Engineering Section's design room. THEY ARE ALSO AVAILABLE ON THE INTERNET FOR YOUR USE UNDER THE ODOT/SPECIFICATIONS HOME PAGE.

Before you start selecting the preprints, or downloading files you may want to review the rest of this section. You may also want to refer to Section 2.1.9.4, "Specifying Proprietary Items", as well as the caution about creating new bid items or altering existing ones in Section 2.4.3.1(3), "Listing Bid Items".

In some situations, you may need a specification for a subject that does not appear to be covered by the ODOT *Standard Specifications for Highway Construction*. There are unused section numbers available in the numerical sequence of the *Standard Specifications*, but be careful about creating a new section by special provision. New sections should be reserved for major items that will be specified fairly often. Get together with the project Specifications Writer to see if you have not overlooked an existing specification that could be used or modified with a special provision.

Using a copy of the Document Assembly Request as a guide, pull those special provision preprints/files that are required for the construction of your structure. A majority of them will be for Part 00500 sections ("Bridges"), but you may also be involved with other subject areas such as:

- Section 00140, "Scope of Work'.
- Section 00150, "Control of Work".
- Section 00170, "Legal Relations and Responsibilities".
- Section 00180, "Prosecution and Progress".
- Section 00220, "Accommodation for Public Traffic".
- Section 00350, "Geotextile Installation".
- Section 00390, "Riprap Protection".
- Section 00396, "Shotcrete Slope Stabilization".
- Section 00450, "Structural Plate Pipe, Pipe Arch, and Arch".
- Section 00830, "Impact Attenuators".
- Section 00920, "Sign Support Footings".
- Section 00930, "Metal Sign Supports".
- Section 01050, "Fences".

2.4.5.1 Where to Begin – (continued)

Where the preprint/file subsection's cover more than one situation, or give options to choose from, cross out that which does not apply. You may have to revise certain provisions to adapt them to your project or draft new text to alter existing specifications to fit. Do not be timid about asking the project Specifications Writer for help!

Have the project Foundation Designer review the special provisions pertaining to foundation work. Also the Fracture Control Engineer, the welding expert of the Preservation Engineering Team, should look over any welding-related provisions.

2.4.5.2 Special Provision Guides - Included here are guidelines for items which deserve special attention. Where possible, a reference is made to the section of the ODOT *Standard Specifications for Highway Construction* that the guide pertains to.

(1) Cable and Turnbuckles for Seismic Retrofit and Safety Systems - The basic information for specifying steel cable, or structural wire rope, and turnbuckles is found in Sections 5.2.5.3, "Special Provisions for Cables" and 5.2.5.4, "Special Provisions for turnbuckles".

(2) Providing Plans of Existing Bridges (Section 00501.02) - If an existing bridge is to be altered, such as in a widening, include its plans or pertinent drawings with the contract plans as "For Information Only" documents. (See Section 4.2.4.12.)

If an existing bridge is to be removed and its plans will not be included with the contract plans, use the statement about availability of plans at the Project Manager's office in Section 00501.02, "Plans", of the special provision preprint/file. If an existing bridge is not to be removed, which means Section 00501 will not be included in the special provisions and its plans will not be in the contract plans, add the Section 00501.02 statement under Section 00120.15, "Examination of Work Site and Bidding Documents" of the special provisions.

When your special provisions say plans of the existing bridge are available at the project Manager's office, be sure to send copies for their use.

(3) Structure Salvage Items (Section 00501.45) - If an item of an existing structure is designated to be salvaged, or seems appropriate to salvage for use in maintenance repair, contact the District Manager for confirmation. Provide the following information in the special provisions Section 00501.45, "Salvage":

- Salvage item, Delivery site, and Contact person.
- Name plates, plaques, or other historical items salvaged by the Contractor from existing structures are to be given to the Project Manager. Contact the Project Manager to verify that the Fleet Administration and Surplus Property Supervisor, ODOT Support Services, should be consulted about what to do with the item.

(4) High-Early-Strength Structural Concrete (Section 00540.13) - When you need to specify high-early-strength structural concrete, contact the Structural Materials Unit, Operations Support Section, for help with developing special provisions to modify the *Standard Specifications*.

(5) Transition Guardrail (Section 00810.90) - If your bridge ends have guardrail connections, note the number of connections required in the Bridge Section Notes to Specifications Unit so that the bid item "Guardrail, Transition" and quantity will be included.

2.4.5.3 Processing Special Provisions - After assembling and marking up a set of special provision preprints/files, fill out the Bridge Section Notes to Specification Unit form. The word template file for this form is called NOTE2SPC.DOT. Refer to Section 2.4.6 instructions for making the construction time estimate requested by the form. Attach the completed form to the front of the assembled special provision preprints/files and include it in the Preliminary Plans (20-week) package sent to the Roadway Engineering Section. Make a copy of the completed Notes to Specification's Unit for the Job Record Folder.

In about five weeks, a draft of the complete set of project special provisions will be returned by the Roadway Engineering Section as part of its plans review package distributed 15 weeks before the bid-opening, or letting, date. Review the draft and make your comments in colored pencil. You will have about 2 weeks to make the review.

Some structure-related items to check are:

- Work to be done - On the first page, is the general statement that describes the structure work complete?
- Section 00140.60, "Extra Work" - Is structure extra work listed?
- Section 00150.50, "Cooperation with Utilities" - Are the utility companies involved with your structure among those listed? Are special requirements described?
- Section 00170.30(c), "Water Pollution Control Measures" - Are the Corps of Engineer/Oregon Division of State Land permit restrictions for your structure here?
- Section 00180.40, "Limits of Operations" - Are all the special provision sections with requirements and restrictions that would limit the contractor's operations on or around the structure referenced in this subsection?
- Section 00220, "Accommodations for Public Traffic" - Are special traffic control situations spelled out?
- Part 00500 Sections - Are all structure-related subjects covered and quantities for lump sum bid items correct?
- Sections 00920, "Sign Support Footings", and 00930, "Metal Sign Supports" - Are cantilever sign support and sign bridge quantities shown for lump sum bid items correct?
- Bid Schedule - Are the items and quantities listed in the Bid Schedule accurate and complete?

Again, the project Foundation Designer and Preservation Engineering Team welding expert, the Fracture Control Engineer, should review their areas of expertise.

After your Design Team Supervisor has taken a final look at the reviewed draft, send it directly to the project Specifications Writer using a standard ODOT Transmittal Letter Form. Have a copy of the transmittal letter put in the Project Precontract File.

2.4.6 BRIDGE CONSTRUCTION TIME ESTIMATE

Estimate the time required for construction using a graph similar to Appendix Figure A2.4.6A. Do not include mobilization time in the estimate.

A copy of the graph is included as part of the Preliminary Plans (20-week) distribution. Which is distributed to the Cost Analysis Unit of Program/Project Management Services Also enter the estimated construction time on the Bridge Section Notes to Specifications Unit form which accompanies the assembled special provision preprints/files to the Roadway Engineering Section.

As a follow-up check on how realistic your bar chart estimate is:

- Request a copy of Cost Analysis Unit's anticipated project construction schedule. It is normally prepared before the project advertisement date a month or more before the bid-opening, or letting, date.

- Contact the Construction Project Manager after the contract is awarded and request the contractor's proposed construction schedule. The contractor is required to submit updated schedules periodically.

2.4.7 CONSTRUCTION ASSISTANCE ESTIMATE

As a method of controlling and forecasting ODOT engineering expenditures for construction projects, the Construction Project Manager, puts together a construction engineering budget, for the Region Construction Engineer's approval. Other involved ODOT units submit their anticipated contract administration costs to the Project Manager before a project goes to contract. Each unit reports the estimated amount on the ODOT Project Budget Worksheet form (See Template File PROJBUDG.DOC).

In the Bridge Section, the development of the anticipated construction-related costs reported on the Project Budget Worksheet is called the construction assistance estimate. The Structural Designer is responsible for collecting data, making computations, and completing the Worksheet for the Design Team Supervisor's signature. Remember to check with the Operations and Preservation Engineering Team (welding procedures) for possible input.

Use expenditure account (EA) activity code J46 for project consultations. Example activities that can be charged against a project's construction engineering budget include:

- Review of contractor's working drawings and submittals:
  - Checking shop drawings.
  - Reviewing temporary construction drawings (falsework, cofferdams, shoring).
  - Checking welding procedure.

- Design engineering assistance requested by Project Manager.

- Monitoring of construction activities:
  - Field trips to project site or supplier's plant to solve problems or determine adherence to plans and specifications, usually requested by Project Manager.

- Acquiring permits during construction phase.

- Redesign work required during construction phase.

2.4.7 Construction Assistance Estimate – (continued)

Use expenditure account (EA) activity code J49 for Underwater inspection of footings, cofferdams, and scour protection by ODOT diving crews.

Record your supporting documentation and calculations for the construction assistance estimate on standard Bridge Section calculation sheets. As a guide the average Construction Assistance Budget Estimate will be around 0.5% - 1.0% of the structure cost estimate.

Construction Assistance Estimate (EXAMPLE CALCULATIONS)

1. Labor:

Checking Shop Drawings	4 days
Field Trip	2 days
	6 days

Designers wages = ($3581/173.33hr/mo)(1.74)(8hr/day)=$287/day

Designer	(6 days)($287/day)=		$1722
Foundation		=	1000
Hydraulics		=	500
			$3222

2. Equipment:

Car @ $13.75/day + $0.10/mile
Jeep @ $18.75/day + $0.14/mile

Jeep Expense = 2 days =	$37.50
Mileage 300 miles =	$42.00
	$80.00

Avoid requesting additional money for anticipated items of extra work that could be included in the construction engineering budget. (See Section 2.4.3.1(7), “Anticipated Items”.)

Contact the Bridge Operations Engineer or Underwater Inspection Supervisor for the latest estimated costs of underwater inspection by members of the Bridge Operations Team. The costs for a three-member diving crew may vary from $900 to $1,200 per day, depending on location, boat, and lodging requirements. Inspection of footings may require several trips to the project site if there is more than one footing or footings are constructed at different times.

Estimating time that will be spent reviewing sign, luminaire, and signal support shop drawings can be tricky because both Traffic Engineering Section and Bridge Section checkers may be involved. Read carefully Section 3.1.8.4(3) which explains who checks what and when.

Send the completed original of the Project Budget Worksheet to the Construction Project Manager, at the same time tracings are sent to Specifications (TTS). Make a copy of the Worksheet, attach it to your documentation, and put them in the Job Record Folder.

2.4.8 REVIEW PLANS

2.4.8.1. What Are Preliminary Plans? - When the combination of the Structural Designer's final design and the initial set of structure plans is about 85 - 90 percent complete, the design process has arrived at the Preliminary Plans milestone. For a project with a 3-week advertisement period, Roadway and Bridge Section sends out its Preliminary Plans package to outside reviewers 20 weeks before the bid-opening, or letting, date. Refer to Section 2.4.1.3, "Final Design Timetable".

Prior to giving a set of Preliminary Plans to the Design Team Supervisor for internal review and before outside distribution, the Structural Designer completes the following:

- Final Estimate, unchecked (Section 2.4.3).
- Marked-up special provision preprints and Bridge Section Notes to Specification Unit (Section 2.4.5).
- Bridge construction time estimate (Section 2.4.6).
- Construction assistance estimate (Section 2.4.7).

The Designer Checker is usually assigned to the project at this time. (See Section 2.4.9.1.)

For when and how to obtain drawing numbers, see Section 4.4.1, "Request for Drawing Numbers".

2.4.8.2 Internal Review of Preliminary Plans - For your Design Team Supervisor's review, submit the draft distribution list and a set of half size prints of the Preliminary Plans as well as:

- Unchecked Final Estimate Sheet.
- Marked-up special provision preprints and Bridge Section Notes to Specifications Unit.
- Bridge construction time estimate.
- Construction assistance estimate (completed Project Budget Worksheet and supporting documentation).
- Copies of the *Foundation Report* and *Hydraulics Report.*

Drawings should have "Review Plans" stamp on them as directed in Section 2.1.3.5

2.4.8.3 Processing Preliminary Plans - After changes noted by the Design Team Supervisor are made, deliver (via the standard ODOT Transmittal Letter Form) the following to the Front Office or the Roadway Designer (See Section 2.3.9.2, for a more detailed description of the distribution process) for the "Preliminary Plan" distribution:

- Bridge Distribution List. (Boilerplate transmittal letters and distribution lists are located on the ODOT ftp site, at techserv\roadway\offadmin.
- One copy of Bridge Preliminary Plans.
- "x" copies of the Preliminary Estimate, with recipient's name on each copy (post-it note)
- one copy of the marked up boilerplate Special Provisions
- "x" copies of the Construction Time Estimate, with recipient's name on each copy (post-it note)
- "x" copies of the Construction Assistance Estimate, with recipient's name on each copy (post-it note)

2.4.8.3 Processing Preliminary Plans –(Continued)

Retaining Walls - For projects with Retaining Structure Walls, send a set of Preliminary Plans to approved Retaining Structure Wall suppliers to give them more lead time for developing proposals for the contractors. The Advance Letter Word Template file is RETWALLS.DOT.

2.4.8.4 What are Advance Plans - When the combination of the Structural Designer's final design touches and any changes resulting from "Preliminary Plan" reviewers comments, the set of structure plans is about 95 - 100 percent complete, and the design process has arrived at the Advance Plans milestone. For a project with a 3-week advertisement period, Roadway and Bridge Section sends out its Advance Plans package to outside reviewers at 15 weeks before the bid opening, or letting, date. Refer to Section 2.4.1.3, "Final Design Timetable".

2.4.8.5 Processing Advance Plans – About a week before the "Advance Plan" distribution date, deliver (via the standard ODOT Transmittal Letter Form) the following to Roadway Specification Writer for the "Advance Plan" distribution:

- Bridge Distribution List.
- One copy of Bridge Advance Plans.
- "x" copies of the Final Estimate (unchecked), with recipient's name on each copy(post-it note)

2.4.8.6 Review of Roadway Plans - The Roadway and Bridge Engineering Sections sends out their "preliminary plans" for review at the same time, 20 weeks before the bid opening, or letting, date. Normally, two sets of half size plans and draft special provisions will be sent with the transmittal letter. Send the letter to the Project Precontract File and keep a set of plans in the Job Record Folder. If you have any comments, mark up the other set of prints and return it to the project Roadway Designer, using a standard ODOT Transmittal Letter Form.

The Roadway and Bridge Engineering Sections "advance plans" are sent for review at 15 weeks before bid opening, or letting, date. This mailing consists of two sets of half size plans. The transmittal letter goes to the Project Precontract File and the set of plans to the Job Record Folder. Another set will be reviewed by the Geo/Hydro Section, and comments will be given to the Structural Designer to be used for further comments and returned to the Specifications Writer with a standard ODOT Transmittal Letter Form.

2.4.9 DESIGN CHECK

2.4.9.1 Design Checker Assignment - A part of the final design phase is the design check. A Structural Designer, preferably from another Design Team, is assigned as checker once the initial design is virtually complete and the first issue of plans are ready for outside review. This should happen at about the time Preliminary Plans are distributed or 20 weeks before the bid-opening, or letting, date. See Section 2.4.8.1.

For structural design, the level of detail to be checked varies with the complexity of the project and the amount of experience of the Designer and Checker. The Design Team Supervisor will decide the class of design check to be done at the time the project is assigned to the Designer.

Before beginning, the Checker should meet with the Designer to discuss the level and details of the review. They may also want to decide where the design check set of calculations will eventually be filed. The Checker can put the design check calculations in his or her calculation book or have them included with the Designer's set of calculations and calculation book. See Sections 2.1.5.2 and 2.1.6.6(2).

If the design check calculations are filed in the Checker's calculation book, then that book number is listed with the Designer's book number on the plans. Refer to Section 2.1.6.2, "Calculation Book Numbers".

2.4.9.2 Class I Check - The Class I check is a comprehensive design review covering all aspects of the project. It will be done primarily for:

- Major complex structures.
- Steel and post-tensioned bridges.
- Structures designed by an inexperienced Designer.
- Structures checked by an inexperienced Checker.

The Checker is responsible for the following:

- Review of location data and correspondence files.
- Review of construction time and seasonal requirements, permit applications, work-in-stream restrictions, and utility installations and conflicts.
- Review of foundation and hydraulic requirements.
- Check for consistency of alignment and details with roadway plans.
- Thorough check of geometry, alignment, grades, clearances, and construction details.
- Verification of structure length, roadway width, structure type selection, aesthetic treatment, span arrangement, bent type and configuration, and rail type.

2.4.9.2 Class I Check – (continued)

- Complete independent structural analysis of all components according to design specifications and current office practice. The Checker should make a quick, longhand check of the most important structural elements before beginning a computer analysis of the design.
- Independent check of Final Estimate quantities and reconciliation of figures with Designer.
- Confirmation that all items listed in the Checklist for Final Design (Appendix Figure A2.4.1.2A) have been satisfied.

2.4.9.3 Class II Check - The Class II check is a review of design concepts and construction details and does not necessarily include a structural analysis. It will be done primarily for:

- Minor prestressed bridges designed by an experienced Designer.
- Incidental structures such as box culverts, structural plate pipes, sign supports, and low retaining walls.

The Checker should discuss with the Designer the need for more in-depth review of particular items or areas.

The Checker is responsible for:

- Review of correspondence, job record files, and design calculations.
- Confirmation that foundation and hydraulic requirements are met.
- Verification of geometry, alignment, and structure type selection.
- Confirmation with Designer that critical structural items have been analyzed during the final design. If appropriate, the Checker should make a cursory check of such items as total P/A bearing and maximum bending moments of beams.
- Completeness of plans.
- Check of construction details and Final Estimate quantities.

2.4.10 PROCESSING FINAL PLANS

2.4.10.1 Getting Plans Signed - Bridge Section's Final Plans are a set of structure contract drawings, 100 percent complete, signed, sealed, and ready to deliver to the project Specification Writer sometime from 12 to 8 weeks before the bid-opening, or letting, date. (See Section 2.4.1.3, "Final Design Timetable".) The drawings are full size mylars, normally CAD plots, produced after all changes and revisions resulting from reviews by the Design Checker, Design Team Supervisor, Region, other ODOT units, and other interested parties have been made.

The Bridge Engineer signs only the title sheet of each set of structure plans. The purpose of the Bridge Engineer's signature is to verify that the engineering work was performed under the authority and endorsed design policies of the Bridge Engineer.

Full responsibility for the drawing details rests with the Structural Designer, Structural Drafter, Design Checker, and the Design Team Supervisor

After the drawings are signed, send them to Repographics for half-size paper copies. After the half-size copies are completed, the Structural Designer fills out a standard ODOT Transmittal Letter Form and hand-carries the Final Half-size Plans, accompanied by the transmittal letter original and a copy of the checked Final Estimate, to the project Specification Writer. (Remember that the checked Final Estimate is confidential and should be handled accordingly.) Notify the Front Office when the Final Plans are taken to the Specification Writer by giving the person in charge of the General Drawing File the yellow file copy of the transmittal letter. Don't forget to put an "out" card in the Drawing File.

In the title block of the structure title drawing, there is a place to show the Federal-aid construction project number for federally-funded projects. (If the project is to be constructed with State funds, the word "STATE" is printed in the blank.) However, the Fiscal Management Unit, Program/Project Management Services, normally assigns the Federal-aid construction project number about nine weeks before the bid-opening, or letting, date, notifying the Bridge Engineer in writing. That means, in some instances, the Final Plans may have already been delivered to the Specification Writer after the notification arrives. The Structural Designer needs to be aware of this potential problem and make sure the Federal-aid number is eventually put on the title sheet before the project contract plans are printed for distribution to the bidders.

The following are some other items the Structural Designer needs to take care of during this Final Plans period:

- Review Roadway Engineering Section's final drawings that are directly related to structure work and sign off in the left margin of the original mylar drawings.
- Send notification of bikeway involvement or no bikeway involvement to the Bikeway/Pedestrian Program Manager according to Section 2.4.4.
- Send a revised Project Budget Worksheet to the Construction Project Manager, if there are significant changes to the original worksheet.

2.4.10.2 Last-Minute Changes - Avoid drawing and estimate revisions after the Bridge Engineer has signed the Final Plans, especially after the 8-week deadline. The Specifications Unit needs approximately five weeks prior to the advertising date for final preparation, review, and printing of the contract documents. (See Section 2.4.1.3, "Final Design Timetable".)

The Structural Designer is responsible to see that these late changes are made and carefully documented. Refer to Section 4.7.11 for drawing revision procedures and Section 2.4.3.6 for revision of Final Estimates. If a drawing is added to the structure Final Plans after a project is advertised, the Roadway Engineering Section must be notified in writing so that the drawing number can be added to the title sheet of the contract plans. See Section 1.4.1, "Correspondence", for details about the required paperwork.

Although every attempt should be made to wait until after the contract is awarded, essential changes to the plans and special provisions, that would significantly affect the contract cost or character of the work, can be made during the advertisement period, by a Revision Letter up to 10 days before the bid opening, or letting, date. However, a Revision Letter is expensive and causes additional stress for the Specifications Unit at a time when the pressure is great to get the job completed on time.

2.5 BRIDGE LOAD RATING

2.5.1 THE WHY AND WHO OF LOAD RATING

A key element in a bridge management system is the load rating of bridges--that is, determining the safe load capacity of the weakest member of a bridge. For the Bridge Section, the Load Rating Coordinator of the Bridge Operations Team has overall responsibility for the load-rating program. The Coordinator maintains a file of completed Load Rating Summary Reports and supporting calculations for each bridge, on the Oregon highway system.

According to the newly-clarified plan agreed upon with FHWA, The ultimate goal is to load rate all structures in the state's inventory that are designed for H15 or HS15, and also all H20 or HS20 bridges that were originally designed by the Working Stress Method. The break point where ODOT switched to HS20 Load Factor Method designs was October 1974.

It is still considered most efficient to do the design-related portion of the remaining load ratings in-house where the designer is already familiar with the structure. These will be rated as they come up in the normal course of design work in accordance with the following policy:

Load rate any structure encountered in the design process that has significant dead load modifications (such as rail changes or overlays) or that has been widened, as long as it is one of the following:

1. An H15 or HS15 design (regardless of design method)

2. An H20 or HS20 design by the Working Stress Method.

In the absence of specific design specification information, assume Working Stress Design applies whenever the plan date is older than October 1974. If the original portion of a widened structure meets these criteria, load rate the entire structure even though the widening is designed for HS25.

Regardless of modifications, do not load rate

1. Any structure entirely designed for HS25.

2. Any MS18 structure designed by the Load Factor Method.

In the absence of specific design specification information, assume that Load Factor Design applies whenever the plan date is newer than October 1974.

Do not use the general Load Rating EA for design related load ratings without permission from the Load Rating Coordinator. Every effort should be made to complete a design-related load rating before the design EA number expires.

Where rating of a design job is warranted by the above criteria, design budgets should include an appropriate, separate itemized allowance for load rating work. See the Load Rating Coordinator for assistance on estimating the scope of load rating work. In cases where existing design budgets do not include load-rating time, Designers and their Supervisors are asked to deal with the problem in one of the following ways, in descending order of preference:

1. Request additional design money from Region to accomplish the required load rating.

2.5.1 The Why and Who of Load Rating – (continued)

2. Absorb the load rating time into the design EA number. Be sure to use a "LR" in the work code when reporting your time.

3. Contact Bridge Operations (Load Rating Coordinator or Operations Supervisor) for permission to use the general Load Rating EA number, or for a decision not to load rate the structure.

The Structural Designer completes a Load Rating Summary Report for a new or reconstructed bridge after the final design has been checked. Or a Structural Designer receives an assignment from the Load Rating Coordinator, through the Design Team Supervisor, to load-rate an existing bridge that may or may not have been previously rated. Engineering consultants are also hired to rate existing bridges.

Permit requests for loading that do not conform to the standard HS, legal, or permit vehicle loads described in Section 2.5.3 require special, detailed review by the Load Rating Coordinator or an assigned Structural Designer. They are processed according to Section 3.2.2, "Permit Load Reviews".

2.5.2 WHERE TO LOOK FOR HELP

The purpose of Section 2.5 is to give a brief overview of and some background about load rating. However, before you proceed with the calculations and completing the Load Rating Summary Report, you will need to refer to the *Bridge Load Rating Manual* issued by the Load Rating Coordinator to each Structural Design Team or available to anyone else load-rating our bridges. Carefully read the "Load Rating Procedures" section, which not only details "Filing and Reporting", but summarizes and supplements the basic criteria and procedures given in the following references:

- AASHTO *Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges.* Originally published in 1989.

- Section 5, "Specifications for Checking Capacity of Existing Bridges", AASHTO *Manual for Maintenance Inspection of Bridges.* Includes updates to the original 1983 edition.

- AASHTO *Standard Specifications for Highway Bridges*, Division I, "Design", as modified by "ODOT Design Instructions".

When reading these references, do not be confused by the use of different names for the same method of structural design. Service Load Design can also be referred to as Working Stress Design or Allowable Stress Design. Load Factor Design is sometimes called Strength Design Method. For load rating, Load Factor Design has been expanded to Load and Resistance Factor Design (LRFD).

2.5.3 VEHICLES FOR LOAD RATING

2.5.3.1 HS Loading - Until 1989, load-rating bridges only involved calculating FHWA-required Inventory and Operating Ratings expressed as multiples of the AASHTO Standard HS truck shown in Figure 3.7.7.A of the *Standard Specifications for Highway Bridges*. Although HS truck Inventory and Operating Ratings (see Sections 2.5.4.2 and 2.5.4.3) are still a FHWA requirement, AASHTO has now developed a single Rating Factor (Section 2.5.4.1) in conjunction with legal load vehicles that better represent the actual field situations and conditions than the HS load ratings.

2.5.3.2 Standard Legal and Permit Loading - In addition to the AASHTO HS truck, ODOT uses three standard legal load vehicles and four standard permit load combinations to rate bridges. Like HS trucks, these vehicles are 6 feet wide and occupy a 10 foot wide lane. The axle loads are distributed according to AASHTO design specifications.

ODOT has modified and expanded the three AASHTO standard legal loads, which are shown in Figure 2 of the *Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges*, to produce the three Oregon Legal Load Types illustrated in the *Bridge Load Rating Manual*. (Note that the previously required Type 3S2 Unit with minimum spacing has been eliminated.) For bridges with spans greater than 200 feet but less than 300 feet, the lane loading shown by Figure 3 of the *Guide Specifications* is used in lieu of the Oregon Legal Load Types.

ODOT developed the four Oregon Standard Permit Loads, shown in the *Bridge Load Rating Manual*, to anticipate the more common special permit requests. Note that these loads are different than the five Permit Loads used prior to November 1993.

2.5.4 BASIC TERMINOLOGY

2.5.4.1 Rating Factor - As defined by AASHTO, the Rating Factor (RF) is the ratio of the safe level of live loading to the load produced by a nominal or standard vehicle.

$$RF = \frac{\text{Total Capacity or Resistance - Dead Load}}{\text{Live Load including Impact}}$$

RF greater than 1.0 means satisfactory for standard legal or permit loads

RF less than 1.0 means restrict loads, bridge may need posting, strengthening, repair, or closure.

2.5.4.2 Inventory Rating - An Inventory Rating is a load level, expressed in terms of an AASHTO MS truck, that a bridge can theoretically carry for an indefinite period of time. In other words, this is the safe load under normal, daily traffic conditions. A new bridge will have an Inventory Rating of HS20 or HS25. An older bridge might have a lesser rating which would depend on its physical condition and original design rating, possibly HS10 or HS15.

2.5.4.3 Operating Rating - An Operating Rating is the absolute maximum load level, expressed in terms of an AASHTO truck, that a bridge can, in theory, occasionally accommodate. A new bridge designed for HS25 loading might have an Operating Rating of HS30, meaning an HS30 truck will produce operating stress levels.

2.5.5 WHAT! NO PLANS?

If no plans for an existing bridge are available, request field personnel to make field measurements of member sizes if possible. For reinforced concrete or prestressed concrete members, attempt to determine the reinforcing steel area.

Refer to the following in the AASHTO *Manual for Maintenance Inspection of Bridges* for allowable stress assumptions:

- Tables 6.6.2.1-1 through 6.6.2.1-4 of Article 6.6.2.1, 'Structural Steel".
- Article 6.6.2.3, "Reinforcing Steel".
- Article 6.6.2.4, "Concrete".

See Article 6, "Timber Structures", of the "Load Rating Procedures" section, *Bridge Load Rating Manual,* for allowable stress assumptions based on the physical condition of the timber members.

2.6 PROCEDURES FOR STANDARD DRAWINGS

2.6.1 WHO IS RESPONSIBLE FOR STANDARD DRAWINGS?

The Bridge Section's Office Practice Coordinator is responsible for:

- Overseeing the separate bridge Standard Drawing File of original full size mylars.
- Preparation of reused drawings for annual update of the ODOT *Manual of Metric Standard Drawings for Design and Construction.*

A Structural Design Team is normally given the assignment of developing a new or revising an existing standard drawing and guiding it through the approval process.

2.6.2 USE OF STANDARD DRAWINGS

Section 4.4.2, "Title Sheet", covers working the bridge standard drawings with the project structure drawings. How to list the standard drawings on the structure title sheet is also explained.

2.6.3 STANDARD DRAWING FILES

The original full size mylars of Current Bridge Section standard drawings are stored in the Office Practice Coordinators work area. When the mylars are needed for printing contract plans, making revisions, or responding to special requests from outside the Bridge Section (see also last paragraph of Section 2.6.6), they are checked out and removed only through the Office Practice Coordinator. Use the form, "Request for Bridge Standard Drawing Mylars". Supplies of the form are kept in each Design Team room.

The ODOT *Manual of Standard Drawings for Design and Construction* includes the latest, approved drawings printed on letter size paper. The manual is distributed by the Roadway Standards Engineer and includes Roadway, Bridge and Traffic Standard Drawings. It is issued to each Bridge Section Designer and Drafter and distributed to other ODOT units, other government agencies, and private companies.

2.6.4 DEVELOPING NEW STANDARD DRAWINGS

The creation and approval of a new bridge standard drawing is done as follows:

- A Design Team is assigned to develop and draft the standard drawing.
- A half size print is reviewed and then circulated by the Design Team Supervisor among the Design Teams, the "B" Team, and other ODOT units if necessary.
- The full size Mylar is revised to incorporate comments and suggested changes acceptable to the Design Team Supervisor and then is submitted to the Bridge Engineer for signature.
- The signed full size Mylar is given to the Office Practice Coordinator for distribution of prints and filing. See Section 2.6.6, "Distributing Standard Drawings".

2.6.5 REVISING STANDARD DRAWINGS

Standard drawings are continually being revised and updated. The revision process should take in consideration that standard drawings are legal documents. If the design concept on which a drawing is based is changed, the drawing should be redrawn, rechecked, approved, and stamped by current design personnel. Do not use unapproved drawings as they may have unchecked or incorrect details.

After a proposal for a significant revision to a standard drawing is initiated by or assigned to a Design Team, a Structural Designer or Drafter takes the following steps:

- Circulate a half size print with revisions noted in color among the Design Teams and other interested ODOT units after initial review and approval by the Design Team Supervisor.

- Obtain the Design Team Supervisors final approval of acceptable revisions produced from review comments and suggestions.

- Check out the original full size Mylar from the Office Practice Coordinator and make approved changes. If hand-drawn revisions are made on a CAD-produced drawing, be sure the revisions are also made in the CAD file.

- Mark the changes in red on a letter size or half size print of the existing version being revised and attach it to a completed Standard Drawing Additions and Changes form. Include in the "remarks" of the form the Design Team Supervisor's recommendation as to whether the revision is extensive enough to have the existing drawing number replaced with a new one.

- Submit the form and attached print with noted revisions as well as the changed full size Mylar to the Office Practice Coordinator for general distribution and filing.

For minor revisions, eliminate the first step of the procedure just described and proceed with checking out the original Mylar after receiving the Design Team Supervisor's approval of the revision.

2.6.6 DISTRIBUTING STANDARD DRAWINGS

In general, for a new or revised bridge standard drawing, the Office Practice Coordinator:

- Provides half-size copies of revised drawings to the Repographics Unit to be included in the contract plans. .

- Provides letter size copies to the Roadway Standards Engineer for publication and distribution of the ODOT *Manual of Metric Standard Drawings for Design and Construction*.

- Files the full size Mylar in the Standard Drawing File in the Office Practice Coordinator's work area.

The Office Practice Coordinator provides revised drawings for an annual distribution of letter size prints of all new or revised standard drawings approved over the past year to holders of the *Manual of Metric Standard Drawings for Design and Construction*. However, in the interval before prints are issued for the *Manual*, these standard drawings are used in contract plans as they are approved and become available.

2.7 REVIEW OF CONSULTANT PLANS

When a designer checks plans prepared for local agencies by consultants, there are relationships between the consultant, ODOT, the local agency & FHWA which should be accounted for. Refer to the Local Agency Project Manual for the instructions we give to consultants designing projects for local agencies. Under the Oregon Federal Stewardship Plan (1993), ODOT has taken on the oversight role for all Non-NHS projects. FHWA standards and directives do not apply to Non-NHS standards and directives. AASHTO is the primary design code ODOT uses, but not the only design code available to consultants on local projects. The Facilities Management Section (Jim Hansen, 986-5792) is available to help us review building structures. When a consultant is designing a local agency project under an ODOT contract (flexible services), our relationship with the consultant requires them to design a project as ODOT would in-house. When a local agency contracts with a consultant to design a project directly, ODOT is in more of an advisory (comment) role and less of a review (approval) mode.

SECTION 2: APPENDIX

A2.1.2.2 Other Design Specifications, Manuals, and References

(1) Design Team Libraries - In addition to the Team library references listed in Section 2.1.2.1, 'Standard Specifications and Standard Drawing Manuals", the following material is also found in each Structural Design Team library unless noted otherwise. Duplicate copies of some of the publications are also in the Bridge Section Library.

- AASHTO *Guide for Development of Bicycle Facilities*. See also ODOT *Oregon Bicycle Plan* of this list.
- AASHTO *Guide Specifications for Bridge Railings*.
- AASHTO *Guide Specifications for Bridge Temporary Works*.
- AASHTO *Guide Specifications for Fatigue Design of Steel Bridges*.
- AASHTO *Guide Specifications for Fatigue Evaluation of Existing Steel Bridges*.
- AASHTO *Guide Specifications for Fracture Critical Non-Redundant Steel Bridge Members*.
- AASHTO *Guide Specifications for Horizontally Curved Highway Bridges*.
- AASHTO *Guide Specifications for Design of Pedestrian Bridges*.
- AASHTO *A Guide for Protective Screening of Overpass Structures*.
- AASHTO *Guide Specifications for Design and Construction of Segmental Concrete Bridges*.
- AASHTO *Guide Specifications for Seismic Isolation Design*.
- AASHTO *Guides Specifications for Structural Design of Sound Barriers*.
- AASHTO *Guide Specifications for Strength Evaluation of Existing Steel and Concrete Bridges*.
- AASHTO *Guide Specifications for Alternate Load Factor Design Procedures for Steel Beam Bridges Using Braced Compact Sections*.
- AASHTO *Guide Specifications for the Design of Stress-Laminated Wood Decks*.
- AASHTO *Guide Specifications Thermal Effects in Concrete Superstructure*.
- AASHTO *Construction Handbook for Bridge Temporary Works*.
- AASHTO *Manual for Condition Evaluation of Bridges.* Replaces AASHTO *Manual of Maintenance Inspection of Bridges,1983*.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(1) Design Team Libraries - (continued)

- AASHTO *A Policy on Geometric Design of Highway and Streets*. A basic text for highway planning and design.
- AASHTO *Roadside Design Manual*. Current information and operating practices relating to roadside safety design.
- AISC *Manual of Steel Construction*: *Allowable Stress Design*, Ninth Edition 1986, American Institute of Steel Construction.
- AISC *Manual of Steel Construction: Load & Resistance Factor Design*, First Edition 1989, American Institute of Steel Construction. Copy available in Structural Design Team 1 library, Room 327.
- AITC *Timber Construction Manual*, Third Edition 1985, American Institute of Timber Construction.
- ANSI/AASHTO/AWS *Bridge Welding Code*, D 1.5. A copy is available in the Preservation Engineering Team area.
- ANSI/AWS *Structural Welding Code: Steel*, D 1.1. Used for incidental structures such as luminaire poles, traffic poles, Bridge railing posts, etc. A copy is available in the Preservation Team area.
- ASTM *Standard Practice for Use of the International System of Units*, E380-91a, American Society for Testing and Materials.
- Bridge Section *Bridge Permits Manual*. Designer's responsibilities regarding applications for U.S. Corps of Engineer/Division of State Lands, U.S. Coast Guard, and Public Utility Commission (railroad projects) permits. See Section 2.3.3, "Permits--Potential Trouble!"
- Bridge Section *Cost Data Instruction Manual*. Instructions for submittal of actual design and construction data to Bridge Section Cost Data Coordinator. See Sections 3.1.4, "Structure Cost Data Preparation", and 3.1.5, "Design Cost Data Preparation'.
- Bridge Section *Example Designs*. A notebook with examples of design procedures, such as seismic isolator modeling, too bulky to include in the *Office Practice Manual*.
- Bridge Section *Impact Attenuator Design Manual*.
- Bridge Section *Retaining Structures Manual*. A guide for design, selection, and review of ODOT standard retaining walls or preapproved proprietary retaining walls.
- Bridge Section *Structural Steel Girder Design and Detailing Guidelines*.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(1) Design Team Libraries - (continued)

- Bridge Section *Structure Cost Data Books*. Distributed by Bridge Section Cost Data Coordinator. Structure costs taken from project bids submitted by contractors and published annually beginning in 1971.

- Caltran *Bridge Design Practice Load Factor Design*, 1980, Office of Bridge and Structures Design, California DOT.

- Caltran *Falsework Manual*, 1988 with revisions, Office of Structure Construction, California DOT.

- Caltran *Trenching and Shoring*, 1991, Office of Structure Construction, California DOT.

- FHWA *Bridge Inspector's Training Manual/90*, July 1991. A good reference for Designers to review to better understand the realities of bridge design and construction. Extensive glossary of bridge terminology. Copies in Bridge Operations Team office. Also some Structural Designers have copies.

- FHWA *Evaluating Bridge Scour*. Copy in Geo/Hydro Section office.

- FHWA *Guidelines for Making Pedestrian Crossing Structures Accessible*. Report No. FHWA-IP-84-6.

- FHWA *Manual on Design and Construction of Driven Pile Foundation*, 1985 with updates.

- FHWA *Seismic Design and Retrofit Manual for Highway Bridges*, 1987, Report No. FHWA-IP-87-6.

- FHWA *Seismic Retrofitting Guidelines for Highway Bridges*, Report No. FHWA/RD-83/007.

- FHWA *Steel Sheet Piling Design Manual*, 1984. Originally published by United States Steel Company and updated and reprinted by FHWA.

- ODOT *Bridge Computer Manual*, Bridge Section. Presently out of print. Some Designers of each Design Team have a copy.

- ODOT *Bridge Load Rating Manual*, Bridge Operations Team, Bridge Section.

- ODOT *Bridge Log*, Bridge Operations Team, Bridge Section. Inventory of structures by highway number and milepoint on Oregon primary and secondary highway system updated annually. Structures include vehicular, pedestrian, and sign bridges, box culverts, and pipe culverts 6' and over in diameter.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(1) Design Team Libraries - (continued)

- ODOT *Highway Design Manual*, 1993, Project Services Unit, Engineering Services Section. The major reference for road design.
- ODOT *Hydraulics Manual*, 1990, Hydraulics Unit, Bridge Preliminary Design Team, Bridge Section.
- ODOT *Nonfield-Tested Material Acceptance Guide*, Field Operations Unit, Operations Support Section. Copy included toward front of each contract special provisions booklet.
- ODOT *Oregon Bicycle Plan*, Bikeway/Pedestrian Program Office, Engineering Services Section. See also AASHTO *Guide for Development of Bicycle Facilities* of this list.
- ODOT *Oregon City Maps Atlas* Transportation Inventory and Mapping Unit, Transportation Development Branch. Periodically updated. (City maps will eventually be included in the *Oregon County Maps Atlas*.
- ODOT *Oregon Coding Guide for the Inventory and Appraisal of Oregon Bridges*, Bridge Operations Team, Bridge Section.
- ODOT *Oregon County Maps Atlas*, Transportation Inventory and Mapping Unit, Transportation Development Branch. Periodically updated.
- ODOT *Oregon Highway Straightline Charts Atlas*, Transportation Inventory and Mapping Unit, Transportation Development Branch. Pictorial inventory of highway features, by highway number and milepoint, of primary and secondary highway system. Periodically updated.
- ODOT *Oregon Plan of Action for Transportation 1989*, Program/Project Management Services. Excellent source of information about ODOT's project development process. Due to be replaced by a *Project Development Manual*.
- ODOT *Qualified Products List*, Materials Unit, Operations Support Section. Published every 6 months. See Section 2.1.10.1, "Evaluation of Construction/Maintenance Products'.
- ODOT *Soil and Rock Classification Manual*, 1987, Geotechnical Services Unit, Engineering Services Section.
- ODOT *Standard Highway Spiral*, Technical Bulletin No. 20, Revised Aug 1973. Some Structural Designers of each Design Team have copies.
- ODOT *Traffic Volume Tables*, Transportation Research Section. Traffic counts by highway number/milepoint for primary and secondary highway system, published annually.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(1) Design Team Libraries - (continued)

- *Oregon Occupational Safety and Health Code*, Accident Prevention Division, Department of Insurance and Finance. Set of volumes in Preservation Engineering Team library.
- *Segmental Bridge Design Seminar Notebook*, April 1991, Figg Engineers, Inc.
- PTI *Post-Tensioning Manual*, Fifth Edition 1990, Post-Tensioning Institute.
- U.S. Forest Service *Wood Handbook: Wood as an Engineering Material*, 1987.
- WCRSI *Post-Tensioned Box Girder Bridges: Design and Construction*, 1969, Western Concrete Reinforcing Steel Institute. Been around awhile, but still has some good basic information.

(2) Bridge Section Library - The following material is located in the Bridge Section Library unless noted otherwise. The list is by no means complete. Items listed in Section 2.1.2.1, "Standard Specifications and Standard Drawing Manuals", and the previous Appendix Section 2.1.2.2(1), "Design Team Libraries", that are also found in the Bridge Section Library are not listed here again.

- AASHTO *A Guide for Accommodating Utilities Within Highway Right-of-Way*. Copy included in *ODOT Utility and Miscellaneous Permits Manual*.
- AASHTO *A Guide on Design Standards-Interstate System*, July 1991.
- AASHTO *Guide to Metric Conversion*.
- AASHTO *Materials, Part I: Specifications* and *Part II: Tests*. Two volumes.
- AASHTO *A Policy on the Accommodation of Utilities Within Freeway Right-of-Way*. Copy included in ODOT *Utility and Miscellaneous Permits Manual*.
- ACI *Building Code Requirements for Reinforced Concrete (ACI 318-89) and Commentary (ACI 318R-89)*, American Concrete Institute.
- ACI *Cement and Concrete Terminology* SP-19(85), American Concrete Institute.
- ACI *Cracking in Prestressed Concrete Structures* SP-113, 1989, American Concrete Institute.
- ACI *Design Handbook: Volume I - Beams, One-Way Slabs, Brackets, Footings, and Pile Caps* SP-17(84), American Concrete Institute.
- ACI *Esthetics in Concrete Bridge Design* ACI MP-1, 1990.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(2) Bridge Section Library - (continued)

- ACI *Formwork for Concrete* SP-4, Fifth Edition 1989, M.K. Hurd, American Concrete Institute.
- ACI *Joint Sealing and Bearing Systems for Concrete Structures* SP-94, Volumes 1 and 2. American Concrete Institute.
- ACI *Manual of Concrete Practice*, American Concrete Institute. Revised annually. Encyclopedia of concrete design and construction:
  - *Part 1: Materials and General Properties of Concrete*.
  - *Part 2: Construction Practices and Inspection*.
  - *Part 3: Use of Concrete in Buildings-Design, Specifications, and Related Topics*.
  - *Part 4: Bridges, Substructures, Sanitary, and other Special Structures*.
  - *Part 5: Masonry, Precast Concrete, Special Processes*.
- ACI *Reinforced Concrete Design Handbook, Working Stress Method* SP-3 1965, American Concrete Institute.
- ACI *Repairs of Concrete Structures--Assessments, Methods, and Risks* SCM-21(89), American Concrete Institute. Seminar manual.
- AISC *Design Manual for Orthotropic Steel Plate Deck Bridges* 1963, American Institute of Steel Construction.
- AISC *Detailing for Steel Construction* 1983, American Institute of Steel Construction.
- AISC *Engineering for Steel Construction: A Source Book for Connections* 1984, American Institute of Steel Construction.
- ASTM *Annual Books of ASTM Standards*, American Society for Testing and Materials. Various volumes from Sections 1 through 4, 8, 9, 11, 14, and 15.
- Bridge Section photo albums: Early Oregon concrete and steel bridge construction (pre-1940).
- Bridge Section video cassettes collection: Various subjects such as structural design workshops, construction techniques, maintenance procedures, field trips, manufacturer and supplier's product installations, material testing, etc.
- Caltran *Standard Specifications*, California DOT. Road and bridge construction specifications.
- CRSI *Manual of Standard Practice*, Concrete Reinforcing Steel Institute.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(2) Bridge Section Library - (continued)

- FHWA *Federal-Aid Policy Guide*, Volumes 1 and 2. Copies in Front Office.
- FHWA *Recording and Coding Guide for Structure Inventory and Appraisal of the Nation's Bridges*, 1988. Copy in Bridge Inventory Coordinator's office.
- FHWA: Various research-and-development and demonstration project reports as well as informational booklets.
- *Guide to Design Criteria for Bolted and Riveted Joints*, Second Edition 1987, Geoffrey Kulak, John W. Fisher, and John H. Struik.
- National Forest Products Association, *National Design Specifications for Wood Construction* 1982.
- ODOT *Basic Surveying for Highway Workers*, Ron Busey, ODOT Training Unit and Association of Engineering Employees.
- ODOT *Construction Manual*, Operations Support Section.
- ODOT *Field-Tested Materials Acceptance Guide*, Field Operations Unit, Operations Support Section.
- ODOT *Maintenance Field Operations Manual*, Operations Support Section.
- ODOT *Maintenance Guide*, Operations Support Section.
- ODOT *Metric Convention Manual*, Project Services Unit, Engineering Services Section.
- ODOT *Policy and Procedures*. Policy and procedure statements, directives, and delegation orders issued periodically.
- ODOT *Principles of Writing Highway Construction Specifications*, Specifications Unit, Roadway Engineering Section. Notes and handouts from 1976 seminar.
- ODOT *Railroad and Utility Manual*, Railroad and Utility Unit, Right-of-Way Services. Actually Chapter 10 of the *Right-of-Way Manual*.
- Ontario Province *Ontario Highway Bridge Design Code* and *Design Code Commentary* (two volumes) 1983, Highway Engineering Division, Ontario, Canada.
- Oregon Secretary of State *Oregon Blue Book*. Official encyclopedia of facts and figures about the State, county, and city governments published annually. Latest copy in the Front Office.
- *Orthotropic Bridges: Theory and Design*, 1967, M.S. Troitsky.

A2.1.2.2 Other Design Specifications, Manuals, and References - (continued)

(2) Bridge Section Library - (continued)

- PCA *Design and Control of Concrete Mixtures*, Thirteenth Edition 1988, Portland Cement Association.
- PCA *Notes on ACI318-83 Building Code Requirements for Reinforced Concrete with Design Applications*, Portland Cement Association.
- PCI *Precast and Prestressed Concrete Handbook*, Third Edition 1985, Precast/Prestressed Concrete Institute.
- Transportation Research Board *National Cooperative Highway Research Program Reports*, National Academy of Engineering.
- Transportation Research Board *Transportation Research Record*, National Academy of Engineering.
- USS *Composite Steel Plate Girder Bridge Superstructures, Load Factor Design* 1979, United States Steel Company.
- WSDOT *Bridge Design Manual, Volume 1: Criteria and Volume 2: Design Aids*, Bridge and Structures Office, Washington State DOT.
- WSDOT *Standard Specifications for Road, Bridge, and Municipal Construction*, Washington State DOT and American Public Works Association (APWA).

A2.1.9.3 Experimental Features Program

Example Cover Letter

Scott Nodes
Research Unit

August 5, 1992

O.M. Parent
Principal Structural Design Engineer

Catching Slough Bridge 2278E
Catching Slough Bridge Section
Coos River Highway
Coos County

Attached is Experimental Features Work Plan #OR92-01B for the deck on this structure. This is transmitted for processing and transmittal to the FHWA.

GAP:krm

Attachment

Figure A2.1.9.3A

A2.1.9.3 Experimental Features Program (continued)

EXPERIMENTAL FEATURES PROJECT WORK PLAN #OR92-01B
Concrete Bridge Deck with Isotropic Reinforcing

Objective
This project will evaluate the short-term performance of a deck with isotropic reinforcing. Good long-term performance has been demonstrated by others ("Long-term Serviceability of Isotropic Reinforced Bridge Deck Slabs"; Fu, Alampalli, and Pezze; New York State Department of Transportation; 1991) for decks which do not have construction or other early life problems. The project can be extended if conditions warrant further evaluation beyond this proposal's limit.

Isotropic deck reinforcing is being used as a cost savings feature. Initial construction cost saving is from reduced material requirements and more constructable reinforcing placement. Long-term savings results from reduced deck-cracking severity with the attendant reduction in deck deterioration.

Installation
The deck will be constructed of normal materials (Class 4350 concrete and ASTM A615 Grade 60 reinforcing steel) with normal placing and curing practices for the following project:

Catching Slough Bridge Section
Bridge 2278E

The materials will be placed per the contract drawings to provide uniform reinforcing longitudinally and transversely, bottom and top of deck, thereby giving an isotropically reinforced deck.

The project is funded by the FHWA and the State of Oregon.

Evaluation
The performance will be monitored and evaluated by visual inspection. The inspections will be at the following times by the listed personnel.

At Construction Completion
Construction Project Manager's representative, Regional Bridge Inspector, and Bridge Section representative.

One year after Construction Completion
Regional Bridge Inspector, and Bridge Section representative.

Two years after Construction Completion
Regional Bridge Inspector, and Bridge Section representative.

The first inspection will verify conformance to plans and specifications. It is normal procedure for all decks. The inspection will include a baseline crack survey, which shows the observed cracking and approximate deck geometry. Subsequent inspections will be for excessive or abnormal deck cracking or other unanticipated defects.

Written reports summarizing visual findings will be prepared for each inspection performed after construction completion. The reports will include a comparison of subsequent cracking to the baseline crack survey to evaluate the effect of live loads on cracking. Three reports are planned. The final report will also provide a conclusion for the findings to that time. All written reports will be by a Bridge Section representative.

Figure A2.1.9.3A-continued

A2.1.9.3 Experimental Features Program (continued)

Estimated Cost

Visual Inspection

At Construction Completion

Project Manager's representative	2 hr. x $25/hr. x 1.74 factor	$90
Regional Bridge Inspector	2 hr. x $25/hr. x 1.74 factor	$90
Bridge Section representative	2 hr. x $25/hr. x 1.74 factor	$90

One year after Construction Completion

Regional Bridge Inspector	2 hr. x $25/hr. x 1.74 factor	$90
Bridge Section representative	2 hr. x $25/hr. x 1.74 factor	$90

two years after Construction Completion

Regional Bridge Inspector	2 hr. x $25/hr. x 1.74 factor	$90
Bridge Section representative	2 hr. x $25/hr. x 1.74 factor	$90

SUBTOTAL $630

Report Preparation

At Construction Completion

Bridge Section representative	8 hr. x $25/hr. x 1.74 factor	$350
Research Unit representative	4 hr. x $25/hr. x 1.74 factor	$170
Publish report (Research Unit)		$200

One year after Construction Completion

Bridge Section representative	8 hr. x $25/hr. x 1.74 factor	$350
Research Unit representative	4 hr. x $25/hr. x 1.74 factor	$170
Publish report (Research Unit)		$200

two years after Construction Completion

Bridge Section representative	8 hr. x $25/hr. x 1.74 factor	$350
Research Unit representative	4 hr. x $25/hr. x 1.74 factor	$170
Publish report (Research Unit)		$200

SUBTOTAL $2160

TOTAL $2790

The need for special inspection equipment is not anticipated and its cost is not included in the estimated costs above.

Project Manager's representative cost will be charged to the construction contract administration budget ($90). Regional Bridge Inspector costs will be charged to the Regional Bridge Inspection budget ($270). Bridge Section representative costs will be charged to Bridge Section accounts ($1320). Research Unit costs will be charged to the federal HPR (Experimental Features account $1110).

Figure A2.1.9.3A-continued

A2.1.9.3 Experimental Features Program (continued

Schedule

Completion of Construction/first Inspection	November 1994
Second Inspection	November 1995
Third Inspection	November 1996

Reports will be issued approximately two months after each inspection.

Identification

Oregon Department of Transportation
Bridge Section
Transportation Building, Room 301
Salem, OR 97310

Principal Investigator: Guido A. Portier – of the Bridge Section

Figure A2.1.9.3A-continued

A2.1.9.4 Specifying Proprietary Items

PROPORIETARY ITEMS IN FEDERAL-AID CONTRACTS

1. Basis for requirements: Competition

   23 USC 112 "... the Secretary (of Transportation) shall require such plans and specifications and such methods of bidding as shall be effective in securing competition".

2. Regulations apply to process or product specifications.

3. What is proprietary?

   a. Product specified by brand name.

   b. A specification written around a specific product in such a manner as to specify an attribute or process that is unique to that product and excludes other similar products.

   c. Manufacture or use of the product by any party would infringe on a patent or copy right, or require payment of a premium or royalty.

4. A proprietary item on a Federal-aid project may be used only under the following conditions:

   a. The proprietary item is allowed in competition with other equivalent products using one of the following methods:
      - Generic end result specification – nonproprietary
      - Generic process or product attribute specification (may be patterned after a manufacturer's specification but sanitized to eliminate reference to brand names and patented aspects and open enough to allow at least two alternatives) – nonproprietary.
      - Multiple brands – all or at least two (preferably three) alternates must be specified (interim use only in exceptional circumstances). Use either:
        (1) Manufacturer's specification incorporated into contract – proprietary, or
        (2) Name brands only in the contract documents with or without reference to manufacturer's specification or in the approved products list – proprietary.

   b. A public interest statement can be developed by the Highway Agency and approved by FHWA when the product is either essential for synchronization (compatibility) with existing system or it is the only suitable product or method hat exists.
      - Other products or processes will not work.
      - Other products or processes may work but are otherwise unreasonable.
      - Either of the above conditions should be verified by the Highway Agency and documented. This finding should be periodically reviewed.

   c. It is experimental. The intent and use of the experimental program is to permit the State time to test and/or evaluate new and untried materials or products capable of providing the intended function, upon which they can further develop term research nor to otherwise circumvent the prohibition against brand name items. Reports must be prepared and submitted to FHWA for dissemination to other interested agencies.

5. A2.1.10.1 Evaluation of Construction/Maintenance Products

Example of Product Evaluation Form:

Oregon

DEPARTMENT OF TRANSPORTATION
Operations Support

Interoffice Memo

DATE: August 26, 1997

TO: Horace King
Traffic Management Section
Section

FROM: Mike Dunning
Operations Support Section

P 1057

SUBJECT: PMC #1158

Following is a product that has been submitted to ODOT for review, and inclusion on our "Qualified Products List".

Product Name: PMC #1158

Product # 1057

Category: Traffic Loop Sealant; 00990.43

We have had it on the **Conditional List** since December 1994.

The manufacturer has asked that we move it from the Conditional List to the Qualified List. I am submitting a list of several projects the product has been used in ODOT projects. Please note that PMC 1158 used to be called J-Pat 1158.

6/95, C11533 Medford - Vilas Rd; Larry Carson, 541/830-6400.
12/95; C11481; Oakland/Shady Hwy @ Cames Rd; Bill Ferguson; 541/957-3574.
6/20/97; Chemawa Rd and I-5 Off Ramp; Irv Patten; 503/986-2706.
6/22/97; Kingsvalley Hwy and Ellendale - Dallas; Irv Patten, 503/986-2706.

Conclusions:

Can You support moving PMC #1158 from the **"Conditional List" to the "Qualified List"** for the Loop Sealant category?

☐ YES ☐ NO

Comments: _____

_____ Reviewed by: _____

After you send me your response, I will bring the product to a Product Evaluation Committee Meeting. Let me know if I can help, my phone number is 986-3059. You may keep the copies of product data that are attached. Thanks!

Figure A2.1.10.1A

A2.1.10.1 Evaluation of Construction/Maintenance Products – (continued)

Guidelines for Reviewing New Products

PCC REPAIR MATERIALS

02010.10-PCC Patching

The following Specifications are used for the primary basis of review on PCC patching materials.

1. **Compressive Strength:**
   For aggregate 3/8" or larger, 4"x8" cylinders (ASTM C 39-86 or AASHTO T22)
   For aggregate 3/8" or smaller, 2" cubes (ASTM C 109-91 or AASHTO T106)

SPECIFICATIONS	CURE TIME	POSITIONING	
		HORIZONTAL	VERTICAL
Rapid Hardening	24 hrs.	3000 psi	
	28 days	4500 psi	4000 psi
Very Rapid Hardening	3 hrs.	3000 psi	
	28 days	4500 psi	4000 psi

2. **Length Change:**
   0.15% maximum increase after 28 days in water based on length at 3 hours, and 0.15% maximum decrease after 28 days in air based on length at 3 hours per ASTM C 928-92A (no AASHTO equivalent).

3. **Working Time:**
   Manufacturer's recommendation

4. **Chloride Content:**
   0.1% maximum by weight, per AASHTO T 260-93 (no ASTM)

CONCRETE BONDING AGENTS

02060.10-Epoxy Injection for Crack Repairs

The requirements for this category are the same as those for Type II epoxy bonding agents listed below, as well as some additional strength requirements for Type I epoxies. Tests required are as follows.

1. All tests required for type II epoxy bonding agents
2. Compressive Strength: 8000 psi at 7 days (min)(ASTM D 695-91)
3. Tensile Strength: 5000 psi at 7 days (min)(ASTM D 638-91)

A2.1.10.1 Evaluation of Construction/Maintenance Products (continued)

CONCRETE BONDING AGENTS (continued)

02070.10-Epoxy Bonding Agents

ASTM C 881-90 (AASHTO M 235) specifications for "Epoxy Resin Adhesives" are used as the basis for review. Type II is adequate for most bridge applications. Type I should be used for injection for crack repairs, and Type VI should be used to bond segmental precast elements. The critical items to be reviewed should include:

1. **Working Time (Gel Time or Pot Life):**
   At least 25 minutes for all test temperatures listed below (except 5 minute minimum when automatic mixing and dispensing is used).

Class	Temperature Range	Test Temperature
A	Below 40°F	0 ± 2.0°F
B	40 - 60°F	50 ± 2.0° F
C	Above 60°F	73 ± 2.0°F

2. **Moisture Insensitivity:**
   Products must be able to be applied to a damp surface.

3. **Bond Strength:**
   1000 psi at 2-day moist cure,
   1500 psi at 14-day moist cure (ASTM C 882-91)

4. **Linear Coefficient of Shrinkage on Cure:**
   0.005 or less (ASTM D 2566-91)

5. **Compressive Strength:**
   5000 psi at 7 days (ASTM D 695-91)

6. **Tensile Strength:**
   2000 psi at 7 days (ASTM D 638)

7. **Elongation at Break (min):**
   1 percent

Note: AASHTO M 235 requires a minimum gel time of 30 minutes. "Gel time" is approximately equivalent to "pot life". The 25-minute pot life limit was chosen because it was the lowest pot life of products commonly available.

02070.20 - Non-Epoxy Bonding Agents

ASTM C 1059-91 "Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete" is used as the basis for review. NOTE: This specification refers to latex-based systems. Products listed as water-based epoxies are classified as non-epoxy bonding agents and must meet the same bond strength requirements as latex-based systems.

1. **Type II**
   Non-redispersable

2. **Bond Strength:**
   1250 psi after immersion (ASTM C 1042-91)

A2.1.10.1 Evaluation of Construction/Maintenance Products (continued)

***Guidelines for Reviewing New Products* (continued)**

GROUTS

02080.10-Epoxy Grout

Epoxy grouts generally have much higher strengths than non-epoxy grouts. The important factors when reviewing epoxy grouts are moisture insensitivity, and working time as per test method ASTM C 881-90. These and other factors are discussed below:

1. **Moisture Insensitivity**:
   Products must be able to be used on a damp surface. Any product which states that the concrete surface must be dry when the grout is poured should be rejected.

2. **Working Time (Gel Time or Pot Life):**
   At least 25 minutes at 75^{o} F.

3. **Compressive Strength**:
   5000psi at 7 days, cured at 75^{o} F. Typically, epoxy grouts have strengths over 10,000 psi, so this should not be a problem.

4. **Shrinkage**:
   0.1 percent maximum (ASTM D2566-91)

02080.20 – Non-Epoxy Grout and 02080.30 - Keyway Grout

Nonshrink grout is listed in the *ODOT Qualified Products List* under "Nonepoxy Grout" and "Keyway Grout". Our requirements for products in both categories are the same. Both categories must meet meet the requirements of ASTM C 1107-91a: "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)". These and other requirements are listed below:

1. **Non-Shrink:**
   The material should have expanded no more than 4 percent at final set. Measure volume change according to ASTM C 827-87.

2. **Compressive Strength**:
   3500psi at 7 days and
   5000psi at 28 days (ASTM C 109-91)

3. **Working (Gel) Time:**
   45 minute minimum, per manufacturer's recommendations

4. **Non-corrosive/Non-metallic/Non-ferrous/Non-staining:**
   a. No aluminum powder - can result in uncontrolled expansion
   b. No metallic products – stain when exposed to rain
   c. No chlorides - cause corrosion

A2.1.10.5 Railroad Bridge Design

Example of Letter to Railroad:

May 6, 1997

Charles A. Lundgen
Engineer, Public Works
Burlington Northern Railroad Company
2100 FIC
999 Third Ave., Suite 2200
Seattle, WA 98104

Murphy Road – Lava Butte (Middle Unit)
The Dalles-California Highway
Deschutes County
Bieber Line Overcrossing & M.P. 4.86
PUC Crossing Number 10A-4.8-B

As you are aware, the Oregon Department of Transportation is proposing to widen and improve the above section of highway, which would require the replacement of the existing railroad structure over the highway. The project is tentatively scheduled for construction starting the summer of 1999. The Oregon Department of Transportation would like Burlington Northern Railroad Company to consider the following proposals.

ODOT requests the State's Bridge Section to design the railroad structure over the State highway. The Bridge Section of the Oregon Department of Transportation is experienced in the design of railroad structures and is familiar with AREMA specifications and applicable design loading. ODOT feels the State can perform the design in a more cost effective and efficient manner. The following is a list of some railroad structures designed by ODOT's Bridge Section.

Tualatin Uxing of S.P.R.R., Bridge #2258A, a C.I.P. Post-Tensioned concrete through girder built in 1975;

U.P.R.R. (Kenton line) U'xing, Bridge #9682, a Steel Deck Girder built in 1979;

U.P.R.R. Oxing of "BC", Bridge #13514G, a Steel Box Girder built in 1979;

O.E.R.R. Uxing (B.N.R.R. E66.6), Bridge #16096, a Steel Deck Girder built in 1983;

Uxing U.P.R.R. Mainline North, Bridge #4696A, a Steel Through Girder built in 1985;

U.P.R.R. Oxing of N.E. 181st, Bridge #7090A, a Steel Deck Girder built in 1989;

A copy of the Tualatin Uxing Bridge plans are enclosed for your information

If further information is required for consideration of the design functions, please call me at your earliest convenience. I can be reached at telephone number (503) 986-3658. It is important that we receive a response at your earliest convenience so that we do not delay the schedule of the project.

Figure A2.1.10.5A

A2.1.10.5 Railroad Bridge Design (continued)
Example of Letter to Railroad: (continued)

Through earlier communication and cooperation with Burlington Northern Railroad Company, ODOT has developed a preliminary alignment to accommodate the new railroad structure. I have enclosed the following roll maps for your further review and approval:

1. 2 rolls X-sections for railroad grade along N5 alignment

2. 1 roll Railroad Encroachment Map.

3. 2 rolls Railroad PUC map (Horizontal and Vertical alignment).

4. 2 rolls Vicinity map for BNRR structure – Bridge #3365.

The Oregon Department of Transportation would also like Burlington Northern Railroad Company to consider the type of bridge structure. ODOT proposes a continuos two span post-tensioned concrete through girder structure very similar to that detailed on the enclosed bridge drawings. The bent skew and span lengths would be approximately the same as shown on the drawings. This structure was built in 1975 and has performed very well with little or no maintenance.

We are proposing this type of structure for the following reasons. We have found concrete to be a durable, low maintenance construction material. Concrete structures have historically been less expensive than steel structures in our state. Concrete structures are not fracture critical and therefore would provide greater protection from impact and fatigue cracking than a steel through-girder. A concrete structure would provide architectural features consistent with those of our upcoming Bend Parkway project, which is nearby. Skewed bents would allow a much shorter structure and a narrower median, reducing both construction and right-of-way costs.

In order for ODOT to further proceed with the plans for the above mentioned project, we need Burlington Northern Railroad Company to respond to the State's above mentioned proposal as summarized:

1. Will BNRR accept the design of the structure to be performed by ODOT?

2. Does BNRR approve of the vertical and horizontal alignment for the newly relocated railroad line?

3. Is a Continuous Two Span Post-Tensioned Concrete Through Girder acceptable to BNRR?

Thank you for your prompt attention to these critical issues. Please call me if you have any questions. I can be reached at (503) 986-3658.

Cordially,

Mathew C. Caswell, P.E.
Railroad and Utilities Engineer

Enclosures

Figure A2.1.10.5B

A2.2.2.1 Project Prospectus

PROJECT PROSPECTUS

PART 1 — PROJECT REQUEST (PAGE 1 OF 2)

KEY ID # 09030							
SECTION: NE 148th Avenue Soundwall 97-4					REGION: 1	MAINTENANCE DISTRICT: 2B	
STATE HIGHWAY #: 2	HIGHWAY NAME: Columbia River			MILE POST FROM 11.45 TO 11.53			LENGTH: 135m (440 ft.)
[X] URBAN [ ] RURAL	CITY		COUNTY: Multnomah	ROAD/STREET NAME			
ROUTE #: I-84	NHS _X_YES __NO	HPMS: 4	FC: 11	APPLICANT (IF OTHER THAN STATE)			
US CONGRESSIONAL DISTRICT			STATE SENATE DISTRICT			STATE REPRESENTATIVE DISTRICT	

COST ESTIMATES (000'S)		PROJECT DATA		RIGHT OF WAY	
PRELIMINARY ENGINEERING	$ 51	GRADING	X	FILES (#)	9
RIGHT OF WAY	$ 25	PAVING		ACRES (HECTARES) (#)	0.2 AC (.08)
ROADWAY	$	STRUCTURES	X	RELOCATIONS (#)	
STRUCTURES	$ 82	SIGNING		WORK BY STATE/CONSULTANT/APPLICANT	
SIGNALS	$	SIGNALS		PRELIMINARY ENGINEERING (S,C,A)	S
ILLUMINATION	$	ILLUMINATION		CONSTRUCTION ENGINEERING (S,C,A)	S
TEMPORARY PROTECTION	$			RIGHT OF WAY DESCRIPTIONS (S,C,A)	S
UTILITY & RECONST. COSTS	$ 63	ENVIRONMENTAL CLASS (1,2,3)	2	RIGHT OF WAY ACQUISITIONS (S,C,A)	S
ENGINEERING & CONTINGENCIES	$ 25	DESIGN CATEGORY (1-7)	7	CONSTRUCTION BY	
TOTAL CONSTRUCTION	$ 170	WORK TYPE (1-12)	12	[X] CONTRACT [ ] OTHER	
TOTAL ESTIMATE	$ 246			[ ] STATE FORCE [ ] CITY FORCE [ ] COUNTY FORCE	

RECOMMENDED LET DATE BY FEDERAL FISCAL YEAR:	(QUARTER / YEAR) 2/98	RECOMMENDED FUND SOURCE:	(PE) State	(R/W) State	(CONST) State

RECOMMENDED PROGRAM REVISIONS

[ ] POSTPONE [ ] CANCEL	SECTION	FUNDS	CUR. YR.	ESTM. (000's) $
[ ] POSTPONE [ ] CANCEL	SECTION	FUNDS	CUR. YR.	ESTM. (000's) $

ITEM	EXISTING	PROPOSED
TRAVEL LANES (#)	6	6
STRUCTURES (#)	1	1
SIGNALS (#)		
BIKE WAY (Y/N)	N	N
AVERAGE DAILY TRAFFIC	N/A	N/A
YEAR OF AVERAGE DAILY TRAFFIC	N/A	N/A
THROUGHWAY	Y	Y

DEFINE THE PROBLEM

Proposed facility will replace an existing facility, to be located north of the UPRR and east of NE 148th Ave. The existing facility was constructed by the developer of the adjacent parcels prior to a State project which constructed soundwalls in this area in the 1980's. The existing facility is in poor condition and is ineffective. The previous soundwall project omitted this section because of the existence of the private facility at the time of construction. The Govenor's office has been involved in megotiations with the adjacent property owners.

PROPOSED SOLUTION **ATTACH SKETCH MAP**

Construct a new section of soundwall north of UPRR and east of NE 148th Ave. The new facility will be approximately 135 M (440 ft.) long and 4 M (13 ft.) high.

REQUESTED, REGION ENGINEER	DATE	TRANSP. COMM. APPROVAL DATE	PROGRAM YEAR	FUNDING
X				

KU-MCBRIDGE (8-96)

Figure A2.2.2.1A

A2.2.2.1 Project Prospectus (continued)

PROJECT PROSPECTUS
PART 1 — PROJECT REQUEST (PAGE 2 OF 2)

KEY ID #	
09030	
SECTION	**REGION**
NE 148th Avenue Soundwall	1

PROJECT JUSTIFICATION

The proposed soundwall will replace an existing fence/soundwall facility, located along the north right-or-way line of the UPRR east of NE 148th Avenue. The existing fence/soundwall was constructed by the developer of a single family residential subdivision (Columbia Shores) located on the parcels adjacent to the north UPRR right-of-way line. The existing wall was constructed prior to a State project which constructed soundwalls in this area in the 1980's. The existing concrete and wood facility is in poor condition and is ineffective. The previous soundwall project omitted this section because of the existence of the private facility at the time of constructioin. Because this development preceded the ODOT soundwall project in the 1980's, the replacement of the existing soundwall is justified. The Governor's office has been involved in negotiations with the adjacent property owners for the construction of the new soundwall. An August 19, 1996 letter by Bruce Warner, the Region 1 Manager at that time, committed ODOT to the construction of this soundwall.

A more recent single family residential development, located immediately to the east of the Columbia Shores subdivision, has constructed a wooden wall along the north UPRR right-of-way line. Because this was vacant land at the time of the original soundwall project in the 1980's, the section through this newer development is not a part of this proposal.

ADDITIONAL INFORMATION FOR PROJECTS REQUESTED BY LOCAL JURISDICTIONS

RESPONSIBLE LOCAL OFFICE TO BE CONTACTED FOR THE FOLLOWING ACTIVITIES:

1. **Public Hearing / Citizen Involvement** _____ **(Office)** _____ **(Phone)**
2. **Environmental / Planning** _____ **(Office)** _____ **(Phone)**
3. **Pre-Engineering** _____ **(Office)** _____ **(Phone)**

THIS OFFICIAL REQUEST IS FROM:

The City of _____ **and/or** _____ **County**

By _____ **By** _____

By _____ **By** _____

By _____

ADMINISTRATION RECOMMENDATION

KU-MCBRIDGE (8-96)

Figure A2.2.2.1B

A2.2.2.1 Project Prospectus (continued)

PROJECT PROSPECTUS

PART 2 — PROJECT DETAILS

NOTE: ATTACH DESCRIPTION AND SKETCH MAP

KEY ID # 09030

SECTION: NE 148th Avenue Soundwall

REGION: 1

ENTER: S - STATE C - CONSULTANT A - APPLICANT
E - EXISTING N - NO

PERMITS AND DOCUMENTS

STATE CLEARING HOUSE	N	SIGNS (PERMANENT)	N	STORM SEWER	N	AIRPORT CLEARANCE	N	WETLANDS	N
CITIZEN'S ADVISORY COMM.	S	STRIPING (PERMANENT)	N	LANDSCAPING	N	LAND USE ACTIONS AND PERMITS	S	ENDANGERED SPECIES	N
PHOTOGRAMMETRY	N	PROJECT SIGNING	N	IRRIGATION	N	FLOOD PLAN	N	HAZMAT	N
RECONNAISSANCE SURVEY	N	DETOUR	N	BORROW SOURCE	N	BUILDING	N	HISTORIC RESOURCE	N
PUBLIC HEARING	N	ILLUMINATION	N	MATERIAL SOURCE	N	CORPS OF ENGRS. / DSL REMOVAL / FILL	N	DEQ INDIRECT SOURCE AIR	N
FIELD SURVEY	S	RR CROSSING	N	DISPOSAL SITE		COAST GUARD	N	DEQ NON-POINT SOURCE WATER	N
VICINITY MAP	S	RR PROTECTION	N	LOCAL AGREEMENT	N	GEOLOGY AND MINERALS	N	ARCHAELOG. SURVEY	N
SOILS/GEOTECH INVESTIGATION	S	RR SEPARATION	N	SENSITIVE LAND	N	SIGNALS	N	NOISE STUDY	S
HYDRAULIC STUDY	N	RR ENCROACHMENT	S	VALUE ENGINEERING	N	OLD (#)	NEW (#)	SECTION 4(F)	N
RIGHT-OF-WAY				SURPLUS PROPERTY	N	**UTILITIES**	N	**(LIST BELOW)**	

RIGHT OF WAY LIAISON	EASEMENTS (#)	ACCESS CONTROL (Y / N)	COMPANIES
S	1	CURRENT: Y PROPOSED: Y	

ACQUISITIONS		RELOCATIONS	
SIMPLE (#)	COMPLEX (#)	BUSINESS (#)	RESIDENTIAL (#)

DESIGN STANDARDS	DESIGN SPEED	EXCEPTION (Y/N)

TYPICAL SECTION

EXISTING

	BIKE PATH	SIDE-WALK	CURB TYPE	PARKING	SHOULDER / BIKELANE	LANE 3	LANE 2	LANE 1	MEDIAN	LANE 1	LANE 2	LANE 3	SHOULDER / BIKELANE	PARKING	CURB TYPE	SIDE-WALK	BIKE PATH
ENGLISH					10'	12'	12'	12'	26'	12'	12'	12'	10'				
METRIC					3.6M	3.6M	3.6M	3.6M	7.9M	3.6M	3.6M	3.6M	3.6M				

PROPOSED

SUGGESTED BASE DESIGN

ITEM	NEW WORK	OVER EXISTING	ITEM	NEW WORK	OVER EXISTING

STRUCTURE	LENGTH	WIDTH	COST	STRUCTURE	LENGTH	WIDTH	COST
BRIDGE 1	135 M	4 M (HEIGHT)	82,080	**BRIDGE 5**			
BRIDGE 2				**BRIDGE 2**			
BRIDGE 3				APPROVED, LOCATION ENGINEER X			DATE
BRIDGE 4				REVISION APPROVED X			DATE

KU-MCBRIDGE (8-96)

Figure A2.2.2.1C

A2.2.2.1 Project Prospectus (continued)

KEY ID #

SECTION **BRIDGE NO.** **REGION** **COUNTY**

1) ESTIMATED RIGHT-OF-WAY IMPACTS (INCLUDING EASEMENTS, NUMBER OF PARCELS, ACREAGE, AND IMPROVEMENTS)

2) ESTIMATED TRAFFIC VOLUME, FLOW PATTERN, AND SAFETY IMPACTS (INCLUDING CONSTRUCTION IMPACTS, DETOURS, ETC.)

3) ESTIMATED LAND USE AND SOCIOECONOMIC IMPACT (INCLUDING CONSISTENCY WITH COMPREHENSIVE PLAN)

4) ESTIMATED WETLANDS, WATERWAYS, AND WATER QUALITY IMPACTS

5) ESTIMATED BIOLOGICAL AND THREATENED & ENDANGERED SPECIES IMPACTS

6) ESTIMATED ARCHEOLOGICAL AND HISTORICAL IMPACTS

7) ESTIMATED PARK AND VISUAL IMPACTS

8) ESTIMATED AIR, NOISE, AND ENERGY IMPACTS

9) ESTIMATED HAZMAT IMPACTS

10) PRELIMINARY IDENTIFICATION OF POTENTIAL AREAS OF CRITICAL CONCERN AND CONTROVERSIAL ISSUES

RECOMMENDED PROJECT CLASSIFICATION

CLASS 1 Draft & Final Environmental Impact Statement — Reconnaissance

CLASS 2 Categorical Exclusion — Programmatic Categorical Exclusion

CLASS 3 Environmental Assessment & Revised Environmental Assessment

PREPARED BY — FHWA OR STATE OFFICIAL APPROVAL

DATE — TELEPHONE NUMBER — DATE — TELEPHONE NUMBER

3/18/97

Figure A2.2.2.1D

A2.2.3.7 Request for Bridge Number

FEDERAL-AID PROJECT NUMBERING

EXEMPT FUNDING SOURCE HIGHWAY TYPE & NO. SEQUENCE NO.

FEDERAL-AID PROJECT NO.: X-STP-S022(1)

FUNDING SOURCE (partial list only)

I : INTERSTATE COMPLETION

IM : INTERSTATE MAINTENANCE

NH : NATIONAL HIGHWAY SYSTEM

STP : SURFACE TRANSPORTATION

CM : CONGESTION MITIGATION/AIR QUALITY

BRF : BRIDGE REPLACEMENT FEDERAL

BHF : BRIDGE REHABILITATION FEDERAL

BRO : BRIDGE REPLACEMENT OFF SYSTEM

BHO : BRIDGE REHABILITATION OFF SYSTEM

TBRF : TIMBER BRIDGE REPLACEMENT FEDERAL

TBHF : TIMBER BRIDGE REHABILITATION FEDERAL

TBRO : TIMBER BRIDGE REPLACEMENT OFF SYSTEM

TBHO : TIMBER BRIDGE REHABILITATION OFF SYSTEM

HIGHWAY TYPE & NO.
S = STATE HIGHWAY C = COUNTY ROAD

(1) For a project on a state highway you would use “S” followed by the three digit state highway number, even projects within city limits.
EXAMPLE: STP-S007(1) SEE ATTACHED SHEET FOR STATE HIGHWAY NUMBERS.

(1) For a project on a county road you would use “C” followed by the three digit federal county FIPS code.
EXAMPLE: X-BRO-C001(1) SEE ATTACHED SHEET FOR COUNTY FIPS CODES.

(2) For a project on a city street you would use the first four digits of the federal city FIPS code.
EXAMPLE: X-HES-3125(1) SEE ATTACHED SHEET FOR CITY FIPS CODES.

(3) For a project on multiple state highways or not on any highway but where state funds are paying match use S followed by three 0 0 0.

(5) For a project on multiple county highways* or not on any county highway but where county funds are paying match use C follow by three 0 0 0.

(4) For a project on multiple city streets**use four 0 0 0 0.

* or a project in more than one county.
** or a project in more than one city.

Figure A2.2.3.7A

A2.2.3.9 Preparing and Processing Job Record Folder

BRIDGE ENGINEERING SECTION
Oregon Department of Transportation

PROJECT PERSONNEL REFERENCES

Structure Name_____

Structure Number_____ County_____

Project Manager_____Phone No._____

Region___ Region Manager_____Phone No._____

Region Fed-Aid Specialist_____Phone No._____

County Engineer/Contact_____Phone No._____

Structural Designer_____Phone No._____

Structural Drafter_____Phone No._____

Final Design Checker_____Phone No._____

Foundations Designer_____Phone No._____

Hydraulics Designer_____Phone No._____

Roadway Designer_____Phone No._____

Specifications Writer_____Phone No._____

Figure A2.2.3.9A

A2.3.1.2 TS&L DESIGN AIDS

CHECKLIST FOR TYPE, SIZE & LOCATION SUBMITTAL

BRIDGE_____

SECTION_____

HIGHWAY_____ **M.P.**_____

COUNTY_____ **BRIDGE NO.**_____

PRELIMINARY DATA

YES	NO	NONE	
☐	☐	☐	*Project Prospectus received*
☐	☐	☐	*Vicinity map or data received*
☐	☐	☐	*Foundation Report or data received*
☐	☐	☐	*Hydraulic Report received*

YES	NO	NONE	
☐	☐	☐	*Grade line verified*
☐	☐	☐	*Alignment verified*
☐	☐	☐	*Location Narrative received*

PLAN AND ELEVATION DRAWING

YES	NO	NONE	
☐	☐	☐	*Alignment data*
☐	☐	☐	*Roadway and lane width*
☐	☐	☐	*Intersection stations*
☐	☐	☐	*Intersection angles*
☐	☐	☐	*Span lengths and numbers*
☐	☐	☐	*Bent stations and numbers*
☐	☐	☐	*Angles between bents and centerline*
☐	☐	☐	*Existing structures*
☐	☐	☐	*Right-of-way lines*
☐	☐	☐	*Detours*
☐	☐	☐	*Utilities*
☐	☐	☐	*North Arrow*
☐	☐	☐	*Location Map:*
☐	☐	☐	*North Arrow*
☐	☐	☐	*Project location arrow(large scale)*
☐	☐	☐	*Nearest town*

YES	NO	NONE	
☐	☐	☐	*Proposed truck or railroad loading note*
☐	☐	☐	*Type of bridge rail indicated*
☐	☐	☐	*Expansion and fixed bearings indicated*
☐	☐	☐	*Elevation datum*
☐	☐	☐	*Existing ground line*
☐	☐	☐	*High water elevation*
☐	☐	☐	*Proposed ground line*
☐	☐	☐	*End slope and protection shown*
☐	☐	☐	*Hydraulic data*
☐	☐	☐	*Grade lines*
☐	☐	☐	*Typical bent sections*
☐	☐	☐	*Roadway clearances*
☐	☐	☐	*Railroad final clearance and construction clearance*
☐	☐	☐	*Title block includes MPt location for Interstate and State highways.*
☐	☐	☐	*Title block includes existing bridge number, and/or county number*
☐	☐	☐	*Location by nearest 1/16 section* for railroad structure

OTHER

YES	NO	NONE	
☐	☐	☐	*Job Record Sheet completed*
☐	☐	☐	*TS&L Narrative*
☐	☐	☐	*Sketches of architectural treatment*

YES	NO	NONE	
☐	☐	☐	*TS&L Estimate*
☐	☐	☐	*Basis of TS&L indicated*

Figure A2.3.1.2A

A2.3.2.2 Traffic Handling and Data

OREGON STATE HIGHWAY DIVISION
ACCIDENT DATA UNIT
Accident Data Request Form

Requested by_____ Date_____

_____ Phone_____

_____ Project EA_____

_____ Date Wanted_____

Collision Diagram_____ Period: From_____ To_____

Listings: Manual___ PRC___ County_____

By Yr.4___ 3R___ City_____ UA___

Summary_____

Data Extract_____

Roadway Name	Hwy./Route	From	To
_____	____/____	_____	_____
_____	____/____	_____	_____
_____	____/____	_____	_____

Special Instruction:_____

_____

_____

Job Nos._____ Date Received_____/_____

Printout Date/Rec'd._____ Completed_____/_____

No. of Accidents_____ Mailed_____/_____

Time Spent on Project_____

6/89

Figure A2.3.2.2A

A2.3.8.3 TS&L Narrative - Example

TO: Memo to File

FROM: Guido A. Porter, P.E.
Structural Design Engineer

SUBJECT: **Preliminary Narrative**
River Road O'xing I-84 Br. 18153
River Road O'xing UPRR Br. 18154
Chenoweth Intchge Retaining Walls OT 18155
Old Columbia Hwy Retaining Walls OT 18156
Chenoweth Creek Bridge Widening Br. 07553
Chenoweth Creek U'xing Old Columbia Hwy Br. 00506
Port of The Dalles (Chenoweth) Intchge Section
Columbia River Hwy (I-84) M.P. 82.08
Wasco County

PROJECT JUSTIFICATION

The primary reason for this project is to provide access to the north part of The Dalles, Port of The Dalles and the planned Columbia River Gorge Discovery Center. This area is currently accessed by a partial interchange. The current I-84 interchange provides only "eastbound off" and "westbound on" access. The scheduled opening date for the Columbia River Gorge Discovery Center is Memorial Day (May) of 1997.

STRUCTURE FEATURES

Br. 18153:

The proposed roadway on this structure consists of four 12' traffic lanes and two 6' shoulders for a total width of 60 feet. Adding 7 foot sidewalk and 1.5 foot rail to each side of the roadway gives a total structure width of 70 feet.

The 1.8 m shoulders are considered adequate provision for bicycle traffic.

Protective fencing is required on all freeway overpasses as per House Bill 2507. The proposed protective fencing is either a 6 foot standard Type "A" or an ornamental fence. A Visual Enhancement Committee (VEC) is involved in making a recommendation on the appearance of the fencing.

The 32" rails on this structure will meet PL-2 rating. The VEC is involved in making a recommendation on the appearance of the ornamental rail. The ornamental rail may resemble historic rail or an architectural treatment that has yet to be determined.

The proposed design Live Load is HS25.

Figure A2.3.8.3A

A2.3.8.3 TS&L Narrative – Example Continued

The foundation report has not been completed, but the Foundation designer has given preliminary information for design.

The underlying material varies from exposed Columbia River Basalt to a shallow deposit of loamy sand. Scabland is the dominant cover type in the region.

The basalt rock provides excellent foundation for spread footings.

This structure must be open by Memorial Day of 1997. To expedite the construction of this bridge, our present proposal is to use Precast Prestressed Tub Beams. After the concrete deck has been placed, the structure will be post-tensioned. Falsework required for this bridge is minimal.

Br 18154:

The proposed roadway on this structure consists of two 12' traffic lanes, a 14' median and two 6' shoulders. A 7' sidewalk is also added to each side of the roadway.

The 6 foot shoulders are considered adequate provision for bicycle traffic.

The proposed Railroad Overcrossing requires protective fencing. An 8' standard Type "C" is considered adequate.

The 32" rails on this structure will meet PL-2 rating. The VEC is involved in making a recommendation on the appearance of the ornamental rail. The ornamental rail may resemble historic rail or an architectural treatment that has yet to be determined.

The proposed design Live Load is HS25.

The foundation report has not been completed. See Bridge 18153 for soil data.

This structure is not on the critical path for the opening of the Discovery Center. The proposed design for this structure is an RCBG-PT on spread footings. The spread footings will be built on MSE (Mechanical Stabilized Earth) wall abutments. Extensive falsework is required. The minimum vertical clearance required over the railroad is 23'. The minimum vertical clearance required during construction is 21.5'.

OT 18155:

The proposed on and off ramps will be constructed on fill and MSE walls. The proposed MSE walls can be constructed of 6" cast-in-place concrete core wall or precast panels. A 3" to 6" thickness of architectural treatment is being considered by the VEC. The desired appearance of the wall considered is columnar basalt.

Figure A2.3.8.3A-continued

A2.3.8.3 TS&L Narrative – Example Continued

The rails on the MSE walls will meet PL-2 rating. The VEC is also reviewing the appearance of the rail. The ornamental rail may resemble historic rail or an architectural treatment that has yet to be determined.

The foundation report has not been completed. See Bridge 18153 for soil data.

The on ramp is on the critical path for the opening of the Discovery Center. However, there should be no problems constructing both the on and off ramps prior to the opening date of the Discover Center. Selecting the MSE wall type will expedite the construction of the retaining walls. It is proposed to place the architectural treatment separate from the MSE wall. Constructing the architectural treatment may be completed after the ramp has been opened to traffic is optional if time becomes critical.

OT 18156:

The location of the proposed retaining wall is between the Old Columbia Highway and the existing trailer houses. Additional roadway width is required for left turn storage capacity. The type of wall proposed is a cast-in-place L retaining wall. Minimum architectural treatment is considered for this wall.

The rail on this CIP wall will meet PL-2 rating. The proposed 44" rail may resemble historic rail or an architectural treatment that has yet to be determined.

The foundation report has not been completed. No information was available at this time.

This wall is not on the critical path for the opening of the Discovery Center.

BR 07753:

This structure has been widened previously in 1959. It is proposed to widen the northbound (west bound) by a minimum of 26.5' and widen the southbound (east bound) by a minimum of 25.5'. Widening the structure for the north bound traffic is to provide adequate safe merging from the on ramp. Widening the structure for the southbound traffic is to provide adequate safe exiting to the off ramp.

The proposed rail on this structure will meet PL-2 rating. A type F rail is proposed, however, an ornamental rail is acceptable.

The proposed design Live Load is HS25.

Widening a structure requires seismic retrofit review. The existing structure is an RCDG-CIP and is continuous. It appears that minimum seismic retrofit is required.

The foundation report has not been completed. See Bridge 18153 for soil data. The Hydraulic Report has been completed. The waterway opening area required is 218 ft^2. The high water elevation is 116.4'. Widening the structure will not be a problem. It is recommended that class 100 riprap be used on all fill slopes below elevation 118'.

This structure is not on the critical path for the opening of the Discovery Center.

Figure A2.3.8.3A-continued

A2.3.8.3 TS&L Narrative – Example Continued

BR. 00506:

This structure was built in 1920. The existing structure is a 60' RCDG-CIP. The original rail was retrofitted in 1948 with a flex-beam guardrail.

The draft EIS discussed the restoring the original rail. The current roadway width is 22.5'. The desirable minimum roadway as request by roadway is 24'.

The proposed rails retrofit is to duplicate in appearance of the original reinforced concrete standard type with arched openings and caps. To provide the additional roadway width, the rail will cantilever and will be supported by corbels. It is anticipated to design the curb as a beam to support the dead load.

When plans become available, they will be coordinated with the HCRH Advisory Committee and the SHPO.

During preliminary review of this structure, a bridge inspection report rated the deck and surfacing at 6, indicating that the deck is marginally acceptable. The existing deck has approximately 11" of ACWS. If the proposed improvements to the highway are going to increase traffic appreciably, we recommend removing the existing ACWS and overlay the deck with LMC. This will require lowering the roadway grade at both ends of the bridge. Road work in the Columbia River Gorge National Scenic Area is necessary. Dwight Smith, Cultural Resource Specialist said it is not a problem provided no horizontal alignment or roadway width changes are made.

This structure is not on the critical path for the opening of the Discovery Center.

ALTERNATE CONSIDERED

A single structure for the interchange was considered. The main structure would be three spans RCBG-CIP or PT that would cross I-84 and UPRR. The on and off ramps would be multiple span RCBG-CIP with the approach constructed with retaining walls. The ramps would meet the main structure at a central bent. The central bent is a massive box that is designed for lateral load due to seismic. With the ramps attached to the main structure, it will form a raised intersection. This alternative was considered and not advanced for several reasons:

The construction cost for this alternative is $4,997,000 without E&C. This is about $136,700 (w/o E&C) more than the proposed structures. However, if the type of architectural treatment proposed for this project was excluded, the construction cost for this alternative is $4,878,000 without E&C. If the type of architectural treatment proposed for Br 18153, 18154, and OT 18155 was excluded, the construction cost for this alternative is $4,309,000. This single structure alternative is about $569,000 (w/o E/C) more than the proposed structures.

Additional time is required to design this alternative than the proposed structure. This is due to seismic design and additional detailing.

To meet the construction complete date, additional lead-time is required.

Figure A2.3.8.3A-continued

A2.3.8.3 TS&L Narrative – Example Continued

PROVISIONS FOR TRAFFIC

TP&D will be required on this project. Minimum disruption is anticipated for Br 18153, 18154 and 07553. Relocation of off ramp at I-84 may be necessary to avoid construction vertical clearance problem. Br. 07553 will require TP&D. During the construction of the rail retrofit for Br 00506, one way traffic must be maintained. If a bridge deck overlay is constructed on this bridge, it may be necessary to close traffic temporarily. OT 18156 will also need TP&D. During the construction of the retaining wall, shoring may be necessary to maintain opening traffic on the road.

UTILITIES AND PERMITS

Requests have been received to provide for 12" diameter water main on Br 18153 and 18154. Requests also have been received but not formalized to provide supports for existing waterline and future sewer line on Br 00506.

Division of State Lands, UPRR permits will be required.

RECOMMENDATIONS

Br 18153 River Road O'xing I-84

Design and construct a single span RCBG-PT Precast Tub Beams on vertical cast in place abutment with protective fencing. With ornamental rail, ornamental protective fencing and architectural treatment on walls, the estimated cost for this work is $1,373,130 excluding E&C.

Br. 18154 River Road O'xing UPRR

Design and construct a single span RCBG-PT on MSE wall abutment with protective fencing. With ornamental rail and architectural treatment on walls, the estimated cost for this work is $870,540 excluding E&C.

OT 18155 Chenoweth Interchange Retaining Walls

Design and construct MSE walls with provisions for architectural treatment. The estimated cost for this work is $2,617,000 excluding E&C.

OT 18156 Old Columbia Hwy Retaining Walls

Design and construct a CIP L retaining wall with an ornamental rail. The estimated cost for this work is $193,200 excluding E&C.

Br 07553 Chenoweth Creek Bridge Widening

Design and construct an RCDG-CIP with an ornamental rail. The estimated cost for this work is $837,900 excluding E&C.

Br 00506 Chenoweth Creek U'xing Old Columbia Hwy

Design and construct a rail retrofit with an appearance of the original rail. Bridge Deck Overlay should be considered. The estimated cost for this work is $44,300.

Figure A2.3.8.3A-continued

A2.4.1.2 FINAL DESIGN AIDS

CHECKLIST FOR FINAL DESIGN SUBMITTAL

BRIDGE_____

SECTION_____

HIGHWAY_____ **M.P.**_____

COUNTY_____ **BRIDGE NO.**_____

DESIGN DATA

YES	NO	NONE	
☐	☐	☐	*Vicinity map or data received*
☐	☐	☐	*Hydraulic Report or data received*
☐	☐	☐	*Foundation Report or data received*
☐	☐	☐	*Grade line verified with Roadway*
☐	☐	☐	*Alignment verified with Roadway*
☐	☐	☐	*Job Record approved*
☐	☐	☐	*Permit requirements met*
☐	☐	☐	*Correspondence file reviewed*

BENT DETAILS

☐	☐	☐	*Col. steel properly dim. w/splices*
☐	☐	☐	*Neg. moments at x-beams reinforced*
☐	☐	☐	*Footing elevations shown*
☐	☐	☐	*Skew angles shown*
☐	☐	☐	*Utility holes shown and noted*
☐	☐	☐	*Hinges shown and detailed*
☐	☐	☐	*Seismic restraints shown & detailed*
☐	☐	☐	*Guardrail connections at end bents*
☐	☐	☐	*Concrete finish sketch shown*

SUPERSTRUCTURE DETAILS

☐	☐	☐	*Deck elevations shown*
☐	☐	☐	*Bearing devices shown and detailed*
☐	☐	☐	*Required No. of devices given*
☐	☐	☐	*Expansion allowed for*
☐	☐	☐	*Camber diagram shown*
☐	☐	☐	*Joints shown and detailed*
☐	☐	☐	*Stage construction detailed*
☐	☐	☐	*Pour schedule shown*
☐	☐	☐	*Concrete finish sketch shown*

BEAM DETAILS

☐	☐	☐	*Beams located and dimensioned*
☐	☐	☐	*Beam cross sections shown*
☐	☐	☐	*Prestressed beam details included*
☐	☐	☐	*Interim bars shown in top of stem*
☐	☐	☐	*Bar extensions adequate*
☐	☐	☐	*End anchorages of longitudinal bars sufficient*
☐	☐	☐	*Post-tensioning details/data included*

PLAN AND ELEVATION DRAWINGS

YES	NO	NONE	
☐	☐	☐	*Footing plan shown*
☐	☐	☐	*Alignment & bearings shown*
☐	☐	☐	*Skew angles shown*
☐	☐	☐	*Bent fixity(free,exp.,hinge, etc.)shown*
☐	☐	☐	*Slope paving shown*
☐	☐	☐	*Footing elevations*
☐	☐	☐	*Bearing values or min. pile tip El. shown*
☐	☐	☐	*Drainage provided for*
☐	☐	☐	*Military loading noted and shown*
☐	☐	☐	*Stationing shown*
☐	☐	☐	*Clearance shown(RR, navigation, highway)*
☐	☐	☐	*Minimum construction clearances shown*
☐	☐	☐	*Rail at ends shown*
☐	☐	☐	*Location map shown*
☐	☐	☐	*Detour shown*
☐	☐	☐	*Existing structure shown*
☐	☐	☐	*Utilities shown and located*
☐	☐	☐	*Grade line diagram shown*
☐	☐	☐	*Elevation datum shown*
☐	☐	☐	*General notes complete*
☐	☐	☐	*Accompanying drawings shown correctly*
☐	☐	☐	*North arrow shown*
☐	☐	☐	*Hydraulic data & high water mark shown*

ESTIMATE AND SPECIFICATIONS

☐	☐	☐	*Estimate checked*
☐	☐	☐	*Foot or bikeway estimate & letter completed*
☐	☐	☐	*Drain pipe included*
☐	☐	☐	*Excavation included or noted*
☐	☐	☐	*Notes to specifications completed*
☐	☐	☐	*Construction time estimate chart completed*

MISCELLANEOUS

☐	☐	☐	*Advance plans sent*

Figure A2.4.1.2A

A2.4.1.3 Final Design Timetable

BRIDGE SECTION SCHEDULING DATES AND DEFINITIONS

(3 – WEEK ADVERISING PERIOD)

DESIGNATION	TIME PRIOR TO BID	DEFINITION OR REQUIREMENTS
Preliminary Plans	20 WEEKS	1. Combination of final design and plans are 85-90 percent complete. 2. Bridge Section notes to Specifications Unit with assembled project special provisions preprints to Specifications Unit. 3. Unchecked final estimate, bridge construction time estimate, and construction assistance estimate.
Advance Plans	15 WEEKS	Combination of checking and plans are 95-100 percent complete. Send updated plans (which include field corrections) to Roadway Section during the 16th week.
Contract Plans	12 WEEKS	1. Final update of special provisions to Specifications Unit. 2. Preferred date to submit 100 percent final signed drawings and checked final estimate to Specifications Unit.
Contract Plans	8 WEEKS	Last date to submit 100 percent final signed drawings and checked estimate to Specifications Unit.
PS&E	7 WEEKS	Plans, specifications, and estimates submitted to Fiscal Management Unit.
PS&E	6 WEEKS	Plans, specifications, and estimates submitted to FHWA. (if applicable)
Finalize PS&E	5 WEEKS	Last chance to make minor corrections to plans, specifications, and estimates.
Printing	4 WEEKS	
Advertisement	3 WEEKS	Plans, specifications, and estimates changes by Revision Letter. Latest mailing date is 10 days before bid opening, or letting date.

NOTE: For longer advertising periods, adjust above periods of time accordingly.

Figure A2.4.1.3A

A2.4.3.1 What Will It Cost? (continued)

SECTION_____Programming Estimate $_____

HIGHWAY_____Project Length_____

COUNTY_____Completion Time_____

Kind of Work_____

EA No._____Letting Date_____Project No._____

ESTIMATED CONSTRUCTION AUTHORIZATION

(original) (revised)

Estimated Contract Amount. . $_____ _____

Anticipated Additional Items:

Royalty Payment..... ..... _____
Permit Fees..... ..... _____
Slide Corrections..... ..... _____
Railroad Protective Costs.... ..... _____
Other Railroad Costs..... ..... _____
Permanent Signing..... ..... _____
Permanent Pavement Striping.. ..... _____
Temporary Pavement Striping..... ..... _____
Remove Pvmt. Strip.(Exist.&Temp.). ... _____
Temporary Erosion Control.... ..... _____
State Furnished .... _____
Roadside Seeding & Mulching.... ..... _____
Statistical Asphalt Bonus..... ..... _____
Statistical PCC Bonus..... .... _____
PCC Smoothness Bonus..... ..... _____
State Responsibility for Damages. ..... _____
Bikeway Signs..... .... _____
Bikeway Striping & Legend.... ..... _____
_____.... .... _____

Total Anticipated Items.....$_____ _____
Subtotal..... .....$_____ _____

Contingencies (4 ½%).....$_____ _____
Engineering..... ....$_____ _____

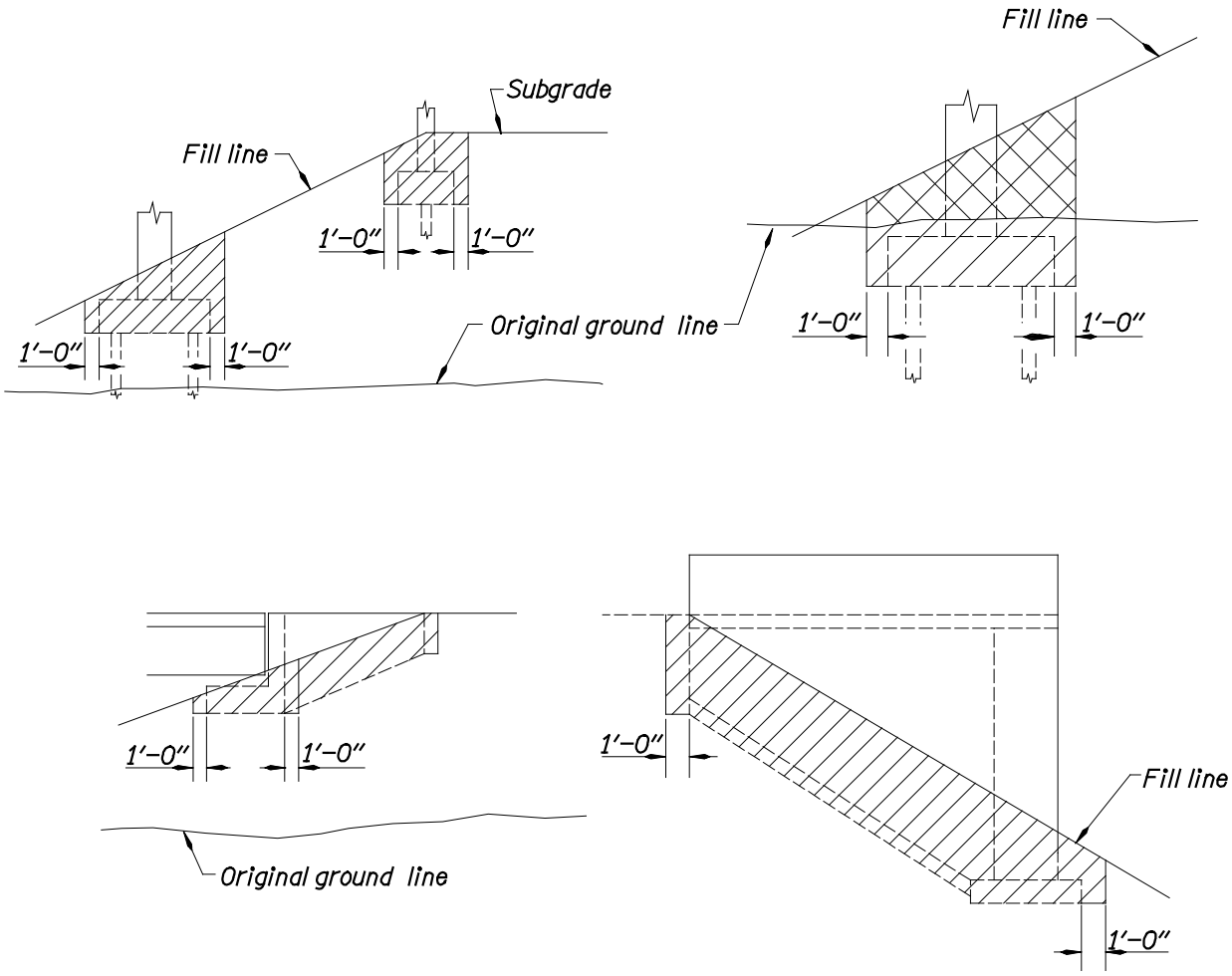
Estimated Net Authorization, Construction....$_____ _____

APPROVED

_____ **Specwriter**_____
Roadway Engineering Manager

Figure A2.4.3.1A

A2.4.3.2 Notes About Bid Items and Estimating



Hatched areas will always be a pay item.

Cross hatched area will be a pay item except when grading and structural work are under separate contracts and this area is excluded by the Special Provisions.

EXCAVATION LIMITS IN FILL AREAS

Figure A2.4.3.2A

A2.4.4.1 Who Needs to Know?

Example Letter

(Example Letter Deleted)

A2.4.6 Bridge Construction Time Estimate

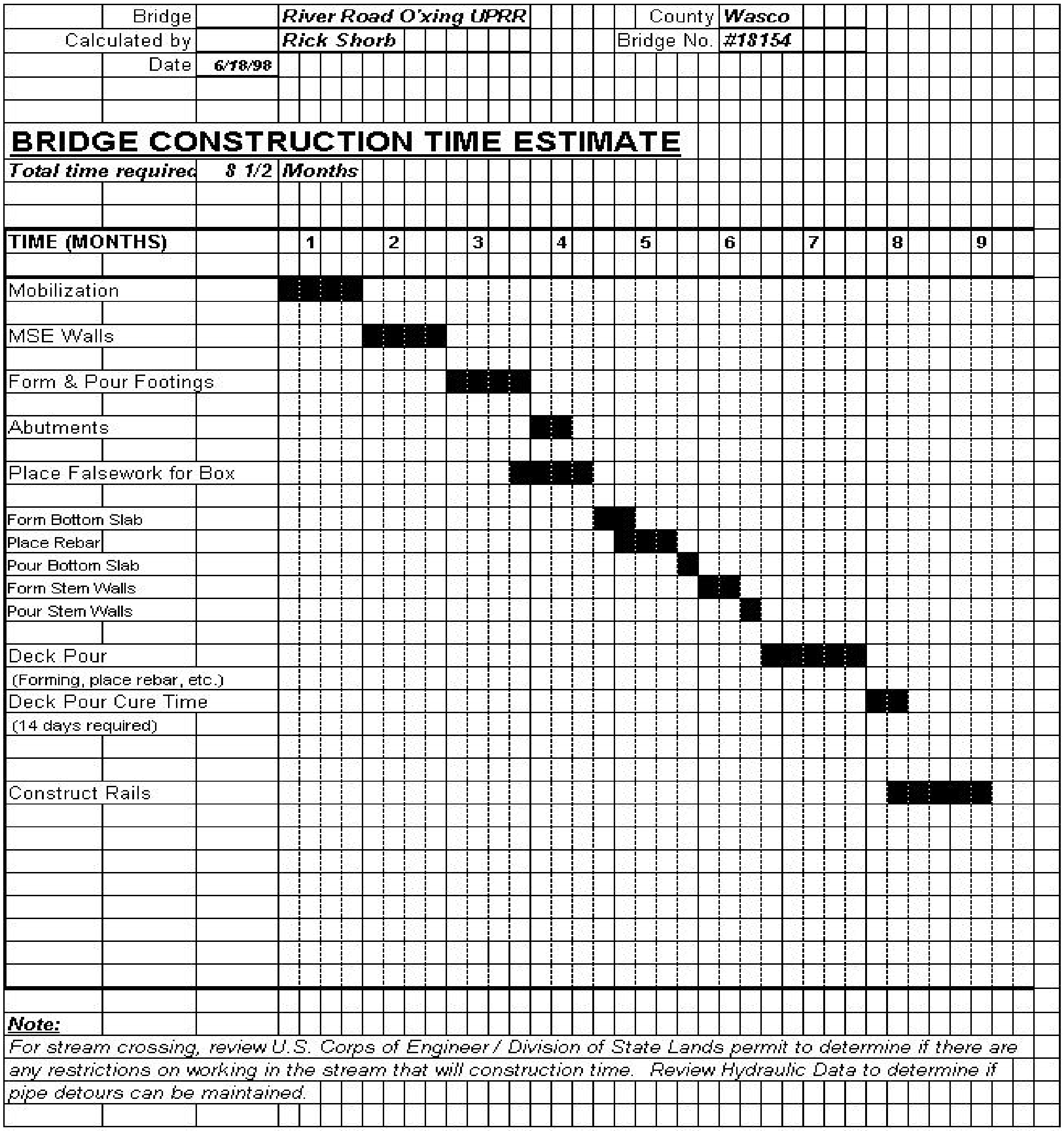


Figure A2.4.6