2-3-2004

Bridge Design Guide : February 2004 Update

Maine Department of Transportation

2 PRELIMINARY DESIGN

2.1 Preliminary Design Report

The Preliminary Design Report (PDR) documents the justification for decisions made in the conceptual design process. Forms are available electronically that assist in completing the PDR. At the end of the preliminary design phase, all those invested in the project have reviewed the scope of work, and this scope is considered final. The PDR is then used as the starting point to proceed to final design.

For those projects with spans of 50 feet or less, consideration should be given to a reduced preliminary design effort, as discussed in Section 1.5 Small Bridge Initiative.

The PDR is organized into the following sections. The depth of study and extent of investigation of options will depend upon the complexity of the project. Samples of completed forms are found in Appendix B PDR Forms. A description of each section follows the listed sections.

1. Title Page
2. Table of Contents
3. Background Information
4. Location Map
5. Bridge Recommendation Form
6. Summary of Expected Impacts
7. Summary of Preliminary Design
8. Existing Bridge Synopsis Form
9. Hydrology/Hydraulic/Scour Report
10. Preliminary Plan
11. Photographs
12. Summary of Existing Upstream and Downstream Bridges
13. Site Inspection Report
14. Information Reports
15. Survey Plans of Existing Bridges
16. Hydrology/Hydraulic/Scour Data
17. Miscellaneous Information
18. Traffic and Accident Data
19. Estimates

For routine maintenance-type projects such as bridge wearing surface replacements and bridge painting, a one-page “shortform” PDR may be used in lieu of the standard forms and sections listed. When warranted, additional information about the project can be attached to this form. A sample of a completed form is found in Appendix B PDR Forms.

2.1.1 Title Page

The Title Page contains the following:

PRELIMINARY DESIGN REPORT
BRIDGE NAME and NUMBER
OVER
RIVER NAME
TOWN, MAINE
FEDERAL PROJECT NUMBER
PIN NUMBER

2.1.2 Table of Contents

This should be a properly identified index of pages.

2.1.3 Background Information

This page provides a quick reference for background information on the project. Much of this information is found either in MaineDOT's ProjEx, the Planning Report, or Bridge Management's SI&A sheet, all of which will be provided by the Project Team. The following sections are completed as shown below:

Program Scope: Copy verbatim the scope from the Biennial Transportation Improvement Program (BTIP).
Program Reads: Copy verbatim the contents of the project description in the BTIP.

Project Background: Provide a brief written description of the project's background, including site review by the 6-Year Plan team, any previous studies and recommendations, requests by Towns, and any other pertinent information.

Structurally Deficient: A structure is structurally deficient if the condition rating for the deck, superstructure, substructure, or the culvert and retaining wall is 4 or less. A structure may also be structurally deficient if the evaluation rating for the overall structural condition or waterway is 2 or less.

Functionally Obsolete: A structure is functionally obsolete if the appraisal rating for the deck geometry, under clearances, or approach roadway alignment is 3 or less. A structure may also be functionally obsolete if the evaluation rating for the overall structural condition or waterway is 3. Any

bridge classified as structurally deficient is excluded from the functionally obsolete category.

2.1.4 Location Map

This should be from the Highway Atlas, U.S.G.S., or another map showing the project location. Do not use copyrighted material such as a DeLorme's Maine Atlas and Gazetteer.

2.1.5 Bridge Recommendation Form

All portions of the Recommendation Form should be completed as shown below. A complete description of each component should be included under that component. There are several variations to this form depending on the project scope. If there are parts that are not applicable to the structure type, they need not be included.

Review by - Signature of Engineer of Design is obtained here prior to proceeding with any further work.

Project - State the type of project. Examples:

> “Bridge replacement with 300 ft of approaches, including transitions”
> “Bridge rehabilitation project with no approach work”
> “Bridge replacement as part of Arterial Program project”
> “Bridge replacement with approaches by Arterial Program”

Alignment Description - Give a description of the horizontal and vertical alignments at the structure location and the relationship to the existing alignment. Example:

> "1200’ horizontal curve located approximately 30’ upstream of existing bridge and a 500’ sag (crest) vertical curve with a finish grade 3.5’ higher than existing bridge."

Approach Section - Give a description of the typical approach section at the bridge, including the type of guardrail. Example:

> “Two 11' paved lanes with 3’ shoulders (30’ rail-to-rail) with standard sideslopes. 21” aggregate subbase course gravel with 3” pavement thickness. Type 3 guardrail.”

Spans - Give the span lengths along the centerline of construction on straight tangents, and along working lines or chord lines for structures on a curve. If on a curve, indicate span lengths as "along long chord" or

should be conducted using the Newmark Method (Newmark, 1965). This method approximates the cumulative vertical deformation or settlement at the back of the slope for a given earthquake ground motion. The failure mass is modeled as a block on a plane. A maximum allowable seismic settlement of 6 inches at a bridge approach, resulting from the design earthquake event, is considered acceptable. Refer to Section 3.7 Seismic for loading considerations.

doubt, guidance from one of the Construction Engineers may be requested.

Guidelines on when to specify Method A, Method B, or Method C are as follows:

Method A should be specified where quality above the specification requirements is of value. Examples of where Method A is appropriate include, but are not limited to: footings, abutments, structural seals, piers, superstructures, decks, sidewalks, curbing, wearing surfaces, barrier, retaining walls, box culverts, bases for overhead sign supports, and mast arm traffic signal supports. P, the unit value for pay adjustment purposes, must be provided in the Special Provision that is included in each contract. P values reflect the price per cubic yard for all pay adjustment purposes. P values will be established on an annual basis and should not be based strictly on bid history information.

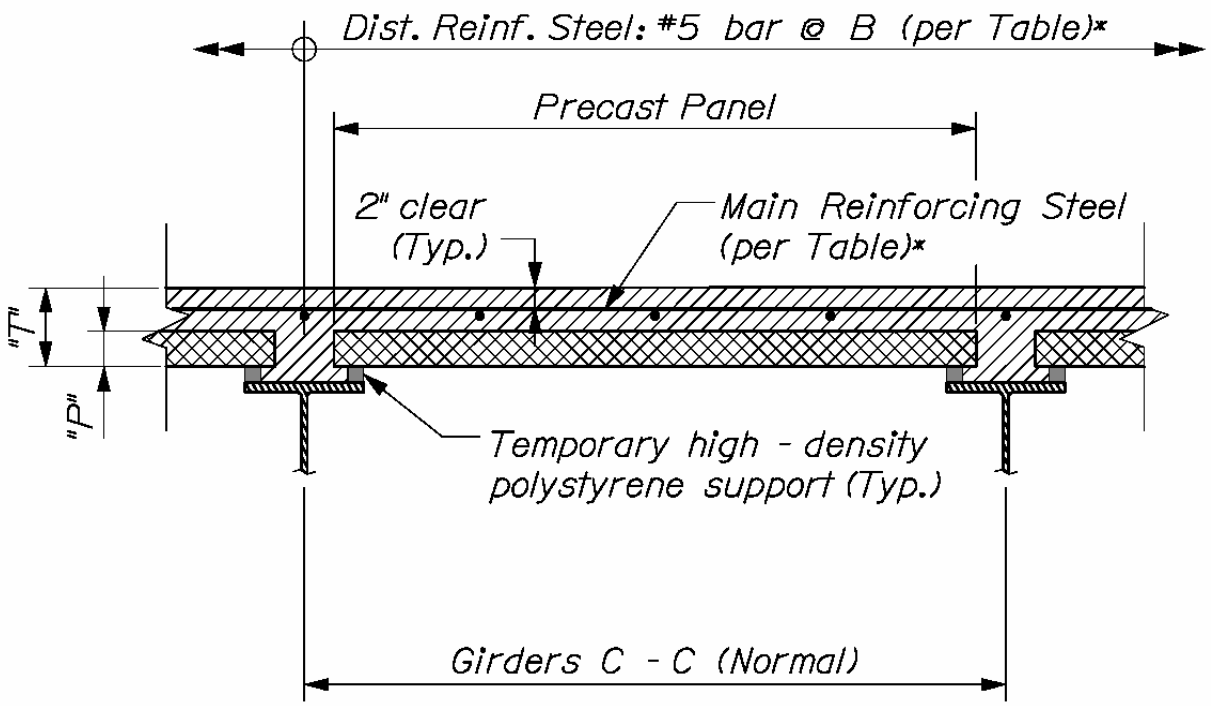
Method B should be specified where concrete must meet specifications but where there is no value added by quality exceeding the requirements of the specifications. Examples of where Method B is appropriate include, but are not limited to: approach slabs, concrete fill, pipe pile concrete, non-structural seals, traffic signal bases, and sign bases when not cantilevered. Method B may also be specified for the concrete items that normally call for Method A when the quantities are such that if Method A were specified, an inordinate amount of QA testing would be required and the benefit of specifying Method A over Method B would not differ significantly.

Method C should be specified where concrete quality still has to meet the specifications, but the benefits and costs to the Contractor and to the Department to develop and administer a Quality Control Plan, as required by specifications, are not justified. Examples of where Method C is appropriate include: armored joint repairs; surface repairs to wing walls, bridge decks, abutments, piers, and box culverts; and modifications to existing end-posts. This method should not be specified for structural elements that are expected to have a long design life.

6.2.1.2 Reinforcing Steel

Reinforcing steel, both plain and epoxy-coated, should be deformed bars meeting the requirements of AASHTO M 31. In general, the minimum bar size should be #5 for main reinforcing members and #4 for stirrups.

The use of epoxy-coated reinforcing steel is felt to be a cost effective solution to rebar corrosion for selected locations. The following locations in concrete bridge elements should incorporate the use of epoxy-coated reinforcing steel:



TRANSVERSE SECTION

* For extra distribution steel in negative moment areas, see Section 6.2.2.1

DESIGN: Load & Resistance Factor Design per AASHTO LRFD- Specifications for Highway Bridges 1998 and Interim Specifications through 2002

LOADING: HL-93 Modified for Strength I (Impact = 33%)

STRESSES: Prestressing steel ~ f's = 270,000 psi
Es = 78,500,000 psi
Reinforcing steel ~ fy = 60,000 psi
Concrete ~ f'c = 4,350 psi (Cast - in - place)
f'c = 6,000 psi (Precast)

MATERIALS: Strands ~ 3/8" ϕ, Grade 270 (Low relaxation)

Figure 6-2 Precast Deck Panels on Girder Superstructures

B.10 Preliminary Cost Estimate

PROJECT: Anytown, Common Bridge - Alternative No. 1 Precast Voided Slabs with Integral Abutments and Pile Bent Pier. Temporary Bridge. Deck Area: 33' x 80' = 2640 SF	**PIN:** 010000.00 **ESTIMATED BY:** LRT

SUPERSTRUCTURE:	2640 SF	x	$85	=	$225,000
ABUTMENTS:	2640 SF	x	$35	=	$90,000
PIERS:	2640 SF	x	$15	=	$40,000
COFFERDAMS:	2 EA	x	$5,000	=	$10,000
STRUCTURAL EXCAVATION & BORROW:	250 CY	x	$20	=	$5,000
RIPRAP:	250 CY	x	$40	=	$10,000
EXISTING BRIDGE REMOVAL:	2640 SF	x	$20	=	$50,000
DETOUR AND/OR TEMPORARY BRIDGE:	2640 SF	x	$45	=	$120,000
REHABILITATION CONTINGENCIES:			0%	=	$0
MISCELLANEOUS (TCP'S, FIELD OFFICE, ETC.):			7%	=	$45,000
MOBILIZATION:			7%	=	$45,000

STRUCTURE SUBTOTAL	=	**$640,000**

APPROACHES:	500 LF	x	$300	=	$150,000
MISCELLANEOUS:			7%	=	$10,000
MOBILIZATION:			7%	=	$10,000

APPROACHES SUBTOTAL	=	**$170,000**

TOTAL CONSTRUCTION COST	=	**$810,000**

PRELIMINARY ENGINEERING:	11%	=	$90,000
RIGHT OF WAY:		=	$10,000
CONSTRUCTION ENGINEERING:	11%	=	$90,000
OTHER:		=	$0

TOTAL PROJECT COST	=	**$1,000,000**

B.11 "Shortform" Preliminary Design Report

TOWN - Anytown **BRIDGE -** Common Bridge **PIN -** 10000.00
DESIGNED BY - ABC **DATE -** 3/1/04 **BRIDGE NO. -** 1234
APPROVED BY - _____ **DATE -** _____ **STATE ROUTE -** 9

PROGRAM SCOPE - Bridge Wearing Surface Replacement

PROGRAM DESCRIPTION – Replacement of deficient wearing surface on Common Bridge (#1234) over Raging River, located 0.16 of a mile easterly of Route 9. This bridge is over 20' in length.

PROJECT RECOMMENDATION - Place 3" bituminous wearing surface on ¼" membrane waterproofing, rehabilitating existing concrete deck as needed. Modify existing expansion joints to accommodate thicker wearing surface and replace seals. Replace two broken bridge rail posts.

BRIDGE ROADWAY SECTION - Two 11' lanes with 4' shoulders for a total curb-to-curb width of 30'.

SPANS - 80'-140'-80' **SKEW -** 30 ° ahead on left

HIGHWAY SYSTEM - State Highway **FUNCTIONAL CLASSIFICATION -** Minor Collector - Rural

TRAFFIC - **2003** **AADT** 1000 **ACCIDENT DATA, CRF -** 1.0

2023 **AADT** 1200 **DHV** 200 **POSTED SPEED -** 45 mph

UTILITIES - Verizon, Anytown Sewer, Anytown Water, State Cable, CMP

EXCEPTIONS TO STANDARDS - N/A

MAINTENANCE OF TRAFFIC AND CONSTRUCTION SCHEDULE- Maintain two-way traffic with staged construction and temporary traffic signals for one construction season.

BTIP – 04/05

ADVERTISING DATE – Sep. 2004

	Program Amount	Total Approved	Recommendation
Preliminary Engineering =	$120,000	$120,000	$120,000
Construction [STRUCTURE =	$850,000	$850,000	$700,000
APPROACHES =			$150,000
Construction Engineering =	$120,000	$120,000	$120,000
Right-of-Way =	$10,000	$10,000	$10,000
Total =	**$1,100,000**	**$1,100,000**	**$1,100,000**

PROJECT FISCALLY APPROVED **DATE** _____ ___