4. Bridge Type Selection Report

Bridge type significantly influences structure performance, functionality, and long-term maintenance. The bridge type selection process involves evaluating many features to identify the most appropriate bridge type for the site.

Potentially relevant features include the elements of the bridge (e.g., foundations, abutments, piers, girders, bearings, expansion joints), materials (e.g., concrete, steel), and geometrics (e.g., clearances, structure depth, structure width, span lengths). High-cost features or those with a "fatal flaw" should be eliminated early in the evaluation process.

The Bridge Type Selection Report documents the findings of this selection process and recommends the most appropriate bridge type.

4.1. Bridge Type

4.1.1. Simple Bridges

Bridge type selection for simple bridge projects is straightforward, and the preparation of a formal Bridge Type Selection Report is not necessary. In these cases, the bridge engineer or consultant will send this determination to the Chief Bridge Engineer for approval. Then, the Chief Bridge Engineer submits a project package to the regional project manager. This submission will include the following:

- a cover memorandum (see Figure 4-1 for a sample)
- a description of the bridge
- a cost estimate based on preliminary quantity calculations, and
- General Layout and Site Plan sheets for the bridge.

4.1.2. Complex Bridges

Due to size, location, terrain, environmental considerations, local preferences, or other factors, the ideal bridge type may not be apparent. For these more complex bridge projects, prepare a Bridge Type Selection Report to identify feasible structure alternatives.

In this report, evaluate each viable bridge type considering initial and long-term costs, constructability, serviceability, and compatibility with the site. Prepare a cost estimate for each alternative. The Report typically includes a recommendation for the preferred bridge type.

MEMORANDUM

State of Alaska

Department of Transportation & Public Facilities
Statewide Design & Engineering Services Division/Bridge Design

TO:	Sarah Schacher, P.E. Project Manager Northern Region	**DATE**: **BRIDGE NUMBER** **TELEPHONE**: **FAX**:	January 13, 2011 1520 465-2975 465-6947
FROM:	Richard A. Pratt, P.E. Chief Bridge Engineer	**TEXT TELEPHONE**:	465-3652
CONTACT:	Elmer Marx, P.E. (907) 465- 6941	**SUBJECT**:	Preliminary Design Holden Creek Bridge

As requested, we have prepared preliminary General Layout and Site Plan drawings for the subject crossing.

The preliminary cost estimate for the proposed bridge is attached. The cost estimate includes all materials and labor for the bridge related pay items as well as 10% for mobilization and demobilization, 15% for construction engineering, and 4.79% for ICAP. The unit bid prices are based upon the recently bid Oksrukuyik Bridge that is very similar to the proposed bridge and relatively close in location. Based upon the recent bid tab data, the estimated cost of the Holden Creek Bridge is quite a bit greater than is normally anticipated.

We do not yet have the foundation or hydraulic recommendations for this site. Also, the roadway plan, profile and typical section data have not been finalized. Consequently, a 25% contingency is included. As information becomes available, we will incrementally decrease the contingency value (percentage) until we provide the final bridge cost estimate.

The proposed roadway geometry requires replacement of the existing bridge on the same alignment. A detour structure will be required to accommodate traffic during construction of the replacement bridge. Although we suspect that a culvert(s), ice road, or other non-bridge option may be feasible at this location, we have included the cost of a detour bridge in the preliminary estimate.

The existing structure has a history of hydraulic related problems. Maintenance personnel reported that approximately 15 years ago the bridge was pushed downstream during a high flow event. Also, the bridge is considered scour critical (NBI Item 113). In order to address these problems, we propose to raise the roadway profile grade by about eight feet. The resulting bridge provides significantly more vertical and horizontal clearance and should eliminate future problems.

Please contact Elmer if you have any questions.

EEM/bm

Figure 4-1
Cover Memorandum

4.2. Procedures

4.2.1. Use of Manual Chapters

Several other chapters within the *Alaska Bridges and Structures Manual (Manual)* are important for identifying, evaluating, and selecting the bridge type. Chapter 11 "Structural Systems and Dimensions" is especially useful in the evaluation process.

The remaining chapters in Part II "Structural Design" of this *Manual* are predominantly directed toward the detailed design of the structural elements; however, these chapters may present DOT&PF policies and practices that impact bridge type selection.

4.2.2. Distribution/Approval

The bridge engineer or consultant prepares the Bridge Type Selection Report and coordinates with applicable DOT&PF sections when conducting the study (e.g., Roadway Design, Hydraulics). The report includes a cover memorandum that is submitted to the Chief Bridge Engineer for approval. The Chief Bridge Engineer signs and forwards the memorandum and report to the regional project manager.

4.2.3. Design Study Report

Section 450.5.2 of the *Alaska Preconstruction Manual* discusses the Design Study Report (DSR), which documents the basis for the preferred design alternative. The regional project manager prepares the DSR. Typically, the Bridge Type Selection Report will be an Appendix in the DSR.

4.2.4. Study Initiation

A "Start-Up Package" from the regional project manager or highway designer is required to begin the preliminary bridge layout, type selection, and cost estimates needed for the type selection process. The "Start-Up Package" includes:

- proposed roadway plan & profile data
- topographic data in the vicinity of the bridge site including a hydraulics survey
- roadway typical section
- right-of-way limits
- utility locations and utilities to be carried on the new bridge
- environmental design criteria and commitments; and
- preliminary hydraulic and geotechnical recommendations, when available

4.3. Report Format and Content

In general, prepare the Bridge Type Selection Report in the sequence and format discussed below. All topics may not be required for every structure site. Provide sufficient detail for the reader to understand the decision-making process.

Cover Page

Include the bridge name, location, and bridge number. Include the title of the report (i.e., Bridge Type Selection Report) directly beneath the identification information. On the bottom of the page, include the author's contact information, date of the report and engineering seal (if required).

Executive Summary

On the first page of the report, provide a one or two paragraph summary that identifies the purpose of the bridge type study, location of the bridge, number of alternatives studied, and types of structures considered. Identify the preferred alternative and list the evaluation criteria used to select this structure type.

Table of Contents

Provide a table of contents for the major sections and appendices of the report.

Introduction

Briefly describe the history and purpose for the project. If the project involves a bridge replacement, describe the existing structure and why the existing bridge needs to be replaced. Indicate the overall width and length, span lengths, skew angle, superstructure, substructure, and foundation types. Also, identify the existing vertical clearance if the bridge is located over a road or railroad.

Site Conditions

Discuss the following, as applicable:

1. Location. Identify the general location of the bridge (e.g., distance and direction from towns, lakes, major rivers or landmarks; milepost number on existing highways). Use GoogleEarth, a USGS map, etc., to identify the location if appropriate.

   Also, include a general description of the terrain and any special structural features required due to the terrain (e.g., deep cuts, long spans, high fills). If the terrain varies significantly among alternatives, describe the terrain for each alternative.

2. Bridge and Roadway Alignment. Describe the new structure's alignment in relation to the existing alignment, if applicable. State if the horizontal alignment will be located on a curve or tangent. Describe the alignment (e.g., grades, vertical curve, superelevation transition). If the proposed alignment varies among alternatives, describe the alignment for each alternative. See the *Alaska Preconstruction Manual* for DOT&PF policies and practices on road design.

3. Size. Document the proposed width and length of the bridge. See the *Alaska Preconstruction Manual* for DOT&PF criteria for bridge widths. Structure length calculations are found in Section 11.8 of this *Manual*.

4. Vertical Clearances. Discuss the minimum vertical clearances over roads or the water elevation based on the design flood event. See the *Alaska Preconstruction Manual* for vertical clearance requirements. If the structure is over navigable water, discuss the navigational clearances (horizontal and vertical) required by the US Coast Guard.

5. Foundation/Soil Conditions. Describe the soil conditions at the structure site and how they affect the type selection and design of the foundation.

6. Hydraulic Conditions. Section 11.2 discusses the objectives and nature of the Hydraulics Report prepared by the hydraulics engineer. Use the preliminary hydraulic analysis to indicate the required channel dimensions and bridge waterway opening. Address existing and anticipated scour issues.

7. Seismic Acceleration. Include the seismic parameters for the site as described in the *AASHTO Guide Specifications for LRFD Seismic Bridge Design* and state if soil liquefaction may be an issue. If available, discuss how past seismic events at the site have damaged existing structures. See Section 11.4.6.

8. Material & Equipment Transport. Explain how the construction materials and equipment can be transported to the site for at least one alternative. Describe how transport issues affect the design and type selection (e.g., weight, length).

9. Miscellaneous. Describe other site conditions that may affect the design and selection of the structure, including:

    a. utilities
    b. right-of-way
    c. fish habitat
    d. environmental issues
    e. aesthetics
    f. construction
    g. potential for future widening

Bridge Type Summary

For each alternative considered, document the following information:

- foundation, substructure and superstructure type
- structure dimensions (e.g., overall length, skew, deck geometry, number of spans, span lengths)
- abutment and pier location and size
- anticipated seismic performance
- constructability (e.g., weight, special equipment requirements, historic experience)
- construction phasing
- maintenance considerations
- special requirements (e.g., utilities, temporary falsework, temporary bridges)
- transport issues
- aesthetics
- right-of-way
- initial and long-term costs
- recommendation for bridge type selection

Summary of Results

Provide a summary of the alternatives considered. Present the alternatives in a tabular format. For each alternative include the title, a very brief description, estimated cost, and advantages and disadvantages.

Preferred Alternative

Identify the preferred alternative. Summarize the positive and negative features of the recommended configuration and the reasons for its selection. Include preliminary General Layout and Site Plan sheets in the Bridge Type Selection Report. Show any existing structures with foundation elements and their relationship to the new bridge.

The Chief Bridge Engineer recommends the final bridge type to the regional project manager.

Appendices

Use of appendices is acceptable to reduce the size of the report or to provide additional information. Some topics that may be addressed in the appendices include:

- decommissioning existing bridge
- proposed construction procedures
- itemized bridge cost estimates
- life-cycle cost calculations
- illustrations of the substructures and superstructures considered
- construction sequences

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