

# **Bridges and Structures**

## **Structure Alternatives Report Guidelines**

The Structure Alternatives Report serves two purposes:

1. Documenting the decision making process used to arrive at a recommendation on what type of structure should be carried forward to the detailed design stage.
2. Assembling all information required for the engineer to complete the detailed design.

When complete, the Structure Alternatives Report provides a detailed discussion on alternatives considered for all elements of the bridge structure, and will contain, in a summarized format, all of the information necessary for the engineer to complete the detailed design of the bridge. Once the recommendations contained in the Structure Alternatives Report have been accepted by the department, the consultant can complete the Project Design Brief and proceed with the detailed design.

The Structure Alternatives Report shall contain the following items:

### 1. Background Design Information

Relevant design information from other reports and sources should be summarized. All information necessary to complete the detailed design of the bridge should be included, as well as any information that may affect the choice of structure type that is recommended. Where applicable, relevant design information shall include:

#### A. Roadway Design Information

- Bridge Location
- Name and/or control section for overpassing and underpassing roadways
- Roadway designation for overpassing and underpassing roadways (current and ultimate)
- Lane and shoulder configurations for overpassing and underpassing roadways (current and ultimate)
- Horizontal and vertical geometry of overpassing and underpassing roadways
- Skew
- AADT and ADTT for overpassing and underpassing roadway

#### B. Hydrotechnical Design Information

- Design highwater EL, design flow, design velocity
- Design ice EL, design ice thickness, design ice crushing strength
- Potential for drift
- Requirement for river training works and estimated rip rap volumes
- Reference to DD drawings in Appendix if applicable.

### C. Geotechnical Information

- Brief summary of soil investigation program including location and depth of boreholes.
- Summary of soil stratigraphy at bridge site.
- Summary of feasible foundation types as presented by the geotechnical engineer.
- Anticipated settlement
- Need to account for down drag on piles
- Need for slide mitigation

### D. Design Standards

- List published design standards and version on which the bridge design shall be based.
- Typical standards include Canadian Highway Bridge Design Code CAN/CSA S6, Alberta Transportation Bridge Structures Design Criteria, and Alberta Transportation Specifications for Bridge Construction.

### E. Design Data Drawings (If Applicable)

- To be included in an appendix.

## 2. Construction Issues

Provide a complete discussion of any issues that may affect the construction or constructability of the bridge structure, approach roadways, and/or river training works. Highlight issues that may affect the choice of bridge type that is recommended for detailed design. Examples of construction issues that may be discussed include: restricted activity periods, limited access, traffic control, accommodation of utilities, environmental issues, and any other issue that could complicate the construction of the bridge.

## 3. Tendering Issues

Provide a complete discussion of any issues that may affect the tendering strategy for the bridge project. Highlight issues that may affect the choice of bridge type that is recommended for detailed design. Examples of tendering issues that may be discussed include: accelerated schedules, tendering different phases of the project separately, alternate delivery methods, and any other issue that could affect the tendering of the project.

## 4. Geometry and Span Configuration

Provide a complete discussion on the vertical and horizontal geometry of the bridge and how it may affect design choices such as deck width, span lengths, and drainage. Provide discussion on all span configurations considered including advantages and disadvantages of each. Provide a recommendation on the best span configuration for this bridge and on the location of fixed and expansion bearings. In cases where the optimum span configuration is dependent on the type of structure chosen it may be necessary to consider multiple span configurations in detail.

## 5. Structure Alternatives

Generally, a high level discussion between the department and the consultant is held, resulting in the identification of a number of reasonable alternatives to consider in the Structure Alternatives Report. A summary of these discussions should be included at the beginning of the Structure Alternatives section of the report. Only the agreed upon reasonable options need to be considered in detail in the report.

A detailed discussion of alternatives for all aspects of the bridge structure shall be provided and a recommendation on the best alternative shall be made. In cases where cost plays a significant role in choosing the best alternative, reference shall be made to the cost estimate section of the report.

### A. Foundations

- Discussion on all foundation types considered including advantages and disadvantages of each.
- Recommendation on best foundation type for the bridge.
- Provide all axial and lateral soil parameters for the recommended alternative required to complete the design of the bridge.

### B. Abutments

- Discussion on all abutment types considered including advantages and disadvantages of each.
- Abutment seat and diaphragm requirements
- Wingwalls
- Approach Slab Requirements
- Discussion on need for slope protection, retaining walls, other site specific constraints.
- Reinforcing requirements
- Discussion on any special drainage requirements, including subsurface and roadway drainage.
- Recommendation on best abutment type for the bridge. The choice of abutment may be dependent on the span configuration or superstructure type being considered. When this is the case, different abutment types may be considered for different options.

### C. Piers

- Discussion on all pier types considered including advantages and disadvantages of each.
- Required pier collision loads, including any special design requirements.
- Special design requirements for stream or ice flows.
- Reinforcing requirements
- Aesthetics
- Recommendation on best pier type for the bridge.

#### D. Girders

- Discussion on all girder types and configurations considered, including number of girder lines and girder spacing, and advantages and disadvantages of each.
- Need for diaphragms and lateral bracing
- Recommendation on best girder type and configuration for the bridge.

#### E. Deck

- Discussion on all deck types considered (eg. CIP Concrete, Partial Depth Precast, Full depth precast, etc) including advantages and disadvantages of each.
- Reinforcing requirements, including a discussion on the exposure class of the bridge and the types and locations of corrosion resistant reinforcement.
- Minimum deck thickness
- Waterproofing membrane
- Wearing surface
- Deck drains
- Wick drains
- Medians / Sidewalks

#### F. Barriers

- Discussion on type and performance level requirements for the bridge barriers
- Need for separation barrier / pedestrian barrier for sidewalk / MUT.
- Need for combination barrier
- Approach rail requirements
- Special requirements to accommodate drainage.
- Recommendation on best barrier type for the bridge.

#### G. Joints & Bearings

- Discussion on appropriate types of joints and bearings considering anticipated loads and thermal movements.
- Recommendation on type of joints and bearings to use in design.

### 6. Cost Estimates

Type B cost estimates shall be prepared for all structure alternatives considered. In cases where different structure alternatives will have significantly different maintenance and rehab requirements, life cycle cost estimates shall also be prepared. Results of the cost estimates shall be summarized in tabular format in the main body of the report and details of the estimates shall be included in an appendix. All assumptions used in the cost estimates shall be clearly stated in the main body of the report.

### 7. Design Decisions and Recommendations

Design decisions for each element of the structure shall be summarized and a recommendation shall be made on which alternative shall be carried forward to detailed design. Where two or more alternatives prove equally preferable, the recommendations contained in BPG 2 "Alternate Design" shall be followed.