

Freeboard at Bridges

Introduction

Freeboard at a bridge is the minimum clearance between the bottom of the girders and the design highwater or ice elevation. In general, freeboard amounts have been provided at bridges in Alberta to allow passage of drift, debris, and ice at highwater levels, as well as to accommodate uncertainty in the design highwater elevation or the possibility of an event more extreme than the design event. Assignment of fixed minimum freeboard amounts can result in lost opportunity to optimize a crossing, especially at sites where there are significant constraints on the gradeline due to existing infrastructure. Recent practice has accounted for potential to optimize a bridge opening by considering a range of freeboard amounts and selecting the optimal value. It is recommended that AT's current freeboard practice be documented and published, with consideration of site specific factors where technically justified and documented.

Background

- The 1992 AT publication “Guidelines for Bridge Structures Standards Approvals and Design” (SAD) provided recommendations for bridges that can be summarized as about 1.0m for major bridges and ranging from 0.3m to 0.9m for standard bridges depending on the classification of the roadway.
- The Canadian Highway Bridge Design Code (CHBDC) specifies freeboard requirements for bridges in section 1.9.7, which can be summarized as not less than 1.0m for bridges on freeways, arterials, and collector roads, and not less than 0.3m on other roads. This section of the CHBDC has been excluded from application in Alberta in the Engineering Consulting Guidelines document.
- Freeboard is not specifically applied at culverts due to the additional factors that apply in culvert sizing (see “Design Guidelines for Bridge Size Culverts”, and “Culvert Sizing Considerations”). However, ponding of water against the soil above the culvert crown is generally avoided.
- Recent practice for major and standard bridges has been to use 1.0m of freeboard as a starting point, and to optimize the gradeline by evaluating other options while considering costs and risks.

Recommendation

In order to maintain the ability to optimize the design of a bridge opening, it is recommended that a value of 1.0m be used as a starting point in the optimization process. Lower values can be considered if the following conditions are met:

- Lowering the gradeline by reducing the freeboard could result in a significant reduction in cost due to less re-building of the approach roadway and reduction or elimination of negative impacts to adjacent existing infrastructure and property

- There is a high degree of confidence in the design highwater level, and there is limited potential and/or history for drift or ice accumulation at the site.
- Thorough technical justification and documentation must be provided including consideration of costs, benefits, and risks. Department concurrence is required.
- A minimum freeboard of 0.3m is required at the low end of all bridge structures over watercourses.

Additional factors to be considered are:

- Bridges on a significant grade will result in larger clearances over most of the waterway than the minimum clearance at the low end of the bridge.
- Bridges with no in-stream piers provide less risk of drift and ice accumulations.
- Potential flooding impacts to upstream property must be considered.

Contact

Questions or further information on this guideline may be directed to the Bridge Planning Specialist, Alberta Transportation.

Adopted:

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