

# Circular 5

## Guideline for Alberta Railway Bridge Safety Management Program (BSMP)

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## Foreword

This Guideline was developed in consultation with the Province of Alberta's Railway Industry.

The objective of this Guideline is to provide railway companies with Alberta Transportation's expectations with respect to railway bridge safety.

The responsibility of a railway is to ensure the safety of its operation and consequently, that bridges retain their structural integrity and do not suffer catastrophic failures or undesired events resulting in death, injury, environmental damage, property damage, or other loss.

## Part A – General

### 0.1 - Definitions

"Bridge" means a railway bridge that the railway is responsible for with respect to inspection, evaluation, repairs, and the posting of load limits, and means any structure with a deck, regardless of length, which supports one or more railway tracks.

"Bridge Safety Management Program (BSMP)" means part of the railway Safety Management System (SMS) that facilitates the management of risks associated with bridges.

"Professional Engineer (P.Eng)" means a person who is a member of the Association of Professional Engineers and Geoscientists of Alberta or equivalent association and is qualified as a bridge engineer.

"Railway Administrator" means a person designated under section 51 of the *Railway (Alberta) Act* as the Railway Administrator.

"Railway Bridge Inspector" means a person deemed by a company to be competent as per the definition of "competent" as defined in the "Interpretation" section of the Alberta Industrial Railway Regulations. Also see Part C 2.4

"Railway Safety Officer" means a person designated under section 51 of the *Railway (Alberta) Act* and includes any person authorized by the Railway Administrator to carry out duties or functions on behalf or in the place of or a Railway Safety Officer.

"Railway" means the railway as defined by the *Railway (Alberta) Act* .

"Safety Evaluation" means the documented review conducted by a Bridge Engineer or competent Third party Bridge Inspector of all relevant bridge inspections, evaluations, assessments, reports, information and circumstances relating to a bridge to ensure that it is safe for its intended use.

"Safety Management System" means a document based on the Alberta safety management system guideline and required by the Railway Regulations AR177/2002.

“Visual Inspection” means a documented inspection made by a Bridge Inspector under the direction of a Bridge Engineer to record any changes or repairs and identify defects which may have developed or deteriorated since the last inspection. It includes measuring specific defects, verifying the general conditions of the bridge and its surroundings in order to confirm its general safety.

## **0.2 - Scope**

This guideline has been developed to assist a railway company formulate a BSMP. A railway is required to:

- a. Establish, implement and maintain a BSMP that identifies and mitigates, to the extent possible, hazards to users and other parties who may be exposed to risks associated with bridges and related activities;
- b. Implement, maintain and continually improve the BSMP;
- c. Conduct annual visual bridge inspections (conducted by the railways authority’s designated internal Bridge Inspector);
- d. Conduct five year safety evaluations conducted by a Competent Third party Bridge Inspector or a Bridge engineer; and
- e. Audit the bridge inspections and safety evaluations as part of the SMS audit requirement.
- f. Conduct detailed engineering assessments as needed and as ordered by the Bridge Engineer, Bridge Inspector, Competent Third Party Bridge Inspector or Provincial Rail Safety Officer.

## **0.3 - Application**

This Guideline applies to a railway under the jurisdiction of the *Railway (Alberta) Act*.

## **0.4 - Responsibility**

The railway is responsible for the condition of bridges over which it or other railway companies operate trains regardless of agreements, division of ownership, or maintenance expense. The railway shall ensure that the track is being adequately supported and shall be able to control, and restrict if necessary, the movement of trains on its segment of track, including the track on a bridge.

A railway is required to implement and maintain a safety management system to manage safety of all aspects of railway operations. The BSMP shall form part of and be referenced in a railway’s SMS as Section N Bridge Safety Management Program.

A railway shall engage the services of an engineering company that employs a Bridge inspector that is a competent Bridge Engineer (P.Eng) or a bridge inspector that is competent to inspect railway bridges.

## **Part B – Bridge Safety Assurance**

### **1.1 - Scope**

This part outlines the requirements of a BSMP to ensure the structural integrity of bridges and safe railway operations.

### **1.2 - Safety Management Systems (SMS)**

A railway is required to implement and maintain systems to manage safety of all aspects of railway operations. The BSMP shall form part of and be referenced in a railway's SMS as Section "N" Bridge Safety Management Program.

## **Part C – Qualifications and Designations of Responsible Persons**

### **2.1 - Scope**

A railway's BSMP shall identify clear authorities, responsibilities and accountabilities for the BSMP.

### **2.2 - Bridge Safety Management Responsibility**

A railway's BSMP shall identify the position within the railway that is accountable for the management of bridge safety.

### **2.3 - Bridge Engineer**

A Bridge Engineer is a professional engineer, contracted or employed by a railway that is responsible for, and has the related experience in, the following functions as they apply to the particular engineering work to be performed:

- a. determine the forces and stresses in bridges and their components;
- b. prescribe safe loading conditions for bridges;
- c. prescribe inspection, maintenance, repair and modification procedures for bridges; and
- d. design repairs and modifications to bridges.

A Bridge Engineer should be authorized to restrict the operation of traffic over a bridge according to its immediate condition or state of repair.

## **2.4 – Competent Third Party Bridge Inspector**

A Competent Third Party Bridge Inspector is a person who is designated by a railway authority, responsible for conducting routine external bridge safety assessments for the railway company. The Competent Third Party Bridge Inspector is intended to be a person with considerable experience and practical knowledge in conducting railway bridge inspection, maintenance and repair. The Competent Third Party Bridge Inspector is also intended to be an external service provider or contractor that can provide an independent review of the railway authority's internal annual inspections and also provide an independent assessment of the condition of the railway company's bridges.

The Competent Third Party Bridge Inspector should have the authority to make recommendations on:

- a. establishing maintenance plans for specific bridges;
- b. increase the frequency of periodic inspections for specific bridges;
- c. restrict the operation of traffic over a bridge;
- d. identify the bridges that require detailed engineering assessments.

## **2.5 - Bridge Inspector**

A Bridge Inspector is a person who is designated by a railway authority and deemed to be technically competent and have the related experience to view, measure, report and record the condition of a bridge and its individual components, under the direction of the designated Bridge Engineer or Competent Third Party Bridge Inspector.

A Bridge Inspector should be authorized to restrict the operation of traffic over a bridge according to its immediate condition or state of repair.

As a minimum it is recommended that the internal Bridge Inspector should have a minimum of two (2) years of experience in track inspection and maintenance combined with having taken basic training in bridge inspection and maintenance.

Each railway should have designated individuals qualified as Bridge Engineers, Bridge Inspectors, and Competent Third Party Bridge Inspectors. For each individual designated, the records should include the basis for the designation (qualifications and related experience) in effect.

## **Part D – Capacity of Bridges**

### **3.1 - Scope**

Each railway's BSMP should prevent the operation of equipment that could damage a bridge by exceeding safe stress levels in its components or by extending beyond the horizontal and vertical clearance limits of the bridge.

### **3.2 - Determination of Bridge Load Capacities**

In consultation with the bridge engineer a railway will, but is not limited to:

- a. determine the forces and stresses in bridges and their components;
- b. prescribe safe loading conditions for bridges;

- c. prescribe inspection, maintenance, repair and modification procedures for bridges; and
- d. design repairs and modifications to bridges.

In addition, each railway should:

- a. determine the safe load capacity of each of its bridges, the load capacity is intended to be the safe load capacity not the ultimate or maximum load capacity;
- b. documented the load capacity of each bridge in the railway's BSMP, together with the documented method by which the capacity was determined;
- c. the load capacity shall be determined by a Bridge Engineer using engineering methods and standards applicable to the particular class, configuration, and type of bridges being evaluated;
- d. bridge load capacity may be determined from existing design and modification records of a bridge, provided that the bridge substantially conforms to its recorded configuration. Otherwise, the load capacity of a bridge should be determined by measurement and calculation of the properties of its individual components, or other methods as determined by a Bridge Engineer;
- e. where a bridge inspection reveals that the condition of a bridge or its component might adversely affect the load capacity of the bridge to carry the traffic operated, a Bridge Engineer should determine a new capacity;
- f. railway bridge load capacity may be expressed in terms of numerical values related to a standard system of railway bridge loads, but should in any case be stated in terms of weight and length of individual or combined cars and locomotives, for the use of transportation personnel; an
- g. bridge load capacity may be expressed in terms of both normal and maximum load conditions. Operation of equipment that produces forces greater than the normal capacity should be subject to any restriction or conditions that may be prescribed by the Bridge Engineer.

### **3.3 - Protection of Bridges from Over-weight and Over-dimensional Loads**

A railway should know what rolling stock is allowed to operate on its network, their equipment rating, and restrictions required. A railway shall have and ensure the implementation of documented procedures for the operation of equipment as part of their BSMP by way of documenting the normal weight or dimension restriction on a bridge.

Equipment exceeding the normal weight or dimension restriction should only be operated under conditions determined by the Bridge Engineer, who has properly analyzed the stresses resulting from the proposed loads.



The railway is expected to advise other railway companies operating over a railway bridge of the normal loads permitted over it. Railway companies should develop, maintain, and enforce written procedures to restrict a load that exceeds those limits, unless specific authority has been granted and in accordance with restrictions placed by the railway.

Each railway should document the allowable weight over all bridges in the railway time table and issue instructions to the personnel who are responsible for the configuration and operation of trains over its railway bridges to prevent the operation of cars, locomotives and other equipment that could exceed the capacity or dimensions of its railway bridges. The Bridge Engineer should be informed of any substantial change in train operation or traffic patterns, which may affect bridge safety. These instructions should:

- a. be expressed in terms of maximum equipment weights, and either minimum equipment lengths or axle spacing.
- b. be expressed in terms of feet and inches of cross section and equipment length, in conformance with common railway industry practice for reporting dimensions of exceptional equipment in interchange in which height above top-of-rail is shown for each cross section measurement, followed by the width of the car of the shipment at that height.
- c. apply to individual structures, or to a defined line segment or group(s) of line segments where the published capacities and dimensions are within the limits of all structures on the subject line segments.

### **3.4 - Railway Operations during Bridge Repairs or Modifications**

Each railway's BSMP should specify procedures for any repair or modification that materially modifies the capacity of a bridge or the stresses in any primary load-carrying component of a bridge. At a minimum, design for repairs or modifications shall be performed under the direction of a Bridge Engineer. The design should specify the manner in which traffic or other live loads may be permitted on the bridge while it is being modified or repaired.

Each repair or modification pursuant to this part should be performed under the direction of a Bridge Engineer who is designated and authorized by the railway to supervise the particular work to be performed. The Bridge Engineer should ensure that the repair or modifications were completed in conformity with the design.

Routine bridge maintenance and repairs that do not materially modify the capacity or design of a bridge do not need to be performed under direction of a Bridge Engineer, but as a minimum should be performed under the direction of the railway's bridge inspector. Traffic and other live loads shall not be permitted while work is being performed under the direction of the railway's Bridge Inspector, unless the movement is related to or necessary for the bridge repair.

## **Part E – Bridge Inspection**

### **4.1 - Scope**

Each railway's BSMP should provide for an effective bridge inspection program.

The railway should clearly define and document the different types of inspections to be undertaken for their bridges, including the frequencies of these inspections in their BSMP.

### **4.2 - Bridge & Overhead Bridge Inventory**

The railway is expected to maintain an inventory of all bridges located on its right of way and documented in the BSMP section of the SMS. At a minimum, this inventory is expected to include the following information:

- a. location (i.e. subdivision and mileage);
- b. bridge type;
- c. total length;
- d. average span length;
- e. maximum height;
- f. year built;
- g. deck type;
- h. obstacle being crossed (i.e. water body, roadway);
- i. geo-referenced coordinates (i.e. longitude, latitude);
- j. bridge rating, which may be expressed in terms of the individual bridge capacity or line capacity based on the governing bridge rating on the line segment;
- k. line / load capacity;
- l. date of line / load capacity evaluation;
- m. the name of the party responsible for the inspection and maintenance of the bridge; and
- n. the mile location and latitude and longitude coordinates.

### **4.3 - Scheduling of Bridge Inspections**

- a. each BSMP should include a visual inspection by a Bridge Inspector for each bridge in service at least once each calendar year with not more than 540 days between any successive inspections.
- b. each BSMP should include a cursory inspection for each overhead bridge for which the railway authority does not have inspection and maintenance responsibilities, at least once each calendar year with not more than 540 days between any successive inspections.

- c. a bridge should be inspected more frequently when a Bridge Engineer or Bridge Inspector determines that such inspection frequency is necessary considering the conditions noted on prior inspections, the type and configuration of the bridge, and the weight and frequency of traffic carried on the bridge.
- d. each BSMP should define requirements for the special inspection of a bridge, as per section: (*Special Inspections*) of this Guideline.
- e. any bridge that has not been in service and has not been inspected in accordance with this section within the previous 540 days should be inspected and the report of said inspection reviewed by a Bridge Engineer or Competent Third Party Bridge Inspector prior to resumption of service.

#### **4.4 – Bridge Inspection Procedures**

- a. the bridge inspection procedures shall be as specified by a Bridge Engineer who is designated as responsible for reviewing the bridge inspections. The inspection procedures should incorporate the methods, means of access, and level of detail to be recorded for the various components of that bridge or class of bridges.
- b. the bridge inspection procedures should ensure that the level of detail in the inspection procedures are appropriate to the configuration of the bridge, conditions found during previous inspections, and the nature of the traffic moved over the bridge, including equipment weights, train frequency, length and level of damage.
- c. the bridge inspection should be designed to detect, report, and protect deteriorations and deficiencies before they present a hazard to safe railway operations.

#### **4.5 - Special Inspections**

Each railway's BSMP should include a procedure for the protection of traffic and for the inspection of any bridge that might have been damaged by a natural or accidental event, including but not limited to flood, fire, ice flows, debris flows, subgrade instability, rock instability, effect of beaver dam failure, earthquake, derailment, vandalism, vehicular or vessel impact.

#### **4.6 - Underwater Inspections**

Each railway's BSMP should include provisions for underwater inspections for the detection of scour or deterioration of bridge components that are submerged and where the foundation cannot be inspected due to the depth of water, high water flow or poor visibility.

The railway should have in place an underwater inspection program to identify which bridges to inspect, the items to inspect, and the frequency of underwater inspections to provide reasonable assurance of the foundation's integrity.

The railway should be knowledgeable of the risks posed by scour, erosion and stream stability hazards.

#### **4.7 - Inspection of Brush and Drainage Channel Conditions**

- a. each railway's BSMP shall include provisions for the inspection of brush conditions under and adjacent to bridges and ensure that vegetation is controlled to reduce the fire hazards to bridges and enable a thorough bridge inspection to be carried out.
- b. each railway's BSMP shall include provisions to ensure each drainage or other water carrying facility under or immediately adjacent to the bridge is maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

#### **4.8 – Unmanned Aerial Vehicles (UAV)**

- a. Use of UAV's may be used as a supplementary inspection tool but is not to be used a sole replacement for traditional bridge inspection methods and techniques.
- b. UAV operation must be conducted in accordance with Transport Canada's Regulation governing UAV operations.

#### **4.9 - Bridge Inspection Reports**

- a. each railway should keep a record of each inspection that has been performed on those bridges under this part.
- b. each record of an inspection under the BSMP described in this part should be prepared from notes taken on the day(s) the inspection is made, supplemented with sketches and photographs as needed.
- c. each BSMP should specify that every bridge inspection report should include, as a minimum, the following information:
  1. A precise identification of the bridge inspected, (including geo referenced coordinates);
  2. The date(s) on which the inspection was carried out;
  3. The identification and written or electronic signature of the inspector;
  4. The type of inspection performed, in conformance with the definitions of the inspection types in the railway's BSMP;
  5. An indication on the report as to whether any item noted thereon requires expedited or critical review by a Bridge Engineer, and any restrictions placed at the time of the inspection; and
  6. The condition of components inspected, which may be in a condition reporting format prescribed in the railway's BSMP, together with any narrative description necessary for the correct interpretation of the report.
  7. Each railway authority's BSMP should specify the retention period and location for bridge inspection records. The retention period should be

no less than five years following the completion of the inspection.

#### **4.10 - 5 Year Review of Bridge Inspection Reports**

The railway authority's BSMP should specify the manner and timeline in which bridge inspection reports should be reviewed and no less than once every five years and should review the previous three to five annual bridge reports. The Five Year Safety Evaluation must be conducted by The Competent Third Party Bridge Inspector or the Bridge Engineer to:

1. Determine whether inspections have been performed in accordance with the relevant schedule and specified procedures;
2. Evaluate whether any items on the report represent a present or potential hazard to safety;
3. Require any modifications to the inspection procedures or frequency for that particular bridge;
4. Schedule any repairs or modifications to the bridge that are required to maintain its structural integrity; and
5. Determine the need for further higher-level review.

It is recommended that as part of the safety evaluation, the Competent Third Party Bridge Inspector or Bridge Engineer conduct a visual inspection of the bridge(s) being reviewed. The scope of the visual inspection and bridge inspection procedure should be determined based on the recommendation of the Competent Third Party Bridge Inspector or Bridge Engineer.

A Bridge Engineer or Competent Third Party Bridge Inspector shall review potentially imminent failure conditions identified during bridge inspections prior to the next train movement.

A safety evaluation should be carried out in accordance with timelines identified in the BSMP. Records of a safety evaluation should identify, at a minimum, the bridge evaluated, the date of the evaluation, the responsible Bridge Engineer and/or Competent Third Party Bridge Inspector, and the conclusions and recommendations resulting from the safety evaluation.

A railway company is required to implement and maintain a process for the identification of safety issues and concerns, evaluating and classifying risks by means of a risk assessment, and undertake necessary control strategies

#### **4.11 - Bridge Hazard Identification and Risk Assessment**

A railway is required to implement and maintain processes for the identification of safety issues and concerns, evaluating and classifying risks by means of a risk assessment and necessary control strategies.

## **Part F - Engineering Work**

### **5.1 - Scope**

All the engineering work relating to railway works, including design, construction, evaluation or alteration, shall be done in accordance with sound engineering principles. A professional engineer shall take responsibility for the engineering work.

### **5.2 - Engineering work related to Bridges**

Engineering work includes, but is not limited to:

- a. Preparing bridge design and specifications;
- b. Determining bridge load capacities;
- c. Developing construction, repair and modification procedures;
- d. Developing inspection and evaluation procedures;
- e. Reviewing bridge inspection reports and conducting safety evaluations;
- f. Evaluating proposed maintenance deferrals;
- g. Verifying that construction, repair and modification work is completed in accordance with design and specifications.

## **Part G – Documentation, Records and Audit of BSMP**

### **6.1 - Scope**

Each railway's BSMP should provide for the verification of the effectiveness of the program and the accuracy of the resulting information, including the validity of bridge inspection reports and bridge inventory data, and the correct application of movement restrictions to railway equipment of exceptional weight or configuration.

### **6.2 - Audits, General**

A railway shall, as part of their annual railway audit include the audit protocol number 19 "Bridge Safety Management Program".

### **6.3 - Audits of Inspections**

- a. each railway's BSMP should incorporate provisions for an annual railway audit to determine whether the inspection provisions of the program are being followed, and whether the program itself is effectively providing for the continued safety of the subject bridges; and
- b. the annual railway audit should include an evaluation of each bridge inspection report to determine whether the inspections were conducted and corrective action taken as per the Bridge Engineers direction/recommendation.

### **6.4 - Documents and Records**

Each railway should document their BSMP and keep records under this part. The BSMP inspections shall be made available to an Alberta Transportation Rail Safety Officer

upon request, as soon as reasonably practicable.

The railway should retain, where possible, pertinent drawings for as long as they are responsible for or own the bridge and inspection records as per the Bridge Inspection Records section of this guideline.

When maintenance responsibilities for track and bridges are assigned to another railway, it should be assigned or given access to pertinent bridge documents and drawings.

## **6.5 - Record Retention**

### a. General

A railway may create and maintain any of the records required by either electronic storage or hard copy.

### b. System security

Where applicable, the integrity of the bridge inspection records should be protected by a security system that incorporates a user identity and password, or a comparable method, to establish appropriate levels of program and record data access.

### c. Record Retention

Bridge inspection records should be, at a minimum, retained for five consecutive annual bridge inspections.

## **Part H – Railway Administrator and Railway Safety Officer**

### **7.1 – Scope**

All provincially regulated railways are under the jurisdiction of the *Railway (Alberta) Act* and the Alberta Railway Regulations (AR177/2002) should obtain an operating approval from the Railway Administrator.

### **7.2 Responsibilities**

The Alberta Transportation Railway Administrator and a Rail Safety Officer(s) is responsible for the administration of the *Railway (Alberta) Act*.

In accordance with the *Railway (Alberta) Act* a Railway Safety Officer may issue a direction as per Section 37(1).

If, in the opinion of the Rail Safety Officer, a railway bridge is found to be non-compliant with the repairs required to correct the defect findings of the Bridge Inspector and/or the Bridge Engineers inspection reports, a Railway Safety Officer may issue a direction or order the cessation of use.

In addition, should the Rail Safety Officer have reason to believe additional inspections are required, a direction maybe issued.

A railway's responsibility is defined in this guideline in Part A-General, Section 0.4-Responsibility.