

MMM Group Limited
1045 Howe Street, Suite 700
Vancouver, BC Canada V6Z 2A9
t: 604.685.9381 | f: 604.683.8655
www.mmmgrouplimited.com

Project: 5012802

March 20, 2015

Jonathan Huggett, P. Eng.
Johnson Street Bridge Interim Project Director
City of Victoria
623 Pandora Avenue
Victoria, BC V6V 3B9

Ref - Johnson Street Bridge Replacement Project – Moveable Bridge Seismic Performance

Design Approach Summary

The Johnson Street Bridge has been designed as a “critical” bridge (similar to the “lifeline bridge” classification as per Canadian Highway Design Code) for the Design Level Earthquake defined to have a return period of 1000 years using AASHTO LRFD Movable Highway Bridge Design Specifications. We have already confirmed that the bridge will remain functional for all vehicular traffic after the Design Level Earthquake. With respect to the bridge performance after a 2500-year return period seismic event, we wish to clarify that the 1:2500 year event is not part of the seismic design criteria specified in the JSB 2012 PDR and was not analyzed in the design. The comment that we made with regard to what could be expected after the 1:2500 year event was in direct reference to the AASHTO LRFD Bridge Design Specifications **Commentary C3.10.5**.

JSB Bridge Machinery System

Hardesty & Hanover utilized the AASHTO LRFD Bridge Design Specifications, Fifth Edition (2010) and the AASHTO LRFD Movable Highway Bridge Design Specifications, Second Edition (2007) with revisions through 2010, for the seismic design of the bascule pier and bascule span. Hardesty & Hanover used the single level, 1000-year return period Design Level Earthquake event as per the AASHTO specifications. The details of various seismic load cases analyzed and predicted seismic performance of mechanical systems evaluated are summarized below.

Hardesty and Hanover has evaluated various seismic load cases in accordance with AASHTO LRFD Movable Highway Bridge Design Specifications associated with the open and closed operations of the bascule span.

Load Condition 1A

Design Level Earthquake:	1000-Year Return Period
Load Applied:	100% of Design Level Earthquake
Span Configuration:	Span in seated Condition, Locks Engaged
Code/Performance Requirements:	Possible loss of movable bridge operation Repairable Damage

Results by System:

- ▶ Span Lock System..... Potential damage to lock bar receiver
- ▶ Centering Device and Lateral Restraint ... Potential damage to receiver
- ▶ Operating Machinery No permanent damage anticipated
- ▶ Span Support Machinery No permanent damage anticipated
- ▶ Rear Lateral Restraint Potential damage to restraint beam

Notes for this condition

- ▶ Potential damage anticipated is to ancillary systems which can be removed and replaced as necessary to allow operation (opening/closing) of the movable span subsequent to the Design Level Earthquake.
- ▶ As part of the design, special protection features (breakaway features) were included for the overall benefit of the structure in the event of a Design Level Earthquake.
- ▶ It should be noted that the longevity of machinery components subjected to a Design Level Earthquake may be reduced from the overall design life due to the high incidence of load.
- ▶ With span in seated position, vehicular traffic can continue to utilize the structure.

Load Condition 1B

Design Level Earthquake:	1000-Year Return Period
Load Applied:	100% of Design Level Earthquake
Span Configuration:	Span in Opening or Fully Opened Position
Code/Performance Requirements:	<i>Condition not required by Code, Not Evaluated</i>

Load Condition 2A

Design Level Earthquake:	1000-Year Return Period
Load Applied:	50% of Design Level Earthquake
Span Configuration:	Span in seated Condition, Locks Engaged
Code/Performance Requirements:	No loss of service or permanent damage

Results by System:

- ▶ Span Lock System..... No permanent damage anticipated
- ▶ Centering Device and Lateral Restraint ... No permanent damage anticipated
- ▶ Operating Machinery No permanent damage anticipated
- ▶ Span Support Machinery No permanent damage anticipated
- ▶ Rear Lateral Restraint No permanent damage anticipated

Notes for this condition

- ▶ It should be noted that the longevity of machinery components may be reduced from the overall design life due to the high incidence of load under this condition.

Load Condition 2B

Design Level Earthquake:	1000-Year Return Period
Load Applied:	50% of Design Level Earthquake
Span Configuration:	Span in Opening or Fully Opened Position
Code/Performance Requirements:	No loss of service or permanent damage

Results by System:

- ▶ Span Lock System..... Not Applicable for this Condition
- ▶ Centering Device and Lateral Restraint ... Not Applicable for this Condition
- ▶ Operating Machinery No permanent damage anticipated
- ▶ Span Support Machinery No permanent damage anticipated
- ▶ Rear Lateral Restraint Not Applicable for this Condition

Yours truly,

MMM Group



Jianping Jiang, Ph.D., P.Eng.
Vice President
Bridges, Transportation
Partner