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June 16, 2011

Mr. Olivier Chouc
Vice President and General Counsel
Canadian National Railway Company
935 de La Gauchetiere Street West
Montreal, Quebec, H3B 2M9 Canada

RE: QUEBEC BRIDGE – MILE 2.7
OVER ST. LAWERENCE RIVER
BRIDGE DETERIORATION DUE TO DE-ICING

Dear Mr. Chouc:

During winter months the Quebec Bridge, along with all other roads of the area, are plowed and de-icing salts applied to keep the roadways safe for the public. De-icing salts cause accelerated deterioration of bare steel through the formation of corrosion resulting in a reduction of the thickness of steel shapes and plates and ultimately reducing the carrying capacity of bridge members. The question of possible solutions to retard/eliminate this accelerated deterioration of metalwork on the Quebec Bridge is addressed therewith.

INSPECTION REPORT

Roche Ltd. performed an extensive, detailed inspection of the Quebec Bridge in 2010. The Inspection Report is contained in 10 volumes and has thousands of written notes on metalwork blemished, losses of metalwork from corrosion and hundreds of illustrative photographs in support of their findings. Modjeski and Masters, Inc. was retained to review the entire report which was performed by this writer.

In review of bridge conditions, bridge metalwork losses on upper elements, well above the influence of de-icing salts are generally typical of conditions found on most bridges: minor corrosion along seams, between multiple plies of plates and angles, and pitted horizontal plate diaphragms that contain collected debris.

Metalwork losses on the Quebec Bridge in lower areas that are exposed to de-icing salts include above normal type corrosion. In addition, undercutting and hole development of web plates just above bottom flanges, pitting of vertical plates that normally would not expect to pit, and advanced metalwork section loss deterioration on horizontal surfaces such as diaphragms, flanges and lacing bars has also been noted.

OBSERVATIONS

As a part of the review of the Roche Inspection report, a site visit was made in February 2011 to observe reported conditions.

At the time of the visit, recent snow removal product had frozen atop the railroad floor system elements extending from the roadway across to the railroad girder furthest from the highway. Main bridge bottom chords, and all bracing elements below the roadway level either had frozen slush deposits or whitish residue noted. Above the roadway level, members near the roadway also had whitish deposits assumed to be de-icing salts transported by mist from passing vehicles. Appended photographs attest to the deposits of roadway snow removal product and the whitish residue.

Bridge metalwork with abnormal deterioration has been splashed or coated by mist from roadway traffic and snow removal efforts that contains de-icing salts. That metalwork generally includes the entire length of bridge railroad through plate girder spans and associated floor system within the bridge, all main truss and deck truss elements below the level of the roadway and to a much lesser amount, bridge elements to about 20' above the roadway. Oddly enough, not impacted by the de-icing salts are the highway support elements directly under the roadway that are protected on the inside faces from de-icing contact. However, at roadway joints where there is water leakage containing de-icing salts, these same support elements are deteriorated like the railroad support system.

OPTIONS TO REDUCE/ELIMINATE BRIDGE DAMAGE

There are a number of options that have been forwarded to address the reduction and/or elimination of bridge damage from the application of de-icing salts including, no de-icing salt usage, change types of de-icing salts, change methods for plowing the bridge, wash down the bridge in the Spring, and so forth.

De-icing salts will be tracked onto the bridge no matter whether the bridge uses no salts or changes types of salt. That being said, changing to less corrosive salt on the bridge and its approaches would reduce significantly the damages caused by de-icing salts to the structure. Changing plowing methods may reduce the disbursement of salt contact with many members. Subject to the complexity of the structure and the environmental challenge washing the bridge annually would reduce debris accumulation, as well as associated moisture and corrosion.

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Mr. Olivier Chouc, Vice President

One option is to place a solid, lightweight vertical barrier behind the railings and provide a drainage system that carries all roadway water down to ground. The barrier system would be tall enough that splash would not contact the railroad girder spans nor truss to the roadway side. The roadway deck would be sealed and there would be no open-over-the-side drainage to fall onto bridge elements below roadway level. It may be necessary that the drainage system have heat tracers in the lines to keep them from freezing. As noted above and in the appended photographs, the inside faces of the roadway girder supports which are sealed from the roadway deck do not have significant corrosion. This would be the objective of the barrier system.

The wind load on a barrier system would be less or approximately equivalent to the wind load on the vertical surface of a train. Total dead load on the bridge would be minimal. The barrier system does not replace performing bridge maintenance, but should assist in keeping up with the demand.

Should it be decided to continue functioning as-is, maintenance costs will continue to increase with time.

Very truly yours,

Donald F. Sorgenfrei, P.E.
Sr. Vice President

CC: CN – Greg Porisky, PE