Ontario

FACT SHEET

Ministry of Transportation

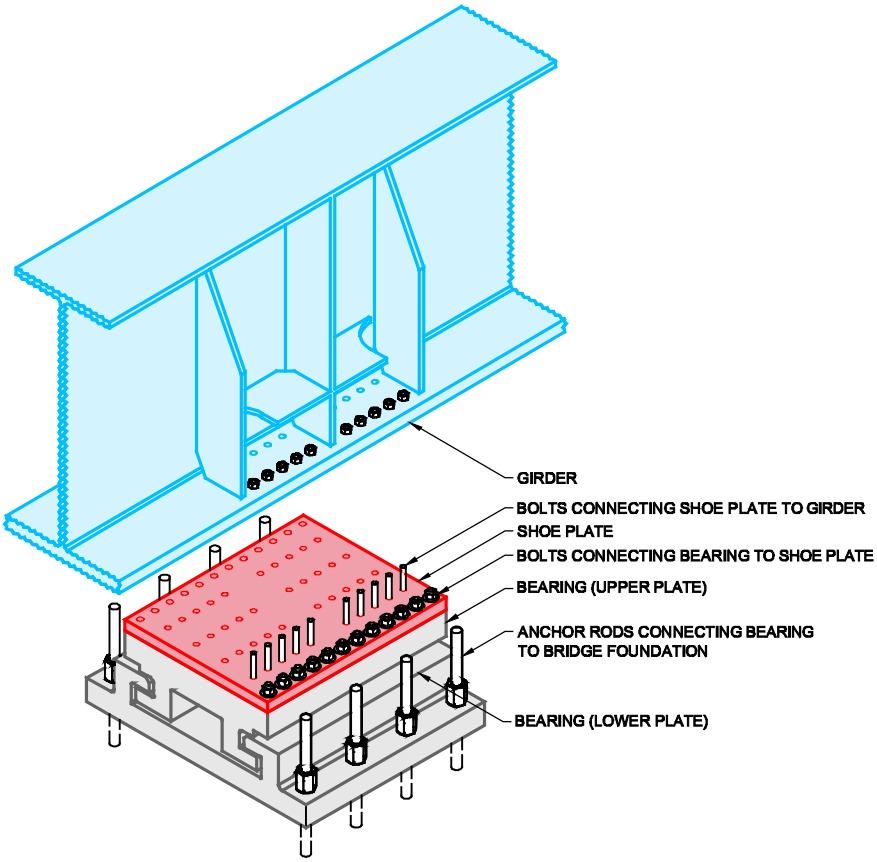
Nipigon River Bridge – Investigation

September 22, 2016

Background

Following the unexpected closure of the Nipigon River Bridge on January 10, 2016, two firms were contracted to conduct bolt testing. The testing confirmed that the bolts broke due to overloading.

A thorough engineering analysis was conducted to determine the cause of the malfunction of the tie-down connection on the northwest corner of the bridge. This analysis was undertaken by ministry bridge engineers and an independent engineering consultant with expertise in cable stayed bridges – Associated Engineering (Ont.). These analyses were conducted independently and at their conclusion reached the same findings.



COMPONENTS

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The investigation

The two engineering groups were tasked with:

- Providing independent engineering advice relating to:
  - The design of the bridge and/or its components
  - The construction of the bridge and/or its components
- Providing independent findings related to the northwest tie-down connection.

With a specific focus on:

- Review and analysis of the bearing and associated components
- Review of construction documentation for fabrication and installation of the bearings
- Structural analysis including computer modeling of the bearing and girder connection
- Compliance with the Canadian Highway Bridge Design Code (CHBDC)

The findings

Both engineering groups have now completed their work.

The engineering reviews found that there were three main factors that led to the malfunction: shoe plate flexibility, a lack of rotation in the bearing, and improper tightening of the bolts.

1. **The shoe plate**

   The review found that the shoe plate was too flexible, creating a “prying action” which increased the forces on the two outer rows of bolts. This additional force resulted in the bolt heads/nuts bending, stretching and eventually breaking.

2. **The bearing**

   The bearing did not rotate. The lack of rotation increased the forces being placed on the bolts, causing the bolts to break.

3. **The bolts**

   Proper tightening keeps the forces in the bolts more consistent when the load on the bridge changes.

Other factors were also found, but their contribution to the cause was minimal. Neither cold temperatures nor wind were contributing factors in the failure.

Permanent Retrofit

The design of a permanent retrofit for the bridge is well underway and will be reviewed by Associated Engineering (Ont.). Please see the fact sheet Nipigon Bridge – Permanent Retrofit for more information.