The Collapse Of The Quebec Bridge

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Agenda

- History
- Hierarchical Management Structure
- Progress of the Bridge
- The Day of the Collapse
- Investigation
- Case Analysis
- Spin-off of the disaster: The Iron Ring
- Conclusion
- Endnotes
- Bibliography
- Open Discussion (Question answer period)
History

• In 1882 Quebec Bridge Company was granted the contract for the bridge

• Due to short finance, nothing was done until 1887 when Quebec Bridge was incorporated with the Railway Company

• Now the new management demanded to get the project rolling a.s.a.p. and Theodore Cooper, the most reputed engineer of that time became the main consulting engineer for the project
Construction was contracted to: Phoenix Bridge Company

Initial design was produced by: Peter Szlapka, which was reviewed and approved by Cooper.

Upon Cooper’s recommendation the “loading of the bridge...[was increased]...by extending the length of the center span from... [1,600 to 1,800 feet].”

The reason being is that “Piers constructed in deeper water would be subject to the heavy ice floes of the main channel. Closer to shore, they would be less vulnerable...[so, it’s quicker to build],...speeding up the completion of the entire work by at least one year.
• To keep down the increased cost of steel in the superstructure..., Cooper recommended... modified specifications that would allow for higher unit stresses.”

• Again there was a slack time until “...1903 [when]... Canadian Government... [granted]... $ 6.7 million.”

• Things started speeding up again and to fabricate the steel with no more loss of time ...” there was no re-computation of assumed weights for the bridge under the revised specification”.

• Cooper did not intervene. He decided to accept the theoretical estimates of the Phoenix Company”, without review!
Hierarchical Management Structure

Quebec Bridge Company & Railway Company

Theodore Cooper
(Consulting Eng.)

Phoenix Bridge Company
President: John Sterling Deans

Railway Company
Chief Eng: Collingwood Schreiber

Edward Hoare
(Onsite chief design eng.)

General workers & others

Norman McLure
(Onsite personal assistant of Cooper)
Progress Of The Bridge

- Cooper hardly visited the site as his health declined.

- In 1903 Collingwood (Railway Eng.) wanted the department to hire another Consulting Engineer to review Cooper’s work.

- Cooper was annoyed and refused any sort of subordination.

- In 1903 Robert Douglas (Eng. Of Railway) criticized the high unit stresses on the bridge.
• Nothing was done as “… confidence in Cooper was the byword just then...”. 5

• On Feb 1, 1906 E.L. Edwards (inspector) notified Cooper of the actual weight of the steel in the bridge to be way over initial estimation.

• Cooper considered the weight to be still within reasonable limits.

• In June 1907 McLure reported buckling at 7-L and 8-L compression chords and later 8-L and 9-L chords were found bent.

• On Aug 27, 1907 9-L chord which was “three quarters of an inch out of line”….was now “two & one quarter inches “, out of line. 6

• Work was freezeed for that day and McLure wrote to Cooper.
The Day Of The Collapse

- Work resumed as Hoare saw no immediate danger

- McLure met Cooper at New York and notified the increased deflection in 9-L, and immediately Cooper sent a telegram to Phoenixville which read: “Add no more load to bridge till after due consideration of facts.” 7

- “Telegram reached at 3:00 pm, John Deans read it and disregarded it” 8

- Bridge collapsed at: 5:15 pm, Aug 29, 1907

- “Eighty five workers crashed into the water, [and] only 11 survived.” 9
The Collapse
Investigation

- Royal Commission which was appointed by the government to inquest the case concluded that “failure is attributed… [to the] errors in judgment on the part of these two engineers”, Cooper and Szlapka. 10

- John Deans was criticized for poor judgment and Bridge Company for “appointing the unqualified Edward Hoare as responsible engineer at the site.” 11
Case Analysis

• **Stakeholders:** Government, Quebec & Railway Company, Phoenix Company, Cooper and Szlapka along with other engineers, workmen, and public.

• **Causes for failure**
  1) Short Finance
  2) Time Constrain
  3) Negligence to follow proper professional procedures:
     i.e: - disregard for re-computations of revised specs.
     - Dean disregarding the telegram of Cooper
  4) Ego of Cooper, i.e: refusing subordination and stopping the drafts to be individually reviewed
Broken Laws of ethics

• “It is the duty of a practitioner to the public, to the practitioner’s employer, to the practitioner’s clients, to act at all times with”:
  • Fairness and loyalty to associates, clients & employer
  • Fidelity to public needs
  • Devotion to high ideals of personal honor & professional integrity
  • Knowledge of developments in the area of professional engineering relevant to any services that are undertaken, and
  • Competence in the performance… 12
“Practitioner must co-operate in working with other professionals engaged on a project”.

**Broken Laws and associated engineers**

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<tr>
<th>Fidelity to public</th>
<th>Loyalty to associates</th>
<th>Competence in performance</th>
<th>Co-operation to other professionals</th>
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<tr>
<td>Cooper</td>
<td>John Dean</td>
<td>Edward Hoare</td>
<td>Cooper</td>
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<td>Szlapka</td>
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Spin-Off of the Collapse: The Iron Ring
(The Ritual of the calling of an Engineer)

- Initiated in 1922 by seven Engineers
- Purpose: to motivate consciousness of the profession and to emphasize the need for the engineers to abide by the Professional Code of Ethics
- Worn in: the pinky finger of the working hand as a constant reminder of the importance of preserving human lives
- Copyrighted: in Canada and US
Conclusion
Lessons to be learned:

- Always place public safety at the forefront of your professional consciousness
- Maintain professional behavior and never let ego get the better of you
- Co-operate and respect your associates
- Welcome professional criticisms &
- All in all, have high standard of professional conduct, be true to yourself in terms of your capabilities and follow the Code of Ethics.
EndNotes

Bibliography

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