

# Lecture 24 — Professional Misconduct

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Engineers are human beings – they make mistakes.

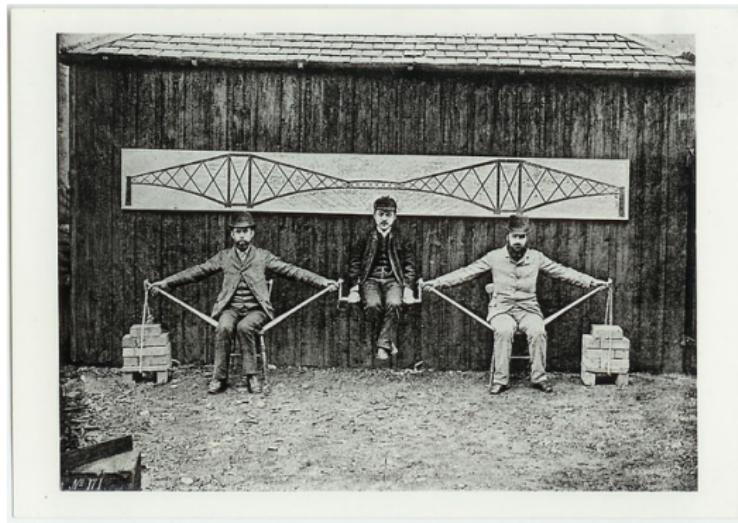
We cannot expect engineers to be perfect, but the goal is to minimize the effects and create a culture and work environment that reduces the chance of errors.

Some mistakes and problems will be unavoidable.

Prior to the construction of the Tacoma Narrows Bridge, no engineer considered wind as a possible factor in the construction of a suspension bridge.

The first Apollo mission saw the astronauts almost destroy the control panel when they loosened their straps.

Mistakes can sometimes come from carelessness, poor practice, negligence...  
We will start by looking at the mistakes made in the Quebec Railway Bridge.



The design was a cantilever bridge: the lower members (steel beams) are under compression; the upper members in tension.

# Quebec Bridge is Falling Down...

The principle of cantilever bridges is sound; they're used all over the world.  
Including as the replacement for the bridge that failed!

What might be some other causes of failure?

As only half the bridge was built, it was possible to inspect the steel support beams still in fabrication.

*The work done by the Phoenix Bridge Company in making the detail drawings and in planning and carrying out the erection and by the Phoenix Iron Company in fabricating the material was good, and the steel used was of good quality.*

So it isn't that. But, are engineers responsible for checking these things?

## Penny-Wise, Pound-Foolish

There was insufficient money to perform anything more than the absolute minimum number tests required.

Engineering is not about getting the job done at the cheapest possible rate – it's about reasonable pay for competent engineering work.

A practitioner shall uphold the principle of adequate compensation for engineering work.

Cooper had designed bridges across North America before...

Cooper, however, was almost 70 years old at the time of the disaster and had only visited the construction site twice.

An engineer can have his or her licence revoked, suspended or limited in cases where the practitioner is found incompetent.

## Don't Ignore the Warnings

There were bent members for almost a month prior to the collapse and workers were skipping work rather than work on a bridge they felt was dangerous.

Listen to your contractors and workers: you might have an engineering degree, but they will, at least for a few decades, more experience than you.

Do not be embarrassed if you make a mistake – contractors know engineers are human, too, and they appreciate it when they acknowledge their mistakes...

## This isn't supposed to bend...

The engineers all argued as to the cause of the bent members even though the inspectors stated that they were true (straight) when installed.

Theories:

- They were bent while they were being built in Phoenix.
- They were damaged while being unloaded from the trains.
- They were damaged while being installed.

None of which were correct...

Norman McLure was the only engineer who recognized the danger.

Engineers must co-operate in working with other professionals engaged on a project and act towards them with courtesy and good faith.

Cooper had curved members added to the structure for aesthetic reasons. These increased the secondary stresses and added difficulties to fabrication.



35. View showing progress. Date, Aug. 28, 1967. Note that the little traveller has been moved forward into position for erecting the fourth panel of the suspended span. Note also the condition of the big traveller.

The most important thing must always be public safety, not how “pretty” it is.

No set of final designs was ever prepared – all work was based on designs that had modifications and calculations using different notations.

This can lead to tremendous confusion and disarray.

Any final designs, plans, drawings, or any other document must be sealed, dated and signed by the engineer.

Contractors and officials are taught that a drawing should only be relied upon if it has been correctly sealed.

The failure on the part of the Quebec Bridge and Railway Company to appoint an experienced bridge engineer to the position of chief engineer was a mistake.

Hoare restarted work after Norman McLure stopped construction two days prior to the collapse.

Hoare seemed to be more interested in maintaining the schedule.

An engineer should not undertake work the practitioner is not competent to perform by virtue of the practitioner's training and experience.

The bridge was designed by Szlapka, the chief designer for Phoenix.

Cooper approved this design without thoroughly checking the calculations.

It is wrong to seal any final drawing, specification, plan, report or other document not actually prepared or checked by the practitioner!

Cooper refused to submit his designs to an engineer who would have been appointed by the Ministry of Railways and Canals.

Cooper claimed this would undermine his authority.

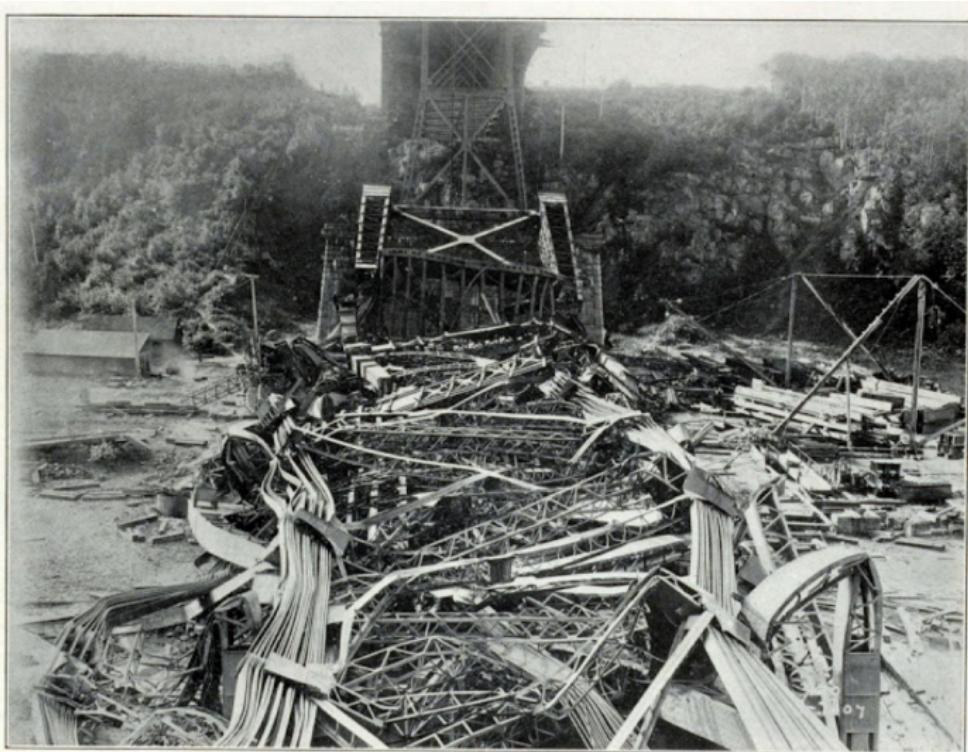
Engineers must understand it does not undermine their authority to have someone else validate their work.

# The Aftermath



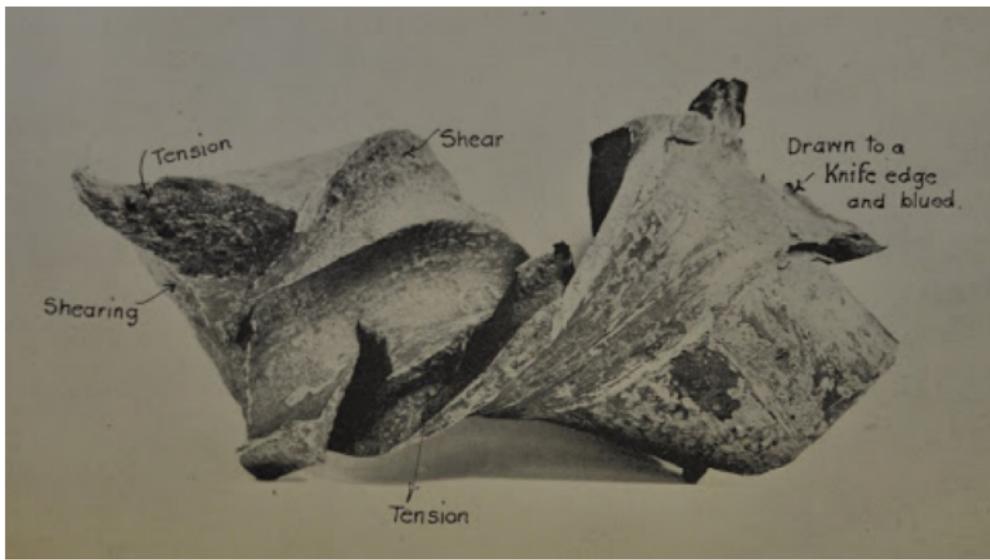
Q. View from the west of the wreckage inside the main pier. Note the twisted web of ASL; the lower end of post P4 inside CP6L; the splice plates between A11L and 10L cantilever arm; CP5L; and the spawling of the masonry coping which was struck by A11R.

# The Aftermath

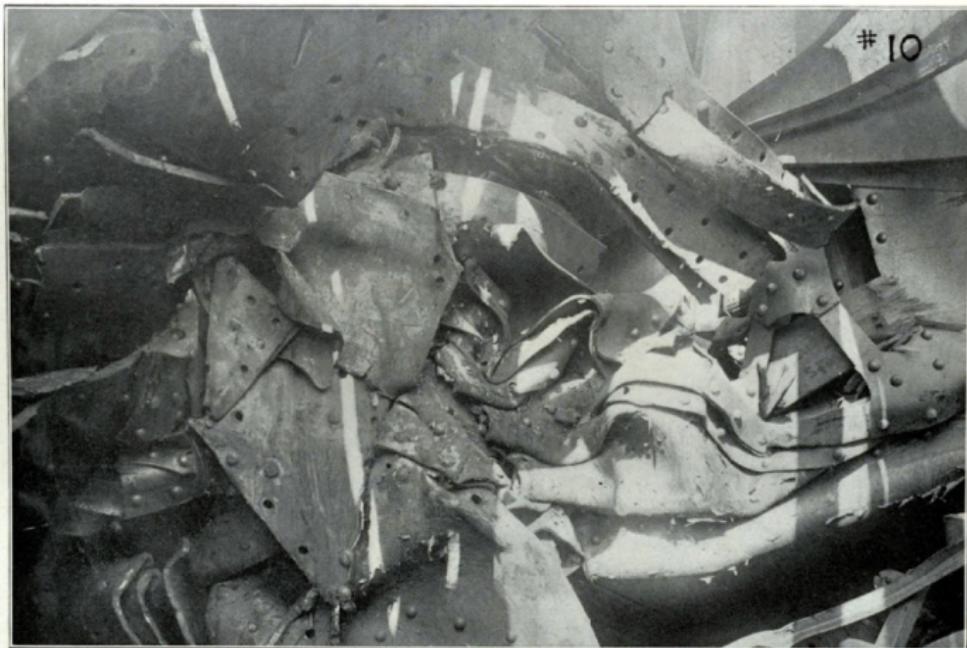


20. General view from the main pier southwards. Note the moderate damage to the upper laterals.

# The Aftermath

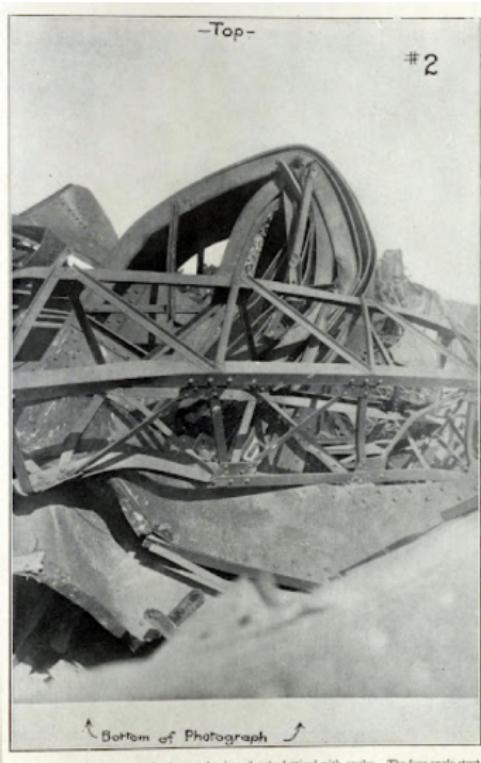


# The Aftermath

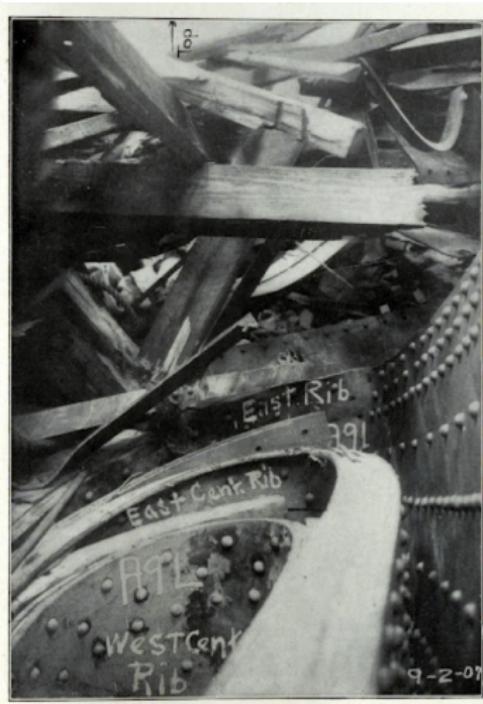


10. Shows the complete chaos to be seen at some points of the wreckage. This view is interesting only as an indication of the magnitude of the forces at work during the catastrophe. Even in this distorted mass there is no evidence of poor material.

# The Aftermath



2. Shows buckling of a post having two laminated webs fastened with angles. The four-angle strut in the foreground is part of the lateral system.



21. View of bend shown in 20, but taken looking north. Date, Sept. 2, 1907.

The Discipline Committee may find a member of the Association or a holder of a temporary licence, a provisional licence or a limited licence to be incompetent if in its opinion,

- (a) the member or holder has displayed in his or her professional responsibilities a lack of knowledge, skill or judgment or disregard for the welfare of the public of a nature or to an extent that demonstrates the member or holder is unfit to carry out the responsibilities of a professional engineer; or
- (b) the member or holder is suffering from a physical or mental condition or disorder of a nature and extent making it desirable in the interests of the public or the member or holder that the member or holder no longer be permitted to engage in the practice of professional engineering or that his or her practice of professional engineering be restricted.

# Professional Misconduct

As a consequence of a number of engineering disasters, behaviour detrimental to acceptable practice has been collectively labeled **professional misconduct**.

Section 72 (2) of O.Reg. 941 gives the definition of professional misconduct.

You do not have to memorize these; they will be provided for you in any exam.

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(a) negligence; that is, an act or an omission in the carrying out of the work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(b) failure to make reasonable provision for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(c) failure to act to correct or report a situation that the practitioner believes may endanger the safety or the welfare of the public

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(d) failure to make responsible provision for complying with applicable statutes, regulations, standards, codes, by-laws and rules in connection with work being undertaken by or under the responsibility of the practitioner

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(e) signing or sealing a final drawing, specification, plan, report or other document not actually prepared or checked by the practitioner

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(f) failure of a practitioner to present clearly to the practitioner’s employer the consequences to be expected from a deviation proposed in work, if the professional engineering judgment of the practitioner is overruled by non-technical authority in cases where the practitioner is responsible for the technical adequacy of professional engineering work

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(g) breach of the Act or regulations, other than an action that is solely a breach of the code of ethics

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(h) undertaking work the practitioner is not competent to perform by virtue of the practitioner’s training and experience

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(i) failure to make prompt, voluntary and complete disclosure of an interest, direct or indirect, that might in any way be, or be construed as, prejudicial to the professional judgment of the practitioner in rendering service to the public, to an employer or to a client...

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(i) ... and in particular, without limiting the generality of the foregoing, carrying out any of the following acts without making such a prior disclosure:

- 1** Accepting compensation in any form for a particular service from more than one party.
- 2** Submitting a tender or acting as a contractor in respect of work upon which the practitioner may be performing as a professional engineer.
- 3** Participating in the supply of material or equipment to be used by the employer or client of the practitioner.
- 4** Contracting in the practitioner’s own right to perform professional engineering services for other than the practitioner’s employer.
- 5** Expressing opinions or making statements concerning matters within the practice of professional engineering of public interest where the opinions or statements are inspired or paid for by other interests,

Note that any secret commissions are also considered criminal under the Criminal Code of Canada:

## **Secret commissions**

426. (1) Every one commits an offence who

(a) directly or indirectly, corruptly gives, offers or agrees to give or offer to an agent or to anyone for the benefit of the agent – or, being an agent, directly or indirectly, corruptly demands, accepts or offers or agrees to accept from any person, for themselves or another person – any reward, advantage or benefit of any kind as consideration for doing or not doing, or for having done or not done, any act relating to the affairs or business of the agent's principal, or for showing or not showing favour or disfavour to any person with relation to the affairs or business of the agent's principal; or

- (b) with intent to deceive a principal, gives to an agent of that principal, or, being an agent, uses with intent to deceive his principal, a receipt, an account or other writing
- i) in which the principal has an interest,
  - ii) that contains any statement that is false or erroneous or defective in any material particular, and
  - iii) that is intended to mislead the principal.

## **Privity to offence**

(2) Every one commits an offence who is knowingly privy to the commission of an offence under subsection (1).

## **Punishment**

(3) A person who commits an offence under this section is guilty of an indictable offence and liable to imprisonment for a term not exceeding five years.

What is an indictable offence?

- It requires either an indictment following a preliminary hearing to determine if there is a *prima facie* case
- Allows for a trial by jury
- Can apply for a pardon after ten years
- Also known as a felony

This contrasts with summary conviction offences:

- Maximum sentence is 6 months or a fine of \$5,000
- Must be charged within six months and no fingerprints required
- Can apply for a pardon after five years
- Also known as a misdemeanour

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(j) conduct or an act relevant to the practice of professional engineering that, having regard to all the circumstances, would reasonably be regarded by the engineering profession as disgraceful, dishonourable or unprofessional

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(k) failure by a practitioner to abide by the terms, conditions or limitations of the practitioner’s licence, provisional licence, limited licence, temporary licence or certificate

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(I) failure to supply documents or information requested by an investigator acting under section 33 of the Act

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(m) permitting, counselling or assisting a person who is not a practitioner to engage in the practice of professional engineering except as provided for in the Act or the regulations

72. (2) For the purposes of the Act and this Regulation, “professional misconduct” means:

(n) harassment; that is, engaging in a course of vexatious comment or conduct that is known or ought reasonably to be known as unwelcome and that might reasonably be regarded as interfering in a professional engineering relationship

# How to Avoid Professional Misconduct

- (a) Don't be negligent.
- (b) Try to preserve life, health, property.
- (c) Correct/report dangerous situations.
- (d) Comply with statutes, regulations, codes, by-laws...
- (e) Check anything you sign/seal/date.
- (f) If a non-technical authority requires a dangerous deviation from a design, you must point this out clearly and preferably in writing.
- (g) Abide by the PEA and O.Reg.941
- (h) Only engage in work in which you are competent
  - (i) Disclose any potential conflicts of interest
- (j) Don't behave disgracefully, dishonourably, or unprofessionally.
- (k) Obey the terms/conditions/limitations of the license.
- (l) Cooperate with any investigation.
- (m) Don't encourage/support unlicensed people practicing
- (n) Don't harass people.

# References & Disclaimer

- [1] D. W. Harder, "ECE 290 Lecture Materials," 2013.  
Online; accessed 31-May-2016.
- [2] J. Vale, "ECE 290 Course Notes," 2011.

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