DECISION AND REASONS

In the matter of a hearing under the *Professional Engineers Act* and in the matter of a complaint regarding the conduct of A MEMBER of the Association of Professional Engineers of Ontario and A HOLDER of a Certificate of Authorization.

This matter came on for hearing before a panel of the Discipline Committee on December 11 and 12, 2006, and September 18, 2009, at the Association of Professional Engineers of Ontario (association) in Toronto. The association was represented by Neil J. Perrier. Christopher Wirth acted as independent legal counsel (ILC). The member and holder were not represented by counsel.

THE ALLEGATIONS

The allegations against the member and holder, as stated in Appendix A of the Notice of Hearing dated July 31, 2006, are as follows:

It is alleged that the member is guilty of incompetence and that the member and holder are guilty of professional misconduct, the particulars of which are as follows:

1. The member was, at all material times, a member of the Association of Professional Engineers of Ontario. The holder was, at all material times, the holder of a Certificate of Authorization. The member was, at all material times, the engineer responsible for the engineering services of the holder.

2. Two privately owned cable suspension bridges at Eagle Canyon Adventures (ECA), north of Dorion, ON, were open to the public all year for sightseeing and rappelling. ECA was owned by Harvey Hamel (Hamel). The first bridge, with a span of 85 metres, was constructed in 1991 and the second bridge, with a span of 135 metres, was constructed in 2004. These bridges were not designed or constructed under the direction of a professional engineer. Workers employed by ECA occasionally used these bridges, and the Ministry of Labour (MOL) had concerns about the safe loading capacity of the bridges. Tim Merla, P.Eng. (Merla), of MOL requested ECA to provide a report bearing the seal and signature of a professional engineer stating the load limits in accordance with the *Occupational Health and Safety Act*.

3. On November 16, 2004, the member issued a sealed and signed report to MOL. This report indicated that no allowance was made for a build-up of snow on the bridge. The member certified that the 1991 bridge could safely carry 12 people and the 2004 bridge could carry 16 people.

4. In a memorandum dated November 23, 2004, addressed to the member and holder, Merla requested clarification on load sharing of the four cables of each bridge, reduction factors for the rope terminations, 10 per cent dead load used for the rain and wind allowance, 15 per cent of live load used for dynamic load, snow accumulation limits, rappelling allowance and horseplay exclusion. Merla also questioned the member if he had examined the condition of the wire rope inside the plastic sheath and the rope core bulging out of the end terminations on the old bridge.

5. On December 3, 2004, in a letter to Hamel, which was not sealed or signed, the member and holder provided the revised load carrying capacity in response to Merla's letter of November 23, 2004. The member concluded that the 1991 bridge could carry 12 people (no change) and the 2004 bridge could carry eight people (a reduction from the 16 people noted previously). In the same letter, the member requested that Hamel forward the revised loading capacity of the bridges to Merla.

6. On January 10, 2005, in a letter to the member and holder, Merla asked if the member was confident that unequal load sharing would not occur.

7. On January 26, 2005, in a letter to Hamel, which was not sealed or signed, the member and holder responded to Merla's letter of January 10, 2005. At the request of the member, Hamel forwarded the response to Merla. The member had, again, reduced the loading capacity of the 1991 bridge and the 2004 bridge to 11 people and seven people, respectively, to account for the possibility of some eccentric loading resulting in unequal load sharing of the cables.

8. In summary, it appears that the member and holder:
   (i) provided incorrect loading capacities of the suspension bridges;
   (ii) did not provide calculations on the limitations of the critical elements of the bridges; and
   (iii) failed to examine the actual conditions of the bridges.

9. PEO retained an independent expert, W. Victor Anderson, P.Eng. (Anderson), of Delcan Corporation (Delcan), to review the work of the member and the holder. In a report dated November 30, 2005, the expert provided the following conclusions and comments:

(a) A comparison of the benchmark evaluation process developed by Delcan to the process apparently used by the member showed a marked lack of completeness in the work carried out by the member. This was shown clearly in the sequence of follow-up letters and responses, which the member generated in response to questions from MOL;

(b) There is evidence of a series of errors and omissions in the member's work. For example, critical path elements of the bridges (such as the cable terminations) were not evaluated in the original instance. No commentary or calculation is provided as to the anchorages. Several other elements of the bridges remain unexplored;

(c) The actual condition of the bridges seems not to have been fully taken into account. A key factor in this is the exposure of the rope core in the main cable, at the cable loop, and the evident substandard condition of the cable structure at that location. There was an effort to examine the cable structure, but this seemingly missed the poorest condition and, therefore, potentially the most critical element of the cable;

(d) The calculations by the member included some inherent significant factors of safety, and these generated answers as to allowable pedestrian loads, which were very limited. However, factors of safety are not intended to cover errors and omissions;

(e) Delcan identified some thoughts, which may have entered into the member's process of evaluation, and which may explain some elements of it. For example, he may have considered the history of the 1991 bridge as to snow load, compared to pedestrian live load. There is no evidence of this, however; and

(f) The bridges are in service under very limited load restrictions but, based on Delcan observations, the bridges should be subject, at an early date, to rigorous inspection, testing, analysis and evaluation by a firm expert in bridge engineering and with experience in cable-supported structures of this type.

10. By reason of the aforesaid, it is alleged that the member and holder:
   (i) breached section 53 of Regulation 941 under the *Professional Engineers Act* by failing to apply his seal to the letters of December 3, 2004, and January 26, 2005;
   (ii) issued two reports with erroneous values of the loading capacity of the bridges;
   (iii) failed to evaluate and provide calculations on the limitations of critical elements of the bridges (such as cable termination design and anchorage capacity);
   (iv) failed to conduct a complete evaluation of all other elements of the bridges (such as the timber decking, the hangers, the fencing and cable struts);
   (v) failed to examine the actual condition of the bridges (such as the condition of wire rope in the plastic sheath and rope core bulging out of the end terminations on the old bridge); and
   (vi) acted in an unprofessional manner.

11. By reason of the facts aforesaid, it is alleged that the member is guilty of incompetence, as defined in section 28(3)(a), and that the member and holder are guilty of professional misconduct, as defined in section 28(2)(b), of the *Professional Engineers Act*, R.S.O. 1990, Chapter P. 28.

12. "Incompetence" is defined in section 28(3)(a) as: "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."

13. "Professional misconduct" is defined in section 28(2)(b) as: "The member or holder has been guilty in the opinion of the Discipline Committee of professional misconduct as defined in the regulations."

14. The sections of Regulation 941/90 made under the said act and relevant to this misconduct are:

(a) Section 72(2)(a): negligence as defined at section 72(1) means 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;

(b) Section 72(2)(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;

(c) Section 72(2)(d): failure to make responsible provision for complying with applicable statutes, regulations, standards, codes, bylaws and rules in connection with work being undertaken by or under the responsibility of a practitioner;
(d) Section 72(2)(g): breach of the act or regulations, other than an action that is solely a breach of the code of ethics;
(e) Section 72(2)(h): undertaking work the practitioner is not competent to perform by virtue of the practitioner's training and experience; and
(f) Section 72(2)(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.

Counsel for the association advised that the association was not calling any evidence with respect to the allegations set out in paragraph 9(c) of the Notice of Hearing.

PLEA OF THE MEMBER AND HOLDER

The member and holder denied the allegations set out in the Notice of Hearing.

OVERVIEW

The hearing arose as a result of the involvement of the member and holder in the inspection of two suspension bridges to determine their condition and safe loads. The bridges were built in 1991 and 2004, and spanned Eagle Canyon, near Dorion, north of Lake Superior. They were on private property and were designed and constructed by the owner of the property, Hamel, who was not a professional engineer. The original bridge, built in 1991, had a span of about 280 feet and the second bridge, built in 2004, had a span of about 440 feet.

In July 2004, MOL inspectors visited the site as a result of a complaint by a member of the public and took photographs to illustrate what they believed to be unsatisfactory conditions. They reported to Merla, regional engineer in the MOL office in Thunder Bay. Merla recommended that a stop work order be issued to the owner, outlining deficiencies and requiring an inspection of both bridges by a professional engineer. Hamel phoned the member, told him of the ministry report, and asked him to visit the site to assess the condition of the bridges and to provide a report to the ministry. The member attended the site in November and inspected the bridges. There were some records of the construction of the original bridge but no drawings.

The member reported his findings in November 2004 to Hamel and to Merla. Merla responded to the member in November asking how some factors had been determined, and expressing his concerns that some loads had not been considered. In December, the member responded to these questions in a letter to Hamel. The letter was signed, but not sealed. He confirmed that rope termination factors were not included in his November report. Allowing for them on the 1991 bridge did not change the allowable loading. On the 2004 bridge, including rope termination factors reduced the allowable loading from 16 to eight people.

On January 10, 2005, Merla again wrote to Hamel asking for confirmation that the member had considered unequal loading of the cables. The member replied on January 26, 2006 that he believed that the bridge would act as a unit. To provide for the possibility of some unequal loading, however, he made an allowance of 10 per cent on the live load. This reduced the allowable number of people on each bridge by one.

EVIDENCE OF TIMOTHY MICHAEL MERLA, P.ENG.

Merla testified that he was a regional engineer for MOL, based in Thunder Bay. He graduated from Queen's University in mechanical engineering in 1977 and was a member of the association. He joined MOL in 1988 after a period working in industry.

Two MOL inspectors from the Thunder Bay office visited the Eagle Canyon bridges in July 2004 to investigate a complaint from a member of the public about what were alleged to be inadequate rope terminations on the original bridge. The two bridges, built in 1991 and 2004, were on privately held property and spanned Eagle Canyon near Dorion, north of Lake Superior. The owner, Hamel, told the inspectors he had overseen the construction of the bridges. He was not a professional engineer. The bridges were used by tourists viewing the canyon and as part of a hiking trail. There was also rock climbing in the canyon and rappelling from the centre of the bridge.

After receiving the complaint, Merla investigated to find out which agency had jurisdiction for public safety on the bridges. He found there wasn't one. As there were two workers at the site, he was able to use his ministry's legislation. He recommended issuing two orders to the inspectors: first, a stop work order on the 1991 bridge, based on the end connections of the wire rope, the clip connections, and the bulging of the core. He also recommended an engineering report for each bridge to specify the load limits to ensure that they were not overloaded.

Hamel arranged for repairs to be made to the cable terminations on the 1991 bridge and asked the member to prepare a report on the load limits. The member prepared reports on each bridge dated November 16, 2004, and faxed them to Merla in Thunder Bay. These reports were stamped and sealed by the member. The MOL inspector then returned to the site, observed the repairs, and removed the stop work order.

Merla testified that he received the member's engineering reports specifying the load limits on each bridge at his office in Thunder Bay on November 16, 2004. He reviewed the reports and had questions about how the factors had been determined, as well as some concerns that certain loads had not been taken into account. On November 23, 2004, he wrote a letter to the member asking how it was ensured that the load was shared equally by all four cables on both the 1991 and 2004 bridges.

Merla also asked if the reduction factor for the end terminations had been applied, how the member determined the allowance of 10 per cent of dead load for the rain and wind allowance, and if there was a maximum wind speed above which the bridges should not be used. Merla also asked the member how he arrived at the 15 per cent of live load for use as a dynamic load, what accumulation of snow would result in the bridge being closed, if rappelling from the bridge would be permissible, and for clarification about how running and horseplay would be prohibited. Concerning the 1991 bridge, Merla also asked if the bulging rope core at the end terminations had been corrected, and if the member was able to verify the condition of the wire rope inside the plastic sheath. Counsel for the association asked how Merla determined that the member had applied an equal load factor to all four cables. Merla responded that the member had determined the total load the bridge could accommodate by using the maximum load of each of the four cables.

The member replied to these concerns in a letter dated December 3, 2004, addressed to Hamel. Merla testified that, in this letter, the member reconfirmed that he believed the cables would all share the load equally. The member confirmed that rope termination reaction factors were not included in his original report. Allowing for these factors for the original bridge did not change the allowable loading. On the 2004 bridge, allowing for the rope termination factors reduced the maximum number of people on the bridge to eight from 16. The member's report suggested that, if the bridge cable sag was increased to 14 feet, this would result in increasing the maximum number of people on the bridge to 14. The member clarified how he had obtained the factors for rain, wind allowance and dynamic load. As regards snow on the bridge, the member stated that an accumulation of snow that covered the surface of the deck would result in closure. Running and horseplay were to be prohibited. Rappelling would be permitted under specific conditions. The member also reported that the terminations on the 1991 bridge had been upgraded and the rope core exposure had been corrected. Merla testified that this agreed with the information he had received from his MOL inspectors.

Merla further testified that he was still concerned by the assumption that the four cables share the load equally and that, if uneven load sharing occurred, the cables might then be stressed beyond their safe working load. On January 10, 2005, he wrote to the member asking him to confirm that he was confident that unequal load sharing could not occur or whether he wished to re-evaluate the design.

The member replied to Hamel in a letter dated January 26, 2005. Merla said the member wrote in his letter that the cables were tensioned so that profiles were the same, indicating an equal load in each cable. They were then tied together by struts and fencing, which, in his opinion, would cause them to act as a unit. Wind loading and dynamic sway forces could result in some uneven loading. These were not analyzed in detail, but were accounted for by applying a factor of 10 per cent on the live load. To provide for the possibility of some eccentric loading or unequal load sharing of the cables, he allowed a further 10 per cent of the live load. This reduced the number of people on each bridge by one; so the allowable number on the original bridge was reduced from the member's original estimate of 12 to 11 and, on the 2004 bridge, the original estimate was reduced from 16 to seven.

Responding to a question from counsel for the association, Merla testified that he was not comfortable that an adequate design review had been conducted. For this reason, he notified PEO of his concerns in early February 2005.

CROSS-EXAMINATION BY THE MEMBER

The member asked Merla if the member's two letters sent after the original engineering report were signed. Merla testified that they were. The member asked if there were written instructions regarding the scope of work of the engineering assessment. Merla testified that the original order sent to Hamel dated August 24, 2004, stated the type of loads to be looked at: dynamic, wind, dead load, etc.

The member stated that he had not had the advantage of seeing this order and that Hamel had told him that he had not received any direct written instructions from the ministry. After receiving advice from the parties, the chair ruled that the member could look at the order and decide if he wished to have it entered into evidence.

The member noted that most concerns seemed to be related to load factors. Did he have any other concerns? He noted a mention of severe corrosion on the cables. Was this a judgment call? If so, who made it, and how was it determined that it was severe?

Merla replied that he made the judgment call based on the photographs of the end terminations. In his opinion, they were evidently corroded with the core exposed. His opinion was based on the photographs taken in August 2004. He agreed that he did not see similar evidence in the photographs taken in November 2004.

RE-EXAMINATION BY COUNSEL FOR THE ASSOCIATION

Counsel asked that the document referred to in the member's cross-examination be entered into evidence. Merla testified that the document was a project form left with Hamel by the inspectors after they visited the workplace on August 23, 2004. The form, in part, stated: "…Tension on the bridge

cable and anchorage may exceed the manufacturer's stated safe working loads. This tension is dependent on cable deflection and load sharing, and all loads/load combinations likely to be applied to the bridge. These loads include the dead load of the bridge components, live loads due to occupancy (people), snow, wind, and dynamic loading due to impact. The owner shall provide a report from a professional engineer stating the load limits of the old bridge structure and its anchorage."

QUESTIONS FROM PANEL MEMBERS

Colin Moore, P.Eng., noted that the project form entered into evidence was unsigned and inquired as to its admissibility. Counsel for the association advised that it was clearly admissible as it provided relevant information about the concerns of the MOL and, further, that it could not be a matter of admissibility as it had already been admitted into evidence. He also noted that it was not a question of the association failing to disclose as this document was not in the possession of the association and that he saw it for the first time at the same time as the member.

Responding to a question from the chair, Merla told the panel that MOL's inspectors leave a project report at the worksite. This form has to be signed by the recipient and posted at the workplace. The inspector told Merla that he had discussed it with Hamel. The copy entered into evidence was not an original, but was printed off the computer database.

Merla, responding to questions from Derek Wilson, P.Eng., testified that two stop work orders were issued. The first was a stop work order on the 1991 bridge as a result of the observed deficiencies in the end cables. There was a second order issued for each bridge to have a load limit provided in a written report by a professional engineer. There were no orders issued to prevent people from using the bridge until the engineering investigation had taken place as his ministry only had legislation to protect the workers. No other agency had responsibility for the bridges.

Responding to questions from Tim Benson, P.Eng., Merla testified that he knew of no code that covered the design of bridges similar to these. One of the issues that concerned him on the 1991 bridge was that there were no thimbles at the end of the wire rope, which caused crushing of the rope and the core to be exposed. There were also only three wire rope clips on the termination where there should have been five, and some, if not all of the clips, were attached in the wrong manner. The saddle was on the wrong end of the rope. Some evidence of corrosion could be seen on one of the cables. The 2004 bridge appeared to have very little sag for the span, and that was the reason for asking for it to be checked and a load limit given for both bridges. Although there was no code covering the design of bridges like this, there were a number of manuals published, as well as manufacturer's documentation about recommended practices.

The chair asked if the reason for this complaint was simply the changes in the number of people permitted on the bridge. Merla testified that it was his concern that the reports suggested to him that perhaps not all factors had been considered; that every time he asked a question, new factors were applied, and the permissible number of people continued to decline.

RE-EXAMINATION BY THE MEMBER

Merla agreed that the clips, symbols and saddles he was concerned about had all been repaired when the ministry revisited the site at the end of October 2004.

EVIDENCE OF TIMOTHY JOHN WRIGHT, P.ENG.

Timothy John Wright, P.Eng. (Wright), testified that he was currently a principal and technical director of transit structures with Delcan. He joined Delcan in 1987. He graduated in civil and structural engineering from Sheffield University in the UK in 1970 and had been licensed with the association and the Institution of Civil Engineers in the UK since 1977.

Much of his career was in bridge design. While at Delcan, he had personally designed 30 to 40 bridges and had been responsible for the design of hundreds of bridges in Ontario. Delcan's regular work also included annual and biannual inspections of the construction and condition of bridges. Among other projects, Wright was responsible for the inspection of the Thousand Islands Bridge. This is a major border crossing between Canada and the US and includes a major cable suspension bridge. Wright's responsibilities included inspection of all the bridge spans, including the suspension span. He also wrote the inspection reports and completed the inspection forms.

The member asked if Wright had ever worked on a small pedestrian suspension bridge such as the Eagle Canyon bridge. Wright testified that he had worked on one some years ago. It was constructed without professional engineers and was mostly timber construction with rope suspenders. He did an evaluation and the bridge was subsequently closed. Responding to a question from counsel for the association, Wright testified that he felt confident to provide an opinion about the bridges under question.

Counsel for the association stated that the evidence and testimony showed that Wright had over 30 years of experience in bridge engineering. This included his involvement in the inspection of hundreds of bridges across Ontario, including the Thousand Islands Bridge. This evidence demonstrated that Wright was qualified to give opinion evidence on the standard of practice of the profession in issuing reports regarding the condition of bridges. The panel accepted Wright as an expert witness in the area of bridges.

Wright testified that the association approached Delcan in March 2005 to review the issues surrounding this complaint. Delcan provided a scope of work in April 2005. This covered a third-party review of the engineering reports produced by the member to focus on whether there were any errors and/or omissions by the member, the potential impact of any such errors and omissions, and a review of all the available data, including data available from existing codes and manufacturers. Also to set out the methodology Delcan would have used

if asked to carry out a similar evaluation and to compare it with the approach used by the member.

The review included the November 2004 reports on the bridges together with the member's subsequent letters of January and February 2005. They also reviewed the photographs taken in July 2004 by MOL inspectors. They were not engaged to visit the site.

Wright testified that he understood the bridges were designed by the owner of the bridge, or the father of the owner, in the case of the 1991 bridge. Neither of them were professional engineers. He understood that the bridges were generally used for recreational hiking and that some rappelling off the side of the bridge was also done. After reviewing the material provided, he concluded that the key elements included: cable terminations and loop, cable clips, cable wedge anchors, turnbuckles, thimbles and the anchorages to the rock. Also, the struts supporting the cables, hangers that connected the two sets of cables, fencing, the deck system and the cable protection placed over the upper cables.

The cable terminations on the 1991 bridge used a folded back cable with cable clips. It was basically three clamps, which were at different angles of connection. The 2004 bridge used a cable wedge anchor.

The key finding in the member's November 16, 2004 report was that the safe allowable load on the 1991 bridge was 12 people and the maximum load on the 2004 bridge was 16 people. On November 23, 2004, Merla wrote to Hamel raising some concerns. The member responded on December 3, 2004. The maximum load on the 1991 bridge remained the same but, on the 2004 bridge, the maximum number was reduced from 16 to eight. Merla wrote again on January 10, 2005, about his concerns as to whether there was equal load sharing between the cables. The member then revised his original estimates and reduced the safe load on the original bridge to 11 people and, on the 2004 bridge, to seven people.

Wright testified that it seemed the member had been incompetent. If his original results had been correct, he would not have sent two follow-up letters reducing his estimate of the safe load. Wright agreed that he could not find any applicable code that would apply directly to a bridge of this type. The closest might be the Canadian Highway Bridge Design Code. However, the bridges were already built, so any attempt to evaluate would be back engineering. This meant that one had to use engineering judgment. To do this, you required a lot of background information or background knowledge, and it needed to be very well documented.

Wright testified that, in his experience, the standard of practice for evaluating bridges like this should include:

- gathering data about the original construction;
- discussion with the owner of the bridge about the history, design, construction, and in-service history;
- discussion with individual firms involved in the original design and construction;
- visual examination and inspection of every element on the bridge with detailed documentation;
- sampling materials for testing to identify them and verify information;
- structural analysis; and
- identifying key critical elements of the bridge and finding a governing factor considering each and every component of the bridge, verifying this on site, and documenting it in a report.

The types of load to be considered in preparing the report should include first the dead loads that would be obvious from looking at the bridge together with any available drawings of the construction.

Significant live loads included pedestrians and snow loads. With the prolonged span, you wanted a very light structure, and estimating the wind loads would be very difficult, unless you were able to do some kind of a wind tunnel testing. Interviewing users of the bridge to collect observations about its behaviour under actual conditions might be useful.

Wright testified that Delcan used this approach when evaluating the member's reports and conclusions. They considered both equal and eccentric live loads. Wright believed that it was entirely possible there would be eccentric pedestrian live loads. People would tend to walk down the middle of the structure and hold the rails, but they also used the bridge for looking down the canyon when they would tend to gravitate towards the side and also, when watching people rappelling off the sides of the canyon. So, allowing for uneven pedestrian loading would be a prudent approach.

They also considered snow loads and found that these were significantly greater than any pedestrian loading. It was their understanding that the structure was clear of snow, but it may not have been at certain times. The snow load was probably 10 to 15 times the pedestrian load.

Wright testified that one of the key issues was the anchorages of the bridge. All that was visible on the photographs were cables vanishing underneath concrete. In the member's report, he referred to a four-inch diameter steel bar, but there was no indication of the size of the hole, whether it was drilled, whether it was excavated, what the length of the dowels might be, or the type of concrete used. In the case of the original bridge, there was not even the mention of the size of the bar.

The member's original report did not refer to cable terminations. This was a serious omission. There was also no reference

to the struts. The member assumed that the bridge cables were all uniformly loaded. In his report of January 26, 2005, he considered the eccentric loading of pedestrians and the fact that they could stand closer to one side of the bridge than the other. This reduced his maximum load on the original bridge from 12 people to 11 and, on the 2004 bridge, from eight to seven.

The member applied a factor of safety of four. Wright believed this to be the industry standard and that it was a reasonable factor of safety. In Wright's opinion, factors of safety should not be used to cover other possible errors and omissions.

In Wright's opinion, the work carried out was reasonable but incomplete. There were errors and omissions. The cable terminations and the unbalanced loading were overlooked, and the struts and anchorage were reviewed but not documented in any detail.

Wright testified that, based on the photographs introduced as evidence, improvements had been made to the cables between the time of the photographs taken by MOL inspectors in July 2006 and the member's visit in November 2006. Responding to questions from counsel for the association, Wright also testified that a signed and sealed report reviewing a pedestrian suspension bridge that left out areas, such as the struts and the cable terminations, would not meet the standards of practice of the engineering profession for this type of work.

CROSS-EXAMINATION BY THE MEMBER

Wright agreed that the calculations done by the member, accepting his load factors, were correct. Wright estimated the snow load on the two bridges would be equivalent to over a hundred people. Wright had not been on site nor had he contacted the owner or constructor of the bridge, but Anderson had talked to the owner. Hamel mentioned that his father, not a professional engineer, designed the bridges and that Wire Rope Industries (WRI) in Thunder Bay provided some assistance, and that there were detailed construction records of the old bridge, including photographs of the anchorages. Hamel confirmed that the member had been on site. Hamel was comfortable that the bridges would handle 50 people and was disappointed that the member's recommendation was much lower. The load limits on the bridges were posted in accordance with the member's recommendations. The original bridge had seen significant snow loads, but the new bridge had been kept essentially clear of snow.

QUESTIONS FROM THE PANEL

Responding to questions from the panel, Wright testified that:

- It probably would not be possible to do wind tunnel testing on a project of this size;
- Delcan reviewed the member's assumptions and found them not unreasonable;
- He would have recommended closing the original bridge in the condition when the MOL first looked at it. The connections were definitely of concern;
- The snow load did represent a considerable overload for the bridge, but there was no instrumentation to say how well it was behaving, nor did the member comment in his report that he had considered this;
- He agreed that the member's calculations in his report were arithmetically correct;
- Considering the probable large snow load, he would also have probably recommended that the bridge be kept clear of snow and ice and not allowed people on the bridge in winter; and
- He found the member's report to be brief. He would have expected at least 10 to 15 pages. Considering that the member was perhaps the first professional engineer to review the bridges, he would have expected a more thorough approach.

RE-EXAMINATION BY COUNSEL FOR THE ASSOCIATION

Wright testified that, when the member inspected the second bridge in November 2004, it would not have seen any snow load as it was only built in 2004.

Reviewing a photograph taken in July 2004 of cables on the original bridge built in 1991, he agreed there were indications of strain and that they might have been caused by snow loading.

FURTHER CROSS-EXAMINATION BY THE MEMBER

Wright testified that he was unable to estimate the cost of instrumenting and load testing the bridges, or the time it would take.

TESTIMONY OF THE MEMBER

The member asked to be considered as an expert witness. After receiving submissions from counsel for the association and advice from the ILC for the panel, the chair ruled that, while the member might well be qualified to be an expert witness in other circumstances, he could not be considered a third-party witness providing objective, impartial assistance to the panel in this case. He, therefore, could not be considered an expert witness.

The member testified that he had long experience in bridges and cable supported systems. After graduating from the University of Alberta in 1961, he spent three years in an engineering unit of the military, mostly in bridging and airfield construction, using tables and polls. He then joined C.D. Howe Company in Thunder Bay and worked there for 10 years. His work was mostly associated with grain elevators, plus a three-year stint as resident engineer for a nuclear reactor in Taiwan. He returned to Thunder Bay and spent nine years with Cook Engineering. His work involved mining and hoisting facilities, and ship loaders for the grain industry using long cantilever booms supported by cable systems.

He then formed Resource Engineering, which was involved in many cable-supported systems. He later joined UMA in Thunder Bay, where he was involved in papermill and sawmill projects, and designed many suspension bridges for

pipelines carrying chips and sawdust. During this time, he was accepted as an expert witness on a case concerning a crane accident.

Since 1991, he has been an independent engineering consultant. Most of his work involved inspection and quality verification engineering for most of the bridges being built in Northern Ontario. He was currently the main QVE engineer on a multi-span bridge replacing an old timber bridge.

He was approached by Hamel in November 2004 and asked to review the two bridges to establish the number of people who could be transported across the bridge. He first interviewed the owner to find out the records of the original construction of the two bridges, he then inspected the bridges, surveyed the actual cable profiles, took pictures of the site and returned to his office to write his report.

Hamel provided the member with photos of the construction of the anchorage of the 2004 bridge. The anchorage consisted of 12 four-inch-diameter high-strength steel dowels inserted into the bedrock at each end of the bridge. The holes were six feet deep. The bedrock in the photos appeared to be massive, with very few cracks. Each of the four cables was connected to a turnbuckle that was, in turn, connected to a heavy steel plate eight inches wide by one and one-quarter inches. There was a five-inch hole at the other end of the plate that was fitted over one of the 12 dowels drilled into the bedrock. The remaining eight dowels were arranged around the four connected to the cables and the whole mass then encircled with steel cables loading chains and reinforcing steel. This was then covered with about 18 inches of concrete.

On the original 1991 bridge, the loads were much less. The cables terminated at turnbuckles connected to two-inch diameter dowels inserted 30 inches into the bedrock. Half-inch gusset plates were welded to the dowels and the dowels were then embedded in 18 inches of concrete.

The member testified that, on his first visit to the site, knowing that the ministry had mentioned severe corrosion of a cable, he asked Hamel to cut off one end of a cable on the original bridge. The sample was taken from the loose end lying in the sand in November and sent to his office in November.

WRI supplied the cable for both bridges. Paxton of WRI visited the site before the member's November visit and advised the member that he had seen little corrosion. The member visited Paxton at his lab at WRI with the sample cut from the cable end. They unbraided the cable and confirmed there was little corrosion. A sample cut from the cable was put into evidence. The cables supplied by WRI for the 2004 bridge were galvanized, so there was no question of corrosion.

Merla's letters to Hamel raised questions about load sharing between the cables. The member testified that he included a further 10 per cent factor to the live load to allow for this. In conclusion, he reminded the panel that what the MOL inspectors found in July was not what he saw in November, as the owner had made improvements to the bridges in that time.

CROSS-EXAMINATION BY COUNSEL FOR THE ASSOCIATION

The member agreed that neither bridge was designed by a professional engineer and that, to the best of his knowledge, no other professional engineer had ever inspected either bridge. His instructions from the owner were to determine the limit on the number of people who could be on the bridge. He acknowledged that his report could have been more detailed. It would have been appropriate for him to document his thought processes on each component of the bridge. He agreed that the cables and their terminations, cable clips, wedge anchors, turnbuckles, thimbles, anchorages and struts supporting the cables were all critical elements of the bridge structure. Any documentation he reviewed and that led to his conclusions should have been documented in his report.

The member agreed that his original report on the 2004 bridge considered the turnbuckle loading to be the governing factor. He compared the available information with the design limit of the turnbuckle. His report did not consider the rope termination factor, which he included in his first revision that reduced the safe load from 16 to eight people. This factor should have been included in the first report. His later allowance for unequal loading of the cables should also have been included. This reduced the load on each bridge by one person.

STANDARD OF PROOF

The association bears the onus of proving the allegations in accordance with the standard of proof, which the panel is familiar with, set out in *Re Bernstein and College of Physicians and Surgeons of Ontario* (1977) 15 O.R. (2d) 477. The standard of proof applied by the panel, in accordance with the Bernstein decision, was a balance of probabilities with the qualification that the proof must be clear and convincing and based upon cogent evidence accepted by the panel. The panel also recognized that the more serious the allegation to be proved, the more cogent must be the evidence.

In this case, the panel considered the allegations and their possible consequences to be serious as a question of public safety was at issue.

DECISION

Having considered the evidence and the onus and standard of proof, the panel finds that the member and holder are not guilty of negligence as defined in paragraph 72(2)(a) of Regulation 941/90, and that the member and holder are guilty of professional misconduct as defined in sections 72(2)(g) and 72(2)(j) of Regulation 941/90 of the *Professional Engineers*

Act, R.S.O. 1990, Chapter P. 28. In particular, the panel finds that the member and holder:

- failed to express limitations in their report;
- failed to consider all the factors in the first report and so had to issue two revisions, which reduced the safe loading on the bridges; and
- signed the revisions to the reports, but did not sign and seal them.

Accordingly, the panel finds the member and holder guilty of professional misconduct.

REASONS FOR DECISION

It is uncontested that Hamel engaged the member and holder to provide an engineering report on the safe loading of the two bridges to meet the requirements of the order issued by Merla. It is also uncontested that the member attended at the site and knew that the bridges were not designed by a professional engineer and that this was the first examination by a professional engineer.

Limited information was available to the member as no drawings were available to him, and the bridges were already built. In using his professional judgment, he failed to express limitations on his conclusions that he knew or should have known.

When pressed by questions from Merla, he conceded that he failed to properly consider the rope termination factors on the two bridges. This did not reduce the safe load on the original bridge, but did reduce the safe load on the 2004 bridge from 16 to eight.

With regard to live loads, Wright's uncontested expert evidence was that the member's report should have considered the possibility of unequal loading on the cables. The member did this in the second revision to his report. This reduced the safe load on each bridge by one person.

Under cross-examination, the member conceded that he should have signed and sealed the revisions to his original report that was signed and sealed.

The member was found guilty of section 72(2)(g) for not signing and sealing his original report. Further, the member was found guilty of an unprofessional act under section 72(2)(j) for a failure to fully report analysis considerations and limitations in the original report, and for failure to consider all the factors in the first report. The evidence did not support a determination of negligence under section 72(2)(a), given the engineering judgment required, the safety factor included, and the uncontested accuracy of the calculations performed.

PENALTY

The panel will reconvene to hear penalty submissions but, if the parties are agreeable, the panel invites written submissions. If written submissions are agreed to, the association's penalty submissions are to be delivered within two weeks from the date of these reasons, the member's submissions within two weeks after delivery of the association's submissions, and the association's reply submissions within one week following delivery of the member's submissions. If the panel is to reconvene, it will be at the earliest possible date that the association, the member, and the panel are available.

RECOMMENDATIONS

The panel makes two recommendations:

1. The panel notes that all three professional engineers agreed that there was no legislation covering suspension bridges on private property similar to those at Eagle Canyon. It urges the association to approach the government of Ontario to advise them of this and to seek measures to protect public safety.

2. The panel notes that clients may ask engineers to accept a verbal engagement. In this case, it would have been prudent for the engineer to have confirmed to the client in writing their understanding of the scope of the work to be undertaken.

PENALTY

Following the issuance of this panel's Decision and Reasons dated December 23, 2008, and finding the member and holder guilty of certain instances of professional misconduct and, in accordance with the panel's directions, the parties provided written submissions as to the penalty to be imposed. The panel has considered the submissions and determines as set out herein.

The association sought the following terms of penalty in relation to the findings of the panel of the Discipline Committee:

(a) that the member and holder shall attend the Discipline Committee to be reprimanded;
(b) that the fact of the reprimand shall be recorded on the register;
(c) that the licence of the member and the holder's Certificate of Authorization shall be suspended for a period of six months from the date of the final Decision and Reasons of the panel;
(d) that the suspension of the licence of the member and the holder's Certificate of Authorization shall continue until such time as the member successfully completes the following technical examinations:
    (i) 98-Civ-A1 Elementary Structural Analysis, and
    (ii) 98-Civ-B1 Advanced Structural Analysis;
(e) that in the event that the member does not complete the technical examinations referenced in paragraph (d) above, within 12 months of the date of the final Decision and Reasons of the panel, his licence and the holder's Certificate of Authorization shall be suspended;
(f) that in the event that the member does not complete the technical examinations referenced in paragraph (d) above, within 24 months of the date of the final Decision and

Reasons of the panel, his licence and the holder's Certificate of Authorization shall be revoked; and

(g) that a summary of the Decision and Reasons in this matter be published in Gazette with reference to names.

The member requested that the time delay of almost two years in reaching a decision be taken into account and that the penalty should be considered as "already served." The member also identified a factual error in the panel's Decision and Reasons, specifically, one of the panel's reasons for its finding of professional misconduct was that the member did not sign and seal his original report. The member is correct. This finding was a factual error and, by this penalty decision, the panel corrects the Decision and Reasons to delete that finding. The panel considered the impact of this error and decided that the remaining findings still amount to professional misconduct and so confirms the panel's decision to find the member and holder guilty of professional misconduct.

In reaching its decision as to penalty, the panel considered the following:

(a) protection of the public;
(b) maintaining public confidence in the profession's ability to self-regulate;
(c) general deterrence;
(d) specific deterrence;
(e) rehabilitation;
(f) aggravating circumstances; and
(g) mitigating circumstances.

PENALTY DECISION

Having considered the evidence and the submissions by association counsel and the member, the panel orders:

1. that the allegations, decision, reasons and penalty be published in the official publication of the association without the member's name; and

2. a reprimand to the member emphasizing the unprofessional nature of his behaviour.

REASONS FOR PENALTY

The panel considered the confusion that arose due to the lack of specific regulations and standards, and the member's inappropriate actions to address his client's interests, as outlined in the Decision and Reasons, as a factor in the imposition of a penalty that would bring home to the member the unprofessional nature of his conduct. The panel considered the member's experience and current health as mitigating circumstances.

The panel considered that it has some general concern as to the protection of the public, but that there was no clear evidence that the bridge is unsafe. The panel considered the length of time this matter has taken to reach the penalty phase as a mitigating factor, and also takes note of the deletion of the erroneous finding as to the signing and sealing of the final report as another factor in formulating a penalty.

The panel considers this penalty will provide a reminder to the profession to be careful when amending one's analysis to avoid giving the perception that their work is defective, and to provide clear statements of limitations of their analysis. The panel accepted the association's argument that the member appears to minimize or deflect responsibility for his conduct. The panel noted that there was no evidence provided that the professional misconduct in this case was representative of the member's general standard of practice.

In the end, the panel believes that the public interest is being served by the penalty decision given and by its recommendation below.

PUBLIC SAFETY RECOMMENDATION

The panel, in deciding on penalty, finds it necessary to highlight one of its recommendations to the effect that all three professional engineers agreed that there was no legislation covering suspension bridges on private property similar to those at Eagle Canyon. If this is a correct statement of the state of the legislation, the panel urges the association to approach the government of Ontario to advise them of this and to seek measures to protect public safety.

The panel notes that, in the penalty submissions from the association counsel, it does not appear this recommendation has been addressed. The panel would like to reaffirm this recommendation with the expectation that the association pursue it.

The written Decision and Reasons was signed by Roydon Fraser, P.Eng., as chair on behalf of the other members of the discipline panel: J.E. (Tim) Benson, P.Eng., Glenn Richardson, P.Eng., Colin Moore, P.Eng., and Derek Wilson, P.Eng.

DISCIPLINE HEARING SCHEDULE

SEPTEMBER 13-15, 2010
KRIS OLSON, P.ENG.

OCTOBER 6-7, 2010
PAUL S.C. LIM, P.ENG. AND P. LIM AND ASSOCIATES LTD.