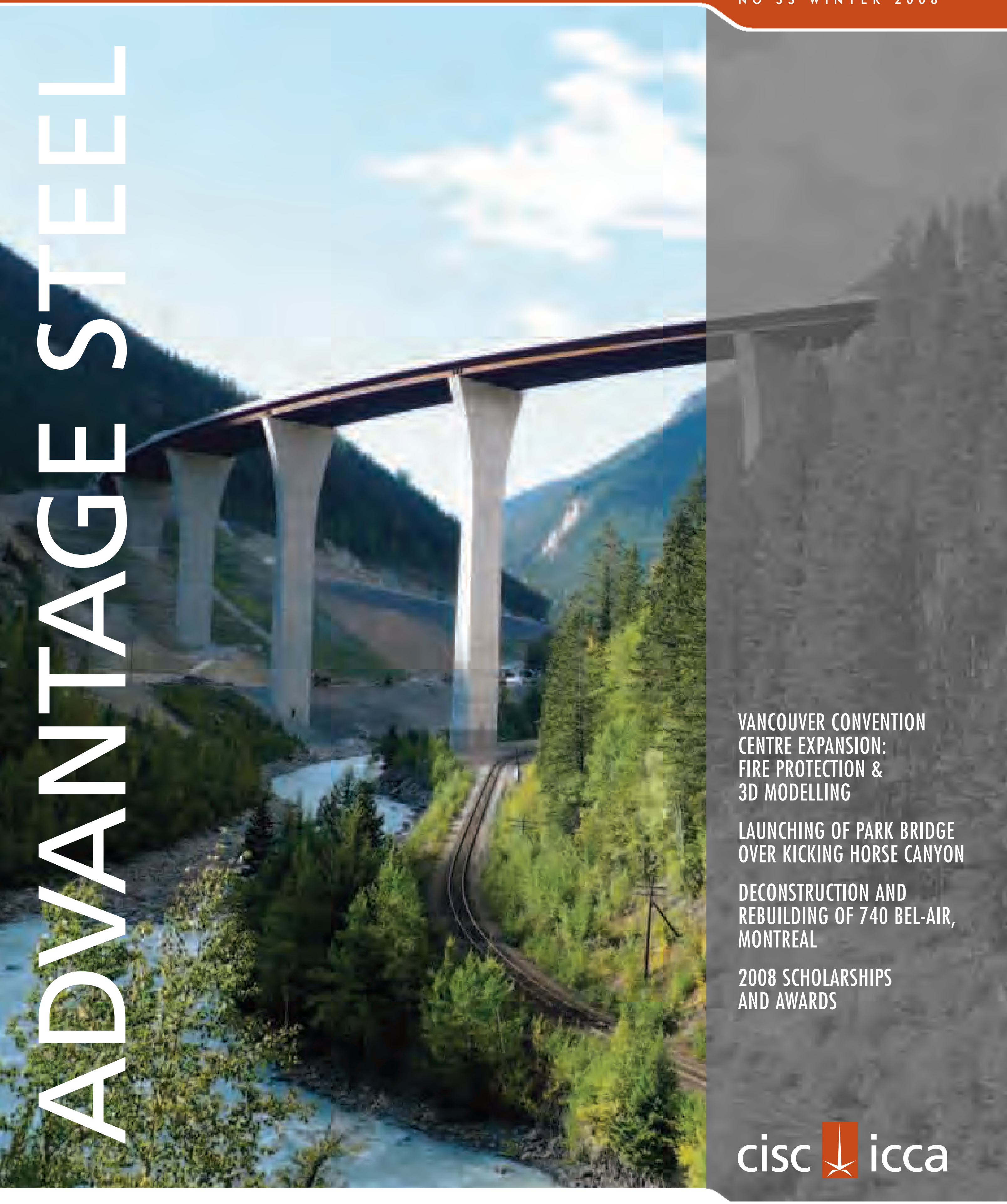
NO 33 WINTER 2008

ADVANTAGE STEEL



VANCOUVER CONVENTION CENTRE EXPANSION: FIRE PROTECTION & 3D MODELLING

LAUNCHING OF PARK BRIDGE OVER KICKING HORSE CANYON

DECONSTRUCTION AND REBUILDING OF 740 BEL-AIR, MONTREAL

2008 SCHOLARSHIPS AND AWARDS

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CANADIAN INSTITUTE OF STEEL CONSTRUCTION

FROM THE EDITOR

In this issue we focus on British Columbia with two articles on the Vancouver Convention Centre Expansion Project. One examines the enhanced fire protection and the other looks at how 3D modelling simplified the construction process. Also in BC we examine the Kicking Horse Pass bridge. This bridge was launched over a high gorge without disruption of either rail nor road traffic–truly a great achievement for Canadian steel bridge engineering.

Moving east to Montreal, we have a case study of the reconstruction of 740 Rue Bel-Air. The project illustrates how an old, polluted industrial site can be deconstructed and rejuvenated. The process with its site remediation and new construction has revitalized the immediate neighbourhood. At the same time it qualified for LEED™ Gold rating.

Our annual review of the various Scholarships and Academic Awards provided across the country is always an interesting read. Congratulations to all the recipients. Will Koroluk Will Koroluk looks at the challenge of comparing different materials in our new column "For Green's Sake". "Ask Dr. Sylvie" examines missing ULC ratings, field welding of HSS beams and reinforcement of steel columns. "Seismic Corner" reviews the order of yielding and ductile behaviour.

Best wishes in 2009!

Michael I. Gilmor, P.Eng.
President CISC

IN THIS ISSUE

CISC HEAD OFFICE
3760 14th Avenue, Suite 200, Markham, Ontario L3R 3T7
Phone 905-946-0864 Fax 905-946-8574 Email: info@cisc-icca.ca

CISC ONTARIO REGION
3760 14th Avenue, Suite 200
Markham, Ontario L3R 3T7
Phone 905-946-0864 ext. 106
Email sjohn@cisc-icca.ca

CISC ATLANTIC OFFICE
15 Eydie Drive
Rothesay, New Brunswick E2E 4Z2
Phone 506-849-0901
Email alock@cisc-icca.ca

CISC QUÉBEC OFFICE
2555, rue des Nations, bureau 202
St-Lau ent, Québec H4R 3C8
Phone 514-332-8894 Fax 514-332-8895
Email sboulanger@cisc-icca.ca

CISC CENTRAL CONTACT ALAN LOCK
Email alock@cisc-icca.ca

CISC BC CONTACT MIKE GILMOR
Email mgilnor@cisc-icca.ca

CISCI ALBERTA CONTACT MIKE GILMOR
Email mgilnor@cisc-icca.ca

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CHAIRMAN Don Obo owsky, *Waiward Steel Fabricators Ltd.*
EDITOR Michael I. Gilmor, P.Eng.
ASSISTANT TO THE EDITOR Rob White, BFA
EDITING/TECH ADVISOR Sylvie Boulanger, P.Eng. Ph.D
PUBLISHER Richard So en
Design Print Media
Tel 416-465-6600 designprint@sympatico.ca
DESIGN & FORMATTING Ka herine Lalonde
KLDESIGN
info@kldesign.ca

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Canadian Institute of Steel Construction
3760 14th Avenue, Suite 200
Markham, Ontario, Canada L3R 3T7

COVER PHOTO:
Kicking Horse Canyon Bridge | *B.C. Ministry of Transportation*

PHOTO ON THIS PAGE:
Launching of the New Park Bridge, Kicking Horse Canyon, British Columbia | *KWH Constructors*

Photo: B. Voutaz

Sylvie Boulanger, P.Eng. Ph.D. - *Ask Dr. Sylvie is a column for Advantage Steel aimed at readers seeking technical information on steel structures. Questions are welcome on all aspects of design and construction of steel buildings and bridges. Suggested solutions may not necessarily apply to a particular structure or application, and are not intended to replace the expertise of a professional engineer, architect or other licensed professional. Questions for Dr. Sylvie, or comments on previous questions, may be submitted by e-mail to* ***sboulanger@cisc-icca.ca****.*

ASK DR. SYLVIE

MISSING ULC RATING

I am an architect and want a fire-protection solution that provides a 1-hour rating on a W460x52 edge beam connected to a HSS203x203 column. I can find 4-hour, 3-hour and 2-hour rating values for a combined gypsum board and steel girder assembly but cannot get a 1-hour rating for this manufacturer. What are my alternatives? - R.M.

It would appear that a common industry practice is to consider three alternatives:

1) Take a higher rating (1.5-hour if it exists for that company, or 2-hour rating).
2) Provide the minimum thickness gypsum board (ignore its contribution) and use another type of fire-protection (cementitious or fibrous) to obtain a 1-hour rating.
3) Use the rating of a column with the beam dimension. Since the column ratings generally include more fire-protection, we can assume this approach to be conservative.

However, before going that route of alternatives, you need to make sure that this assembly does not exist in the ULC directory. Looking at the ULC directory pages under "N" and "O" (beams, floor and ceiling) and the 500 series (membrane fire protection with gypsum boards), there are four listings, O501 to O504, all protecting a minimum W200x36 beam with 2 layers of 15.9 mm gypsum board and all having a 2-hour listing. Note though that there might be some listings that were finalized after the annual ULC directory was printed. They might be available from the gypsum board manufacturer directly (one could view their website and get advice from their technical sales staff). But no such luck with your assembly. I know that you have already made your M/D calculations based on NBCC (Appendix D-2.6.4), and took into account a one-layer gypsum board protection but that only yielded a 45-minute rating.

Looking at the three alternatives, the first two alternatives are plausible - one will have to use two layers of gypsum boards (be fire resistant for two hours instead of one) or use 1-hour spray-applied fire-resistive material (SFRM, for example 13mm of fibre in N809 gets one hour) and then box in the beam with one layer of thin membrane boards for cosmetics (probably costs more than putting on two layers).

Now for the third alternative. A column isn't a beam — does that sound Shakespearean? By that we mean that the tests are different, i.e. two types of fire tests and gypsum board behaviour — bending beam and unloaded column affect boards differently during the test. Boards can pop off a deflected floor beam assembly close to the end of a test. ULC S101 fire test standard has an unloaded column with its fire protection on it and terminates the test when the temperature of the steel has exceeded 538 deg. C. A beam test on the other hand requires the application of load and three criteria for ending the test - 1) the beam can no longer hold the load; 2) the passage of flame or hot gas is taking place and 3) the temperature limits are in excess of 140 deg. C average or 180 deg. C on the individual thermocouple situated on unexposed side.

I know you have decided on option 3 and you appear not to be alone. Dr. Farid Alfawhakiri of the American Iron and Steel Institute suggests the same approach when you need to get a rating for a HSS beam. Since ratings do not exist for HSS beams, one can conservatively use ratings performed on HSS columns. See the Steel Interchange section in Modern Steel Construction, July 2006 issue.

I would like to thank Louis-Raymond Gratton of A/D Fire and George Frater of the Canadian Steel Construction Council for their help in developing a solution to this question.

FIELD WELDING OF A HSS BEAM

For adding a support structure that allows us to hang a scoreboard in an existing sports centre, one engineer suggested we weld an HSS beam directly onto the flange of a fairly large W column. However, we are now working with another engineer that questions this practice. I am an architect and would like to know if we need to be concerned? - B.G.

There are many ways to connect steel members and some are better than others. There is a big difference between what the fabricator needs to do to achieve weld quality in the field compared to what is needed in the fabricator's shop. In the field, bolting allows the fabricator more room to accommodate tolerances. And when that's not feasible, you try to use simple welding procedures, such as downhand welding and avoid welding abutting members, overhead welding, etc.

There are a few alternatives that you can consider that would avoid welding the HSS beam directly onto the flange of the W shape. Depending on the loading conditions, one alternative could be to first weld a seat or angle onto the flange, then weld the HSS beam onto the seat.

REINFORCEMENT OF STEEL COLUMNS

Our firm will be involved in modernizing a hospital. The building is in steel and we have to reinforce the existing columns for seismic rehabilitation and increased gravity loads due to additional floors. Unfortunately, we have found very little literature on the subject of steel column reinforcement under load. Do you know of a good source of references? - P.M.

The AISC document entitled **Design Guide 15 - AISC Rehabilitation and Retrofit Guide: A Reference for Historic Shapes and Specifications (2002)**. See: **www.aisc.org/design_guides**

Section 4.1.2 should be of interest. Generally, column reinforcement can be accomplished by welding on plates or other sections. This will generally greatly increase the radii of gyration as well as the cross-sectional area, both key to determining a compression member's factored resistance. Columns can also be encased in concrete. Numerous examples of column reinforcement are cited in the above-mentioned section but particularly in section 5. I highly recommend this publication for your library (I know, you are going to go broke if you buy all my recommendations — that is, if you read all the issues)! You can download the guide for 80USD as a non-member or for free as an AISC member. A professional membership is very advantageous for a consulting firm as you then have access to a multitude of technical resources free (in the electronic version) or at a reduced price (for the paper version).

I often refer to this publication to help out engineers. In fact I just answered a question to J.F.B. who wanted to find the properties of a steel bridge built in 1910. The properties of ASTM A7 steel — a standard that appears in 1900 for bridge applications — can be found at Table 1.1a. The properties of historical steels, both ASTM and CSA, can also be found on Page 6-5 of the CISC Handbook of Steel Construction.

Think about the history we have as an industry. It is difficult not to view it as a sign of durability and kept promises, but enough of that, it's getting late; I will stop here.

SEISMIC CORNER — THE ORDER OF YIELDING AND DUCTILE BEHAVIOUR

Alfred F. Wong, P.Eng.

Generally, ductile seismic-force-resisting steel frames are required to be proportioned in accordance with capacity-based design principles. The design typically follows the procedure below:

1) Identify the ductile yielding mechanisms versus other failure modes
2) Determine the probable capacity of the yielding mechanism(s)
3) Proportion the structure to allow primary yielding to precede any secondary yielding
4) Proportion the structure to ensure that the factored resistance against each undesirable failure mode at least equals the load effect at the attainment of the probable capacity of the yielding mechanism(s).

Clause 27 of CSA S16-01 designates the yielding (energy-dissipating) elements in seismic-force-resisting steel frames in ductile, moderately ductile and limited-ductility types. The rest of these seismic-force-resisting systems should be designed as non-dissipating or capacity-protected elements. The accompanying table serves as an aid for the purpose of identifying yielding versus capacity-protected elements in seismic-force-resisting steel frames.

Yielding Elements versus Capacity-Protected Elements
Seismic-Force-Resisting Steel Frames

structural steel seismic-force-resisting system		primary yielding elements	secondary yielding elements	capacity protected-elements
moment-resisting frames	ductile	plastic hinging in beams[1]	shear yielding in panel zones	columns[1], connections
	moderately ductile			
	limited-ductility**			
	conventional construction	undefined		where $I_EF_aS_a(0.2) >$ 0.45, connections of primary members[3]
ductile eccentrically braced frames		beam links	–	braces, columns, outer beam segments, connections
concentric-ally braced frames	moderately ductile	braces[1]	beams[4] in low-rise chevron frames	columns, beams, connections
	limited-ductility			
	conventional construction	undefined		where $I_EF_aS_a(0.2) >$ 0.45, connections of primary members[3]

[1] *Plastic hinging is permitted in fixed column bases and near the top of single-storey columns.*

[2] *Capacity design need not apply where $I_EF_aS_a(0.2) \le 0.55$ and frame height ≤ 60 m ($I_EF_aS_a(0.2)$ is defined in NBC 2005). Sentence 4.1.8.10.1 of NBC 2005 applies nonetheless.*

[3] *Alternatively, these connections shall be proportioned for a ductile mode of behaviour.*

[4] *Beams in low-rise chevron frames are designed to yield after the compression brace framing from below has buckled, but the tension brace may remain elastic.*

Sometimes the yielding elements are grossly oversized because wind effects, stockiness or section availability dictates the design. In that case, the design forces for the capacity-protected elements need not exceed forces corresponding to $R_dR_o = 1.3$, recognizing that these elements generally possess an over-strength level that justifies $R_o = 1.3$. It should be noted that when this upper force limit controls the design of certain critical elements, such as tension brace connections, they should be detailed for general ductile behaviour (See Commentary to Clause 27.5.4.2 of S16-01).

In a ductile system, the yielding elements are required to undergo stable inelastic action and dissipate energy. Therefore, all undesirable failure modes must be precluded. For example, in order to allow plastic hinging in a beam, the beam itself must be prevented from lateral-torsional buckling.

Illustration courtesy of MCM/DA + LMN Architects

FIRE PROTECTION
AT THE VANCOUVER CONVENTION CENTRE

Glenn A. Gibson, M.Eng., P.Eng., CP | Kin Man Wong, M.Sc., P.Eng., CP

ROCK - PAPER - SCISSORS, OR IS IT: FIRE - WATER - STEEL? A WINNING COMBINATION AT THE VANCOUVER CONVENTION CENTRE EXPANSION PROJECT

Exposed steel structural assemblies at the Vancouver Convention Centre Expansion Project (VCCEP), located in the Exhibition Halls and supporting occupancies above, will be protected by the building's enhanced sprinkler systems. The fire protection engineering analysis completed for this project demonstrates that sprinkler *water* will protect the structural *steel* as well as the otherwise required method of applying passive cementitious or fibre-based thermal insulating fire proofing directly to the steel.

The building codes have long taken a "belt-and-suspenders" approach to fire protection and life safety. This is particularly the case for fire protection of the building structure. Over recent building code cycles, the model National Building Code of Canada has maintained passive protection such as fireproofing applied to load-bearing steel, while requiring increasing sprinkler protection, to the extent that essentially all buildings above six storeys are required to be sprinklered throughout and have a 2-hour fire-resistance rating.

Similarly, the applicable Vancouver Building By-law 1999 (VBBL) requires all floors and supporting structure of the VCCEP to have a 2-hour fire-resistance rating and sprinkler protection. For the most part, VCCEP has been designed to meet this requirement. However, complying with this prescriptive requirement for the 250,000 ft.^{2} Exhibition Halls was a concern for the stakeholders: aesthetics, ongoing maintenance and costs. The challenge to the project design team was to develop a design that would address the building code objectives and stakeholder interests without applying passive fire proofing to the steel structure within the Exhibition Halls.

Although the 1999 VBBL was applicable to the project, the design team used the format and the methodology of the NBC 2005 to develop, document and demonstrate that the proposed design will meet the building code objectives. In addition, the fire protection of the steel structure was evaluated in conjunction with the overall fire protection and life safety performance of the building using success trees. The success tree analysis resulted in an integrated approach to the overall fire protection and life safety performance of the building, and was used to develop the performance criteria for the major fire protection and life safety features, including:

- ☐ structural fire protection,
- ☐ exiting, and
- ☐ use of interior wood ceiling members and interior wall finishes.

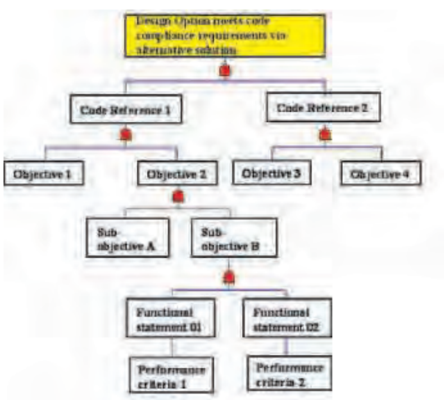


Figure 1: Success Tree[1]

In response to the performance objectives determined by the success tree analysis, the proposed design concept was to improve the sprinkler system's effectiveness and reliability. The enhanced sprinkler system would then provide the foundation to a fire protection and life safety design that achieves the code objective for the various design issues, including the protection of structural steel.

Based on the success tree analysis, the proposed integrated dual sprinkler and structural steel system should achieve the following performance objectives as an alternative solution to the VBBL prescriptive requirements:

- ☐ the enhanced sprinkler system should perform to control/suppress the anticipated fire scenarios;
- ☐ the surface temperature of the steel structural elements should not exceed the threshold values for the designed duration; and
- ☐ the steel structural elements and framework should perform within the structural design limits.

The alternative solution for the exposed steel structure was based on:

- ☐ the height of exposed structural steel above the floor;
- ☐ the enhanced sprinkler system design;
- ☐ concrete columns providing at least a passive 2-hour fire-resistance rating to a height of 6 m (20 ft.) above the floor; and
- ☐ mobile water cannons at each end of the exhibition halls available for firefighters' use.

The high ceilings provide a benefit by delaying the build-up of heat that could lead to flashover, and delaying the descent of the smoke layer. However ceiling height alone is not necessarily adequate to prevent the ceiling from reaching critical temperatures that could cause the fire to flashover, resulting in temperatures that could cause failure of the steel structure. This was the case in the 1967 fire in the McCormick Place Convention Center (refer to **Figure 2** below). The exhibition halls at McCormick Place were approximately the same size (area and height), with a structural system of long-span steel trusses. However, the exhibition halls were not sprinklered.

Photo Credit: Mayor's Committee to Investigate McCormick Place Fire. Report of the Investigation of the McCormick Place Fire of Jan 16, 1967
Figure 2: McCormick Place Fire, 1967

Two key considerations of the enhanced sprinkler system design are:

- ☐ reliability, and
- ☐ delivering an adequate quantity of water to control the fire and achieve the temperature objective.

Reliability will be achieved by providing a unique dual system (referred to as the A / B system), as shown in **Figure 3**.

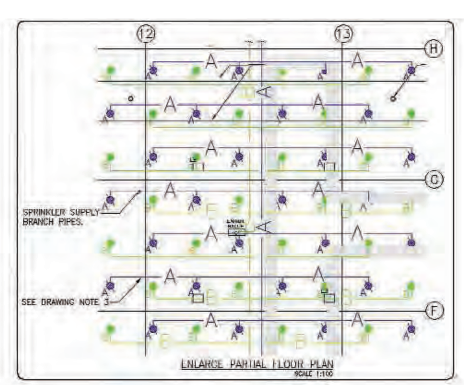


Figure 3: A/B Sprinkler Systems

The Exhibition Halls will be protected by two, essentially independent, sprinkler systems with multiple water supply sources, including two independent connections to City water mains, a sea water pumping facility drawing water from Burrard Inlet below, and siamese pumper connections. Each system would have a reliability approaching 99% as reported by Richardson.[2] These systems will provide overlapping coverage meeting the following criteria:

Table A: Hydraulic Design Criteria - Exhibition Halls

SYSTEM OPERATION	DESIGN DENSITY gpm/ft.^{2} (lpm/m^2)	DESIGN AREA ft.^{2} (m^2)
Both Systems (Normal)	0.45 (17.0)	5000 (465)
One System (Impaired)	0.20 (8.1)	5000 (465)

- sprinkler head type for Exhibition Halls to be extra-large orifice (K=11.0), quick-response sprinklers in order to provide effective droplet characteristics for water discharge at the ceiling level.
- hose demand in conjunction with sprinkler system design will be 500 gpm (1892 lpm), with additional allowances to be made for the water cannon equipment to be implemented on the Exhibition Levels

The performance-based sprinkler system applications for the Vancouver Convention Centre Expansion Project (VCCEP), which are based in part on an article from the NFPA *Journal* (May/June 2004)[3] on the recently completed Boston Convention and Exhibition Centre and the McCormick Place fire tests reported in *Fire Technology*,[4] as well as the requirements of NFPA 13-1999, "Installation of Sprinkler Systems."

The Exhibition Halls will incorporate large open floor areas with ceiling heights (i.e., clear height to the underside of the deck) ranging from approximately 10-13 m (33-43 ft.).

Fire modelling using the computational fluid dynamics model FDS Version 4.0[5] was completed to quantify the temperatures and heat flux at exposed steel members as well as confirming the area of sprinkler activation. The modelled scenarios covered a flashover fire involving the upper level of a 2 level exhibition booth right next to a column. **Figure 4** is a photograph of the column. **Figure 5** is the FDS simulation of the column exposed to a flashover fire occurring in the 2nd level of an adjacent 2-level non-sprinklered booth.

Figure 4: Photograph of Column

Performance of the proposed exposed steel supporting structure/enhanced sprinkler protection system was determined as follows:

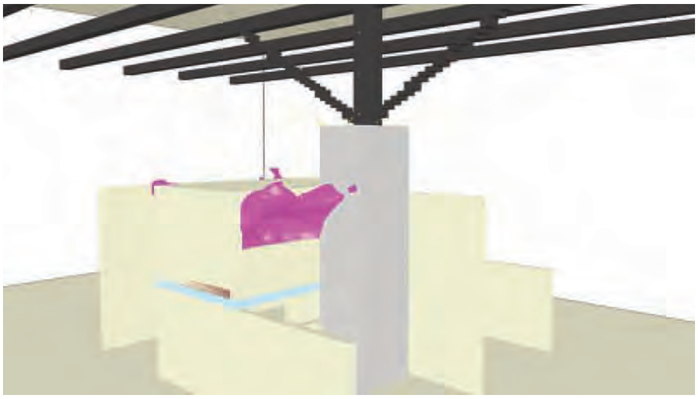


Figure 5: FDS Simulation of Column

- the combination of sprinkler cooling and height of the exposed steel structure above fire reduces the ambient (200°C) and exposed surface (not greater than 60°C) temperatures well below the threshold bulk steel temperature that would affect the structures' stability (550°C);
- suppression at the fuel surfaces is ignored to account for shielded combustion;
- the height of concrete encasement (6.5 m) protects the structures from direct flame impingement (for both 1 and 2 level booths);
- partial failure of the dual sprinkler system increases the level of exposure to the supporting structures but the effect is insignificant to the endurance of these structures;
- based on the ignition criteria for cellulosic materials (surface temperature > 350°C and critical heat flux of 10 kW/m^2), the sprinkler discharge prevents the booth fire from spreading to a neighbouring booth across a 3 m aisle;
- partial failure of the dual sprinkler system has a significant yet still lower than threshold increase in the level of exposure to adjacent booth; furthermore, the first sprinkler will be activated (at 163 s) while the maximum exposed booth surface temperature is lower than 90°C;
- the designed areas of sprinkler operation (dual and single systems) are adequate relative to the modelled fire scenarios.
- for a fast growth t^2 fire burning under shielded condition with a steady-state heat-release rate of 14 MW, the exposure to a booth across the aisle from the booth on fire does not reach the threshold level for a significant duration (160 s) after the time of first sprinkler activation had the sprinkler been incorporated.

The proposed structural fire protection design is expected to perform as well as or significantly better than the benchmark acceptable solutions of Division B (i.e., applying passive fire proofing to the structural steel). As previously noted, the prescriptive building code requirements take a belt-and-suspenders approach and assume that a single sprinkler system could fail and therefore require a "back-up" system in the form of passive fire protection. However, under this scenario, the same outcome that occurred at McCormick Place may be expected.

The passive fire proofing applied to the structural steel is intended to provide thermal insulation for a 2-hour duration (this is under standard fire test conditions and may not coincide with "real" time). After the 2-hours, threshold temperatures could be exceeded, resulting in failure of the structure and extensive fire damage throughout the building. In comparison, in the case of the performance-based design, even if one sprinkler system fails, a second, back-up, system is available to control the fire and limit the damage to the building and structure.

In conclusion, the performance of the steel structures within the Exhibition Halls protected by an enhanced sprinkler system is demonstrated through fire modelling. The dual sprinkler system design eliminates single point of failure, providing assurance that the sprinkler system will operate. The increased sprinkler density and hydraulic design area will provide assurance that sprinklers will have the capacity to control the fire and limit the temperature of exposed steel structural members.

The combination of sprinkler *water* and structural *steel* will withstand the potential fire exposures and maintain the integrity of the structure.

ACKNOWLEDGEMENTS

The authors would like to extend our thanks to the VCCEP, Project Team and Glotman Simpson Consulting Structural Engineers for their support in pursuing an innovative solution for this project.

[1] K.M. Wong, G.A. Gibson, "Structured Design and Presentation of Alternative Solutions based on the Objective-based National Building Code of Canada 2005," *Proceedings of the 6th International Conference on Performance-Based Codes and Fire Safety Design Methods*, SFPE, 2006.

[2] J.K. Richardson, "The Reliability of Automatic Sprinkler Systems," National Research Council Canada CBD-238, July 1985.

[3] J. Nicholson, "Fire and Life Safety Challenges at the Boston Convention and Exhibition Center," *NFPA Journal*, Vol. 98 No. 3 (2004), 62-67.

[4] W.A. Webb, "Effectiveness of automatic sprinkler systems in exhibition halls," *Fire Technology*, Vol. 4, No. 2 (1968), 115-125.

[5] K. McGrattan, "Fire Dynamics Simulator (version 4.0) Technical Reference Guide," *NIST Special Publication 1018*, February 2005.

3D MODELLING SIGNIFICANTLY SIMPLIFIES THE CONSTRUCTION PROCESS OF THE VANCOUVER CONVENTION CENTRE EXPANSION

John Leckie

On the $883-million expansion of the Vancouver Convention and Exhibition Centre, there where not a lot of shop drawings going back and forth.

That wasn't because there were not a lot of shop drawings. There were — more than 20,000 of them. They just didn't make it onto paper. The structural engineers for the project, Glotman Simpson Consulting Engineers, decided to go out on a limb and use the three-dimensional model created with Tekla software for approvals rather than creating the paper drawings to be circulated for approval.

When the fabricator, Canron Western Constructors Ltd., created the shop drawings, they put them on the project FTP site where they could be reviewed by the structural engineers and the architectural team on the project—Musson Cattell Mackey Partnership, Downs/Archambault & Partners and LMN Architects.

Rob Simpson, a principal of Glotman Simpson, said he does not believe the project could have been completed without the use of the 3D software. The complexities of the design were just too great to be handled on paper, in his view.

Jim McLagan, vice-president of Canron, doesn't go quite that far. It could have been done manually, he says, but it would have required a lot more work on the part of everyone involved.

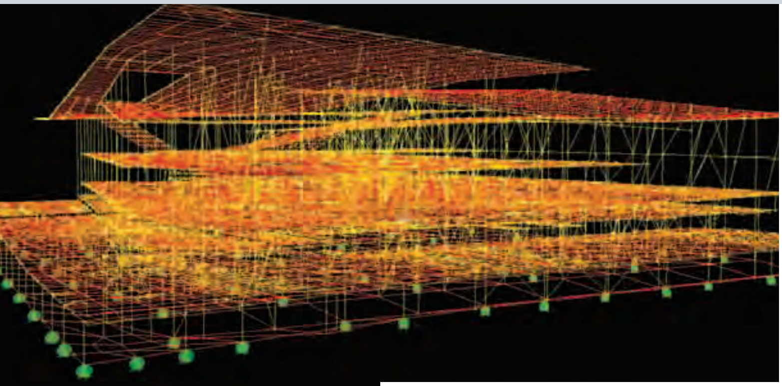
To McLagan's mind, the benefits to the environment of not producing 20,000 paper sets of drawings for circulation are all well and good but the major benefit of the 3D program is the accuracy that it creates.

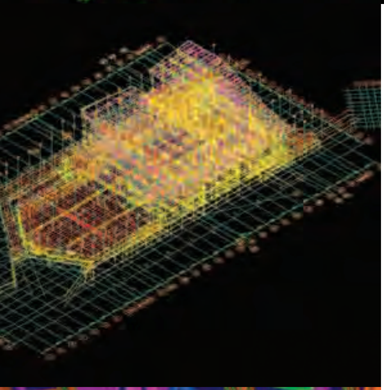
"It's like a spreadsheet where you are dealing with .0001 where manually we would round things to a quarter of an inch."

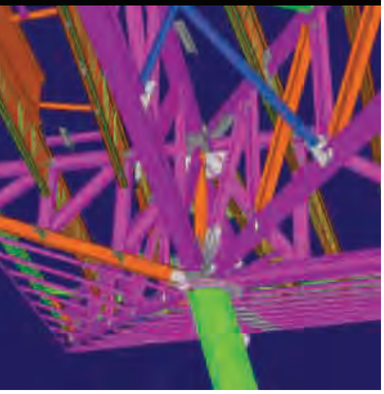
Canron has plenty of experience with the complexities of major projects of this type. The firm fabricated structural steel for both Safeco Field and Qwest Field in Seattle, respective homes of major league baseball's Seattle Mariners and the National Football League's Seattle Seahawks. It had also helped construct convention centres in Seattle, Portland and Honolulu so Vancouver's project, while it had its challenges, was always seen as quite doable.

Many of the challenges for this project were a result of timing.

It is debatable if the expansion of the convention centre would have gone ahead if the Olympics had not come along. It had originally been developed as the Canada Pavilion at Expo 86 and, within a decade, had been booked to capacity. Studies had indicated that Vancouver was losing $100 million in convention delegate spending because the existing centre was not large enough to house major groups hoping to hold their conventions in the city. The Olympics, however, provided the impetus to go ahead. The expanded centre will provide the media broadcast centre for the upcoming Olympics.







The Olympics, however, also created a problem for the project. Skilled workers were in demand, which meant Canron had to scour most of Canada to find tradesmen to work in the field. Shop labour wasn't as much of a problem.

"Our shop labour has been fairly consistent for decades," McLagan says. While the firm put more than a quarter of a million man-hours into the project, 85 per cent of the fabrication was done in Vancouver at the firm's Annacis Island plant. About 10 per cent of the steel was fabricated in Portland and about five percent was farmed out to a few local fabricators and one fabricator in Edmonton.

The fabrication was challenged due to of the accuracy involved, McLagan says. "There were over 200 truss sections. These are very difficult to assemble accurately because some of those truss components become one very long component. Sometimes there were two parts, sometimes three and often four. When they are attached together, the camber and location has got to be precise." At the same time, some of those components weighed up to 60 tonnes and were up to 20 feet deep. They were difficult to handle, both in the shop and on the site.

On the site, there were all the usually problems of a congested, urban site plus the addition to the convention centre was being constructed on a precast deck over the water. The deck was limited as to the weight it could hold during the construction period. "We sometimes had to erect multiple shoring towers to keep the load on the deck within the allowable parameters," McLagan says.

Congestion on the site was something Canron was used to dealing with.

At the beginning, while the foundation was still being prepared and the anchor rods were being installed, it was particularly tight. As the site cleared a bit, things got better but the project still required careful marshalling of materials to ensure everything was there when it was needed but not before.

To keep the project moving, the firm used three cranes on the project; two crawler cranes and one of the largest tower cranes. Often two of these cranes would be working in tandem, lifting a single piece up for installation.

"The geometry of the project is such that there are very few pieces that are in horizontal plane," McLagan says. "On the north side, even the columns slope out about 11 degrees towards the water so there are not many components that are actually square. That gave the project a complexity right from the beginning to actually produce the shop drawings and make the details right through to fabricating and erection."

The project went exceptionally well, McLagan said. Substantial completion for the steel portion of the project was reached in May, which meant most of the remaining work has involved small crews finishing off handrails and bracing that couldn't be completed until the concrete had been poured. The building itself is scheduled for completion in March 2009.

McLagan said the use of the 3D program worked well. The architects and engineers could review drawings and attach their comments directly to them. While these programs have been around for some time, it requires the consultants to get away from their normal routine to use them the way they were used on this project but the savings in paper and the increase in accuracy that result make it worthwhile, he says.

Images courtesy of Glotman Simpson Consulting Engineers.

Figure 5 - Nose

Figure 7 - Launch system

KICKING HORSE CANYON PROJECT
LAUNCHING OF THE NEW PARK BRIDGE

Ahmad Khashan, Robert Gale, Paul Hopkins, and Greg Orsolin

INTRODUCTION

When British Columbia decided to improve a section of the Trans-Canada Highway through the Rocky Mountains, they turned to a public-private partnership and awarded the design-build contract in a competitive bid to Trans-Park Highway Group (TPHG).

The project includes the construction of the new Park Bridge, crossing the Kicking Horse Canyon, high above the Kicking Horse River. Both steel and concrete options were considered early in the concept development. The design-build team chose steel and the incremental launching method to erect the steel structure.

GEOMETRY

The new Park Bridge has six spans (Figure 1). It is 406 metres long and about 90 metres high. The roadway alignment at the bridge location is on a 6% longitudinal grade and curves horizontally with a radius of 550 m and a 5.5% super elevation.

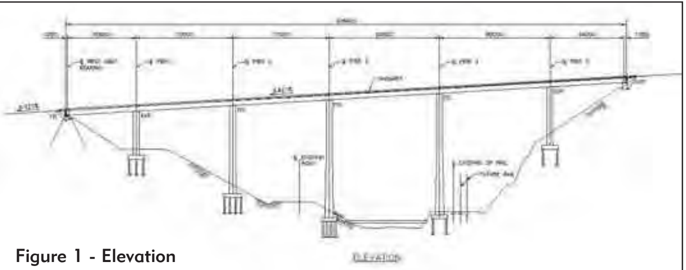


Figure 1 - Elevation

The bridge is designed to accommodate 2 lanes of traffic in each direction. There are four main steel girders, 3 metres deep and spaced at 6.9 m. Three sub-stringers are supported on intermediate cross-frames which are spaced at about 6 metres apart (Figure 2).

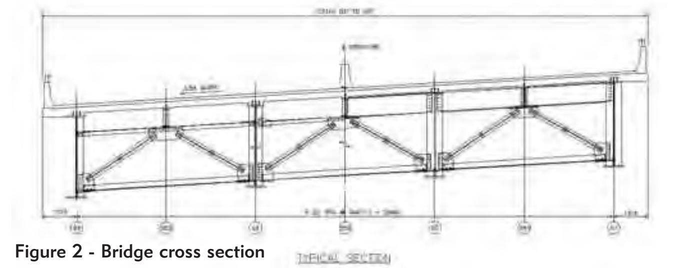


Figure 2 - Bridge cross section

ANALYSIS AND DESIGN

It is the first time that a curved steel plate girder bridge of this magnitude was incrementally launched in North America. It was launched upgrade in two phases. Each phase consists of a pair of girders complete with cross-frames, lateral bracing and sub-stringer.

The bridge was designed in accordance with the Canadian Highway Bridge Design Code CAN/CSA-S6-00. The steel super-structure was designed for different launch stages in addition to the final in service condition. Two independent structural finite element models were developed one by the designer and another by the erector. The results were cross-checked between the two.

PLATE GIRDERS

The girders were fabricated with different plate sizes due to different loading and with variable span length due to the curvature. They were checked for load effects and conditions during the launch. For the web, the capacity check includes web crippling and yielding in addition to shear capacity. For the flanges, the check includes strength and stability, and contact pressure from the support rollers on the bottom flange. As a result, girder flanges larger than what is needed for the final in-service condition were provided,

Figure 6 - Pier equipment

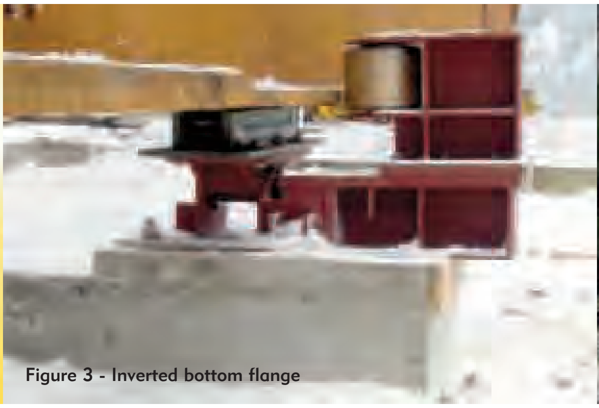


Figure 3 - Inverted bottom flange

Figure 4 - Assembly bed

including wider and thicker top and bottom flanges in the negative moment region over pier 5. The additional steel required for the launch erection, including the weight of top and bottom lateral bracing, is within 10% of the total steel weight.

CROSS-FRAMES AND LATERAL BRACINGS

The cross-frames were designed as primary load carrying members. They served to stabilize and to transfer loads between adjacent girders and to support the sub-stringers in the final in-service condition. During the launch the cross-frames served to stabilize and maintain the girders in upright position. Back-to-back structural tee sections were used as diagonal members of the cross-frames to resist large compression forces and to minimize axial eccentricity.

Bottom lateral bracings were provided throughout the length of the bridge and top lateral bracing in the leading two spans. The use of top and bottom lateral bracing in conjunction with intermediate cross-frames provided the needed torsional stiffness for the curved girder-pair in the cantilever portion of the structure during the launch. The bottom lateral bracings also helped to maintain the girders in longitudinal position, to even out the forward pushing force and to carry the transverse wind loading between piers during launching.

STEEL DETAILS

The girders' constant-width bottom flange in conjunction with the guide rollers, helps to steer each girder pair into proper horizontal alignment during the launch and to allow the flange clamps and the wedge brakes of the launching system to function.

The bottom flange plate thickness transitions were inverted (Figure 3) to provide a levelled surface of the bottom flange and to allow the girders to move smoothly over the roller assemblies. Similarly the field splices for the bottom flange were detailed with a central gap between the outer splice plates to allow passage of the roller assembly.

The girders were cambered for the accumulated deflection of time history loading. This includes the deflection of each girder-pair at the end of each launch, the effect from the added weight of the middle-bay cross-frames and sub-stringer, the weight of precast deck panels, and deck pouring sequence.

In order to accommodate differential displacement of the as-launched girder-pairs and construction tolerances, the middle-bay cross-frames were fabricated with oversized bolt holes.

Wide flange sections were used as bottom lateral bracing in the leading two spans of the bridge and in the negative moment regions over the piers to accommodate the large compression forces during the launch. Their ends were detailed to clear the launching system at the west abutment.

LAUNCHING

The bridge was launched as two separate parallel girder-pair units with each unit weighing about 1300 tonnes. When assembled, the cross-sectional envelope of a girder-pair was over 3 metres tall and almost 7.5 metres wide.

ASSEMBLY BED, LAUNCHING NOSE, AND PIER EQUIPMENT

The assembly bed, west of the west abutment, sloped to the same 6% grade of the bridge (Figure 3) was used to assemble girder-pairs. Individual girders were lifted off transport trucks and placed into position in the assembly bed using a 200-ton crane. The longest segment was 37 m long and the heaviest girder weighed 55 tonnes. The assembly bed also includes two temporary foundations under each girder line. Each foundation is equipped with a support roller and a guide roller that is used to guide the girder pairs into correct horizontal alignment during the first launch to pier 1.

The nose girders, approximately 26 metres long and weighing nearly 30 tonnes, were bolted on the leading end of the girder-pair. The nose girder tips were curved up to accommodate deflections of up to 2 m of the cantilevered girder-pair during the launch (Figure 4). They were also designed to help guide the girder pair into correct transverse alignment on the pier ahead.

On top of every pier were a set of guide brackets and a roller bracket on both girder lines (Figure 5). The roller brackets (composed of equalizer beams) and the two Hilman rollers, they support, function to mitigate the high reaction and rotation of the girders from the cantilever span. The guide brackets were attached to the pier top via anchor rods and the guide brackets were adjustable transversely in order to help maintain proper girder-pair alignment.

Figure 8 - Launch to pier 5

LAUNCHING SYSTEM

The launch system had four major components: flange clamps, launch cylinders, wedge brakes, and return carriage (Figure 6). The final commissioning of the launch system took place during the first launch and it took nearly three successive 10-hour shifts to launch the first span. By the eleventh launch, the entire span was completed in about 4.5 hours (Figure 7).

LAUNCHING SEQUENCE

A cycle of the launch system normally took about 5 minutes. It took about 50 cycles of the launch system to complete the longest (80 m) launch and over 250 cycles to fully launch one girder-pair.

The sequence for the scheme involved the assembly sufficient length of a girder-pair in the assembly bed and then launch to the pier ahead. This sequence was completed 6 times for each girder-pair.

After a girder-pair was launched six times, from West Abutment to East Abutment, the girder-pair was jacked down at each pier onto the permanent bearings. After both girder-pairs were launched to their final position, the middle-bay cross-frames and sub-stringers were installed. KWH, the erector, started assembling the launch equipment and girder-pairs in early December 2006, launched the last span of the last girder-pair in May 2007, and substantially completed the erection in the middle of June 2007. The General Contractor installed precast deck panels and the cast-in-place concrete deck.

The launches were tracked by survey equipment to ensure that the cantilever deflections were close to the theoretical values (Figure 8) and girder stresses during launch remained within acceptable limits. The safety of the launch system allowed the launches to proceed with ongoing vehicle and train traffic below — with no delay or disturbance to either.

CONCLUSIONS

Construction of the project started in November of 2005 with an expected road opening in September of 2007 and a final completion in the spring of 2008. Meeting this aggressive schedule requires active construction year-round, even in difficult winter weather conditions. The new park bridge was officially opened to traffic on August 31, 07.

Due to the height of the bridge and site constraints in addition to worker safety and stability of the individual curved girders, the design-build team decided it was best to have a controlled at-grade assembly area at the west abutment and launch the girders as a stable girder-pair unit.

The successful erection of this bridge, isolated high in the mountains and during winter conditions, has proven that this pioneering launch system is a viable method of erecting suitable types of steel superstructures. Potential applications for the system include launching over urban highway, or other transportation systems, with no shutdown to traffic or night work necessary. The relatively compact launch system needs only to have the abutment designed to accommodate the launching forces and an adequate length of assembly area behind the abutment.

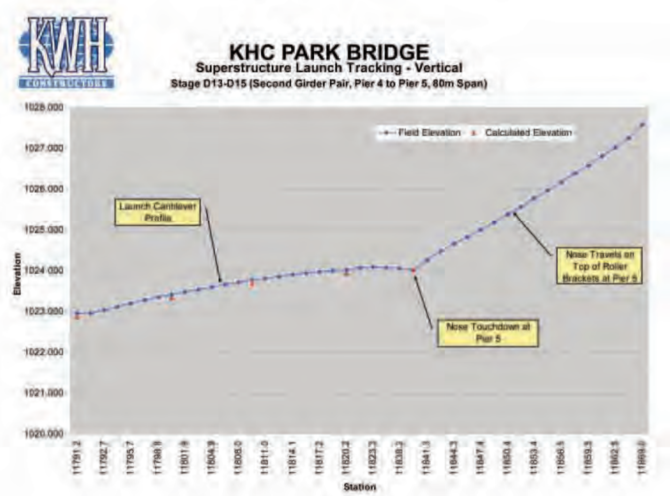


Figure 9 - Tracking elevation

OWNER: B.C. Ministry of Transportation
STRUCTURAL ENGINEER: Parsons Corporation
GENERAL CONTRACTOR: Flatiron Constructors Ltd.
CISC STEEL FABRICATOR: Rapid-Span Structures Ltd. & Structal - Bridges, A Division of Canam Group Inc.
CISC STEEL DETAILER: Tenca Steel Detailing Inc.
STEEL ERECTOR: KWH Constructors Corp.

Images: provided by Flatiron, Parsons and KWH Constructors

THE DECONSTRUCTION AND REBUILDING OF 740 RUE BEL-AIR MONTREAL, QUEBEC

Mark Gorgolewski

The new government building at 740 rue Bel-Air, in Montreal's revitalized west end, is an example of how the deconstruction of an old building can provide materials for a new project at the same location. In addition to the strategy to minimize the environmental impact of materials by reclaiming and reusing materials wherever possible, the project incorporates a range of other innovative green features such as natural ventilation, day lighting systems, geothermal heat sources, radiant floor heating systems, solar heating, and water management systems. The combined effect of these strategies is expected to qualify the project for a gold LEED green building rating and provide energy savings of more than 40 per cent, compared to energy requirements of conventional construction methods.

Many of the original building components and materials were salvaged and reused (in this and other projects) or recycled, and new materials were carefully screened and selected with impact on the environment in mind. Materials from the old buildings reused in the new project included steel joists, steel cladding, bricks, and crushed concrete (as fill). This case study focuses on the issues arising during the deconstruction, design, and construction process that particularly relate to the reuse of steel components.

BACKGROUND

The site at 740 rue Bel-Air in Montreal consisted of a series of industrial buildings dating from 1851, with various more recent additions. Previously, it had been used for a variety of heavy industries, including a foundry, but in more recent times the buildings served as storage space. An old drawing from a newspaper indicates that these buildings were the first in Montreal to use saw-tooth north-facing lighting in the roof. However, the buildings were altered considerably over many years and the original roof structure had been replaced. It was estimated that the existing steel roof structure dated from the 1950s.

By the late 1990s, the site was run down and contaminated. Public Works and Government Services Canada (PWGSC), who owned the site, wanted to redevelop it to help revitalize the neighbourhood around the St. Henri district of Montreal. They proposed a facility to house various government departments, including the Royal Canadian Mounted Police, the Canada Customs and Revenue Agency, Human Resources Development Canada, and the Department of National Defence's Naval Reserve. In total, over 15,000 m^2 of floor area was created for warehousing, office space, and other specialized uses. Sharing facilities such as meeting rooms, storage space, and heating and lighting systems allows the tenants to benefit from the economies of scale and save unnecessary building costs.

PWGSC also wanted to use the project to demonstrate a green building approach and showcase a range of green strategies, including reuse of the buildings or components and recycling of materials that were already on the site. The idea for reusing materials was strongly embedded in the client's request for proposals from architects as part of an overall green strategy aimed to achieve a LEED green building rating of gold.

DECONSTRUCTION PROCESS

The site was seriously contaminated with heavy oils, slag, and other industrial pollutants from its previous use as a foundry, and required considerable remediation. This entailed removing large amounts of contaminated soil, which in turn meant that most of the old buildings on site had to be removed. Originally, the architects had hoped to keep at least some of the existing buildings and find new uses for them, thereby reducing demolition waste and avoiding consumption of new resources. Keeping the buildings would also have facilitated storage of reclaimed materials during construction and assisted in programming the new construction process. However, as the soil remediation progressed, it became

clear that it would not be economical to maintain the structural integrity of the old buildings while removing substantial—amounts of contaminated soil. Although attempts were made to keep some of the buildings, or parts of buildings, eventually doing so proved to be uneconomical, and gradually more and more of the buildings were demolished.

This piecemeal process of removing buildings affected the layout and shape of the new building, as the first strategic design decisions were made when it was still expected that some of the original buildings would be reused. As it became clear that little would remain, there was no time to reconsider the whole design, rather, the scheme had to be extended to accommodate the newly demolished areas of the site.

At an early stage, the client appointed AEdifica, a Montreal architectural practice, to oversee the deconstruction process and identify materials that could be reused, either on site or elsewhere. A contractor specializing in deconstruction (as opposed to demolition) was hired to take down the existing building and find ways of reusing as many components as possible and recycling the rest of the material, where possible. Most of the material was reused off site in other projects around Montreal, or was sent for recycling. A full materials audit was carried out, tracing which materials were available and where they were disposed of. AEdifica estimates that the overall cost of the deconstruction process was no higher than the cost of traditional demolition, when the revenue resulting from the reused materials is considered. However, timing is critical. The deconstruction process requires more time for careful handling of reusable materials and this must be built into the project schedule. Also, deconstruction requires space for storage of the reclaimed materials, ideally on site, but if necessary, elsewhere, while new uses are being found for them.

Approximately 325 open-web steel roof joists were identified as suitable for reuse. In addition, a considerable amount of steel cladding, some brick, some timber, and electrical and mechanical equipment such as elevator components could be reused. Other materials such as wiring, pipes, wood beams, and other steel sections were suitable for recycling, and concrete was crushed to use as fill during the shoring process or for site engineering works.

DESIGN PROCESS

An architectural consortium was appointed for the design of the new buildings, including architects with local expertise and others with a green building track record. The architects developed initial conceptual ideas for the site, organizing the structural system around the parking bay and warehouse racking grid requirements. They then inspected the materials and components available from the deconstruction of the existing building to assess their potential for reuse in the new building, and the designs were revised to suit the available materials.

Continued on page 24

Photo courtesy of Deutsch Associates Architects/Photographer: Jesus [illegible]

Access to information at the appropriate time in the design process was found to be crucial. Initially, information about the components from old drawings and specifications was not available to the designers. Thus, the precise dimensions of the components that might be reused were not known to the design team when the critical structural spacing decisions were being made. This meant that the designs had to be based on estimates; the architects had to maintain as much flexibility as possible in the design to accommodate a range of sizes, which complicated matters. Old drawings can save time and facilitate the design process, as well as increasing opportunities for reuse. In this case, the architects found relevant information which initially was thought to have been lost at the Public Works Canada archive, and which helped them to identify the structural characteristics of components.

The open-web steel joists were deemed useful for the new roof structure. However, to establish their structural integrity and suitability, X-ray imaging and chemical analysis had to be carried out, at a cost of approximately $20,000 Cdn. This showed that they were suitable for the new building, provided they were used at closer centres than modern joists. Initially, 100 joists were put aside for use on this project, with the remainder being disposed of for other reuse projects or for steel recycling. Ultimately, some 65 joists were reused.

The designers also identified the potential for reuse of steel cladding for internal finishes in some of the larger warehouse spaces, and the old brick, although unsuitable for use externally, was appropriate for internal wall surfaces.

CONSTRUCTION PROCESS

The project was divided into three contractual phases:

☐ Deconstruction

☐ Site remediation, shoring, and other ground works

☐ New construction

This led to some coordination problems and issues with contractors not accepting responsibility for dealing appropriately with the materials being reclaimed. Unfortunately, the deconstruction process caused damage to some of the steel joists, which made them unsuitable for reuse. There was also a shortage of suitable storage space on site during construction. This caused the joists to be moved several times around the site, from one external storage area to another, and eventually to be placed in a storage yard off site. This multiple handling, and the time delay between deconstruction and reuse (over two years), led to damage to about 15 per cent of the steel joists and resulted in additional costs.

Eventually, the open-web steel joists were sent to a steel fabricator for sorting and minor refabrication. This was necessary, as it was found that there was some variation in their length. Although some were adapted in length in the workshop, there were still problems that required adjustment of the joist seats on site. The joists were also cleaned and repainted prior to installation on site. The steel cladding required trimming of damaged areas and repainting prior to installation in the new building.

CONCLUSIONS

The increasing awareness of the value of old buildings, both for adaptive reuse and for the value of reusable components within them, led PWGSC to set out a green strategy which included reusing construction materials right at the start of the project, even before demolition was considered. This established strong guidelines for the conservation and reuse of the materials already available on the site. The deconstruction of the old buildings on the site and integration of various materials from those buildings into the new project provide many lessons for the reuse of structural steel and other components, including:

- ☐ Deconstruction of a building, rather than demolition, is economically viable but managing the materials with the necessary care requires added time, and this must be built into the schedule.
- ☐ The role of the client is crucial in any deconstruction and reuse strategy. The client needs to accept that there are some additional risks involved and more time is needed for the reclaiming and reuse of materials.
- ☐ Deconstruction requires space for storage of the reclaimed materials, either on site or elsewhere, before new uses can be found for them, and they can be removed.
- ☐ Because of the nature of the connections of the components, steel is particularly suited to deconstruction and steel components can be readily reused. Other materials can offer additional problems due to the nature of connections and the characteristics of the materials.
- ☐ The availability of information at the appropriate time in the design process is important. Information about sizes of available reclaimed components needs to be available to designers in the early stages of design to facilitate appropriate design decisions.
- ☐ The availability of drawings and specifications of the building from which the steel components are reclaimed can save time and facilitate the design process, as well as increasing reuse opportunities.

The reuse of steel at 740 rue Bel-Air demonstrates the relevance of a comprehensive materials strategy in a project aiming to significantly reduce the environmental impact of a new building, thereby achieving a high LEED green building rating. The success of this project opens the way for more projects to adopt similar strategies, based on the lessons that have been identified above.

FURTHER INFORMATION

CaGBC. (2004). LEED Canada NC v1.0 Green Building Rating System, Ottawa, Canadian Green Building Council. See **www.cagbc.com**

Another excellent resource is **www.reuse-steel.org**.

PROJECT SUMMARY

Owner/client
Public Works and Government Services Canada and The Department of National Defence

Design architects
A consortium comprising: ABCP, Beauchamp-Bourbeau (now Provencher Roy & Associés Architects), and Busby & Associates (now Busby Perkins + Will)

Deconstruction architects
AEdifica

Structural engineers
Saia Deslauriers Kadanoff Leconte Brisebois Blais

Mechanical and electrical engineers
Pageau Morel et Associés

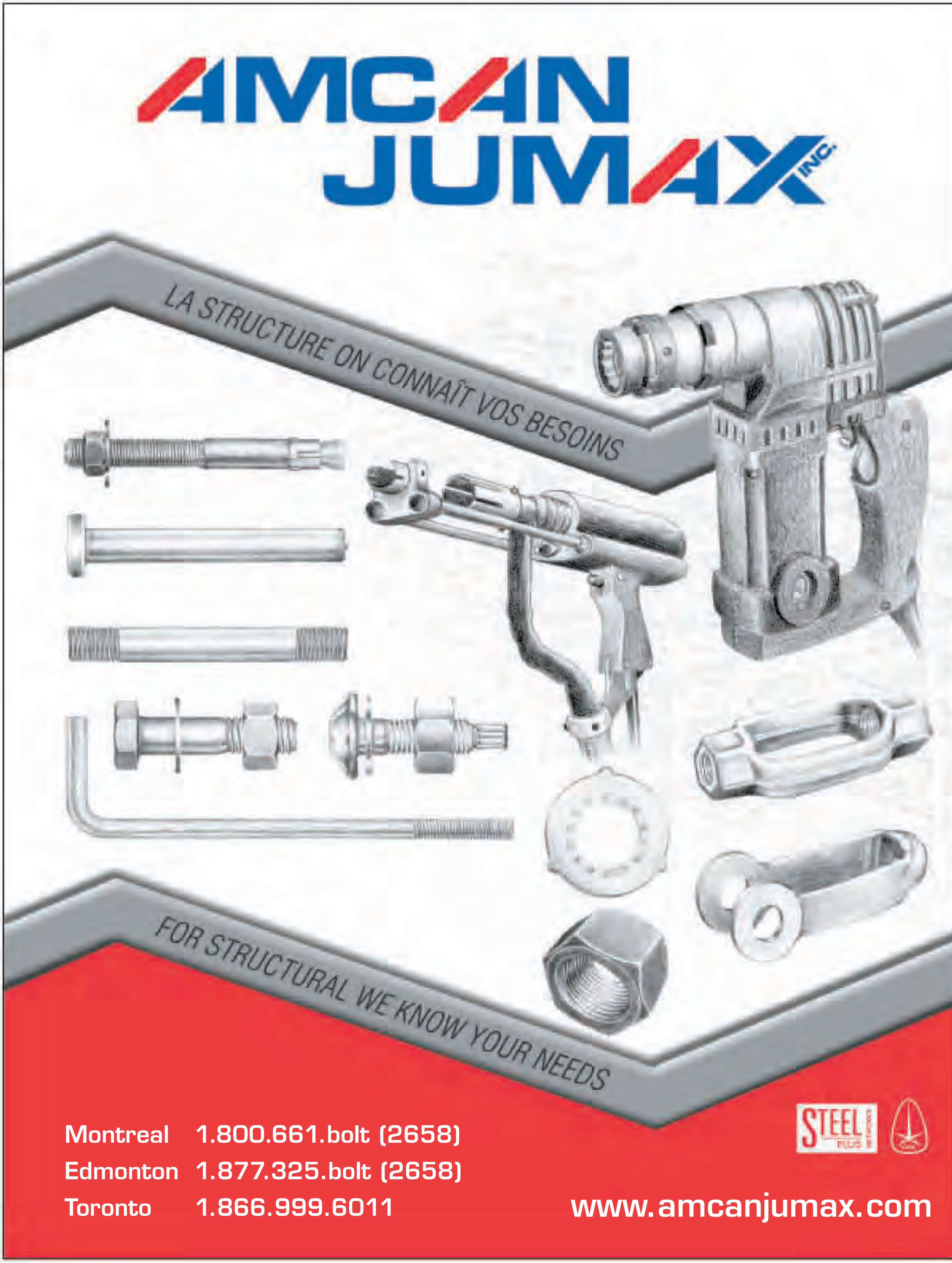
Steel fabricator
Soudure Germain Lessard, Acier Métaux Spec, Canam

Steel suppliers
Acier Leroux, Acier Pacifique, Acier Robel

Contractor
The Decarel Group

Budget
$44 Cdn million

The author is grateful for the information and images provided by Guy Favreau of AEdifica, Claude Bourbeau of Provencher Roy & Associés Architects and Stéphan Blais of Saia Deslauriers Kadanoff Leconte Brisebois Blais.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STEEL

SCHOLARSHIPS AND AWARDS

Rob White

G.J. JACKSON MEMORIAL FELLOWSHIP AWARD

The G. J. Jackson Fellowship is awarded annually by the Steel Structures Education Foundation in memory of the late Geoffrey Jackson. Mr. Jackson was for many years a leader in the Canadian structural steel fabrication industry and was a founding member of the Steel Structures Education Foundation. The Award is presented to Canadian engineering students conducting graduate studies in structural engineering, with major emphasis on steel structures. This prestigious award is currently valued at $15,000, over a one-year period. This award is presented at the SSEF Annual General Meeting and commemorated with the Geoffrey J. Jackson Memorial Medal.

After careful deliberation the committee concluded that the 2008 Jackson Fellowship recipient is **Theresa Anne Holden**, from the *University of Alberta*. Theresa was presented with her award at the annual SSEF / CISC convention this past June in St. Andrews, New Brunswick.

Theresa is a Master's student, working under the supervision of R. Cheng. Theresa will be researching the effectiveness of fatigue repair of steel bridge girders using Carbon Fibre Reinforced Polymers (CFRPs). The test program will include full-scale tests of cracked girders repaired using CFRP patches. The girders will contain typical flame cut details from existing North American steel bridge girders. They will be pre-fatigued then repaired and tested under cyclic loading until failure. The repaired girders will be tested against a control group of un-repaired specimens. The use of CFRP repair as a rehabilitation scheme for steel structures subject to light to moderate fatigue damage is considered a cost-effective method to extend the life of the structure.

This year's judging committee was composed of Joe Schneider and Stig Skarborn, members of the SSEF Board of Governors, and David MacKinnon, SSEF staff representative.

2008 SSEF ARCHITECTURAL STUDENT DESIGN COMPETITION

"cantilever"

The Challenge

Perhaps the most organic of all structural forms, examples of cantilevers surround us in a myriad of structural wonders as exemplified in the diversity of trees and plant life that inhabit our planet. The range of solutions that have been incorporated by nature to solve the requirements for plants to sustain life have provided inspiration for architectural solutions as applied to a range of purposes throughout the millennia. Ranging from utilitarian to exquisite in their execution, the range of responses have all, nonetheless, had to come to terms with one simple problem: the reduction of a load path to a single pathway through the application of tension and balance to achieve a harmonious solution. The cantilever cannot hide its structural requirement; it must, instead, be celebrated and exploited, both architecturally and structurally.

Students were challenged to design a cantilever structure on a site of the designers' choosing. While the purpose, span and scale of the cantilever was left to the discretion of the designer, it is important to focus on what it means for us to engage and experience structure as "cantilever". The structure must be primarily steel, but otherwise, the material palette was open.

The jury consisted of Chris Adach (M & G Steel Ltd.), Neb Erakovic (Halcrow Yolles), and Roger Pavan (Pavan Architects).

Award of Excellence

Matin Moghaddam and **Mathew Winter**, University of Waterloo
Faculty Advisor: Terri Meyer Boake and Vincent Hui
Amount: $3,000

Award of Merit

Andrew Dadds and **David Domanski**, University of Waterloo
Faculty Advisor: Terri Meyer Boake and Vincent Hui
Amount: $2,000

2008 SSEF ARCHITECTURE SCHOLARSHIP

The SSEF is pleased to provide scholarships to students enrolled in accredited professional Schools of Architecture across Canada. These students must show innovation and excellence in steel design. The precise criteria for the award were developed by the individual School and Faculty / Administration.

Scholarship for Excellence in Steel Design
Evguenia Chvetchenko, University of Waterloo, $2,000.00

Scholarship for Structural Steel Design Course - Intermediate
Geoff Christou, University of Waterloo, $1,000.00

Scholarship for Excellence in Steel Design
Jennifer Cutbill / Leila Araghian, University of British Columbia, $1,500.00

Architectural Student Scholarship
Francois Martineau / Patricia Pronovost / Krystel Flamand, University of Laval, $1,000.00

2008 SSEF UNIVERSITY RESEARCH GRANTS

The SSEF actively promotes the research of topics that are considered to be of interest and importance to the steel industry. More than 63 research grants have been awarded to full-time members of engineering faculties of Canadian universities over the past 11 years. In 2008, SSEF was able to provide funding of approximately $110,000. Among the research projects funded this year are "Economical Plate Shear Walls" and "Comparing Carbon Emissions from Constructing a Steel and Concrete Frame Building". The principal researcher of the highest ranked proposal also receives the **H.A. Krentz Research Award** and a gift of $5,000. This year's recipient is Dr. Robert Driver of the University of Alberta. For further details and the application process, please go to the SSEF web site at: **www.ssef.ca**.

CISC also offers a number of scholarship award programs and initiatives for students across Canada. Funded through regional efforts, these initiatives are offered to students conducting studies in the field of structural engineering, and are designed to help promote structural steel studies at Canadian education institutes. The following awards have been presented in the Atlantic, Ontario, and Central regions in 2008.

Atlantic Region

The Atlantic region's scholarship program is open to applicants who will be doing a postgraduate degree on research in structural steel structures or a related topic at one of the four Atlantic Engineering Universities (University of New Brunswick, Université de Moncton, Dalhousie University and Memorial University). Two awards, each in the amount of $2,500 are available annually.

One award has been presented in 2007 / 2008 to Gino Lefrancois of the University of Moncton. His research work is directly related to the steel construction industry and the topic is steel floor vibration characteristics.

Ontario Region

The Ontario Regional Committee awarded eight scholarships in 2008 to students who excelled in their steel design courses, six of which were presented to engineering students and two to architectural students. Chosen recipients were selected based on input from their professors at each respective institution. This year's recipients are:

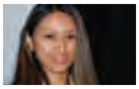
- **Sara Albinger,** Ryerson University, Architectural – Professor Vera Straka, sponsored by MBS Steel Ltd. and Skyhawk Steel Construction Limited

- **Ron French**, University of Western Ontario – studying under the direction of Professor Mike Bartlett, sponsored by Spec-Sec Inc. & Dymin Steel

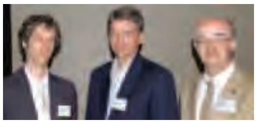
- **Jeffrey Giroux**, Windsor University – studying under the direction of Professor Murty Madagula, sponsored by Benson Steel & Niagara Structural Steel

- **Tarana Haque**, University of Toronto, Engineering – studying under the direction of Michael Gray, sponsored by Telco Steel Works & Mariani Metal Fabricators
- **Sean Keating**, Carleton University – studying under the direction of Professor Heng Aik Khoo, sponsored by Dymin Steel & M & G Steel

- **Arash Akhavan Khaleghi**, Ryerson University, Engineering – studying under the direction of Professor Khaled Sennah, sponsored by Skyhawk Steel & MBS Steel
- **Joel Legault**, University of Toronto, Architectural – studying under the direction of Professor Ted Kesik, sponsored by Mariani Metal Fabricators & Spec-Sec Inc.



- **Akemi Marshall**, McMaster University – studying under the direction of Professor Mike Tait, sponsored by Walters Inc. & Telco Steel Works
- **Colin Smith**, Queen's University – studying under the direction of Professor Colin McDougall, sponsored by Benson Steel & Niagara Structural Steel



- **Gerry Zegerius**, Waterloo University – studying under the direction of Professor Lei Xu, sponsored by M & G Steel & Walters Inc.

These awards provide each recipient with $2000 in scholarship funding. The applicants must be undergraduate students who excel in the steel design course during their third year and who also selected a steel elective in their final year. The award presentations were part of the Ontario Region's 24th Annual Spring Reception held May 15, 2008 at the Toronto Congress Centre.

British Columbia Region

The BC Regional Committee has offered a Fabricator's Engineering Apprentice program for the past eight years. The program formally integrates a UBC student's academic studies with work experience in co-operative employer organizations, for a four-month work-term working with both a CISC fabricator and structural engineering consultant. Congratulations to the following students who were selected to participate in the 2008 program. The CISC steel fabricator employer is also listed. These students were presented with a certificate award at the BC Region's 2008 Steel Design Awards of Excellence in Vancouver held on November 19, 2008.

- **Robert Crompton**, Canron Western Constructors Ltd.
- **Henry Chan**, J.P. Drafting Ltd.
- **Bernard Lai**, George Third & Son Ltd.
- **Jonathan Woo**, Empire Iron Works Delta
- **Alireza Maoumi**, KWH Constuctors

Central Region

The Central Regional Committee has established an annual scholarship award in the amount of $2,000, which is presented to a student(s) enrolled in the College of Engineering at the University of Saskatchewan. In 2008, the award was shared by **Cameron Beauregard** and **Jocelyn Dziadyk** with each receiving $1,000.

PIZZA AND POP PRESENTATIONS

The Atlantic Regional Committee is continuing with this concept to showcase and discuss the benefits and merits of working with structural steel within the steel industry, at Universities and Community Colleges in the Atlantic region.

We bring the lunch, the people and the content! These meetings can be arranged with students and / or professors on site at the campus. CISC's Atlantic Regional Director, Alan Lock will facilitate the meeting and bring along a local CISC steel fabricator(s), and an industry consultant, as well as representatives from a local steel erector or steel detailer to enhance the presentation, if possible. This is a great opportunity for senior civil engineering students to view and discuss the latest industry drawings and pictures, and hopefully increase their knowledge and interest in working with structural steel.

On March.19th a presentation was made to the Civil Engineering Technology students and instructors at the NSCC in Dartmouth. This presentation included a local consultant, two fabricator representatives and the local CISC representative. The presentation was well received and CISC was asked to consider arranging a similar presentation for a larger audience at NSCC next year.

A second "Pizza and Pop" presentation was done for the Dalhousie final year Civil Engineering students and professors which included a tour of a local fabrication shop. As in previous presentations it was well attended and the shop tour proved to be the highlight of the event.

For more information about these education initiatives or to find out how to apply for an award, please contact your regional director or visit our websites at www.cisc-icca.ca and www.ssef-ffca.ca.

FOR GREEN'S SAKE

The steel construction industry has implemented several initiatives to reduce its environmental footprint. In this space, we will provide brief overviews of the many ways in which the steel construction industry is going green. Your questions can be sent to Sylvie Boulanger, Director, Sustainable Development, Canadian Steel Construction Council at sboulanger@cisc-icca.ca.

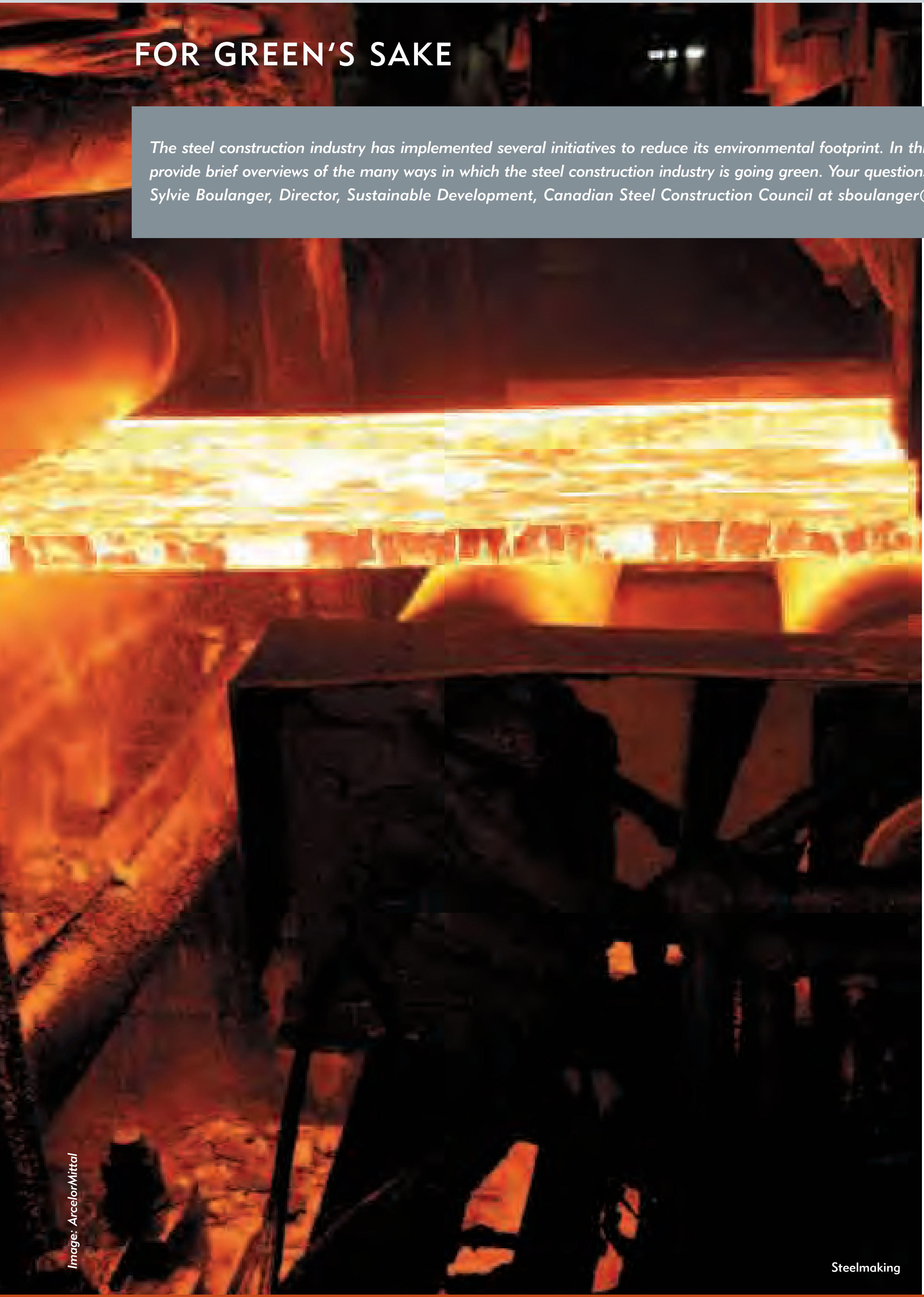


Image: ArcelorMittal

Steelmaking

THE COMPARISON CHALLENGE

Will Koroluk

Concerns about energy and the environment have existed for decades now—sometimes much in evidence in the popular press, but at other times decidedly out of fashion. The increasingly visible spectre of climate change, however, has generated more worry, more research, more debate than any environmental issue ever has. Last summer's spike in energy prices added more impetus to the conversation.

The research community has been aware of growing environmental problems for many years, of course, and much work has been done in exploring the relationships that exist between building materials and construction processes, and the environmental impacts that result during the production, distribution and use of those materials. In the process, a whole new vocabulary has developed in an attempt to describe in simple terms something that is anything but simple.

Consider the concept of embodied energy, which is just one of the factors considered when attempting to measure sustainability. Often thought of as a single idea, it can be thought of in two parts—initial embodied energy and recurring embodied energy.

The initial embodied energy in structures is the non-renewable energy used in gathering and processing raw materials, then converting them into products needed in construction. This is sometimes referred to as indirect energy. Then comes direct energy—energy used to transport the materials to the building site and the construction itself.

Recurring embodied energy represents the non-renewable energy used to maintain and repair components and systems during the building's lifetime. Calculating embodied energy is complicated, and involves the use of a number of data sources. The final answer is a number that can represent megajoules or gigajoules per kilogram or tonne or square metre. Complicating all this is the fact that the answer can be different in different countries or areas within a country, because of such variables as shipping distances.

The energy embodied in building materials, whatever they may be, likely represents only six to 10 per cent of the energy that the building will consume in total during its lifetime. Operating a building, after all, costs far more that constructing it. Even so, it's necessary to view the final number with care, simply to ensure the context is accurate, that one is comparing apples with apples. That's because, when considering embodied energy, a tonne of one material can't be compared with a tonne of another. Steel, for example, is usually thought of as incurring high energy consumption per tonne. But think of what you can do with that tonne.

Steel buildings typically weigh roughly half as much as a similar building constructed with concrete. That means half as much material to obtain a building with a similar energy footprint. And all that steel—which already has a lot of recycled content—will be recycled again when the building reaches the end of its life. It's important, too, to understand how marrying two materials into a single product or assembly affects not only performance, but the amount of energy embodied in that assembly. Radiant floor systems might be made of concrete or steel and concrete, and the energy embodied in each can be markedly different.

Facade systems, which typically include a lot of steel, can have an impact on perhaps 30 per cent of a building's energy consumption, so how the steel is married to concrete can not only have a bearing upon embodied energy, but also have a profound effect on energy use during the life of the building. All of this makes tonne-for-tonne comparisons specious; an environmental profile is much more than comparing a tonne of this with a tonne of that. So one must be careful of embodied energy numbers, because there are different ways of arriving at them. It's not possible say that this is 10-per-cent better than that, and so make a decision on that basis.

Of course, embodied energy alone is only one factor involved in a complex decision-making process. We must bear in mind that what matters most is the total context—how all materials fit together in an over-all picture that has many parts. As environmental concerns have grown (with climate change being the latest, but most important) the concept of life-cycle analysis has grown in both complexity and sophistication. Now, scientists talk of life-cycle assessments, life-cycle inventories, and life-cycle impact assessments among other things. It's a necessary step, as we have come to realize the complexity of the structures we're building, and the many different impacts imposed on the environment during a structure's lifetime—from site planning to final demolition, recycling and reuse.

Now the World Steel Association—which until recently was known as the International Iron and Steel Institute—is in the late stages of a second extensive study to measure and benchmark the CO2 emitted per tonne of steel manufactured at its members' plants. This effort, the association says, is the cornerstone of the steel industry's global approach to CO2 reduction. Once all the data are collected and verified, a series of regional reports will be issued. The industry has already shown real progress in reducing emissions per tonne of steel produced. But more important, the data will enable steel companies and associations to establish new benchmarks and to set future emission targets.

We didn't get into the environmental mess we're in overnight. We're not going to get out of it overnight, either, which is why the industry must have the ability to make long-term commitments based on current and verifiable data. These are exciting times, in which environmental concerns have led us into an unparalleled period of discovery and innovation. More is needed.

All the talk we hear about embodied energy, about carbon or energy footprints, about life cycles, is just part of the drive for sustainability that is leading researchers down many previously unexplored paths. As they find their way, the results they achieve will yield new tools for architects and engineers to use so that our buildings—and the way we build them—can make positive contributions to the environment, instead of degrading it.

It's an objective worth working toward—for green's sake.

WHAT'S COOL, WHAT'S HOT, WHAT'S NEW

BRINGING SOFTWARE TRAINING TO LOCAL HIGH SCHOOLS

The OSCO Construction Group is partnering with some educators from Saint John, N.B. high schools to bring new, state-of-the-art software to students and promote careers in the field of computer-animated drafting.

"We were seeing a real need to recruit young people and show them the kind of interesting, technical work that we do," says Lisa Frazee, Detailing Manager at Ocean Steel, part of the OSCO Construction Group. "The teachers told us that students were often frustrated in their AutoCAD courses because of old systems and slow processes," explains Frazee. "We offered to help by donating our time to train teachers on SDS/2, the software that we use everyday to create 3D drawings."

"Currently, there is no secondary-level training available for people who are interested in working as a drafting detailer," explains Lanigan, HR Recruiter with OSCO. "Now, we will have the chance to recruit students for co-op terms and some may even continue to work with our company after graduation."

COURSES

The 2005 National Building Code of Canada introduces very substantial technical changes, and to reconcile the new NBCC requirements, CSA issued S16S1-05, Supplement #1 to CAN/CSA-S16-01 (CSA S16). All of these changes necessitate a fresh look at the underlying framing decisions to be made by designers. In response, CISC is offering two one-day courses intended to provide an understanding of the design theory and the rationale behind code provisions as well as the application of specific Code formulae and requirements.

Steel-Framed Commercial Building Design

This course will be offered once again in major centres across Canada and will focus on practical and economical solutions for framing a six-storey building. Practical steel framing concepts and integration with architectural and mechanical features will be discussed. The course notes will include design solutions for the wind-resisting system as well as typical members and components of the gravity frame.

Toronto, ON – March 3, 2009
Premiere Convention Centre, Richmond Hill

Montreal, QC - March 18, 2009 (French)
La Plaza Hotel

Seismic Design of Steel-Framed Buildings

This high-demand course will be offered in seismically active centres in Canada again and will cover the design of various categories of braced frames and moment frames to the requirements of NBCC 2005 and CSA S16-01 (S16S1-05) incorporating design examples for buildings ranging from one to ten storeys in height.

Toronto, ON – March 4, 2009
Premiere Convention Centre, Richmond Hill

Montreal, QC - March 19, 2009 (French)
La Plaza Hotel

2009 ASCE/AISC NATIONAL STUDENT STEEL BRIDGE COMPETITION

CISC and SSEF are proud sponsors of the ASCE/AISC National Student Steel Bridge Competition. The design of bridges is perhaps the most exciting challenge for a structural engineer. This competition fosters the challenge of designing and testing a bridge. Students are encouraged to apply their theoretical knowledge in a hands-on project that addresses the full breadth of steel design requirements, including: aesthetics, speed of erection, lightness, stiffness, economy and efficiency.

The 2009 competition will take place May 22nd and May 23rd at the University of Nevada, Las Vegas. AISC and the competition cosponsors assist with travel funds for those teams invited to compete. The first top team from each region receives (US) $1000. The second top team from each region receives (US) $500. SSEF contributes $1000 to each Canadian team that qualifies for the National competition. SSEF also tries to match a team with a local CISC Steel Fabricator. CISC Regional Committees provide varying levels of financial support for Canadian teams attending regional competitions.

ONTARIO DIVISION FIVE SPECIFICATIONS

The Ontario region is pleased to announce the Ontario Division Five Specifications for Structural Steel. This specification has been developed by CISC's Ontario region to ensure the most cost effective and schedule efficient project for the owner. It is intended to be a basic document and is to remain unchanged except that job specific requirements may be outlined in the Appendix A. You can download a copy of the document from CISC's website at **www.cisc-icca.ca/ONDiv5Specs**

STEEL FABRICATION QUALITY SYSTEMS GUIDELINE AND COMMENTARY

Prepared with the help of the Alberta Region Quality Assurance Subcommittee, this new Commentary will provide fabricators with clear, easy-to-follow information on the CISC Steel Fabricator Quality System Guideline originally published in 2002.

The 2nd Edition Guideline and Commentary is currently available in electronic PDF format only and may be downloaded from the CISC website: **www.cisc-icca.ca/publications/technical/codes/qualityguide/**

CISC AND SSEF ANNUAL CONVENTION

The 2009 Annual Convention will take place from June 17th to 20th in Winnipeg, Manitoba at the Fort Garry Hotel. We anticipate attendance of over 250 delegates who will be representing the steel industry from across Canada.

The City of Winnipeg is located at the junction of the Red and Assiniboine Rivers, characterized by slow but steady growth–it is the eighth largest city in Canada and dominates the Manitoba economy.

Winnipeg is a wonderful, diverse place, best know for it's superb restaurants and excellent shopping facilities. It offers a little something for everyone. Diverse architecture and great parks that are home some of the most beautiful trees in Winnipeg, just add to the city's character.

The Fort Garry Hotel is designated a national historic site. Since 1913, this former Grand Trunk Pacific Railway hotel has stood as a symbol of Winnipeg's importance as a North American transportation hub and of the prairie city's affinity for old world elegance. One of Winnipeg's most prestigious landmarks, The Fort Garry is now in its 10th decade. This fine establishment has 230 rooms and offers a top-notch staff waiting to please all guests.

The Central Regional Committee has a number of tours and evening venues planned for our attendees to experience the very best of what Winnipeg has to offer!

NEW MEMBERS

At the November meeting of the CISC Board of Directors the following organizations were elected as new members.

Fabricators
Tardif Metal Inc.
15971 Boul. de la Colline
Lac St-Charles, QC, G3G 3A7
Tel: 418 849 6919 | Fax: 418 849 7744

Tecno Metal Inc.
1495 rue Provinciale, Quebec, QC, G1N 4S9
Tel: 418-682-0315 | Fax: 418-682-3652

Detailer
Acklam Drafting Service
375 Elm Grove, Tecumseh, ON, N8N 4H1
Tel: 519 979 1674 | Fax: 519 979 3123

Supplier
Behlen Industries Limited
927 Douglas Street, Brandon, MB, R7A 7B3
Tel: 800 663 7538 | Fax: (204) 725-4932

IKG Industries
1111 Davis Drive, 1-120, Newmarket, ON, L3Y 9E5
Tel: 905 953 7779 | Fax: 905 953 7774
www.ikgindustries.com

EVENTS

The Steel Conference, NASCC 2009
April 1 – 4, 2009 Phoenix, Arizona
www.aisc.org/nascc

CSCE 2009 Annual Conference – On the Leading Edge
May 27 – 30, 2009 St. John's, NL
www.csce.ca/2009/annual

Structures Congress 2009
April 30 – May 2, 2009, Austin, Texas
www.content.asce.org/conferences/structures2009/

ASCE/AISC National Student Steel Bridge Competition
May 22 – May 23, 2009, Las Vegas, Nevada
www.ssef.ca/competitions

CISC and SSEF Annual General Meetings
June 17 – 20, 2009 Winnipeg, MB
Fort Garry Hotel

33rd IABSE Symposium on Sustainable Infrastructure: Environment Friendly, Safe
September 9 – 11, 2009 Bangkok, Thailand
www.iabse.org/conferences/bangkok2009/index.php

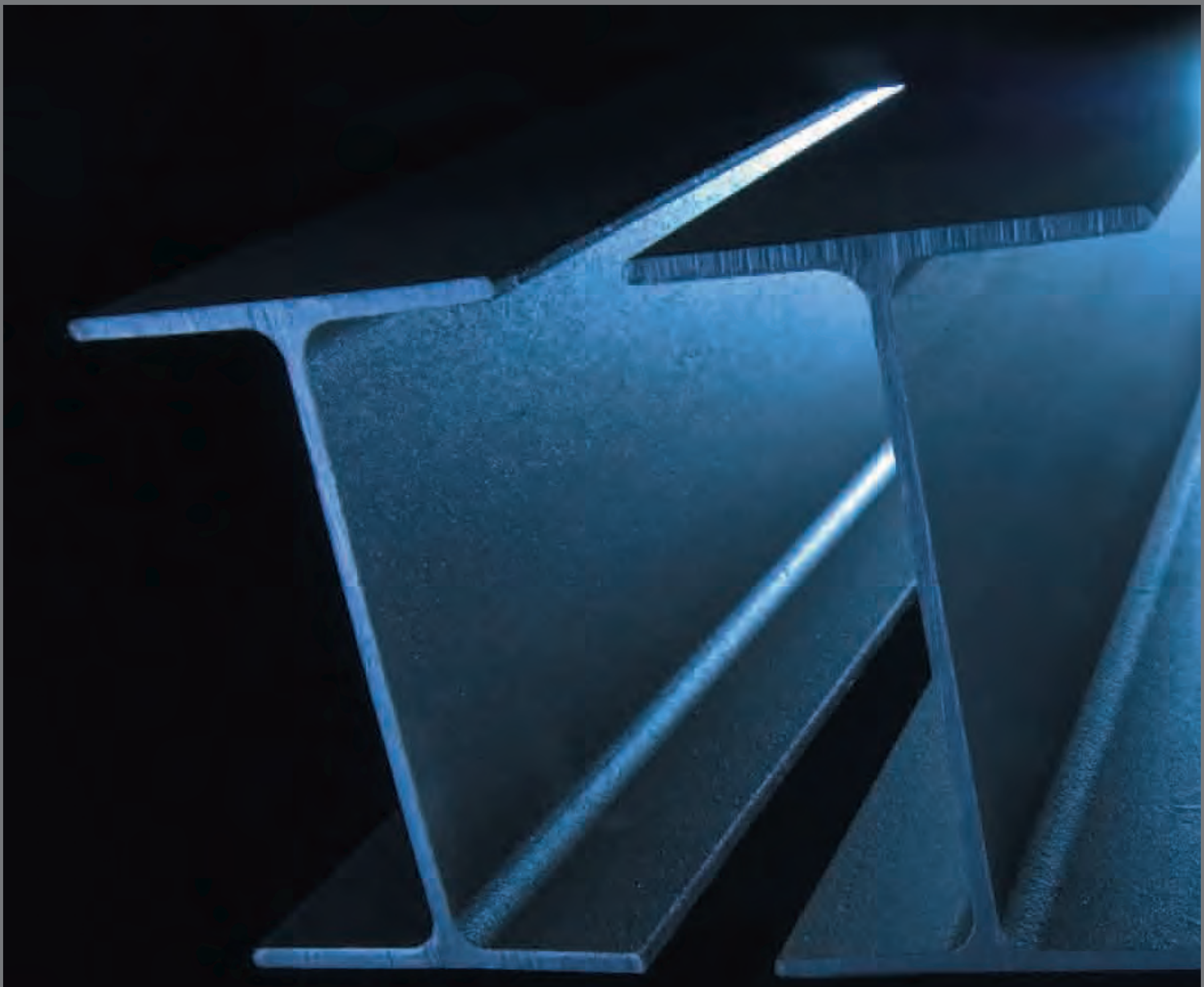
Ninth U.S. National and Tenth Canadian Conference on Earthquake Engineering: Reaching Beyond Borders
July 25 – 29, 2010 Toronto, ON
www.eeri.org/site/content/view/410/2/

REGIONAL ACTIVITIES

Ontario Region Professional Members Meeting
February 25, 2009 – Congress Centre, Toronto
www.cisc-icca.ca/ontarioprofessional

Alberta Design Awards
March 26, 2009 – Shaw Conference Centre, Edmonton
www.cisc-icca.ca/albertaawards

Ontario Design Awards
May 13, 2009 Awards Ceremony / Spring Reception
Living Arts Centre, Mississauga
February 27, 2009 – Intention to Submit deadline
March 31, 2009 – Project Submission deadline
www.cisc-icca.ca/ontarioawards

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Atcon Industrial Services Inc. Br
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www.atcongroup.com

* **Canam - Canada,** S,J
A Division of Canam Group Inc.
Moncton, N.B. (506) 857-3164
www.canam-steeljoist.ws

Cherubini Metal Works Limited S,P
Dartmou h, N.S. (902) 468-5630
* Mount Pearl, Nfld. (709) 745-8060
www.cherubinigroup.com

Marid Industries Limited S
Windsor Junction, N.S. (902) 860-1138
www.marid.ns.ca

MacDougall Steel Erectors Inc. S
Cornwall, PEI (902) 855-2100
www.mse-steel.ca

MQM Quality Manufacturing Ltd. S,P
T acadie-Sheila, N.B. (506) 395-7777

Ocean Steel & Construction Ltd. S,P
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www.oceansteel.com

Prebilt Structures Ltd. S,P
Charlottetown, P.E.I. (902) 892-8577
* Summerside, P.E.I. (902) 436-920l

RKO Steel Limited S,P
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www.rkosteel.com

Tek Steel Ltd. S
Fredericton, NB (506) 452-1949

Titan Metal Group Ltd. S
Saint-Antoine, NB (506) 525-2416
www.titansteelg oup.com

QUÉBEC REGION

Acier Métaux Spec inc. S
Chateauguay, Québec (450) 698-2161
www.metauxspec.ca

Acier Robel inc. S
St-Eustache, Québec (450) 623-8449
www.acier obel.com

Acier Trimax Inc. S
Ste-Marie, Beauce, Québec (418) 387-7798
www.trimaxsteel.com

Alma Soudure Inc S
Alma, Québec (416) 669-0330
www.almasoudure.com

B.K. Fer Ouvré/Iron Works Inc. S
St-Bruno, Québec (450) 441-5484

Constructions PROCO Inc. S
St. Nazaire, Québec (418) 668-3371
www.p oco.ca

FASLRS Métaux Ouvrés F.G. S
St-Léonard, Québec (514) 852-6467
www.fgmetal.com

Industries Canatal Inc. S
Thetfo d Mines, Québec (418) 338-6044
www.canatal.net

Canam Canada, S,J
une division de Groupe Canam Inc.
Ville de St. Geo ge, Québec (418) 228-8031
* Boucherville, Québec (450) 641-4000
* Sainte-Foy, Québec (418) 652-8031
www.canam-poutrelle.ws

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Lainco Inc. S
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Les Aciers Fax Inc. S
Charlesbourg, Quebec (418) 841-7771

Les Acier Jean-Pierre Robert inc. S
Laval, Québec (450) 661-4400
www.jprobert.ca

Les Charpentes d'acier Sofab Inc. S
Boucherville, Québec (450) 641-2618
www.sofab.ca

Les Constructions Beauce-Atlas Inc. S
Ste-Marie de Beauce, Québec (418) 387-4872
* Montréal, Québec (514) 942-7763
www.beauceatlas.ca

Les Industries V.M. inc. S
Longueuil, Québec (450) 651-4901

Les Métaux Feral Inc S
St-Je ome, Québec (450) 436-8353

Les Structures C.D.L. Inc. S
St-Romuald, Québec (418) 839-1421
www.structurescdl.com

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Rimouski, Québec (418) 724-9433
www.structuresgb.com

Les Structures Gialay Inc. S
Varennes, Québec (450) 929-4765

Locweld Inc. S
Candiac, Québec (450) 659-9661
www.locweld.com

Métal Moro Inc. S
Montmagny, Québec (418) 248-1018

Métal Perrault Inc.
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www.querometal.com

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www.structalponts.ws

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Tardif Metal Inc. S,P,B
Lac St-Charles, QC (418) 849-6919

Tecno Metal Inc. S,B
Quebec, QC, (418) 682-0315

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www.aclsteel.ca

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B ampton ON (905) 793-7793

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www.burncomfg.com

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A Division of Canam Group Inc.
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www.canam-steeljoist.ws

Central Steel Fabricators Limited S,J
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Central Welding & Iron Works Group S,P
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www.central-welding.com

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Ed Lau Ironworks Limited S
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www.edlau.com

Etobicoke Ironworks Limited S
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www.eiw-ca.com

Fortran Steel Inc. S
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www.fortransteel.com

G & P Welding & Iron Works S,P
North Bay, Ontario (705) 472-5454
www.gpwelding.com

Gorf Contracting Limited S,P
Schumacher, Ontario (705) 235-3278
www.gorfcont acting.com

Lambton Metal Service S
Sarnia, Ontario (519) 344-3939
www.lambtonmetalservice.ca

Laplante Welding of Cornwall Inc. S
Cornwall, Ontario (613) 938-0575
www.laplantewelding.com

Lorvin Steel Ltd. S
B ampton, Ontario (905) 458-8850
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M & G Steel Ltd. S
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M.I.G. Structural Steel S
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www.migsteel.com

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Bolton, Ontario (905) 857-6404

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CENTRAL REGION

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Coastal Steel Construction Limited S,P
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www.coastalsteel.ca

Elance Steel Fabricating Co. Ltd S
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Falcon Machinery (1965) Ltd.
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www.falcongalv.com

IWL Steel Fabricators Ltd. S,P
Saskatoon, SK (306) 242-4077
www.iwlsteel.com

JNE Welding S,P
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* **Omega Joists Inc.** J
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www.omegajoists.com

Shopost Iron Works (1989) Ltd. S
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www.shopost.com

Supreme Steel Ltd. S,P
Saskatoon, SK (306) 975-1177
www.supremesteel.com

Weldfab Limited S
Saskatoon, SK (306) 955-4425
www.weldfab.com

ALBERTA REGION

Bow Ridge Steel Fabricating S
Calgary, Alberta (403) 230-3705

C.W. Carry (1967) Ltd. S,P
Edmonton, Alberta (780) 465-0381
www.cwcarry.com

Canam – Canada, A Division of Canam Group Inc J
Calgary, Alberta (403) 252-7591
www.canam-steeljoist.ws

Capital Steel Inc.
Edmonton, Alberta (780) 463-9177

Collins Industries Ltd. S
Edmonton, Alberta (780) 440-1414
www.collins-industries-ltd.com

Empire Iron Works Ltd. S,P,J
Edmonton, Alberta (780) 447-4650
www.empirei on.com

Eskimo Steel Limited S,P
Sherwood Park, Alberta (780) 417-9200
www.eskimosteel.com

Garneau Welding Inc. S
Morinville, Alberta (780) 939-2129
www.garweld.com

Moli Industries Ltd. S
Calgary, Alberta (403) 250-2733
www.moli.ca

Norfab Mfg. (1993) Inc.
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Northern Weldarc Ltd.
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www.nor hern-weldarc.com

Omega Joists Inc. J
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* Calgary, Alberta (403) 250-7871
www.omegajoists.com

Petro-Chem Fabricators Ltd. S
Edmonton, Alberta (780) 414-6701

Precision Steel & Manufacturing Ltd. S
Edmonton, Alberta (780) 449-4244
www.precisionsteel.ab.ca

Rampart Steel Ltd. S
Edmonton, Alberta (780) 465-9730
www. ampartsteel.com

RIMK Industries Inc.
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Spartan Steel Ltd. S
Edmonton, Alberta (780) 435-3807

Supermétal Structures Inc., Western Division S,P
Edmonton, Alberta (780) 435-6633
www.supermetal.com

Supreme Steel Ltd. S,P
Edmonton, Alberta (780) 483-3278
www.supremesteel.com

Supreme Steel Ltd., Bridge Division S,P
Edmonton, Alberta (780) 467-2266
www.supremesteel.com

Triangle Steel (1999) Ltd. S,P
Calgary, Alberta (403) 279-2622
www.trianglesteel.com

TSE Steel Ltd. S
Calgary, Alberta (403) 279-6060
www.tsesteel.com

W.F. Welding & Overhead Cranes Ltd. S
Nisku, Alberta (780) 955-7671
www.wfwelding.com

Waiward Steel Fabricators Ltd. S,P
Edmonton, Alberta (780) 469-1258
www.waiward.com

Whitemud Ironworks Limited S
Edmonton, Alberta (780) 465-5888
www.whitemud.com

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Port Coquitlam, B.C. (604) 583-9760
www.canam-steeljoist.ws

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Delta, B.C. (604) 524-4421
www.supremesteel.com

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Abbotsford, B.C. (604) 852-2131
www.cli on.com

Dynamic Structures Ltd. S,P
Port Coquitlam, B.C. (604) 941-9481
www.empireds.com

Empire Iron Works Ltd. S
Delta, B.C. (604) 946-5515
www.empirei on.com

George Third & Son S,P
Burnaby, B.C. (604) 526-2333
www.geo hird.com

ISM Industrial Steel & Manufacturing Inc.
Delta, B.C. (604) 940-4769

J.P. Metal Masters Inc. S
Maple Ridge, B.C. (604) 465-8933
www. jpmetalmasters.com

M3 Steel (Kamloops) Ltd. S,P
Kamloops, B.C. (250) 374-1074
www.m3steel.com

Macform Construction Group Inc.
Langley, BC (604) 888-1812

* **Omega Joists Inc.** J
Surrey, B.C. (604) 596-1138
www.omegajoists.com

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www. apidspan.com

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www.solidrocksteel.com

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Kelowna, B.C. (250) 765-8800

Wesbridge Steelworks Limited S
Delta, B.C. (604) 946-8618
www.wesbridge.com

X.L. Ironworks Co. S,J
Surrey, B.C (604) 596-1747
www.xliron.com

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Lachenaie, Québec (450) 654-0270

ABC Drafting Company Ltd. B
Mississauga, Ontario (905) 624-1147
www.abcd afting.com

ACL Structural Consultants Ltd. B
Sylvan Lake, Alberta (403) 887-5300
www.acl-corp.com

A.D. Drafting B
B ampton, Ontario (905) 488-8216

Acklam Drafting Service
Tecumseh, ON, (519) 979-1674

Aerostar Drafting Services B
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Automated Steel Detailing Associates Ltd. (ASDA) B,Br,P
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www.asda.ca

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www.bld.ca

B.D. Structural Design Inc./ Dessin Structural B.D. Inc. B,Br,P,J
Boucherville Québec (450) 641-1434
www.bdsd.com

Cadmax Detailing Inc./Dessin Cadmax Inc. B,Br
Boisbriand, Québec (450) 621-5557
www.cadmax.ca

CADD Alta Drafting & Design Inc.
Edmonton, Alberta (780) 461-7550
www.caddalta.com

Datadraft Systems Inc./ Les Systèmes Datadraft Inc. S,P,J,B
Montréal, Québec (514) 748-6161
www.datadraft.com

Detailed Design Drafting Services Ltd. B
Parksville, B.C. (250) 248-4871
www.detaileddesign.com

Dessins de Structures DCA Inc.
Levis, Québec (418) 835-5140
www.structuredca.ca

Draft-Tech Inc.
Windsor ON (519) 977-8585

GENIFAB B,Br
Charlesbou g, Quebec (418) 622-1676
www.genifab.com

Haché Technical Services Ltd./ Haché Services Techniques Ltée B,P
Caraquet, N.B. (506) 727-7800

Husky Detailing Inc. B
London, Ontario (519) 850-9802
www.huskydetailing.com

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Nanaimo, B.C. (250) 758-6060
www.intersteel.ca

IRESCO Ltd. B
Edmonton, Alberta (708) 433-5606
www.steeldetailers.com

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JP Drafting Ltd. B,Br,P,J
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www.jpdrafting.com

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www.kgsg oup.com

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www.steltec.ca

Les Dessins Trusquin Inc. B,Br
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Maximum Steel Detailing Inc. B
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www.mddrafting.com

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www.mtecinc.ca

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www.p odraftinc.com

Ranmar Technical Services B,P
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www. anmartech.com

Saturn Detailing Services Ltd. B
Winnipeg, Manitoba (204) 663-4649

SDI Structural Drafting Inc. B,Br,P
Edmonton, Alberta (780) 463-2140
www.sdiinc.ca

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Prince George, B.C. (250) 561-1646
www.tdsindustrial.com

Techdess Inc. B
Saint-Jérôme, Québec (450) 569-2629
www.techdess.com

Tenca Steel Detailing Inc. Br
Charlesbourg, Quebec (418) 634-5225
www.tensorengr.com

Workpoint Steel Detailing Ltd. S
Surrey, B.C (604) 574-2221

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Niaga a Falls, Ontario (905) 354-3700
www.esfox.com

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Boisbriand, Québec (450) 430-2212
www.montacier.com

Montage D'acier International
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Supermétal-Mojan Inc. B,Br,J
St-Romuald, Québec (418) 834-1955
www.supermetal.com

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Acier Picard Inc.
St-Romuald, QC (418) 834-8300
www.acierpica d.com

Legend: *sales office only B-buildings Br-bridges S-structural P-platework J-open-web steel joist

A/D Fire Protection Systems Inc.
Laval, Québec (450) 661-0006
www.adfire.com

Advanced Bending Technologies Inc.
Langley, B.C. (604) 856-6220/ 1-800-563-2363
www.bending.net
(Rolled or bent structural sections)

Altitube Steel Inc./Acier Altitube Inc.
Laval, Québec (514) 637-5050
www.altitube.com
(Specializing in tubes (HSS), structural pipe)

Amercoat Canada
Montréal, Québec (514) 333-1164
Oakville, Ontario (905) 847-1500
www.ame coatcanada.com
(Protective paints and coatings)

American Iron & Metal Inc./
La Compagnie Américaine de Fer et Métaux Inc.
East Montréal, Québec (514) 494-2000
www.scrapmetal.net

Amcan Jumax Inc.
St-Hubert, Quebec (450) 445-8888
www.jumax.net
(bolts, studs, anchors, hot-dip galvanization)

Atlantic Industries Limited
Do chester, NB (506) 379-2428
www.ail.ca
(galvanizing)

Behlen Industries Limited
B andon, MB (800) 663-7538

Blastal Coatings Services Inc.
B ampton, Ontario (905) 459-2001
www.blastal.com
(Wheelbrating, blasting, glass bead services, epoxy coatings, enamels, zinc rich primers, metalizing, plastic flame coating)

Blastech Corporation
B antford, Ontario (519) 756-8222
www.blastech.com
(Abrasive blasting, glass bead blasting application of liquid coatings, baked on coatings and powder coatings of metalizing)

Bolair
Mississauga, ON (905)564-2231
www.bolair.ca
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Borden Metal Products (Canada) Limited
Beeton, Ontario (905) 729-2229
www.bordengratings.com
(Aluminum, Stainless Steel, Steel Grating)

Brunswick Steel
Winnipeg, Manitoba (204) 224-1472
www.brunswicksteel.com
(Steel - Structures plate bars hss)

Cloverdale Paint Inc.
Edmonton, Alberta (780) 453-5700
www.cloverdalepaint.com
(Specialty hi-performance industrial coatings and paint products)

Commercial Sandblasting & Painting Ltd.
Saskatoon, Saskatchewan (306) 931-2820
(Sandblasting and protective coating applications)

Corrcoat Services Inc.
Surrey, BC (604) 881-1268
(Sandblasters & Coaters)

CMC Steel division of Crawford Metal Corp./
Acier CMC division de Crawford Metal Corp.
Longueuil, Québec (450) 646-6000
(Angles, channels, hss, beams, plates)

Custom Plate & Profiles
Delta, B.C. (604) 524-8000
www.customplate.net
(Cut to size steel plate in various grades to 12" thick. Stock size sheets of plate to 12")

Daam Galvanizing Inc.
Edmonton, Alberta (780) 468-6868
www.daamgalvanizing.com
(Hot dip galvanizing)

Devoe Coatings
Edmonton, Alberta (780) 454-4900
www.devoecoatings.com
(Coating, paint)

EBCO Metal Finishing L.P.
Richmond, B.C. (604) 244-1500
www.ebcometalfinishing.com
(Hot dip galvanizing)

EDVAN Industries Inc.
Nisku, Alberta (780) 955-7915
www.edavancan.com
(Shear & form of steel plates & coil, supply of safety grating – grip strut, pert-o grip, traction, tread))

Endura Manufacturing Co. Ltd.
Edmonton, Alberta (780) 451-4242
www.endura.ca
(Paint and Coating Materials)

Fisher & Ludlow, A Division of Harris Steel Limited
Longueuil, Québec (450) 670-5085
Edmonton, Alberta (780) 481-3941
Surrey, B.C. (604) 888-0911
www.fisherludlow.com
(Welded steel /aluminum/stainless steel grating, "Grip Span" and "Shur Grip" safety grating)

Frank's Sandblasting & Painting
Nisku, Alberta (780) 955-2633

General Paint/Ameron Protective Coatings
Vancouver, B.C. (604) 253-3131
www.generalpaint.com
(Shop primers, protective coatings, paint)

Globec Machinery/Globec Machineries
Quebec, QC (418) 864-4446
www.globec-machinery.com

IKG Industries
Newmarket, ON (905) 953-7779
www.ikgindustries.com

Industrie Dry-Tec Coating inc.
Terrebonne, Québec (450) 965-0200
www.drytec.ca
(Grating, metallizing, paint)

J & M Sandblasting & Painting
Oshawa ON (905) 436-6582
www.jmsandblasting.com
(Sandblasting and protective coating applications)

Kubes Steel Inc.
Stoney Creek, Ontario (905) 643-1229
www.kubessteel.com

La Corporation Corbec
Lachine, Québec . (514) 364-4000
www.corbec.net
(Supplier of hot dip galvanizing only)

Lincoln Electric Company of Canada LP
Toronto, Ontario (416) 421-2600
www.lincolnelectric.com
(Welding equipment and welding consumables)

Les Industries Méta-For Inc.
Terrebonne, QC (405) 477-6322
www.meta-for.ca

MAGNUS Inc.,
Ste-Thérèse, Québec (866) 435-6366
www.magnus-mr.ca
(SDS/2 Design software)

Marmon/Keystone Canada Inc.
Langley, B.C. (604) 857-9844
Leduc, AB (708) 986-2600
www.marmonkeystone.com
(Hollow Structural Sections, A106 Seamless Pipes)

Micron Coatings Inc.
Edmonton, Alberta (780) 432-4519
www.mic oncoatings.ca
(Protective coatings)

Midway Wheelabrating Ltd.
Abbotsford, B.C. (604) 855-7650
www.midwaywheelab ating.com
(Wheelabrating, sandblasting, industrial coatings)

Moore Brothers Transport Ltd.
B ampton, Ontario (905) 840-9872
www.moorebro hers.ca

Pacific Bolt Maufacturing Ltd.
New Westminster, BC (604) 524-2658
www.pacolt.com
Steel fasteners, structural bolts, anchor bolts, tie rods.

Peinture Internationale (une division de Akzo Nobel Peintures Ltée.)
Dorval, Québec (514) 631-8686/1-800-361-2865
www.internationalpaints.com
(Protective coatings, corrosion-resistant paints)

Pipe and Piling Supplies Ltd./ Tuyaux et Matériel de Fondation Ltée.
St. Hubert, Québec (450) 445-0050
www.pipe-piling.com
(Hot Roll-Wide-Flange-Bearing Pile Beams)

Pure Metal Galvanizing, Division of PMT Industries Limited
Rexdale, Ontario (416) 675-3352
www.puremetal.com
(Custom 'Hot-Dip' Zinc Galvanizing; Pickling and Oiling)

Red River Galvanizing Inc.
Winnipeg, Manitoba (204) 889-1861
www.redrivergalvanizing.com
(Supplier of hot dip galvanizing only)

Reliable Tube (Edmonton) Limited
Acheson, Alberta (780) 962-0130
www.reliable-tube.com
(HSS Tubing, ERW Tubing, CDSSM Tubing)

Reliable Tube Inc.
Langley, B.C. (604) 857-9861
www.reliabletube.com
(Hollow structural steel tube)

Samuel, Son & Co. Ltd
Winnipeg, Manitoba (204) 985-6600
www.samuel.com
(Structural Sections incl. Bar. angle, shapes and plate)

Selectone Paints Limited
Weston, Ontario (416) 742-8881
www.selectonepaints.ca
(Paint primers, fast dry enamels, coatings)

Sherwin-Williams Canada
Ville d'Anjou, Québec (514) 356-1684
www.sherwin.com
(Specialty industrial coatings)

Silver City Galvanizing Inc.
Delta, B.C. (604) 524-1182
(Custom 'Hot-Dip' Zinc Galvanizing; Pickling and Oiling)

S.N.F. Quebec Metal Recycling (FNF) Inc./ S.N.F. Québec Métal Recyclé (FNF) Inc.
Laval, Québec (514) 323-0333
www.snf.ca
(Ferrous and nonferrous metal recycling)

Terraprobe Testing Ltd.
B ampton ON (905) 796-2650
www.terraprobe.ca
(Structural steel inspections)

Tri-Krete Coatings Company
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(Sandblasting; protective coatings; metallizing)

VARSTEEL Ltd.
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www.varsteel.ca
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VICWEST Corporation
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Moncton, N.B. (506) 857-0057
Winnipeg, MB (204) 669-9500
www.vicwest.com
(Steel Metal floor/roof deck, wall and roof cladding)

Vixman Construction Ltd.
Milton, Ontario (905) 875-2822
www.vixman.com
(Roof and Floor Deck)

Western Industrial Services Ltd. (WISL)
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www.wisl.ca
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Western Studwelding Supply
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(Stud Welding Equipment and Supplies; Sales, Service, Rental)

Wilkinson Steel and Metals, A division of Premetalco Inc.
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Vancouver, B.C. (604) 324-6611
www.wilkinsonsteel.com
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www.atlastube.com

Essar Steel Algoma Inc.
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* Calgary, Alberta (403) 263-4102
* Burlington, Ontario (905) 331-3400
www.algoma.com 1-800 387-7850

Gerdau Ameristeel
Whitby, Ontario (905) 668-8811/1-800-263-2662
www.ameristeel.esolutionsg oup.ca

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* Scarborough, Ontario (416) 321-4949/1-888-576-8530
* Calgary, Alberta (403) 543-8000
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www.acier-leroux.com 1-800-241-1887

Acier Pacifique Inc. (514) 384-4690
Laval, Québec 1-800-361-4167
www.pacificsteel.ca

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www.russelmetals.com

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www.dymin-steel.com

Metalium Inc.
Laval, Québec (450) 963-0411
www.metalium.com

Russel Metals Inc.
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Mississauga, Ontario (905) 819-7777
Edmonton, Alberta (780) 439-2051
Winnipeg, Manitoba (204) 772-0321
www.russelmetals.com

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Niaga a Falls, Ontario (905) 354-5691
www.salitsteel.com

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Mississauga, Ontario (905) 819-7297/1-800-387-3714
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www.a celormittal.com

Corus International Americas
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Portland, OR 1-800-468-8913

Nucor-Yamato Steel Company
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www.nucoryamato.com

AFFILIATED MEMBERS

CWB Group
Burlington, Ontario (905) 637-9194
Mississauga, Ontario (416) 542-1312
Oakville, Ontario

INDIVIDUAL

William J. Alcock, P.Eng, N. Vancouver	604-986-0663
Jonathan B. Atkins, P.Eng., To onto	416-489-7888
Dwain A. Babiak, P. Eng., Calgary	406-338-5826
Ryan C. Bakay, P.Eng., Calgary	403-289-2912
F. Michael Bartlett, P.Eng., London	519-661-3659
Leonard G. Basa aba, P.Eng., Vancouver	604-664-5409
Marc Bélanger, ing., Val-Brillant	418-742-3111
Gordon J. Boneschansker, P.Eng., Fredericton	506-452-1441
Eric Boucher, ing, Québec	418-871-8103
Gordon D. Bowman, P.Eng., Gloucester	613-742-7130
Geo ge Casoli, P.Eng. Richmond	604-273-7737
F ançois Charest, ing., Repentigny	450-581-8070
Bruno Chouinard, Ing., Montréal	819-694-1874
Simon Claude, Ing., T ois-Rivières	514-525-2655
Michel P. Comeau, P.Eng., Halifax	902-429-5454
Marc-André Comeau, ing, Salaberry-de-Valleyfield	450-371-8585
Frédéric Côté, ing., Sherbrooke	819-565-5974
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Arno Dyck, P.Eng., Calgary	403-255-6040
Curtis H. Feeg, P.Eng., Calgary	403-540-0677
Roberto Filippi, ing., Montréal	514-881-9197
Richard Frehlich, P.Eng., Calgary	403-281-1005
Alex L. Fulop, P.Eng., Vaughan	905-760-7663
Bernard Gérin-Lajoie, ing, Outermont	514-279-4821
Jean-Paul Giffard, ing., St-Jean-Chrysostôme	418-839-7937
James M. Giffin, P.Eng., Amherst	902-667-3300
Daniel Gi ard, ing, Chambly	450-447-3055
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Gary L. Hodgson, P.Eng., Niagara Falls	905-357-6406
J. David Howard, P.Eng., Burlington	905-632-9040
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Ron Kekick, P. Eng., Markham	905-474-2355
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René Laviolette, ing., Lévis	418-304-1405
Marc A. LeBlanc, P.Eng., Dieppe	506-382-5550
Steve Lécuyer, ing, Montréal	514-333-5151
Jeffery Leibgott, ing., Montréal	514-933-6621
William C.K. Leung, P.Eng., Woodbridge	905-851-9535
Constantino (Dino) Loutas, P.Eng., Edmonton	780-423-5855
Clint S. Low, P.Eng., Vancouver	604-688-9861
Douglas R. Luciani, P.Eng., Mississauga	905-542-0547
James R. Malo, P.Eng., Thunder Bay	807-345-5582
J. C aig Martin, P.Eng., Mississauga	905-826-5133
Ciro Martoni, ing., Montréal	514-596-1000
Alfredo Mastrodicasa, P.Eng., Woodbridge	905-856-2530
Brian McClure, P.Eng., Nanaimo	250-713-9875
Philip A McConnell, P. Eng., Edmonton	780-450-8005
Allan J. McGill, P.Eng., Port Alberni	250-724-3400
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Jason Mewis, P. Eng., Saskatoon	306-978-7730
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