NO 34 SUMMER 2009

ADVANTAGE STEEL

RESIDENTIAL CONSTRUCTION, PART THREE: JOIST FLOOR SYSTEMS

VANCOUVER CONVENTION CENTRE EXPANSION PROJECT

2008 BC AND QUEBEC STEEL DESIGN AWARDS

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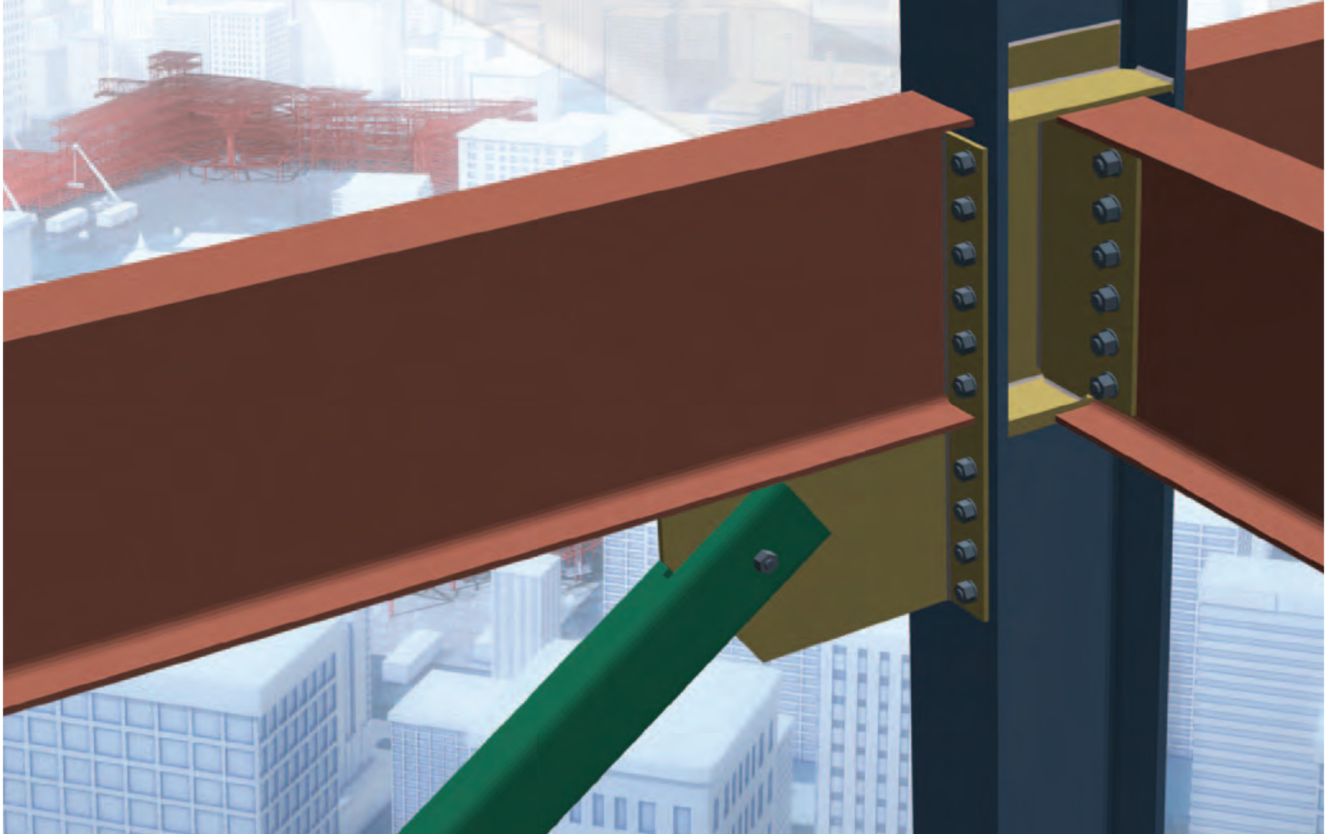

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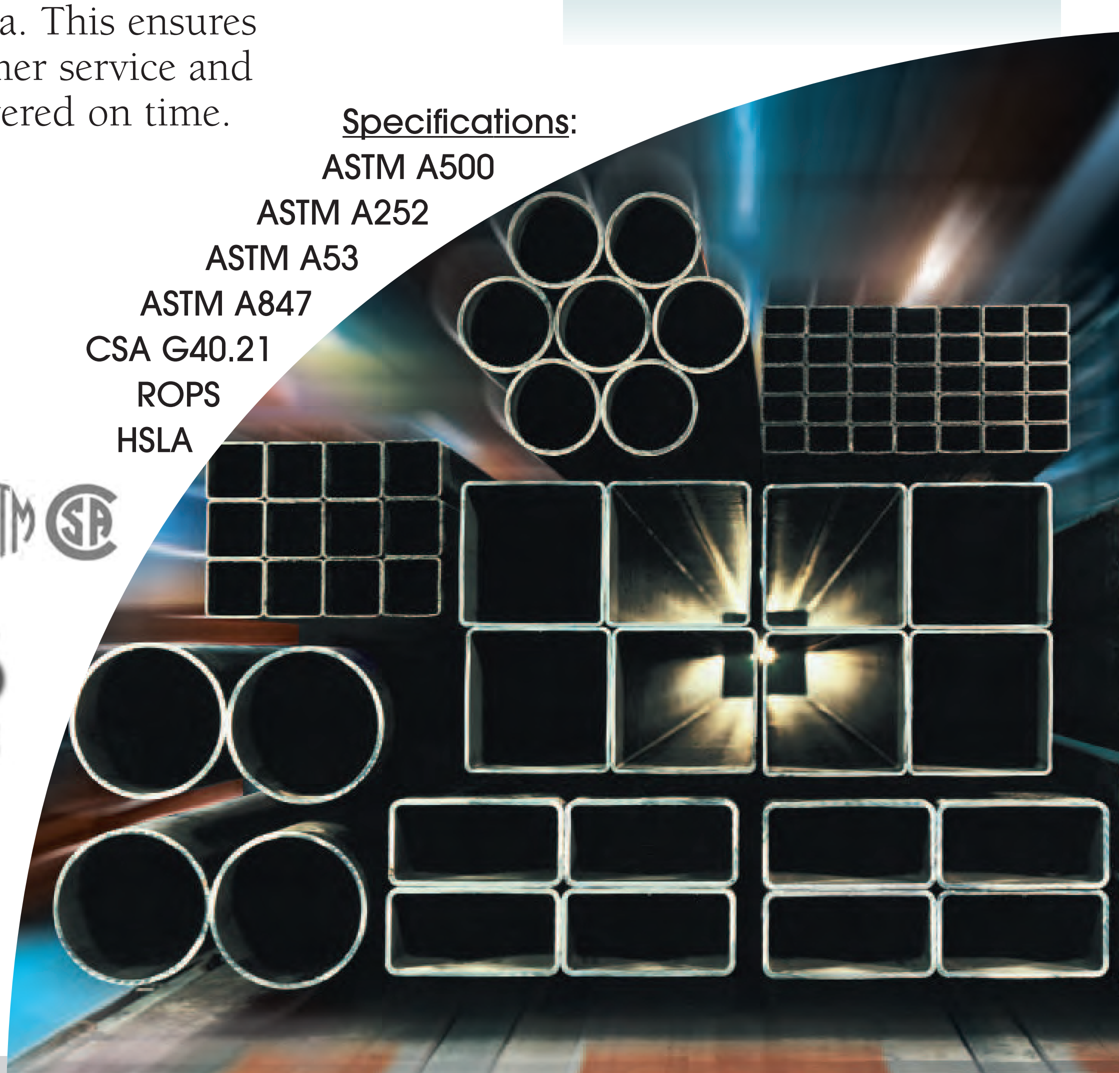

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FROM THE EDITOR

Starting on the West Coast, we return to the Vancouver Convention Centre Expansion to reveal the complex engineering behind this structure with this third article by Robert D. Simpson and Jacques Beaudreault. It is one of several recent steel projects constructed in BC with some especially constructed for next year's Winter Olympics. The 2008 BC Steel Design Awards, Engineering Award recipient is the state-of-art Olympic Park ski jumps. The image above is of the Griffiths Drive Pedestrian Bridge in Burnaby, which received the BC Region's Architectural Award. Moving east, we have numerous exciting structures featured in the 2008 Quebec Region's Steel Design Awards.

John Leckie concludes our three part series on Residential Construction with a review of applicable composite steel floor systems, including the Hambro system. "Seismic Corner" examines limited-ductility moment-resisting frames – connection options. "Ask Dr. Sylvie" answers questions on elliptical tubes, K factors for X-braces, different values used for notional loads in various standards and, pays tribute to Canadian structural steel researchers and the Steel Structures Education Foundation. Will Koroluk returns with "For Green's Sake" discussing the fundamental efficiency of steel.

Michael I. Gilmor, P.Eng.
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Professional engineers, architects, structural steel fabricators and others interested in steel construction are invited to enquire about CISC membership. Readers are encouraged to submit their interesting steel construction projects for consideration for inclusion in this publication by contacting CISC.

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Griffiths Drive Pedestrian Bridge, Burnaby |
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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

I have the great privilege to meet and interact with top Canadian researchers in the area of steel construction. I thought I would share the answers some of them regularly provide to real-life problems.

ELLIPTICAL TUBES

We are currently pricing a project that specifies EHS 480 x 240 x 13 for two feature columns, and we are having difficulty sourcing the material. The service centre we usually deal with has not been able to secure a supplier. Can you offer any suggestions as to suppliers in Canada? -- P.A.T.

Elliptical Hollow Sections (EHS) are stocked in British Columbia by Reliable Tube. They keep five sizes. Unfortunately, they do not keep the size you are looking for. The next biggest stock in Canada that we know of is probably held by…Professor Jeff Packer at the University of Toronto as he is currently conducting research on them! Unfortunately, however, he does not have that size. Most recently EHS were used as columns in Ontario for the Oshawa Legends Centre and that job was fabricated by CISC member Benson Steel in Ontario. I also know that George Third and Sons, another CISC fabricator member, also fabricated and installed elliptical tubes for another job a few years back. You may want to contact one of them.

For your information, EHS are produced in the UK by Corus Tubes and also in France. The latter was Tubeurop, then Arcelor Tubes, but now it is owned by Condesa (a Spanish company). The easiest way to order them, at present, is from Corus as they have a marketing and delivery set-up for North America. Even in Europe they are not that common, so rolling schedules are infrequent. You might want to consider contacting the Corus representative for North America, Brad Fletcher. His email and telephone number are CAI_Tube@corusgroup.com and 847.592.3712. He can arrange for price, delivery time, etc. to be quoted. EHS 480 x 240 x 12 is the standard size produced to the Euronorme standard EN10210, but Corus may have the 1/2" wall size you are seeking.

For those who are unfamiliar with elliptical tubes, there is absolutely no structural advantage to having an elliptical shape. It's all architectural. The aspect ratio between the long and short dimension is 2:1. I find them pretty unique though and can understand their use as Architecturally Exposed Structural Steel appeals to architects. For the engineers who are stuck designing with them, it isn't as bad as it seems: there are solutions! For your interest, the University of Toronto research group has produced a set of EHS section properties, in the format of the CISC "Handbook of Steel Construction" so should you require such information, please contact Dr. Packer directly at jeffrey.packer@utoronto.ca. I shouldn't say it's all architectural because it turns out that EHS have superior mechanical properties to North American cold-formed HSS. The steel has a fine grain structure; is fully weldable; has negligible residual stresses, thus making it ideal for hot-dip galvanizing. But why don't I stop here and we'll ask Jeff to write an article on this in our next issue!

Now should you get the job, Jeff Packer would really appreciate it if you could send him all your EHS leftovers.

UNSUPPORTED BRACE LENGTH

For a one-storey X-brace connected at the middle, can we assume that the central connection will provide lateral restraint? In other words, can I use a K of 0.5L, where L is the overall length of the brace? -- G.M.

Yes according to Professor Robert Tremblay of École Polytechnique. Several researchers, including Professor Denis Beaulieu of Université Laval and Professor Tremblay, have demonstrated that if you pay attention to the detail of the brace interrupted at the intersection, you can use a value for K of 0.5. If you glance at the Commentary for clause 27.5.3.1 of CSA S16-01 in the Handbook (9th Edition), it explains that bracing systems with slender braces designed to act both in tension and compression have significant lateral overstrength due to differences in their compressive and tensile capacities. When determining the brace slenderness, KL, the actual support conditions of the braces must be taken into account. In X-bracing when the brace end connections are detailed with single vertical gussets, K can be taken equal to 0.4 and 0.5 for in-plane and out-of-plane buckling, respectively (El-Tayem & Goel 1986, Sabelli & Hohbach 1999, Tremblay et al. 2003). For other bracing, K factors of 0.5 and 1.0 can be used for in-plane and out-of-plane buckling, respectively (Astaneh-Asl and Goel 1984, 1985). The length L can be taken as the length between the locations of the anticipated plastic hinges at the ends of bracing members.

photo: S. Boulanger

THE 0.005 NOTIONAL LOAD FACTOR

The AISC Specification uses a notional load factor of 0.002 along with the requirement that the analysis to be based on reduced member stiffnesses. In regards to Canadian requirements in CSA Standard S16-01 Clause 8.7.2, would it be correct to assume that 0.003 notional load accounts for the reduced member stiffnesses? -- L.W.

No. According to Professor Gilbert Grondin of the University of Alberta in Edmonton, loosely speaking, the difference accounts for the inelastic effect. It may not be possible to break it this cleanly, but both the American and Canadian versions are trying to account for the same effects (initial out-of-plumb and inelastic behaviour) using two slightly different approaches. There is interaction between the two effects, so it is not easy to separate one effect from the other. A University of Alberta PhD student, Ian MacPhedran, did look at the various approaches used around the world (a paper containing some of the findings was presented at the 2007 CSCE conference). The conclusion was that the simpler Canadian approach is fine.

On behalf of CISC, I would like to take this opportunity to thank Canadian researchers who have advanced structural steel knowledge and made its use more sustainable, efficient, economical and safe. Since the Steel Structures Education Foundation gives out over $100,000 of research money every year and we showcase their work, readers are encouraged to learn more by visiting the SSEF's website: www.ssef-ffca.ca

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SEISMIC CORNER
LIMITED-DUCTILITY MOMENT-RESISTING FRAMES – CONNECTION OPTIONS

Alfred F. Wong, P.Eng.

Steel bracing generally offers the most economical solutions for lateral load resistance whereas steel moment-resisting frames are usually selected in situations where architectural or other constraints do not permit steel bracing and plate walls. Mixed use of braced frame and moment-resisting frame is also a common practice. NBCC 2005 and CSA Standard S16-01 include provisions for 4 types of seismic-forces-resisting steel moment frames, namely ductile, moderately-ductile, limited-ductility and conventional construction. While ductile moment-resisting frames are more suitable for high seismicity applications limited-ductility moment-resisting frames offer a viable solution in common situations, including buildings that are taller than 15 metres in moderate seismicity categories and post-disaster buildings in low and moderate seismicity categories.

Clause 27 of CSA Standard S16-01 stipulates performance criteria for beam-to-column connections for *limited-ductility moment-resisting frames* and these criteria are to be met by means of physical testing. Alternatively, these connections can be proportioned and detailed in accordance with the specific requirements provided in Clauses 27.4.4.2 to 27.4.4.6 (herein and after referred to as prescriptive design option).

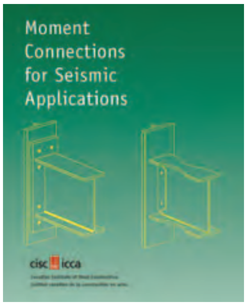


Figure 1

TEST-QUALIFIED CONNECTIONS

When test-qualified connections are to be used they must satisfy the physical testing criteria as stipulated in Clause 27.2.5.1 of S16-01, attaining a minimum inter-storey drift angle of 0.02 radians. In lieu of project specific tests, connections that have been proven suitable by tests and documented by a reliable source may be used. FEMA document, FEMA-350 and CISC publication "Moment Connections for Seismic Applications" provide such information. The CISC publication, as shown in Figure 1, can be purchased from the CISC and is also available as a free download from CISC's website, cisc-icca.ca. This publication includes bolted end-plate connections and the reduced beam section connection. It should be noted that it covers primarily connections qualified for ductile moment-resisting frames that are required to attain a minimum inter-storey drift angle of 0.04 radians (twice the requirement for the limited-ductility frames). Therefore, when end-plate connections are used in limited-ductility frames, some of the restrictions imposed for ductile frames, such as maximum beam depth, minimum span-to-depth ratio and maximum column depth, are relaxed.

PRESCRIPTIVE DESIGN OPTION

Instead of qualification by physical testing, moment connections in *limited-ductility frames* may be proportioned in compliance with capacity design principles. In this case, they are required to resist the expected beam moment capacity, $1.1R_yM_{pb}$ but need not resist forces greater than the effect due to 2 times the factored seismic load in combination with the companion gravity loads, provided that the controlling mode of behaviour is ductile. The force level corresponding to R_dR_o = 1.3 serves as the upper limit when other load effects, such as wind, dictate the use of beams substantially stronger than those that are required for seismic effects. However, when all welded connections are selected they must be connected for full capacity because Clause 27.4.4.4 does not permit the use of partial-joint-penetration groove welds and fillet welds for tensile force resistance.

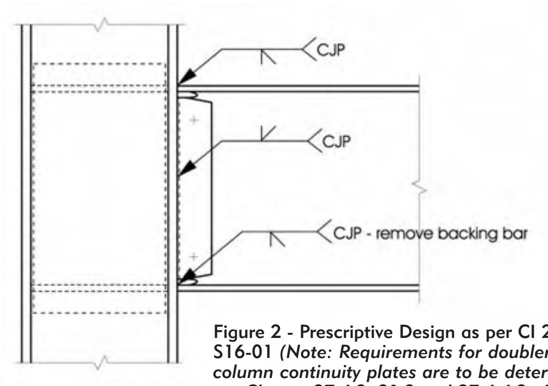


Figure 2 - Prescriptive Design as per Cl 27.4.4.2a of S16-01 ***(Note: Requirements for doubler plate and column continuity plates are to be determined as per Clauses 27.4.3, 21.3 and 27.4.4.3 of S16-01.)***

An all welded connection that is in compliance with *CSA W59* and detailed as shown in Figure 2 naturally meets the prescriptive requirements of Clauses 27.4.4.2 and 27.4.4.4 and can be proportioned to satisfy Clauses 27.4.4.3 and 27.4.4.5. In this case, the dimension "x" (defined in Clause 27.2.3.2 as the distance from the centre of the beam plastic hinge to the column face) may be taken as half the beam depth.

Inconsistent footnote symbols have been noted in the Seismic Corner Article in Issue No. 33, "The Order of Yielding and Ductile Behaviour": Footnote 2 in the table applies to "limited-ductility moment-resisting frames" only.

Composite steel joists (Hambro System) under construction, Extendicare, Red Deer, AB

RESIDENTIAL CONSTRUCTION
PART THREE – JOIST FLOOR SYSTEMS

John Leckie

In this third part of our look at the use of steel in residential construction, we examine open-web steel joist floor systems for residential buildings.

"Residential construction is still least-cost solutions so you keep structural costs lower to have more money to use on finishes," says Roy McBride of Halifax-based BMR Engineering. Some of steel's natural advantages, such as the ability to create longer spans, often don't count for much in residential construction, where the layouts are in modules of 12-foot widths. So, often, other factors have to be in play.

The Amalfi Residences on the Ravine in the Greater Toronto Area was intended to be a traditional, three-storey concrete condominium project but it ran into several problems. The first was site conditions. There was only a thin crust of soil capable of supporting shallow foundations directly below the basement floor slap of the underground parking structure. If the building got too heavy, deep foundations would be required, necessitating caissons 40 feet or deeper on one side of the site and driving up the cost as a result.

The second problem was that the owner wanted high-end units, resulting in a design where the layout of the upper suites did not line up with the support structures in the parking structure. That could be solved with transfer beams on the ground floor to carry the loads from above. If those beams were concrete, however, they would be both heavy—causing foundation problems—and large—stealing precious headroom from the parking garage.

The solution was to change the design of the floor system to a composite steel-concrete structure that reduced the weight of the structure and the lateral seismic loads by about 57 per cent. Mechanical and electrical services could be run through the open-web steel joists of the supporting structure, resulting in cleaner open spaces in the structure.

In addition, the steel for the project was fabricated while construction was underway on the parking structure. The three upper floors were erected in seven weeks, dramatically cutting the construction time for the building. In this particular instance, steel had advantages that made it much more attractive in a building that would, under other circumstances, have been built out of another material.

A ready and relatively inexpensive supply of aggregate and a workforce used to dealing with concrete means concrete has a distinct advantage in the residential sector in the Atlantic Provinces, McBride says. When they do use steel, two systems tend to be used. The first includes steel beams with open-web steel joists supporting an inch and a half metal deck with a total thickness of concrete and deck of four inches. The other is a composite deck system developed by Hambro.

The Hambro system has several advantages. Because it is a composite system using a concrete deck with steel support, it is very light. And it has the advantage of getting a one, two or three-hour fire rating, depending on the structure.

The system was developed in the late '60s and early '70s, says Hambro vice-president Francois Dutil. The system uses an open-web steel joist with an S-shaped attachment on the upper chord that is embedded in the concrete deck, developing a composite action that results in greater strength and less weight.

Hambro uses a set of rollbars to provide internal stability to the joists when the concrete deck is being poured and also to provide support for the reusable plywood forms for the concrete deck.

M. I. Gilmor

Amalfi Residences, Toronto

Cherry Lane Towers, Penticton, BC

In the Hambro system, the top "S" chord acts compositely with the slab. No permanent bottom chord bridging is required. Clips generally installed at third points on the bottom chords accept the Hambro roll bars and act as bottom chord bridging during the concrete pour. No shoring is required unless noted. The plywood forms may be stripped when the concrete reached 500 psi which typically takes 24 hours or less. Fire-rated gypsum board later completes the assembly.

The deck is 3 ½ inches of concrete with wire mesh reinforcement. After it is poured, the rollbars are removed and the plywood is stripped as soon as it meets a strength of 500 psi, and work begins on the next level.

Early on, the proprietary rollbars were problematic because contractors did not want to invest in the equipment if they were not going to be building a lot of buildings with the Hambro system. It was not long before the company started including the loan of the rollbars with the system. Mechanical and electrical systems fit easily through the open web on the individual floors, eliminating bulkheads and increasing overall floor space. It is also easy to place tubing for radiant heating in the slab and do it with a single pour.

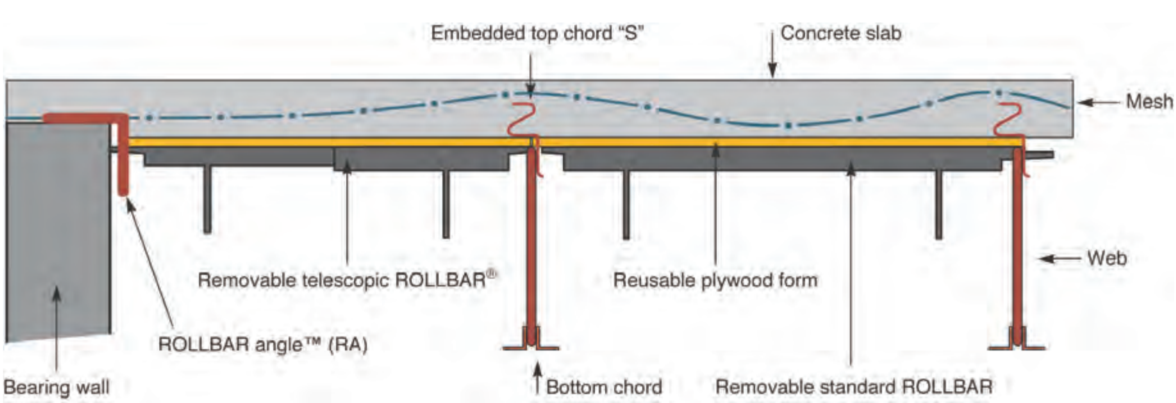
Dutil says the system has been used in hotels, motels and university dormitories, primarily in the United States. Because the overall system is so light, it is possible to ship a truckload of 20,000 square feet of material virtually anywhere in North America at a reasonable cost. At one time, the company operated from its plant in Quebec only but over the years has added plants in Calgary, Florida and Washington State.

A major key to the success of the system is its fire rating. "It has been tested in the fire furnace at both UL and ULC." Dutil says. "Because the top chord is embedded in concrete, the deck works as a heat sink so it keeps the joist much cooler than the standard joist or beam would be. "The system gets a one,- two- or three-hour fire rating with only a half-inch of drywall, he says.

Another system where steel has an advantage is in tilt-up construction, although it is not a system that is particularly popular with steel people because it does not use a lot of steel. With tilt-up construction, concrete panels are poured onsite and piled on top of each other until time for erection. The panels are lifted by crane and placed on the footings, held in place by temporary braces until the full structure is in place. It is essential to get these panels, which form the structural wall for the building, stabilized quickly and that often means a floor and roof deck system using structural steel.

"The most economical system is open web steel joist and steel deck," says Ian Oulton, president of RKO Steel in Dartmouth, Nova Scotia. "Occasionally it will be steel beams and deck but the open web and deck tends to be more economical."

The system is relatively popular in the Atlantic Provinces, Oulton said. It has been used for schools, offices and warehouses because it can get a building up fairly quickly. It has also been used on a series of senior citizen's homes. As a system, it has some safety challenges when the panels are being moved around and before they are stabilized.



Cross-section with Hambro Terminology

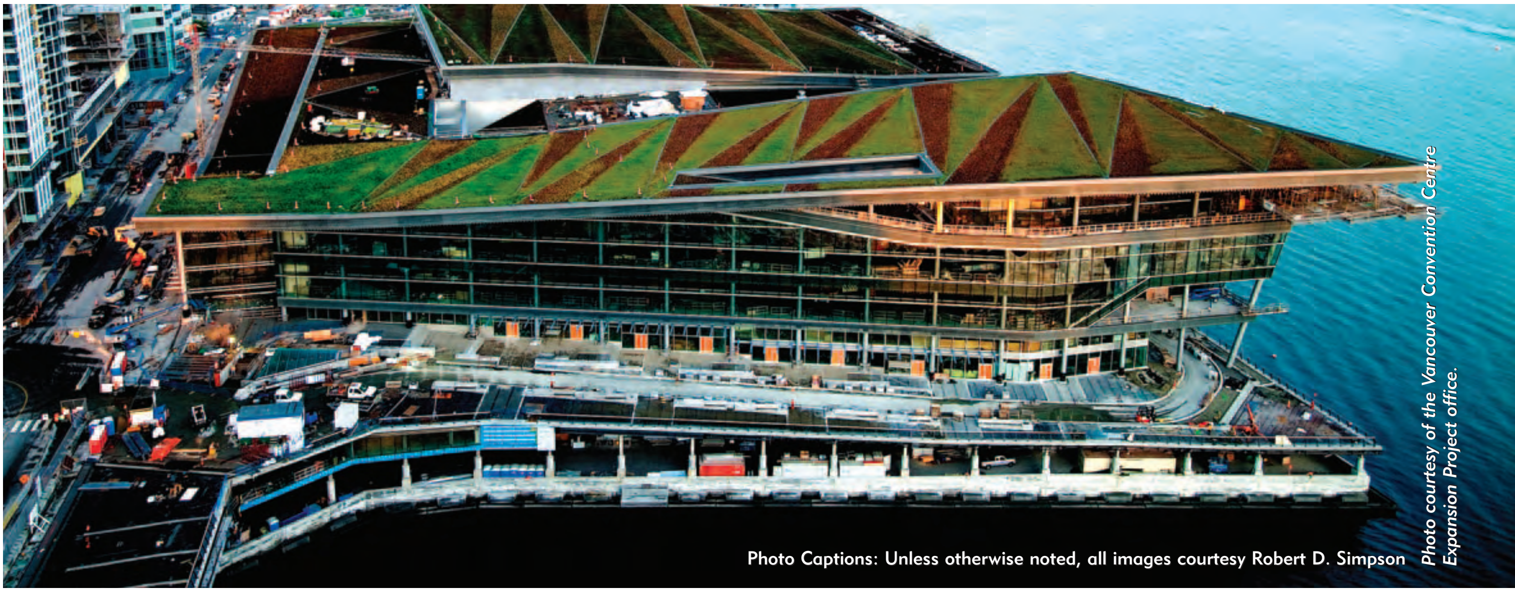


Photo Captions: Unless otherwise noted, all images courtesy Robert D. Simpson

Photo courtesy of the Vancouver Convention Centre Expansion Project office.

VANCOUVER CONVENTION CENTRE EXPANSION PROJECT

Robert D. Simpson and Jacques Beaudreault

In one grand sweeping gesture the waterfront in Vancouver is changed in perpetuity: The new Vancouver Convention Centre Expansion Project now adorns the shoreline of Burrard Inlet. A gleaming jewel with a fuzzy top, the building is an affable mingling of glass, steel and wood under an expansive natural landform roof that makes the building appear more like a park from a distance. Together with stunning views of the Inlet, Stanley Park and the North Shore mountains, it makes a thrilling experience for the first time visitor.

CONCEPT - CREATIVITY - RESULTS

The architectural offices of DA Architects + Planners, Musson Cattell Mackey Partnership (MCM) and LMN Architects teamed to plan and design the new Vancouver Convention Centre. Design challenges faced by the team were characteristic of large format mixed use buildings on a constrained project site, and were further complicated as the building hovers over water. This test of logic required a much higher degree of collaborative design effort amongst the building design team, particularly between the architects and structural engineers.

PCL Constructors Westcoast Inc. and steel constructors Canron Western Constructors Ltd. completed the project in advance of their originally anticipated schedule by careful planning and by drawing upon their experience on other large projects including stadiums, oil sands and bridges. These achievements are just parts of a connected sequence between architectural design creativity, structural engineering inventiveness as well as the contractor's and fabricator's ability to bring to life the dreams of more than 4 dozen dedicated design professionals.

THE CHALLENGE:

Deemed the world's best convention centre in July 2008, for the second time by International Association of Congress Centers, the existing facility was performing to the highest standard. Yet the landmark was in need of an update and the scale of conventions on the world market had outgrown the old facility. Facing over $100 Million per year in lost business, an expansion was due. Unfortunately, this wasn't going to be easy on this very limited project site with the worst possible soils conditions and, of course, a tight budget. The new Vancouver Convention Centre will handle 15,000 visitors at once, with 5,000 people for dinner, certainly a major player on any convention circuit and a pride for Canada!

The waterfront site chosen for the building was a small irregularly shaped piece of soft intertidal zone incapable of supporting any significant loading, however its location was fantastic, directly adjacent the existing Vancouver Convention Centre. A marine deck structure was planned as the "foundation" for the building structure that would hover over the intertidal zone on nearly 1,000 steel pipe piles 900 mm in diameter with lengths up to 60 meters into the soft foreshore soils and resting on bedrock. Lost habitat was replaced along the edges of the marine deck with a concrete "skirt" that offered habitation for many sea creatures. Tidal waters wash underneath the building offering additional habitat for those creatures that like to hide in darkened spaces, a feature normally lost when humans manipulate the waterfront. The marine structure was designed by Westmar Worley Parsons.

Architectural notions at the concept stage included very large spans, juxtaposed spaces, angular shapes, heavy loads At the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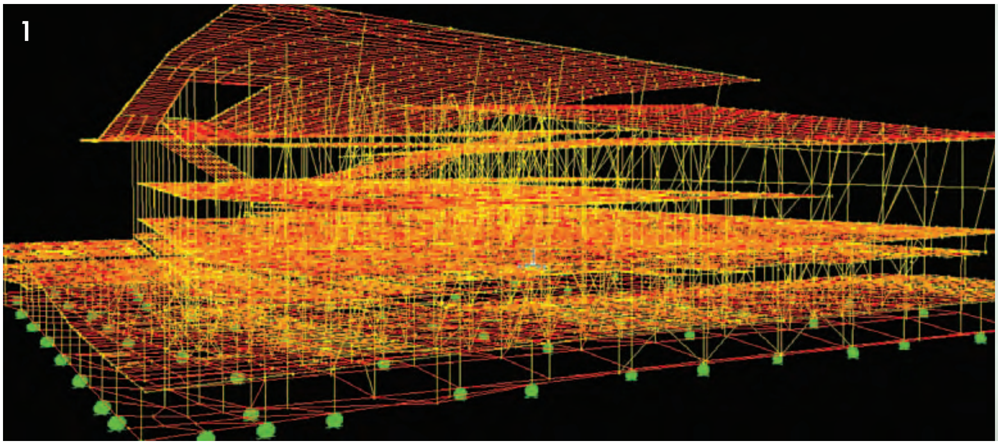


(1) SAP Model for 3D analysis was translated directly to other programs for structural modeling. (2) Complicated steel joints made simple(r) with the use of Tekla detailing software. The Tekla model was built in the Structural Engineering office and was provided to the fabricators as a 3D design model for their use.

lowest level was to be the exhibition hall measuring 91meters x 227 meters x 9.14 meters high and could not be moved or modified without losing the "A" classification so important on the convention circuit. At the next level up the architects needed a 450 car parking lot and above that a massive ballroom with adjacent smaller meeting rooms, each with minimal structural depth and maximum building volume.

Pinched within the confines of two immovable limits, the high tide mark and an existing city street, the structure above the expansive exhibition hall could be no deeper than 600 mm which was clearly not achievable by any conventional methods. Fortunately a few columns could be permitted in the exhibition hall in 27.4 by 36.6 m bays however the meeting rooms, ballroom and foyer had to be clear span. The key solution for planning the structure turned out to be steel trusses the full depth of floor levels and in a number of cases, multiple floor levels. Special configuration of deep trusses allowed for door openings through the truss walls as required for architectural layout.

GREEN ROOF:

Objectives for the building design included a 6 acre living "landform" roof with a plant variety that was proven by test plots in Vancouver and watered by recycled black water treated on site. The PWL Partnership Landscape Architects picked plants native to BC for best growth performance and to enhance the habitat for native birds and bees. The 180 mm of "lightweight" growing medium would compact to 150 mm during normal consolidation and resulted in a load upon the roof structure of 2.4 kPa. Field measurements during installation ensured that variations in soil depth did not cause a design concern. On long span structures, added roof loading can cause significant increases in gravity supporting structure and also in seismic lateral resisting systems. It was determined that each incremental inch of soil thickness would add roughly $600,000 worth of additional structure to the building. Therefore it was important for the design team to establish an appropriate value point for the thickness of the growing medium where additional thickness provided diminishing returns in terms of plant life and variety. Still, the green roof proved to be an overall cost advantage when considering alternative architectural solutions for such a highly visible roof.

(3) Anchoring large forces into the marine deck required the bases to be cast into the deck beams. Steel templates were essential for positional control of the anchors and were used throughout the project.

LEED:

Apart from plenty of LEED considerations typical to most buildings, the design team implemented a number of unique new solutions such as rainwater filtering and direct discharge of clean rainwater to the ocean, cooling the building with ocean water, black water treatment on site, use of treated black water for toilets in the building, use of treated black water for plant irrigation, sprinkler solutions for fire control (Advantage Steel Winter 2008), recycled materials and design innovations such as 3D collaboration.

BIM: REVIT, SAP, TEKLA, NAVISWORKS

"Tools of the trade" have changed for Structural Engineers! Our ability to create innovative solutions has improved by magnitude shifts every few years. The latest change is with Building Information Modeling (BIM) that has again transformed the design process, particularly for some unique and complex buildings like the new Vancouver Convention Centre. Glotman Simpson took full advantage of 3D modeling, design, presentation and delivery of documentation via electronic communication, only using paper copy for minor information and for backup.

Early in the design development Glotman Simpson proposed the use of BIM for the structural engineering solutions for the project. While the good old-fashioned pencil was used for "napkin" design, it quickly became apparent that the next step of 2D plans and sections would be prone to difficulty and misunderstandings.

Architectural design utilized Revit 3D modeling to assist in massing and layout and Glotman Simpson proposed to implement the steel detailing software Tekla together with SAP2000 and Revit Structure to provide the structural modeling at the design stage. By employing Tekla early in the project, the structural design information became the springboard for shop drawings and fore-shortened the tendering and shop drawing period considerably. Upon first implementation in early design, the structural engineer was suddenly freed of his conventional limitations and the design evolved with greater precision and haste than ever before. As an example, 3D conceptualization provided a genuine understanding of the building that allowed experienced engineers utilizing approximate and shortcut methods to estimate preliminary steel quantities within 5% of the final built configuration.

Extensive and ongoing coordination was necessary to optimize the structure together with architectural layout, mechanical systems, kitchen equipment, storage requirements, back of house equipment pathways, and so on. The architects imported 3D Tekla structural information into their Revit models to look for clash between structure and other building components. After creating a compliant structure, the process was repeated with steel connection materials and a number of surprises were avoided. Due to the complexity of building components and irregular building shapes, many of these potential problems could never have been discovered with pencil drawings.

Later PCL implemented a 4D scheduling program Navisworks to electronically construct the various building components on a timeline. On the structural side, Tekla was imported to Navisworks and assembled section by section. Glotman Simpson received the Navisworks schedule to review the building for temporary stability during the course of construction. The process allowed PCL to advance the edges of the building and allow glazing installation earlier than otherwise scheduled, advancing the overall project on the critical path.

Every building system flows through a truss at some place. Trusses became 4 stories high to accommodate openings at intermediate levels and variable locations. The side wall trusses of the ballroom support a sloping roof 21 meters high and extend to the parking levels forming trusses 26 meters deep. Trusses provided excellent inter-story stiffness for building integrity however care was needed to ensure the seismic bracing system could function effectively and allow the necessary seismic energy dissipation.

4

(4) Trusses span over the exhibition hall carrying the ballroom floor above and 450 car parking within the truss level

5

(5) Eccentric Braced Bays provide seismic and wind resistance and were placed in the few solid walls available and within service rooms causing intense coordination using Revit and Tekla software.

TRUSSES:

In the midst of this complexity, a simple solution was developed. A basic grid pattern of 13.72 meters x 9.144 meters became the theme for the structure – almost. Trusses running north-south at 13.7 m spacing became the primary grid system and coordinated nicely with the 27.4 m grid of the exhibition hall below. Thus every second wall truss would have good support onto the foundation structure. All edges of the building are askew to the grid thus causing anomalies at many locations. Still, the architectural massing and space planning followed the principle grid pattern thus allowing for a very efficient structure considering the clear spans and loading requirements for the project.

GLASS PERIMETER WALL:

To further magnify the spacious foyers the architects planned an entirely glass perimeter to wrap the building in glass, floor to ceiling. Different from most convention facilities, the "outside-in" design offered fabulous views taking in the "sails" of the existing Vancouver Convention Centre, Burrard Inlet, Stanley Park and the North Shore mountains. Visitors to the foyer would enjoy views like none other in the world of convention centers, but the loss of the perimeter wall for structural bracing offered a major challenge to the structural engineering.

ECCENTRICALLY BRACED FRAMES:

Eccentric braced steel frames were chosen for lateral load resistance and seismic energy dissipation. Very few options were available for lateral brace locations, mainly around the perimeter of the exhibition hall and through the mechanical spaces that run along the north side of the exhibition hall. No space is wasted in the mechanical rooms that run the 227 m length of exhibition hall. Careful coordination with architectural and mechanical allowed the systems to occupy the same spaces with minimal difficulty. By strategically selecting locations of lateral resistance in proportion to the associated mass of the building, the resisting system was balanced to the building mass.

(6) "Outside – in" architecture embraced the views of the City, Stanley Park, Burrard Inlet and North Shore mountains with clear glass perimeter walls soaking in the view. (7/8) High capacity springs were created from cupped spring washers to provide a mechanism to resist lateral loads produced by leaning column, yet allow the building to sway under seismic loading without interrupting seismic energy dissipation. The system also functions as a seismic centering mechanism.

LEANING COLUMNS:

The leaning columns are a dramatic architectural statement along the north face of the building, overhanging the seawall and reaching the highest point of the structure 44 meters above. The columns lean toward the north at an angle of 15 degrees, therefore imposing 27% of the gravity force as a lateral force on the building bracing. The horizontal force on each of the dozen leaning columns is greater than the design seismic inertia associated with the same gravity mass causing a challenge for the seismic system. Eccentric braced bay systems must be free of sustained lateral forces in order to function properly. If a lateral force is placed upon the braced frame then it would tend to yield one direction only, resulting in an unstable condition early in a seismic event. Therefore it was important to resist the leaning load with a system other than the seismic braces so that the eccentric braces would be free to sway and yield in both directions equally.

Balancing the leaning columns without affecting the seismic system required a diagonal brace of constant force – or something akin to a "sky hook". The seismic system must be allowed to move freely and yield in both directions without the brace system attracting the seismic loading. Also, when the seismic system yields and extends the movement range, the column brace needs to allow the movement without significantly changing its load. Only two possible systems showed promise of solving the dilemma: 1) columns leaning the opposite direction or 2) a spring tension system. The balanced leaning column system might be technically feasible but within the context of efficient building design the introduction of other leaning columns would not be possible. Thus, a tension spring system was required.

SPRING TENSION SYSTEM:

The cupped spring washer solution selected was attractive since very high forces can be achieved through a relatively small spring washer assembly. Cupped spring washers are placed face to face in pairs and assembled in series to provide for the total required movement. Force and displacement limits of each spring assembly are determined from the analysis of an individual spring washer and the total required movement determined by the collection of washers.

Stability is enhanced at all times since the spring system counters the seismic forces when it moves, thus adding a self-centering mechanism to the building design. Self-centering can help buildings survive very long duration seismic events and could, perhaps, help our landmark survive the big one!

COLLABORATION - INSPIRATION - PERFORMANCE

Exceptional teamwork that both challenges the participants yet accommodates missteps leads to great results. By following the guiding principle that "no idea is a bad idea" the team constantly explored outside the box. The requisite out-of-sequence design and construction lead to early tendering and the beginning of construction on this highly complex puzzle when lagging team members were just beginning their work. Architectural details were in design development when the structure design was complete and tendered. Lockstep progression on this large project was impossible thus drawing on the contractor's cooperation to accommodate changes. Yet the final structure - with its steel trusses, eccentrically braced frames, leaning steel columns, spring system - is still very much like the first one conceived, just with plenty of refinements. To achieve results in a short timeline, key people need to be on top of their game the whole way. The experience is most rewarding when the right team of individuals with a "can-do" attitude are there to help each reach the same goal.

Robert D. Simpson PEng StructEng is a principal senior structural engineer with Glotman Simpson Consulting Engineers located in Vancouver B.C. Glotman Simpson provide structural engineering services for all sizes and types of innovative building structures. rsimpson@glotmansimpson.com

Jacques Beaudreault MAIBC, MRAIC, CP, LEED AP, of Musson Cattel Mackey Partnership located in Vancouver, B.C. is partner in charge of architectural collaboration for the project.

NUCOR-YAMATO STEEL

Photo courtesy of Deutsch Associates Architects/Photographer Jessie Shotwell

BRITISH COLUMBIA AND QUEBEC 2008 STEEL DESIGN AWARDS

BRITISH COLUMBIA REGION AWARDS

ARCHITECTURAL AWARD
Award of Excellence
Griffiths Drive Pedestrian Bridge

OWNER: City of Burnaby
ARCHITECT: Busby Perkins + Will Architects
STRUCTURAL ENGINEER: Fast + Epp Structural Engineers
PROJECT MANAGER: Urban Systems Ltd.
GENERAL CONTRACTOR: GCL Contracting & Engineering Inc.
STEEL FABRICATOR: Cougar Metal 2005 Ltd.
STEEL DETAILER: Genifab Detailing & Engineering
STEEL ERECTOR: KWH Constructors

Fast + Epp was retained by the City of Burnaby to design a pedestrian bridge over Griffiths Drive as part of an overall urban trail revitalization. Working closely with Busby Perkins + Will Architects and Urban Systems Civil/Lead Consultants, the team produced an innovative solution for a single arch bridge concept that responded best to the construction budget, challenging site constraints and the strong aesthetic criteria.

The pedestrian bridge comprises a main arch span for the portion over the roadway and a series of elevated "jump spans" beyond the arch at each end to support the bridge deck until it meets the at-grade urban trail.

The bridge showcases the strength, versatility and elegance of structural steel in all aspects of it design. From the gracefulness of the long spanning arch to the lightness of the tension cables this bridge was enhanced by the use of structural steel.

EGINEERING AWARD
Award of Excellence
Whistler 2010 Olympic Park Ski Jumps

OWNER: VANOC
ARCHITECT: CJP Architects Ltd.
STRUCTURAL ENGINEER: Sandwell Engineering Inc.
GENERAL CONTRACTOR: Emil Anderson Construction Inc.
STEEL FABRICATOR: George Third & Son Ltd.
STEEL DETAILER: Deltech Consultants Ltd.
STEEL ERECTOR: KWH Contractors Ltd.

The Vancouver Organizing Committee (VANCOC) for the 2010 Olympic Winter Games retained Sandwell as prime consultant for the overall design of the Whistler Nordic Competition Venue including the K125 and K95 Ski Jumps.

The steel triangular tubular truss was selected as being most suitable for the ski jumps based on site accessibility, cost, aesthetics, and ability to be fabricated to the exacting tolerance of the international Ski Federation and be "demountable". Furthermore, the steel truss design minimized foundations on the steep slope.

Proactive communication and teamwork between the Owner, Engineer, Fabricator and Erector resulted in a very successful project achieving approval from the International Ski Federation (FIS) inspectors and the International Olympic Committee (IOC).

QUEBEC REGION DESIGN AWARDS

COMMERCIAL/INSTITUTIONAL PROJECTS
Winner
Expansion of Jean-Lesage International Airport, Québec City

Jury Mention: For the clarity of the architectural concept, the aesthetic details of the fasteners and the sharing of the 3D model between the engineer and the manufacturer.

ARCHITECT: Consortium d'Architectes GPC
STRUCTURAL ENGINEER: Dessau Inc.
GENERAL CONTRACTOR: Verreault inc.
OWNER: Aéroport de Québec inc.
STRUCTURE MANUFACTURER: Tecno Metal Inc., Canam Canada

The project consisted of a redevelopment necessitating demolition and reconstruction work on more than 60% of the air terminal's original surface. The architectural concept called for a metal structure, trusses and posts of variable height for the curved roof on the outside, and frames for the glass walls higher than 10 m. The frame of the street level and first floors is concrete, while the structure of the roof and of the big glass walls is structural steel. The roof's lateral stability is assured by the combined action of rigid-hinged arches and horizontal braces with concrete shear walls erected around the stairwells and elevator shafts. The steel structure is a key component of this original, innovative concept, exclusive to the Québec City air terminal.

COMMERCIAL/INSTITUTIONAL PROJECTS

Honourable Mention

Expansion of Centre de formation Émile-Legault, Saint-Laurent

Jury Mention: For beautiful steel integration, giving the building interior an elegant and conservative look.

ARCHITECT: Leclerc / Birtz Bastien Beaudoin
Laforest architectes Structural Engineer: Dessau Inc.
GENERAL CONTRACTOR: Consortium M.R. Canada ltd
OWNER: Commission scolaire Marguerite-Bourgeoys
STRUCTURE MANUFACTURER: Quirion Métal inc.

INDUSTRIAL PROJECTS/BRIDGES

Winner

Kicking Horse Canyon Bridge, Phase 2, British Columbia

Jury Mention: For its streamlined, slender shape and its integration into the environment in a bold and successful launch context.

STRUCTURAL ENGINEER: Parsons Overseas Company of Canada Ltd.
GENERAL CONTRACTOR: Flatiron Constructors Canada Ltd.
OWNER: British Columbia Minister of Transportation
MANAGER: Bilfinger Berger Project Investments Inc.
STRUCTURE MANUFACTURER: Structal-Bridges,
a div. of Canam Group Inc.; Rapid-Span Structures Ltd.
DETAILER: Les Dessins de Structure Tenca inc.
STEEL ERECTER: KWH Constructors Corp.

The new bridge makes it possible to cross the Kicking Horse Pass, at an altitude of about 1600 m, between Golden, British Columbia and Lake Louise, Alberta. The project consisted of widening the road into a four-lane highway. Phase 2 included, in particular, the replacement of the second existing bridge. A steel structure was considered as the most practical option, in view of the site's isolation, the difficult access to the job and the project timeline. One of the particularities of this curved bridge composed of welded I-beams is that it was erected in incremental launches. This was to be the biggest bridge of its kind built in North America. Measuring a little over 400 m long, it was launched in two sequences. Its structure consists of 4 main beams and 3 stringers supported by intermediate braces. The bridge has 6 pans ranging from 50 m to 80 m.

NON-QUEBEC PROJECTS

Winner

Battery Wharf, Boston

Jury Mention: For overcoming complex erection logistics within the context of a major residential project, involving both inclined walls and cantilevered elements.

ARCHITECT: The Architectural Team, Inc.
STRUCTURAL ENGINEER: McNamara/Salvia, Inc.
GENERAL CONTRACTOR: Skanska USA Buildings
OWNER: Leggat McCall Properties LLC
STRUCTURE MANUFACTURER: Supermetal Structures Inc.

This project is composed of 105 luxury condominiums and 150 hotel rooms with two underground parking levels. It main special feature is that two of the complex's four buildings are over the ocean. They rest on a system of concrete piles driven into the rock on the ocean bottom. These piles required a special barge-based installation system. A series of reinforced concrete beams with prefabricated concrete slabs compose the deck supporting the buildings. To allow crane traffic and operation without affecting the deck, a system of wooden mats and steel beams had to be designed to ensure that the loads were well distributed to the reinforced concrete beams and piles. This project thus stands out for the originality of its design and its complexity.

RESIDENTIAL PROJECTS/RENOVATIONS

Winner

Residence Alfredo-Gagliardi, Montreal

Jury Mention: For satisfying difficult technical constraints by the use of eccentric braces and optimum space distribution.

ARCHITECT: Lapointe Magne et associés
STRUCTURAL ENGINEER: Tecsult | Aecom inc.

GENERAL CONTRACTOR: Consortium M.R. Canada ltée.
OWNER: OMHM
STRUCTURE MANUFACTURER: Tecno Metal Inc.; Canam Canada
DETAILER: Dessins de Structure DCA inc.

Located on top of one of the Jean-Talon station entrances, this housing project was developed under the home support program for seniors with diminished autonomy by the OMHM. It contains 95 affordable rental units adaptable for people in wheelchairs. A steel structure and Hambro floors were chosen to limit the loads applied to the metro station. The use of steel made it possible to erect two more floors than a reinforced concrete variant. The designers opted for a lateral load resistance system of ductile eccentric braces. The absorbed energy is dissipated by shear plasticization of the coupling beam, which varies in length from 300 to 700 mm throughout the project. A braced bay thus was designed with coupling beams assembled to a post.

JURORS' FAVOURITE
Winner
Pavillon Espace 400e, Quebec

Jury Mention: For the unifying effect of the façade, its positive environmental impact, its transparency and the lightness of the project's materiality.

ARCHITECT: Consortium Dan Hanganu + Côté Leahy Cardas
STRUCTURAL ENGINEER: SNC-Lavalin inc.
GENERAL CONTRACTOR: EBC inc.
OWNER: Parks Canada / PWGSC
STRUCTURE MANUFACTURER: Les Aciers Fax inc.; Canam Canada

A former warehouse located on the Louise Basin, Espace 400e, the flagship building of Quebec City's 400th anniversary activities, went through its second major renovation since Quebec 1984. Like a lantern, the building is modulated by a "variable emissivity" envelope, which changes depending on the point of view, the time and the season. A green roof, accessible to visitors, was developed on the west side. A solar wall installed on the south façade acts as a solar captor and accumulator. The glass and steel "double skin" applied in projection of the existing building ensures the envelope's performance. Electromechanical devices allow opening or closing of air intakes and vents, according to the orientation of the facades and the season. The use of vertical steel joists made it possible to minimize the weight and handle the stresses related to the curtain wall. The greatest difficulty was to design fasteners allowing the anticipated thermal movements.

JURORS' FAVOURITE
Honourable Mention
Walkway of the Brown Basin Interpretation Centre, Québec City

Jury Mention: For its aesthetic triangulation and successful integration of the existing support members

ARCHITECT: Gagnon, Letellier, Cyr, Ricard, Mathieu Architectes
STRUCTURAL ENGINEER: Tecsult | Aecom inc.
GENERAL CONTRACTOR: Verreault inc.
OWNER: Québec Port Authority
STRUCTURE MANUFACTURER: Sturo Métal inc.
DETAILER: Dessins de Structure DCA inc.

GREEN BUILDINGS
Winner
Centre communautaire de la Pointe-Valaine, Otterburn Park

Jury Mention: For integration of sustainable development principles, recovery of materials and the aesthetic presence of steel.

ARCHITECT: Smith Vigeant Architectes
STRUCTURAL ENGINEER: Groupe EGP
GENERAL CONTRACTOR: Progest-EBC
OWNER: Ville d'Otterburn Park
STRUCTURE MANUFACTURER: Les Métaux Feral inc.

Opening on the Richelieu River, this pavilion is a cultural and recreation centre constructed on the site of the building which, before burning down, accommodated the oldest canoeing club in Québec. The new building presents a fluid course of large steel spans, favouring entrances and exits, as well as indoor traffic due to a combination of several levels easily accessible by ramps. Its local architectural inspiration makes use of several materials. The use of honeycombed prefabricated slabs made it possible to integrate a radiant heating/cooling system and obtain a durable and unique surface finish. For the roof structure, the designers opted for high energy performance insulated panels (R=40) instead of a conventional roof with multiple components. The building surpasses the MNECB reference building and should consume 55% less energy.

YOUNG ARCHITECTS/ENGINEERS
Honourable Mention
Carl Boutin –
Walkway of the Bell Canada Business Campus, Île des Soeurs

Jury Mention: For attention to detail and a wise choice of elements adapted to existing architectural constraints.

YOUNG ENGINEER: Carl Boutin, Eng., SDK et associés inc.
SPONSOR: Norman Kadanoff, Eng., SDK et associés inc.
MANUFACTURER: Sofab Structural Steel Inc.

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 MATERIAL EFFICIENCY OF STEEL

Will Koroluk

Of all the materials we use in our day-to-day lives, none is more ubiquitous than steel. It is everywhere. Look around you. I'll guarantee you can find at least a dozen things in the room you're in that are made—at least in part—of steel.

Steel is fundamental to our way of life here in the industrial world. It's an essential element in economic growth. Before the world economy went into the tank last autumn, demand for steel had been expected to grow annually by somewhere between three and five per cent worldwide, with China, India and Russia leading the way. Demand has likely slumped along with the economy, but there can be no doubt that as the economy rebounds, so too will the demand for steel.

Ever-increasing demand is nice, but we must all be mindful of the warnings we've had about climate change and the need for sustainability. Indeed, the consensus among earth-system scientists is that we need to act decisively and soon, if we are to prevent irreversible damage to our planet. We must, they tell us, ensure that global greenhouse gas emissions peak no later than the next decade, and be cut in half by mid-century.

For some industries, that will be a challenge, since little heed has been paid to the amount of carbon dioxide (CO_2) released into the atmosphere. But there is an industry that has been working on the problem for a while:

STEEL

The International Energy Agency tells us that the iron and steel industry accounts for between four and five percent of global CO_2 emissions. Most of that CO_2 comes from the chemical interaction between coal and coke (carbon) and iron ore in a blast furnace during the ore-reduction process that produces the metal that is then converted to steel. And so far, there is no substitute for carbon in steel-making.

Clearly, there is a need for technological remedies, and work on them is well under way. In the meantime, though, the industry is taking an intensity-based approach. That means that instead of aiming for a so-called "hard cap" on the amount of CO_2 released in the making of each tonne of steel, the industry wants to reduce emissions per tonne step by step over a period of time. So making a tonne of steel 10 years from now, for example, will result in a smaller CO_2 release than a tonne made today.

This approach was at the core of a speech given late last year by Ian Christmas, director-general of the World Steel Association. Speaking at a climate conference in Poznan, Poland, Christmas said the worldwide industry recognizes that developing countries won't accept an absolute emissions cap "because of their legitimate desire to raise the living standards of their population." That desire inevitably means there will be growth in their economies, leading to higher demand for steel, he said.

Steel, by its very nature, makes an intensity cap more acceptable and easier to achieve than a hard cap.

CONSIDER

Recyclability has long been known as one of steel's most valuable properties. Recycling uses less energy and fewer material resources than making new steel with a higher ratio of iron ore.

Blast furnace slag is the main by-product. It contains mostly lime and hydrated silica, and almost all of it is used—frequently as a component in the manufacture of cement. Using slag can reduce CO_2 emissions in cement production by about half, and in some countries, as much as 80 per cent of the cement contains granulated blast furnace slag. That's a real boon for the cement industry, which is another industrial sector that is busy waging war on climate change. But slag can also be used in road building and as railway ballast. And it can be used in the glassmaking process, as well as for and other industrial applications.

The steel industry pays attention to something called "material efficiency." That's a measure of how much material used in the production of steel is not disposed of as waste. In 2006, just 2.8 per cent of material used in the production of crude steel ended up in permanent disposal. The rest ended up as steel and useable by-products. So 97.2 per cent of that material did not end up as waste. Think that's pretty good? The industry's target is 100-per-cent material efficiency. Zero waste.

The steel industry is working hard to provide lighter, safer and longer-lasting structures for transportation and construction. It is working with designers to create products that are easy to reuse and/or recycle at the end of their useful lives. It is also working on carbon capture and storage, a technology that, so far, is not widespread. Steelmakers are hoping they can capture the CO_2 from the top gas of their blast furnaces. The top gas would then be recycled and the CO_2 sequestered. They are also working toward the use of sustainable biomass to fire their furnaces. But if all their efforts bear fruit, eliminating CO_2 from the steelmaking process remains unlikely. So it's worth remembering that steel products can offer savings over the life cycle of a product that are greater than the CO_2 emitted during their production.

An example the industry uses is wind turbines. Over a period of 20 years, a three-megawatt turbine can deliver 80 times more energy than is used in its production and maintenance. And when the turbine reaches the end of its life cycle, the steel in it is 100-per-cent recyclable.

While the man on the street may not think of steel as being light, builders know that it is—and efforts are being made to make it even lighter. Another example the industry likes to use is the Eiffel Tower, in Paris. If it were to be rebuilt today, the industry says, engineers would need only one-third as much steel. Modern cars built with new, stronger steel are as much as 25-per-cent lighter than older cars.

Steel, you see, is not a single product. There are more than 3,500 different steels in use today with many different physical, chemical and environmental properties. About three-quarters of them were developed in the last couple of decades. So, faced with the growing challenges caused by global climate change, the steel industry has a lot of weapons in its arsenal.

Its intensity-based approach to reduction of greenhouse gas emissions is a recognition that what might work here won't necessarily work there. A single, global agreement for the steel industry is probably an unrealistic objective. Better, then, a pragmatic, sectoral approach with agreements setting out national or regional objectives.

It's a case of different strokes for different folks—for green's sake.

NEWS AND EVENTS

CISC WELCOMES ED WHALEN

The Canadian Institute of Steel Construction (CISC) is pleased to announce the appointment of Ed Whalen, P. Eng. as President effective March 25, 2009.

Mr. Whalen brings 25 years of industry experience to his new role. Mr. Whalen joins the CISC from CWB Group where he held the position of V.P. Business Development. He also held General Manager positions in their QUASAR and CWB Learning Centre divisions. Prior to joining the CWB Group, Mr. Whalen was President of Whalen Engineering specializing in weld engineering and structural steel inspections. He holds an Engineering degree from Carleton University and an International Welding Engineering diploma from the International Institute of Welding.

THANK YOU TO MIKE GILMOR

In 1968 the Canadian Steel Construction Council provided a research grant of $5,400 to the University of Toronto to support a project entitled "Incorporation of CSA S16 in ICES-STRUDL". The graduate student working on that project was Michael Gilmor. Thus began Mike Gilmor's involvement with CSA Standard S16, which governs the design of steel structures in Canada. Today, Mike is Vice-Chairman of the Technical Committee responsible for this Standard.

This steady progression from graduate student to Vice-Chairman of the S16 Committee is symbolic of Mike's career. After completing the research project and receiving his Masters degree in structural engineering, Mike was hired in 1970 by the CISC to work as a Development Engineer. Thirty-nine years later he retired from the top job at CISC, the position of President.

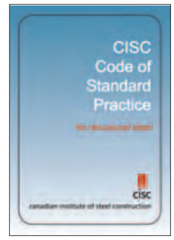
His career has been marked by many achievements, and these were recognized by his peers in 1992 when he was elected a Fellow of the Canadian Society for Civil Engineering for his excellence in engineering and for services rendered to his profession and to Canada. In 2001, he was honoured for his work on national and international standards when the Canadian Standards Association presented him their Award of Merit. An honour of a different kind occurred when he became one of a very small number of Canadians to serve as Chairman of the prestigious U.S. based Research Council on Structural Connections, a position he held for six years.

Mike has also served on other CSA committees, the Standing Committee on Structural Design for the National Building Code, and ISO Technical Committee 167 which deals on an international basis with materials, design and fabrication of steel structures. He was a co-author of the Canadian textbook " Limit States Design of Steel Structures" and is the long serving editor of the CISC Handbook of Steel Construction. In recent years, he has also served as editor of Advantage Steel and has been instrumental in bringing this publication to its present level of excellence.

I had the pleasure of recommending in 1970 that Mike be hired by the CISC and subsequently had the privilege of working with Mike for most of his career. Always reliable, he has been a pillar of strength for many years in the Canadian steel fabricating industry.

Thank you Mike for a job well done, and congratulations on an outstanding career.

Hugh Krentz | *April 10, 2009*



CODE OF STANDARD PRACTICE, 7TH EDITION

The CISC Code of Standard Practice for Structural Steel is a compilation of usual industry practices relating to the design, fabrication and erection of structural steel. Topics include governing standards, responsibility for design and erection, quotations, contract documents, tender drawings, painting, delivery, inspection, site conditions, and much more.

The 7th Edition features a new Appendix on Architecturally Exposed Structural Steel (AESS). Fabrication requirements for various degrees of AESS – ranging from "basic" to "showcase" elements – are incorporated in a Category Matrix.

Another highlight is the new Appendix on Digital Modelling, to be used when paper-based contract documents are replaced by a model-based (electronic) system such as the Building Product Model (BPM).

An electronic PDF version may be downloaded from the CISC website: **www.cisc-icca.ca/publications/technical/codes/csp/**

Of additional interest are two recent Advantage Steel articles. *The Canadian Matrix: A Category Approach for Specifying AESS.* **www.cisc.ca/publications/advantagesteel/31/**

Alberta Region Presents "Courses between Courses" includes a look at BIM technology. **www.cisc.ca/publications/advantagesteel/32/**

UNIVERSITY PIZZA & POP PRESENTATIONS

The Atlantic Regional Committee continues with this popular program. On November 17, 2008 a presentation was given to the Senior Civil Engineering class from Dalhousie University. Over 40 students and professors took part in an in-depth tour of a local fabrication shop. All aspects of steel fabrication were discussed through a guided tour of the fabrication office and shop. This is the third year Dalhousie University has requested a tour for the Senior Civil Engineering class and has indicated that it has been well accepted by the students and faculty and has been a great help in the students understanding of the steel fabrication business.

Also, on February 13, approximately 50 third and fourth year Civil Engineering students from the University of New Brunswick had a tour of Ocean Steel's office and plant. The students were also introduced to past UNB graduates presently working at Ocean which gave them time to mingle and learn about opportunities in the steel business.

CANSTRUCTION NOVA SCOTIA

A Dalhousie Civil Engineering team sponsored by the Atlantic Region CISC participated in the 2009 CANstruction competition in October but for the first time in four years did not win an award. The number of participants in the competition continues to grow as does the recognition of the event.

The team members were **Renee MacKay-Lyons**, **Andrew Murphy**, **Josh DeYoung**, **Brian Piquatte**, **Shannon O'Connell**, **Jason Rye**, and **Christian Macintosh** The faculty supervisor was **Dr. Yi Liu**.

CONGRATULATIONS TO CAST CONNEX CORPORATION

Cast ConneX will be the inaugural winner of the Canadian Society for Civil Engineering's **Excellence in Innovation in Civil Engineering Award** for their work in developing and commercializing their standardized, earthquake-resistant, cast-steel connectors! The award, under the category of CSCE's prestigious Career Awards, recognizes "outstanding innovation in Civil Engineering that has had a significant and far-ranging beneficial impact on the prosperity and well-being of society."

Given the breadth of the Civil Engineering discipline, the fact that an innovation in the steel construction industry is topping this year's list is something to celebrate.

2008 CANADIAN CONSULTING ENGINEERING AWARDS

McCormick Rankin earns engineering award for Ottawa rapid bridge replacement. **http://dcnonl.com/article/id32876**

2008 GOVERNOR GENERAL'S MEDALS IN ARCHITECTURE

Steel is Recognized

The Royal Architectural Institute of Canada (RAIC) and the Canada Council for the Arts awarded the Governor General's Medals in Architecture for 2008 to the following recipients. We are pleased to see structural steel is an essential component in most of the projects.

- **Terrence Donnelly Centre for Cellular and Biomolecular Research**, University of Toronto (Toronto, ON) - architects Alliance & Behnisch Architekten
- **Nk'Mip Desert Cultural Centre** (Osoyoos, BC) - Hotson Bakker Boniface Haden architects + urbanistes
- **Jaypee Institute of Information Technology** (Noida, Uttar Pradesh, India) - Le Groupe Arcop
- **Canada's National Ballet School Project Grand Jeté** (Toronto, ON) - Kuwabara Payne McKenna Blumberg Architects & Goldsmith Borgal & Company Ltd. Architects, Architects in Joint Venture
- **ROAR_one** (Vancouver, BC) - Lang Wilson Practice in Architecture Culture Inc. and Hotson Bakker Boniface Haden Architects Associated Architects
- **House at 4a Wychwood Park** (Toronto, Ontario) - Ian MacDonald Architect Inc.
- **New Canadian War Museum** (Ottawa, ON) - Moriyama & Teshima Architects, Griffiths Rankin Cook Architects: Architects in Joint Venture
- **Gleneagles Community Centre** (West Vancouver, BC) - Patkau Architects
- **Winnipeg Centennial Library Addition** (Winnipeg, MB) - Patkau / LM Architectural Group
- **Communication, Culture and Technology Building**, University of Toronto (Mississauga, ON) - Saucier + Perrotte architects
- **Scarborough Chinese Baptist Church** (Scarborough, ON) - Teeple Architects Inc.
- **Trent Chemical Sciences Building** (Peterborough, ON) - Teeple Architects Inc. and associate architects Shore Tilbe & Irwin

The Governor General's Medals in Architecture recognize outstanding achievement in recently built projects by Canadian architects. This program, created by the RAIC, contributes to the development of the discipline and practice of architecture, and increases public awareness of architecture as a vital cultural force in Canadian society. These awards are administered jointly with the Canada Council for the Arts, which is responsible for the adjudication process and contributes to the publication highlighting the medal winners.

Descriptions, biographies and downloadable images of the architectural firms and their winning buildings are available from the Royal Architectural Institute of Canada's web site. **www.raic.org/honours_and_awards/awards_gg_medals/2008recipients/index_e.htm**

NEW MEMBERS

At the March meeting in Edmonton the CISC Board of Directors elected the following organizations as new members.

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EVENTS

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/

IABSE Symposium Creating and Renewing Urban Structures
September 14 – 19, 2008 Chicago, U.S.A
www.iabse.org/conferences/

Canadian Society for Civil Engineering (CSCE) Conference
May 27 – 30, 2009 St. John's, NF
www.csce.ca/2009/annual/

CaGBC National Summit and Trade Show
June 9 – 11, 2009 Montreal, QC
www.everybuildingcanbegreen.ca/

Contech
November 25, 2009 Montreal, QC
www.contech.qc.ca

Construct Canada
December 2 – 4, 2009 Toronto, ON
www.constructcanada.com

International Symposium on Tubular Structures
December 15 – 17, 2010 Hong Kong, China
www.hku.hk/civil/ISTS13

REGIONAL ACTIVITIES

Ontario Region Golf Day
September 10, 2009

Quebec Region Design Awards and Symposium
November 18, 2009, Montreal

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

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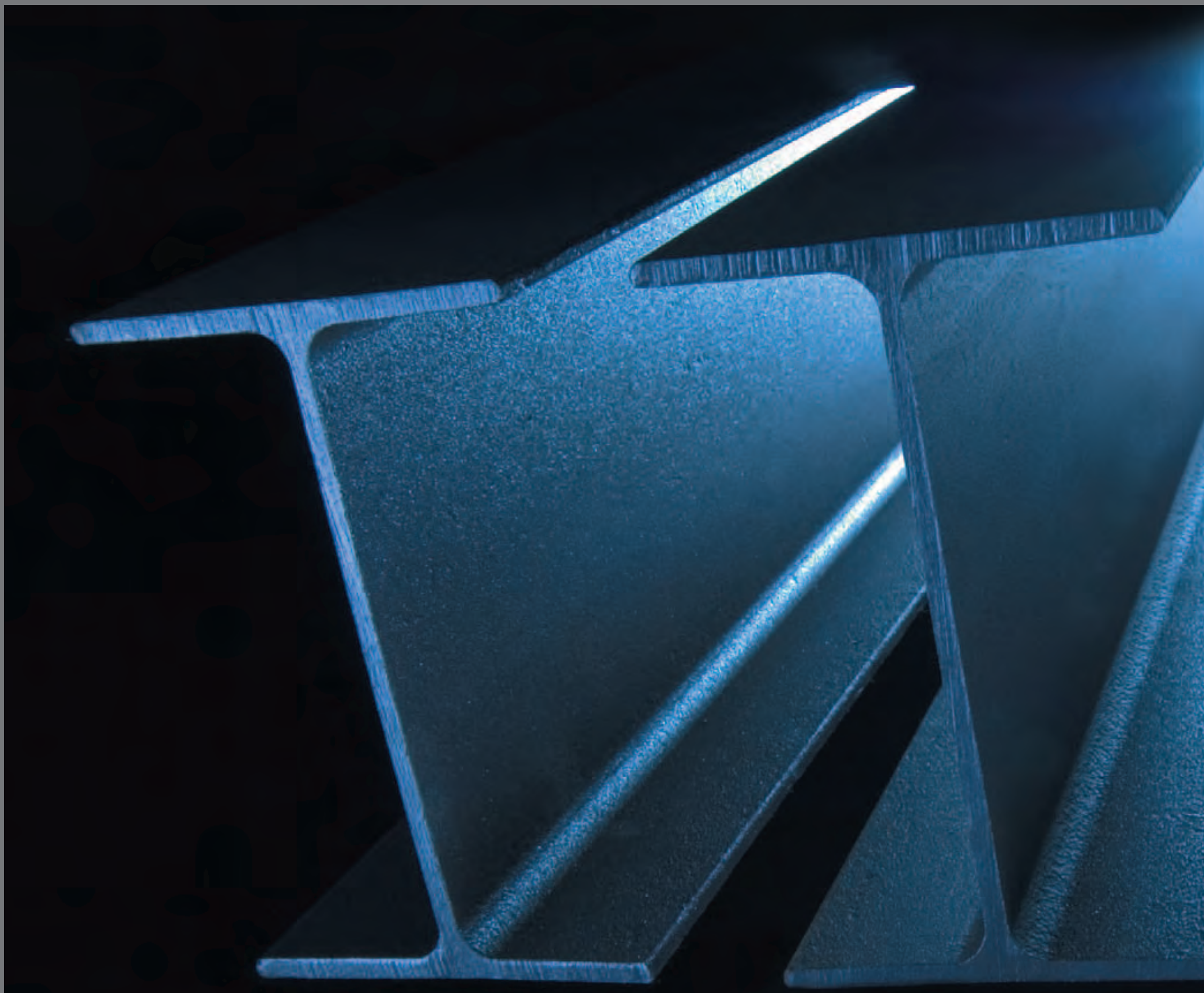

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London, Ontario (519) 850-9802
www.huskydetailing.com

International Steel Detailing Ltd. B
Nanaimo, B.C. (250) 758-6060
www.intersteel.ca

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

JCM & Associates Limited B,P
Frankford, Ontario (613) 398-6510

JP Drafting Ltd. B,Br,P,J
Maple Ridge, B.C. (604) 465-3568
www.jpdrafting.com

KGS Group Steel Detailing Division
Winnipeg, MB (204) 896-1209
www.kgsgroup.com

Les Dessins de Structures Steltec Inc. B
Ste-Thérèse, Québec (450) 971-5995
www.steltec.ca

Les Dessins Trusquin Inc. B,Br
Laval, Québec (450) 688-7336

Maximum Steel Detailing Inc. B
Langley, B.C. (604) 514-1474

M & D Drafting Ltd. B,Br,P
Edmonton, Alberta (780) 465-1520
Surrey, BC (604) 513-4210
www.mddrafting.com

M-Tec Drafting Services Inc. B
Sherwood Park, Alberta (780) 467-0903
www.mtecinc.ca

ProDraft Inc. B,Br,P
Surrey, B.C. (604) 589-6425
www.prodraftinc.com

Ranmar Technical Services B,P
Mt. Pearl, Nfld. (709) 364-4158
www.ranmartech.com

River City Detailers Limited B
Winnipeg MB (204) 221-8420
www.rivercitydetailers.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

Summyx Inc., Quebec B
Ste-Marie Beauce, QC (418) 386-5484
www.summyx.com

TDS Industrial Services Ltd. B,P
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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Niagara Falls, Ontario (905) 354-3700
www.esfox.com

K C Welding Ltd. B
Angus, Ontario (705) 424-1956

Montacier Plus Inc. B,Br
Boisbriand, Québec (450) 430-2212
www.montacier.com

Montage D'acier International
Terrebonne, Québec (450) 965-7360

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.acierpicard.com

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.amercoatcanada.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.
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www.jumax.net
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Atlantic Industries Limited
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www.ail.ca
(galvanizing)

Behlen Industries Limited
Brandon, MB (800) 663-7538

Blastal Coatings Services Inc.
Brampton, Ontario (905) 459-2001
www.blastal.com
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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.
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www.cloverdalepaint.com
(Specialty hi-performance industrial coatings and paint products)

Commercial Sandblasting & Painting Ltd.
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(Sandblasting and protective coating applications)

Corrcoat Services Inc.
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CMC Steel division of Crawford Metal Corp./ Acier CMC division de Crawford Metal Corp.
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(Angles, channels, hss, beams, plates)

Custom Plate & Profiles
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www.customplate.net
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Daam Galvanizing Inc.
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www.daamgalvanizing.com
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Devoe Coatings
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www.edavancan.com
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Endura Manufacturing Co. Ltd.
Edmonton, Alberta (780) 451-4242
www.endura.ca
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Fisher & Ludlow, A Division of Harris Steel Limited
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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
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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
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www.jmsandblasting.com
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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
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www.lincolnelectric.com
(Welding equipment and welding consumables)

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

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www.magnus-mr.ca
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Leduc, AB (708) 986-2600
www.marmonkeystone.com
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www.midwaywheelabrating.com
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www.moorebrothers.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.)
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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
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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.
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(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
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Terraprobe Testing Ltd.
Brampton ON (905) 796-2650
www.terraprobe.ca
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Tri-Krete Coatings Company
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VARSTEEL Ltd.
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www.varsteel.ca
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Surrey,B.C. (604) 590-2220
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)

Waxman Industrial Services Corp.
Brantford ON (866) 294-1699
www.waxmanindustrial.ca

Western Industrial Services Ltd. (WISL)
Winnipeg, Manitoba (204) 956-9475
www.wisl.ca
(Abrasive Blasting & Painting Services)

Western Studwelding Supply
Edmonton, Alberta (780) 434-3362
(Stud Welding Equipment and Supplies; Sales, Service, Rental)

Wilkinson Steel and Metals,
A division of Premetalco Inc.
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www.wilkinsonsteel.com
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(Structurals - angles, flats, beams, channel, plate)

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www.atlastube.com

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* 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.esolutionsgroup.ca

SSAB Enterprises, LLC
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* Scarborough, Ontario (416) 321-4949/1-888-576-8530
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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

Dymin Steel Inc.
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www.dymin-steel.com

Metalium Inc.
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www.metalium.com

Russel Metals Inc.
Lakeside, N.S. (902) 876-7861
Mississauga, Ontario (905) 819-7777
Edmonton, Alberta (780) 439-2051
Winnipeg, Manitoba (204) 772-0321
www.russelmetals.com

Salit Steel (Div. of Myer Salit Ltd.)
Niagara Falls, Ontario (905) 354-5691
www.salitsteel.com

York-Ennis, A Division of Russel Metals Inc.
Mississauga, Ontario (905) 819-7297/1-800-387-3714
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www.arcelormittal.com

Enraz Oregan Steel Mills Inc.
Portland, OR 1-800-468-8913

Nucor-Yamato Steel Company
Blytheville, AR (870) 762-5500
www.nucoryamato.com

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