ADVANTAGE STEEL

NO 48 WINTER 2014

2013 Quebec Steel Design Awards of Excellence

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+ The art of the bridge: Pedestrian bridges experience a renaissance

A comparative Life Cycle Assessment: Steel vs. concrete framing

Tension-only bracing

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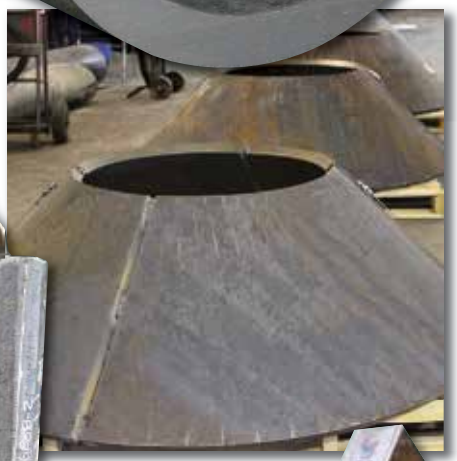

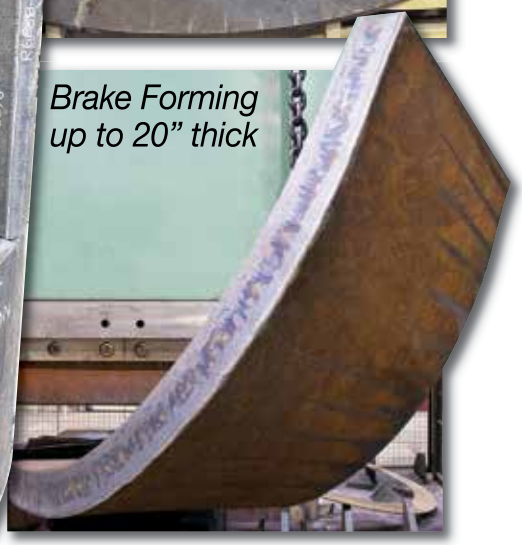

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By Ed Whalen, P.Eng.
President

The bridge to fair trade

I have presented numerous times in the recent past on the need for governments to "think Canadian" when it comes to procurement. As each level of government is trying to develop new programs to stimulate new businesses and improve productivity, the low hanging fruit is right in front of them.

Canadian governments at all levels should implement procurement policies in favour of Canadian companies within their trade obligations. This would be done not through protection or bias but by leveling the playing field taking into consideration reciprocal market access, product component dumping, government and other subsidies, and currency manipulation. Fair trade is a popular concept these days, and why not? More and more Canadian manufacturing jobs are being lost, while imports increase, exports decrease and our balance of trade goes negative.

The federal government has a great opportunity. It recently announced that it will spend over $40 billion in much needed infrastructure replacement. The first sizable project is the Champlain Bridge replacement in Quebec. Here is the opportunity for the federal government to send a message to the rest of the world to free up market access and trade fairly by implementing a reciprocity and fair trade provision for this project and for the rest of the $40 billion.

As consumers, we want cheap. We put pressure on governments to lift duties and increase trade with countries that have perceived cheaper products. What we fail to realize is that those Canadian duties are in place because products are being dumped. The net effect is an unfair hollowing-out of our industries and our middle class. While Canadian companies are getting bombarded with unfair trade competition here at home, we are being locked out of markets in those same countries that are taking our market share at home. It has been proven that countries need to be manufacturing to have a strong and healthy economy. For those that are quick to state that manufacturing is dead in developed countries, one only needs to look at Germany to see that this type of thinking is very wrong. But as individuals we don't have an eye on the big picture, and this is why we need governments with the help of industry to do that for us.

When governments procure from non-Canadian companies they are themselves negatively affecting Canada's trade imbalance, which by the way is in a deficit as of the fall of 2013. Canada needs to have exporting opportunities and that can only be done by having a fair chance at home and abroad.

CISC is working with governments at all levels to realize the power of procurement. Only with their help will Canada grow and prosper in the ever-global economy.

ADVANTAGE STEEL

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Professional engineers, architects, structural steel fabricators and others interested in steel construction are invited to inquire 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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By Alfred F. Wong, P.Eng.
Director of Engineering

Question 1: I am calculating the laterally unsupported bending resistance of a singly symmetric I-section having flanges of unequal thickness. What should be the value of t in the expressions for β_x and C_w provided in Sub-clause 13.6 (e) of S16-09?

ANSWER: In both expressions, the value for 'd-t' may be taken as the centroidal distance between the flanges. C_w may also be calculated using the formula given under Built-up Sections in Part 6 of CISC Handbook of Steel Construction.

Question 2: What are the key characteristics of ASTM A1085 HSS as compared to A500 Grade C and CSA G40.20/21 products?

ANSWER: In a nutshell, ASTM A1085 HSS are produced to meet requirements comparable to those of CSA G40.20/21 350WT Category 1. The material is required to conform to a minimum average Charpy V-notch impact value of 25 ft-lb at 40°F (approximately 34 J at 4°C), as represented by the test specimen. In addition, a maximum yield stress at 70 ksi (approximately 485 MPa) as well as a minimum yield stress at 50 ksi (345 MPa) apply. Minimum corner radius control is another measure unique to A1085 square and rectangular HSS. All in all, A1085 HSS are superior to A500 products in various aspects.

Question 3: What sectional properties may I use for the design of ASTM A1085 HSS?

ANSWER: Wall-thickness and mass tolerances for ASTM A1085 products are essentially the same as those specified for HSS in CSA G40.20-13. Hence sectional properties provided for CSA G40.20 HSS in CISC Handbook of Steel Construction, which are calculated from nominal wall thickness, depth, width and diameter, may be used for design. Since A1085 is a new standard, it is not included in Clause 5.1.3 of S16-09; until it is covered, use of A1085 may require Approval in accordance with Clause 5.1.1.

Question 4: How do I determine the factored axial compressive resistance of an ASTM A1085 HSS column?

ANSWER: Since the manufacturing method for A1085 HSS is also permitted for the manufacturing of Class C CSA G40.20 HSS the factored axial compressive resistance of an A1085 HSS column may be determined in accordance with 13.3.1 with the value of n taken as 1.34. The factored axial compressive resistance tables for Class C G40.20 HSS Columns in the CISC Handbook of Steel Construction may be used provided an adjustment for the small difference in F_y values (345 MPa vs. 350 MPa) is accounted for. Purchasers of A1085 HSS may specify heat treatment, as Supplemental Requirement S1, which also conforms to the stress-relieve requirement for Class H G40.20 HSS. Hence an n-value of 2.24 may be used for A1085 HSS supplied with Supplemental Requirement S1.

However, use of notch-tough steel as gravity columns is an exception.

Question 5: Are ASTM A1085 products readily available?

ANSWER: ASTM A1085 is a new standard, introduced in 2013. Atlas Tube Canada ULC has started taking orders in 2013. Time will tell if they will be readily available from service centres.

Questions on various aspects of design and construction of steel buildings and bridges are welcome. They may be submitted via email to faq@cisc-icca.ca. CISC receives and attends to a large volume of inquiries; only a selected few are published in this column.

By Alfred F. Wong, P.Eng.
Director of Engineering

Tension-only bracing

Braces in a tension-only braced frame are designed to resist, in tension, 100 per cent of lateral shear forces in the braced frame. Since the resistance of braces acting in compression is ignored in the design, tension-only braced systems must be direct-acting and concentrically braced frames. Over the last 25 years, ductile design provisions for tension-only braced frames have been introduced in modern codes and standards in multiple code cycles. This article aims to identify the various types of tension-only braced frames, covered in CSA S16-09 and NBC 2010, and the range of application for each type and its subset.

Traditional tension-only bracing

Tension-only braced frames have been commonly used in construction of buildings that have a high storey(s) but are subjected to relatively small lateral forces, such as single-storey buildings. Since all braces are assumed to resist tension only, very slender braces (KL/r > 200) can be used, resulting in use of lighter braces and material saving. In many applications, the maximum slenderness limit for tension members (KL/r ≤ 300) need not apply, provided vibrations and sag at service load levels can be controlled.

Seismic applications

Traditional tension-only braced frames generally exhibit a pinched hysteretic behaviour. Except for low seismicity applications, S16-09 generally specifies frame height limits and member and cross-sectional stockiness requirements for the braces where ductile behaviour is an explicit design requirement. S16 permits the use of tension-only bracing in three types of seismic force-resisting systems named in the National Building Code: *Moderately ductile concentrically braced frames (MDCBF), limited ductility concentrically braced frames (LDCBF) and conventional construction (CC).*

1. *Moderately ductile concentrically braced frames*

   Tension-only braces in *MDCBF* are required to meet the stringent cross-section stockiness and the maximum member slenderness limits for compression braces (KL/r ≤ 200) used in *MDCBF*, among other requirements. Consequently, these tension braces resemble the compression braces used in *MDCBF* instead of the above-mentioned slender braces. In addition, tension-only *MDCBF* are restricted to a maximum height of 20 metres, except for low seismicity ($I_E F_a S_a(0.2)$ < 0.35) applications. These restrictions and limits are summarized in the table below. With regard to brace

TABLE - FRAME HEIGHT, BRACE SLENDERNESS AND B-TO-T LIMITS FOR TENSION-ONLY BRACED FRAMES

SFRS	$I_E F_a S_a(0.2)$[a]	max. height	maximum KL/r	maximum b/t
Conventional Construction[b]	< 0.35	no limit	300[d]	n/a
	≥ 0.35, but ≤ 0.75	60 m		if height > 15 m the stricter limits for LDCBF and Class 2 sections apply
	> 0.75[c]	40 m		
LDCBF	< 0.35	no limit	200 if over 2 storeys, else 300[e]	except for braces having KL/r > 200 in 1- & 2-storey frames, comp. brace limits apply
	≥ 0.35	40 m		
MDCBF	< 0.35	no limit	200	compression brace limits apply
	≥ 0.35	20 m		

Notes:
a) as defined in NBC 2010;
b) not permitted for Assembly Occupancy where $I_E F_a S_a(0.2) \geq 0.35$ and height > 15 m, and all Post-disaster Buildings;
c) or $I_E F_v S_a(1.0) > 0.30$;
d) this limit may be waived if other means for vibrations and sag control is provided;
e) this is a seismic performance requirement.

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connection design requirements, the provision for ductile rotation at or near the brace ends also applies to tension-only braces. An example is shown in the figure on the right.

2. *Limited ductility concentrically braced frames*

Design requirements for tension-only *MDCBF* also apply to tension-only *LDCBF* but Clause 27.6 of S16-09 permits a number of exemptions and relaxations. The maximum frame height limit for moderate and high seismicity ($I_E F_a S_a(0.2) \geq 0.35$) applications is relaxed to 40 metres. Moreover, for one- and two-storey buildings, the cross-section stockiness and maximum member slenderness limits for the braces are also relaxed:

a) Where KL/r > 200, there is no restriction on cross-section stockiness (b/t ratios) and

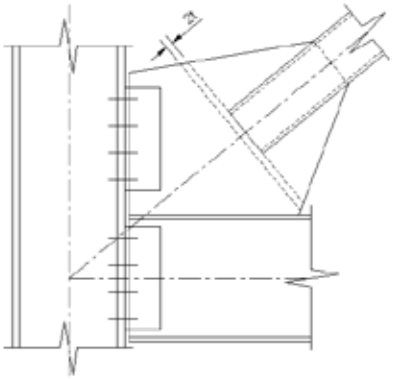

FIGURE – A COMMON BRACE END DUCTILE HINGE ROTATION DETAIL

b) KL/r ≤ 300.

It should be noted that the brace slenderness is restricted to 300 as a seismic performance requirement. It should not be confused with the serviceability limit for tension members in general (KL/r ≤ 300), which may be waived if vibrations and sag are controlled by other means.

3. *Conventional construction*

Traditional tension-only braces (slender) may be used for *conventional construction* in low seismicity ($I_E F_a S_a(0.2) < 0.35$) applications without any height restriction and for *conventional construction* of low-rise buildings (height ≤ 15 m) in higher seismicity applications. Otherwise, the braces must satisfy a specific b-to-t limit, i.e. the stricter of *LDCBF* and *Class-2-section* limits.

Conventional construction featuring slender tension-only braces remains popular for low-rise and small buildings in low seismicity applications. Their suitability and cost effectiveness for other applications depend on many factors, including building *Importance Category*, seismicity, building height, diaphragm force magnitude, etc.

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Bow Building, Calgary. Photo courtesy of CWB

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By Tareq Ali, RPM
Director of Marketing

Case study: A comparative Life Cycle Assessment

An LCA of steel vs. concrete framing for a multi-unit residential building in Edmonton

This landmark study, carried out by Dr. Mark Gorgolewski and Ivan Pinto of the Department of Architectural Science at Ryerson University, and funded by the Steel Structures Education Foundation (SSEF), was recently launched at a CISC conference.

The primary objective of this study was to evaluate the environmental impacts of using alternative structural framing systems in multi-unit residential buildings through a quantitative assessment of the design using Life Cycle Assessment (LCA) methodologies. The research focused on a steel-framed building compared to a similar building using a concrete structure.

The functional unit selected for this study was a multi-storey residential project, The "Signature" in Edmonton, Alberta, with a projected lifecycle of 50 years for the purpose of the LCA study.

LCA defined

Using a Life Cycle Assessment (LCA) approach allows for a comprehensive assessment of the environmental performance of a product over its full life cycle.

LCA, as defined by ISO 14040 and 14044, is the compilation and evaluation of inputs and outputs of a product system and their potential impacts on the environment during the product's lifetime. In other words, it is a scientific framework that evaluates the inherent environmental impacts of products over their life span, including resource extraction, manufacturing, use and disposal, therefore allowing the identification of hotspots and improvement opportunities in each life cycle phase. LCAs also help us understand the embodied impacts (from manufacture of materials, transport, etc.) compared to operational impacts which occur during the period the building is actually occupied and in use.

The most commonly used environmental impact indicators, and their units of measurement, are illustrated to the right:

Environmental impacts calculated by Athena EIE

Primary energy consumption (PEC): MJ

Fossil fuel consumption (FFC):

Global warming potential (GWP): kg CO_2 eq

Acidification potential (AP): moles H^+ eq

Human health respiratory effect potential (HHR): kg $PM_{2.5}$ eq

Eutrophication potential (EP): kg N eq

Smog potential (SP): kg NO_x eq

Ozone depletion potential (ODP): mg CFC-11 eq

BUILDING DETAILS

Location : Edmonton, Alberta

Total built area: 44,495 square metres

THE SIGNATURE, EDMONTON, ALBERTA

Research methodology

Alternative designs for a steel-framed structure with precast concrete floor slabs and a concrete cast-in-place structure were developed by the project engineers for the Signature multi-storey residential project.

The only variation to the building's design was the structural systems, namely for columns, beams, shear walls, floor slabs/decks, roof slabs/decks and footings.

In order to calculate the structural materials for the steel-framed option, the actual materials specifications and quantities of each component were extracted from the Revit models provided by the project team. The spreadsheet outputs from Revit, a leading Building Information Modeling (BIM) software, and included all the structural components from the original design. Then actual weight factors were added for each steel component to reach the above values. An alternative concrete-framed structure was proposed by the design team for columns, beams, slab and shear walls, and this was used to calculate the material quantities for a concrete structure for the whole building.

In order to evaluate the building's operational performance, the original building design was modelled using the eQuest Energy Simulation software.

The LCA software tool used in this research was the Athena Environmental Impact Estimator (EIE), one of the leading building LCA tools in North America designed to facilitate easy modelling of whole building assemblies.

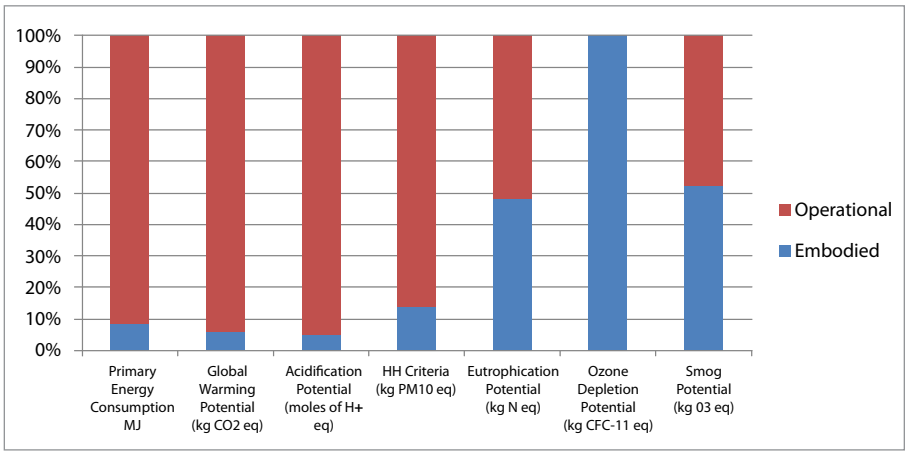
The 'functional unit' sets the boundaries or scope, ensures consistency and validates the fairness of the study. In this report the functional unit is the "Signature" multi-unit residential building located in Edmonton, in which the only design variation is the structural system.

Key research findings

- The Operational Impacts of the building over its 50-year life are by far the dominant factors for most environmental impacts (including primary energy, global warming potential, acidification potential and human-health respiratory effect potential).
- The differences in Embodied Impacts between steel and concrete for the building structure are small.
- Embodied Impacts are mostly dominated by the manufacturing stage of the building's materials and components.
- Embodied Impacts, particularly from the manufacture of building materials and components, are significant for eutrophication potential, ozone depletion and smog potential.
- For the steel-framed building option, ozone depletion impacts of pre-fabricated hollow core concrete can have a large impact on the results. This significantly affected the ODP indicator for the steel-framed building.

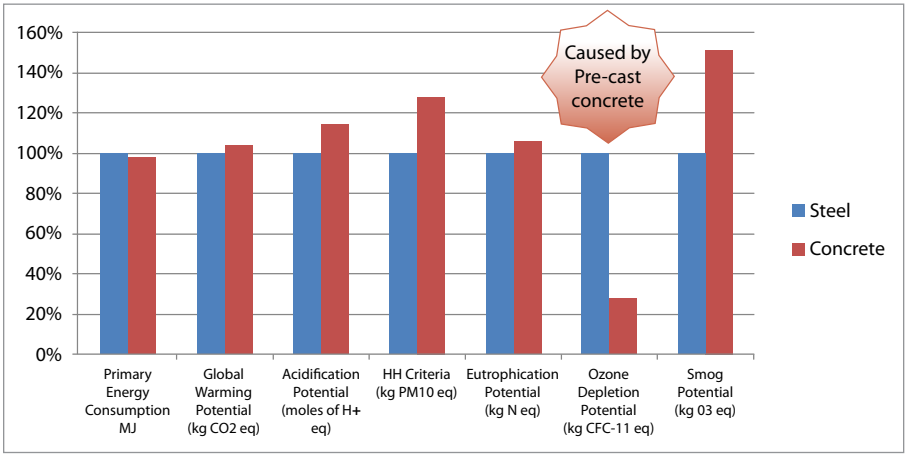
Embodied vs. operational impacts for the steel structural option

The figure below demonstrates the relation between embodied impacts and operational impacts. It shows that most of the environmental impacts caused by the proposed building occur throughout the operational phase (50-year life of the building) due to operational energy consumption which is by far the dominant factor. This is encouraging as operational impacts can often be reduced more easily than embodied impacts by using more energy efficient equipment and a better building envelope, reducing the carbon intensity of electricity, relying more on renewable sources of energy, and even by changing the occupants' life-style.

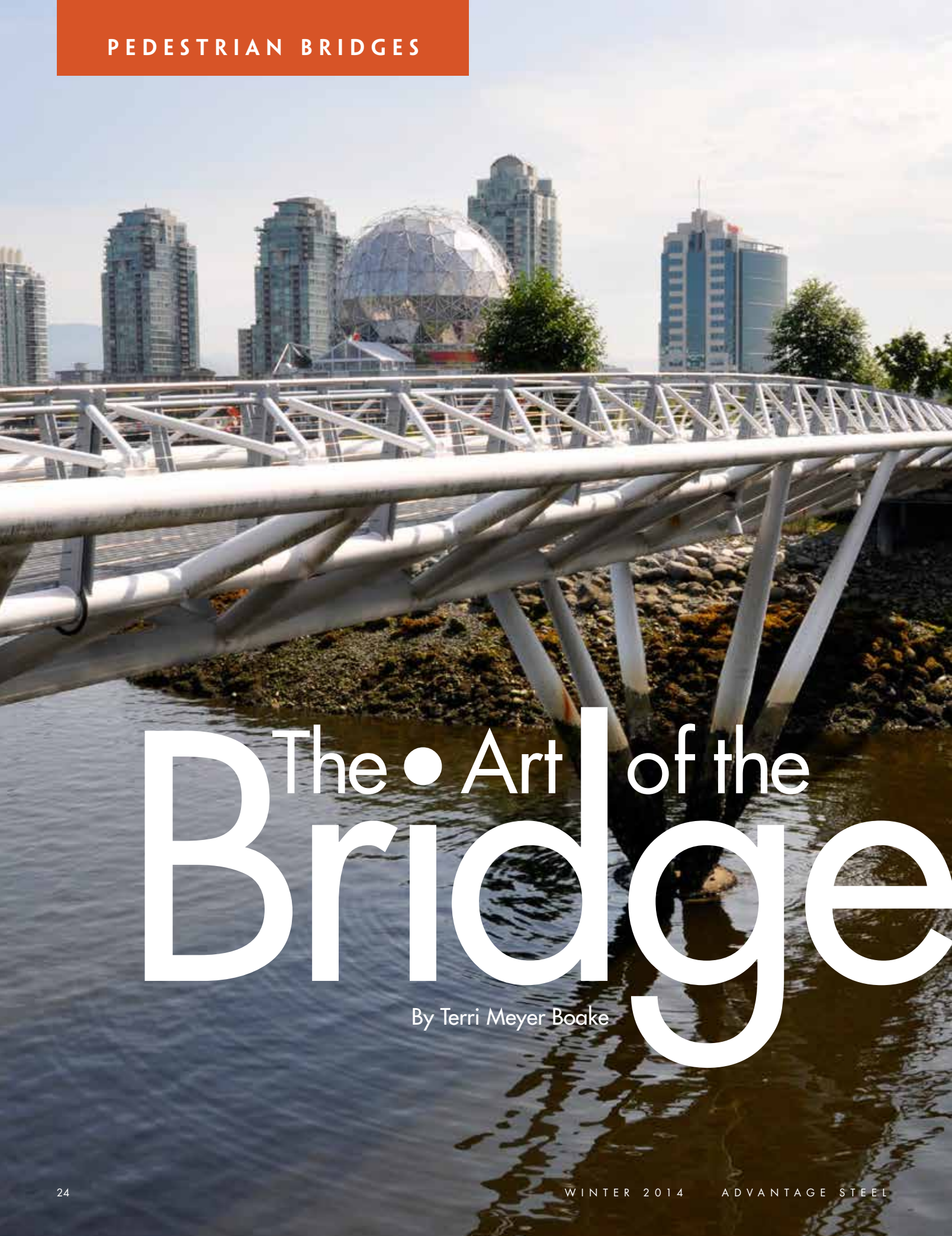


Embodied impacts comparison for steel and concrete framed buildings

The figure below shows a comparison between the total embodied impacts (excluding operating impacts and recurring impacts from maintenance) of the steel and concrete structural options. For many categories the difference is small and well within the 15 per cent margin of error for such assessments. The only significant variations are for Acidification Potential, Human Health Respiratory Criteria, and Smog Potential where the steel structure appears to have a lower impact, and Ozone Depletion Potential where the concrete option shows a lower impact. Ozone Depletion Potential (ODP) is higher for the steel option due to the use of precast concrete slabs which the Athena database assesses to have a high ODP.



Overall, this study clearly demonstrates that steel and concrete are comparable in their environmental impacts as structural framing systems, with steel having a smaller footprint in most environmental impact categories. These findings further reinforce the sustainability benefits of building with steel, both during construction, operation and with the numerous possibilities of recycling and reuse at the end of the building's life.



The Art of the Bridge

By Terri Meyer Boake

Since the early days of cast and wrought iron, the bridge has been able to serve simultaneously as a means of crossing and an expression of a significant spanning structure. Unlike structures that are hidden inside of buildings, the long span solution of the bridge is iconic in the public realm.

Early iron bridges often took on truss or arch shapes, their exposed steel detailing highlighting the joinery of the period. The material limitations of iron often resulted in the need for multiple piers at the point of crossing. The invention of higher strength steel and cables facilitated the creation of new bridge typologies and permitted much longer spans.

The car dominated society of the later 20th century and its massive road and highway networks tended to downplay the role of the expressive bridge structure. Crossings were numerous and came to be treated in a routine manner. High strength materials resulted in spans that were achievable with beams, with the use of suspension cables and more elaborate steel truss structures reserved for more significant vehicular bridges over major crossings.

The 21st century has seen a resurgence of the pedestrian and the bicycle. Major roadways and waterways are now seen as barriers that divide neighbourhoods and separate parts of cities, making it difficult for pedestrians and bicycles to navigate or cross without having to go many kilometres out of their way.

As a result, a new genre of bridge type has evolved to address the need to reconnect the divided parts of the city and make the path of the pedestrian or cyclist a delightful one to traverse. Many of these bridges are located in significant urban areas, encouraging designers to be more innovative and expressive with their bridge solutions. As the pedestrian and cyclist loads are much lighter than vehicular bridges, the bridges can also be lighter which permits a wide range of design expression.

AESS approach

A tendency has emerged to select innovative AESS approaches to address these design problems. As a result, the pedestrian bridge is effectively being used as "public art" – but with a purpose. The cost of the AESS solution might be higher than an ordinary structure, but the dual purpose seems to

justify the expense. This has provided the steel industry with an opportunity to showcase its AESS skills. AESS pedestrian bridges are charged with going well beyond serviceability in the creation of new iconic landmarks in the city.

These projects are not without their challenges, given that they must be detailed and finished in a way that is capable of resisting the harshness of our northern climate as well as the wear and tear provided by use. The type of detailing used on most of the recent projects would see AESS 2 or 3 categories used. Although AESS 2 is normally intended for use on projects at a viewing distance > 6m and AESS 3 for projects < 6m, the detailing on many of these bridges tends to avoid the type of remediation or grinding that might be found on AESS 3 work. Neatly done welds and well arranged bolted connections that are typical of AESS 2 projects are suited to many of these bridge designs, even when viewed more closely. Where you may enter AESS 3 territory would be in cases where many custom or bent sections are fabricated for the project.

> "A new genre of bridge type has evolved to address the need to reconnect the divided parts of the city"

These bridges must be detailed and finished to prevent corrosion. This has not necessarily resulted in the exclusive use of galvanized or weathering steel as these materials may not suit the form and desired aesthetic effect of the bridge, which often includes colour.

If painted solutions are desired, the coating system must be specified to be extremely durable and the detailing conscious to prevent the capture of water and snow. Galvanizing is sometimes used on the walking surface if it is designed in steel. Weathering steel bridges tend not to be used in urban situations due to run-off issues and the staining on adjacent concrete. Weathering steel is more commonly found in park settings where the adjacent landscape can mask run-off. For all materials the use of de-icing agents must be avoided or regulated as these can result in rapid degradation.

One of the key challenges for bridges is erection. Access is usually restricted (or you would not need to bridge!) resulting in logistical challenges. Bridges over roadways cannot impede the traffic, making scaffolding or temporary shoring supports questionable. Bridges over rivers or in difficult natural settings may preclude the use of scaffolding. Often there are environmental restrictions at river sites that necessitate the use of a clear span in order to avoid damaging the riverbed, negating pier supports. Fabricators have become innovative, floating the sections on barges if over a river crossing or launching sections from abutments to avoid the use of scaffolding.

The "art" angle

Bridge as Art, in AESS 2 or 3, allows for some exciting embellishments to detailing in terms of member choice and connection design. "Art" allows

the design to be governed not exclusively by efficiency, but also by the artistic expression of the structural system. The result seems to be the development of three key types that have been derived from more straightforward functional forms. The primary influence on the generated typology seems to focus on the specific expression of the structure that is supporting the walking surface.

- The mast and cable system is designed as a variation of a suspension system. The location of the mast is often eccentric or sloped, resulting in a very dynamic appearance to the structure. The structural deck that supports the walkway is quite light.

- Tubular trusses are also used, having the pedestrian walk *through* the structure.

- The structural support system for the deck can be located beneath the walking surface, so it is less apparent when the bridge is crossed, but very apparent when viewed from a distance.

Handrail detailing also plays an important role in the expression and experience of the bridge and varies with each of the three systems. The handrail system is often required to discreetly act as a safety barrier to prevent falls to the surface below. It is often higher than a regular guardrail where the bridge is located over a roadway or train yard. In these cases the designers tend to use materials, meshes and light cable systems to continue to allow views through the bridge.

When AESS is used to elevate a pedestrian bridge to public art, each bridge can create a unique experience for the user, enhancing the urban environment. The possibilities are endless.

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Quebec Region Steel Design Awards of Excellence

Celebrating outstanding projects in steel

The gala ceremony for the 2013 CISC Quebec Region Steel Design Awards of Excellence was held at the Palace Convention Centre in Laval on October 3. It was a fabulous event, with a unique stage shaped like a hockey rink and a blue, white and red colour theme. Over 400 fabricators, suppliers, drafting firms, professional engineers and architects from all across Quebec attended the ceremony. The evening also featured a silent auction for hockey paraphernalia, raising over $8,000 for Chris Nilan's Knuckles Foundation to benefit the Montreal Children's Hospital.

Earlier in the day, the Quebec Region hosted the 5th Annual Steel Symposium and Exhibition. Individual and plenary sessions covered topics on fabrication, design, codes and standards, inspection, professional liability and research. Close to 300 professionals attended, including a large contingent of young professionals.

GREEN BUILDING

Bibliothèque du Boisé, St. Laurent

TEAM:
Cardinal Hardy / Labonté Marcil / Eric Pelletier (Consortium)
- Acier Sélect Inc.
- Pomerleau
- SDK et associés
- Ville de Montréal

Bibliothèque du Boisé, located in the Montreal suburb of St-Laurent, encompasses 3,000 square metres of library space, an exhibition centre and a museum reserve. The materials used in the construction of the structure highlight the project's various components: the steel structure with its interesting spans, the sculpted roof with its informal ease, and the walkway with its unique sense of lightness. The library's main entrance and its large skylight have also become significant identifying features.

STAIRS AND ARCHITECTURAL WALKWAY

Monumental Stairway, John Abbott College Science and Health Technologies

TEAM:
SDK et associés
- John Abbott College
- EBC Inc.
- Fer Ornemental Jean-Guy Robert Inc.
- Saucier + Perrotte Architectes

The architects on this stairway project at John Abbott College asked the engineering firm SDK to design a staircase without columns. They wanted the staircase to have a very slender appearance and to give the impression of floating on air. Despite a number of challenges presented by a change in direction and levels, SDK succeeded in its goal. The result is an undeniably streamlined staircase, with an elegant and majestic presence.

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COMMERCIAL – INSTITUTIONAL

Bibliothèque Guy-Bélisle, St-Eustache

TEAM:
SDK et associés
- ACDF Architecture
- Sofab Structural Steel Inc.
- Opron Construction Inc.
- Ville de Saint-Eustache

The new library in Saint-Eustache was built with respect for the shoreline of the nearby Mille-Iles river, as well as its abundant plant and wildlife. The project integrated an attractive outdoor terrace, resulting in an atmosphere of wellbeing that harmonizes with the waterway. Engineers were committed to seeking efficient solutions that were expeditious to construct and straightforward to coordinate – all at a reasonable cost to deliver maximum impact. It was clear early on that a structural steel solution was needed for the construction of the cantilevers. The final structure allows for maximum flexibility in laying out library shelving.

Bibliothèque du Boisé, St. Laurent

TEAM:
Cardinal Hardy / Labonté Marcil / Eric Pelletier (Consortium)
- Acier Sélect Inc.
- Pomerleau
- SDK et associés
- Ville de Montréal

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RESIDENTIAL – RENOVATION

Expansion of Clinique API de Laval

TEAM:
Groupe-conseil Structura international
- Dorbec Construction Inc.
- Fiducie immobilière Bruno Carré
- Structures Sim-Con Inc.
- TLA Rive-nord
- VET Dessin

The three-storey steel frame building expansion of the API clinic in Laval provides nearly 2,500 square metres of floor space in a high-quality, user-friendly environment. The structure was designed to minimize the number of interior columns. Many of the frame's steel members are intentionally left exposed, contributing to the unique architectural expression of this innovative, daring structure. Special care was also taken with the exposed assemblies.

INDUSTRIAL PROJECTS

Arvida Aluminum Smelter,
AP60 Technology Centre, Jonquière

TEAM:
Supermétal
- Rio Tinto Alcan
- SNC-Lavalin/Hatch Joint Venture
- Gemayel + Emmian + Kirimidtchiev Architects
- Techdess inc.
- BD Dessin Structural

The new Arvida Aluminum plant integrates harmoniously within its industrial context, while simultaneously standing out thanks to its striking architecture. It is a style of architecture that partners well with the high-tech operation found within its walls. There were a number of challenges – engineering, fabricating and erection – in completing the construction on the building. In the end, the project's stakeholders achieved their goal of showcasing the two jewels of the Quebec metals industry – steel and aluminum. Steel, after all, is required to make aluminum.

BRIDGE PROJECTS

A30 PPP – Beauharnois Canal Bridge

TEAM:
Cardinal Hardy / Labonté Marcil / Eric Pelletier (Consortium)
- Arup Canada
- Ministry of Transport of Quebec
- Nouvelle Autoroute 30 SENC
- Structal-Bridges, a division of Canam Group Inc.

The bridge over the Beauharnois Canal and the St. Lawrence Seaway is without question the biggest structure to be built as part of the New Autoroute 30 infrastructure project in Quebec. The massive crossing is 2.5 kilometres long and includes 1.5 kilometres of composite box girder deck with 15,500 tonnes of structural steel and spans of 82 metres over the canal and 150 metres over the seaway. Numerous advanced metal construction techniques were used in its erection.

Deh Cho Bridge, Fort Providence, Northwest Territories

TEAM:
Structal-Bridges, a division of Canam Group Inc. & Tenca
- Associate Engineering
- Community Partners Deh Gah Got'ie First Nation
- Government of the Northwest Territories
- Infinity Engineering Group Ltd.
- Rapid-Span Structures
- Ruskin Construction Ltd.

The 1,045-metre long Deh Cho Bridge is a guyed lattice structure composed of nine spans and two towers, each supporting 12 cables. It has 110 lattice beams, with a total structural weight of 4,280 tonnes, and two steel towers. The bridge is an excellent example of the use of structural steel in bridge engineering. Steel's great strength, combined with lightweight modeling principles (guyed lattice girder bridge), made it possible to erect an economically optimum superstructure while maintaining an exceptionally light weight.

PROJECTS OUTSIDE QUEBEC

Nathan Phillips Square, Toronto, Ontario

TEAM:
VET Dessin
- Beauce Atlas
- Blackwell + Bowick Engineers
- PCL Constructors
- Perkins + Will Canada
- City of Toronto

For Toronto's iconic Nathan Phillips Square, structural steel provided a crisp geometric expression that perfectly complements the high modernism of City Hall. Steel's inherent strength accommodated complex eccentric and kinetic loads, while nonetheless resulting in an overall feeling of lightness. Steel was the best solution for the project as it allowed for excellent quality control during fabrication and rapid construction. It also provided durability and minimum maintenance requirements for a cost-effective solution.

YOUNG ARCHITECTS / ENGINEERS

Expansion of Clinique API de Laval

TEAM:
Groupe-conseil Structura international
- Dorbec Construction
- Fiducie immobilière Bruno Carré
- Structures Sim-Con
- TLA-Rive-Nord
- VET Dessin

The three-storey steel frame building expansion of the API clinic in Laval provides nearly 2,500 square metres of floor space in a high-quality, user-friendly environment. The structure was designed to minimize the number of interior columns. Many of the frame's steel members were intentionally left exposed and contribute to the modern architectural expression of this innovative, daring structure. Special care was also taken with the exposed assemblies.

John Abbott College Science and Health Technologies Pavilion, Montreal

TEAM:
SDK et associés
- John Abbott College
- EBC Inc.
- Fer Ornemental Jean-Guy Robert Inc.
- Saucier + Perrotte Architectes

Brightly illuminated thanks to a high six-level atrium, and enlivened by a playful monumental staircase, the Science and Health Technologies Pavilion at John Abbott College attracts plenty of interest. It adds a unique space full of light and gaiety to an otherwise traditional-looking campus. The pavilion was built according to specific environmental standards that take into consideration energy efficiency, efficient water and heating consumption, and use of local materials. The professional team involved in its construction is currently seeking LEED GOLD certification for this project.

Redevelopment of Casino de Montréal

TEAM:
Pasquin St-Jean & Associés
- Casiloc
- Consortium MSDL & Provencher Roy
- Pomerleau
- Tecno-métal

The $15-million budget for the reconstruction of Casino de Montréal has resulted in an extraordinary, eye-catching structure. The building's unique entrance – a focal point for visitors – draws a lot of attention, as does its new roof, resting only on an angulated and cantilevered steel truss from its foundation. Also notable is a concrete-steel composite elliptical column 1,200 mm long by 800 mm wide. The two members together pick up all the stresses of the new roof, including the seismic stresses.

JURY FAVOURITE

Bibliothèque du Boisé, St. Laurent

TEAM:
Cardinal Hardy / Labonté Marcil / Eric Pelletier (Consortium)
- Acier Sélect Inc.
- Pomerleau
- SDK et associés
- Ville de Montréal

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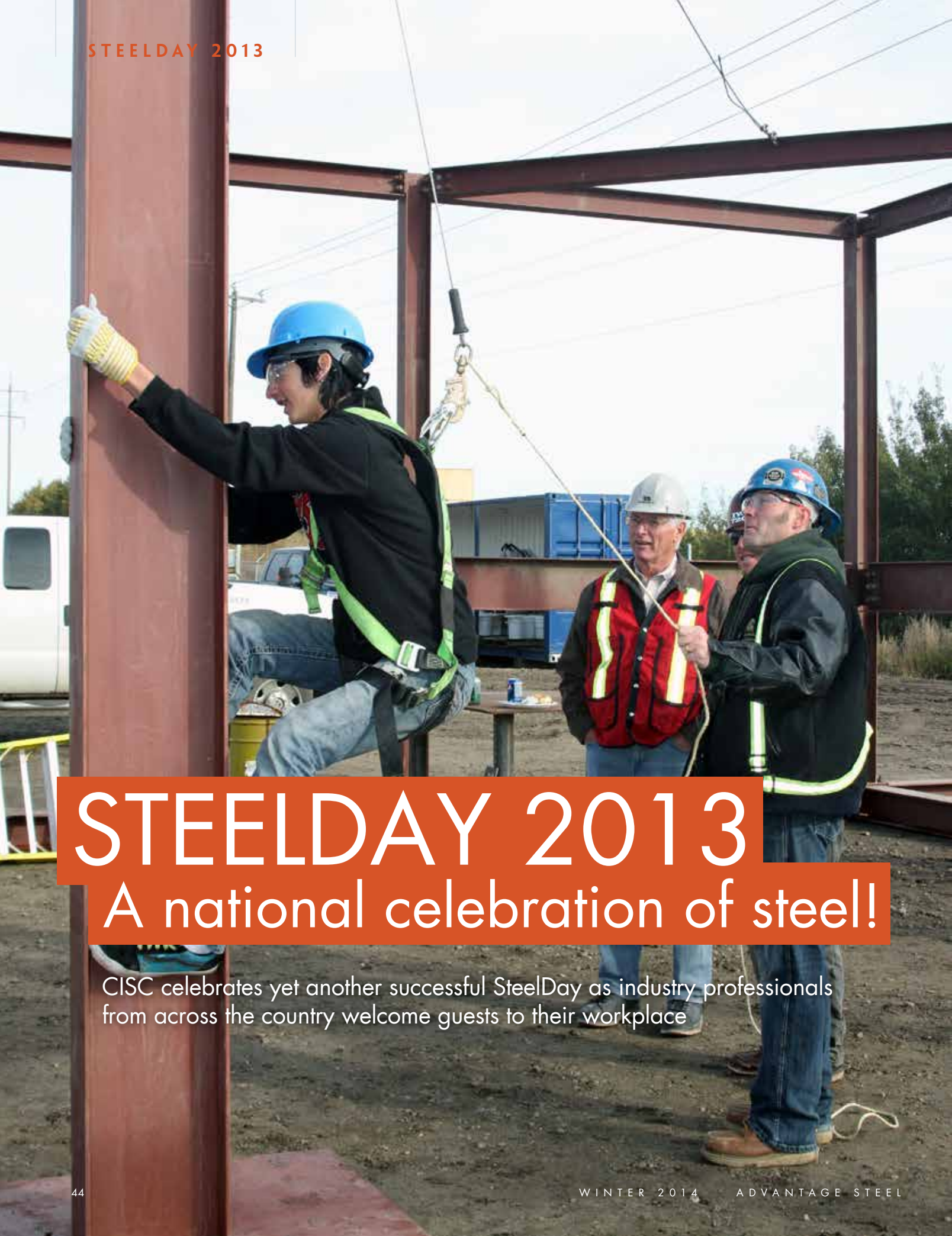

STEELDAY 2013
A national celebration of steel!

CISC celebrates yet another successful SteelDay as industry professionals from across the country welcome guests to their workplace

The CISC family of members and associates hosted yet another fabulous SteelDay on October 4, 2013.

With a variety of activities ranging from plant and shop tours to 3D modelling and virtual welding demonstrations, and even a steel column climbing challenge, attendees were treated to an exciting, informative and enjoyable day to tour and learn about the steel construction industry.

Many of the tours also ended with a bit of socializing over a barbeque lunch and refreshments, and some locations provided a memorable steel souvenir to their guests.

While measuring the success of SteelDay includes many qualitative and quantitative considerations, attendance numbers continue to be a key metric. As such, this year was a resounding success, with over 2,600 attendees and 34 hosts across the country. British Columbia led the charge with over 1,000 attendees, followed by Quebec with over 600 attendees.

Feedback from host organizations across the country reflects the value that SteelDay provides: an opportunity to host customers, consultants and the local community to showcase and promote your business, raise awareness of the performance and versatility of steel, and demonstrate the commitment and innovation of our industry.

We recognize that planning and hosting a successful SteelDay requires considerable time and resources, and we are once again very thankful to our generous hosts this year.

Atlantic

The Atlantic Region had another fantastic SteelDay. Cherubini had a huge success with visitors arriving by bus from universities, community colleges, competitors, engineers and subtrades. Each visitor was welcomed in the board room with coffee and doughnuts followed by an extensive shop tour. Each group attending was also introduced to CISC by a regional representative. The following Monday, the Premier of Nova Scotia also visited Cherubini and was given a personalized tour.

Marid Industries also received a large amount of visitors who were offered coffee and doughnuts followed by a shop tour and an explanation of their shop equipment. RKO Steel was visited by Dalhousie students accompanied by a Dalhousie professor. Russel Metals held their open house In St. John's, Newfoundland and they had a good turnout. Ocean steel held their open house in Saint John, New Brunswick, and all visitors received refreshments prior to a shop tour.

Quebec

CISC Quebec Region held its Steel Symposium, Trade Show and Steel Design Awards of Excellence on October 3, 2013, at the Palace Convention Centre, in Laval, Quebec, which was also part of the SteelDay festivities. The day was a fantastic event and included an interdisciplinary conference capped off by a fabulous gala awards ceremony rewarding unique steel projects. Thirteen awards were presented to outstanding projects in nine different categories. Many companies from the Quebec region were present at the Trade Show and the turnout was great with 600 in attendance over the entire event.

Ontario

Both hosts in the Ontario Region were very enthusiastic and felt that SteelDay was a great success for them. Samuel, Son & Co., Limited is the fifth largest processor and distributor of carbon steel, stainless steel and aluminum in North America. They opened the doors at their plant in Hamilton that morning and were visited by engineers, CISC members, fabricators and some educators. They were given an overview of Samuel by Bill Hutton, and there was a health and safety discussion, a plant tour and then a question and answer session at the end.

Dowco's Mississauga office also took part. Dowco Consultants Ltd. is a company that offers services in Steel Detailing, Consulting, 3D Modelling, BIM Services, Pre-Detailing, and Connection Design. They are a worldwide leader in providing BIM solutions for the construction industry. They prepared videos about their work and showed their visitors some sample projects of work they had completed in the past, namely the World Trade Center in New York.

Manitoba / NW Ontario

The Manitoba / NW Ontario Region tripled their number of SteelDay hosts in 2013. Attendees increased a whopping 631 per cent over 2012, and from all indications the tours were well received and went off without a hitch. Highlights revolved around the varying job types and organizations that attended during the events. Some of the attendees included the City of Winnipeg bridge/construction department, Province of Manitoba Infrastructure and Transportation, suppliers who had never been through the plants they serve, Hutterite colonies, engineers, educators,

friendly competitors and students as well as representatives from both the government and private sector. Next year we hope to hold various tours again and are looking at other activities that are suited for this type of introductory event.

Saskatchewan

SteelDay 2013 in Saskatchewan saw two host sites in Saskatoon draw a very engaged audience of guests to their sites to learn more about the capabilities of CISC member firms and the contribution of steel construction to building our communities. Both our host companies, Elance Steel and Provincial Galvanizing, reported significantly increased attendance at their events. We were able to attract students, engineers and others in the design community to tour our shops and get some hands-on experience with various aspects of steel fabrication. Elance Steel was able to showcase their expanded shop capacity for both fabricated steel and specialized metals, while Provincial Galvanizing provided their guests with a firsthand experience with the intricate process of galvanizing metal to provide a crucial protective coating. The enthusiasm and commitment for SteelDay remains strong in Saskatchewan with several companies planning now for SteelDay 2014, eager to showcase their capabilities and spirit of innovation in steel design and construction.

Alberta

SteelDay 2013 in Alberta featured five host sites showcasing the contribution of steel construction to building our community. All host sites reported an increase in attendance over previous years and an enthusiastic response from all their guests to what they saw and experienced. We were able to show them how a bridge girder is fabricated at Supreme Bridge division and how the process of galvanizing coats and protects steel at Daam Galvanizing. At Collins Industries, guests were given hands-on experience with welding and grinding as well as a simulation exercise on the benefits of collaboration in construction. Supreme Steel's Acheson campus hosted some 300 guests, including high school and university students, providing them with an ironworker simulation and tours of their newly expanded fabrication facility and module assembly yard. Leder Steel hosted their first SteelDay event, showing their guests their newly expanded fabrication shop and yard. We were pleased to host a broad range of guests at our SteelDay sites from students to design engineers, government officials and construction contractors, demonstrating the innovation and capabilities of the steel construction industry.

British Columbia

SteelDay in British Columbia has had a spectacular reception by a large number of hosts (15 this year) and the feedback has been most positive. Our members have come to realize that through investment in this event there is a return commensurate with the time and effort put into participating. BC Region had over 1,000 people in attendance across all the events, making this our most successful SteelDay yet.

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News and Events

Attend NASCC 2014 and Experience the Latest Innovations in Steel Design and Construction

You are invited to attend NASCC: The Steel Conference in Toronto, March 26 - 28, 2014 at the Metro Toronto Convention Centre!

NASCC is the premier event for engineers, fabricators, detailers and erectors in the structural steel industry encompassing steel design and construction. Over 3,500 industry professionals come to find out what's new, who's got it, and how it can work for them. Adding to the excitement of this year's conference is the World Steel Bridge Symposium which brings together bridge design engineers, construction professionals, academicians, transportation officials, fabricators, erectors and constructors to discuss and learn state-of-the-art practices for enhancing steel bridge design, fabrication and construction techniques.

The two conferences will offer more than 100 technical sessions and feature more than 220 exhibitors in 50,000 net square feet of exhibit space. Exhibitors demonstrate a wide range of products including fabrication equipment, detailing software, connection products, safety equipment, engineering software and coatings.

For more information visit www.aisc.org/nascc.

NEW CISC ONTARIO REGIONAL SCHOLARSHIP AWARD

The CISC Ontario Scholarship award is an exciting new program being presented in conjunction with the Ontario Erectors Association (OEA), and is in addition to the Region's existing scholarship programs. The Scholarship is available to students who will be admitted in this academic year to either a first or second year of full-time graduate studies in structural engineering, with major emphasis on the study of steel structures. It is in the amount of $20,000, distributed over twelve months. Candidates for either a Master's Degree or a Doctoral Degree are eligible to apply. Applications must be received by the Canadian Institute of Steel Construction (CISC) Ontario Region no later than March 28th, 2014.

For more info contact: Patricia Penney-Rouzes, Ontario Regional Manager, Email: ppenney-rouzes@cisc-icca.ca Telephone: (905) 946-0864, ext.104

Save the Date: 2014 CISC ANNUAL GENERAL MEETING AND CONFERENCE

St. John's, Newfoundland , Sep 30, 2014 - Oct 5, 2014

Nucor-Yamato Steel: Celebrating 25 Years of Innovation, Ready for the Work That Remains

This year marks the 25th anniversary of Nucor-Yamato Steel Co. The company is celebrating this landmark, but they also know there's more work to be done and they look forward to pioneering throughout the next 25 years.

Nucor-Yamato is celebrating because of their track record of innovation. Their mill in Blytheville, Ark., was the first in the Western Hemisphere to produce 44-inch deep wide flange structural shapes. These beams consistently helped with a range of projects across the country, often reducing the amount of steel needed, saving both time and money.

The company also developed the largest H-Piles ever produced. The new sections of HP16 and HP18 were the industry's first new H-Pile sizes in decades, giving engineers and contractors a more economical way to handle heavier design loads when constructing deep foundations for buildings and bridges.

For more information please visit www.nucoryamato.com.

ADDENDUM

For the "Steelworks on Display" article featuring the revitalization of Toronto's Union Station in the last issue of *Advantage Steel*, CISC would like to proudly identify Walters Inc. as the CISC Fabricator Member on this project.

Continuing Education Courses

CISC is pleased to offer one new course – Single Storey Building Design – and a selection of training programs, short courses and seminars throughout the winter and spring of 2014. The popular Connections I webinars started on January 7, and the three-day Inspection of Steel Building Structures course, which leads to a designation as a CISC Accredited Steel Inspector - Buildings, will be available in more locations this year. In addition, CISC is creating more opportunities for self-paced training in basic strength of materials, connection design and fire protection.

For full course schedule, information, online registration and the latest updates, please visit our website at www.cisc-icca.ca/courses, or request a copy of our course calendar.

Connections I
– Online Course –

This course is the second in a three-level series intended to develop the skills necessary for the design of steel connections as related to the construction of steel-framed structures.

The main objective is to assist steel industry personnel in their understanding of basic connection design principles, and to design simple welded and bolted connections suitable for fabrication. Participants will also understand the origin of the rules and standards used in the steel industry.

This training has the following goals:

- Understand and apply the major principles of the static forces and strength of materials in connection design;
- Recognize the properties and characteristics of steel;
- Use the appropriate connecting elements (bolts and welds); and
- Develop curiosity and critical judgment.

Course Leader:
Royce Johnson, M.Eng., P.Eng., Structural Engineer, Waiward Steel Fabricators Ltd.

Webinar Format (20@2hrs)

Tuesdays and Thursdays, 7:00 p.m. to 9:00 p.m. ET, starting January 7, 2014

Single Storey Building Design
– New Course –

This course focuses on practical and economical solutions for framing a single-storey warehouse building with attached office area to the requirements of the 2010 National Building Code of Canada and the pertinent provisions of CSA Standard S16-09.

Practical steel framing concepts and integration with architectural and mechanical features will be discussed. The presenters will highlight major changes in NBCC 2010 and CSA S16-09.

Topics include ponding of rainwater, snow drifting, companion load combinations, wind and seismic loads, notional loads, P-delta effects, selection of deck and joist systems, design of Gerber girders, design of interior and exterior columns, girts, base plates and anchor rods, selection and design of braced frames and roof diaphragm, fire protection issues, steel fabrication considerations, material selection, and economics.

Course Leader:
R. Mark Lasby, B.Sc., P.Eng., Principal Structural Engineer, Fluor Canada Ltd., Vancouver

Course dates and locations to be announced soon.

Inspection of Steel Building Structures
– Accreditation Program –

This three-day course will prepare inspectors, designers, building officials, fabricators, erectors and other specialists for the inspection of steel-framed buildings in the field. A course participant who achieves an 80 per cent grade on the optional three-hour final exam on the fourth day will be designated by CISC as an Accredited Steel Inspector - Buildings.

Applicable sections of the National Building Code of Canada, CSA S16 plus referenced material, product and quality standards, CISC Code of Practice and CISC Certification guidelines will be addressed. Typical structural, erection and shop drawings for steel-framed buildings will be explained. Material identification, tolerances, bolting and welding processes and procedures will be reviewed. Included are OWSJ, floor and roof deck, shear studs, surface preparation and coatings.

Course Leader: Robert E. Shaw, Jr., PE, President, Steel Structures Technology Center, Inc.

Course dates and locations to be announced soon.

Connections for Design Engineers
This course is intended to provide practical guidance to steel designers and clarify the complementary roles of the fabricator and the design engineer with respect to connection design. Emphasis is placed on connections and their impact on costs and economy.

The basic objective is to assist designers in their understanding of how connections influence member

design and vice versa, and to emphasize the importance of considering both connections and member selection for optimum economy. The scope of the course is limited to connections normally encountered in common types of steel building structures.

The presenters will highlight major changes in S16-09 that influence the design of structural steel connections. Topics include high strength bolts, welds, bolts in tension and prying, slip-critical connections, welds and bolts in combination, eccentric connections, simple shear connections, seated beam connections, connection to concrete, column connections, moment connections (W & HSS Sections), bracing connections, gusset plates and truss connections.

Course Leaders:
John R. Mark, M.Sc., P.Eng., Past President, M&G Steel Ltd
Peter C. Birkemoe, Ph.D., P.Eng., Professor Emeritus, University of Toronto

Ottawa, ON	June 9
Toronto, ON	June 10
Halifax, NS	June 11
Fredericton, NB	June 12
Winnipeg, MB	September 9
Regina, SK	September 10
Calgary, AB	September 11
Vancouver, BC	September 12

Assemblages en acier pour ingénieurs concepteurs
Ce cours est conçu pour offrir des conseils pratiques aux concepteurs et clarifier le rôle complémentaire du fabricant et de l'ingénieur en structures pour la conception des assemblages. L'accent est placé sur les assemblages et leurs conséquences sur les coûts et l'économie.

Le principal objectif est d'aider les concepteurs à mieux comprendre comment les assemblages influencent la conception des éléments de charpente et vice-versa, et d'insister sur l'importance de réfléchir au choix des assemblages et des éléments de charpente pour une économie optimale.

Les sujets abordés incluent les principales modifications à la norme S16-09, les boulons à haute résistance, les soudures, les boulons en traction et à effet de levier, les assemblages anti-glissement, les assemblages mixtes soudures-boulons, les assemblages excentriques, les assemblages en cisaillement simple, les assemblages de poteaux, les assemblages à tasseau, les assemblages sur du béton, les assemblages rigides (profilés tubulaires et en W), les assemblages de contreventement, les assemblages à gousset et les assemblages de fermes.

Conférenciers :
Serge Dussault, M.Eng., ing., Vice-président, ingénierie, Groupe Canam
Danilo D'Aronco, M.Ing., ing., Associé et directeur de l'ingénierie, DPHV

Montréal, QC	18 mars
Québec, QC	20 mars

New Members and Associates

CISC welcomes the new members and associates approved by the board:

Associate Technical
Luciano Patricelli

Associate Consultant Company
Les Conseillers BCA Consultants Inc.
Architecture Open Form
J.L. Richards & Associates Limited

Associate Erector
Superior Steel Erectors Ltd.

Associate Supplier
Peddinghaus Corporation
Dowco Technology Services Ltd
PPG Protective & Marine Coatings

Associate Builder/Stakeholder
Ironworkers Local 97

Steel Fabricator
Sandro Steel Fabrication Ltd.
Ready Arc Welding (2000) Inc.

Associate Professionals
Charles Bouchard
Ahmad Afshin
Brian Garrison
Daniel Gauthier
Van Wall
Nick Bevington
Philip Beauregard
Brian Johnson
Dale Harrison
Jacob Kachuba
Khan Munawar
Tony Latiza
Terrence D Smith
Alexis Djumbong
Tim Krahn

Common Codes and Standards for Design and Construction of Steel Structures
Current Status and Future Publication Targets

Current Status and Future Publication Targets			
CODE/STANDARD/SUPPLEMENT/ COMMENTARY/REFERENCED DOCUMENT	**CURRENT EDITION**	**NEXT EDITION/ REVISION**	**PUBLICATION TARGET**
National Building Code of Canada (NBC)	NBC 2010	NBC 2015	2015
NBC Structural Commentaries (Part 4 of Div. B)	NBC 2010 Str. Comm.	NBC 2015 Str. Comm.	2015/2016
CSA S16 Design of Steel Structures	CSA S16-09	S16-14	June 2014
CISC Commentary on CSA S16 (Part 2 of CISC Handbook of Steel Construction)	CISC Handbook 10th Edition[1]	CISC Handbook 11th Edition[2]	2015
CISC Moment Connections for Seismic Applications	1st Edition	2nd Edition	June 2014
CSA S6 Canadian Highway Bridge Design Code	CSA S6-06	S6-14	Sept. 2014
- Supplements to CSA S6	CSA S6S3-13	None planned	
CSA S6.1 Commentary on Canadian Highway Bridge Design Code	CSA S6.1-06	S6.1-14	Sept. 2014
- Supplements to CSA S6.1	CSA S6.1S3-13	None planned	
CSA G40.20/G40.21 General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel	G40.20-13 G40.21-13	TBA	
CSA W59 Welded Steel Construction (Metal Arc Welding)	CSA W59-13	TBA	
CSA W47.1 Certification of Companies for Fusion Welding of Steel	CSA W47.1-09	W47.1-14	2014
CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members	CSA S136-12	TBA	
CSA S136.1 Commentary on CSA S136	CSA S136.1-12	TBA	

[1] *CISC Handbook of Steel Construction - 10th Edition includes CSA S16-09, its Commentary, CISC Code of Standard Practice - 7th Edition, and design and detailing aids in accordance with CSA S16-09*
[2] *CISC Handbook of Steel Construction - 11th Edition includes CSA S16-14, its Commentary, CISC Code of Standard Practice - 7th Edition, and design and detailing aids in accordance with CSA S16-14*

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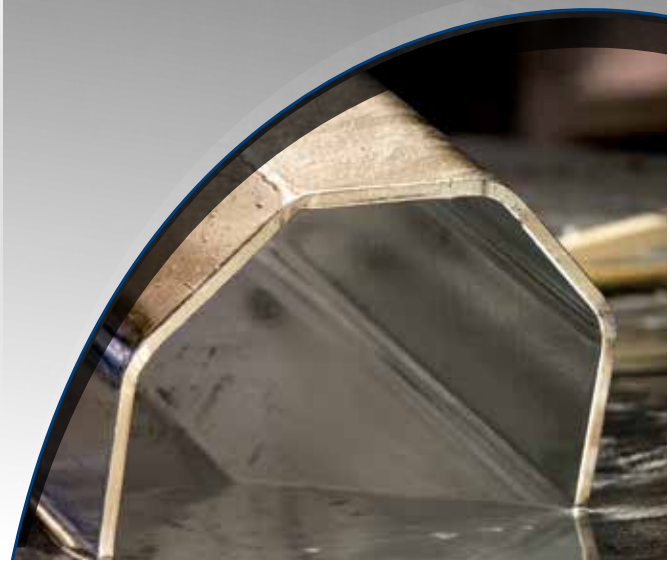

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