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NO. 65 FALL 2019

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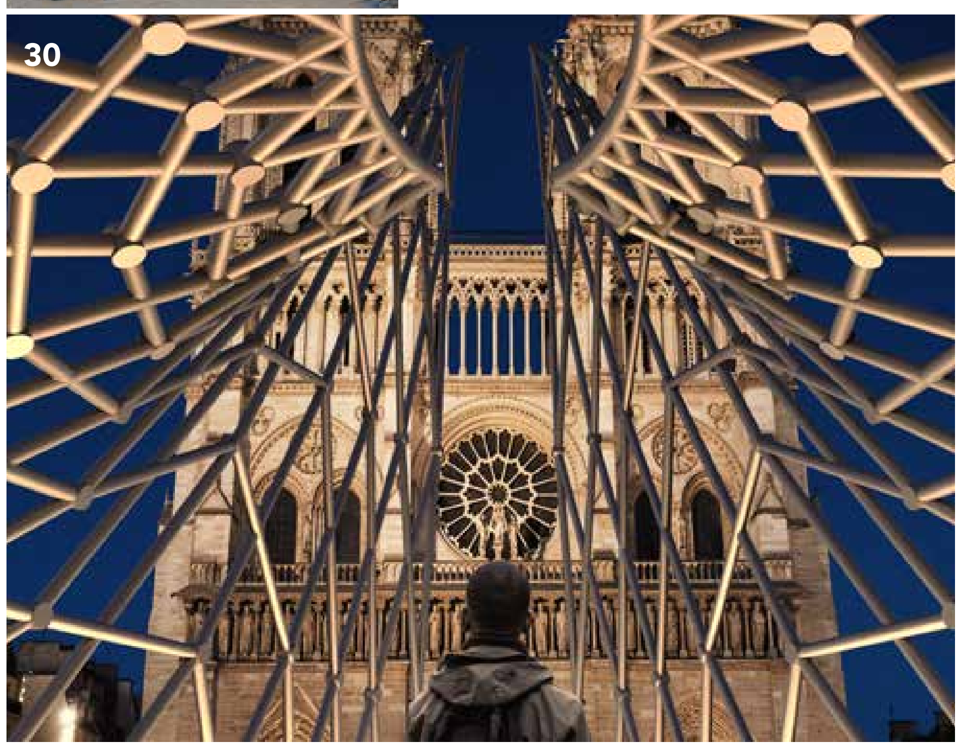
FEATURES

IN EVERY ISSUE



COLUMNS

The Canadian Institute of Steel Construction (CISC) is the Voice for the Canadian Steel Construction industry. The CISC represents a diverse community of structural steel industry stakeholders including manufacturers, fabricators, erectors, service centres, consultants, detailers, industry suppliers, owners and developers. Steel construction industry stakeholders are encouraged to apply to become a member or associate. Visit cisc-icca.ca for more information. If you are working on a project that you think should be featured, send us an email at ciscmarketing@cisc-icca.ca.

On the Cover: "Safe Hands" - Toronto, ON

Photo courtesy of M&G Steel Ltd.

Ed Whalen, P.Eng.
President & CEO, CISC

Are you a steel fabricator or steel manufacturer?

The answer may be why you lack competitiveness

Canadians love to joke about our litigious cousins south of the border and their lack of ownership for their actions. They misuse a product, blow themselves up, go to court, receive high settlements and the result we see is warning manuals thicker than user manuals and warning stickers on every inch of a product. Of course, the ugly stickers are removed and the warning manuals are thrown into the recycle bin unread. Despite all of this, the courts continue to hear cases of self-inflicted injury/stupidity and continue to pay out. Why can't Americans be more like us?

Today we got the results of the U.S. Department of Commerce's (DOC) provisional duty assessment against Canada for anti-dumping of fabricated structural steel. Canada was assessed by the DOC less than 1% and therefore 0% duty for fabricated steel crossing the border. Music to my ears. Cough … sham.

The trade action taken by the AISC – or more correctly their fabricator and mill members – against Canada was not the first time. Back in 2001, a similar petition was filed. It was ultimately thrown out when Canada was found to be trading fairly. Fast forward to today and it seems history is repeating itself with a bad case of déjà vu.

We are only too knowledgeable about how countries like China are illegally trading and we support AISC's action on those countries, but why did they add Canada? Simply because we are not American. They tout free and fair trade but only one-way trade; one way from the U.S. to other countries. They want to force us to use their products but prevent us from selling ours. Doesn't sound too free and fair to me. Can you say "Buy America," boys and girls?

Don't worry though, our government has a plan. Over 50% of construction steel used in Canada is American. The Liberal government recently waived anti-dumping duties on fabricated steel for two LNG plants in B.C., sending the entire project to China. No steel for you.

Now before we beat up on our anti-competitive American cousins, let's stop and pause on what similar thinking has been going on within our own country. For years I've been hearing conspiracy theories about one province or another getting assistance from one place or another, resulting in an uneven playing field. So this trade action by the Americans helps disprove those conspiracy theories at least from the province of Quebec. The U.S. Department of Commerce audit process is so thorough you would hope the CRA doesn't go to a DOC boot camp.

So, if no shenanigans then, how are companies beating your price? Having travelled extensively across the country and internationally in my past and present job(s), I can tell you every plant has different layouts, equipment, management styles, quality and ultimately, overheads. Some companies are high tech, some are low and some are in between. But what I feel is most dramatic about the industry today is how some companies are operating like manufacturers rather than fabricators. Like the auto industry, they are squeezing out efficiencies, raising quality, and investing in continuous improvement, productivity and people.

Many, and possibly most Canadian fabricators, like Americans, are

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> "It's time to take a walk into your shop and have a good hard look. Are your people trained as well as they could be? Do you have the latest and greatest in machines? What is your slowest process and bottleneck? What are your repair rates in the shop and the field? Are you meeting schedules? How often are you litigating? Are you getting the extras you are owed? What are your electricity and heating costs? Have you tried to better your results year over year? Have you tapped into programs available to you?"

looking forward with their fabricator glasses on. They believe they are locally, nationally and internationally competitive but haven't done much to stay in front of the curve if they even know what that is.

It's time to take a walk into your shop and have a good hard look. Are your people trained as well as they could be? Do you have the latest and greatest in machines? What is your slowest process and bottleneck? What are your repair rates in the shop and the field? Are you meeting schedules? How often are you litigating? Are you getting the extras you are owed? What are your electricity and heating costs? Have you tried to better your results year over year? Have you tapped into programs available to you?

The age of fabricators is coming to an end. The era of manufacturing is upon us. It's time to take a hard look at your own business, take responsibility for your success and think and act like a global manufacturer. AS

CISC provides this column as part of its commitment to the education of those interested in the use of steel in construction. Neither CISC nor the author assumes responsibility for errors or oversights resulting from the use of the information contained herein. Suggested solutions may not necessarily apply to a particular structure or application and are not intended to replace the expertise of a licensed professional engineer or architect.

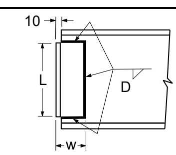
Charles Albert, P.Eng.
Manager of Technical Publications & Services, CISC

Question 1: I'm using Table 3-38 in the Handbook to design a welded double-angle connection. The supported beam has a web thickness that is less than the minimum tabulated value, but the factored beam reaction is also less than the weld capacity given in the table. Could I still use the table in that case, and how would I proceed?

Answer: If the factored beam reaction is less than the weld capacity given in the Handbook (see Figure 1), you may prorate the required beam web thickness accordingly. A design example illustrating this calculation can be found on page 3-67.

FIGURE 1
Table 3-38 – Welded Double-Angle Beam Connections

WELD GROU



Web-Framing Legs with Welds

TWO C-SHAPE WELDS ULS Factored Load Resistance (kN)							
Angle Width, W							
76 mm				64 mm			
Fillet Size D (mm)				Fillet Size D (mm)			
5	6	8	10	5	6	8	10
368	442	590	737	354	425	567	709
532	639	852	1060	524	628	838	1050
705	846	1130	1410	660	792	1060	1320
1670	2000	2670	3340	1620	1940	2590	3230
Minimum Required Web Thickness of Supported Beam² (mm)							
7.6	9.1	12.1	15.2	7.6	9.1	12.1	15.2

E

1. Resistances are based on F_y = 345 MPa.
2. Coped beams may have additional requirements. See Dc
3. For supporting material with beams framing from both sid

Question 2: In a particular bolted connection, the bolt nuts can be held in place but cannot be turned due to lack of space. Is it permissible to use the turn-of-nut method by turning the bolt heads instead?

Answer: For turn-of-nut installations in building applications, either the nut or head may be turned. In CSA S16-14 Table 8, it is stated, "Nut rotation is rotation relative to a bolt regardless of whether the nut or bolt is turned." The RCSC Specification for Structural Joints Using High-Strength Bolts supplies additional information (although RCSC recommendations are not generally mandatory in Canada): "When it is impractical to turn the nut, pretensioning by turning the bolt head is permitted while rotation of the nut is prevented ...".

If hardened washers are required (e.g. for pretensioned assemblies), however, they must be placed under the turned element (CSA S16-14 Clause 23.4.1).

Question 3: In seismic applications, energy-dissipating elements must meet the requirement: Fy ≤ 0.85 Fu (S16-14 Clause 27.1.5.1). But according to the mill test certificates, some of the ASTM A500 hollow structural sections that we received don't seem to meet this requirement. Am I missing something?

Answer: In Clause 8.3.2(a), Fy and Fu represent the published minimum specified values for the steel grade, as defined in Clause 3.2, and not the test values reported on the certificates. As mentioned in the CISC Commentary in Part 2 of the Handbook, most structural steels will meet this requirement, except for some high-strength grades such as CSA G40.21-700Q or 700QT. AS

Questions on various aspects of design and construction of steel buildings and bridges are welcome. They may be submitted via email to info@cisc-icca.ca. CISC receives and attends to a large volume of inquiries; only a selected few are published in this column.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Michael Holleran, P.Eng.
Chairman of CISC's Education & Research Council

Research is the Cornerstone of Innovation

RESEARCH IS THE cornerstone of innovation. The Education and Research Council (ERC) encourages our most important resource – our leading researchers – to push boundaries, think creatively, and be pioneers. The ERC encourages the research community to develop ideas and turn their ideas into successful results that keep the steel design community at the forefront of competitiveness. The ability for the steel community to be flexible and proactive has never been as important as it is today. In a world of geopolitical uncertainties, globalization, and emerging construction methods, the ability for steel designers and fabricators to innovate and adapt to their industries' requirements is vital. For many in the steel community, the road to innovation starts with education and research (E&R).

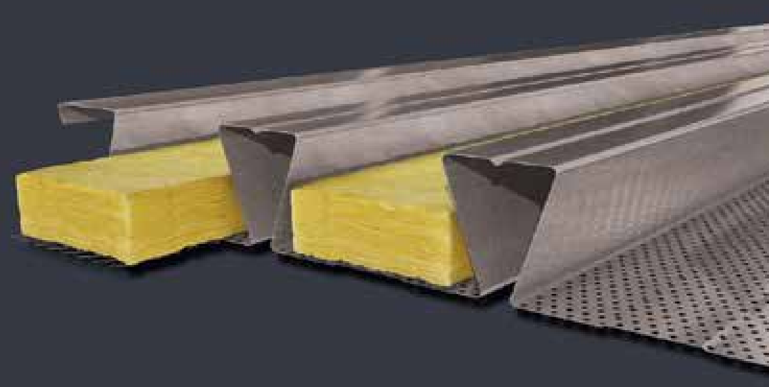
Education and Research has always been recognized as an important factor in economic growth, leading to highly valued design processes and technologies which are needed to sustain steel's competitive advantage over other construction materials. Successful innovations in the steel industry have not happened by chance, rather they have emerged through the financial support and ongoing encouragement from the leading stakeholders in the steel industry.

The Education and Research Council (ERC) is proud to be a leader in steel research with over $2.2 million in grants over the past 20 years. These investments are often used as an initial investment and are generally leveraged for additional research funding. The ERC's mandate is to support the development of expertise, knowledge, and innovation in steel design and construction in order to maximize the benefits to the steel industry as a whole. For the 2019-2020 research cycle the ERC has granted funding to the five highest ranked research proposals. The proposals that have received funding originated from Dalhousie University, McMaster University, University of Waterloo, Lakehead University and University of Alberta. These five recipients are among the leading steel researchers throughout Canada, and the Research Committee believes the selected projects will undoubtedly enhance the steel community. On behalf of the ERC, we wish continued success with your future research endeavours.

The H.A. Krentz Research Award is awarded to the researcher with the highest ranked proposal. I am pleased to announce that Dr. Kyle Tousignant is the 2019 H.A. Krentz Research Award recipient. Dr. Tousignant is a researcher from Dalhousie University in Halifax, NS, and received this award based on his proposed research entitled "Design of Single-Sided Fillet Welds in Tension." The Research Committee recognized the significant economic benefit his project will have on the fabrication of steel connections. Congratulations, Dr. Tousignant!

Once again, please consider supporting the ERC to ensure steel research continues and the growth of the structural steel industry remains strong for the next generation. Your funding is needed in order to sustain steel education and research. A full list of recent research projects can be viewed on the CISC website. Please contact the CISC for more information on how your funding can directly support education and research in the steel industry. AS

"Successful innovations in the steel industry have not happened by chance, rather they have emerged through the financial support and ongoing encouragement from the leading stakeholders in the steel industry."



The Canadian Steel Bridge Competition

Marie-Pier Diotte, ing. jr, General Director, CNSBC

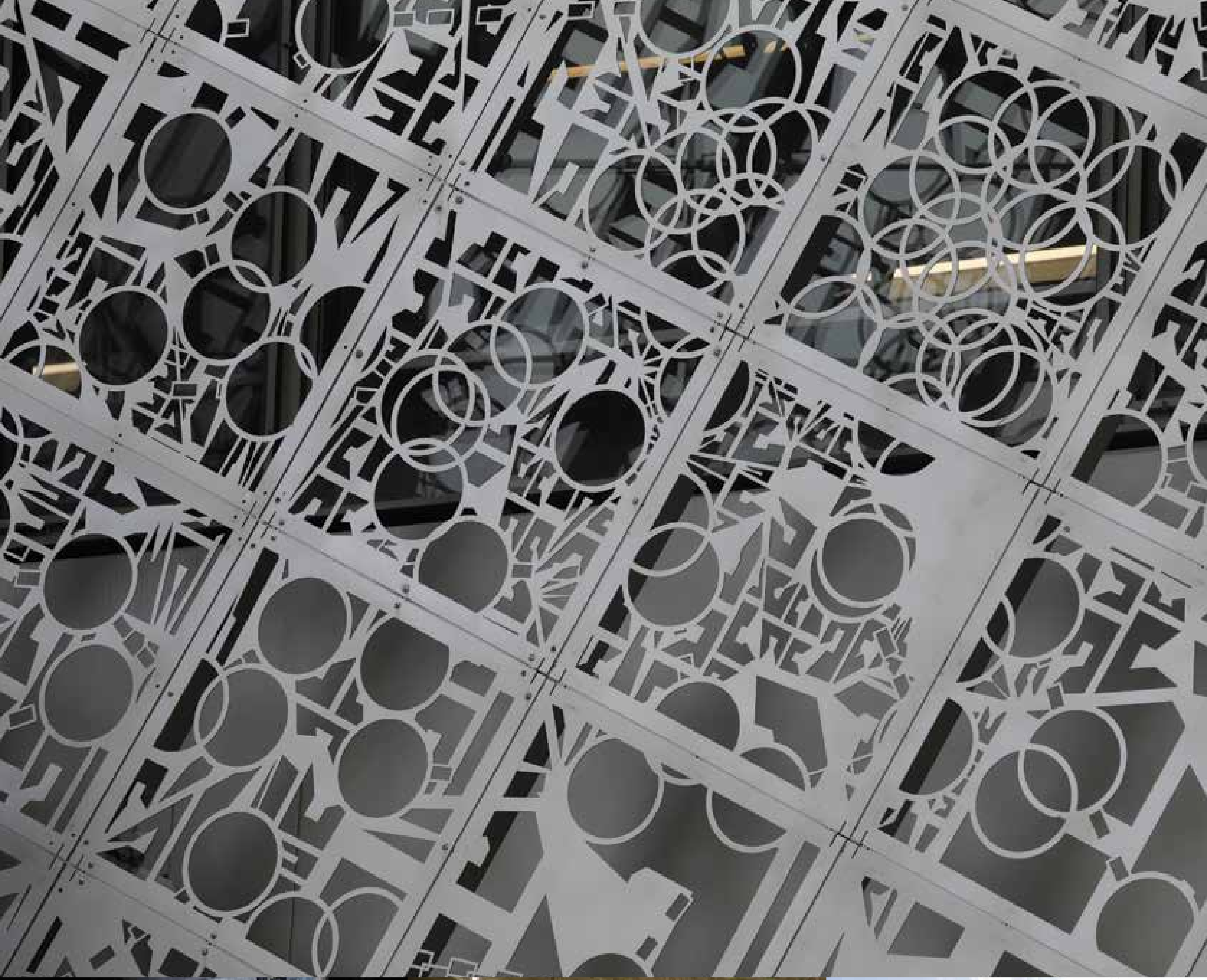
THE CANADIAN NATIONAL Steel Bridge Competition (CNSBC) is pushing the limits in the name of engineering, and sharing knowledge in a practical, friendly, motivating and enriching context!

The competition is the brainchild of two ÉTS graduates, and was brought to a new level in 2019, in collaboration with the Canadian Institute of Steel Construction (CISC) and the Canadian Society of Civil Engineering (CSCE). People wanted to see a high-caliber competition in Canada similar to the AISC-ASCE "Student Steel Bridge Competition" in the U.S., where several Canadian universities were already participating.

In 2019 the competition went international for the first time, with universities from China, Mexico and Puerto Rico taking up the challenge of designing the best steel bridge. A prototype on the scale on which 2,500 lbs are applied, according to six cases of possible loadings, while only one will be tested in competition!

Future engineers are called upon to plan, be innovative and demonstrate their skills while complying with the regulations established by the CSCE Student Competitions Committee. Each team is evaluated according to specific criteria such as oral presentation, architectural design, speed of assembly, economic performance, efficiency and weight of the structure.

The competition allows students who play the game to shine; it promotes the expression and dedication of future engineers in a practical setting where audacity is at the rendezvous! AS



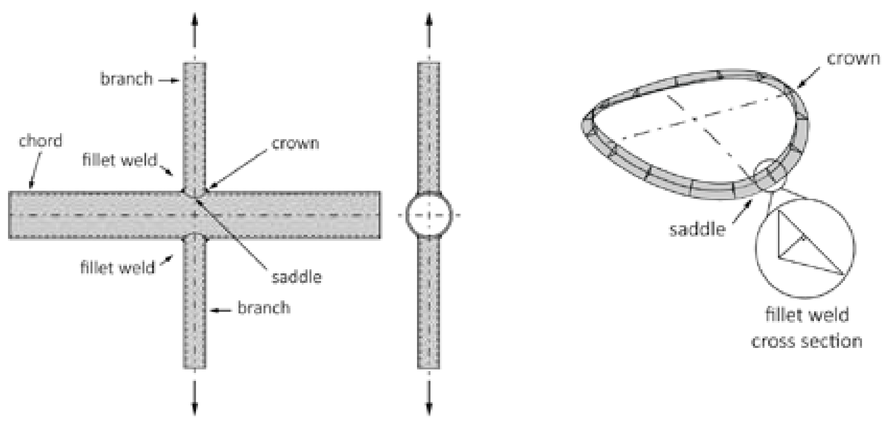
WELD EFFECTIVE PROPERT

By Dr. Kyle Tousignant, Assistant Professor, Department of Civil & Resource Engineering, Dalhousie University

FOR HOLLOW structural section (HSS) connections, welds can be designed either to achieve the capacity of the connected branch member wall or to be "fit for purpose" (i.e. to resist the forces present in the branch member). The latter approach typically results in smaller, more economical welds, but it requires the use of weld effective properties. Weld effective properties account for the inherent non-uniform loading of the weld perimeter in an HSS joint, which is primarily due to differences in the relative flexibility of the chord member in the direction of the applied load from the branch.

Over the last 30 years, research has been conducted to determine weld effective properties for rectangular hollow section (RHS) connections, including gapped and overlapped K-connections, T-, Y- and X- (or Cross-) connections, and moment-loaded T-connections. In 2010, recommendations based on this research were adopted as design rules in Section K4: "Welds of Plates and Branches to RHS" of AISC 360-10 (now Section K5, in AISC 360-16). In Canada, similar methods to calculate weld effectiveness (i.e. weld effective properties for *RHS connections*) are available in Packer & Henderson (1997). These are referenced in Part 3: "Connections and Tension Members" of the 11th edition of the CISC Handbook. However, AISC 360 and Packer & Henderson (1997) are both silent concerning weld effective properties for *circular hollow section (CHS) connections*. This is because – until recently – no supporting research had been performed.

FIGURE 1: CHS-to-CHS X-connection test specimens



(a) CHS-to-CHS X-connection

(b) weld geometry

EXPERIMENTAL TESTING

With the financial support of CISC and the federal government, and in-kind support from Walters Group and Atlas Tube, an experimental testing program was carried out at the University of Toronto to establish weld effective lengths for axially loaded CHS T-, Y-, and X-connections. A set of 12 connection test specimens, fabricated from large-size ASTM A500 dual-certified Grade B/C HSS, were designed to be "weld critical" (i.e. to fail by weld fracture) under axial tension applied to the branches, as shown in Figure 1a. The chord members were HSS 10.75 × 0.500 and HSS 16.00 × 0.500, with branches (inclined at 90° or 60° to the chord) selected to obtain branch-to-chord width ratios (β) ranging from 0.25 to 0.47 and branch-to-chord thickness ratios (τ) ranging from 0.60 to 0.99. Welding procedure specifications were developed (in conjunction with trial sectioning) to achieve minimal but adequate root penetration, and a professional fabricator

FIGURE 2: Testing arrangement

IES FOR HSS CONNECTIONS

was employed to deposit the fillet welds around the branches. The test welds were laid using a semi-automatic flux-cored arc welding process with a CO_2 shielding gas.

Prior to testing, the fillet welds were ground to a triangular shape, as shown in Figure 1b, and careful measurements were made of their geometric and mechanical properties. The test specimens were instrumented with strain gauges adjacent to welds and loaded to failure by a 2700-kN capacity universal testing machine, as shown in Figure 2. All 12 of the specimens performed as intended, with

> "...it was found that fillet weld effective lengths in CHS-to-CHSX-connections are (a) primarily a function of β and D/t and (b) become larger (relative to the total weld length) as β and D/t become smaller."

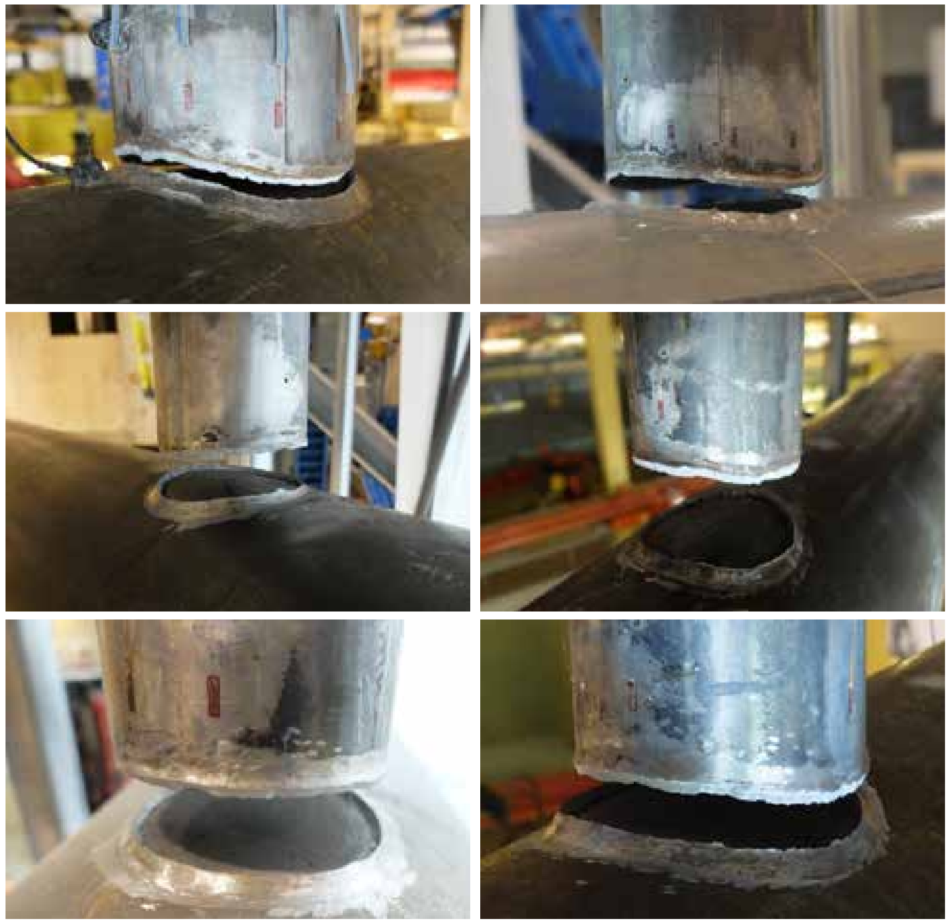
failure occurring by fracture along a plane through the fillet weld. Several typical examples of weld fractures from the testing program are shown in Figure 3.

The strain gauges installed on the specimens adjacent to the welds indicated non-uniform loading of the branch (and hence the weld), which (a) peaked around the saddle points (see Figure 1b), and (b) was more pronounced in the specimens with high β and slender chords (i.e. high chord diameter-to-thickness, or D/t, ratios).

FINITE ELEMENT MODELLING

Non-linear finite element (FE) models, with weld fracture, were validated against the results of the experimental tests, and an FE parametric study was performed to extend the test database. The FE parametric study consisted of 256 CHS-to-CHS X-connections, with wider variations in β, D/t, τ and the branch inclination angle (θ) compared to the experimental tests (namely $0.10 \le \beta \le 0.50$, $10 \le D/t \le 50$, $0.20 \le \tau \le 1.00$, and $60° \le \theta \le 90°$). These parameters were kept within the limits that allow fillet welds, per AWS D1.1. As planned, all 256 of the FE connection models showed failure occurring – again – by weld fracture.

FIGURE 3: Weld fractures



Through this experimental and FE research, it was found that fillet weld effective lengths in CHS-to-CHS X-connections are (a) primarily a function of β and D/t and (b) become larger (relative to the total weld length) as β and D/t become smaller. Specifically, the weld effective lengths ranged from 0.58 to 1.0 times the total weld length within the parameter range studied, and welds in connections with $\beta(D/t) \le 8$ were 100 per cent effective. The analytically observed "weld-effective-length trends" in CHS-to-CHS X-connections will be prevalent in CHS-to-CHS T- and Y-connections of similar geometries (under branch axial loading), and apply regardless of weld type (e.g. fillet weld or partial joint penetration groove weld) if the welds are designed to be "fit for purpose." For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connections with partially effective weld lengths, the "effective weld" is illustrated in Figure 4.

DESIGN RECOMMENDATIONS

An effective-length design method for welds in CHS-to-CHS T-, Y-, and X-connections has now been proposed for AISC 360. In AISC 360-22, the so-called "directional strength-increase (or sinθ) factor" will be allowed for single-sided fillet welds that connect CHS branches to base plates, cap plates and HSS chords (and hence for CHS-to-CHS connections). The proposed design method has therefore been verified to meet AISC's target reliability index ($\beta^+ \geq 4.0$ for connections, per Section B3.1 of the AISC 360 Commentary) in conjunction with using the "sinθ factor" for fillet welds. On the other hand, CSA S16-19 no longer permits the "sinθ factor" for single-sided fillet welds that connect elements in tension (including HSS branches). This change from CSA S16-14 is based on

FIGURE 4: Proposed effective weld for CHS-to-CHS T-, Y-, and X-connections

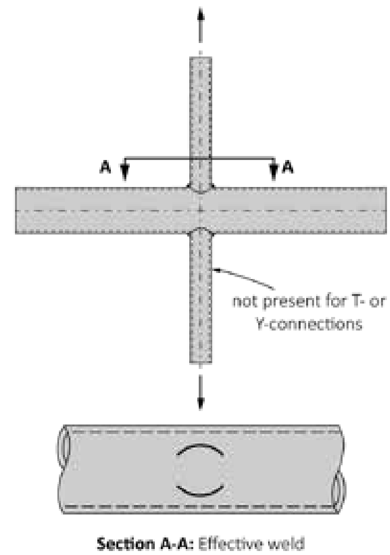
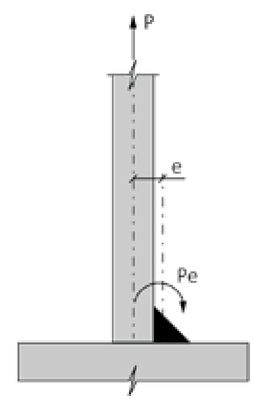


FIGURE 5: : Local bending about the axis of a single-sided fillet weld



recent experiments and FE analysis on single-sided fillet welds around the ends of HSS that (a) confirmed bending about the weld axis occurs when the HSS wall is in tension (see Figure 5), and (b) showed, in some cases, that the welds did not develop the same "strength increase" at failure predicted by the "sinθ factor."

NEXT STEPS

The next step in this ongoing research is to clearly determine the factors that affect the strength of single-sided fillet-welds (in both HSS and non-HSS connections). This research will be critical to potentially improve steel fabrication economy. With the financial support of CISC and the federal government, a research project, with this aim, will be carried out at Dalhousie University beginning in September 2019. AS

FEATURE

SAFE HANDS PROJECT

1 Bloor St E, Toronto

By Chris Adach P.Eng., Project Manager, M&G Steel Ltd.

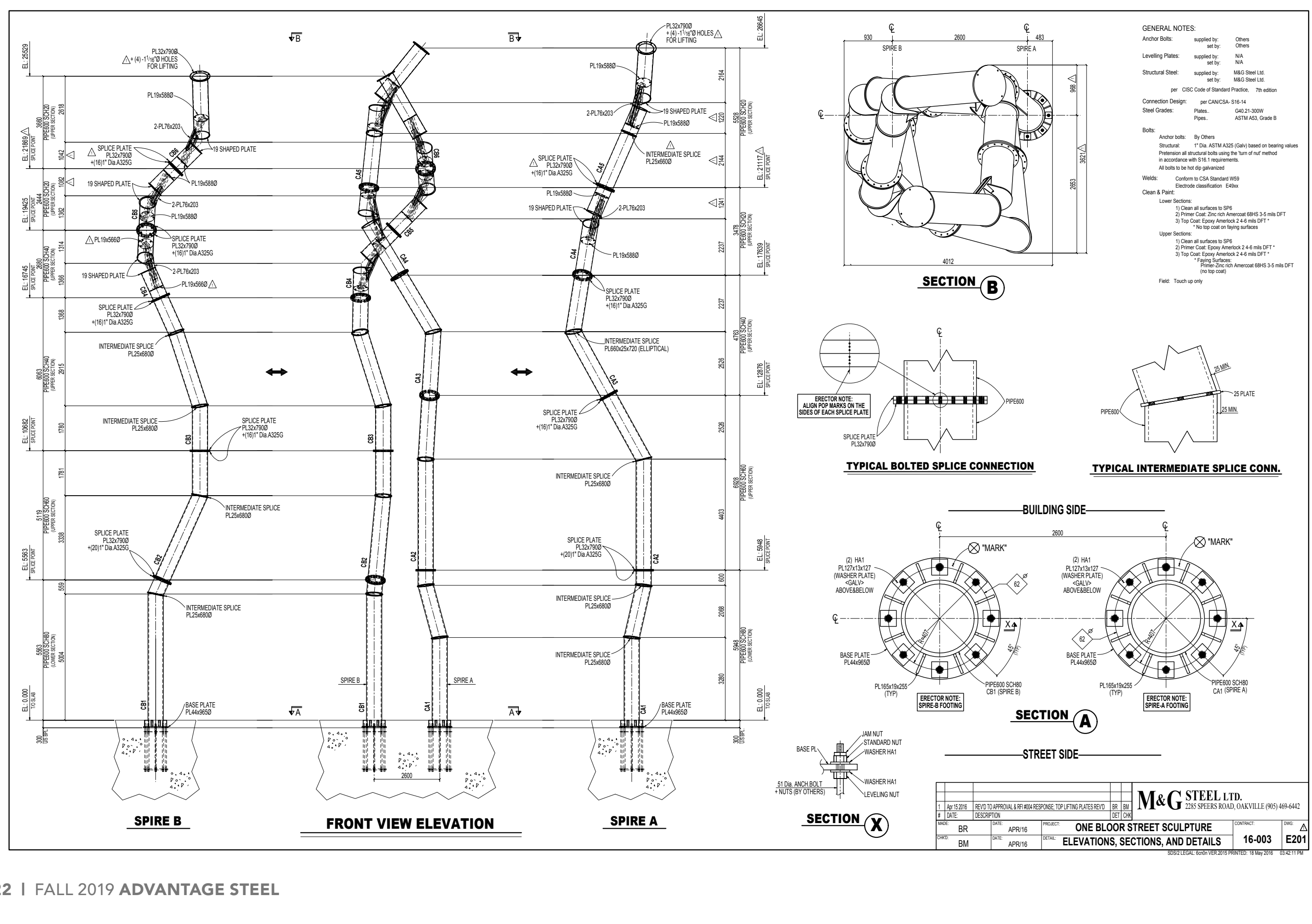
IMAGINE STANDING on the sidewalk and looking up 700 feet into the sky and thinking that this structure is impossibly high. Now imagine being on the balcony of the 75th floor and looking down and thinking "I hope this building is solid."

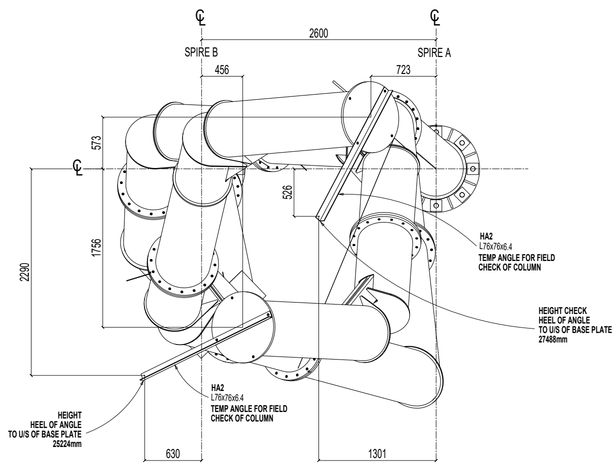
The public trusts that their buildings and bridges are safe and secure for them to use at any time. Neither wind nor snow nor loading conditions can degrade the prime directive of engineers, architects and builders for public safety. This largely successful notion results in the confidence of people in their development professionals and their institutions. Ron Arad, renowned UK artist and architect, explored the interplay of artist and material while contemplating this concept, and imagined what has become a tribute to those people and organizations who do their jobs well: the notion of "Safe Hands."

The sculpture located at 1 Bloor St E in Toronto was commissioned by the developer of that 76-storey tower, Great Gulf. The commanding 88-foot-tall pair of intertwined "spires" consists of 24" diameter steel pipes of varying wall thickness designed by Toronto's Blackwell Structural Engineers. The steel pipes, or bones, were fabricated by M&G Steel and provide the necessary stability and flexibility for the crushed stainless steel surface skin that was developed and applied by Streamliner Fabrication. Components were preassembled in Etobicoke and shipped downtown for installation by Stampa Steel erectors.

There were enormous challenges at every turn. This nontraditional structure had to be

modelled extensively and connections for each of the components developed to resist any contemplated applied loads, including those during construction from the foundation to the highest point on top. The modelling provided CNC digital files which were used to ensure accuracy and to guide robotic equipment. Nothing was square on this project. All but one of the end cuts were beveled so precision skew cutting the 24" pipe required the large plasma cutting equipment and skills of Comco Pipe and Supply (Division of Russel Metals). The assembled pipe sections are 3D in nature and were sub-assembled by M&G Steel (Division of TAGG Industries) in Oakville by talented fitters and welders who relied on "old school" techniques to lay out and set datum lines (with the occasional help of a Robotic Total Station radio controlled survey tool to verify control points). The various segments were shop preassembled to ensure fit in the field prior to shipping to Streamliner Fabrication. The bare steel was coated with a high performance zinc rich paint system to address corrosion protection for years to come. Subsequently, Steve Richards and the innovative people at Streamliner applied the stainless steel skin after crushing it in a custom designed hydraulic press to achieve the unique folds and never-to-be-repeated configuration. In Ron Arad's own words,"…the secret of making things different is to try to make them exactly the same…". The diameter of the assembly





FIELD CHECK PLAN

> There were enormous challenges at every turn. This nontraditional structure had to be modelled extensively and connections for each of the components developed to resist any contemplated applied loads, including those during construction from the foundation to the highest point on top.

doubled from 24" to 48"and the high gloss surface cladding required enormous care in handling and shipping. In the wee hours of the evening, the Safe Hands were shipped into the experienced hands of Stampa Steel Erectors. One of the busiest intersections of Toronto, Yonge and Bloor, was temporarily closed to permit a crew of night hawks (aka ironworkers from local 721) to hoist and connect the spires with hundreds of 1" diameter high strength bolts. The close proximity to the glass curtainwall coupled with challenging weather conditions and a restricted timeline combined to test the crews who ultimately were successful in erecting one of Toronto's most unique public art sculptures.

The combined efforts of a dedicated team which included the City of Toronto, developer Great Gulf, artist Ron Arad, sous-artist Steve Richards, supplier Russel Metals, steel fabricator M&G Steel, erector Stampa Steel and the ironworkers of local 721 have resulted in an eye-catching piece of art and structure at the corner of Yonge and Bloor streets that will be celebrated for a long time to come.

Safe Hands now welcome and assure all of the ability and commitment to public safety from the team of professionals and creative artists who made this project a reality. There are fewer more unique structures nor beacons in the City of Toronto announcing the welcome to a prominent city address. AS

GARRISON CROSSING

Iconic Toronto Landmark erected by E.S. Fox Limited

By Steve Matthews, G.S.C., Structural Steel and Bridge Division, E.S. Fox Limited

COMMUNITIES IN Toronto will have a convenient connection to the waterfront – Trinity Bellwoods Park and the Fort York Grounds – upon completion of the Garrison Crossing Project, a construction initiative including two new bridges, increased park space and new trails that will enhance accessibility and connectivity for the growing communities in Toronto. The final steps of the project are underway as crews complete multi-use trails and install lighting and signage. Notable milestones took place in 2018, when two new stainless steel pedestrian and cycle bridges were erected by the E.S. Fox Limited Structural Steel and Bridge Division.

In July 2018, E.S. Fox Limited erected the first of two Pedelta designed bridges. The North span measured over 176 feet long. It was lifted at a weight of 318,500 lbs. in one piece by one of the largest crawler cranes in North America, supplied by Sterling Crane Canada. The crane was built onsite, with the 32 truckloads of components arriving at the construction site at Ordnance Street off Strachan Avenue in a "just in time" manner, to minimize interference with the numerous construction projects taking place in the direct vicinity. After discussions with the Greater Toronto Rail Operators and the

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build team CreateTO, it was decided that a crawler of this size and capacity would work best as it required the least amount of rail traffic disruption and no track protection. The crane weighs 725 metric tonnes, has a footprint of roughly 30 metres by 13 metres and can lift 894 metric tonnes. The machine performed a lift radius of 165 feet and exerted a weight of 4 million lbs. onto the crane pad. The terminology "super-lift" is correctly used on this project.

In October 2018, the South span was erected. The second of the two bridges was more complicated to install, as it features an inverted arch beneath the deck, forming a support foot. The same crane and similar methods were used to install the bridge over the south rail corridor under shutdown conditions similar to the North span.

Image A shows the North bridge span being prepared for lifting. The surface of the structure was "white glass-bead" blasted onsite, giving the finish a uniform anodized look.

Image B shows the crawler crane hooked onto the bridge, ready for the super-lift. The bridge was fitted with a 4-way bridal rigging setup, with legs up to 145 feet long, and an auxiliary stabilizing sling on the arch, using a 20-ton chain-fall. For protection of the finish on the bridge, the rigging used was light-weight Kevlar/Nylon slings, complete with custom-made triangular stainless steel arch softeners. The bridge arch alone at 48 tons is an architecturally inspired true triangular shape with sharp corners.

Image C shows the super-lift over the rail corridor, just 1.4 miles from Union Station. A lengthy traffic diversion plan was developed and enforced by Metrolinx during the rail corridor shutdown.

In precise adherence with the engineered super-lift plan, Image D depicts the bridge structure being landed onto the permanent bearings, just after 2:13 a.m. The rail operators had issued a full shutdown of all rail traffic, including the Go-Train, freight traffic, and all Union-Pearson traffic. Due to the asymmetrical loading, a temporary anti-tip restraint system was installed prior to cutting the crane loose and welding out the bearing plates. Crews worked simultaneously on both abutments. During the shutdown, the precast panels were also installed. Rebar placement started immediately after the precast panels were set, to optimize the shutdown time granted, and adhere to the tight schedule. AS

DESIGNING WITH STEEL

The 2019 Architectural Student Design Competition

By Richard Woodbury

THE CANADIAN INSTITUTE of Steel Construction recently announced the winners of its Architecture Student Design Competition, which has run annually since 2001. Competitors are required to design projects meeting certain criteria, with the key point being the use of steel. The competition is open to students studying architecture at a Canadian school. Here's a glimpse at the three winning projects from this year's competition.

AWARD OF EXCELLENCE: Anthropique

When Ryerson University students Rita Wang and Shengyu Cai were working on their submission, they decided to take on what's been called the most-pressing issue of our time: climate change.

The pair proposed Anthropique, an urban wetland pavilion in Technoparc, Montreal. The site is one of the few urban wetlands in the city and is located close to the city's downtown and to the Pierre Elliott Trudeau International Airport. According to the Sierra Club, the wetland area is home to more than 80 nesting species that include raptors, songbirds, herons and ducks.

"We wanted to provide possible solutions to some realistic problems," says Wang.

The wetland has three ponds and the structure is proposed for the largest pond. The pavilion would encourage people to explore nature by providing them with a platform to interact with the site. The lower level would allow researchers to study the water ecosystem, while the upper surface could be used for bird watching, field trips or informal public lectures.

The pavilion has a translucent look to it that blends seamlessly into its surroundings.

"It gives a certain level of transparency that would allow people from the inside to look out and people from the outside to also see what's going on within the structure," says Wang.

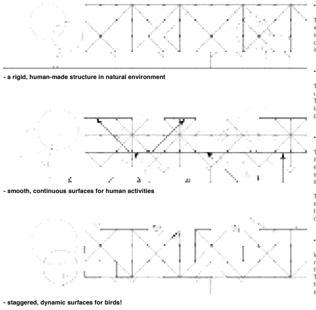
For this year's competition, students were tasked with creating a pavilion solely made of steel.

"Throughout history, architects have designed small independent structures, pavilions, that marked the landscape," says the competition requirements. "They often displayed formal and sculptural qualities, having to address many viewpoints. They acted as a destination, terminating an axis or as a window, framing a scenery.

Wang and Cai received the Award of Excellence for this year's competition.

Wang says they chose the Technoparc as a location because of flooding that Montreal has experienced in recent years. Consider that in both in 2017 and 2019, states of emergency were declared in the city over flooding concerns.

SITE PLAN 1:2000



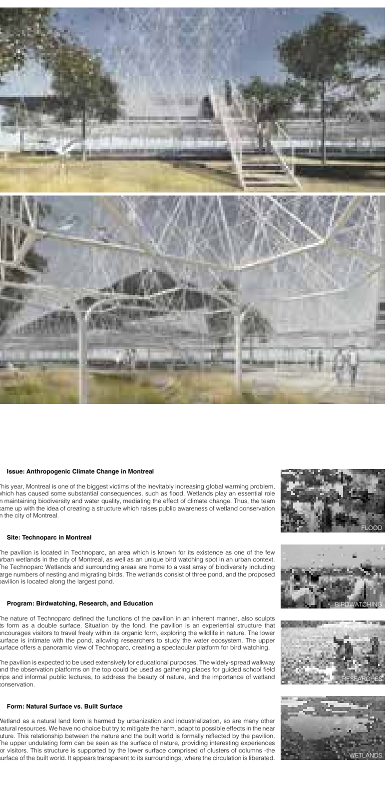
CONCEPTUAL DIAGRAM

AWARD OF EXCELLENCE: "ANTHROPIQUE"
Rita Wang and Shengyu Cai
Ryerson University

"This could be the new normal and we're expected to see more extreme precipitation due to global warming, which will continue to impact rivers [and there will be more] urban flooding," she says.

Wang and Cai invested a lot of time and effort in the project. One of the challenges they faced was the huge amount of research needed for a site-sensitive design, says Cai.

"Since we chose a site far away from our residence, we had to dig hard in Google to gather the GIS data and technical drawings," Cai wrote in an email from Copenhagen, where he is now doing his co-op placement. "We asked our friends in Montreal to take site



AWARD OF MERIT: "FRAMING HISTORY"
Peter Song and Eugene Woo
University of Waterloo

pictures for us so that we could have a better understanding of the current site situation."

As winners, the pair splits a $3,000 prize.

"We were really excited that our efforts were recognized by the jury," Cai wrote. "We believe our intention of the project to raise public awareness of global warming and environmental degradation will reach more people, thanks to the win."

Wang and Cai say participating in the contest helped further their professional skills.

"The most important thing is that it trained my sensibility to the built world as a designer," Cai wrote. "I needed to identify an urgent real-world issue that called for innovative architectural solutions and conducted sufficient research to support the proposal."

Wang and Cai say steel was the perfect material for the project and cited several reasons why, including its high tensile strength, making it highly resistant to fracture or breakage. As well, steel's ductility and malleability allow it to be deformed under compression without fracturing.

"These properties of steel give us the confidence to create this intricately-woven structure of the pavilion," Cai wrote.

AWARD OF MERIT: Framing History

A timely project was also on the minds of University of Waterloo architecture students Peter Song and Eugene Woo. The pair's

AWARD OF MERIT: "WAVERIDER"
Owen Melisek and Silas Clusiau
University of Waterloo

submission, Framing History, proposed a pavilion at Notre-Dame de Paris, the 856-year-old French cathedral that was heavily damaged in a fire this spring.

"Its impact was momentous on the architecture community across the world, even with the students and faculty at Waterloo Architecture," says Song.

The pavilion has an entry and exit point. As the user approaches the exit point, the threshold of the pavilion frames the spire that was once there. The pavilion measures 13 metres in height, paling in comparison to the 69-metre height found at Notre-Dame's façade.

On the surface, steel might seem an odd fit given the materials found at Notre-Dame.

"This is a very historic area where we're placing this alien-looking pavilion, so having as much of the pavilion as possible, kind of, deviate from the architectural style and the materials of Notre Dame was important because having something so stark, the contrast … requires visitors to think about the differences," says Woo.

From a logistics standpoint, steel was the perfect material. It's strong and can be formed in unique shapes.

Song says the shape of the pavilion was only possible using a steel diagrid system.

"Within the pavilion, there are no separate structural membranes that transfer the load of the pavilion into the ground. We were able to create an open space within the pavilion and even on the upper parts of the pavilion to not impede the view that we are trying to show the visitors of Notre Dame," he says.

Woo described the project as "intense," but says the process of going back and forth with Song and making changes was very satisfying.

> "We were really excited that our efforts were recognized by the jury. We believe our intention of the project to raise public awareness of global warming and environmental degradation will reach more people, thanks to the win."
>
> - Shengyu Cai, Ryerson University

"Each step was a visible and tangible step towards our goal and it just feels so good," he says.

Song and Woo were one of the two Award of Merit winners, which comes with a $2,000 prize for each team. The other Award of Merit winners were Owen Melisek and Silas Clusiau for their submission, Waverider, a waterfront pavilion located on Kavouri Beach in Greece.

AWARD OF MERIT: Waverider

This structure would float in the water and follow the waves. It would be capable of doing that thanks to the use of hollow steel framing and buoyant masses. People would enter the Waverider from the beach and would use the walkway to get to the main structure, allowing them to feel as if they're walking on water.

Melisek says he and Silas Clusiau helped come up with the idea by thinking of what kind of setting steel wouldn't be ideal in and set out to disprove that. "Nobody can imagine steel moving very much … and steel being in water," says the second-year architecture student at the University of Waterloo.

The components needed for Waverider include cables, a walkway structure, small attachment parts, wave floaters, handrails and cylindrical parts. The finishes used on the different pieces varied, but were either stainless steel with a rough finish, stainless steel with a smooth finish, or galvanized steel.

As for locale, Melisek says they needed to pick a beach that didn't have significant tide changes, so that ruled out an ocean setting.

Melisek says given the wet, salty environment with turbulent movement and the need for the materials to stretch long distances, there was only one feasible option.

"With modern solutions, steel is the only thing we could have put there," he says. AS

NEWS AND EVENTS

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SEP 6/ CISC SASKATCHEWAN REGION 2019 GOLF TOURNAMENT

Moon Lake Golf & Country Club
905 Valley Road
Saskatoon, SK

SEP 13/ STEELDAY 2019

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Find a SteelDay event near you at www.steelday.ca!

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The Windsor Ballrooms
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Montréal, QC

NOV 15/ CISC ONTARIO'S STEEL DESIGN AWARD OF EXCELLENCE

Globe & Mail Centre
351 King St E., #1600
Toronto, ON

Success at Ontario Skills Competition

By Marty Verhey, Human Resources Manager, Walters Inc.

SKILLS ONTARIO STRIVES TO BUILD Ontario's skilled trades and technologies workforce. The Skills Ontario Competition is Canada's largest skilled trade and technology competition. It offers a unique opportunity for top students to showcase their talents, demonstrate that they are the best in their field, and perhaps win a medal in the process.

The competition draws over 2,400 competitors, 35,000 spectators and has 70 skilled trade and technology contest areas. This competition gives elementary, high school and post-secondary students the opportunity to participate in workshops and to discover new career opportunities that they didn't know existed. The event also draws employers looking for prospective young talent.

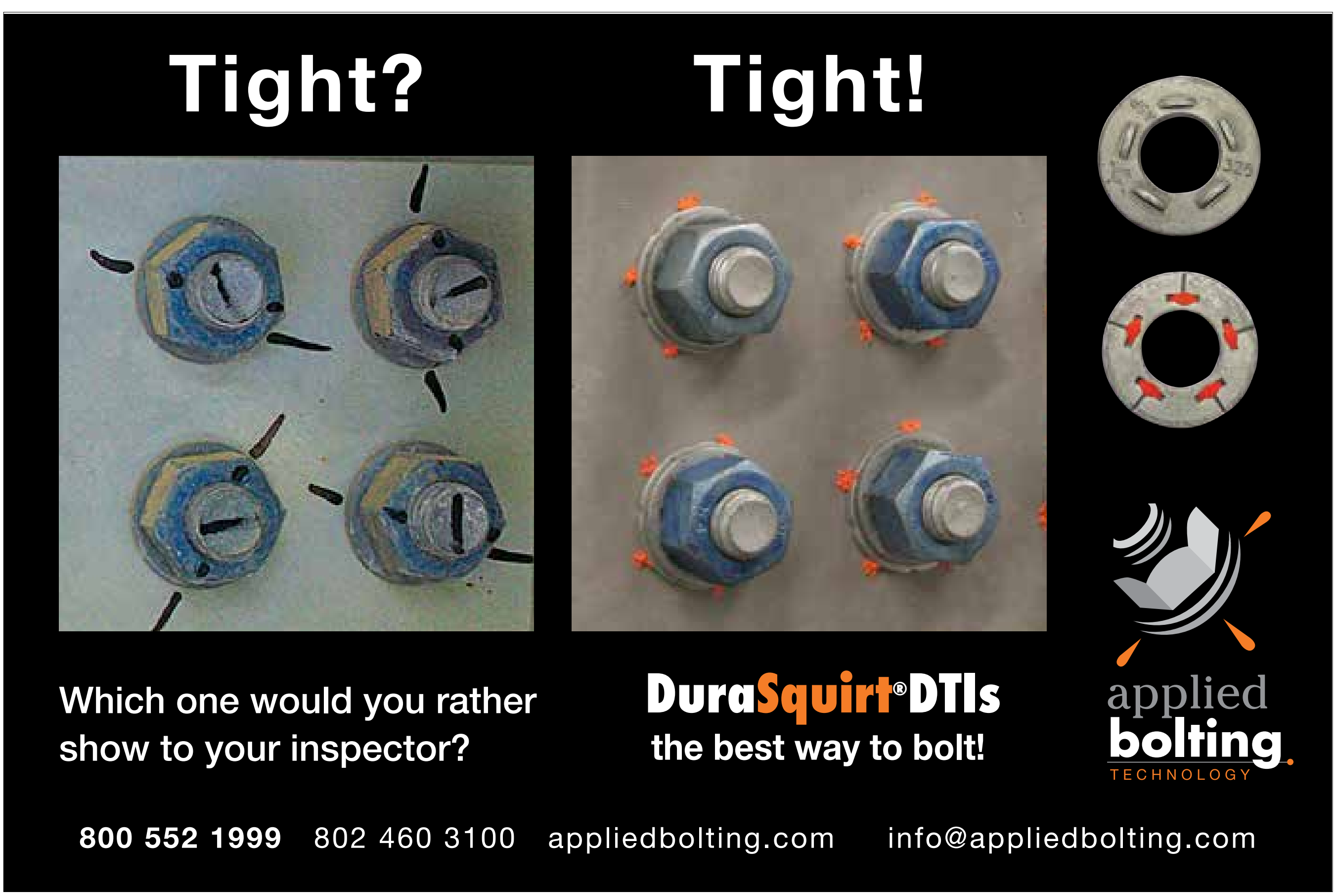
This was Walters Group's fourth year in attendance at the event. This year CISC joined forces with Walters as the official Silver Sponsor of the Metal Fabrication (Fitter) contest. The contest evaluates competitors' accuracy and quality of fitting, dimensional accuracy of welds, print reading, and weld symbol interpretation. Going head to head in fabricating a beam assembly, the contest remained friendly, yet the challengers were very interested in each other's handiwork.

The Walters team really enjoyed spending time with the keen students who popped by their booth to try their hand at welding under the guidance of a few of their welders and fitters who blew the kids away by simply doing what they do every day on the job. Their passion and excitement for their work was contagious as they explained the welding process and clearly answered every question. The students (and teachers alike) who participated were in absolute awe. "That was so cool!" resounded over and over.

"This being my first time at Skills Ontario, I was impressed by how engaged the students were with the hands-on experiences presented, in particular at our booth with students actually doing real welding. I was impressed to see the quality of the workmanship from the competitors. I would like to thank Walters staff for their timeless efforts to make the competition meaningful. I will be sharing with the CISC Ontario members that we need to continue to support this event as it is an opportunity to promote careers in our industry to current students. This is a chance to invest in our youth for the future of the industry," shared Mike Fox, Ontario Regional Manager, CISC.

"We extend our sincerest thanks and congratulations to the entire team for helping to make the 2019 competition a resounding success. All of the competitors agreed that it was a great experience. We hope that everyone will be back to make the 2020 event even better!" shared Peter Olynyk and Peter McIntosh, Walters Co-chairs.

Walters Group also participated in the Skills Ontario Young Women's Conference, which is the largest young women's conference in Canada. This event offers young women the opportunity to explore careers in the skilled trades and technologies by participating in hands-on activities and speaking with mentors. Mentors Kaylyn Roloson (fitter) and Michelle McCorquodale (welder), who work at Walters Stoney Creek plant, demonstrated to the female students that skilled trades and technologies careers offer many great opportunities. They discussed the rewards of their chosen career paths and provided advice, guidance and inspiration. These are key events in the effort to build the momentum for a skilled, diverse and robust workforce in Ontario. AS



COMMON CODES AND STANDARDS FOR DESIGN AND CONSTRUCTION OF STEEL STRUCTURES

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 2015	NBC 2020	Dec. 2020
NBC Structural Commentaries (Part 4 of Div. B)	NBC 2015 Str. Comm.	NBC 2020 Str. Comm.	2021
CSA S16 Design of Steel Structures	CSA S16-14	CSA S16-19	Sep. 2019
CISC Commentary on CSA S16 (Part 2 of CISC Handbook of Steel Construction)	CISC Handbook 11th Edition[1] 3rd Printing[2]	CISC Handbook 12th Edition	late 2020
CISC Moment Connections for Seismic Applications	2nd Edition[3]	3rd Edition	Sep. 2019
CSA S6 Canadian Highway Bridge Design Code	CSA S6-14	CSA S6-19	Sep. 2019
CSA S6.1 Commentary on Canadian Highway Bridge Design Code	CSA S6.1-14	CSA S6.1-19	Sep. 2019
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 W59-18	CSA W59-23	Sep. 2023
CSA W47.1 Certification of Companies for Fusion Welding of Steel	CSA W47.1-09 (R2014)	CSA W47.1-19	Summer 2019
CSA S136 North American Specification for the Design of Cold-Formed Steel Structural Members	CSA S136-16	Supplement No. 1	Spring 2019
CSA S136.1 Commentary on CSA S136	CSA S136.1-16	Supplement No. 1	Spring 2019

[1]CISC Handbook of Steel Construction - 11th Edition includes CSA S16-14, its Commentary, CISC Code of Standard Practice - 8th Edition (new), and design and detailing aids in accordance with CSA S16-14

[2]3rd Printing of Handbook has been updated to reflect changes introduced in CSA S16-14 Update No. 1 released in Dec. 2016

[3]Adopted in S16-14 by reference

TBA = to be advised

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