

ArcelorMittal

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Do you have a project using sheet steel that you would like to see in Steel Design? The editor welcomes submissions of completed buildings - commercial, institutional, industrial, recreational and residential – using components made from steel, including cladding, steel decking, light steel framing, steel roofing, steel doors, steel ceiling systems and steel building systems.

> The Editor, Steel Design 1039 South Bay Road Kilworthy, Ontario POE 1G0 E-mail: davidfollis@vianet.ca

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COVER PHOTO: EV3 BUILDING - UNIVERSITY OF WATERLOO AFrame 416-465-24761







3 EV3 Building

University of Waterloo The extensive use of steel in the construction of the Environment 3 Building at the University of Waterloo helped satisfy several design objectives.

6 Nunavut Trades Training Centre With a short construction season

and daylight hours at a premium



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8 Canadian Aviation Museum Expansion, Ottawa

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12 101b Third Avenue, Ottawa

to hold an earthquake rating.

Avenue in Ottawa's Glebe neighbourhood.

duplex is one of only two houses in the city

Earthquake House



10 Highland Valley Copper Mine, BC

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EV3 Building University of Waterloo Waterloo, Ontario

The extensive use of steel in the construction of the Environment 3 Building at the University of Waterloo helped satisfy several design objectives. To expand and transform aging facilities to address the University's demand for new programs and a growing student population, as well as to create a distinct new image for the faculty. Steel inside and out helped satisfy these design objectives.

EV3 Building University of Waterloo

Construction of the project, completed at the end of August 2011, included a 5,295m² (57,000 sq. ft.) addition and a 465m² (5,000 sq. ft.) renovation to the University's two-storey EV2 building. Previously housed within two adjacent, connected and dated buildings – EV1 and EV2 – that were constrained on a limited site located within the campus ring road, EV3 was built over a large part of the existing building, minimizing its footprint on the campus plan while taking advantage of the ample available vertical space.

Architect Kevin McCluskey, Principal, Akitt, Swanson and Pearce Architects Inc. says, "The project needed to be designed and constructed within limited budget and schedule constraints and the initial LEED silver target was upgraded to LEED platinum – one of only a few buildings in Canada to hold that distinction."

The new four-storey building features structural steel supplied and installed by Telco Steel Works, light steel stud framing for all partions supplied by Bailey Metal and installed by Dixon Drywall, and colourful steel cladding supplied by Vicwest and installed by Commercial Sheet Metal.

The steel structure features two parallel two-storey, 45.72m (150') long steel trusses that span over the existing two storey EV2 building while remaining structurally independent. Two large two-storey 10m high x 47m long

The extensive use of steel in the construction of the EV3 Building at the University of Waterloo features structural steel; interior light steel stud framing for all partitions; light steel wind bearing studs on exterior walls; light coated steel liner panels and colourful prepainted steel wall cladding.





FALL 2012 3



Two large 2-storey 10m high x 47m long (32.8 ft. high x 154 ft. long) steel trusses form the sides of the 3rd and 4th floor addition and are supported on columns located clear of each end of the EV2.

PRIMARY TRUSS:

Supporting columns at ends: WWF500x254, 18.8m high (spliced)

Vertical truss members: W310x283, W310x158, W310x107, 10.1m high

Horizontal members at 3rd floor: W310x226 (ends) W310x342 (center) 47m long

Horizontal members at 4th floor: W410x39, W 410x46 (center), 47m long Horizontal members at roof: W(310x375 (ends)

W310x375 (ends), W310x454 (center), 47m long

Diagonals: W310x313, W310x202, W310x97, (in order outside to center) (32.8 ft. high x 154 ft. long) steel trusses form the sides of the third and fourth floor additions and are supported on columns located clear of each end of the EV2. These trusses support five other 5m high x 30m long (16.4 ft. x 98.4 ft.) members that span perpendicular and support the fourth floor. The third floor is hung from these trusses. "The truss members and supporting columns are visible through the exterior curtain wall glazing and exposed or expressed throughout the interior at specific locations," says McCluskey.

The building's rectangular massing, comprised of structural metal studs with galvanized panel air/ vapour barrier, was chosen for its cost and construction efficiency. It is offset by the playful use of a variety of exterior cladding materials including four-sided SSG curtain wall, multi-coloured corrugated steel siding panels, and aluminum composite panels and architectural masonry. "Steel siding was a costeffective solution that is fast and easy to install and durable. We chose to use the corrugated profile in a contemporary look which brings an appropriate scale and level of texture to the skin of the facade," says McCluskey. "Most striking is the introduction of vibrant green coloured aluminum and glass panels which clearly identify this as the environment building and project a strong sense of identity and confidence as the new home for the faculty. Siding and masonry colours are kept neutral to allow the green to really 'pop'."

The .46mm (.0179") corrugated prepainted steel siding panels are in two colours: 10,000 Series Charcoal QC690 and Stone Grey QC998, with a detailed vertical and hori-



zontal reveal system between the panel colours. The flat panel is AD-300R, .76mm (.0299") thick Bone White used at the back of parapets and the aluminum composite panels are Vicwest 4mm (.157") thick, Duranar finish custom colour Lime Green BK60603 with the liner panel Vicwest L-800, .46mm (.0179") thick, light coated galvanized steel.

At the heart of the building is a new four-storey sky-lit atrium, which cuts east/west through the addition separating the four-storey student spaces to the north from the two-storey faculty offices and EV2 to the south. The atrium features a two-storey living wall, the exposed red brick wall of EV2 and a glass and steel feature stair with





DESIGN AND CONSTRUCTION TEAM: Akitt, Swanson & Pearce Architects 905-607-2444

STRUCTURAL/ELECTRICAL ENGINEERS: Walter Fedy 519-576-2150

DESIGN BUILD CONTRACTOR: Cooper Construction Ltd. 905-829-0444

STEEL CLADDING SUPPLIER: Vicwest

STEEL CLADDING INSTALLER: Commercial Sheet Metal 905-206-1688

STEEL STUD SUPPLIER: Bailey Metal

STEEL STUD INSTALLER: Dixon Drywall 905-761-0378

LINER PANELS INSTALLER: Commercial Sheet Metal 905-206-1688

STRUCTURAL STEEL SUPPLIER/INSTALLER: Telco Steel Works 519-837-1973

a bold cantilever out into the atrium between the third and fourth floors.

Upper levels of faculty spaces offer exceptional working environments. The majority of offices are located along the perimeter, or adjacent to the atrium, and there are two fourth floor sky lit courtyards. "All of this brings a lot of natural light to the interior and the offices are fitted with operable windows and large expanses of glazing at corridor walls," says McCluskey.

The existing EV2 roof has been transformed into a green roof that can be accessed from the third floor and is overlooked by third and fourth floor faculty offices.



The corrugated prepainted steel cladding and masonry colours are kept neutral to allow the vibrant green and glass panels, which clearly identify this as the Environment Building and project a strong sense of identity and confidence as the new home for the faculty.

The atrium (below) features a two-storey living wall, the exposed red brick wall of EV2 and a glass and steel feature stair with a bold cantilever out into the atrium between the third and fourth floors.



ArcelorMittal Dofasco STEEL DESIGN

Nunavut Trades Training Centre Rankin Inlet, Nunavut



With a short construction season and daylight hours at a premium in Nunavut, choosing steel building materials that would enable rapid construction of the 1,900m² (20,450 sq. ft.) Nunavut Trades Training Centre in Rankin Inlet was critical. "Ease of construction is a large factor in northern construction," says Terry Gray, project manager, FSC Architects & Engineers, in Iqaluit. The two-phase construction began in August 2008 and was substantially complete by August, 2010.

Steel is a good fit with northern construction schedules

Part of Nunavut Arctic College, the Training Centre currently offers pre-apprenticeship electrician, oil burner mechanic, plumbing, and trades access programs. The building itself forms a teaching tool: students learn in and from it.

The roof structure consists of 1,800 square metres of 38mm galvanized steel deck at 300mm (Vicwest TSR) on open web steel joists spanning to steel girders. The second and main floors are concrete on a total of 3,396m² (36,554 sq. ft.) of 38mm x 0.76mm (1.5" x .0299") galvanized composite steel deck (Vicwest P-2432) supported by wide flange beam and girder systems.

Light steel framing was used for the nearly 5,400 linear metres of walls, including 18 gauge steel studs for the exterior wind bearing walls. The roof deck consists of 1,800m² (19,375 sq. ft.) of S-TSR-1E 22G G90 from Vicwest. The exterior cladding was 1,888 square metres of light commercial type refinished horizontal and vertical metal strip siding from Vicwest Diamond Rib DR762 and Vicwest Corrugated 22mm D x 68mm W rib-to-rib. "Light steel framing systems allow ease of construction and adaptability to sometimes unforeseen site conditions," Gray says. "Steel cladding was selected for the majority of the

building envelope due generally to cost effectiveness and low maintenance. When used within the Arctic setting, not offers ease of installation during compressed schedules, while providing low maintenance to the end users," Gray explains. "Having steel elements pre-finished with their protective coating provides an ideal solution for both the architect and the contractor in getting the project finished on schedule.



Planned for 70 students, the facility provides a generous computer lab, three classrooms, four fully furnished workshops with labs, two student lounges and a two-storey technical resource library.



Design intent was to

have the building be a

teaching tool in itself. A

construction techniques

wide range of materials, building systems and



The second and main floors are concrete on a total of 3,396m² of 38mm x 0.76mm (1.5" x .0299") galvanized composite steel deck (Vicwest P-2432) supported by wide flange beam and girder systems.



Light steel framing was used for the nearly 5,400 linear metres (17,716') of walls, including 1.22mm (.048") steel studs for the exterior wind bearing walls.

DESIGN AND CONSTRUCTION TEAM

PRIME CONSULTANT: FSC Architects & Engineers (now Stantec) 867-979-0555 ARCHITECT: FSC Architects and Engineers 867-979-0555 OWNER/DEVELOPER: Government of Nunavut STRUCTURAL ENGINEERING: Adjeleian Allen Rubeli Consulting Engineers 613-232-5786 MECHANICAL ENGINEERING: FSC Architects and Engineers 780-439-0090 ELECTRICAL ENGINEERING: FSC Architects and Engineers 867-920-2882 CIVIL/MUNICIPAL ENGINEERING: FSC Architects and Engineers 867-920-2882 COST CONSULTANTS: Hanscomb, Inc. 613-234-8089

CODE AND LIFE SAFETY CONSULTANTS: Gage Babcock and Associates 604-732-3751

MICROCLIMATE SPECIALISTS: Rowan William Davies & Irwin 519-823-1311

FINISHED HARDWARE CONSULTANT: Allmar International 204-668-1000

GENERAL CONTRACTOR: NDL Construction Ltd. 204-255-7300

MECHANICAL CONTRACTOR: Natik 2007 Inc. 867-645-2365

ELECTRICAL CONTRACTOR: Electrix 360-694-5094

CIVIL WORKS CONTRACTOR: NDL Construction Ltd. 204-255-7300

STEEL CLADDING AND DECK SUPPLIER: Vicwest 800-387-7135

PILING CONTRACTOR: Canadrill Ltd. 867-979-6031

Canadian Aviation Museum Expansion Ottawa, Ontario



Phase 1 construction includes an 8,000m² (861,000 sq. ft.) museum collection storage hanger and a two-storey 1,878m² (20,200 sq. ft.) administration and library/archives addition to the existing museum building (on the north side of the existing museum). The main objectives were to provide a unified design for all phases of the complex, increasing the visibility of the museum as well as enhancing its international standing.

Galvalume Plus steel cladding enhances clear and bold building form

The new facility provides a highly visible addition to the existing museum complex with the clear, bold building form and reflective Galvalume steel shell. The exterior steel cladding on both the new museum collection hanger and the Administrative and Library/Archives addition is 22mm (.875") profile, corrugated 0.81mm (.032") AZM180 Galvalume PlusTM, providing both a simple and natural reflective finish to the buildings.

Rooflines and significant wall planes align to suggest

formal completion across open spaces and add compositional clarity to the complex. The gently curved and sloping building form, unifies the complex, contrasts it with the site and the existing museum and so highlights the uniqueness of each.

The simply modulated, reflective Galvalume Plus™ steel shell contrasts with the muted colours of the surroundings, dramatically increasing visibility from the parkways.



The south glazed wall of the hanger, which will be removed in future phases, faces both the Rockcliffe and Aviation parkways and reveals the collection inside.

> The distinctive folded wall geometry, which was created with formed vertical girts, is also used as vertical duct runs to distribute heating in the sloped wall.





The Collection Storage Hanger is 60m (197') wide and has a large interior 48m (157') column-free span along its entire length.



Roof lines and significant wall planes align to suggest a formal completion across open spaces.



New Administration and Library/Archives building with .81mm (.032") AZ180 Galvalume Plus™ steel cladding in a 22mm (.875") corrugated profile.

1

MARY CARLON

Highland Valley Copper Mines British Columbia



The owner was faced with a formidable challenge last year – to beautify the stockpiles of Canada's largest open-pit copper mine. The Highland Valley Copper Mine, located in the southern interior of British Columbia, produces large stockpiles of crushed rock during its operation, and the blowing dust from these piles was a growing concern. The mine hired Triodetic in Arnprior, Ontario, to construct three massive domes (in excess of 400 metres in length from end to end) to cover the stockpiles.

Prepainted galvanized steel covers the copper

Triodetic domes are designed as double curved shells which allow great structural and cost advantages in any span: rise ratio. Less roof mass and reduced horizontal forces result in smaller support/foundation requirements.

"Achieving general acceptance of mining in the world is challenging. Our client had the vision of incorporating the Canadian flag into the design," explains Bill Vangool, Triodetic's President and Chief Engineer. "Showing the flag and reducing dust emissions was a good thing for them to do."

The domes were constructed at Triodetic's plant in Ontario, and took only three days to be assembled on site last October. Each dome required 98,825m² (5,000 sq. ft.) of prepainted Z275 (G90) galvanized steel cladding, using approximately 4,831m² (52,000 sq. ft.) and 3,995m² (43,000 sq. ft.) of Agway Metals 8-175 and 6-175 profiles respectively." Domes are a specialty of ours – we've been building them for over 40 years," says Vangool. "What's unique about these domes is that they were constructed on an angle, which created structural challenges, but resulted in major economies from a cost point of view for the client."

The prepainted galvanized steel cladding is coated with QC7437 Banner Red in the 10000 Series paint system and QC8317 White in the Perspectra Series paint system.

The greatest challenge was figuring out how to create the image of a flag on such a large, curved surface. To achieve the right look, panels were numbered in a complex coordinated system.

"To place the image of the maple leaf on a dome - to

actually install the image of the Canadian flag on a double-curved surface – was a major challenge," says Vangool. "We had to trust that when we screwed the numbered panels into place, it would eventually look like a flag. It was an exciting but nerve-wracking process."

The prepainted galvanized steel cladding is coated with QC7437 Banner Red in the 10000 Series paint system and QC8317 White in the Perspectra Series paint system. "The cladding has a very durable finish. Steel is great for corrosion protection and it has a compact structure. It was also more cost-effective," Vangool says. "There's an inherent strength in steel and it's an easy material to work with."

The final result, Vangool says, just might be the world's largest Canadian flag. "The client was just thrilled with the results, and now people who work on site have fewer issues with volatile dust particles," he says. "I wouldn't be surprised if we receive a request for a flag from a different nation."

DESIGN AND CONSTRUCTION TEAM

OWNER: Teck Resources Limited : 604-699-4000

STEEL CLADDING SUPPLIER: Agway Metals Inc. 1-800-268-2083

STEEL DOME DESIGNER, MANUFACTURER AND INSTALLER: Triodetic Canada 613-623-3434





Each dome required 8,825m² (95,000 sq. ft.) of prepainted galvanized steel cladding, using approximately 4,831m² (52,000 sq. ft.) and 3,995m² (43,000 sq. ft.) of Agway Metals 8-175 and 6-175 profiles respectively.

Designed as double curved shells, to cover the stockpiles, three massive domes are in excess of 400 metres (1,312.34') in length from end to end.

101b Third Avenue, Earthquake House Ottawa, Ontario



The new house on Third Avenue in Ottawa's Glebe neighbourhood, built by The RGB Group, has attracted a lot of attention – even from the City's Fire Chief. Fire prevention is a top priority so, when a non-combustible material is the choice for construction, one can't help but be excited. And the fact that the steel-framed, four-level duplex is one of only two houses in the city to hold an earthquake rating, is all the more impressive. The house was also built to meet the stringent LEED Platinum green building standard.

101b Third Avenue, Ottawa Earthquake House

LEED is an internationally recognized certification program that attests to a building, or community, incorporating strategies aimed at improving performance, increasing energy and water efficiency, reducing carbon emissions, utilizing natural resources and improving indoor environmental quality.

The steel-framed, four-level duplex is one of only two houses in Ottawa to hold an earthquake rating. But that's not all. The house was also built to meet the stringent LEED Platinum green building standard. To the RGB Group, finding sustainable alternatives as a better way to build is a sound economic strategy. "We're always attempting to set the bar higher and enjoy using new construction methods and materials," says Rolf Baumann, founder and CEO of the RGB Group, noting that steel was the obvious material of choice for this project because of its non-combustibility, recyclability and it allowed for more precise construction of a large home on a small lot. The house is 6.4m x 16.2m long (21' x 53') and sits on a 7.62m x 30.48m (25' x 100') lot. The interior of the 372m² (4,000 sq. ft.) duplex is open concept with 2.75m (9') ceilings on each floor. Since there are minimal interior walls, the steel

structure had to be carefully designed to carry the load.

"The constraints of the narrow site led to unique design solutions to ensure the spaciousness expected of a high-end urban duplex," explains Malcolm Wildeboer of Vandenberg & Wildeboer Architects. "The proximity to the lot line required the use of non-combustible materials including steel stud framing, which in turn led to the development of an entire light gauge steel design."

To meet the Ontario Building Code standards, the two property line walls had to be of non-combustible construction and fire rated for one hour, as well as having a thermal protection for heat transfer in case of fire. Again, the decision to use steel made sense.

Morin Bros. Building Supplies Inc. sold the concept and supplied the steel which included paperless fire rated exterior sheeting and exterior mineral insulation for the steel structure. "We used balloon framing which provides excellent sound transmission and fire protection," says



"The proximity to the lot line required the use of non-combustible materials including steel stud framing, which in turn led to the development of an entire light gauge steel design", explains Malcolm Wildeboer of Vandenberg & Wildeboer Architects.

Non-combustible light steel framing contributes significantly to the overall design

Malcolm Wildeboer of Vandenberg & Wildeboer Architects

Gerry Morin. "Basically there were three levels of exterior walls stacked on top of each other supporting the three floors. The floor systems are attached to the exterior load bearing walls which are 10.44m (30') high. The clear span of the steel floor joist was 6.1m (20')." Commenting further on steel's value to the project, Gerry continues, "There is no waste with steel as 95% of the steel used was pre-cut at manufacturing, and the balance 100% recycled. Lightweight is another huge factor. We did not use concrete for the non-combustible floor system. Instead, the LevelRock CSD from USG is used to provide the fire rating and excellent sound ratings. The dead load of the complete floor system is not more than 9.07 kg (20 lbs.) per square foot, compared to a minimum for concrete of 22.68 kg (50 lbs.) per square foot. Also, the lower cost for insurance of a building under construction is another advantage."

Colin Davies, with Cleland-Jardine Engineering Ltd., Structural Engineer on the project, explains that the building matches the quake ratings on commercial buildings and leads the way in exceeding Ottawa's recently bolstered seismic residential building standards due to the city sitting on a known fault line. Ottawa is ranked third for earthquake risk among Canadian urban centres. "It was interesting to work on a challenging project that shows what is possible with new building techniques."

Contemporary in its construction and interior space, the duplex integrate comfortably with the heritage fabric of the Glebe neighbourhood through the extensive use of brick and the articulation of its façades with porches.

DESIGN AND CONSTRUCTION TEAM

ARCHITECT:

Vandenberg & Wildeboer Architects Inc. 613-287-0144

STRUCTURAL ENGINEER: Cleland-Jardine Engineering Ltd. 613-591-1533

GENERAL CONTRACTOR: RGB Group 613-265-2700

LIGHT STEEL FRAMING SUPPLIER: Morin Bros. Building Supplies 613-224-9980

STEEL STUD MANUFACTURER: Steelform Building Products 780-440-4499

SPECIALTY STEEL & CLIPS MANUFACTURER AND SUPPLIER: The Steel Network Inc. (TSN) 1-888-474-4876

The building matches the quake ratings on commercial buildings and leads the way in exceeding Ottawa's recently bolstered seismic residential building standards, states Colin Davies, Cleland-Jardine Engineering Ltd.





101b Third Avenue, Earthquake House Ottawa, Ontario

SPECIFICATIONS:

1st level walls 362S162-54 mils, 3 5/8" stud, 1/5/8" flange, 54 mil (.054")

2nd and 3rd level walls 3625162-43 mils, 3.625" stud, 1/5/8" flange, 43 mil (.043")

Floor joists MegaJoist 12005200-68 mils, 12" C joist with 2" flange 68 mil (.068")

Shear post X braces attachment boots and braces varied from two 362C200-118 mils (2" x 3.625" x 2" stud x .118")

to 362C200-43 mils (2" \times 3.625" \times 2" stud \times .043") Braces were 6" \times 54 mils 50 KSI single flat length

Special jamb studs supplied to frame the doors, windows and CFS beams varied from 362J250-97 mils to 362J250-43 mils $(3.625'' \times 2.5'' \times .5'' \times .097''$ to $3.625'' \times 2.5'' \times .5'' \times .043'')$ Connections clips with engineering values were also used.

The interior of the 4,000 sq. ft. duplex is open concept with 9 foot ceilings on each floor. Since there are minimal interior walls, the steel structure had to be carefully designed to carry the load.





Porsche Centrum, Groningen, The Netherlands

The Porsche Centre not only provides a signature of modern minimalistic architecture complying with corporate design lines, but also shows the almost limitless possibilities in the design of both modern and timeless commercial buildings with the use of Arcelor/Mittal's pre-coated steel.

The inside functions of the building are expressed by its external facades: the showroom facade is built up with innovative flat and curved architectural composite panels made of

steel coated with a PVDF paint system, the façade of the workshop, is made of Granite[®] HDX pre-coated metal cladding systems and a transparent ventilated rain screen system was used for the cladding of the car park.



PROJECT INFORMATION:

ARCHITECT: VBJ Architecten & Surveyers

MAIN CONTRACTOR: Groothuis Bouwgroep

CLADDING CONTRACTOR: PIB HollandGroep b.v., Nijkerk

CLADDING SYSTEM – Rain screen façade, metal cladding and architectural panels: SBC Holland Groep

PHOTOGRAPHER: Mark Sekuur

EDITED TEXT: Constructalia

Sun Slice House

The Sun Slice House on Lake Garda in Italy, designed by Steven Holl Architects, revolves around the natural light of the lake. The red patina of the weathering steel exterior lends the structure a natural feel, letting it seem like an organic part of the landscape.

Designed by: Architect, Steven Holl Architects





Living Steel showcases next-generation architecture in "Houses of Steel"

A commemorative book documenting the visionary and varied responses to the Living Steel's International Architecture Competitions is available globally, presenting 48 unique award winning designs from Living Steel's International Architecture competitions for sustainable steel homes, including single and multi-storey residential projects.

Availability of *Houses of Steel*: *Houses of Steel* is published by Images Publishing and available in all major architecture and design bookstores globally, ISBN 978 1 86470 366 5. *Houses of Steel* is distributed in China, Japan, Taiwan and Korea by Azur Corporation; in Australia by The Scribo Group and in North America and globally by ACC Distribution.

Houses of Steel is available internationally via www.imagespublishing.com Read more about the competition entries www.livingsteel.org/competitions



Bubbletecture H

Designed with "curves of the land" in mind, the 5,000m² (53,800 sq.ft.) Bubbletecture H environmental education centre in Sayo-cho, Hyogo, Japan utilizes weathering steel for exterior cladding. The 1.2mm (.048") thick Weathering steel panels are used for the exterior roof and wall cladding. The material was selected for its maintenance free characteristics and 'patina' once the oxidation process has stabilized, as well as, its blending with the environment. The material is produced by ArcelorMittal Dofasco in Canada where it is called Dofascoloy W[®].



SPECIFICATION: S355JOWP (ASTM A242 – Grade A/A606) ARCHITECT: Endo Shuhei PHOTOGRAPHER: Yoshiharu Matsumura

EDITORIAL INQUIRIES

We would like to hear from you!

If you have comments about this issue or a project you would like to see in an upcoming issue of *Steel Design*, please send a description of the project, include photographs, to:

> The Editor, Steel Design 1039 South Bay Road Kilworthy, ON P0E 1G0 Or email: davidfollis@vianet.ca



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