

## Article

# Steel pin connector finds new application

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A steel pin connector designed to connect round hollow structural section (HSS) elements for use in architecturally exposed structural steel (AESS) applications has found a new use.



Cast Connex's Universal Pin Connectors were used in the assembly of the complex space frame of the University of Alberta's new Physical Activity and Wellness Centre. - Photo: ROBERT BOURDAGES, STANTEC

For the first time the Universal Pin Connector, developed and designed by Cast Connex Corporation for AESS applications, has been used in non-exposed locations in a steel structure.

The reason might be surprising to some engineers: the connectors proved to be economical vis-à-vis conventionally fabricated connections, explains Carlos de Oliveira, of Cast Connex, a Toronto-based company that develops cast steel structural components for buildings and bridge structures.

de Oliveira is referring to the application of about 1,000 of the connectors at the web-member-end connections of the complex space frame that makes up the climbing tower at the University of Alberta's new Physical Activity and Wellness (PAW) Centre.

Only about 200 of those connectors are visible in the finished structure — the other 800 are not exposed.

Stantec senior associate Robert Bourdages says the connectors were a "logical choice" because they eliminated the need to design a special fitting for the round to gusset plate connections.

"We looked at alternative connections but they were awkward, they didn't look elegant and

they weren't clean."

The fact Cast Connex's connectors have only one pin connection was a big plus, adds Bourdages, because conventional connections often require four bolts to meet the load requirements of the structure. "It helped improve erection times and that is why we used them in both visual and non-exposed conditions."

"Before this project we didn't think that the economics could make sense for non-exposed connections, but Whitemud Ironworks (the steel fabricator for the project) studied the overall economics closely and agreed with Stantec that the connectors should be applied to the entire structure, even though 80 percent of the connections are non-exposed," says de Oliveira. "It shows the range of applicability for the connectors is broader than we thought."

The upfront cost for the connectors might have been more than conventional connectors but savings were made at erection, says Bourdages, noting all the connections were fabricated to the same specifications, allowing for quick fit-up.

He sees the merits of the connectors on large-scale projects, where lots of repetition and economies of scale can save time and money.

de Oliveira says the connectors are sculpted to provide smooth transitional geometry, making them ideal for AESS applications.

As fabrication of true-pin connections to hollow structural section (HSS) members is difficult, particularly when esthetics are a concern, the use of Cast Connex's connectors simplifies the design, detailing, and fabrication of critical architecturally exposed structural connections and improves the esthetics of the finished assembly, he says, adding they connect trusses, columns, braces, ties, struts and any member loaded in compression and tension.

He says that Cast Connex provided 3D models of the components to detailers Apex Structural Design to simplify their detailing of the building process.

"Everything went into the Tekla model, which was essential to enabling the construction of such a complex structure."

There are low-cost ways of achieving tension and compression connections using one plate but when the loading gets to a certain point or there are constraints on a member that could cause unwanted eccentricities, than two plates are required in the connection to keep the loads concentric in the member, adds de Oliveira.

"That's where our product becomes more economically viable."

Since Cast Connex commercially marketed the product in 2008, the connectors have been used in AESS applications throughout North America, including at airports, stadiums, museums, community centres and even in residential construction.

de Oliveira says the AESS market has been growing exponentially over the past few years as more architects specify it in commercial and public projects. "The lightness of structural steel compared to concrete allows you to make these structural forms that appear light and airy and enable designers to express the structure as well as the architecture."

He credits the Canadian Institute of Steel Construction as a driving force behind the growth of AESS. The CISC publishes a leading-edge design guide for AESS. "I believe the Canadian standards for AESS will be adopted by the Americans in the near future."

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