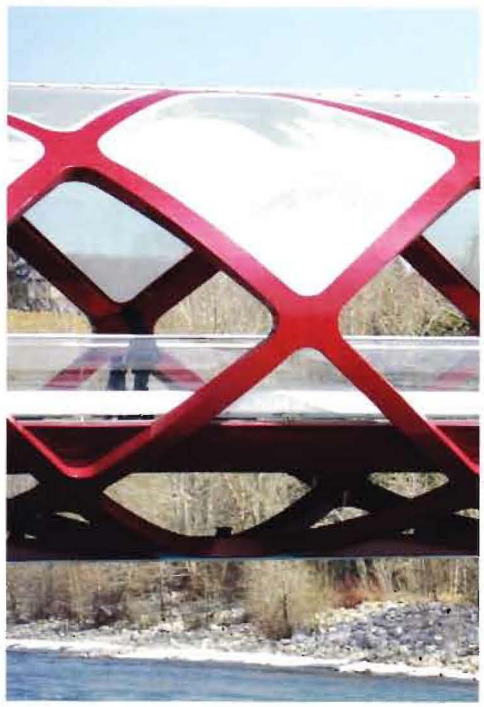
Form, Fit and Finish

Design and Specification of Architecturally Exposed Structural Steel

BY TERRI MEYER BOAKE



There are different ways to approach problems and detailing in exposed steel. The Museum of Flight pedestrian bridge in Seattle (R) and the Peace Bridge in Calgary (L) use similar structural approaches, but completely different material selection and fabrication methods. The Flight Bridge could be classed AESS 3 and the Peace Bridge AESS 4. The expectations from the fabricator are entirely different.

Architecturally exposed structural steel (AESS) is steel that must be designed to be both structurally sufficient to support the primary needs of the structure of the building, canopies, ancillary structures or pedestrian scale bridges, while at the same time be exposed to view, and therefore is a significant part of the architectural language of the building or structure. The design, detailing and finish requirements of AESS will typically exceed that of standard structural steel that is normally concealed by other finishes. AESS must be durable and maintainable. It must be able to resist corrosion if placed in a hostile environment and the design and finishes also resistant to urban pollution and general wear.

The Canadian Institute of Steel Construction (CISC) developed a new suite of documents to assist the design and construction industry in the effective implementation of AESS. Prior to the development of these documents there was not only the absence of a clear standard for AESS, but also no recognition of the need to differentiate the qualities of projects as a function of their use, finish and the ability of people to see or interact with the building or structure. At the core of the approach was the recognition that "not all AESS need be created equal". Early high profile exposed steel that was being used in airports, atriums or museums had fabrication and finish requirements that would be excessively expensive if applied to mid to lower end commercial or industrial projects. Projects could be priced out of existence. There needed to be a clear and definitive communication between the engineer, fabricator and architect that would put them all on the same page.

CISC created a Specification for the Engineer, an Appendix to the Code of Standard Practice for the Fabricator and an Illustrated Guide for the Architect. A "Matrix" ties all of the documents together to create a very complete and coherent means for the team to communicate.

There are four categories that recognize the use, distance of view and final finish on a project. These are further differentiated by characteristics of fabrication that are additive as the categories ascend. Although finishes might be applied last, they must be acknowledged at the outset of a project as the use of a heavier fire retardant or galvanized corrosion protection would suggest a less refined approach to fabrication and detailing that could afford some cost savings. The choice to use bolted or welded connections will also impact the choice of AESS type.

AESS 1 is the first step above standard structural steel. This type of application would be suitable for "basic" elements, which require enhanced workmanship. This type of exposed structure could be found in roof trusses for arenas, warehouses, big box stores and canopies and should only require a low cost premium in the range of 20 – 60 per cent due to its relatively large viewing distance as well as the lower profile nature of the architectural spaces in which it is used.

AESS 2 refers to structures that are intended to be viewed at a distance more than 6 m. The process requires basically good fabrication practices with enhanced treatment of welds, connection and fabrication details, tolerances for gaps, and copes. This type of AESS might be found in retail and architectural applications where a low to moderate cost premium in the range of 40 -100 per cent over the cost of standard structural steel would be expected.

AESS 3 refers to structures that will be viewed at a distance less than 6m. The category would be suitable for "feature" elements — where the designer is comfortable allowing the viewer to see the art of metalworking. The welds should be generally smooth but visible and some grind marks would be acceptable. Tolerances must be tighter than normal standards. As this structure is normally viewed closer than six meters it might also frequently be subject to touch by the public, therefore warranting a smoother and more uniform finish and appearance. This type of structure could be found in airports, shopping centres, hospitals or lobbies and could be expected to incur a moderate cost premium that could range from 60 – 150 per cent over standard structural steel as a function of the complexity and level of final finish desired.

AESS 4 is used for showcase elements where the designer intends that the form is the primary focus of the design. All welds are ground and filled edges are ground square and true. All surfaces are sanded and filled. Tolerances of these fabricated forms are more stringent, generally to half of standard tolerance for standard structural steel. All of the surfaces would be "glove" smooth. The cost premium of these elements would be high and could range from 100 – 250 per cent over standard structural steel — completely as a function of the nature of the details, complexity of construction and selected finishes.

It is common to mix two categories on a project in recognition of varied viewing distances, with ceiling elements often using a lower category. For highly unusual projects the matrix can be used to create a custom set of requirements.

Although only recently released, many projects in Canada are making effective use of the new AESS documents, resulting in smoother communication and a more satisfying project. **CB**

Terri Meyer Boake, BES B.Arch M.Arch LEED AP, is the associate director of the School of Architecture at the University of Waterloo. She is the author of the "CISC AESS Guide for Specifying Architecturally Exposed Structural Steel" and "Understanding Steel Design: An Architectural Design Manual" by Birkhäuser. To download: *http://www.cisc-icca.ca/content/aess/default.aspx*