

## A CATEGORICAL APPROACH

The Canadian Institute for Steel Construction is taking a new approach to specifying AESS requirements.

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### CURRENT SPECIFICATIONS FOR AESS

(architecturally exposed structural steel) tend to invoke a one-size-fits-all set of fabrication requirements above and beyond those necessary for strength and safety. The need to somehow recognize the different levels of finishes to suit the specific architectural expression of the building—and to make it easier for architects and engineers to specify those requirements to fabricators at bid time—prompted a new approach to specifying AESS that emphasizes different categories of AESS, each category's characteristics, and the use of a cost matrix to compare the categories.

### Canadian Initiatives: 2003 to Present

As AISC was developing its AESS Guide, concerns about AESS were also emerging in Canada. Regional initiatives of the Canadian Institute of Steel Construction (CISC) eventually culminated into the national CISC Ad Hoc Committee on AESS in 2005. The idea was to create a dynamic industry dialogue, including architects and engineers, in the hopes of providing a series of documents that would assist in re-visioning the design, specification, and construction process for AESS.

CISC decided it would pursue its category approach and adapt components of what AISC had developed.

The Ad Hoc Committee agreed on several key factors that would influence the creation of the new specification and accompanying guide:

**Not all AESS needs to be created equal.** The existing documents did not differentiate explicitly between types and applications. Airports, commercial buildings, and hockey arenas may all specify AESS, but each building type has different

requirements for its appearance and ultimate cost.

**Distance should play a factor.** AESS that is within view (less than 20 ft from the viewer) would require more attention to the finishing and detailing than would AESS that was greater than 20 ft away. This dimension was roughly based upon a two-story height or distance to a ceiling structure.

**Finish would play a factor.** The selection of a high-gloss paint, galvanizing, or intumescent coating affects the appearance of the final product due to the impact of show-through of the steel finish. Finish also plays into the selection of fire protection systems, which needs to be addressed very early in the project.

**Connection types should be considered.** There should be different approaches to detailing AESS depending on the choice of welded or bolted connections. These connections also require differentiation during fabrication (level of shop fabrication required) and erection (in terms of sequencing).

It was ultimately decided that the new CISC AESS sample specification should adopt a “category” approach in order to be able to incorporate different levels of these primary factors. The combination of categories and characteristics quickly led to the creation of a matrix to describe the attributes of each category and serve as a visual decision-making checklist. The Canadian *Code of Standard Practice* would include an appendix that would elaborate on details relating to the categories and fabrication and erection requirements.

It was also decided that a guide would be written to better explain the intent of the various characteristics by providing more detailed descriptions and images of actual

connections, finishes, and buildings that were not appropriate within the context of either the specification or the appendix. At the same time, more information on protective systems (fire protection, corrosion protection, etc.) and coatings would also be provided.

### AESS Categories and Characteristics

The CISC Ad Hoc Committee on AESS felt that baselines needed to be established that could characterize each of the categories, and that each category would reference recognizable building types as a point of visual orientation. The initial point of technical reference was selected as Standard Structural Steel (SSS) as defined in CSA S16, as it was already an established and well-understood baseline in construction specifications. A set of characteristics was then developed that was associated with each category. Higher level categories include all of the characteristics of the preceding categories, plus a more stringent set of additional requirements.

The characteristics refer to both the fit and finish of the elements. The committee felt it imperative that an understanding of the nature of the final finish be incorporated into this decision-making process. Whether the structure was intended for an interior or exterior application would also impact decisions pertaining to fire protection and finish. It was not felt that finish selection should be part of the specification, as this was more appropriately addressed elsewhere (partially in the new guide) in greater detail. Here are the proposed AESS categories:

**AESS 1 – Basic Elements.** This is the first step above standard structural steel. This type of application is suitable

The new Canadian approach to specifying AEES uses the below matrix to graphically summarize the characteristics required for each fabrication category.

CATEGORY		AEES C Custom Elements	AEES 4 Showcase Elements	AEES 3 Feature Elements Viewed at a distance ≤ 20 ft	AEES 2 Feature Elements Viewed at a distance > 20 ft	AEES 1 Basic Elements	SSS Standard Structural Steel CSA S16
ID	CHARACTERISTICS						
1.1	Surface preparation to SSPC-SP 6		✓	✓	✓	✓	
1.2	Sharp edges ground smooth		✓	✓	✓	✓	
1.3	Continuous weld appearance		✓	✓	✓	✓	
1.4	Standard structural bolts		✓	✓	✓	✓	
1.5	Weld spatters removed		✓	✓	✓	✓	
2.1	Visual Samples		optional	optional	optional		
2.2	One-half standard fabrication tolerances		✓	✓	✓		
2.3	Fabrication marks not apparent		✓	✓	✓		
2.4	Welds uniform and smooth		✓	✓	✓		
3.1	Mill marks removed		✓	✓			
3.2	Butt and plug welds ground smooth and filled		✓	✓			
3.3	HSS weld seam oriented for reduced visibility		✓	✓			
3.4	Cross sectional abutting surface aligned		✓	✓			
3.5	Joint gap tolerances minimized		✓	✓			
3.6	All welded connections		optional	optional			
4.1	HSS seam not apparent		✓				
4.2	Welds contoured and blended		✓				
4.3	Surfaces filled and sanded		✓				
4.4	Weld show-through minimized		✓				
C.1							
C.2							
C.3							
C.4							
C.5							

for “basic” elements that require enhanced workmanship. This type of exposed structure can be found in roof trusses for arenas, warehouses, and canopies, and should only require a low cost premium in the range of 20% to 60% due to its relatively large viewing distance as well as the lower profile nature of the architectural spaces in which it is used.

**AEES 2 – Feature Elements > 20 ft.** This category includes structures that are intended to be viewed at a distance of more than 20 ft. The process requires basically good fabrication practices with enhanced treatment of weld, connection, and fabrication detail, and tolerances for gaps and copes. This type of AEES might be found in retail and architectural applications where a

low to moderate cost premium in the range of 40% to 100% over the cost of standard structural steel would be expected.

**AEES 3 – Feature Elements ≤ 20 ft.** This includes structures that would be viewed at a distance of 20 ft or less. It is 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 are acceptable. Tolerances must be tighter than normal standards. As this structure is normally viewed closer than 20 ft, it might also be frequently subject to touch by the public, warranting a smoother and more uniform finish and appearance. This type of structure could be found in airports, shopping centers, hospitals, or lobbies and could be expected to incur a moderate cost premium that could range from 60% to 150% over standard structural steel.

**AESS 4 – Showcase Elements.** Also known as “dominant” elements, these would be used where the designer intends that the form is the only feature showing in an element. 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 tolerances for structural steel. The cost premium for these elements would be high, ranging from 100% to 250% over the cost of standard structural steel.

**AESS C – Custom Elements.** This category was created to allow for a completely custom selection of any of the characteristics or attributes that were used to define the other categories. It would allow complete flexibility in the specification of AESS, but would therefore require a high level of communication between the architect, engineer, and fabricator. The premium for this type of AESS could range from 20% to 250% over regular steel.

### **Design, Fabrication, and Erection Implications**

Categories would need to be specified at the design stage. A building might include two categories within the exposed portion of the project: AESS 3 for the lower part of an atrium and AESS 2 for the upper, more distant portion, for example. The matrix approach helps qualify what is expected within each category. Initially, the structural engineers would include the AESS specification in the structural steel division of their contract. After categories are specified, they should appear directly on architectural and structural documents. The fabricator would then make a cost estimate based on the categories and would indicate categories on their shop drawings and later on the erection plans.

There are implications on the sequencing, cost, and constructability that are inferred through the categories and char-

acteristics of the matrix. Construction sequencing for AESS members places further limitations on detailing and increases the challenge of erection. Again, finish plays into the equation, as members that are delivered to the site prefinished require a higher level of care during the erection process to minimize damage and excessive remedial work.

### **New Documents**

CISC plans to issue the new AESS Specification documents later in 2008. The documents include:

- ✓ *The Sample AESS Specification for Canada: Architecturally Exposed Structural Steel (AESS)*, a suggested AESS subsection of Section 05120 that includes the distinctive matrix chart. This is the standard specification chapter that is proposed for inclusion in the overall project specification document.
- ✓ *CISC Code of Standard Practice – Appendix I – Architecturally Exposed Structural Steel (AESS)*. The Appendix includes definitions and materials, related to scope, that clarify the terms of reference of the Specification outlined above.
- ✓ *Guide for Specifying AESS*. This document would not form part of the contractual specification, but would be used to clarify the intentions of the Specification, matrix, and Appendix.

When these documents are ready, they will be available for download from CISC’s web site: [www.cisc-icca.ca](http://www.cisc-icca.ca).

It is the intent of CISC that these documents should be used in concert to assist the decision-making process, as each complements, as well as extends, the information of the other. We feel that the category system and accompanying matrix will better respect the variation in requirements for AESS, thereby making AESS steel more competitively priced by eliminating a great range of fabrication and installation work that may be unnecessary. As an increasing number of AESS projects are constructed, we begin to realize that not all AESS is created equal, nor should it be specified as such. MSC

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