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Finally, A New Research Council Spec

"I write the songs that make the whole world sing ..." crooned Barry Manilow circa 1977.

Since 1951, the Research Council on Structural Connections has written the parent bolting application specification which "... makes the whole world sing ..." so to speak. Their specification has been adopted pretty well verbatim by every other major authority having jurisdiction over structural steel bolting that I know of: AASHTO, AREA, AISC, CISC, SEAOC, FHWA, State Departments of Transportation, BOCA, UBC, etc.

Since 1951, the "Council" as they are known, has told building and bridge steel designers how many and what grade of bolts to put into their connections, and what precautions they should take in the design so that the connections really do transmit the applied forces. This is important stuff which is relied on every day by hundreds of thousands of steel designers and detailers throughout the US and often in many other places in the world. You can see who the Council is and the product(s) of their labor on their website www.boltcouncil.org.

The Council is required by their by-laws to publish a new specification every 5 years, and since the last one was in 1994, it's due right now. And it will be here. Their deliberations have produced a final draft version in June, and it's that version that is now being readied for final ballot by the members.

Although I am a member of the Council, I cannot state for certain what the final version will contain. But I am fairly certain that it will at least contain the changes outlined below. If I have mischaracterized any of the new clauses, my apologies, but the industry deserves a "heads up" on some of this stuff, so here goes. The main changes are on the table that follows on the continuing page.

To read the table properly, a few definitions and terminology explanations are required:

Snug Tight

The point at which the plates of the connection, called "plies", have been brought together in "... firm, but not necessarily continuous, contact ..." Difficult to see on big connections. It's not really "... the full effort of a man on a spud wrench .." Snug tight or properly compacted plies is the starting point for ALL bolt tightening methods, since if you don't know you are tightening a bolt against solid steel, you don't know anything.

Pre-Tensioned Shear/Bearing Connections

Connections where the forces are to be resisted by the bolt slipping and then the bolt's shank bearing on the edge of the hole. The bolts are expected to be tensioned.

Slip Critical Connections

Connections where the forces are to be resisted by the frictional resistance between the plies, which has been caused by tightening the bolts to a certain tension which in turn clamps the plies together. If there is a coating on the clamped surfaces it is extremely important to qualify it for slip resistance characteristics, and the Council provides for this.

Tension Connections

Connections where the forces are resisted by bolts loaded externally in a direction parallel to their shank axis, as if to pull the bolts apart in direct tension. Initial tension or preload in the bolts is necessary so that at the design load the clamping force between the plies is not relieved to zero. As long as the clamping force doesn't go to zero, the change in bolt preload is small in normally proportioned connections.

Full Bolt Tension

Achievement of at least the specified preload in each bolt. The specified preload is contained in a table of values in the Council specification. The problem with this is that, although the Council wants a certain preload or bolt tension after installation, except for load indicating washers and perhaps Huck fasteners, there is no way to measure whether that tension really has been achieved. Torque doesn't work very well.

Engineer of Record (EOR)

This is the engineer or engineering firm that takes responsibility for the structure behaving properly under the design loads. In the case of state bridges, it is often the state Department of Transportation itself. The EOR is usually the big boss.

Bolt Tightening Delay Time

The interval of time that the bolt(s) have been out of "protected storage" and not tightened, and therefore subject to weathering and deterioration of their manufactured torque/tension relationship. In the 1994 Council specification a maximum delay time of one work shift is specified (oh, sure!) but there was no penalty specified so that provision was mostly ignored. In the 1999 Council specification a maximum time of 72 hours is to be enforced for all torque-controlled tightening methods; that is, for "calibrated wrench" and "twist-off" bolts. And there's an "or else". If the bolts have been out of protected storage for more than 72 hours, the LOT of bolts must be requalified by the "pre-installation Skidmore test" (see below). This will mean the contractor will have to know where that LOT of bolts has been inserted into the holes, too. The 72 hour rule will not apply for "turn-of-nut", and not for DTI's, either.

Pre-Installation Skidmore Test

A Skidmore-Wilhelm bolt tension calibrator is essentially a hydraulic cylinder through which you tighten some bolts like the ones you are going to use up in the steelwork, and which is set up to read the hydraulic pressure as bolt tension. The Council requires a Skidmore to be available on construction sites so that the bolt assemblies and installation equipment can be "proofed" PRIOR TO ANY BOLTING BEING DONE. The test is pretty simple, but in the 1999 issue it is much clearer in that the test will have to be repeated using bolts withdrawn from the steelwork if they have been inserted and not tightened for more than 72 hours. If the test fails to show the required bolt tension, then the LOT of bolts affected presumably must be replaced, so the contractor will have to know where that LOT of bolts is located. Good luck. **O**

Research Council on Structural Connections
Load & Resistance Factor Design
"Specification for Structural Joints Using ASTM A325 or A490 Bolts"

Summary of Changes Between the 1994 and 1999 Versions as Applied to Bolting Provisions

Date	Issue Involved	Intended Result	Enforcement Specified
1994	Snug Tight Connections	Indeterminate Bolt Tension	Very Loose-A Peened Nut is Sufficient Proof
1999	Snug Tight Connections	Indeterminate Bolt Tension, but not zero	None. Cannot be just hand tight though. Compacted plies mandatory.
1994	Pre-tensioned Shear/ Bearing Connections	Full Bolt Tension Bolt Tension	Inspection only if specified by Eng. of Record
1999	Pre-tensioned Shear/ Bearing Connections	Full Bolt Tension Inspection	Mandatory of Bolt Tension in all situations.
1994	Slip Critical Connections	Full Bolt Tension Inspection	Mandatory of Bolt Tension and Faying Surface Condition
1999	Slip Critical Connections	Full Bolt Tension Inspection	Mandatory of Bolt Tension and Faying Surface Condition - no change.
1994	Tension Connections	Full Bolt Tension Inspection	Mandatory of Bolt Tension and Faying Surface Condition
1999	Tension Connections	Full Bolt Tension	Only Bolt Tension Inspection Mandatory, not Faying Surface Inspection
1994	Bolt Tightening Delay Time	One Shift Max, All Methods	Or What? No Penalty Incurred
1999	Bolt Tightening Delay Time	72 Hour Max for Twist-Off and Calibrated Wrench Methods	Or What? Mandatory Requalification of Tightening Method for Entire Bolt Lot
1994	Pre-Installation Skidmore Test	On Slip Critical or Tension Connections Only	Demonstrate Bolt Assembly Can Achieve 1.05 Times Minimum Preload at Least
1999	Pre-Installation Skidmore Test	On Pre-Tensioned Shear/Bearing and Slip Critical Connections	Demonstrate Bolt Assembly Can Achieve 1.05 Times Minimum Preload at Least