

Observations from the 2014 Steel Design Conference

Contributed by Thomas Vaughan, P.E. | GSC Engineering Inc.

SEAMASS was once again a sponsor of the SFNE Steel Design Conference at Worcester Polytech. I attended and found a broad selection of interesting technical design talks.

Larry Muir presented a discussion of the Uniform Force Method (UFM). His 2008 paper, “Designing Compact Gussets with the Uniform Force Method” presented a modification to the UFM that allows more flexibility in choosing gusset proportions. That paper won the 2014 T.R. Higgins award.



He cautioned that the Lower Bound Theorem requires ‘adequate’ ductility so forces can redistribute themselves. Adding a couple more bolts “just in case” or increasing plate thickness may not make a connection stronger if it becomes too stiff.

Later I asked him about a definitive ‘first paper’ on the derivation of the UFM. I have been trying to find one, but every paper refers me someplace else. The UFM is a bit like a “rumor”, it seems to have just appeared. It seems there isn’t a definitive original derivation published. From what Larry told me, apparently William Thornton sketched out the concept, I believe during an airplane flight, but it was never formally published. A 1990 ASCE/AISC task group recommended it as one of three methods to consider. Although the recommendations of the committee are published, details of the methods aren’t published. The how, if not the why, has been in the Steel Construction Manual for years.

So while not detracting in any way from his creative inspiration, the UFM did somewhat ‘appear’ in the literature – it satisfies equilibrium and the yield criteria are not exceeded so the Lower Bound Theorem (LBT) says it is safe. Thornton published a 1991 paper showing that the UFM results were the closest to certain experimental results so the UFM is close to optimum. The engineer in me is satisfied with the art of a provable ‘how to use’ description. The historian in me was confused until I heard the story.

Professor Jerry Hajjar of Northeastern and Dr. Eric Hines of LeMessurier discussed ongoing and planned research. They may be considered the ‘fathers’ of two major research and testing facilities in the region – the STReSS lab at Northeastern University’s Kostas Center in Burlington which allows full scale structural testing, and the Wind Technology Testing Center in Charleston which allows full scale wind tunnel testing. Dr. Hajjar’s team includes research on new construction techniques that would allow for disassembly and re-use/re-purposing of structural components at the end of a buildings life rather than just recycling. Eric Hines’ current research includes measurement of the ductility of angles to get better information of the flexibility and ductility of seismic connections.

Jim D’Aloisio of Klepper, Hahn & Hyatt in Syracuse discussed thermal bridging. There are products, including some fairly elaborate ones such as Manufactured Structural Thermal Breaks (MSTB’s). He also discussed less drastic measures such as using stainless steel (S/S) or fiber reinforced plastic (FRP) components. I discussed some of these with him afterwards. S/S has one third the thermal conductivity of carbon steel, and while obviously more expensive, using it for lintels and masonry ties, which are in corrosive environments might be worth considering. FRP has even lower conductivity and is already used for ties and lintels in Europe.

Attorney Ross Wecker discussed contract and legal issues in BIM modeling. He also compared AIA and Consensus Docs forms for this particular area.