Recently, we presented two webinars detailing the provisions of Chapter K in AISC 360-16 and how those changes affect HSS connection design. Attendees were invited to pose their questions, and we have included answers to the most common ones here.

Q: Can we see the derivation of the yield line theory equation given in the Manual, equation 9-30?

A: This equation establishes the weak-axis flexural strength of HSS wall elements under out-of-plane transverse loads. In this case, either a plate or an HSS branch member is being connected to the HSS wall. In general, you can find more information about these equations in several articles published in AISC's Engineering Journal. This equation in particular can be found in “Yield Line Analysis of a Web Connection in Direct Tension” by Richard H. Kapp (Engineering Journal, Second Quarter, 1974).

Q: What does “designed by rational analysis” mean? Tests?

A: This phrase is found in the second paragraph of section K1 in the discussion about the limits of applicability pertaining to HSS connections. The purpose of the phrase is to clarify that connections falling outside the given limits of applicability should not be considered prohibited.

Similar to AISC 360-10, some connections are still presented through tables in 360-16. There are limits of applicability associated with each table. For a connection that meets these limits, research (both physical tests and finite element analyses) has proved that the particular limit state shown in the table governs the connection design. However, if the connection under consideration falls outside of the limits of applicability, the engineer must evaluate all limit states to discern which limit state governs the design capacity. The Commentary can be very helpful in gaining insight into which failure modes might control. Note that this is, and has been, current practice for open section connection design.

Q: For the punching shear in the HSS wall, what does the value of 0.93 signify?

A: This is not unique to AISC 360-16 and has been in the Specification since 1997. The 0.93 signifies the reduction to the nominal wall thickness of an HSS due to the large wall tolerance of +/- 10% inherent to ASTM A500. The 7% reduction has already been accounted for in the tabulated section properties in the Manual but must be accounted for in connection calculations as well when evaluating the strength of an ASTM A500 member.

Note: ASTM A1085 tolerances are such that this reduction is not required and the full nominal wall thickness may be used in design calculations.

Q: Are the reductions for the end of the member waived if a cap plate is welded across the end of the member?

A: If a cap plate with adequate thickness is welded to the main member with an adequate weld, then yes, the full resistance of the chord member may be used.

Q: Are the HSS Design Manuals (from STI) up to date with the new 2016 Specification?
A: We are in the final stages of these revisions. They will be available on the STI website in April 2020. We will also have them available at NASCC: The Steel Conference in Atlanta in our booth. Come by to flip through them and say hi!

Q: Is there a reference in the Specification regarding HSS punching shear?

A: The Specification user note in section J10.10 refers designers to the Manual Part 9 for guidance on calculations for this limit state.

As you work through your designs using AISC 360-16, feel free to contact us (https://steeltubeinstitute.org/hss/contact-us/). We are happy to help!