Enhancing Structural Performance: Exploring the Yield-Link® Brace Connection Design - Part 2

Webinar Q&A

Here is the Q&A Report from our live webinar, **Enhancing Structural Performance: Exploring the Yield-Link® Brace Connection Design - Part 2,** held on June 27, 2023.

Thank you for submitting your questions.

You can also view this webinar's recording and the slide deck.

Please send any additional questions to Mary Nunneley (mnunneley@strongtie.com) or Clif Melcher (cmelcher@strongtie.com).

	QUESTION	ANSWER
1	In the first slide, was the Simpson label on the W-Beam indicating the beam itself was coming from Simpson?	First, it is important to clarify that this question pertains to the Yield-Link moment connection (YLMC), not the Yield-Link brace connection (YLBC) product line. However, for neither of those product lines does Simpson provide the main frame members such as the beam, columns, and braces. The Simpson Strong-Tie label is provided along with the connectors in the YLMC kit and is applied after the steel is erected.
2	Do each of these systems have ICC-ES Reports?	Yes, the moment connection and brace frame connection ICC-ES report numbers are ESR-2802 and ESR-4342 respectively. The moment connection is also prequalified in AISC 358.
3	Does this system have any Code approval?	See response to question #2 above.
4	Are the connections supported for the Canadian building code?	Not at this time.
5	Do you have any documentation/approval for use in Canada? The ICC ES report does not state any Canadian compliance.	We will be seeking Canadian approval in the near future. Please contact us for more info.
6	Are these available or special-order pieces?	All fuse plates are carried in inventory and are readily available.
7	Do fuse pairs need to be on 2 sides, or can they be on one side?	The YLBC fuse plates must be used in pairs and installed symmetrically on each side of the brace web in accordance with ICC-ES ESR-4342.
8	Can these be used on WF brace flanges? How about rectangular HSS?	Currently the YLBC must be connected to a wide-flange web only.
9	Is this Yield-Link only good for W shape braces?	See response to question #8 above.

10	Have these connections been used with Tension Control Bolts? Are there limitations on the grip lengths of HS bolts versus the number of link layers per connection?	We have tested with TC, hex head, and threaded rods that have been pretensioned according to RCSC. There is a limitation on the use of the TC and hex head bolts based on a maximum stocked length that is larger than the required grip length of the larger fuse configuration kits. For those larger-grip lengths, a threaded rod should be used.
11	What is the cost of YLBC8-F1?	Please contact our sales team for pricing for your project.
12	Does Simpson treat these similarly to how CoreBrace treats BRBFs with respect to design responsibility? Should the EOR be doing all of the design and specification, or should we be providing design criteria and treating the design of the YLBC as a deferred submittal/delegated design element?	We handle the design responsibility differently than traditional BRB manufacturers. As a designer, you have all the necessary strength, stiffness, and detailing requirements available to you in ESR-4342. We have created software plugins to assist in the design. Part 3 of this webinar series will cover our software offerings in detail. As always, we also have dedicated engineers that can provide design support when needed.
13	1) For Multi-layer Fuses, does the web of the brace have any minimum thickness requirement? 2) Are the bolts subjected to bending or just pure shear?	1) The web of the brace does not have a minimum requirement based on our ESR. However, you will need to do a calculation based on AISC-360 for the applicable limit states such as net tension, block shear, etc. to ensure that the web has the strength for the expected demand. We have a design tool that will assist in that calculation for you. 2) Pure shear for the most part. They are longer so you may get a little bit of combined shear and bending, but they have been shown to be acceptable based on our component and full-scale testing.
14	It looks like there is a minimum limit of flange width to accommodate multi-layer fuses, is this the case?	There is not a minimum thickness of the brace flange. There is a minimum width of 8” for the brace flange to accommodate the slotted flange plate connection.
15	Is fatigue of the fuse plates a concern, and if so, is there an inspection interval for them?	Long-term fatigue testing is not required by AISC 341 to qualify traditional buckling-restrained braces therefore we have not performed them.
16	Are slotted flange plates required or can they be left off?	Yes, they are required because they maintain the out-of-plane stability of the brace-to-gusset connection when the fuse plates plastically deform.

17	What are the design requirements for the Slotted Flange Plates (min. thickness, slot clearance, no welds to gusset plates, etc.)? This appears to be a case-by-case design, but I am curious if there are driving design requirements. What is the overall design intent for these plates?	The slotted flange plates (SFP) are always 8” wide and ¾" thick. The slot width varies based on the gusset thickness plus 1/16” on each side of the gusset. The length of the SFP varies as well based on the bay geometry, member sections, member orientations, and fuse configuration kit. There are geometrical requirements for the YLBC brace-to-gusset connection that were introduced in webinar 1 of this series. Refer to Figure 3 in ESR-4342 for the requirements.
18	Are fuse plates only designed for LRFD or are there product guides for a design using ASD?	The available strengths of the YLBC in ESR-4342 are currently only provided in LRFD. There’s no reason you couldn’t design using ASD loads, but we would need to provide those capacities to you. Please reach out to your local Simpson Strong-Tie representative to request the ASD design strengths.
19	Has there been a study on repetitive non-maximum design level seismic events to determine if the fuse-link deforms or fails from long-term fatigue? And if so, is there a specified predicted safe life span for the fuse-link systems?	Long-term fatigue testing is not required by AISC 341 to qualify traditional buckling-restrained braces therefore we have not performed them.
20	From testing, where in the link plate did failure typically occur? The plates have multiple "neck down" areas. Curious if there was a pattern for which the neck-down area failed first.	The fuse plate failure location was consistent due to combined stresses.
21	Are the distorted fuses easily removable to replace?	Yes, our full-scale test program, introduced in webinar 1 of this series, illustrates the replaceability of the fuse plates after they have been plastically deformed. We performed up to eight tests on a single test frame utilizing the same beams, columns, brace, gusset plates, etc. The only components that were replaced in the program were the fuse configuration kits and their required fasteners. We successfully proved that the fuse plates protect the brace, columns, beams, and gusset plates as intended.
22	After the fuse was activated by a seismic event, how is the connection restored? Does one replace the fuse section, and if so, how does one align the new fuse into the place of the old one, as the beams may no longer be exactly aligned after the seismic event?	This can vary depending on the situation, and the realignment of the building would need to be determined on a case-by-case basis. This issue is not unique to the YLBC system, and a solution would need to be evaluated for each structure. When compared to other concentric braced frames, the YLBC has the benefit of utilizing relatively small replaceable parts at the end of the brace. We successfully proved in our full-scale test program that the fuse plates protect the brace, columns, beams, and gusset plates as intended and you will simply have to replace the fuses.

23	Fuses compress and extend to dissipate energy, so how do they add stiffness to the structure? In the case of torsion control, we need stiffness.	The fuse plates have an elastic axial stiffness, as provided in table 1 of ESR-4342, that will be applied to the bay that includes the YLBC. The addition of the brace and YLBC will make the bay stiffer than it would be without these elements. Although the amount of lateral stiffness of the bay is important, the location of the LFRS bays relative to the center of mass and the other LFRS elements will affect your torsional stiffness as well. Care must be given to the layout of each LFRS element to control torsion.
24	For the slide showing Step 4a, did you say the fuses were modeled as springs in series? I am just double-checking. Thanks!	Correct, the fuse configuration and brace assembly can be idealized as springs in series.
25	The brace deflection of 1.32" should result in a smaller horizontal deflection, not a larger 1.86" deflection?	For the provided geometry and loading of the example, the deflection values in the presentation are correct. Please see Annex A of ESR-4342 for more details.
26	Do the fuses require any maintenance? And do they come in galvanized for a heavy corrosion environment?	There is no maintenance required. You would have to use an alternative corrosion control coating. The fuse plates cannot have an additional heat profile applied without confirmation testing that it would not affect performance
27	Can we combine the Yield-Links with BRBs instead of wide flanges so we can have a potentially shallower brace member?	A more economical solution would be to use the YLBC with HSS braces. We are currently exploring this for potential revisions to the ESR.
28	How can the alignment of bolts and drilling of bolt holes in the gusset plate be ensured to meet the YLBC design criteria?	I believe this question is referring to the fit up of the YLBC to the holes in the gusset plate and brace member. The YLBC fuse plate holes are oversized according to AISC dimensions and provide some flexibility for alignment in the field.
29	How do we model the connection in design software?	The YLBC can be modeled in various ways depending on the software you are using. We have a Modeling Guide available for download on our website that provides directions for each modeling method.