SIMPSON Strong-Tie

Design a Highly Resilient Steel Structure

Webinar Q&A

Here is the Q&A Report from our live webinar, **Design a Highly Resilient Steel Structure,** held on May 25, 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 tellis@strongtie.com or mnunneley@strongtie.com.

	QUESTION	ANSWER
1	Has this product been implemented in buildings yet?	Yes, we do have two structures that have been built with this technology, and several are currently being designed.
2	Can we use these connections to retrofit RC concrete structures?	Absolutely. If you have a unique application for this connection, please contact your Simpson Strong-Tie sales rep.
3	Is this system available in New Zealand, or will it be available in near future?	Yes, this system is available in New Zealand now.
4	Is that connection compliant with Canada Code?	We have not evaluated our YLBC to CSA S16 yet, but in the US the design parameters are similar to those of a BRBF.
5	Can we use these connections for HCAI and DSA projects?	The YLBC is not currently qualified for HCAI and DSA projects.
6	Without licensing fees, but with a proprietary system (buying the Yield-Links directly from SST), how do you compare cost-wise against MiTek's SidePlate that does charge license fees, but the product is fabricated from plates/bolts at any fabricator's shop (i.e., not purchased as a product)?	The YLBC is very competitive with the other types of systems. Compared to the MiTek specifically, when you add in the cost of the large plates, we are very competitive cost-wise. When you are doing your analysis, it is best to make sure you are considering the weight of the plates as well as licensing fees.
7	Can we input these connections in RISA and ETABS and similar software?	Yes, YLBC is integrated with the RAM Structural System and there are Tekla plugins available on our website. ETABS and SAP2000 plugins are coming soon and will be available on our website later this year.
8	Will a plugin for the Yield-Link brace connection software be made for RISA?	We have started a discussion with RISA about including our YLBC in RISA-3D. We do not have an ETA yet on the inclusion of our YLBC in RISA-3D.
9	What software was used for comparing analytical results to test experiments?	SAP2000 and OpenSees
10	What sort of waterproofing is required to protect the energy absorber?	The fuses are typically installed inside the structure, so no special waterproofing is required.
11	Can spray-on fireproofing be used on these connections?	Yes, the assembly just needs to be fully pretensioned and inspected before the fire coating is put on.

12	Is the YLBC system able to be used in exterior industrial conditions? Can the system be ordered/detailed with corrosion protection measures?	See the answer to question 10.
13	Can the connection be exposed to weather?	See the answer to question 10.
14	Please describe the stiffness of the Simpson brace compared to a BRB with equal force resistance. Are the total inelastic strains equivalent?	The equivalent stiffnesses of the BRB and YLBC are generally similar for typical brace configurations. That said, the stiffness for each varies by bay configuration and other parameters such that they are not analogous across structures. One advantage of YLBC is that the stiffness can be determined with certainty upon selection of a fuse configuration and brace size (no stiffness modifier is needed). Design with YLBC is not dependent on a calculated strain as it is with a traditional BRBF. Adjusted fuse configuration strength (maximum force the fuse can deliver to the system) can be determined from fuse deformations associated with the design story drift (no strain calculation is required). The axial force action in the brace induces internal shears and flexure within the fuse component, rather than axial strain in a BRB core. As a result, there is no direct correlation of inelastic strains between the two products.
15	How do the HSS members make use of this product? I would like to visualize this option.	The brace in the YLBC braced frame is qualified as a W14 hot rolled sections. HSS sections can be used for beams and columns only at this time.
16	Are these restricted in use to wide flange shapes? Or could they be used with other shapes?	The brace is limited to a W14x wide flange member. The beams, columns, and struts could be used with a HSS member. That detailing would be very similar to what you would see on any other system. The proprietary portion of the YLBC is the brace-to-gusset connection.
17	Is that applicable to HSS sections? I see all details are for W section bracing.	See the answer to question 15.
18	How does this connection plate connect to HSS brace?	See the answer to question 15.
19	Can these connections be used with HSS bracing members?	See the answer to question 15.
20	Could Brace be Pipe and Conn. YLBC?	See the answer to question 15.
21	Does it have room for field adjustment?	Adjustability is similar to that of any other bolt-braced connection. Holes in the fuse plates are oversized to allow for some adjustability.

22	Does this system require any maintenance during its life cycle (for example, lubrication to assist and ensure free movement)? Does it have a finite lifespan?	No, the lifespan is simply the lifespan of the building. We do not want any lubrication as the main fuse connections are slip critical Class A joints.
23	Can you speak about assembly with faying surfaces and bolt pretension?	It is a class A faying surface per RCSC.
24	Is that static load or the yield load for LRFD strength?	Our published capacities are at LRFD level (i.e., design strength with phi included).
25	In full-scale tests, did both ends yield? If they did, were the peak and residual strain equal in both? Are links required at both ends?	Yes, both ends yielded. The intent of the loading protocol in AISC 341 Section K3 is that the first two cycles are meant to yield the product. The peak and residual strain are fairly similar up until the larger deformation demands, then they begin to vary based on whether the fuses were in compression or tension. In seismic design categories A, B, and C, configurations are only required on one end of your brace. In higher seismic design categories, there is an option to use one or two based on the story drift of the structure. We've outlined those requirements in our code report ICC-ES ESR-4342.
26	If the entire deformation can be realized at one end, would we still need them at both ends? Which is more cost-effective?	In seismic design categories A, B, and C, the connection can be applied only on one end of the brace. For higher seismic regions, the connection must be applied on both ends of the brace unless one of the two following conditions is satisfied: The maximum calculated deformation of an individual fuse configuration associated with a story drift equal to 2% of the story height is less than the design deformation capacity defined in ICC-ES ESR-4342. The maximum deformation of an individual fuse configuration as determined from a nonlinear analysis in accordance with Section C3 of AISC 341-16 is less than the design deformation capacity defined in ICC-ES ESR-4342.

27	To follow up on my previous question, what are the strains in the fuse relative to failure? How many DBEs do you anticipate a fuse being able to survive?	The performance of the YLBC is different from a typical BRBF. The strains in a BRBF are axial and the strains in YLBC are in shear and flexure, so there isn't a direct comparison between the two.
28	Does allowing the rotation at the beams and columns facilitate repair? If they didn't rotate, wouldn't you have damage to the column, beam, and gusset that could make repair more difficult or impossible?	This question is beyond the scope of our research on the YLBC product. It's up to the design team to determine which beam end connection to use. We successfully tested with "simple" connections according to AISC 341 and validated that this type of connection can be used.
29	Is the beam rotation allowed by way of slotted holes?	Correct. Beam connection plates had slotted holes.
30	Does the Ductile Yield-Link Connections for braced frames meet the requirements of CSA S16-2021?	We have not evaluated our YLBC to CSA S16 yet, but in the US the design parameters are similar to that of a BRBF.
31	Is the turn-of-nut method (pretensioning of the bolts) required for these bolted joints?	Any pretensioning method in the RCSC is acceptable.
32	Did you test these connections at the earthquake damaged structures?	We tested the fuses using the deformation-controlled loading protocol defined in AISC 341 Section K3. The first two cycles are meant to yield the part and then the deformation amplitude incrementally increases to two times the design story drift. As indicated, we showed that the damage of a structure with YLBC is localized to the fuse plates and that the beams, columns, braces, and gusset plates were not damaged.
33	How did you develop the internal configuration of the fuse plates (cut outs)?	The yielding region is a proprietary design.
34	How do fuses work? Do some of them fail and others take over?	In multi-ply configurations, there is a redistribution of force resistance if one of the fuses ruptures. The first fuse rupture event occurs well beyond the design basis earthquake level of loading.
35	Do the bolts go through all layers pertaining to the connection? If I assign seven plates to achieve a certain capacity, will the bolts go through all seven? Are the bolts provided with the connections?	Yes, bolts go through all layers of fuse plates; however, not all the fuses are the same length. So, when you're staggering seven fuses, you'll see a cascading shape looking from the side. The bolts are not provided by Simpson Strong-Tie.
36	Is there an issue if when "closed" of the shoulder hitting if displacements get too large?	The dimensional requirements and design methodology for the connection ensures that the gaps will not "close" during large displacements.
37	How much drift do you usually get?	The story drift will depend on many factors such as the bay dimensions, brace configurations, frame sections, and fuse configurations used.

38	Often the braced frame attaches to the foundation below the slab. I understand that the brace must be above the concrete. Can the gusset plate be cast within a concrete closure pour?	The slotted flange plates need to move. We have some typical details online to show how this might look at concrete slab conditions.
39	Would it mess up the capacity if the flange slots were welded to the gusset?	Yes, it would affect the performance of the fuse, because the fuse is intended to be allowed to move.
40	What is the purpose of the flange plates, since they are not connected to the gusset?	The slotted flange plates provide out-of-plane stability. They maintain the alignment of the brace to the centerline of your connection.
41	Is the gusset plate thickness limited to the brace web thickness? It would seem the capacity is limited by the block shear capacity of the brace web. I imagine that is why the connections are pushed back toward the middle of the brace for the multi-plate configuration. Does it also result in heavy braces to get a sufficient WF web thickness? For example, what thickness of brace web would be needed to accommodate the 400k fuse capacity case?	The gusset plate and web thickness can be of different thicknesses, and filler shims may be used to make up the difference in that case. The limit states associated with the brace web thickness do not typically govern. Our design tools perform this calculation check.
42	Is there any bracing requirement for the beams other than ensuring moderately ductile members? like at a V brace connection	Yes, in a chevron configuration, the unbalanced force in the beam must be considered, and beam bracing at the midpoint is required per ICC-ES ESR-4342.
43	Does the fuse plate size determine the section/size of the bracing member?	Yes, the capacity-limited design methodology requires the brace to be designed for the maximum of the maximum expected force that the fuse can deliver and the omega level seismic load.
44	Will this connection affect brace member, beam and column design?	Yes, see the answer to question 43 for brace member design requirements. The beam and column members will be designed for the maximum expected force that the fuse can deliver.
45	Is the diagonal brace limited to W14x family of wide flange sections?	Yes.
46	Your beam-column connection has a lot of bolts. Is it designed to transfer vertical and horizontal forces at the same time that it allows rotation?	Yes, the gravity beam connection was designed as a “simple” connection in accordance with AISC 341.
47	Is only the fuse the “protected zone” or is the protected zone the fuse + the brace?	Only the intended yielding area of the fuse is the protected zone.

48	Would you recommend using these in buildings that are controlled by wind loading?	Yes, this can be designed for an R=3; or if you want a more robust wind design, you can bump it up to an R=8. Even in a low seismic or wind area, using that larger R=8 could really be beneficial for your project in reducing the base shear, which results in more economical drag connections and foundations.
49	What is the maximum building height these brace systems can apply?	The maximum height that we are qualified for is consistent with the system limitations that are stated in ASCE 7-16 for BRBF. There are multiple variables such as vertical loading, architectural design, and seismic loads that affect the applicability of any lateral system. We see this consistently being able to capture the four- to five-story, mid-height steel structures.
50	Do you have design examples NOT using proprietary programs?	Yes, a design example is included in our code report ICC-ES ESR-4342.
51	Do you have a catalog for selection options, etc.	Detailed product information and details are available on our website Strongtie.com. Technical design information is available in our code report ICC-ES ESR-4342.
52	Will a continuing education certificate be issued for this webinar?	A link to the PDH certificate will be emailed to those who completed the majority of the webinar. This webinar did not qualify for CEUs, unfortunately.