Dynamic Seismic Response of Steel Braced Frames with Innovative Bracing Configurations – Sake Table Study

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Objectives of Overall Study

The zipper frames project is a collaborative NEES project between Georgia Tech, University at Buffalo, UC Berkeley and University of Colorado – Boulder. The zipper frames' structural system was first conceived in 1989 by Prof. Khatib at University of Michigan. Even though this structural system is analytically well understood, it has never been tested experimentally. The model that is going to be tested is a particular variation from the traditional zipper frames. It was first developed at GeorgiaTech and it is called suspended zipper frames, where the top braces are designed to remain elastic during a ground motion, preventing the frame to become unstable.
The initial test serves multiple purposes:

1. Perform a shaking table test to a frame with the suspended zipper frame configuration and monitor the sequence of yielding and bucking of the braces.
2. Monitor and provide dynamic data to the other collaboration groups for testing in quasi-static and pseudo-dynamic conditions.
3. Share all data and coordinate information with other sites.
4. Generate experimental data that will allow concluding about the accuracy of the analytical predictions and that will help improving the understanding of the behavior of this bracing configuration.
5. Model dynamic behavior with three dimensional large deformation inelastic models and expand the Lagrangian approach developed by the authors.
6.

Scope of testing at University at Buffalo.

The objectives of the shake table test are:
- To perform a dynamic test to the structure helps to understand the actual behavior of the zipper configuration during a ground motion. Being aware that phenomena like buckling of braces are not directly scalable and the results could possibly not be extrapolated to a full scale structure, the test will be very useful to validate analytical work and assumptions made in simplified computational models.
- Since this is a dynamic test, the sequence of yielding and buckling obtained from the nonlinear static analyses will not be reproduced. However, the redistribution of forces between the braces through the zipper columns can still be monitored and their effectiveness can be assessed.
- The upper story braces should remain elastic through the entire test for the structure to remain stable. The axial hysteresis of all the braces and zipper columns will be monitored to compare to the analytical model predictions
- This test will be the base for comparison for other tests to be performed at other sites. The results from shaking table will be target values of pseudo-dynamic tests at University of California, Berkeley and University of Colorado – Boulder.