Substructure Tests at the University of Colorado as Part of a Collaboratory Research Project on the Behavior of Braced Steel Frames with Innovation Bracing Schemes

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Project Summary

This is part of a collaboratory research project involving investigators from Georgia Tech (GT), University at Buffalo (UB), University of California at Berkeley (UCB), University of Colorado at Boulder (CU), and Florida A&M University (FAMU), with GT acting as the lead institution. The aim of the project is to develop a design methodology for zipper frames and attain a better understanding of the behavior of these frames under moderate and strong earthquake loads. The project will utilize the George E. Brown, Jr. Network for Earthquake Engineering Simulation (NEES) facilities at UB, UCB, and CU, as well as the large-scale experimental facility at GT to test structural components and systems to provide comprehensive data for the development of design recommendations.

In this project, several pairs of braces will be tested at CU using the Fast Hybrid Test system that has been developed as part of the NEES program. During a test, a pair of braces will be treated as part of a three-story zipper frame using a substructuring test method that is illustrated in Fig. 1. The test setup is shown in Fig. 2. As shown in Fig. 1, the test structure considered is a three-story zipper frame, which will be tested on a shaking table at UB. At CU, only the bottom-story braces will be tested with the setup shown in Fig. 2, while the rest of the frame will be modeled in a computer using OpenSees. The design of the test specimen is shown in Fig. 3. Results of these tests will be compared to those of comparable tests performed at UBC to evaluate the consistency of the different test methods developed at the two NEES sites. In the second phase, multi-site tests will be conducted between CU and UBC. In these tests, one laboratory will test the bottom-story braces and the other will test the second-story braces, both of which will be part of the three-story frame modeled in a computer. The tests will involve on-line data exchange between the actuator controllers in the two laboratories and the computational model using the NEESgrid. Results of these tests will be evaluated against the shaking table test results obtained at UB.

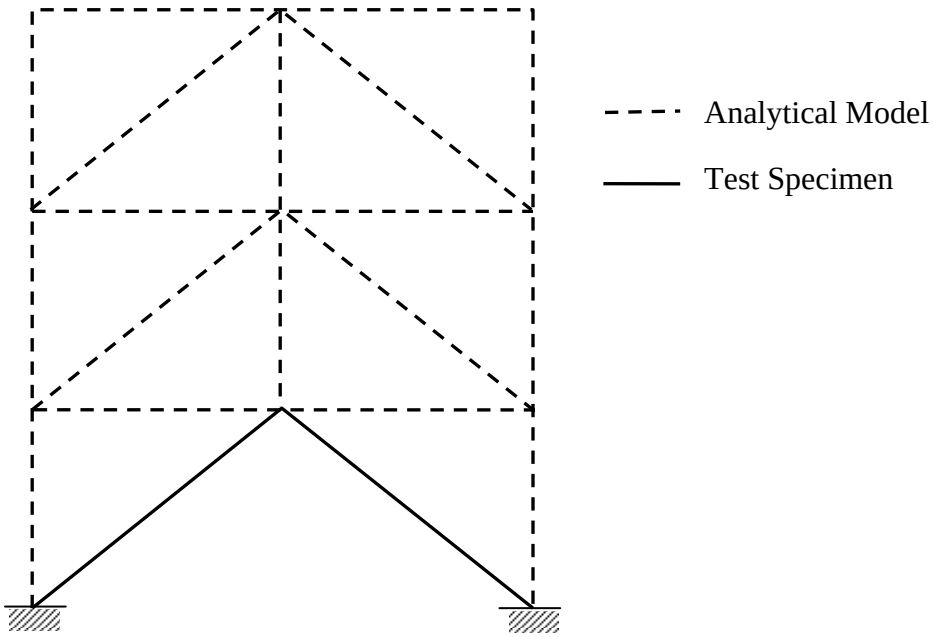

Fig. 1 – Partition of the Test Structure

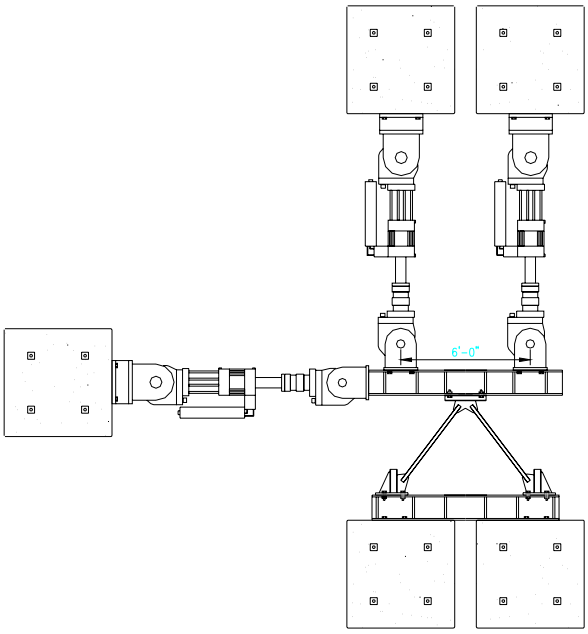

Fig. 2 – Test Setup

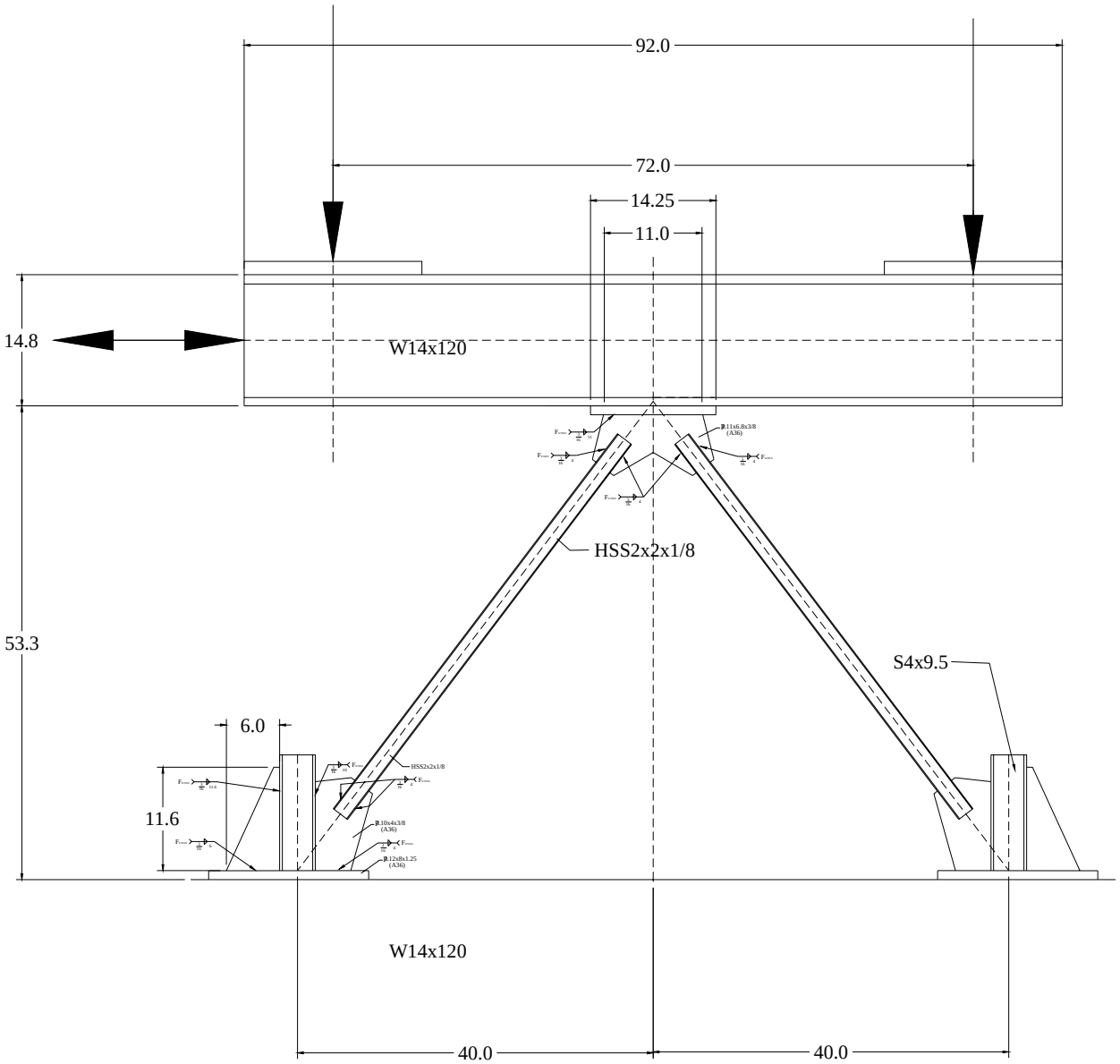

Fig 3 – Test Specimen