Experimental and Numerical Study of an Innovative Infill Web-strips Steel Plate Shear Wall with Rigid Beam-to-Column Connections

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Abstract: Steel plate shear walls (SPSWs) are resilient lateral load-resisting structures that provide efficient energy dissipation while subjected to seismic forces. This study examined experimentally and numerically the cyclic behaviors of innovative infill web-strips (IWS-SPSW) and conventional un-stiffened steel plate shear (USPSW). As a result, two specimens of a 1/3 scale single-story single-bay IWS-SPSW and USPSW were constructed and tested under cyclic lateral loading protocol. Semi-rigid end-plate beam-to-column connectors were used for the steel plate shear walls beam-to-column connection. The steel plate walls with infill web strips showed high ductility and a great shear load-bearing capacity. The hysteresis results showed that the IWS-SPSW had high energy dissipation with no severe beam-column damages; on the other hand, the USPSW displayed high shear load-bearing capacity with less ductility and tearing web plate corners. The FE models were created and validated with experimental data. It has been proved that the infill web-strips can affect an SPSW system's high performance and overall energy dissipation. The material features of the infill web-strips, such as steel strength and thickness, can significantly enhance the system's impact.

Keywords: infill web-strips steel plate shear wall, cyclic test, failure mechanism, hysteresis behaviors

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