



Development of a Heavy Timber Moment-Resisting Frame with Ductile Steel Links

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Summary:

To improve the seismic performance of mid-rise heavy timber moment-resisting frames, a hybrid timbersteel moment-resisting connection was developed that incorporates specially detailed replaceable steel yielding link elements fastened to timber beams and columns using self-tapping screws (STS). Performance of the connection was verified using four 2/3 scale experimental tests. The connection reached a moment of 142 kN m at the column face while reaching a storey drift angle of 0.05 rad. Two specimens utilizing a dogbone detail in the steel link avoided fracture of the link, while two specimens absent of the dogbone detail underwent brittle failure at 0.05 rad drift. All four test specimens met the acceptance criteria in the AISC 341-10 provisions for steel moment frames. The STS connections exhibited high strength and stiffness, and all timber members and self-tapping screw connections remained elastic. The results of the experimental program indicated that this hybrid connection is capable of achieving a ductility factor similar to that of a steel-only moment-resisting connection. This research suggests that the use of high ductility factors in the design of timber systems that use the proposed hybrid connection would be appropriate, thus lowering seismic design base shears and increasing structure economy.

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