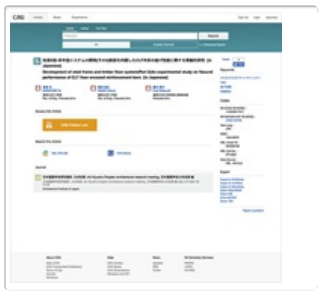

Development of Steel Frame and Timber Floor System: Part 2. An Experimental Study on Flexural Performance of CLT Floor Encased Reinforcement Bars

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Summary:

Low-damage seismic-resistant post-tensioning technologies were first developed during the PREcast Seismic Structural Systems program, coordinated by the University of California San Diego. Different connections were developed and tested as part of the research program, and the most stable solution was the hybrid connection, which provides a combination of re-centering and dissipative contributions. The hybrid connection was later extended to Laminated Veneer Lumber Elements (LVL) and referred to as Pres-Lam (Prestressed Laminated) system. As part of a broader experimental campaign on frame and walls systems, several experimental tests were carried out on small-scale specimens of post-tensioned single walls and on coupled walls systems. More recently 2/3 scale quasistatic tests were performed on different wall configurations. The paper shows the evaulation of the seismic performance factors of post-tensioned timber wall systems, carried out according to the FEMA P695 procedure. The latter utilizes nonlinear analysis techniques, and explicitly considers uncertainties in ground motion, modelling, design, and test data. The technical approach is a combination of traditional code concepts, advanced nonlinear dynamic analyses, and risk-based assessment techniques.

A set of archetype buildings were developed to characterize the behaviour of the system. Several parameters were accounted for, such as the building height, lateral load resisting system, magnitude of the gravity loads and seismic design category. The system archetypes were represented by numerical models developed to simulate the full range of behavioural aspects of the system. Nonlinear quasi-static and dynamic analyses were carried out to determine the system over-strength factors and median collapse capacity of the buildings. The system performance was then assessed by computing the Collapse Margin Ratio (CMR) defined as the ratio of the median collapse (SCT) and MCE (SMT) spectral accelerations.Once the non-linear analysis results confirmed the CMR values were within acceptable values, the trial value of the seismic response modification, R, was confirmed, and the system seismic performance factors were evaluated.

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