RE-BUILDING TRIMBLE NAVIGATION’S OFFICES USING A DAMAGE-LIMITING SEISMIC SYSTEM

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ABSTRACT: Opus International Consultants have recently undertaken the design of a number of new Pres-Lam buildings in New Zealand. Pres-Lam systems utilise large sections of pre-fabricated Laminated Veneer Lumber (LVL) to construct structural frames or walls, which are connected together on site by steel post-tensioning, often with the inclusion of mild steel energy dissipaters at the member joints.

This paper presents a case study of one of these buildings, Trimble Navigation offices, which replaces a concrete building that was damaged in the 2011 Christchurch earthquake sequence: the Christchurch earthquake was a magnitude M6.3 earthquake that struck the Canterbury region in New Zealand's South Island shortly after midday on 22 February 2011, killing 185 people and causing widespread destruction to central business district.

Trimble Navigation, whose Christchurch office burnt down shortly after the Christchurch earthquake, wanted a resilient and sustainable building to house their New Zealand headquarters. A Pres-Lam design was selected as it provides the advantages of a resilient damage-limiting structure as well as the sustainability aspects of timber. The building, with 6,400m² of office space over two levels, utilises LVL Pres-Lam frames in one direction and LVL Pres-Lam walls in the other to resist seismic loads. The building also uses a timber-concrete composite floor system and is due for completion in February 2014.

The design of a Pres-Lam frame and wall building presents some interesting challenges related to the material characteristics of timber. This is particularly relevant at the beam-column joint, where the LVL is in bearing perpendicular to the grain, so creep, low connection stiffness, and relatively low shear modulus, affect the performance of the joint. Consequently, several design iterations were required to achieve an efficient solution that was verified using 2D non-linear static pushover analysis, followed by both 2D and 3D non-linear time history analyses using 11 ground motion pairs.

Development of guidance around the design of Pres-Lam walls and frames is still in the early stages, and there are only a few buildings with timber Pres-Lam frames or walls, so the suite of proven practical solutions is limited. This paper will describe some of the challenges associated with analysis and design of aspects of the Trimble Navigation building, focusing on the beam-column joints, and present options for refinement of the design now that construction is complete.

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