

Numerical Investigation on the Collapse of the CTV Building Caused by the 2011 New Zealand Earthquake

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ABSTRACT

A six-story high, reinforced concrete (RC) framed structure called the Canterbury Television (CTV) building collapsed totally with only the north-core wall remained standing (Fig.1), due to the earthquake of magnitude 6.3 which occurred in New Zealand on 22nd of February, 2011. Many overseas students including Japanese students died in the event. Hyland and Smith [1] investigated on the possible cause of the collapse. They concluded that the building swayed and twisted violently. Once the column on the mid to upper levels on the east face failed, other columns rapidly became overloaded and failed. Then the beams and floor slabs fell down and broke away from the north-core.



Fig.1 Remain of the CTV building after the collapse

Although the collapse behavior has been investigated, the causes of the collapse are not thoroughly specified. Some factors that contributed or may have contributed to the failure include;

1. Structural design: The structure might have lacked allowable stress because shear walls layout were out-of-balance and the columns were too weak with less re-bars and low-strength concrete.
2. Structural damage: Although some damages were observed in the building due to the earthquake which occurred six months before the 2011 Earthquake, the repair had never been operated.

The present work is aimed to figure out the factor that caused the collapse of the CTV building by focusing on the structural design and the structural damage. To simulate the collapse phenomenon, a seismic collapse analysis code for RC framed structures developed using the ASI-Gauss technique [2] is adopted. An analytical model of the CTV building (Fig.2) is constructed based upon the structural drawing of the building. The numerical result showed a collapse behavior of a same feature with the investigation mentioned above, and it showed that the building had a problem with the structural design. We also investigated a connection between the collapse behavior of the CTV building and the structural damage resulted by the prior earthquake.

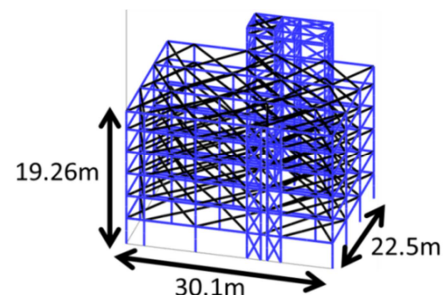


Fig.2 Analytical model of the CTV building

References

- [1] C. Hyland, A. Smith, *CTV Building Collapse Investigation*, Department of Building and Housing, New Zealand, 2012.
- [2] K.M. Lynn, D. Isobe, Finite Element Code for Impact Collapse Problems of Framed Structures, *Int. J. Numer. Meth. Eng.*, **69**(12), 2538-2563, 2007.