THEORETICAL INVESTIGATION OF AUSTRALIAN DESIGNED REINFORCED CONCRETE FRAMES SUBJECTED TO EARTHQUAKE LOADING

By Anthony K.M. Wong

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Department of Civil and Environmental Engineering
The University of Adelaide

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ABSTRACT

Research into the behaviour of structures under seismic/earthquake loading was accelerated following the 1989 Newcastle earthquake and the 1990 Kobe earthquake. Two main points are to be learned from these two events: (1) an area of moderate reactivity can be caught unprepared by an unexpected earthquake and (2) there is a need not only to improved the behaviour of newly designed structures but also to understand how an existing typically "Australian designed" structure will behave under earthquake loading.

The new Australian Loading code AS1170.4 - Minimum Designed Loads on Structures Part 4 - introduced new design methods to bring Australia in line with the design methods used around the world. In areas of low seismicity, structures tend to be governed by gravity and/or wind loads and this type of structures would exhibit little ductility thus will perform poorly under earthquake loading. The research presented is concentrated on the behaviour of reinforced concrete frame structures designed in accordance with AS3600 - concrete structures code. There are three types of moment resisting frames (1) normal moment resisting frame, (2) intermediate moment resisting frame and (3) special moment resisting frame. The normal moment resisting frame was chosen to be investigated because it represented the majority of the existing structures of this type. Furthermore, no special provision in terms of detailing of the reinforcement was made to make allowance for seismic loading with normal moment resisting frame.

A non-linear computer model of a reinforced beam-column joint was produced using the computer analysis program called "Ruaumoko" which allowed the modelling of joint stiffness and strength degradation. A hysteresis rule was chosen by comparing analytical results using the model to the experimental results of 1/2 scale quasi-static joint tests carried out at the University of Melbourne. After calibrating the initial stiffness and the yield level to the Melbourne tests results, the model was used to predict the behaviour of a full scale equivalent of the 1/5 scale reinforced concrete frame dynamically tested at the University of

Adelaide. The results obtained were compared to the experimental results from Adelaide and comments were made with regards to the performance of the computer model.

A computer model of a multi-storey multi-bay prototype structure was created by using the same calibrated beam-column joint model developed earlier and the mode of failure for this prototype structure was identified. A discussion on the Response Modification Factor (R_f) given in AS1170.4 for a normal moment resisting was made and comments were given as to whether the value given in AS1170.4 was conservative. In conclusion, suggestions to areas in need of further research were recommended.

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where references have been made in text.

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