Chapter 1

INTRODUCTION

1.1 Background

When designing for earthquake induced loading, most conventional, popular gravity dominated structural systems possess a major inherent deficiency because of undesirable member proportions. Many structures designed and constructed in Australia belong to this category. The purpose of this study is to investigate the seismic performance of a beam-slab-column system constructed with a re-usable sheet metal formwork system, which is becoming popular in Australia and overseas. This innovative formwork system, Corcon, has been developed and patented throughout the world, by the industry partner, Andy Stodulka of Decoin Pty Ltd.

'Corcon' derives its name from the combination of CORrugation and CONcrete. This reusable lightweight sheet metal form system optimises the traditional rib slab construction by using corrugated arch metal sheet spanning over series of sheet metal beam moulds to form the suspended concrete slab. The corrugated arched metal sheet enables the rib beam spacing to be increased to 1200 mm from the conventional 600 mm.

There have been no investigations reported on the seismic behaviour of concrete beam-arch slab systems, both locally and internationally. Decoin Pty Ltd., the industry partner will work with the University of Melbourne to find an appropriate and economical solution for this important problem.

1.2 Purpose

The purpose of the research presented in this thesis is to investigate the seismic performance of Corcon slab system for various levels of seismicity, with the aim that design recommendations are to be formulated.

The main goal is to assess current Australian design practice and to provide design guidelines for these beam-slab-column systems constructed with the Corcon form work system and to find a detailing strategy which will ensure a sufficient level of ductility for various levels of seismic demands.

1.3 Means to achieve outcomes

The seismic performance of Corcon slab system is to be assessed through experimentally and analytically.

A theoretical model of four-storey framed structure equivalent to those in a typical frame structure constructed with Corcon system is designed and detailed according to the existing rules given in the Australian Concrete Structures Code, AS 3600. The Program RUAUMOKO is used to predict the inelastic dynamic responses of the frame structure, and to determine the expected maximum drift levels for different levels of seismicity.

The experimental work, consists of two tests and is conducted taking an isolated half-scale Corcon interior beam-column subassembly to understand the real Corcon slab performs under cyclic lateral load. The second test was conducted after repairing the damaged first specimen to test the effectiveness of the modified detailing.

The finite element modeling of the sub assemblage is performed using Program ANSYS. The experimental results are used to calibrate the finite element model. The second finite element model is prepared and used to test the performance with improved reinforcement detailing to overcome deficiencies identified in the experiment.

1.4 Aims

- Seismic performance of existing Corcon system designed for gravity loads.
- --------- performance of a similar system retrofitted with CFRP.

1.5 Arrangement of the thesis

This thesis is presented in the following manner:

Chapter 2 presents a range of earthquake engineering topics and structural modelling aspects; a review of literature related to experimental testing, current design practice, theoretical strength evaluation and modeling techniques such as finite element analysis.

Chapter 3 deals with construction and testing of interior Corcon rib beam-column subassemblages tested in the Francis Laboratory at The University of Melbourne.

Chapter 4 presents the results from the half scale interior Corcon rib beam-column subassemblage.

Chapter 5 presents the analytical component of this investigation, such as finite element analysis and time history analysis.

Chapter 6 gives the overall conclusions and future work.