SEISMIC EFFECT ON PRECAST CONCRETE STRUCTURE FOR BEAM TO COLUMN CONNECTION

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ABSTRACT

This is an investigation of the seismic response on the precast structure due to the beam to connection behaviour. Seismic could damage the whole building if it is not properly designed, especially in high seismic region. Connection is one of the crucial elements to limit building damage. A lot of research has been done on monolithic reinforced concrete building but lack of information on the behaviour of precast connection under seismic effect for the whole structure. This research methodology mainly consists of two parts. The first part is finite element static load analysis and the second part is frame seismic load analysis. Finite element static load analysis models 4 types of connection. Three of the connection verified against the experimental result which carried out by P.L Chan (2006). A new connection is created and model. For frame analysis, 3 storey and 21 storey with three type connections stiffness frames are loaded with static load and seismic load. Three types of connection stiffness are pinned connection, new connection and fixed connection. The stiffness of the new connection is obtained from the slope of the total load versus deflection graph in the elastic range. The seismic load is Elcentro earthquake and modified with 0.15g and 0.50g load intensity. From the analysis results, new connection plate with 10mm thickness and Bolt 22 mm diameter has sufficient stiffness, strength and more importantly it has higher ductility. Meanwhile, the frame analysis results show that the new connection behaves as semi rigid connection after compare with pinned connection and fixed connection.

ABSTRAK

Laporan ini bertujuan untuk mengkaji kesan gempar bumi terhadap sambungan rasuk dengan tiang untuk precast struktur . Gempar bumi boleh menyebabkan kerosakan teruk kepada seluruh bangunan jika sambunagan rasuk dengan tiang tidak seusuai. Kajian terhadap aspek ini adalah kekurangan jika dibandingkan dengan bangunan konkrit yang bersifat monolitik. Cara kajian ini terbahagi kepada dua bahagian. Bahagian pertama ialah analisa unsur terhingga dan bahagian kedua ialah gempar bumi analisis bagi kerangka. Analisa unsur terhingga menganalisis empat sambungan model. Keputusan tiga daripada empat model ini dibandingkan dengan keputusan experiment yang pernah dikaji oleh P.L Chan (2006). Satu lagi model ialah sambungan baru yang direkabentuk. Bagi kerangka analisis, gempar bumi tersebut ialah Elcentro dengan pecutan gravity 0.15g dan 0.50g dan dikenakan kepada kerangka. Kerangka tersebut meliputi 3 dan 21 tingkat kerangka dengan tiga jenis sambungan yang berlainan. Keputusan ini daripada analisa unsur terhingga dan kerangka analisis menunjukkan bahawa sambungan baru yang mempunyai 10mm tebal plate dan 22mm diameter bolt adalah sambungan paling sesuai.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Seismic could damage the whole building if it is not properly designed, especially in high seismic region. Connection is one of the crucial elements to limit building damage. A lot of research has been done on monolithic reinforced concrete building but lack of information on the behaviour of precast connection under seismic effect. Therefore, this research is carried out by using computer software as a preliminary understanding of its behaviour.

1.2 Problem Statement And Importance of Study

Although several moment resistant connections are designed through research to sustain high intensity seismic, the connection fabrication is complex which will slow down the construction period. Besides, the actual behaviour of these

connections is still vague. The understanding of the actual connection behaviour is very important, especially designed and constructed for high seismic region. For low seismic region such as Malaysia, seismic effect is not taken into account in design consideration which may lead to tremor felt in high rise building. The effect of Sumatran earthquake is the best prove. As a result, improvement should be made on the connection either in high or low seismic region after analyzing the connection response to the seismic.

1.3 Objectives

The objectives of the study are as follows:

(i) Model three connections which were carried out in laboratory for verification by using Lusas.

(ii) Propose and model new connection by using Lusas to determine the stiffness, strength and ductility by doing parameter change of plate thickness and bolt size.

(iii) Study the effect of new connection stiffness on 3D frame under dynamic load and compare with pinned and fixed connection frame by using SAP 2000.

1.4 Scope of Study

This study focuses on beam to column connection under static and dynamic load. For the static load, the connection is modeled by using Lusas to study the the stiffness, strength and ductility. Meanwhile, the stiffness of the connection from the

finite element analysis is input in 3D frame for modal and linear time history analysis under 0.15g and 0.50g intensity (Elcentro).

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