POST-TENSIONED INFILLS EFFECT ON LATERAL RESISTANCE OF INDUSTRIALIZED BUILDING SYSTEM

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ABSTRACT

Industrialized building system (IBS) has many advantages compared to the conventional cast in-situ construction. The adoption of IBS is slow, especially in the areas subjected to severe earthquakes. The main objective of this study is to investigate the effect of cyclic lateral load of post-tensioned infilled IBS system. It studies the mechanism of failure of IBS system assemblies to a certain performance loads. The method used in this study is entirely laboratory procedural to obtain the result of lateral displacement due to the effect of the post-tensioning infills and making the beams as integral units to the walls infills. It was learned from the experiment that post-tensioned infills to upper beams of IBS frame improves the rigidity of the IBS system as a whole.

ABSTRAK

Sistem bangunan berindustri (IBS) mempunyai banyak kelebihan dibandingkan dengan pembinaan konvensional in-situ. Penggunaan IBS adalah pada tahap minimum, terutamanya di kawasan-kawasan tertakluk kepda gempa bumi. Objektif utama kaijan ini adalah untuk mengkaji kesan beban sisi sistem pasca tegangan terisi IBS. Ia mengkaji mekanisme kegagalan himpunan IBS pada sistem beban tertentu. Kaedah yang digunakan adalah ujikaji sepenuhnya Dalam kajian ini prosedur mendapatkan hasil anjakan sisi akibat kesan dinding dan pasca tegangan menjadikan rasuk sebagai unit bersepadu kepada dinding. Ia meningkatkan ketegaran sistem kerangka dan keseluruhan sistem IBS.

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CHAPTER 1

INTRODUCTION

1.1 Background

Precast is also known as Industrialized Building System (IBS) in Malaysia and it is a construction methods that reduce the time of completion of construction, have a better quality control, saving in labor cost and resistible to weather changes. The most significant of IBS perspectives is the manufacturing of IBS components that haves been developed locally. The effect of foreign labor forces, materials waste, quality control and the time of construction is all about the traditional construction. IBS technology has been broadly spread and accepted in Malaysia and other countries around the world in the construction industry because of its simplicity in construction, giving of design and adequacy of structural performance that match with the needs of compliances.

IBS as a building system, with all the components are manufactured properly out of the site of construction. These components are then transported to the construction assembly on site and utilized in such way to increase the output efficiency of the construction in term of productivity, safety and quality as well. Because all the components are produced in an entirely controlled manufacturing

environment, IBS production is not affected by the weather conditions. In other words, using IBS system reduces the impact of the weather changes on the construction even during the assembly process.

The traditional construction method is mainly dependent on extensive labor forces at sites. This leads to increase in the cost of construction, especially if the construction needs skilled working outside from the country i.e. foreign labors. In other words, utilizing IBS increases the construction industry progression with less labor forces and at high control of quality to meet the target.

Because IBS components are manufactured industrially using specific machines, all the components production are highly controlled in the aspect of dimensions and specifications concerning the strength. Thus, no more adjustments are required at the site of construction. The components should be such that fit each other during the process of assembly on sites.

In addition to the structural and construction features, IBS system can satisfy precisely with the architectural aspects in terms of aesthetic. IBS frame system has been introduced in such way to enhance mechanism failure of structural system for lateral forces produced by the wind and earthquakes which in turn goes a long with the architectural aspects gravity resistance requirements.

The advantages of precast concrete structure are the quality control, better construction management, efficiency of use of materials and saving in time and cost. Comparing to conventional construction which requires more construction space, more working hands, more time for curing of concrete and hardening and less quality control at site. All these lead to the demand of the IBS system to overcome many problems that can be encountered in the traditional construction.

In this study, IBS frame system is proposed to enhance the mechanism of failure of IBS system. The system consists of three precast columns, two precast beams and six precast infill panels'. The prefabricated components are cast and assembled to form an IBS frame system. The new idea of the frame system is to determine how far the precast post-tensioned in fills can contribute to the strength of the IBS system in terms of resisting lateral wind load and earth quakes.

1.2 Problem Statement

Although IBS system is broadly used because of its good features concerning the construction and management aspects, the mechanism of failure of the IBS unit system due to the lateral loads still one of the biggest challenges associated with the structural stability and reliability. In other words, the connections among the precast components are important to the analysis, design and use of the structure.

The goal of the work is to experiment the mechanism of failure of IBS frame system as not a fully fixed joints. Whether precast post-tensioned infill panels connected to the precast post-tensioned beams contribute to strength of the IBS frame system, or on the contrary do not contribute to the strength, instead imposing damages to the unnecessary system at lateral loads.

1.3 Objectives

The main objectives of this study are:

- To build a scaled of 1:5 model of IBS frame system consisting of three precast columns, two precast beams, and six precast infills wall panel.

- To investigate the effect of lateral load on post-tensioned IBS frame with post-tensioned infills system experimentally.

- To find the mechanism of failure of IBS infill's system to lateral pushover cyclic load.

1.4 Scope of Study

IBS system has a better features in construction than the traditional construction method, this study is a part of continuous studies that dedicated for investigating the structural behavior of the IBS frame system. It also investigates the mechanism of failure of post-tensioned infills panels subjected to lateral loads through the experimental work.

The experimental work consists of testing of IBS frame system to investigate the mechanism of failure and the effect of post-tensioned infills panels with beams of the system. The columns and beams are provided with spiral ties. Hence, are the infills contribute to the strength of IBS system or they cause an unnecessary damage to the frame system?

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