SUSTAINABLE HOUSING: LFEA OF PRECAST FRAME

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Special thanks for my parents.

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ABSTRAK

Struktur pra-tuang adalah satu system di mana semua bahagian dan elemen structur tersebut di hasilkan di kilang dan di bawa di tapak bina untuk di pasang. Struktur kerangka bagi perumahan satu tingkat adalah fokus utama dalam kajian ini. Plat keluli berbentuk 'W' digunakan sebagai gentian bagi tetulang. Analysis dijalankan menggunakan perisian COSMOS/M untuk kaedah analisis unsur terhingga lelurus. Seluruh model struktur kerangka ini dimodelkan sebagai 'Solid Element' yang bersambung melalui nod. Kegagalan struktur kerangka dapat diketahui melalui tegasan maksimum, P_1, tegasan minimum, P_3 dan sesaran gabungan.

ABSTRACT

Precast concrete structures is a system where parts, members, and elements of structures are produced in the factory, and transported to the construction site. The frame structure for single storey housing is the focus of this analysis. 'W' shape steel with 5 mm thickness and 480 N/mm^2 strength is proposed to replace all reinforcement in the beam and column. Linear finite element analysis (LFEA) was carried out to predict the mode of failure using COSMOS/M software. The whole frame model is assumed as Solid elements that are connected to each other using nodes. The failure on the structures was based on principal stress P1, principal stress P3, and resultant displacement contour plot.

LIST OF CONTENT

LIST OF TABLE

LIST OF FIGURES

LIST OF SYMBOLS

E_p	-	Modulus Elastic for Stain Hardening
E_s	-	Elastic Modulus
ε_{co}	-	Maximum Compression Stress
ε_{cu}	-	Optimum Compression Stress
f_{cu}	-	Characteristic Strength
f_{ry}	-	Reinforce Yield Stress
f_y	-	Steel Yield Stress
G	-	Shear Modulus
ρ	-	Density
υ	-	Poisson Ratio

LIST OF APPENDIX

CHAPTER I

INTRODUCTION

1.1 Introduction

Precast is not the first choice of Malaysian construction industry to build a building beside 'in-situ' method. This traditional method has been found to be a good practice producing the good quality building, due to time constrains. The use of precast concrete which includes beams, columns, slabs and walls has been recommended by engineers. Precast concrete structure is a component manufactured in the factory, transported to the site, lifted by machines and assembles to exist as a building with other element and member in order to co-exist the external forces.

Precast construction has been used progressively employing several component and materials that are inexpensive, rapid site erection and it lends itself to innovation in design and construction. Advanced technology, including robotics and the use of

computer-aided manufacturing, will lead to more efficient fabrication procedures. The potential for signification reductions in building costs of development is apparent. The high technology together with low labour content makes it suitable for our local environment, without necessarily losing the flexibility of construction form at has resulted the transition from conventional to mass produced "building system" or industrialized building system that may be used in developing countries that are technologically less advanced.

Precast concrete structure may be in the form of shear walls, slabs and stairs panel. While, precast concrete framed structure are structural components such as columns and beams.

Precast concrete frame is not new, but research must continue to make sure the safety and reliability of its use. Linear finite element analysis (LFEA) is one of the tools which may use to improve the prediction of strength of precast frame. LFEA of precast frame requires the use of linear techniques to include the dependence of constituent material properties on varying strain,(C. Taylor et al, 1980). COSMOS/M software is selected to analyse the model of frame structure due to it's elegant result during analysis.

1.2 Objective

The objectives of the thesis are:

i. To model the frame for linear finite element analysis (LFEA) by using COSMOS/M software.

ii. To analyse the frame structure model to determine the critical behaviour upon the loading applied.

iii. To obtain the maximum stresses displacement to recognize failure of the frame structure.

1.3 Scope

This research focused on the behaviour of frame structure consist of stress, strain, and deflection failure. The modelling use COSMOS/M software for running the linear finite element analysis without comparison with laboratory analysis. Mets frame model in this analysis represent one storey precast frame structure to determine its suitability for construction at single storey housing.

1.4 Research Methodology

The research methodology include;

a) Information Gathering

Gather all current research information from existing books, journals, information from internet and thesis.

b) Linear finite element software

COSMOS/M is selected to model the structure to include all restrains and material linearity.

c) Modelling

Geometry modelling is based on engineering drawing. First, the model is modelled using AutoCAD software for coordinate determination for COSMOS/M data input size of model is used in LFEA.

d) Analysis of Precast Frame Structure

Analysis of precast frame structure using linear finite element analysis (LFEA).

e) Result and discussion

Result output of COSMOS/M structured engineering software is discussed in detail in Chapter V.