DESIGN OF SIMPLE FLATS WITH SUSTAINABLE ARCHITECTURE APPROACH IN YOGYAKARTA CITY FROM STRUCTURAL, GEOTECHNICAL, AND COST AND TIME MANAGEMENT ASPECTS

Final Project Report

As one of the requirements to obtain Bachelor's degree in
Universitas Atma Jaya Yogyakarta

Made By:

BERNARDINUS SANDIKO PINAYUNGAN	**191317915**
MUHAMMAD REZA SYAHDAPUTRA R.	**191317762**

INTERNATIONAL CIVIL ENGINEERING PROGRAM

DEPARTMENT OF CIVIL ENGINEERING

FACULTY OF ENGINEERING

UNIVERSITAS ATMA JAYA YOGYAKARTA

YOGYAKARTA

2023

ABSTRACT

Kota Yogyakarta sebagai ibu kota yang dikenal sebagai "kota pelajar" dan "kota wisata", menarik banyak orang dari berbagai daerah untuk belajar atau tinggal di Yogyakarta. Itu membuat kota menjadi lebih ramai di daerah kecil. Selain itu, sebagai kota yang terletak di Ring of Fire, Yogyakarta sangat berpotensi mengalami kerusakan akibat gempa. Di lahan kecil, alternatif selain perumahan adalah rumah susun karena mampu menampung lebih banyak orang di lahan yang lebih kecil. Namun, semakin tinggi bangunan, semakin rentan terhadap gempa. Oleh karena itu, rumah susun harus dirancang tahan gempa dengan menggunakan beton bertulang Sistem Rangka Pemikul Momen Khusus (SRPMK).

Bangunan ini akan memiliki ukuran 28 x 96 m2 dan 5 lantai. Terletak di Jalan Ki Ageng Pamanahan, Kota Yogyakarta, Daerah Istimewa Yogayarta. Luas total situs adalah 8.350 m2. Setiap cerita memiliki tinggi khas 4 meter. Cerita kedua sampai kelima adalah tipikal. Bangunan ini menggunakan pendekatan berkelanjutan dengan menggunakan material hijau untuk atap hijau dan fasad untuk sisi arsitekturalnya. Ukuran bangunannya cukup besar dan berfungsi sebagai tempat tinggal, sehingga bebannya sangat besar.

Acuan yang akan digunakan untuk bangunan tahan gempa adalah SNI 1726-2019 Tata Cara Perencanaan Ketahanan Gempa Struktur Bangunan Gedung dan Non Gedung, SNI 2847-2019 Persyaratan Beton Struktural untuk Bangunan Gedung, SNI 1729-2015 Spesifikasi untuk Bangunan Gedung Baja Struktural, dan SNI 1727-2020 Desain Beban Minimum dan Kriteria Terkait untuk Bangunan

Perancangan akan dimulai dari interpretasi data tanah dari pengujian, penentuan kelas tapak, penentuan sistem struktur, dan perhitungan kurva spektrum respon untuk analisis beban dinamis gempa. Desain berlanjut ke struktur pendukung untuk purlin, truss, slab, balok, kolom, sambungan balok-kolom, balok pengikat, dan tangga. Kemudian untuk substruktur meliputi analisis likuifaksi, analisis jenis pondasi, daya dukung pondasi, perencanaan pondasi untuk struktur beton bertulang, dan analisis penurunan. Keluaran dari perancangan adalah gambar konstruksi, dimana gambar ini akan digunakan untuk pekerjaan manajemen biaya dan waktu. Pekerjaan tersebut meliputi pembuatan work breakdown structure, quantity take-off, dan analisa unit price cost. Kemudian, dengan bantuan Microsoft Project, analisis pekerja dan sumber daya dapat dilakukan. Ini termasuk memaksimalkan pekerja dan sumber daya untuk mendapatkan biaya termurah dan durasi kerja tersingkat. Pada akhirnya, karya tersebut disajikan dalam S-Curve.

Hasil desain pada proyek ini untuk struktur penyangga adalah Purlin C125x50x20x2, Truss 2L90x90x7, 2 sambungan baut D16 mm, sag rod D10 mm, dan jangkar D18mm L150 mm. Untuk pelat lantai akan digunakan 8 jenis two-way dengan tebal 1,5 cm, ukuran balok 50 x 50 cm, ukuran kolom 65 x 65 cm, tebal anak tangga 100 cm, dan tebal landing slab 3 cm. Substruktur menggunakan pondasi tiang bor dengan kedalaman 16 m dan 4 tipe. Ketebalan pile cap adalah 1 meter.

Analisis biaya dan waktu menunjukkan bahwa pembangunan gedung akan memakan waktu 1080 hari dan biaya Rp41.224.131.730,39

Kata kunci: perancangan, struktur, geoteknik, manajemen biaya dan waktu.

ABSTRACT

Yogyakarta City, as a capital city that is known as “student city” and “tourism city”, attracts many people from many regions to study or live in Yogyakarta. It makes the city to become more crowded in small area. Besides that, as a city that is located in Ring of Fire, Yogyakarta is very potential to earthquake damage. Therefore, the building is expected to have resistance for earthquake and have long live period. In small area, an alternative beside housing area is flat because it can accommodate more people in smaller area. However, the taller the building, the more it’s vulnerable to earthquake. Therefore, the flat must be designed earthquake resistance by using reinforced concrete of Special Moment Resisting Frame System (*Sistem Rangka Pemikul Momen Khusus*)

The building will have size of 28 x 96 m2 and 5 level story. It is located in Ki Ageng Pamanahan Street, Yogyakarta City, Special Region of Yogyakarta. The total site area is 8,350 m2. Each story has typical 4 meters height. The building uses sustainable approach by using green material for green roof and fasad for the architectural side. The size of the building is considerably large and it serve as residential area, so the load is a great deal.

The references that will be used for the earthquake resistance building are SNI 1726-2019 *Tata Cara Perencanaan Ketahanan Gempa Struktur Bangunan Gedung dan Non Gedung*, SNI 2847-2019 *Persyaratan Beton Struktural untuk Bangunan Gedung*, SNI 1729-2015 *Spesifikasi untuk Bangunan Gedung Baja Struktural*, and SNI 1727-*2020 Beban Desain Minimum dan Kriteria Terkait untuk Bangunan*

The design will begin from interpreting soil data from test, determining site class, determining the structure system, and calculate the response spectrum curve for dynamic load analysis of earthquake. The design continues to super structure for purlin, truss, slab, beam, column, beam-column joint, tie beam, and stair. Then, for the substructure it encompasses liquefaction analysis, foundation type analysis, foundation bearing capacity, foundation design for reinforced concrete structure, and settlement analysis. The output of the design is construction drawing, where this drawing will be used for cost and time management work. The work includes making work breakdown structure, quantity take-off, and unit price cost analysis. Then, by the help of Microsoft Project, the analysis for workers and resources can be done. It includes to maximize the workers and resources to have cheapest cost and shortest duration of work. At the end, the work is presented in S-Curve.

The design result in this project for super structure are Purlin C125x50x20x2, Truss 2L90x90x7, 2 bolt connection D16 mm, sag rod D10 mm, and anchor D18mm L150 mm. For slab will use 8 types of two way that has thickness of 1.5 cm, the beam size is 50 x 50 cm, the column size is 65 x 65 cm, the stairs thickness is 100 cm, and the landing slab thickness is 3 cm. The substructure uses bore pile foundation with depth of 16 m and 4 types. The pile cap thickness is 1 meter.

The cost and time analysis shows that the building construction will take 1080 days and cost of Rp41,224,131,730.39

Keywords: design, structure, geotechnic, cost and time management

STATEMENT

We, the undersigned below,

Student's Name 1 : Bernardinus Sandiko Pinayungan

Student's Number : 191317915

Student's Name 2 : Muhammad Reza Ramadhani Syahdaputra

Student's Number : 191317762

Truly declare that the Final Project with the title:

"SIMPLE FLATS FOR RENTAL IN YOGYAKARTA CITY WITH A SUSTAINABLE ARCHITECTURE APPROACH IN YOGYAKARTA CITY FROM STRUCTURAL, GEOTECHNICAL, AND COST AND TIME MANAGEMENT ASPECTS"

is an original work and is not the result of plagiarism from the work of others. We, the undersigned, contribute to this Final Project in the same proportion. Thus, we make this statement as a complement to this Final Project document.

Yogyakarta, 17th July 2023

(Bernardinus Sandiko Pinayungan)

(Muhammad Reza Syahdaputra R)

VALIDATION

Final Project Report

DESIGN OF SIMPLE FLATS WITH SUSTAINABLE ARCHITECTURE APPROACH IN YOGYAKARTA CITY FROM STRUCTURAL, GEOTECHNICAL, AND COST AND TIME MANAGEMENT ASPECTS

Made By:

Bernardinus Sandiko Pinayungan	191317915
Muhammad Reza Syahdaputra R.	191317762

Checked by:

Lecturer 3 TAPI 2	Lecturer 2 TAPI 2	Lecturer 1 TAPI 1
(Dr. Nectaria Putri Pramesti, S.T., M.T.)	(William Wijaya, S.T., M.Eng.)	(Johan Ardivanto, S.T., M.Eng.)
NIDN: 0519078003	NIDN: 0529039402	NIDN: 0503069301

Approved by:
Final Project's Supervisor
Yogyakarta, 02 February 2023

(Dr. Eng. Luky Handoko, S.T., M.Eng.)
NIDN: 0518108501

Validated by:

Head of Civil Engineering Department

FAKULTAS TEKNIK
UNIVERSITAS ATMA JAYA YOGYAKARTA

(Dr. Ir. Imam Basuki, M.T.)
NIDN: 0506046601

VALIDATION

Final Project Report

DESIGN OF SIMPLE FLATS WITH SUSTAINABLE ARCHITECTURE APPROACH IN YOGYAKARTA CITY FROM STRUCTURAL, GEOTECHNICAL, AND COST AND TIME MANAGEMENT ASPECTS

Made By:

Bernardinus Sandiko Pinayungan
191317915

Muhammad Reza Syahdaputra Ramadhani
191317762

Has been examined and approved by:

Name		Signature	Date
Leader	: Dr. Eng. Luky Handoko, S.T., M.Eng.		14 July 2023
Secretary	: Baskoro Abdi Praja, S.T., M.Eng.		04 July 2023
Member	: Ir. AY. Harijanto Setiawan, M.Eng., Ph.D.		04 July 2023

PREFACE

All praise to God Almighty because of Him the author can carry out and be able to complete the Infrastructure Design Final Project Report (TAPI) properly and on time. The implementation of Final Project Infrastructure Design is carried out to directly practice the existing knowledge in a design practice so that students are expected to be able to apply the theoretical knowledge that has been taught previously. This report was prepared to meet the graduation requirements for the Bachelor of Civil Engineering Study Program, Faculty of Engineering, Universitas Atma Jaya Yogyakarta. In writing this report, the writing of this report was able to run smoothly because of the many assistances and directions as well as information about the implementation of TAPI. So that the author does not forget to thank:

1. God Almighty, because of His blessings and grace, we were able to carry out and compile the Final Infrastructure Design Report properly.
2. Mr. Dr. Eng. Luky Handoko, S.T., M. Eng., as the Dean of the Faculty of Engineering, as well as the author's Supervisor.
3. Mrs. Vienti Hadsari, S.T., M. Eng., MECRES., Ph.D., as Head of the Civil Engineering Study Program at Universitas Atma Jaya Yogyakarta.
4. Mr. Johan Ardianto, S.T., M. Eng., as a Lecturer at the Final Project Infrastructure Design 1 on Structure Part at Universitas Atma Jaya Yogyakarta.
5. Mr. William Wijaya, S.T., M. Eng., as a Lecturer at the Final Project Infrastructure Design 2 on Geotechnic Part at Universitas Atma Jaya Yogyakarta.
6. Mrs. Dr. Nectaria Putri, S.T., M.T., as a Lecturer at the Final Project Infrastructure Design 2 on Project Management Part at Universitas Atma Jaya Yogyakarta.
7. Friends of the Final Project Infrastructure Design group and other friends as well as all those who have supported the writer who cannot be mentioned one by one.

In conclusion, we hope this report can provide insight and benefit to readers, especially Civil Engineering students at Universitas Atma Jaya Yogyakarta for the perfection of the next report.

TABLE OF CONTENTS

TABLE OF FIGURES

LIST OF TABLES