YOGYAKARTA PUBLIC LIBRARY BUILDING DESIGN PRACTICE

Final Project Report

As one of the requirements for achieving a bachelor's degree from
Universitas Atma Jaya Yogyakarta

By:

RAINER KAROLAN	**191317593**
MALEAKHI H A HUTABARAT	**191317776**

INTERNATIONAL CIVIL ENGINEERING PROGRAM

DEPARTEMENT OF CIVIL ENGINEERING

FACULTY OF ENGINEERING

UNIVERSITAS ATMA JAYA YOGYAKARTA

YOGYAKARTA

2022/2023

INTISARI

Laporan Tugas Akhir yang disusun oleh penulis ini bertujuan untuk merancang struktur atas bangunan, struktur bawah bangunan dan manajemen biaya waktu Gedung Perpustakaan Umum dengan beton bertulang yang dapat menahan beban beban gravitasi dan beban gempa.

Perancangan Perpustakaan Umum 3 lantai ini menggunakan Sistem Rangka Pemikul Momen Khusus (SPRMK), dengan kategori resiko bangunan II dan desain seismik D. Elemen struktur yang dirancang dalam laporan ini dimulai dari pelat, balok, kolom, tangga serta fondasi, ditambah pembuatan manajemen biaya waktu. Beton yang digunakan memiliki fc' = 35 Mpa, serta tulangan baja BJ 37 yang memiliki fy = 240 Mpa. Perancangan bangunan mengikuti acuan Pembebanan Minimum untuk Bangunan dan Struktur Lain pada SNI 1727:2020, Prosedur Perancangan Bangunan untuk Struktur Beton pada SNI 2847:2019, Spesifikasi untuk Bangunan Struktur Baja pada SNI 1729:2020 serta Prosedur Perancangan Bangunan untuk Struktur Baja SNI 03-1729-2002. Software bantu yang digunakan dalam perancangan struktur bangunan menggunakan ETABS, AutoCAD dan Microsoft Project.

Proses perancangan diawali dengan perhitungan beban gravitasi, dimulai dari Beban Mati yang berarti berat dari struktur itu sendiri (Pelat, Kolom, Balok, Atap, Tangga) berdasarkan material dan dimensi nya. Selain itu ada beban mati tambahan yang berasal dari komponen non-struktural seperti arsitektural dan MEP yang tersambung dalam struktur bangunan. Contoh dari beban mati tambahan adalah lantai keramik, perkabelan, perpipaan, jendela, pintu, bingkai pintu dan bingkai jendela. Dan terakhir yakni beban hidup yang datang dari manusia atau barang yang bisa berpindah tempat, dimana sesuai SNI 1727:2013 beban hidup bernilai 4.79 kN/m2. Setelah perhitungan beban gravitasi, dilanjutkan dengan perhitungan beban gempa. Lalu dilanjut perhitungan beban gabungan, dimana menurut SNI 1726:2019, Beban gabungan dihitung dengan rumus 1.2DL + 1.6LL, dan khusus untuk atap ada tambahan beban angin sebesar 0.5WL. Tebal pelat yang digunakan dari pelat 1 sampai pelat 8 adalah 120 mm. Pelat 2 merupakan pelat dua arah, sementara pelat lainnya merupakan pelat satu arah. Balok yang digunakan memiliki dimensi 6000 x 500 x 250 mm3. Untuk tumpuan dan lapangan 300 x 150 mm serta 500 x 500 untuk balok sloof. Tulangan tumpuan atas dan bawah menggunakan 4D-22, Tulangan tumpuan tengah menggunakan 2D-22. Tulangan lapangan atas dan bawah menggunakan 3D-22, serta tulangan lapangan tengah menggunakan 2D-22. Untuk tulangan stirrups tumpuan menggunakan 2D10-40 serta tulangan stirrups lapangan menggunakan 2D10-80. Dimensi Kolom yang digunakan 500 x 500 mm2, dengan tulangan Longitudinal 12D-22, tulangan tumpuan transversal pada sumbu lemah 6D10-120 dan pada sumbu kuat 6D10-120. Tulangan lapangan transversal pada sumbu lemah 2D10-130 dan pada sumbu kuat 2D10-130. Pada tangga, tulangan utama yang digunakan D13-250 dan tulangan penyusutan digunakan D8-250. Fondasi yang digunakan menggunakan bore pile dengan diameter 40 cm menggunakan tulangan 10D22-200 dan 22D22-200

Kata Kunci : Perancangan, pelat, balok, kolom, tangga, fondasi, bored pile.

ABSTRACT

The final project report prepared by this author aims to design the upper structure of the building, the lower structure of the building and time cost management of the Public Library Building with reinforced concrete that can withstand gravity loads and earthquake loads.

The design of this 3-storey Public Library uses the Special Moment Bearing Frame System (SPRMK), with building risk category II and seismic design D. The structural elements designed in this report start from slabs, beams, columns, stairs and foundations, plus time cost management. . The concrete used has fc' = 35 Mpa, and steel reinforcement BJ 37 which has fy = 240 Mpa. The building design follows the Minimum Loading Reference for Buildings and Other Structures in SNI 1727:2020, Building Design Procedures for Concrete Structures in SNI 2847:2019, Specifications for Structural Steel Buildings in SNI 1729:2020 and Procedure for Planning Steel Structure for Buildings in SNI 03-1729-2002. Auxiliary software used in the design of building structures using ETABS, AutoCAD and Microsoft Project.

The design process begins with calculating the gravity load, starting from Dead Load which means the weight of the structure itself (Slabs, Columns, Beams, Roofs, Stairs) based on the material and its dimensions. In addition, there are additional dead loads that come from non-structural components such as architectural and MEP which are connected in the building structure. Examples of additional dead loads are tiled floors, wiring, plumbing, windows, doors, door frames and window frames. And lastly, the live load that comes from humans or goods that can move places, which according to SNI 1727:2013 the live load is 4.79 kN/m2. After calculating the gravity load, proceed with the calculation of the earthquake load. Then proceed with the calculation of the combined load, where according to SNI 1726:2019, the combined load is calculated by the formula 1.2DL + 1.6LL, and specifically for the roof there is an additional wind load of 0.5WL. The thickness of the plate used from plate 1 to plate 8 is 120 mm. Plate 2 is a two-way plate, while the other plate is a one-way plate. The beams used have dimensions of 6000 x 500 x 250 mm3. For support and span, 300 x 150 mm and 500 x 500 for sloof beams. The upper and lower supports use 4D-22, the middle support reinforcement uses 2D-22. Top and bottom field reinforcement using 3D-22, and midfield reinforcement using 2D-22. For support stirrups reinforcement using 2D10-40 and field stirrups reinforcement using 2D10-80. Dimensions Column used is 500 x 500 mm2, with 12D-22 longitudinal reinforcement, transverse support reinforcement on the weak axis 6D10-120 and on the strong axis 6D10-120. Transverse field reinforcement on the weak axis 2D10-130 and on the strong axis 2D10-130. In stairs, the main reinforcement used is D13-250 and the shrinkage reinforcement is used D8-250. The foundation used is bore pile with diameter of 40 cm using 10D22-200 and 22D22-200 reinforcement.

Keywords: Design, slabs, beams, columns, stairs, foundations, bored pile.

STATEMENT SHEET

We as explained below,

Student Name 1 : Rainer Karolan

NPM : 191317593

Student Name 2 : Maleakhi Haholongan Atnel Hutabarat

NPM : 191317776

Assure that Final Project with title of:

Yogyakarta Public Library Building Design Practice

Is an original work and not a result of plagiarism from works of other. We, the undersigned below contribute to the Final Project in equal proportion. Thus, we make this statement as a complement to this Final Project document.

Yogyakarta, 20 February 2023

(...Rainer Karolan.....)

(.MALEAKHI H.A HUTABARAT.....)

Materai
Rp 10.000,-
Dan ditanda
tangani

(.....)

iv

VALIDATION

Final Project Report

YOGYAKARTA PUBLIC LIBRARY BUILDING DESIGN PRACTICE

By:

Rainer Karolan 191317593

Maleakhi H A Hutabarat 191317776

Checked by:

Teaching Lecturer Three TAPI 2	Teaching Lecturer Two TAPI 2	Teaching Lecturer One TAPI 1
(Dr. Nectaria Putri Pramesti, S.T., M.T.)	(William Wijaya, S.T. M. Eng.)	(Johan Ardianto, S.T., M.Eng.)
NIDN: 0519078003	NIDN: 0529039402	NIDN: 0503069301

Approved by:
Final Project Supervisor
Yogyakarta, 2022

(Johan Ardianto, S.T., M.Eng.)
NIDN: 0503069301

Validated by:

Head of Civil Engineering Study Program

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

v

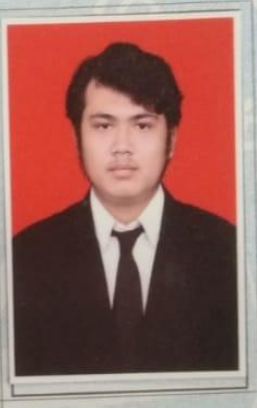
VALIDATION

Final Project Report

YOGYAKARTA PUBLIC LIBRARY BUILDING DESIGN PRACTICE

By:

Rainer Karolan
191317593



Maleakhi H A Hutabarat
191317776

Tested and Approved By:

Name		Signature	Date
Chairman	: Johan Ardianto, S.T., M.Eng.	.....	10/02/23
Secretary	: Baskoro Abdi Praja, S.T., M.Eng	.....	10/02/23
Member	: J. Dwijoko Ansusanto, Ir., M.T., Dr.	.....	10/02/23

vi

PREFACE

Big praise and thanks to God, with all of his graces and blessings, the authors can finish this Final Report as bachelor's degree requirement in International Civil Engineering Program, Faculty of Engineering, Universitas Atma Jaya Yogyakarta.

When making this Final Report, authors aware that guidance and helps from many parties, author can solve the problem that come across. For that, authors say many thanks to all the parties that helps when making this Final Report, it will be:

1. Vienti Hadsari, S.T., M. Eng., MECRES., as Head of Civil Engineering study program Universitas Atma Jaya Yogyakarta
2. Johan Ardianto, S.T., M.Eng., as Final Project Supervisor that guide, give suggestion, and instruction to authors when making this Final Report until finished.
3. All of Civil Engineering study program Universitas Atma Jaya Yogyakarta lecturer that guide authors when learning in university.
4. Both parents and family of authors, that give support and motivation to authors when making this Final Report.

Finally, authors aware that when making this Final Report, there is a lot of mistake and far from perfect. Authors take critics and suggestion to improve this Final Report.

Yogyakarta, 2022

Authors

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE LIST