

**REINFORCED CONCRETE DESIGN OF A TALL  
BUILDING WITH DUAL SYSTEM**

Final Project Report

In fulfilment of the requirement for the degree  
Bachelor of Civil Engineering

Made by:

YANY FATMAH SHARI

Student ID Number: 151316280



**INTERNATIONAL CIVIL ENGINEERING PROGRAM  
DEPARTMENT OF CIVIL ENGINEERING  
FACULTY OF ENGINEERING  
UNIVERSITAS ATMA JAYA YOGYAKARTA**

**2020**

## STATEMENT

I signed below stating that the final project with the title:

### **“REINFORCED CONCRETE DESIGN OF TALL BUILDING WITH DUAL SYSTEM”**

Has never been taken before as other's people works. The idea, data, and quote directly or non-directly derived from writings or ideas of other expressly provided in this final project. If it is proven later that this final project is result of plagiarism, the graduation certificate that I received will be cancelled and returned to Universitas Atma Jaya Yogyakarta.

Yogyakarta,

Who made the remarks,



Yany Fatmah Shari

**APPROVAL**

Final Project Report

**REINFORCED CONCRETE DESIGN OF A TALL BUILDING WITH  
DUAL SYSTEM FOR PT KINO TANGGERANG**

Made by:

**YANY FATMAH SHARI**

Student ID Number: 151316280

Has been checked and approved

Yogyakarta, *November 11, 2020*

Supervisor

**AM. Ade Lisantono, Ir., M.Eng., Dr., Prof.**

Department of Civil Engineering

Chairman



**FAKULTAS  
TEKNIK**

**A. Y Harijanto Setiawan, Ir., M.Eng., Ph.D.**

**APPROVAL**

Final Project Report




**REINFORCED CONCRETE DESIGN OF TALL BUILDING WITH  
DUAL SYSTEM FOR PT KINO TANGGERANG**

Made by:

YANY FATMAH SHARI

Student ID Number: 151316280

Has been examined and approved by:

	Name	Signature
Date		
Chairman	: AM. Ade Lisantono, Ir., M.Eng., Dr., Prof.	 .....
Member	: Yoyong arfiadi, Ir., M.Eng, Ph.D., Prof	 .....
Member	: J. Tri Hatmoko Ir., M.Sc.	 .....

## ACKNOWLEDGEMENT

Al-hamdu lillahi rabbil 'alamin, Allah gave me the best chance do greatest things to help me finish this final project, as my goal since I started to study for bachelor degree. The purpose of the final project is to complete the requirement of undergraduate program (S-1) in International Civil Engineering Program, Department of Civil Engineering, Faculty of Engineering, Universitas Atma Jaya Yogyakarta. I would not forget to express my deep gratitude towards:

1. AM. Ade Lisantono, Ir., M.Eng., Dr., Prof., as my final project supervisor for the support, assistance, advices, and patient. His willingness to give his time during the final project.
2. Johan Ardianto, S.T., M.Eng., as the Coordinator of International Civil Engineering Program for the endless support.
3. All the lectures and staffs in the Civil Engineering Department, both in academic and non-academic for the cooperation.
4. *Terima Kasih kepada orang tua yang atas cinta dan kasih sayang nya sampai detik ini.*
5. All of my friends in International Civil Engineering Program especially batch 2015 for the companionship and support.

Finally, the writer is fully aware that the report is far beyond perfect. Thus, both developing critic and suggestion are expected. Hopefully this report could be beneficial for the readers and the future alumnus.

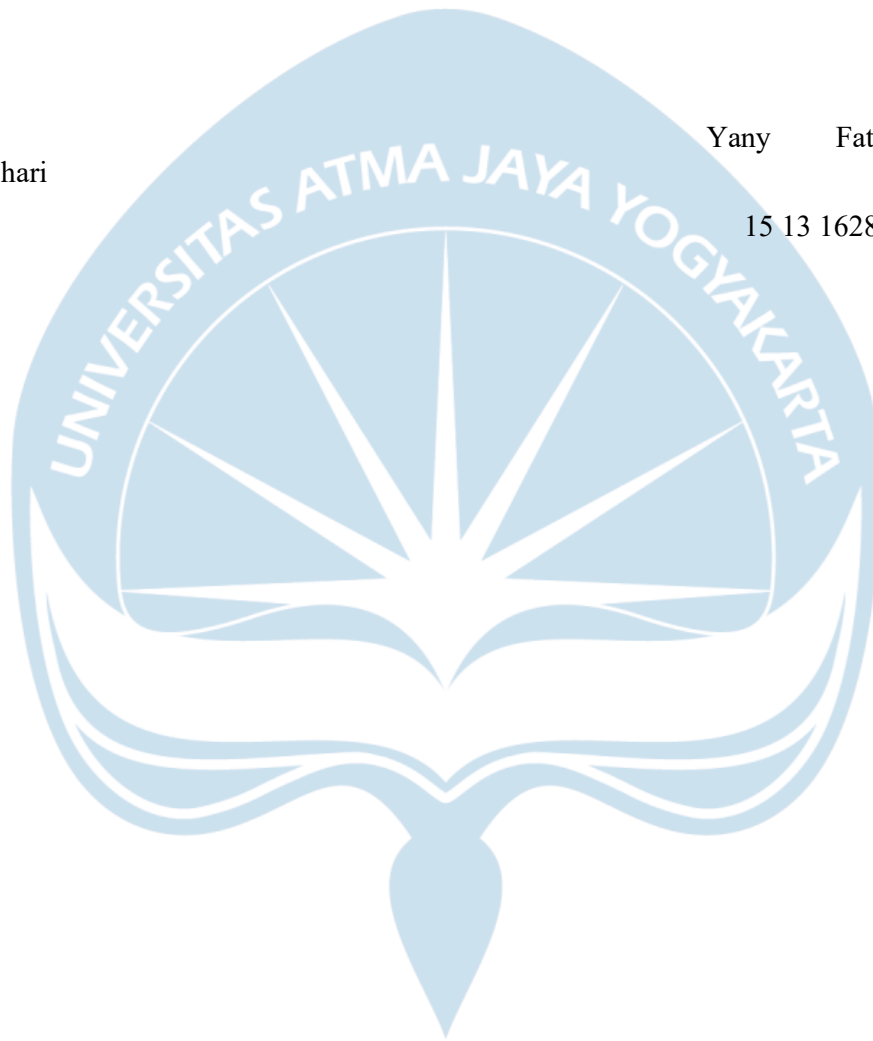
Yogyakarta, Agustus

2020

Shari

Yany Fatmah

15 13 16280





## TABLE OF CONTENT

TITLE PAGE .....	i
STATEMENT .....	ii
APPROVAL.....	iii
APPROVAL FOR EXAMINER.....	iv
ACKNOWLEDGEMENT .....	v
TABLE OF CONTENT .....	vii
LIST OF TABLES .....	x
LIST OF FIGURES .....	xi
LIST OF APPENDIX .....	xii
ABSTRACT.....	xiii
CHAPTER I: INTRODUCTION	
1.1. Background .....	1
1.2. Problem Statement .....	2
1.3. Problem Limitation .....	2
1.4. Final Project Originality.....	3
1.5. Objective .....	3
1.6. Benefit.....	3
CHAPTER II : LITERATURE REVIEW	
2.1. Tall Building .....	4
2.2. Lateral Load Resisting System .....	5
2.3. The Dual System .....	7
2.3.1 The dual system.....	7

2.3.2 Core wall .....	8
-----------------------	---

### CHAPTER III: BASIC THEORY AND METHOD

3.1. Required Strength (U).....	11
3.2. Designing Earthquake Load.....	12
3.2.1 Risk category building structure .....	13
3.2.2 Site Classification for Seismic Design.....	14
3.2.3 Mapped Acceleration Parameter.....	15
3.2.4 Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCER) Spectral Response Acceleration Parameters Based on SNI 1726:2012 .....	16
3.2.5 Design Spectral Acceleration Parameters.....	17
3.2.6 Seismic Design Category .....	17
3.2.7 Approximate Fundamental Period .....	19
3.2.8 Calculation of Seismic Response Coefficient.....	20
3.2.9 Seismic Base Shear .....	21
3.2.10 Number of Modes .....	21
3.3. Reinforcement Concrete Structure.....	12
3.3.1 Design Strength.....	21
3.3.2 Slab Design .....	22
3.3.2.1 One-way Slab.....	22
3.3.2.2 Two-Way Slab .....	23
3.3.3 Beam Design .....	24
3.3.3.1 Beam Dimension .....	24



3.3.3.2	Beam Dimension Longitudinal member reinforcement for beam .....	24
3.3.3.3	Transversal reinforcement for beam .....	25
3.3.4	Column Design .....	24
3.3.4.1	Column Dimension .....	25
3.3.4.2	Slenderness Column .....	25
3.3.4.3	Longitudinal reinforcement for column .....	26
3.3.4.4	Minimum flexure strength of column .....	27
3.3.4.5	Transversal reinforcement for column .....	27
3.3.5	Shear Wall .....	27
3.4.	Methodology .....	14
<b>CHAPTER IV: DESIGN CALCULATION</b>		
4.1.	Two Way Slab Design .....	30
4.1.1	Dimension Estimation .....	30
4.1.2	Detailing Calculation .....	32
4.2.	One Way Slab Design .....	45
4.2.1	Dimension Estimation .....	45
4.2.2	Detailing Calculation .....	46
4.3.	Primary Beam (Girder) .....	54
4.3.1	Dimension Estimation .....	54
4.3.2	Detailing Calculation .....	57
4.4.	Column	
4.4.1	Dimension Estimation .....	75

4.4.2	Detailing Calculation .....	83
4.5.	Core Wall Design.....	96
4.6.	Stairs Design .....	110
4.6.1	Stairs modelling .....	110
4.6.2	Detailing Calculation .....	113
4.7.	Diaphragm Design Analysis	
4.7.1	Diaphragm Design Procedure .....	119
4.7.2.	Diaphragm Design Calculation.....	124
<b>CHAPTER V: EARTHQUAKE ANALYSIS</b>		
5.1.	Risk Category.....	127
5.2.	Earthquake Main Factor.....	127
5.3.	Determining Ss and S1 Parameter .....	127
5.4.	Site Classification .....	128
5.5.	Site coefficient .....	128
5.6.	Category Design Seismic .....	129
5.7.	Structure system and structure parameter based on category design seismic .....	129
5.8.	Factor of Earthquake Response.....	132
5.9.	Mass Participation.....	133
5.10.	Earthquake shear force.....	134
5.11.	Structure Drift .....	135
5.12.	Dual System Check.....	137

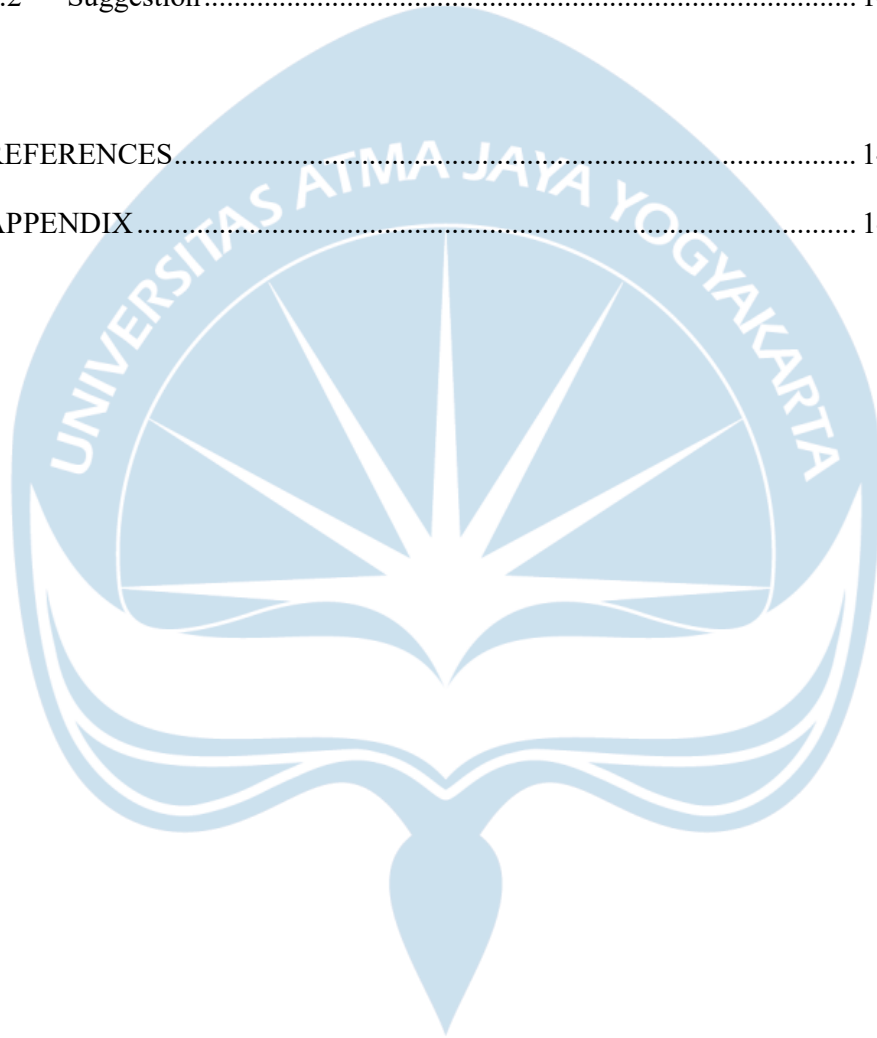
CHAPTER VI: CONCLUSION

6.1 Conclusion ..... 139

6.2 Suggestion ..... 140

REFERENCES ..... 142

APPENDIX ..... 143



## LIST OF TABLES

Table 2.1. Types of Lateral Load Resisting System .....	5
Table 2.2. Structural System Structural system for lateral load resisting concrete buildings.....	6
Table 2.3. Maximum drift of buildings subjected to entire ground motions in percentage %.....	7
Table 2.4. The Average for Maximum drift.....	8
Table 3.1. Risk Category.....	13
Table 3.2. Earthquake Main Factor.....	14
Table 3.3. Site Calsiffication.....	14
Table 3.4 Site Coefficient, $F_a$ .....	16
Table 3.5 Site Coefficient, $F_y$ .....	17
Table 3.6. Seismic Design Category Based on Short Period Response Acceleration Parameter.....	17
Table 3.7. Seismic Design Category Based on 1-S Period Response Acceleration Parameter.....	18
Table 3.8 Structure type based on Seismic design category .....	18
Table 3.9. Values of Approximate Period Parameters $C_t$ and $x$ .....	19
Table 3.10. Coefficient for Upper Limit on Calculated Period.....	20
Table 3.11. Reduction factors for design strength .....	21
Table 3.12. Minimum thickness for non-prestressed beam and one-way slab if deflection neglected.....	22
Table 3.13. for minimum slab without interior beam. ....	23
Table 4.1. Moment on Slab .....	32
Table 4.2. Summary Dimensions of Girder .....	57
Table 4.3. Calculation of Column.....	82
Table 4.4. Diaphragm design force .....	122
Table 4.5. Diaphragm design portion of i element in x-direction of 4th floor .....	122

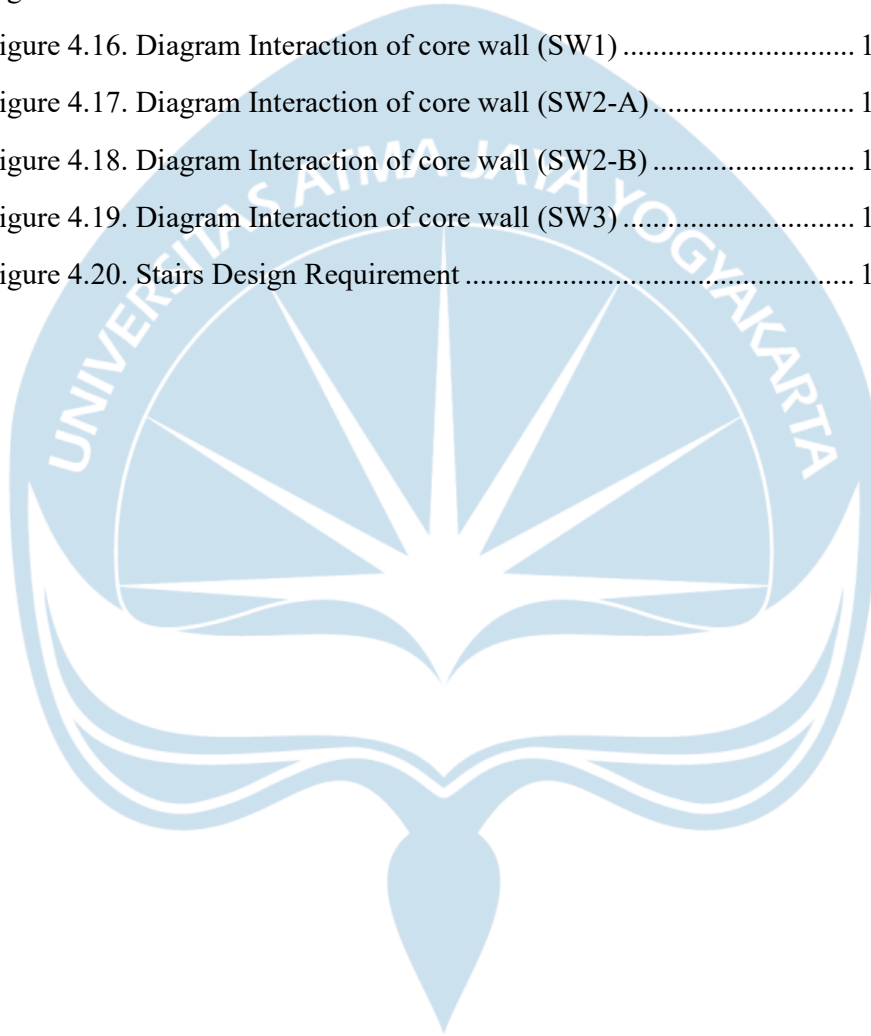
Table 4.6. Diaphragm design portion of i element in y-direction of 4th floor .....	123
Table 4.7. The final calculation of chord and collector reinforcing 4th floor.....	123
Table 4.8. Diaphragm design portion of i element in x-direction of 5th floor .....	124
Table 4.9. Diaphragm design portion of i element in y-direction of 5th floor .....	125
Table 4.10 The final calculation of chord and collector reinforcing 5th floor .....	126
Table 5.1. Risk Category.....	127
Table 5.2. Earthquake Main Factor.....	127
Table 5.3. Respond spectrum design from Etabs.....	130
Table 5.4. Mass Participation.....	133
Table 5.5. Load cases from Etabs .....	134
Table 5.7. Story drift of x-direction .....	135
Table 5.7. Story drift of y-direction .....	135
Table 5.8. Total drift of x-direction .....	136
Table 5.9. Total drift of y-direction .....	137



## LIST OF FIGURES

Figure 2.1. Classification of building height.....	4
Figure 2.2. Floor Plan .....	8
Figure 2.3. Core wall detail location.....	9
Figure 2.4. Deformation Patterns.....	9
Figure 2.5. Moment Resisting by Axial Loads in column .....	9
Figure 2.6. Cantilever Bending of Shear Wall.....	9
Figure 3.1. Flow Chart .....	29
Figure 4.1. Tributary Area for Two way Slab.....	30
Figure 4.2 Detail Reinforcing of Two way Slab.....	45
Figure 4.3 Tributary Area of One Way Slab.....	45
Figure 4.4 Detail Reinforcing of One way Slab.....	54
Figure 4.6. Tributary Area of Girder.....	54
Figure 4.7. Maximum Moment from Load Combination .....	75
Figure 4.8. Tributary Area of Column .....	75
Figure 4.9. Interaction of Beam-column connection of two beams G8 and column C7 .....	94
Figure 4.10. Detail of Beam-Column Connection.....	95
Figure 4.11. Detail of Column .....	96

Figure 4.12. Requirement of Boundary Element .....	101
Figure 4.13. Requirement for special boundary element if $h_w/l_w \leq 2.0$ ...	103
Figure 4.14. Detail Reinforcement of Shear Wall.....	105
Figure 4.15. Detail Reinforcement of Ties on Shear Wall.....	105
Figure 4.16. Diagram Interaction of core wall (SW1) .....	106
Figure 4.17. Diagram Interaction of core wall (SW2-A).....	107
Figure 4.18. Diagram Interaction of core wall (SW2-B) .....	107
Figure 4.19. Diagram Interaction of core wall (SW3) .....	109
Figure 4.20. Stairs Design Requirement .....	110





## LIST OF APPENDICES

Appendix 1 Research Questionnaire.....	39
Appendix 2 Data Analysis .....	44

