FINAL PROJECT

DESIGN OF SIX FLOORS BUILDING BASED ON BUILDING INFORMATION MODELLING (BIM) USING AUTODESK REVIT AND AUTODESK ROBOT STRUCTURAL ANALYSIS PROFESSIONAL

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CIVIL ENGINEERING STUDY PROGRAM
FACULTY OF ENGINEERING
UNIVERSITAS 17 AGUSTUS 1945 SURABAYA

2023

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Prepared as a Requirement for Obtaining a Bachelor of Engineering Degree (ST).
University of 17 Agustus 1945 Surabaya

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2023

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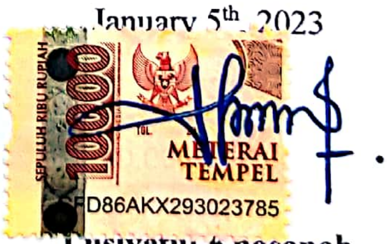

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FOREWORD

Praise is always presented to Allah SWT who has bestowed His grace and guidance, so that the author can complete the Final Project with the title "*DESIGN OF SIX FLOORS BUILDING BASED ON BUILDING INFORMATION MODELLING (BIM) USING AUTODESK REVIT AND AUTODESK ROBOT STRUCTURAL ANALYSIS PROFESSIONAL*". This Final Project was prepared to meet one of the conditions to obtain a Bachelor of Civil Engineering degree at the University of 17 Agustus 1945 Surabaya.

This Final Project has been compiled to the maximum and as well as possible. In the preparation of the Report, of course it is inseparable from the encouragement and assistance of various parties, the data obtained and in addition to literature books and journals and knowledge that has been obtained during the lecture. Therefore, of the completion of this Final Project Proposal, the author wants to say a big thank you to:

1. Beloved parents (Fatoni and Sugimah), brother (Dian Ari Saputra) and litle sister (Anis Raudhotul Jannah) the author, who have provided moral and material support and prayers.
2. Prof. Dr. Mulyanto Nugroho, M.M., CMA., CPA as Rector University of 17 Agustus 1945 Surabaya.
3. Dr. Ir. Sajiyo, M.Kes as Dean of Engineering Faculty University of 17 Agustus 1945 Surabaya.
4. Faradlillah Saves, ST.,MT as Head of Civil Engineering Departement University of 17 Agustus 1945 Surabaya.
5. Retno Trimurtiningrum, ST.,MT as Supervisor who has provided guidance, directions and instructions until the completion of the Final Task Proposal.
6. Indarwanto Hari Susilo as Project Manager of PT. Manajemen Konstruksi Utama which has provided access to data related to the literature study of Gloria Christian Billingual School Building, Grand Pakuwon Surabaya.
7. Friends in arm civil engineering batch of 2018 University of 17 Agustus 1945 Surabaya.
8. As well as friends and all parties that I cannot mention one by one, and have provided support, motivation, and assistance for the author can complete this Final Project Proposal.

Finally, the author realizes that this Final Project is still far from perfection, therefore the author expects constructive criticism and advice for improvement in the future. The author hopes that this Final Project can provide benefits and inspiration for the readers.

Surabaya,
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PERENCANAAN GEDUNG 6 LANTAI BERBASIS *BUILDING INFORMATION MODELLING* (BIM) MENGGUNAKAN *AUTODESK REVIT* DAN *AUTODESK ROBOT STRUCTURAL ANALYSIS PROFESIONAL*

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ABSTRAK

Dengan berkembangnya industri *Architecture, Engineering and Construction (AEC)* banyak sofware yang dikembangkan untuk memenuhi kebutuhan industri konstruksi dengan tujuan untuk meminimalisir *human eror* dikarenakan pengolahan data secara konvensional. BIM mengubah keseluruhan konsep desain atau perencanaan dengan memperkenalkan proses pengembangan desain dan dokumentasi konstruksi. Building Information Modelling (BIM) merupakan sebuah sistem, manajemen, metode, atau runtutan pengerjaan suatu proyek di bidang *Architecture, Engineering, and Construction (AEC)*.

Tujuan dari penelitian ini adalah untuk mengetahui bagaimana penerapan metode BIM dalam perencanaan sebuah gedung dan menggali keuntungan apa saja yang dapat diperoleh dalam penerapan BIM. Metode dalam penelitian ini dilakukan dengan merencanakan ulang salah satu gedung fasilitas pendidikan yang ada di Kota Surabaya menggunakan *Autodesk Revit* untuk desain serta *Robot Structural Analysys Profesional* untuk analisis struktur. Penelitian ini menghasilkan desain optimum elemen balok dan kolom serta perbandingan terhadap metode BIM dan metode konvensional. Dari hasil analisis dan pembahasan dapat disimpulkan bahwa penggunaan *software* penunjang metode BIM lebih efisien daripada konvensional, BIM juga memfasilitasi proses desain dan konstruksi terintegrasi untuk mencapai hasil yang lebih baik. Namun, penggunaan metode BIM perlu dilakukan pengecekan ulang terhadap SNI dalam mendesain sebuah bangunan.

Kata Kunci : *Autodesk Revit, Autodesk Robot Structural Analysis Profesional (RSAP), Building Information Modelling (BIM), Integrasi.*

DESIGN OF SIXS FLOORS BUILDING BASED ON BUILDING INFORMATION MODELLING (BIM) USING AUTODESK REVIT AND AUTODESK ROBOT STRUCTURAL ANALYSIS PROFESSIONAL

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ABSTRACT

With the development of the Architecture, Engineering and Construction (AEC) industry, a lot of software has been developed to meet the needs of the construction industry with the aim of minimizing human error due to conventional data processing. BIM changes the whole concept of design or planning by introducing design development processes and construction documentation. Building Information Modeling (BIM) is a system, management, method, or sequence of work on a project in the field of Architecture, Engineering, and Construction (AEC).

The purpose of this research is to find out how to apply the BIM method in planning a building and explore what advantages can be obtained in implementing BIM. The method in this research was carried out by re-planning one of the existing educational facility buildings in the city of Surabaya using *Autodesk Revit* for design and *Robot Structural Analysys Profesional* for structural analysis. This research resulted in the optimum design of beam and column elements as well as comparisons with the BIM method and conventional methods. From the results of the analysis and discussion it can be concluded that the use of supporting software for the BIM method is more efficient than conventional, BIM also facilitates integrated design and construction processes to achieve better results. However, the use of the BIM method needs to be re-checked against with SNI in designing a building.

Keywords: Autodesk Revit, Autodesk Robot Structural Analysis Profesional (RSAP), Building Information Modelling (BIM), Integration.

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A = The area of the structure (m^2)
A = Whitney tension beam height
A’s = Compression reinforcement area (mm^2)
Ach = Net area of column shear reinforcement (mm^2)
Ag = The cross-sectional area of the beam
As = Tensile reinforcement area (mm^2)
Ash = Area of column shear reinforcement
b = Width dimensions of beams or columns (m)
b_w = width of shear wall segment body
c = Neutral line height
Cc = Concrete pressure
Cd = Deflection magnification factor
Cs = Seismic response coefficient
Cu = The coefficient for the upper bound on the calculated period
d = The distance from the extreme compression fiber to the center of tension reinforcement (mm)
d’ = The distance from the extreme compression fiber to the center of the compression reinforcement (mm)
DL = Dead load (kg/m^2)
Dl = Main reinforcement diameter (mm)
dt = Maximum displacement value
Eh = Horizontal seismic loads
Es = Elastic modulus
Ev = Vertical seismic loads
F’c = Concrete compressive strength (Mpa)
Fa = Site Coefficient based on Sa value
Fv = Site Coefficient based on S1 grade
fy = Melt stress
g = Gravity acceleration (9,8 m/s^2)
h = Height dimensions of beams or columns (m)
hsx = Height between levels (mm)
hx = Height of each floor
Ie = Earthquake Priority Factor
KDG = Earthquake design category
LL = live load (kg/m^2)
Ln = The net length of the beam measured from the face of the column

Mn = Nominal moment
Mnb = The total number of moments that occur in the beam
Mnc = The total number of moments that occur in the column

Mpr- = The negative moment capacity of the beam due to alternating earthquakes is wrong one beam support (1.25 fy tensile steel grade)
Mpr+ = The positive moment capacity of the beam due to alternating earthquakes is wrong one beam support (1.25 fy tensile steel grade)
Mu = Ultimate moment of beam or column
N = Number of levels
Pu = Ultimate axial force
Px = Total vertical design load on and above the story
Q_E = Earthquake load
Qu = The factored load is a combination of dead and live loads
R = Response modification coefficient
Rn = Coefficient of resistance value
s = Bar spacing (mm)
S_1 = The acceleration of the bedrock over a period of 1 second
Sa = Response spectra acceleration
S_{D1} = Determine seismic design categories based on response parameters acceleration over a period of 1 second
S_{DS} = Determine seismic design categories based on response parameters acceleration over short periods
SF = scale factor
S_{M1} = Parameter of the MCE spectral response acceleration in the 1 second period adjusted for the effect of site class
S_{MS} = Parameter of the MCE spectral response acceleration in the short period adjusted for the effect of site class
S_S = Acceleration of bedrock over short periods
T = Period of fundamental vibration of the structure
T_0 = Period at 0 seconds
Ta = Approach fundamental period
TL = long period
Ts = The distance between the stirrup reinforcement and the base of the beam
TS = Period in s seconds
V = Seismic base shear force (kN)

Vc = Strength value of concrete
Ve = The ultimate shear force of the beam used to design the reinforcement stirrups on SRPMK beams (kN)
Vn = Nominal shear force (kN)
Vs = Shear reinforcement style
Vt = The basic shear force of the analysis of variance
Vu = Ultimate shear force obtained from the software (N)
Vx = Design seismic shear force at level x
Vtx = The design value of the base shear due to seismic x
Vty = The design value of the seismic-induced base shear y
W = Weight (kg)
Δ = Story Displacemet
Δa = Permit level drift between floors
Δt = Transfer targets
Δx = Improved center of mass deflection
Δxe = Deflection at the indicated location (mm)
β = Ratio of shear requirement to shear capacity for grade x and x-1
θ = Stability coefficient
Øs = Diameter of stirrup reinforcement (mm)
ρ = Reundancy factor
Ω0 = More powerful factor
Ø = Reduction factor (based on SNI)