

UNDERGRADUATE THESIS

**IMPLEMENTATION OF BUILDING INFORMATION
MODELING (BIM) FOR SIMULATION AND OPTIMIZATION
OF SUSTAINABLE BUILDING DESIGN: PARAMETRIC
SENSITIVITY ANALYSIS IN INDONESIA**



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**CIVIL ENGINEERING STUDY PROGRAM
FACULTY OF ENGINEERING
UNIVERSITAS INDO GLOBAL MANDIRI**

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Submitted as a requirement to obtain the Bachelor of Engineering (ST) degree in the Civil Engineering Study Program, Faculty of Engineering, Universitas Indo Global Mandiri



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APPROVAL PAGE

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AGREEMENT PAGE

This scientific paper in the form of a Undergraduate Thesis report entitled "Implementation of Building Information Modeling (BIM) for Simulation and Optimization of Sustainable Building Design: Parametric Sensitivity Analysis in Indonesia" has been defended before the Undergraduate Thesis Examining Team of the Civil Engineering Study Program, Faculty of Engineering, Universitas Indo Global Mandiri (UIGM) on August 5, 2026.

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MOTTO AND DEDICATION

"Commit your work to the Lord, and your plans will be established"

Proverbs 16:3

Motto:

"Do your best, let God do the rest"

(Author)

Dedication:

With the wisdom of God, the author dedicates this Undergraduate Thesis to:

1. To myself, thank you for fighting until the very end. Thank you for persevering through all the obstacles in this life.
2. The author's parents, beloved father and mother who gave birth to him, raised him, and educated him with endless love, always provided moral and material support so that the author could complete this study.
3. To the author's two siblings, thank you for your support and encouragement from childhood to adulthood.
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INTEGRITY STATEMENT LETTER
FM-PM-10.3/13-02/R0

I hereby declare that this undergraduate thesis does not contain any work that has previously been submitted to obtain a bachelor's degree at any university. To the best of my knowledge, there is no work or opinion written by another person, except those properly cited in this manuscript and listed in the References/Bibliography.

If any plagiarism is found, I am willing to accept the consequences in the form of academic sanctions and other penalties imposed by the authorities in accordance with applicable provisions, regulations, and laws.

Palembang, August 14, 2026



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PUBLICATION CONSENT STATEMENT

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For the sake of scientific development, I agree to grant the Supervisor and the Universitas Indo Global Mandiri (UIGM) Non-exclusive Royalty Free Rights to my scientific work entitled:

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ABSTRACT

IMPLEMENTATION OF BUILDING INFORMATION MODELING (BIM) FOR SIMULATION AND OPTIMIZATION OF SUSTAINABLE BUILDING DESIGN: PARAMETRIC SENSITIVITY ANALYSIS IN INDONESIA

The construction industry contributes up to 39% of total global carbon emissions, making the transition to green building design crucial. This study aims to apply Building Information Modeling (BIM) to simulate and optimize sustainable building design through a parametric sensitivity analysis approach in Indonesia. The evaluation was conducted on two dominant building typologies, namely Type 45 Residential Houses and 3-story Commercial Shophouses, taking into account the humid tropical climate context of Palembang City referring to the SNI 6389:2020 standard. This study uses three independent variables of building facades: Window-to-Wall Ratio / WWR (10%, 20%, 30%), Floor-to-Ceiling Height (3.2 m; 3.6 m; 4.0 m), and the type of solid wall (red brick, concrete block, lightweight brick/AAC), which resulted in 27 alternative design combinations. Three-dimensional modeling was executed using Autodesk Revit software, while building performance was calculated using the EnergyPlus simulation engine and Autodesk Forma Carbon Insights. The output parameters are focused on Energy Use Intensity (kWh/year), Peak Cooling Load (kW), and Operational Carbon Emissions (kg CO₂/year). To resolve conflicts of interest between thermal parameters, this study applies a Multi-Criteria Decision-Making (MCDM) framework with a Weighted Sum Method (WSM) approach to determine the most optimal design variation in reducing space cooling loads and environmental emission impacts.

Keywords: Building Information Modeling (BIM), EnergyPlus, Parametric Design, Energy Efficiency, Weighted Sum Method (WSM).

FOREWORD

With full wisdom, the author expresses gratitude to the presence of God Almighty for all His love and grace, so that the author can complete this Undergraduate Thesis report **Implementation of Building Information Modeling (BIM) for Simulation and Optimization of Sustainable Building Design: Parametric Sensitivity Analysis in Indonesia** This report was prepared to fulfill one of the requirements for completing the Undergraduate Thesis course in the Civil Engineering Study Program, Faculty of Engineering, Universitas Indo Global Mandiri.

The author would also like to express his gratitude to the parties who have provided much assistance in the preparation of the Undergraduate Thesis, including:

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6. Mrs. Ir. Debby Sinta Devi, ST, MT as Head of the Civil Engineering Study Program, Universitas Indo Global Mandiri.
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9. I would also like to thank our fellow civil engineering students from the class of 2022 who have helped and participated in the preparation of this report.

The author realizes that this Undergraduate Thesis still has various shortcomings and errors. Therefore, with all humility, the author sincerely welcomes constructive suggestions and criticisms, as well as guidance, for the improvement of this work in the future.

Palembang, August 14, 2026

Author

A handwritten signature in black ink, appearing to be 'SJB' with a stylized flourish.

Samuel Jeremia B

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