Comparisonal Analysis of RAB (Cost Budget Plan) Metode Konvesional with Metode BIM (Building Information Modelling) (Studi Kasus Gedung Kuliah Tiga Lantai di Yogyakarta)

Anton Ainurrofiq

Department of Civil Engineering, Faculty of Engineering, Sarjanawiyata Tamansiswa University, Yogyakarta
**Corresponding author: anton2017ust@gmail.com*

ABSTRACT
Cost Budget Plan (RAB) is Calculation of the amount of costs required for materials, tools and wages, in volume units, time, and density well as other cost, related to the implementation of work on the project. The purpose of this research is calculate and know the results volume ratio of a software Building Infomation Modelling (BIM) that is One of which is Tekla Structure with conventional calculations. Result of conventional volume calculation and Tekla Structure there are some differences that is: made of concrete, iron, Steel WF, and Light steel. Then the cost is less Rp. 250.889.321,01 (DTwo Hundred Fifty Million Eight Hundred Eighty Nine Thousand Three Hundred Twenty One Point Zero One Rupiah) of cost RAB plenner (Conventional).

Keywords: *RAB, BIM, Tekla Structure Student Version 2020*

1. INTRODUCTION

Research purposes

The objectives of this research are:

1. To find out the comparison of the volume of the results of the conventional method with the method BIM
2. To find out the difference between the results of the volume of iron, concrete and steel for software Tekla Structure with the conventional method
3. To see the comparison of the percentage of the conventional method with the method BIM iron volume, concrete, and iron WF and cost.

Scope of problem

Limitation of problems in the implementation of the construction work of the Three-Story Lecture Building in Yogyakarta there are many things to review, that is:

1. The modeling carried out is to review the Three-Story Lecture Building project in Yogyakarta.
2. Modeling done with the application Tekla Structures Student Version 2020.
3. Volume comparison calculations only review based on the output of the application Tekla Structures Student Version 2020 with conventional methods.
4. Project management that is reviewed only in terms of costs, especially structures, namely iron, concrete and steel materials.
5. Does not perform structural analysis calculations.
6. Not counting Architectural work and MEP (Mechanical Electrical and Plumbing)
7. Not reviewing project scheduling, heavy equipment needs, worker needs, worker wages, and preparatory work.

Literature review

The author states that this research comes from the author's own thoughts, To the author's knowledge, no work has been published by other people or other parties, if there is work or research from other people or other parties except as a general reference and the source will be clearly stated. These references include: Kurnia Fatonah, Dwi Novi Wulansari, [1]entitled Estimasi Anggaran Biaya Struktur Proyek Pembangunan Hotel Quad Makassar Menggunakan Metode SNI, Farras Faridah Putri [2]entitled Evaluasi Anggaran Biaya Struktur Dan Arsitektur Menggunakan Metode Building Information Modeling (BIM), Ranti Ramadiaprani, [3]entitled Aplikasi Building Information Modeling (BIM) Menggunakan Software Tekla Structures 17 Pada Konstruksi Gedung Kuliah Tiga Lantai Fahutan IPB, Bogor, Abd Rahman, 2013 entitled Perbandingan Estimasi Anggaran Biaya Antara Metode SNI Dan BOW Pada Proyek Pembangunan Gedung Joang / Legiun Veteran Republik Indonesia, Abd Rahman [4] entitled Perbandingan Estimasi Anggaran Biaya Antara Metode Sni Dan Bow Pada Proyek Pembangunan Gedung Joang / Legiun Veteran Republik Indonesia, Cinthia Ayu Berlian P., dkk., [5] entitled Perbandingan Efisiensi Waktu, Biaya, Dan Sumber Daya Manusia Antara Metode Building Information Modelling (BIM) Dan Konvensional (Studi Kasus: Perencanaan Gedung 20 Lantai).

Theoretical basis

Buget Plan (RAB)

The project budget plan is calculation of the total cost for the needs of wages and materials, as well as the costs required for project implementation. The general cost budget plan can be concluded as follows

$RAB = (Volume)\ x$ Labor unit price…… (1)

Conventional Methode

On planning RAB generally use the conventional method, which is a general method or often used for calculations RAB by calculating the volume of work by multiplying the length times the width times the height which usually uses applications such as Microsoft Excel as the calculation of each volume and cost, AutoCAD for design 2D from a project, Calculation of the load with manual calculations or the help of Ms. Excel, and Ms. Project as time schedule. Where it takes longer because it requires a lot of software in the process.

Methode BIM (Build Informasi Modelling)

BIM is a unit system, methode or technology that combines some important information in doing design, construction, maintenance. integrated in 3D, 4D, up to 5D modeling.

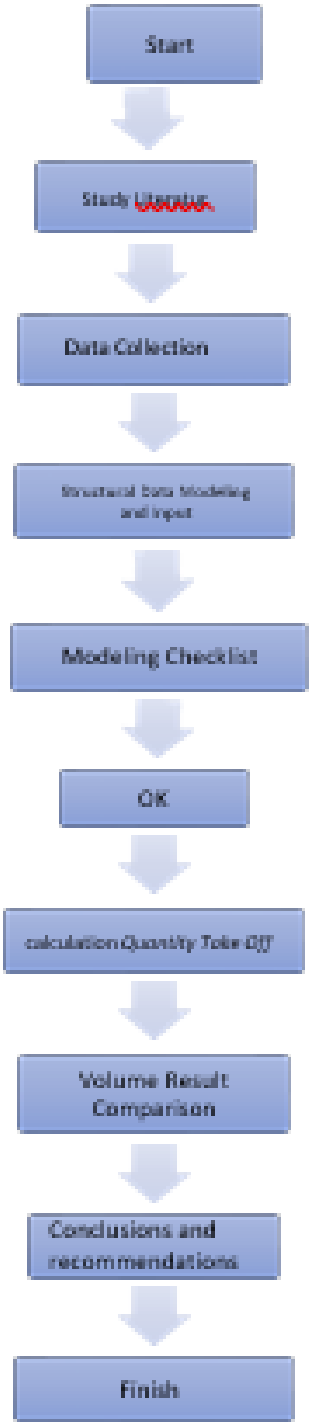
2. METHODS

Research methodology

In this research it is necessary step research from the final project entitled “Analisis Perbandingan RAB (Rencana Anggaran Biaya) Metode Konvesional Dengan Metode BIM (Building Information Modelling)” This is intended to make it easier for researchers to complete this research. This research only covers the analysis of the volume calculation results from the conventional method and the method BIM This research uses standard AHSP (Analisis Harga Satuan Pekerjaaan) 2013, and use software Tekla Structures 2020 Student Version sebagai software calculation of work volume.

Research scheme that explains the research design flow, an analysis plan to support this final project, a schematic of this research flow is made in order to get an idea step In this research process, the following is a schematic chart of the research flow in the final project entitled Comparative Analysis RAB (Rencana Anggaran Biaya) Methode Conventional white Methode BIM (Building Information Modelling).

Research Flowchart

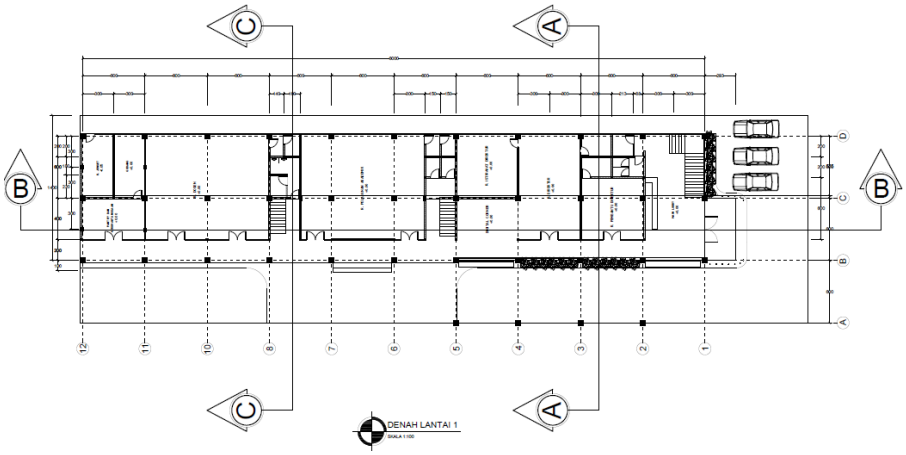


3. RESULTS AND DISCUSSION

Building Data

1.	Name Building	Three-Story Lecture Building in Yogyakarta
2.	Location Building	Jl. Jenengan Raya, Jenegan, Maguwo, Sleman, DIY
3.	Function	Lecture Building
4.	Building area	2.400 m2
5.	Tall building	18,50 meter
6.	Height of each building	
	Floor 1-3	13,00 meter
	Roof	5,00 meter
7.	Number of Floor	3 lantai
8.	Building Structure	
	Main Structure	Beton Bertulang
	Roof Structure	Baja WF, Baja ringan

Denah Perencanaan



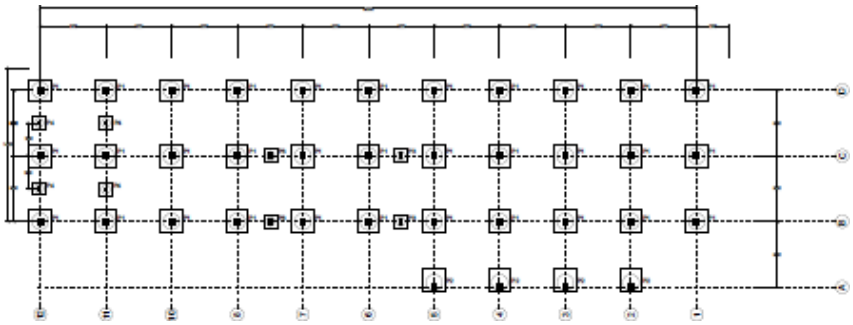
Modeling of CAD to Tekla Structure

The first stage is modeling by reviewing the plan drawings in the form of: softcopy CAD or hardcopy then modeling on Tekla structure, namely making grid lines, determining structural elevation (foundation, sloof, column, main beam, child beam, floor plate, and roof truss),

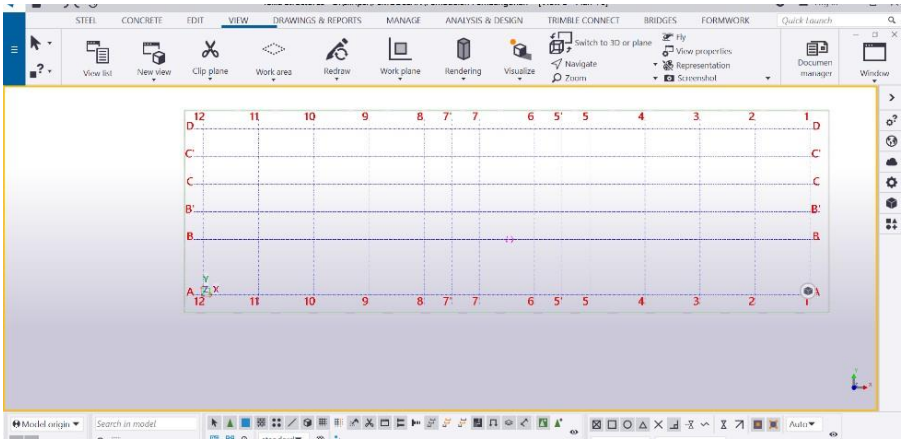
Grid Lines

The first step in modeling in Tekla Structure is to make grid lines. In making grid lines, we also have to understand what positions are needed and also make the elevation of a building from the foundation to the roof. Here are the steps for creating grid lines in Tekla Structure

a. Reading drawings from AutoCAD
   Read the drawing starting from the foundation plan and then make it in Tekla structure entering the distance between the grids and also the notation on the grid lines

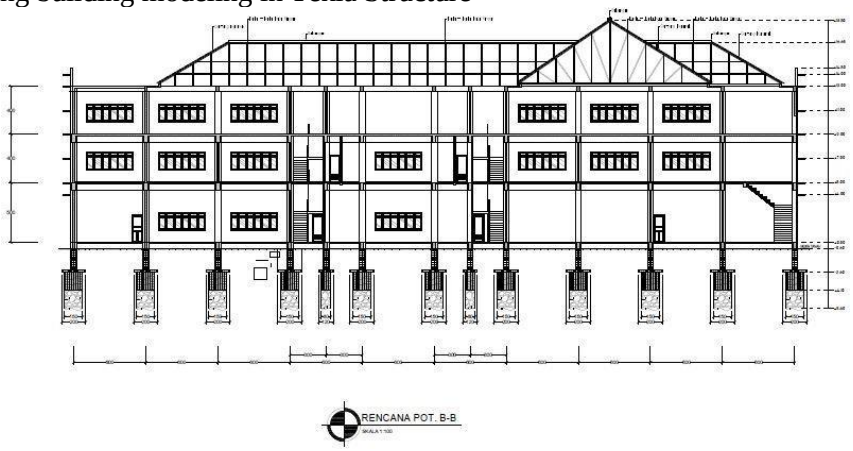


The picture above is an image from autoCAD. It can be seen that the distance between the grids is 600 cm or 6 meters and the distance is 300 cm or 3 m for the P3 and P4 types of foundations, so the grid at Tekla must also be the same.

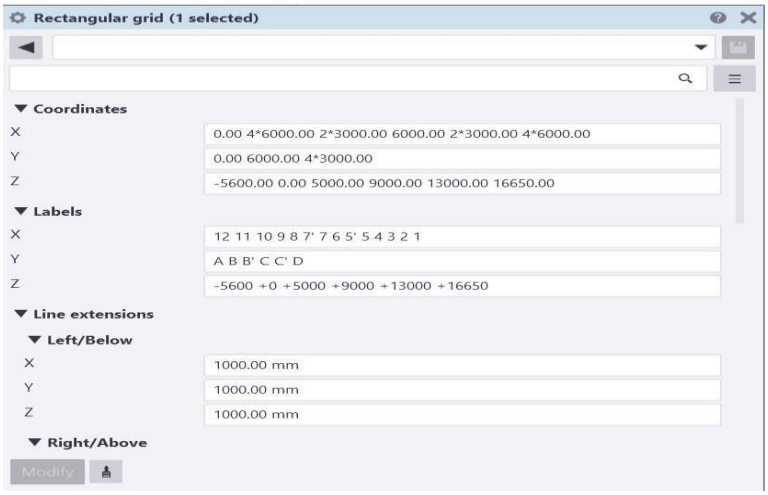


b. View the building pieces

From the snippet of the building plan we can determine the floor elevation where this is very much needed in making building modeling in Tekla Structure



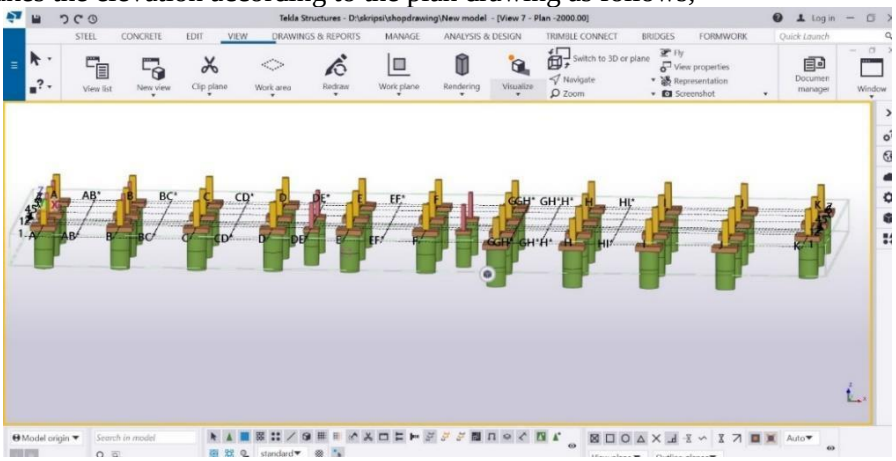
The B-B section shows the elevation of the foundation, ground floor, second floor, third floor, and roof structure. So, in making grid lines on Tekla Structure, you also immediately make the elevation the same as the plan drawing.



Modeling of Foundations, Pedistal Columns, Sloofs, Beams, and Superstructures

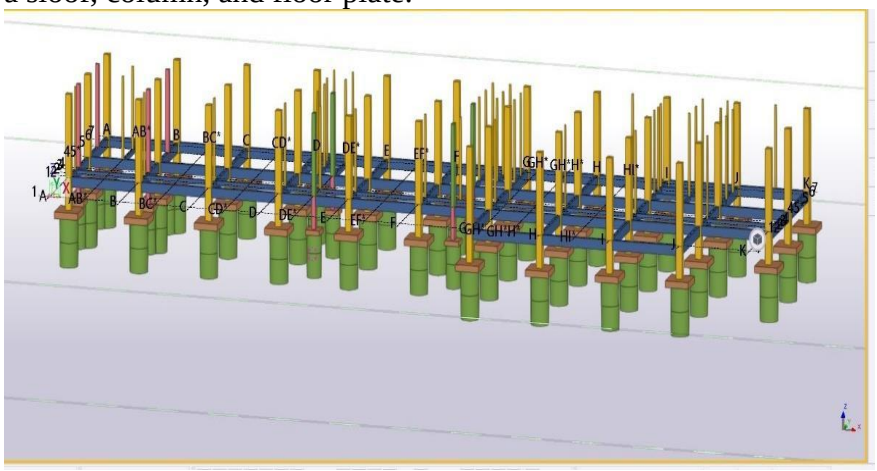
a. Well Foundation Modeling

In the plan drawing the foundation of the well is at an elevation of – 5.00 m from the ground, so the modeling makes the elevation according to the plan drawing as follows;



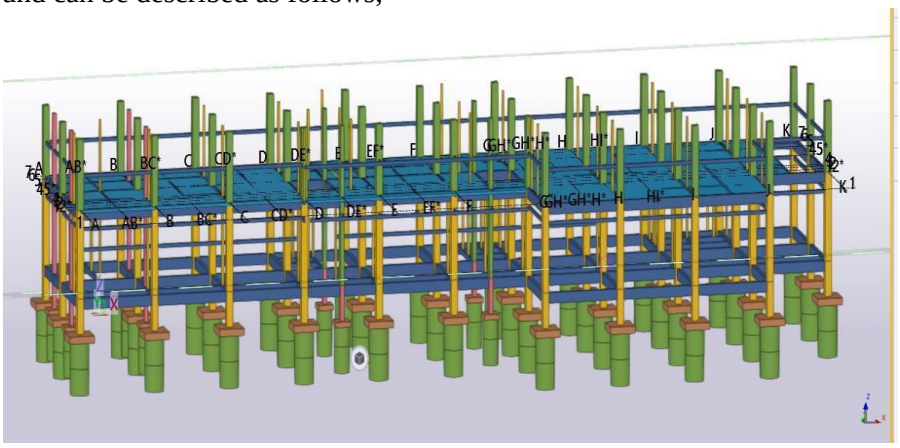
b. Floor Plan 1 (One)

Elevation on the first or ground floor structure is – 0.6 m from the ground, the structure on the first floor is a sloof, column, and floor plate.



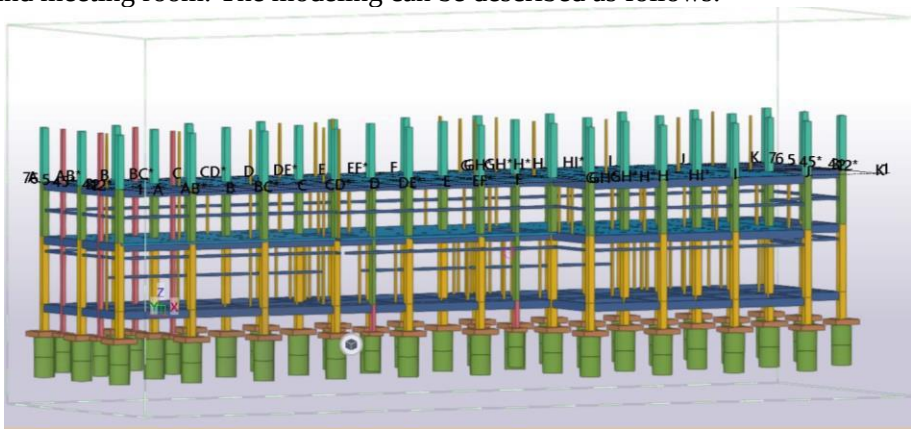
c. Floor Plan 2 (Two)

The second floor structure plan has an elevation of +5.00 from the finish plate ground floor or + 5.60 from the ground can be described as follows;



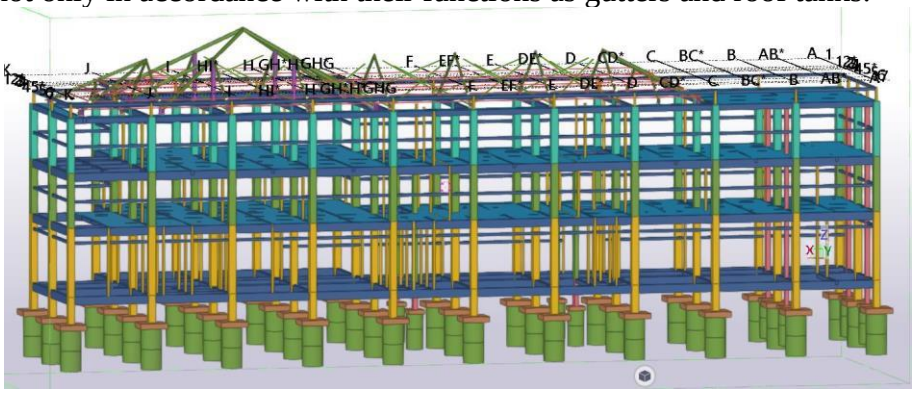
d. Floor Plan 3 (Three)

The third floor is located at a height of + 9.00 from the finish of the first floor which functions as a laboratory and meeting room. The modeling can be described as follows:



e. Floor and Roof Plans

The final structural work or topping off, namely the floor and roof truss, in this work, the floors are not only in accordance with their functions as gutters and roof tanks.



Checklist

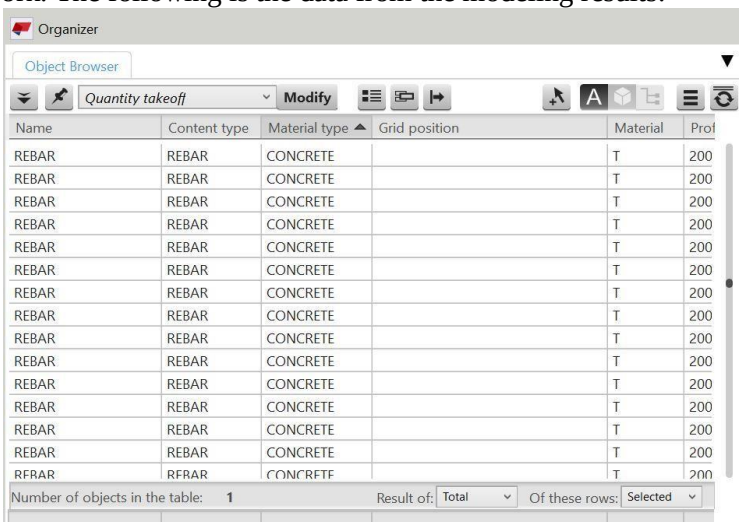
After doing structural modeling using the Tekla structure, we must make sure to check the dimensions of the well foundation, foot plate, sloof, column, beam, floor plate, WF steel and mild steel, make sure it is

the same as the floor planner's drawing. So we have to check the dimensions of the structure step by step as follows.

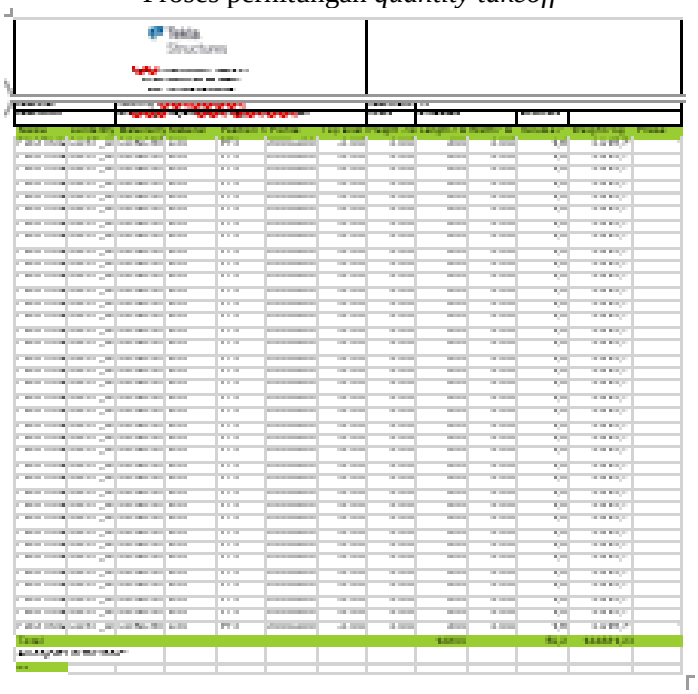
Calculation of the Volume of Material Requirements

a. Concrete Material

The main materials of structural work are concrete and steel reinforcement as a support for the building, so the calculation must be really sufficient to create a strong, strong and earthquake-resistant building. Calculation of the volume of concrete can be done on the Tekla structure after modeling, here is the output data from the quantity take off of the Tekla structure floor from the foundation, first floor, second floor, third floor and roof work. The following is the data from the modeling results.



Proses perhitungan *quantity takeoff*



Results Export dari Tekla Structure

Discussion

After knowing the volume of concrete, iron and costs from modeling in Tekla Structure. So in this study we can see that there are differences in terms of the volume of concrete, iron and the cost of each floor,

namely the lower structure, first floor, second floor, third floor, sub-floor and roof truss, here is a comparison.

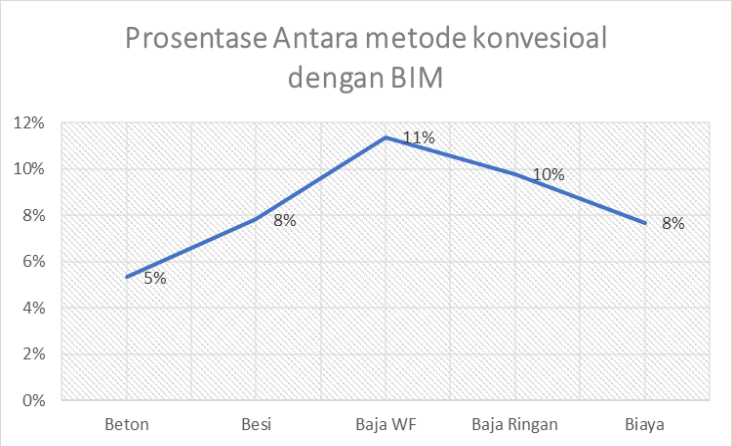
Results of Comparison of Conventional Methods with BIM (Tekla Structure) Methods

Material	Unit	Conventional Method	BIM method	Deviation
Concrete	M^3	753,01	712,88	40,13
Iron	Kg	105.242,43	96.997,32	8.245,11
Steel WF	Kg	16.989,10	15.055,02	1.934,08
Light steel	M^2	665,60	600,44	65,16
Cost	Rp.	3.267.326.887,90	3.016.437.566,89	250.889.321,01

The table above shows that the BIM method is smaller for all calculations of the volume of concrete, iron, WF steel and mild steel for the highest percentage in WF steel volume of 11% with a deviation of 65.16 kg and the lowest percentage in concrete volume of 5% with a deviation of 40.13 m3 then have a big effect on a larger cost of Rp. 250,889,321.01 (Two Hundred Fifty Million Eight Hundred Eighty Nine Thousand Three Hundred Twenty One Point Zero One Rupiah)

Percentage of BIM and conventional methods

Material	Unit	Conventional Methode	BIM Methode	%
Concrete	M^3	753,01	712,88	5%
Iron	Kg	105.242,43	96.997,32	8%
Steel WF	Kg	16.989,10	15.055,02	11%
Light steel	M^2	665,60	600,44	10%
Cost	Rp.	3.267.326.887,90	3.016.437.566,89	8%



4. CONCLUSION

Based on the results of the research above, we can conclude that this final project entitled Comparative Analysis of Wed (Cost Budget Plan) Conventional Method with the BIM Method (Building Information Modeling) can be concluded as follows:

1. Volume of conventional method is bigger than BIM
2. The difference in yield of iron, concrete, WF steel and mild steel is 40.13 kg, 8,245.11 m3, 1,934.08 kg, and 65.16 m2, respectively.
3. The percentage ratio of the volume of iron, concrete, and steel WF and costs are 5% concrete, 8% iron, 11% WF steel, 10% mild steel, and 8% costs.

REFERENCES

[1] K. W. Fatonah and N. Dwi, "Estimasi Anggaran Biaya Struktur Proyek Pembangunan Hotel Quad Makassar Menggunakan Metode SNI," *Univ. 17 Agustus 1945 Jakarta*, 2016.

[2] F. F. Putri, "Evaluasi Anggaran Biaya Struktur Dan Arsitektur Menggunakan Metode Building Information Modeling (BIM)," *Univ. Jember 2017*, 2019.

[3] R. Ramadiaprani, "Aplikasi Building Information Modeling (BIM) Menggunakan Software Tekla Structures 17 Pada Konstruksi Gedung Kuliah Tiga Lantai Fahutan IPB," *Insitut Teknol. Bogor*, 2017.

[4] A. Rahman, "Perbandingan Estimasi Anggaran Biaya Antara Metode Sni Dan Bow Pada Proyek Pembangunan Gedung Joang / Legiun Veteran Republik Indonesia," *Univ. 17 Agustus 1945 Samarinda*, 2013.

[5] C. A. dkk Berlian P, "Perbandingan Efisiensi Waktu, Biaya, Dan Sumber Daya Manusia Antara Metode Building Information Modelling (BIM) Dan Konvensional (Studi Kasus: Perencanaan Gedung 20 Lantai)," 2016.