



Analysis of the Advantages and Disadvantages of Using Autodesk Revit for the Dean Building of the Faculty of Education, Universitas Negeri Semarang

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Abstract. Building Information Modeling (BIM) as a supporting software of the fourth phase of the industrial revolution in Indonesia in the construction sector is a digital technology mode to increase the efficiency and accuracy of construction work to avoid mistakes during the planning to the implementation period. This study uses the Autodesk Revit application to provide the output of working drawings, 3D modeling, and calculate the volume and cost of work carried out in the Dean building of the Faculty of Education, Universitas Negeri Semarang. The purpose of this study is to determine the advantages and disadvantages of using Autodesk Revit for planning the Dean building of the Faculty of Education, Universitas Negeri Semarang. The results of this study are the advantages of using Autodesk Revit for building modeling, including providing convenience with design integration in one application, and avoiding crashes between designs. Autodesk Revit also has weaknesses, such as the need for high hardware specifications on the device, high license prices, the application it is necessary to create a new material family according to the design and size required, Autodesk Revit cannot calculate the preparatory work because the calculation of the volume and cost of Autodesk Revit work is limited to data input.

Keywords: Building Information Modeling (BIM), Autodesk Revit, Modeling, advantages, disadvantages

INTRODUCTION

The rapid development of science and technology has had a major impact in various fields, including the construction sector. The Building Information Modeling (BIM) has made digitizing the construction technology mode for building design and structure replacing AutoCAD. [1]. The advent of BIM and its daily evolution has helped increase the efficiency and accuracy of construction projects through coordination between the parts of the construction project throughout the life cycle of the building [2]. BIM can increase project efficiency, but its implementation was hampered by high initial investment costs, inadequate human resources, low demand, and inadequate technology development [3]. Whereas the implementation of BIM can save material procurement costs and construction projects provide as much as 20% [4].

In Indonesia, the use of Building Information Modeling (BIM) must be applied to non-simple state buildings with an area of over 2000 m² (two thousand square meters) and above 2 (two) floors because Building Information Modeling (BIM) makes it easier in terms of design. After all, it can produce output in the form of structural drawings, architectural drawings, mechanical, electrical, and plumbing (MEP) drawings, landscape drawings, details of the volume of work implementation, and financing management [5]. The provisions for using Building Information Modeling (BIM) are specifically explained and divided according to the method of implementation of building construction into 3, namely labor-intensive which is not required to use BIM, technology-intensive which must use BIM at least up to the fifth dimension, and capital-intensive which must use BIM until with the eighth dimension [6]. Human resources knowledge, skills, and experience are several factors that support success in implementing Building

Information Modeling (BIM), as BIM helps all project stakeholders cover the life cycle of the project. the complete life of a construction project, as well as to develop knowledge and experience during the learning process [7].

One of the mostly used software based on Building Information Modeling (BIM) is Autodesk Revit, a software made by Autodesk that supports the development of new modeling tools oriented to construction digitization [8]. Some of the advantages of Autodesk Revit software are refining art and visualization skills in the construction sector, handling technical aspects in design, such as structural logic, architecture, financing, construction project management, as well as the communication process between construction project parties accurately and efficiently. In detail, Autodesk Revit will provide plan views, 3D models, detailed diagrams, schedules for each structural element, and with V-ray rendering software that displays realistically with high efficiency, and provides 2D, 3D section views, detail quantities, and schedules [9]. BIM-based applications encourage construction actors such as clients, architects, contractors, MEP technicians, Quantity Surveyors, to facility managers to carry out their activities effectively and efficiently through their respective roles and responsibilities in managing construction projects [10].

Building Information Modeling (BIM) based software is urgently needed by construction stakeholders as it offers fast service and accurate quantification from conceptual design to project financial management. It is also supported by government regulations that directly explain the implementation of Building Information Modeling (BIM) in construction projects. This study focuses on the application of the Autodesk Revit application to design and manage the financing of concrete works in buildings to analyze the strengths and weaknesses of Autodesk Revit in general and in its application. provide fast service and accurate quantification from conceptual design to project financial management. It is also supported by government regulations that directly explain the implementation of Building Information Modeling (BIM) in construction projects. This study focuses on the application of the Autodesk Revit application to design and manage the financing of concrete works in buildings to analyze the strengths and weaknesses of Autodesk Revit in general and in its application.

No research has ever been conducted to compare the advantages and disadvantages of using Autodesk Revit, but several previous studies can be used as comparisons and references when preparing this research, namely Yozi Marizan's research that highlights the strengths and weaknesses of Autodesk discussing Revit versus AutoCAD [11], research by Edwin Budi and Vendie Abma discussing the benefits of implementing BIM [12], and research by Rudy Ferial, Benny Hidayat, Regina Citra Pesela, and Darwizal Daoed discussing the advantages and disadvantages of multiple BIM-based applications discussed [13].

TABLE 1. Previous research

Researcher	Title	Analysis result
Yosi Marizan (2019)	Literature Study About the Use of Autodesk Revit Software Case Study Planning for Sukajadi Public Health Center, Prabumulih.	The results of the analysis of the advantages and disadvantages of Revit compared to AutoCAD include the advantages of convenience in software integration, detection of design collisions, and streamlining of the workflow. Sera has the disadvantage of expensive licenses, it requires high hardware specifications.
Edwin Budi Setiawan, Vendie Abma (2021)	Application of BIM Concepts from Case Studies and User Perspectives.	The benefits of implementing BIM are more accurate calculations, faster work, and easier communication and integration
Rudy Ferial, Benny Hidayat, Regina Citra Pesela, Darwizal Daoed (2021)	Quantity Take-Off Berbasis Building Information Modeling (BIM) Studi Kasus: Gedung Bappeda Padang.	The benefits of using Autodesk® Revit® and Autodesk® Naviswork® Manage software for quantity calculation work are: Using this software can minimize various errors due to human error. The disadvantage of using the software is that the level of detail of the BIM model affects the level of precision of the quantity calculation work.

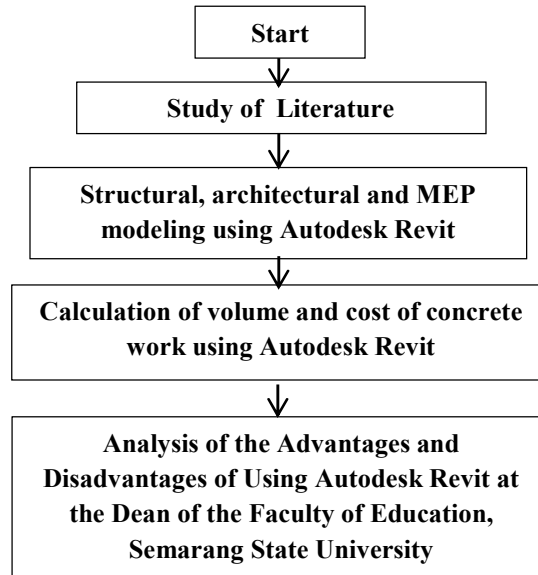
MATERIAL AND METHODS

The subject of this study is the Office of the Dean of the Faculty of Education of Universitas Negeri Semarang. The survey and data collection was conducted in February 2021, the data used was the Detailed Engineering Design (DED) and the Unit Price Analysis by the Dean of the Faculty of Education Universitas Negeri Semarang conducted by the Semarang State Goods and Services Procurement Labor Unit.

TABLE 2. Data of case study

Data	Explanation
Location	Universitas Negeri Semarang
Function	Dean of the Faculty of Education
Number of Layer	3 rd floor
Construction Period	2014

TABLE 3. Research flowchart



Before conducting the research, the researcher conducted a study using secondary data from scientific journals, both national and international, referring to this research as learning material. The research was carried out using a qualitative exploratory analysis approach, which means that this research is creative and flexible. The purpose of this research is to deepen and develop knowledge with the final result in the form of a description. The structural, architectural, and MEP modeling steps are performed using the Autodesk Revit application. The modeling preserves the advantages and disadvantages of the Autodesk Revit application in its application in the Dean's Building of the Faculty of Education, Universitas Negeri Semarang. When modeling, it is easy to see that Autodesk Revit provides standard materials that can be used directly in the form of "family" i.e. elements that represent physical elements or concepts of a specific object when creating models in Autodesk Revit, and the difficulty is that some materials are not available in Autodesk Revit, so you have to manually create them by editing from the available standard materials. After creating the model with Autodesk Revit, proceed to calculate the volume and cost of the concrete job. And in the final stage, the advantages and disadvantages of using Autodesk Revit in the modeling and calculation of the volume and cost of the building of the Dean of the Faculty of Education of Universitas Negeri Semarang will be analyzed.

RESULT AND DISCUSSION

Building Modeling

- A. Modeling the building of the Dean of the Faculty of Education, Universitas Negeri Semarang using Autodesk Revit 2016.
 - a. Structural Modeling

- ❖ Select the type of reinforcement by clicking on the box at rebar shape.
- ❖ Click rebar set. In the layout select “maximum spacing” with preset spacing.
- ❖ Continue introducing the longitudinal reinforcement. Click Placement Orientation ► Perpendicular to Cover to enter parallel to cover Then select the rebar shape in the rebar shape browser.
- ❖ Click rebar set in the layout option, then select fixed number option and set the amount of rebar.

Slabs:

- ❖ Make a longitudinal section of the slab. Then insert the cover.
- ❖ Go back to the Floor Plan ► Structure ► Area.
- ❖ Redraw the rebar in the slab area, adjust the rebar according to the design, and then click “Apply”.
- ❖ If additional reinforcement is present, it can be added by clicking Structure ► Rebar and then selecting the required reinforcement.
- ❖ Set the Placement Orientation ► Parallel to Work Plane. Then set up the rebar set and use the maximum space as needed.
- ❖ Place the slab at the end of the slab, pull, and adjust to the needs of the slab.

Stairs:

- ❖ Create a section that cuts lengthwise on the stairs.
- ❖ Click on the stair and adjust the coverage through Structure ► Cover.
- ❖ Because Revit does not provide a template, you must manually enter the rebar by drawing it through Structure ► Rebar ► Rebar Placement ► Sketch Rebar.
- ❖ Make rebar drawing and adjust rebar set and spacing as needed.
- ❖ To draw at each step, "Copy" can be performed.
- ❖ Set the “References Point” to the starting point of the steps.
- ❖ Draw longitudinal reinforcement through Structure ► Rebar ► Rebar Placement ► Sketch Rebar.

b. Architectural Modeling

It consists of modeling stairs and their reinforcements, walls, doors, windows, floors, and ceilings from Detailed Engineering Design (DED) data. In architectural modeling, there are difficulties, namely the need to edit existing properties to match what is needed.

- Creating stairs through Architecture ► Stairs ► Railing. Edit dimensions by the properties section.
- Creating walls through Architecture ► Wall: Architectural. Edit dimensions by the properties section.

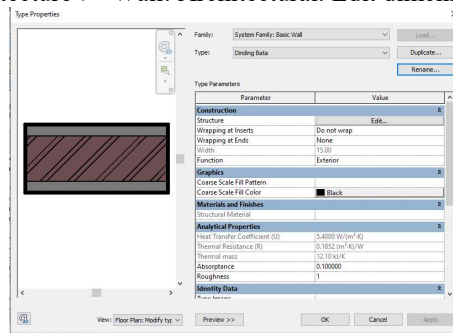


FIGURE 3. Preview custom template of walls

- Creating doors through Architecture ► Door and creating window through Architecture ► Window. Because the available door and window models do not match what is needed, it is necessary to create a new family by duplicating and editing the existing family.
- Create a floor pattern through Floor ► Architectural.

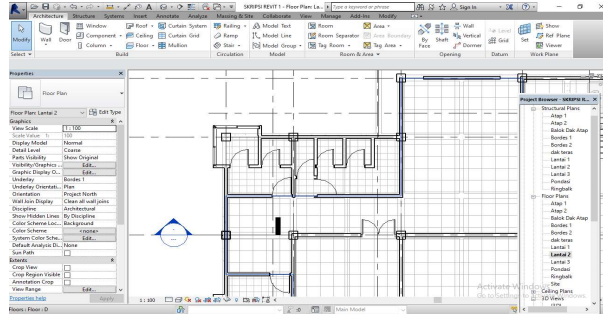


FIGURE 4. Modeling of door, window, and floor

- Create a ceiling through Ceiling menu and then a Properties dialog box will appear to set the required ceiling.
- c. Mechanical, Electrical, and Plumbing Modeling
- It consists of placing plumbing tools in the toilet according to the Detailed Engineering Design (DED) data. The MEP modeling is easy because it only places the plumbing tools provided by Autodesk Revit.
- The placement of the plumbing lavatory through System ► Plumbing fixture.

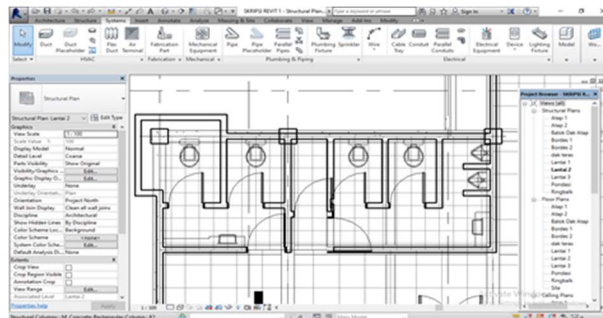


FIGURE 5. The placement of the plumbing lavatory

Calculation Volume of Concrete

The volume of work is to facilitate the calculation of costs in construction projects. Labor costs are the product of quantity calculation and unit price analysis. This research is to Calculate the volume of concrete works in the Dean of the Faculty of Education Universitas Negeri Semarang. The volume calculation is easy because you only need to display the results after making the model.

Steps:

- Click View ► Schedule/Quantities.
- In the Schedule dialog, there are several work items to create, then select the work items to calculate.
- In the Schedule Properties dialog box will find the volume and cost calculation for each work item. And to find the cost for each floor and work item type, you can enter the family, type, base level, volume, and cost. Then click OK.
- For cost value, enter the Unit Price Analysis value used.
- To calculate labor cost, click Edit in the Properties panel on the Filter tab. Then press “fx” in the Schedule Properties dialog to enter a new formula.
- In the calculated value dialog box, type Job Cost, “Common” discipline, and enter “Number”. In the formula, click 3 points, select Volume, click OK.
- Select “Export” option, then “Reports” and “Schedules” to export the BOQ (Bill of Materials) file. Drag the exported TXT file to Ms. Excel to open the BOQ file.

After completing the above steps, the results of calculating the volume of the concrete structural works used in the construction of the Dean of the College of Education, Universitas Negeri Semarang using Autodesk Revit amounted to 502,8 m³.

Advantages and Disadvantages of Autodesk Revit

TABLE 4. Advantages and Disadvantages of Autodesk Revit

Advantages	Disadvantages
<ul style="list-style-type: none"> • Efficient and accurate design due to drawing and layout work, labor volume calculation, and labor cost in one application device. • Based on Building Information Modeling (BIM). • The information provided is fast and accurate as the designs are integrated with each other in Autodesk Revit and the job can be done by one person. • There are multiple export options. • In Autodesk Revit can prevent failures that occur due to discrepancies between structural, architectural, and MEP designs. • Autodesk Revit can minimize errors due to human error from planning, calculating workload, and labor costing to checking for comfort and feasibility because Autodesk Revit does it for you automatically. 	<ul style="list-style-type: none"> • Requires a fairly high spec laptop/computer. • It is quite expensive to install the program. • It requires qualified staff. • Multiple family templates need to be created in advance, for example river stone foundations, L-pillars, curtains, walls, doors, windows, floors, and ceilings made of mild steel. as Autodesk Revit does not provide the required family. • The modeling must be done with great care since it directly affects the results due to the volume obtained and the costs obtained. • Since Autodesk Revit can only calculate entry work, it cannot calculate preparatory work and formwork, manual calculations must be performed, allowing errors.

CONCLUSIONS

1. Applications based on Building Information Modeling (BIM) are necessary to support the advancement of the construction industry and are supported by government regulations that explain the use of Building Information Modeling (BIM) in construction projects.
2. Autodesk Revit is a Building Information Modeling (BIM)-based application that can model structural, architectural, mechanical, electrical, and plumbing (MEP) systems and construction project management on a computer.
3. The results of calculating the volume of concrete construction work in the construction of the Dean of the Faculty of Education Universitas Negeri Semarang are 502,8 m³.
4. Autodesk Revit has many benefits, including the convenience of integrating design into a single application, eliminating deadlocks between designs, more efficient savings in time, cost, and labor, and easier coordination between owners, consultants, and contractors.
5. The weaknesses of Autodesk Revit are the need for high specification hardware in the device, the high license prices, when using it a new family of materials must be created according to the design and size required, the design work must be done with care, so there is no loss of money or loss due to the materials used. Autodesk Revit is unable to calculate material and labor cost losses, which are calculated automatically, for preparatory and formwork, as Autodesk Revit's calculation of volume and cost of jobs is limited only to the data entered.

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