Study of scheduling DPRD building of North Lombok Regency using BIM 5D with Tekla Structural software

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Abstrak
The Lombok Utara Regency DPRD Building Construction Project is a multi-story building construction project using conventional scheduling methods with an S-curve. In accordance with Government Regulation No. 16 of 2021 on the implementation regulations of Law No. 28 of 2002 on building construction, which mandates the use of BIM for medium and high-rise buildings. This study aims to investigate the use of BIM through Tekla Structures software in planning project scheduling based on Detailed Engineering Design (DED) data. The research methodology begins with the collection of relevant references and shop drawing data. Using the obtained data, a 3D model can be created using Tekla Structures 2025 software, followed by scheduling tasks using Tekla Task Manager. The advantages of scheduling using Tekla Structures include the ability to create detailed models and facilitate scheduling through its available features, which display visualizations of each stage of progress. Compared to conventional scheduling using an S-curve, Tekla Structures provides accurate information through the visualizations it displays. The scheduling results for the construction project of the Lombok Utara Regency DPRD Building using the S-curve required 139 calendar days, while using Tekla Structures software required 111 calendar days. This study demonstrates that BIM technology can significantly enhance construction project efficiency.

Keywords*: Scheduling; BIM 5D and Tekla Structures.*

I. INTRODUCTION

Digital technology plays an important role in the field of building construction in planning building construction work. BIM with Tekla Structures software is a form of technological advancement that can be used for various aspects of construction work. One of these is project scheduling. Project scheduling is an aspect of planning a project and allocating available time to execute a coordinated project to achieve optimal results [1]. The purpose of scheduling is to facilitate the formulation of project issues, determine appropriate methods, and ensure activities run smoothly so that the results obtained are optimal [2]. Through Tekla Structures software, project scheduling for building construction work can be done easily and efficiently. In the construction field today, the application of digital technology must continue to be developed because of the increasing market demand for more efficient construction planning [3].

In Indonesia, BIM development has not been fully utilized in the planning and modeling of development projects because most of it is still done conventionally [4]. Conventional scheduling refers to the S curve, a method that shows work progress based on activities, time, and work weight, usually presented in a graph with the weight on the vertical axis and the implementation time on the horizontal axis [5]. The S-curve is used to illustrate and express quantitative values in relation to time [6]. The limitation of scheduling using the S-curve is that it provides limited information with a lack of detail and is only suitable for assessing project progress [7].

However, with the efforts and support of the government in developing construction based on the latest technology, Government Regulation No. 16 of 2021 concerning the implementation of Law No. 28 of 2002 on Buildings was formed, which clearly requires the use of BIM for medium and high-rise buildings [8]. Building Information Modeling (BIM) is a technological advancement in the construction industry that

contains various important design-related information [9]. BIM is a representation of the physical and functional characteristics of a building, which can assist in planning buildings with specific levels, sizes, and qualities in accordance with regulations and requirements [10]. Tekla Structures is one of the BIM software that can manage and generate precise and accurate data [11]. Tekla Structures has capabilities in modeling, detailing, engineering, drawing, reporting, and scheduling [12]. The output from Tekla Structures consists of detailed construction drawings, complete connection details, as well as material lists and volumes that are highly beneficial in planning and executing construction on a large scale [13].

BIM with Tekla Structures software can be used to assist consultants or contractors in creating and managing data accurately and in detail, as well as for 3D structural modeling with complex structural planning [14]. BIM cannot be regarded as ordinary technology; the presence of BIM represents a revolution in addressing the ongoing development of construction using BIM 3D, 4D, 5D, 6D, and 7D [15]. The discussion in this study will focus on the application of BIM using Tekla Structures software in BIM 4D (Scheduling). BIM 4D itself is a visualization method that integrates 3D models into the project timeline, including work execution time, resources, quantities, and project execution stages [16].

This study discusses the use of Building Information Modeling (BIM) with Tekla Structures 2025 software in planning the construction schedule for the North Lombok Regency DPRD building. The aim of this study is to determine the application of Tekla Structures software in creating a building work schedule plan so that it can provide accurate work scheduling results.

II. METHODS

This study applies the use of BIM concepts with Tekla Structures software in planning project work schedules. This study uses primary and secondary data. Primary data consists of data generated from interviews with contractors and consultants. Meanwhile, secondary data is data that was previously available. The secondary data obtained is DED (Detailed Engineering Design) data, which is used as the basis for modeling. This study began by searching for relevant research references, followed by the collection of supporting data used in the study.

The data processing stage begins with 3D modeling using Tekla Structure software with reference to DED (detailed engineering design) data. Then, scheduling is carried out through Tekla Task Manager. From the results of the data analysis, the project work schedule can be determined through BIM using Tekla Structure software. The flow of this research can be presented in a flowchart in **Figure 1**.

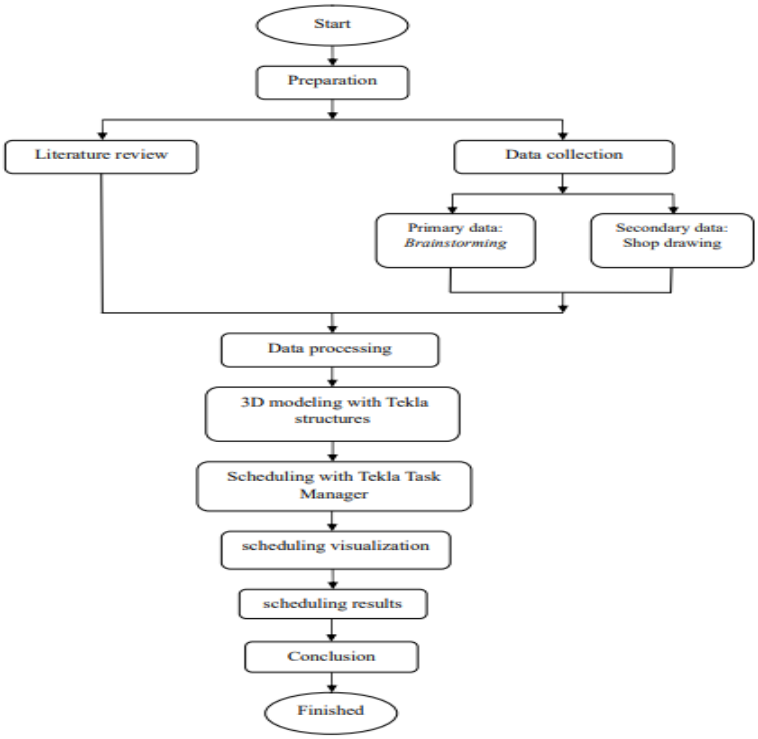

Fig 1. Research flow chart.

III. RESULT AND DISCUSSION

Modeling in Tekla Structures 2025

The modeling was created using Tekla Structures 2025 software using the South-East Asia Environment. Before modeling, there were several stages that had to be considered first, including creating a grid according to the reference drawings obtained to ensure that the drawings were in accordance with the plan. The next step is to determine the type of material to be used based on the detailed engineering design (DED) data for the project. This construction project is a reinforced concrete building consisting of footing foundation modeling, stone foundation, sills, floor slabs, columns, beams, heavy steel roof structures combined with lightweight steel roofs. The results of the modeling can be seen in **Figure 2.**

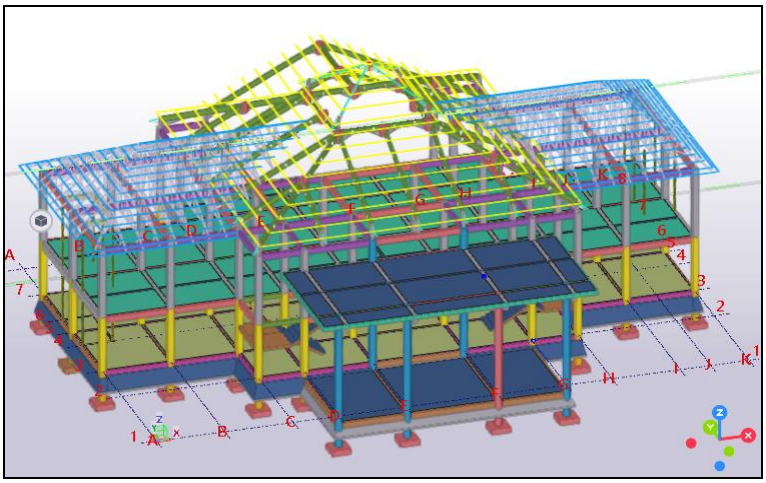

Fig 2. Results of 3D modeling.

Scheduling with Tekla task manager

Project scheduling is based on the results of a visual analysis of the development plan as seen from the model created and from data collected through interviews with contractors and consultants involved in the implementation of the development project. The duration of the work is determined based on the weight of the work and the stages of work carried out sequentially. The interdependency between tasks indicates when the next task can be performed. The interdependency relationships between tasks can be seen in **Table 1**.

Scenario

No.	Task Name	Planned Start Date	Planned Duration (days)	Planned End Date
1	**SUBSTRUCTURE ZONE A**	**08/21/2024**	**19,00**	**09/16/2024**
2	Stone Foundation Zone A	08/21/2024	10,00	09/03/2024
3	Footplat Foundation Zone A	09/04/2024	7,00	09/12/2024
4	Pedestal Column Zone A	09/04/2024	4,00	09/09/2024
5	cylinder Column Zone A	09/10/2024	5,00	09/16/2024
6	**SUBSTRUCTURE ZONE B**	**09/04/2024**	**19,00**	**09/30/2024**
7	Stone Foundation Zone B	09/04/2024	10,00	09/17/2024
8	Footplat Foundation Zone B	09/18/2024	7,00	09/26/2024
9	Pedestal Column Zone B	09/18/2024	4,00	09/23/2024
10	cylinder Column Zone B	09/24/2024	5,00	09/30/2024
11	**UPPER STRUCTURE ZONE A**	**09/10/2024**	**44,00**	**11/08/2024**
12	Sloof zone A	09/10/2024	7,00	09/18/2024
13	Column on the first floor, Zone A	09/19/2024	7,00	09/27/2024
14	Stair Zone A	09/30/2024	7,00	10/08/2024
15	Beam Zone A	09/30/2024	10,00	10/11/2024
16	Column on the second floor, Zone A	10/14/2024	10,00	10/25/2024
17	Ring Beam Zone A	10/28/2024	10,00	11/08/2024
18	**UPPER STRUCTURE ZONE B**	**09/24/2024**	**41,00**	**11/19/2024**
19	Sloof zone B	09/24/2024	7,00	10/02/2024
20	first floor slab	10/03/2024	3,00	10/07/2024
21	Column on the first floor, Zone B	10/03/2024	7,00	10/11/2024
22	Stair Zone B	10/14/2024	7,00	10/22/2024
23	Beam Zone B	10/14/2024	10,00	10/25/2024
24	second floor slab	10/14/2024	7,00	10/22/2024
25	Column on the second floor, Zone B	10/23/2024	10,00	11/05/2024
26	Ring Beam Zone B	11/06/2024	10,00	11/19/2024
27	**ROOF STRUCTURE**	**11/11/2024**	**15,00**	**12/10/2024**
28	Lightweight Steel Roof Frame	11/11/2024	10,00	12/03/2024
29	Roof Truss Zone A	12/06/2024	5,00	12/10/2024
30	Roof Truss Zone B	13/06/2024	5,00	12/10/2024

Table 1. Relationship between job dependency.

The schedule that has been created is then inputted and integrated with the 3D model using Tekla Task Manager. The resulting schedule is a bar chart display that shows when the work will start and end based on the specified duration. The output of the scheduling using Tekla Task Manager can be seen in **Figure 3.**

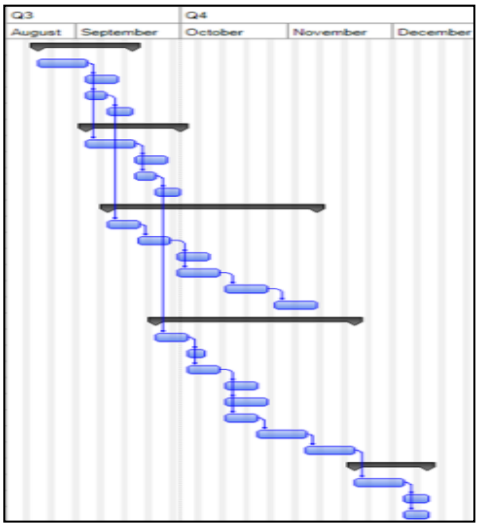

Fig 3. Tekla task manager output.

Scheduling visualization

Visualization is the output generated from previous modeling that displays the model according to the date specified in the model created. The model displayed shows the progress of work that can be distinguished based on image notation with different colors. Visualization makes it easier for users to obtain project progress data so that project schedule monitoring becomes more optimal. The visualization results can be viewed from the progress of work over time using the project status visualization in **Fig 4.**

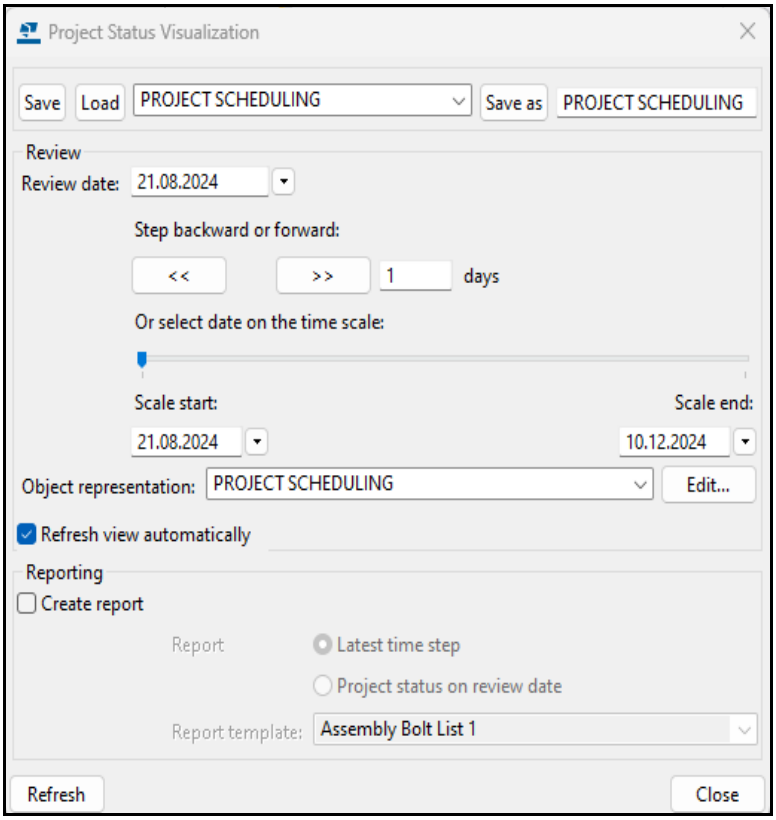

Fig 4. *Projeck status visualization.*

It can be seen in the project status visualization that the project schedule starts on August 21, 2024, and ends on December 10, 2024. The progress of the work can be seen in **Figures 5, 6, and 7.**

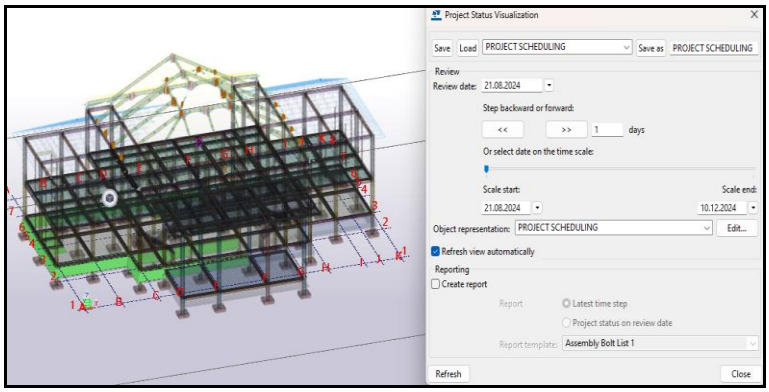

Fig 5. Visualization of August 21, 2024 (start of work).

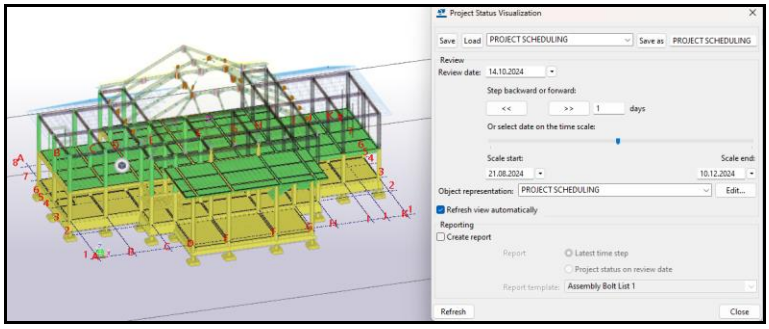

Fig 6. Visualization of October 16, 2024 (mid-project).

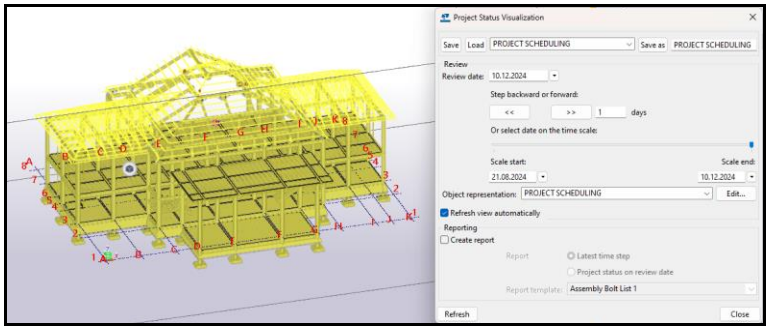

Figure 7. Visualization of December 10, 2024 (end of work).

Tekla Task Manager Scheduling Results

The scheduling results in Tekla Task Manager are calculated from August 21, 2024, to December 10, 2024, as shown in **Figure 5.** The construction work has just begun and is currently in the foundation construction phase for Zone A. The progress of the work can be seen in **Figure 6.** By **Figure 7.** the building construction work has been completed. The total project duration is 111 calendar days.

IV. CONCLUSION

Based on the results of this study, the researcher applied Building Information Modeling (BIM) with Tekla Structures software to analyze the work schedule for the North Lombok Regency DPRD Building. Thus, it can be concluded that Building Information Modeling (BIM) with Tekla Structures software can be used in building modeling to plan project schedules based on the obtained design drawings. The advantage of scheduling with this software is that it can create detailed modeling while scheduling using the features available within it. However, the drawback of scheduling with Tekla Structures software is that it is less effective for non-structural scheduling because Tekla Structures focuses on structural elements.

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