DEVELOPMENT OF WORK BREAKDOWN STRUCTURE USING BUILDING INFORMATION MODELING AT UNJ

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Abstract

Building maintenance must also be carried out on campus buildings, because every day they are used by the academic community in their activities in large numbers. For that we need buildings that are safe, comfortable, and decent. Building maintenance in Indonesia is regulated in the Regulation of the Minister of Public Works No.24/PRT/M/2008 concerning Building Maintenance. This arrangement was updated with the passing of Law number 11 of 2020 concerning Job Creation. Based on this, it is also necessary to know the best building maintenance methods that must be applied based on the right approach. This study aims to plan a maintenance method for the L5 building on the UNJ Campus based on the Work Breakdown Structure (WBS) using Building Information Modeling (BIM). Based on a series of studies on the UNJ Campus L5 building that is integrated with BIM, it will improve the process of maintaining and repairing buildings. The results of this early stage research are expected to provide an overview and recommendations on how to maintain the UNJ Campus building.

Keywords: Building Maintenance, Work Breakdown Structure, Building Information Modelling

Introduction

Buildings that have been standing for decades will experience a decrease in quality, both structural and non-structural. If the building can be used functionally, then the building requires maintenance to minimize the risk of building users (Acampa et al., 2021a; Charef, 2022; Handayaniputri et al., 2019). Strategies in building maintenance are very important to control and prevent damage to building elements (Gao & Pishdad-Bozorgi, 2019; Huang et al., 2019; Q. Li et al., 2020) The selection of this strategy can also save the budget and costs allocated to the maintenance sector of a building (Gao & Pishdad-Bozorgi, 2019; Mydin, 2015). (Flores-Colen & de Brito, 2010) in his article stated that the appearance of buildings, constantly, will always be affected by climate, pollution and environmental conditions. This will worsen and have a serious impact on the building which will affect the safety and comfort in the use of the building (Fu, 2018; Kwong, 2020; Weerasinghe & Ramachandra, 2018). Further described, building maintenance actions are based on an assessment to avoid failure and damage to buildings, through cleaning, repairs, local replacement, and prevention of damage (Bucoń & Czarnigowska, 2021; Gouda Mohamed et al., 2020; Morgado et al., 2017).

Regarding aspects of building maintenance, the Government of the Republic of Indonesia in this case represented by the Ministry of Ministry of Public Works and Public Housing (PUPR) has stipulated Regulation of the Minister of Public Works No.24/PRT/M/2008. This regulation contains Guidelines for Building Maintenance which explains that building maintenance is an activity to maintain the reliability of the building and its infrastructure and facilities so that the building is always fit for function (preventive maintenance)(Acampa et al., 2021b; Hosseini & Maghrebi, 2021; Ismail, 2021). While building maintenance is an activity to repair and/or replace building parts, components, building materials, and/or infrastructure and facilities so that the building remains functional (Ensafi et al., 2022; Omar et al., 2018; Pishdad-Bozorgi et al., 2018).

Building maintenance must also be carried out on campus buildings because every day they are used by the academic community in their activities in large numbers (Geng et al., 2019; Huo et al., 2019; Marenjak, 2012; Uddin et al., 2021). For that, we need buildings that are safe, comfortable, and decent. Jakarta State University (UNJ), with the initial name of the Jakarta Teaching and Education Institute (IKIP) and established on May 16, 1964, is one of the many state universities in Indonesia which has several high-rise buildings. As is the case with other high-rise buildings anywhere, building maintenance at UNJ is needed to keep the building fit.

In terms of building maintenance costs, buildings that are used routinely together must be carefully planned for maintenance and become a requirement from the planning of the building(Kim et al., 2012; Masood et al., 2017; Mejía et al., 2020). Apart from planning good building maintenance methods, to avoid frequent damage to buildings which lead to increased repair costs, and to maintain the safety and comfort of buildings, the UNJ Campus as an educational campus must involve building users as part of the maintenance of its buildings.

Building maintenance methods can be done by way of WBS(Al-Kasasbeh et al., 2021a; Fournier et al., 2023; Park & Cai, 2017). Creating a WBS is a process of depicting the results of work and projects in the form of individual components in the form of a top-down list and the depiction of work components in a hierarchical manner (Al-Kasasbeh et al., 2021b; Kenley & Harfield, 2014; Y. Li & Zhang, 2013). Based on this, then integrated with BIM which aims to improve the process of building maintenance and repair (Bucoń & Czarnigowska, 2021; C. Z. Li et al., 2022; Loeh et al., 2021; Marmo et al., 2020).

From all the descriptions above, it can be concluded that there is a need for a maintenance planning method for the L5 building on the UNJ Campus that uses a

BIM-based WBS. This aims to create the feasibility of the building as well as safety and comfort in carrying out the educational process at the UNJ Campus in general.

Research Methodology

This research was conducted at Building L5 Campus of Jakarta State University, Jalan Rawamangun Muka, East Jakarta. The research was carried out from March to November 2022. The method used in this study is to conduct a literature review and research and development. At this stage, collecting journals or scientific papers related to the research topic. After that, an initial scanning of the journal is carried out, namely a review of the journal which aims to find out the outline of the research. The stages of the research procedure use the research and development method, including analysis, design, development, implementation, and evaluation. The data collection technique used in this study was field observation to determine the initial conditions of the research site and to determine further field procedures, documentation, and interviews.
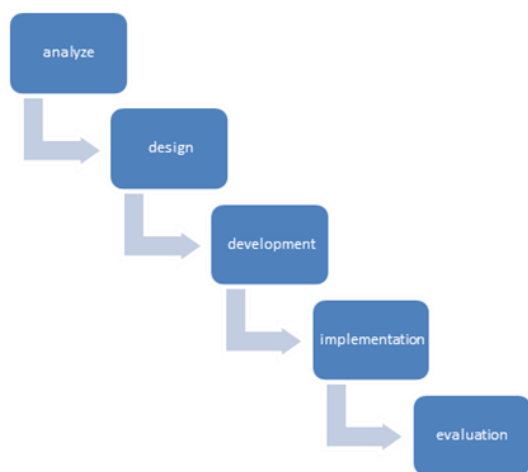

Figure 1. Research scheme using research and development methods

Research Results and Discussion

BIM can function as a real-time documentation tool in a repository to manage information about buildings during their life cycle, so that owners can use them to manage facilities (Azhar et al., 2015). Then with the existence of WBS-based guidelines,

the results show that it is able to improve the performance of building maintenance and repairs (D'Orazio et al., 2022).

The development of an information system (E-maintenance) based on WBS and integrated with BIM is expected to improve the performance of maintenance and repair of WBS-based government buildings using BIM (Matos et al., 2021). In this research, it is intended to develop maintenance work based on WBS using Building Information Modeling (BIM) in the Revit application through four stages:

1. Build a building model using the Revit app.
2. Build WBS parts of the building that will be maintained.
3. Arrange a maintenance schedule for each part of the building.
4. Collaborate on modeling and maintenance schedules for each part of the building.
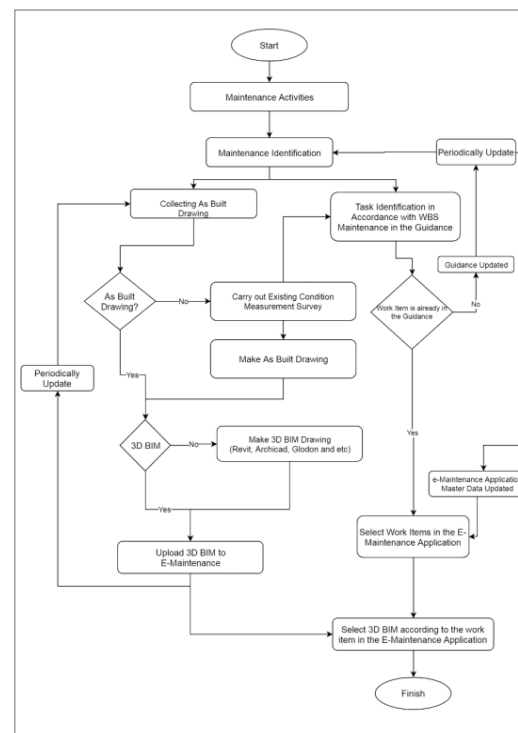

Figure 2. Building maintenance flowchart using BIM

The development of this system is able to bring benefits such as saving maintenance and repair costs, reducing paper use, restructuring human resource management

as well as personnel roles and job descriptions (Nasir, 2014).

Modeling of the UNJ L5 Building

From archival drawings owned by the Civil Engineering family, the 2-dimensional floor plan of the L5 building (Figure 3,4,5) is modeled using the Autodesk Revit BIM application. The modeling of the L5 building seen from the side can be seen in Figure 6.
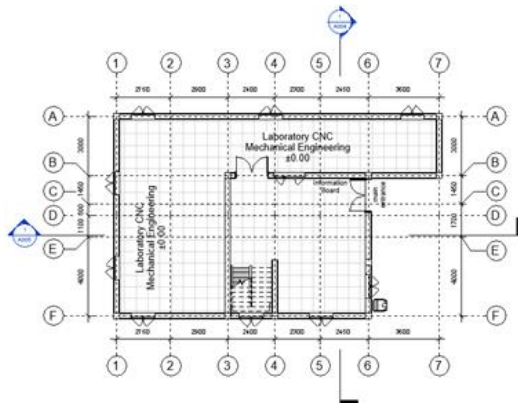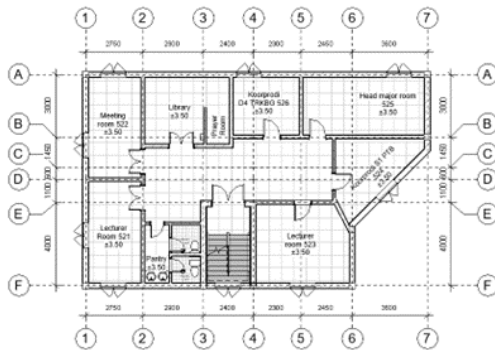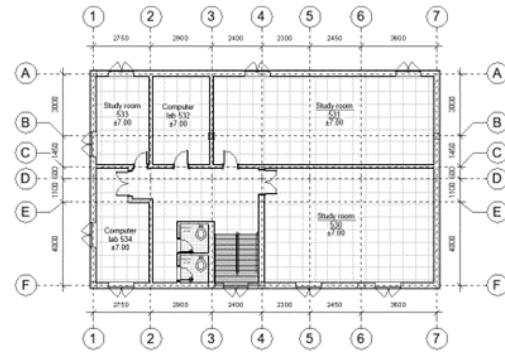

Figure 5.   Floor plan 3 building L5 UNJ

Figure 3.   Floor plan 1 building L5 UNJ

Figure 6.   Side view building L5

Working Breakdown Structure (WBS) Building L5 UNJ

The Working Breakdown Structure (WBS) can display real-time building maintenance and make it easier to breakdown monitoring from one job to another with the WBS. BIM itself can report on anything that needs to be carried out for maintenance from the L5 building so that it will make it easier to check later. Here are the results obtained.

Figure 4.   Floor plan 2 building L5 UNJ

Table 1. WBS Building L5

Level 1 (Project Name)	Level 2 (Task)	Level 3 (Sub-Task)	Level 4 (Work Package)	Design
Building L5 Universitas Negeri Jakarta	Architecture	Facade	Outdoor wall	Expose Brick Wall
				Wall paint
			Window	Glass window
		Inside building	Indoor wall	Wall paint
				Partition wall

Level 1 (Project Name)	Level 2 (Task)	Level 3 (Sub-Task)	Level 4 (Work Package)	Design
				Curtain wall
				Ceramic wall
			Door	Sliding door
				Rolling door
			Window	Window hinges
			Floor	Ceramic floor
			Stair	Railing
		Roof	Ceiling	Gypsum ceiling

Develop a maintenance schedule for each part of the building. Each work item requires a building maintenance schedule.

The following is an explanation regarding the building maintenance schedule which can be seen in Table 2.

Table 2. Maintenance schedule

Level 3 (Sub-Task)	Level 4 (Work Package)	Design	Maintenance schedule
Facade	Outdoor wall	Expose Brick Wall	6 Months
		Wall paint	6 Months
	Window	Glass window	1 year
Indoor building	Indoor wall	Wall paint	6 Months
		Partition wall	6 Months
		Curtain wall	6 Months
		Ceramic wall	6 Months
	Door	Sliding door	2 Months
		Rolling door	2 Months
	Window	Window hinges	6 Months
	Floor	Ceramic floor	Every day
	Stair	Railing	Every day
Roof	Ceiling	Gypsum ceiling	6 Months

Conclusion

BIM is the process of generating and managing construction data during the building cycle, starting from planning, design, construction, use, maintenance and demolition of buildings. The initial steps for the development of the BIM-model for building maintenance services can be prepared in several stages. These stages are, determining the criteria for the BIM function, determining the required information criteria, determining the technical implementation criteria, and determining organizational and legal criteria. The conclusion that can be obtained from this study is that the use of the BIM model can improve services in building maintenance.

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