Optimizing Time Performance in Implementing Green Building Concepts on High-Rise Residential by using M-Pert

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ABSTRACT

Climate change is a threat and crisis that is sweeping the world today, therefore the target of Net Zero Emissions (NZE) by 2060 must be an obligation of all countries. The greenhouse effect, global warming, destruction of the ozone layer, destruction of forests, uncontrolled use of CFCs, and industrial disposal are factors that cause climate change. The consequences of climate change are dire, resulting in droughts, water scarcity, land fires, rising sea levels, flash floods, melting polar ice caps, storms, and biodiversity decline. Green buildings (GB) are important in saving energy, water, and other resources by meeting technical construction standards and applying green building principles with measurable performance. It is expected to reduce carbon emissions or greenhouse gases. From the results of research with the application of M-PERT, it is proven to be able to provide an accuracy of 98.93% implementation time in high-rise residential buildings

Keywords: green building; M-PERT; high-rise residential; time accuracy.

INTRODUCTION

The construction industry plays an important role in various industrial impacts on the natural environment. The industry is characterized by high consumption of energy and resources and high environmental pollution [1]. Studies show that building energy consumption currently accounts for about 30% of total energy consumption, and energy consumption can account for almost 30% of CO2 emissions [2]. During a building's life cycle, 80% of a building's energy consumption occurs during the actual use phase, not during construction [2]. Therefore, a reasonable solution to reduce global greenhouse gas emissions and overall energy consumption is the concept of green building in environmentally friendly high-rise residential buildings.

Green buildings are facilities that are built in a resource-efficient manner with the environment in mind and are considered good facilities [3] [4]. In particular, there are various global green building ranking tools aimed at facilitating the building process.

Three areas are very important as tools for assessing green buildings from micro and macro perspectives: Environment and space, energy efficiency itself, and environmental environment.

Energy efficiency itself and the ecological environment. Several factors indicate the operational performance of green buildings, including several certificates including Gold, Platinum, and Silver. But it is worth noting how much this certificate refers to increased energy efficiency. In fact, according to previous research, a total of 1,446 buildings were certified in China from 2006 to the end of 2013. However, progress has been made, with only 104 buildings having operational certificates and less than 8% using green building materials [6]. In other words, certified buildings are not associated with high operational excellence or high energy performance [7]. Green building operational performance is related to green building metrics alignment [8]; [9] and the strategy and management of these operations.

To reduce global greenhouse gas emissions and overall energy consumption is the concept of green building in high-rise residential buildings in an environmentally friendly way.

O'mara and Bates (2012) Green buildings are also designed with economic and environmental sustainability in mind, taking into account local climate and cultural needs, thereby improving the

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health, safety and productivity of their occupants. I applied. Morsella (2009) explains that the green building movement is now mature enough to demonstrate evidence of the value of green economy in the real estate market for building owners and tenants with the rapid increase in the use of renewable energy, and the conversion of information technology and technology development in the construction of smart cities, eco-districts, and eco-campuses.

In Indonesia, green property is not only in demand but has also become a necessity today, especially in high-rise buildings. This was stated by the Chairman of the Indonesian Real Estate Certification and Advocacy Board (REI) during the discussion 'Towards a Green Indonesia', Wednesday (06/27/2012). According to him, property developers are lured to build buildings with the concept of green building (Berita Satu, 2013). Indonesia itself has set a target to reduce greenhouse gas emissions by 26% by 2020. This is stated in the Presidential Regulation of the Republic of Indonesia Number 61 of 2011 concerning the National Action Plan for Reducing Greenhouse Gas Emissions (RAN-GRK).

RESEARCH METHODS

The study was conducted with a literature study to collect factors that influence High-Rise Residential (X1), Green Building (X2), M-PERT (X3), and Time Variable (Y). Through journals, literature, and regulations related to similar topics, the factors that influence each variable are obtained:

PERT is a time-oriented technique that leads to probabilistic or probabilistic planning [18]. Also in this regard, some studies refer to the termination of PERT activities to accelerate project implementation [19]. This method is an extension of the method developed by Dr. Pablo Ballesteros-Perez developing his PERT method. He is a Lecturer at the School of Construction Management Engineering, University of Reading, UK. This method, which he introduced in 2017, has given him the potential to optimize the project duration of bridge projects by up to 8.8% [20]. In the next phase, individual details are displayed.

• Develop a detailed schedule or scheduling for each stage of the execution of the work.

• Calculate the duration of each phase of the execution of work.

• Develop schedules and analyze project plans.

• Combining the stages of work implementation.

This assessment was carried out on High-Rise Residential objects located in Bekasi City-West Java, Indonesia. High-rise residential building with an area of 9,426 M2 meets Green Building standards. From the results of the assessment of the implementation of building utilization, it shows that the building is still not enough to achieve the Green Building Technical Standard can be met. The researcher can briefly describe some of the work items that constitute an improvement/improvement.

kW/TR or COP of air conditioning equipment following SNI 6390:2020 has the highest value in the assessment and financing value of its repair to become a green building. Researchers made calculations by making improvements to the work of the chiller factory so that the OTTV value was better, which was 34.7W/m2 where it was originally 35.0W/m2.

Then PLTS as a renewable energy source that will be installed in the rooftop area of the building, the source of electricity from solar panel units is used as an alternative source of electrical energy and meets the Green Building Assessment Point. The use of this system can be used as a solution in facing the threat of shortage or crisis of electrical energy so that it becomes an environmentally friendly energy source.

Project duration planning begins with the phase of determining the duration of each work item and ends with determining the total duration of the work and its standard deviation. To conclude this case study, draw up a network diagram of the activities that ran from the first job to the last job. Below are the phases or work items from start to finish for each work item activity.

Table 1. Detention Pond Work

Activity Code	Activity Description
1.1.1	Rainwater Detention Pond Work Pond 1
1.1.1.1	Detention pond excavation
1.1.1.2	Remove excavated soil
1.1.1.3	Working floor pile cap, tiebeam, slab
1.1.1.4	Sandbags pile cap, tiebeam, slab
1.1.1.5	Column
1.1.1.6	Tiebeam
1.1.1.7	Slab
1.1.1.8	Retaining Wall
1.1.2	Reinforcing steel quality of BJTP 24 & BJTD
1.1.2.1	Column
1.1.2.2	Tiebeam
1.1.2.3	Plates

Table 2. Exhause Lobby Work

Activity Code	Activity Description
1.1.7	Lower Ground
1.1.7.1	EF-GF.1-4
1.1.8	Ground Floor
1.1.8.1	EF-LG.1-4
1.1.9	1st Floor
1.1.9.1	EF-1st Floor 1-4
1.1.10	2nd Floor
1.1.10.1	EF-2nd Floor 1-4

Table 3. Building Façade Work

Activity Code	Activity Description
1.1.11	Façade Work
1.1.11.1	Glass Window
1.1.11.2	Automatic Glazed Doors
1.1.11.3	Glazed Doors With Aluminium Frames
1.1.11.4	Glazed Doors And Windows With Aluminiu

Table 4. Water Fixture Work

Activity Code	Activity Description
1.1.12	Water Fixture
1.1.12.1	Kloset
1.1.12.2	Faucet Wastafel
1.1.12.3	Faucet Dinding
1.1.12.4	Urinoir

Table 5. Solar Panel Work

Activity Code	Activity Description
1.1.17	Preparation
1.1.17.1	Survey
1.1.17.2	Preliminary design and planning
1.1.18	Main Equipment
1.1.18.1	Solar Modules

Table 6. Garbage Building Work

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Activity Code	Activity Description
1.1.19	Structure
1.1.19.1	Pilecap
1.1.19.2	Tiebeam
1.1.19.3	Beams
1.1.19.4	Column

The following network is the critical path because all activities are free from slack. The PERT network period is 209 days with a standard deviation of 64.21 days. After determining the performance time based on the PERT method, continue using the M-PERT method to balance the time estimates between pessimistic, average, and optimistic times to calculate the task duration. Get started and use it for acquisitions. Time estimation according to the following formula:

$$\mu_i = \frac{(a + (4 \times m) + b)}{6}$$

With variations for each activity with the following equation:

$$\sigma^2 = \left[\frac{(b-a)}{6}\right]^2$$

Calculation of the correction level to solve for the corrected standard deviation with the following equation:

$$K = \sqrt{\frac{5}{7} + \left(\frac{16}{7} \times \frac{(m-a)(b-m)}{(b-a)^2}\right)}$$

By using the equation above, a simplified PERT diagram is obtained which is continued by using M-PERT which is based on the equation issued or applied by the inventor. There were 5 steps to implement the customization of high-rise residential buildings. The following is a diagram of the work from Step 1 to Step 5 and the results of the method.

Vast amounts of data and information are generated at every stage of a development project. Detailed design information is generated for the successful delivery of the built asset and its final use. Data is also generated throughout the life of the building until it reaches the end of its useful life. Most of the data generated in this last stage is energy consumption data. Data can also be collected on daily level maintenance activities. Building energy performance has an important impact on overall performance [26].

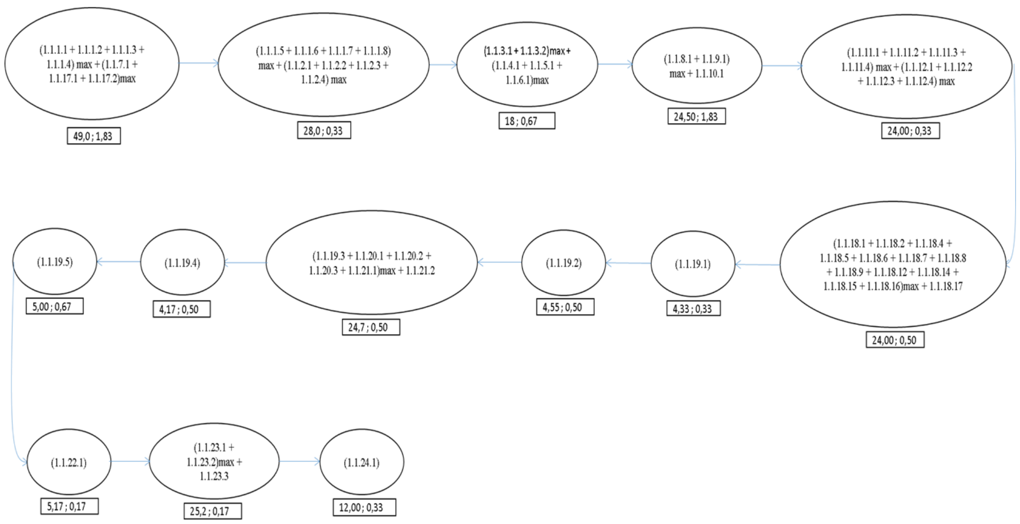

Figure 1. High-rise Residential Green Building Work Diagram Step 1 M-PERT Method

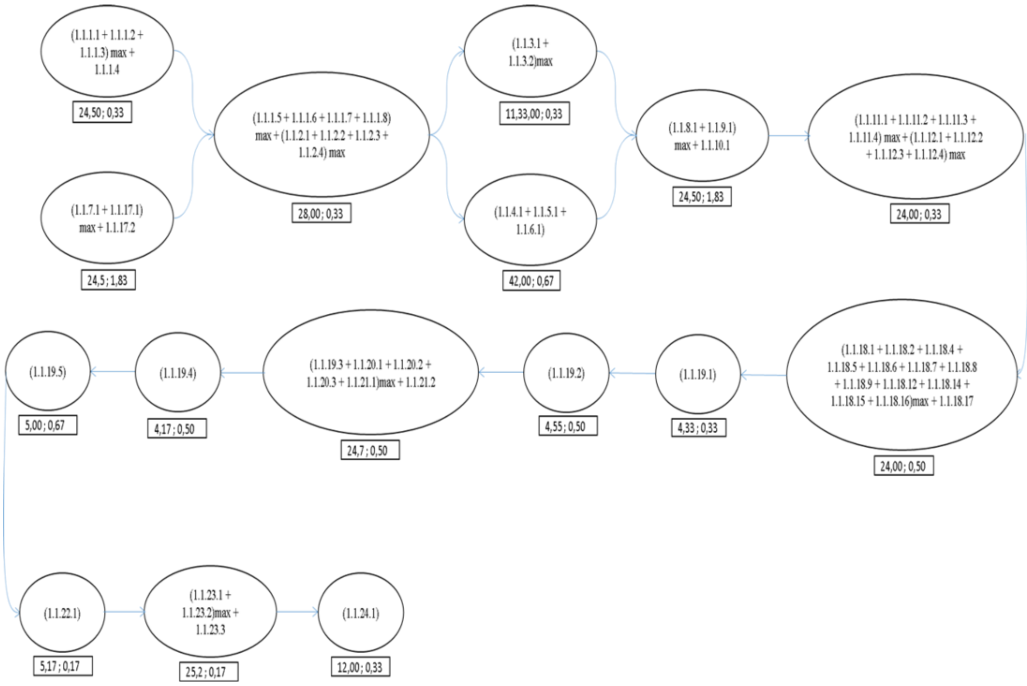

Figure 2. High-rise Residential Green Building Work Diagram Step 2 M-PERT Method

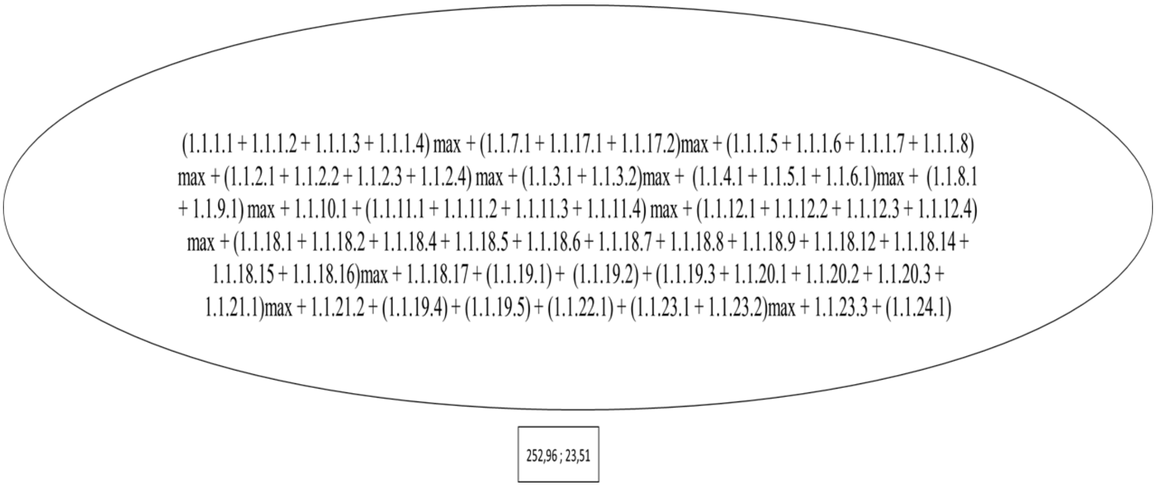

Figure 3. High-rise Residential Green Building Work Diagram Step 3 M-PERT Method

CONCLUSION

The results of research on the time accuracy of Green Retrofitting High-Rise Residential Buildings using M-PERT for the MAIN criteria is 98.88% where the GB Main Retrofit schedule is 250 days with the implementation time after M-PERT is 252.96 days

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