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Construction Management Analysis of the Cimunjul Bridge Development on the Bogor – Ciawi – Sukabumi Toll Road (Bocimi) Section 3

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Abstract
This research analyzes time and cost management in the construction of the Cimunjul Bridge on the Bogor–Ciawi–Sukabumi (Bocimi) Toll Road Section 3, which measures 254.663 meters long and 32.4 meters wide. The purpose of building the Cimunjul Bridge on Bocimi Toll Road Section 3 is to connect Parungkuda–West Sukabumi. This study aims to plan time and cost management based on the Analysis of Work Unit Prices (AHSP) of Cirebon Regency Highways in 2025 and to identify factors affecting time and cost efficiency in constructing the Cimunjul Bridge on the Bogor–Ciawi–Sukabumi Toll Road (Bocimi) Section 3. The method employs a quantitative approach with primary data from project documents and field observations. The results show that the Cimunjul Bridge cost budget plan, using the Cirebon Regency Highways Work Unit Price Analysis in 2025, totals IDR 190,985,225,558.80 with a work duration of 183 days. Work delays generally stem from resource constraints and weather factors, while cost efficiency can be achieved through strict time control using the Critical Path Method (CPM). The research concludes that CPM-based integrated planning and strict monitoring greatly improve time and cost control. Recommendations include adopting real-time digital monitoring and advanced project management tools like Microsoft Project to enhance accuracy and responsiveness in project execution. These findings contribute to both theory and practice in construction management, especially for large-scale bridges in Indonesia.

Keywords: *Time and Cost Management; Cimunjul Bridge; Work Unit Price Analysis (AHSP)*

INTRODUCTION

Time and cost management are two important factors in construction projects that are interrelated and affect the overall success of the project. The implementation of good project management will ensure the work is on budget, completed on time and meets the expected quality standards. Delays in project implementation time have a direct impact on the increase in project costs (Adam et al., 2017; Trebilcock & Rosenstock, 2015). The Cimunjul Bridge, which is part of the Bocimi Toll Road Section 3 project, plays an important role in supporting connectivity in the Sukabumi area, so that the success of time and cost management is the main indicator of the effectiveness of this project (AFRI, 2019; Akbar, n.d.; Salim et al., 2025).

The purpose of building the Cimunjul bridge on the Bocimi Toll Road section 3 is to connect Parungkuda – West Sukabumi (Ependi & Churniawan, 2023; Syaiful et al., 2025). The purpose of the research Construction Analysis on the Construction of the Cimunjul Bridge on the Bogor – Ciawi - Sukabumi (Bocimi) Toll Road Section 3 is to Plan Time and Cost Management in the construction of the Cimunjul Bridge on the Bogor – Ciawi - Sukabumi (Bocimi) Toll Road Section 3. And to determine what are the factors that affect the time and cost efficiency in the construction of the Cimunjul Bridge on the Bogor – Ciawi - Sukabumi (Bocimi) Toll Road Section 3. With the completion of this bridge, it is hoped that the toll road can soon be functionally functional and reduce congestion and travel time. Have multiple spans (the number of spans is mentioned up to six spans).

Previous research has extensively examined time and cost management in bridge construction (Al-Zwainy, 2018; Safi et al., 2015). Akhiruddin (2022) emphasized the importance of integrated scheduling and budgeting in bridge projects to mitigate delays and cost overruns. Setiawan & Al Amin (2024) highlighted the role of modern project management tools, such as the Critical Path Method (CPM), in enhancing schedule reliability. Similarly, Ramadhan & Anwar (2022) identified weather conditions, resource availability, and technical complexities as key factors affecting project timelines and budgets. This study builds upon and expands existing literature by applying these principles to the specific geographical and structural context of the Cimunjul Bridge, incorporating the latest AHSP standards and employing quantitative methods to provide actionable insights for project planning and execution.

Some of the challenges mentioned include the need for soil compaction, abdominal strengthening, weather conditions (rain) that affect earthworks, and coordination of excavation-heaps and bridge structures.

Figure 1. Project Location
Source : Google Earth

Geographically, the location of the Cimunjul Bridge is around Munjul Village, Ciambar District, Sukabumi Regency, right on the border with the Cibodas River between STA 26+537 (Cimunjul) and STA 27+933 (Cibodas).

Based on the results of previous studies such as (Akhiruddin, 2022), (Setiawan & Al Amin 2024), and (Ramadhan & Anwar 2022), most studies highlight the importance of time and cost planning in bridge projects. This study expands the study by analyzing the actual project of the Cimunjul Bridge involving geographical conditions (De Dieu & Wilson, n.d.; Jastino, 2024; LUCIA, 2024; Michard & Aust-Gronarz, n.d.; Ongkowijoyo et al., 2021).

The primary objectives of this study are to develop a detailed time and cost management plan for the Cimunjul Bridge construction using the 2025 Cirebon Regency AHSP as a reference, and to analyze the critical factors that affect project efficiency. In terms of research benefits, this study offers both theoretical and practical contributions. Theoretically, it enriches the body of knowledge in construction management, particularly in bridge projects, by integrating AHSP-based costing with CPM scheduling within a real-world case study. Practically, the findings are expected to serve as a reference for project managers, contractors, and stakeholders involved in the Bocimi Toll Road project, aiding in more accurate budgeting,

realistic scheduling, and proactive risk mitigation. Furthermore, the results can inform policy and planning in similar infrastructure developments across Indonesia, promoting more efficient and cost-effective public construction projects (Fauzan et al., 2023; Kang et al., 2019; Napitupulu et al., 2024; Ostrom et al., 2015; Sandee, 2016; Trebilcock & Rosenstock, 2015).

METHOD

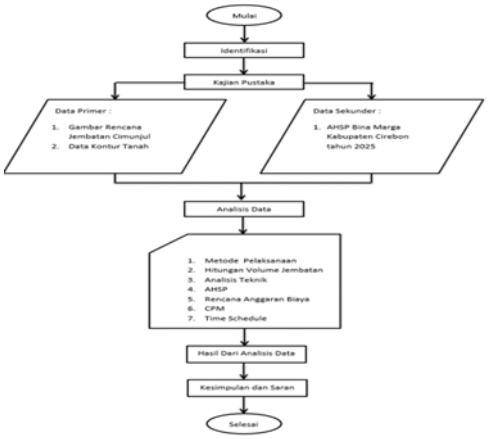

Figure 2. Research Chart

Source: Developed by the author to illustrate the research methodology and data analysis process

This study employed a quantitative research approach to analyze time and cost management in the construction of the Cimunjul Bridge on the Bogor–Ciawi–Sukabumi (Bocimi) Toll Road Section 3. Primary data were collected through direct field surveys, observations, and structured interviews with project stakeholders, including site engineers, project managers, and contractors. Technical documents—such as design drawings, project schedules, and progress reports—were reviewed to gather detailed information on work volumes, material specifications, and project milestones. Secondary data were obtained from the 2025 Cirebon Regency Work Unit Price Analysis (AHSP), project tender documents, and relevant technical standards such as SNI 1725:2016 and SNI 2847:2019. Data analysis was performed using descriptive and analytical techniques, including volume-based budget calculations, the Critical Path Method (CPM) for scheduling, and S-curve modeling for progress monitoring. These methods enabled a systematic evaluation of time and cost parameters, ensuring that the findings were grounded in accurate project data and aligned with national construction standards.

RESULT AND DISCUSSION

The Cimunjul Bridge is one of the main bridges in the construction of the Bogor-Ciawi-Sukabumi (Bocimi) Toll Road Section 3 which connects Parungkuda with West Sukabumi. This bridge is located in Munjul Village, Ciambar District, Sukabumi Regency. In terms of construction, the Cimunjul Bridge has several stretches with the main structure in the form of girders, bridge floors, and safety walls or barriers on the left and right sides.

The construction of the Cimunjul Bridge is an infrastructure project located in Cimunjul Village with a total length of 254,663 meters and a width of 32.4 meters. This bridge is designed

using a 1.2-meter diameter bore pile foundation with a total of 189 bore pile points to ensure the stability and carrying capacity of the structure.

The scope of project work includes preparatory work such as mobilization, land clearing, and signage installation, followed by earthworks including ordinary excavation work and selected piles from excavation sources, foundation work including bore pile followed by lean concrete pilecap casting and pilecap casting, lower structure work there are column/pier work, abutment, and pierhead, upper structure work including girder installation, Bearing Installation On, Slab Work, Stepping Plate Work ¸Diaphragm Work, 150mm Drainage Pipe Work, Barrier and Parapet Casting, AC-WC Asphalt Coating Work, to finishing work in the form of floor coating painting thermoplastic road markings, so that the bridge can function optimally and safely for road users.

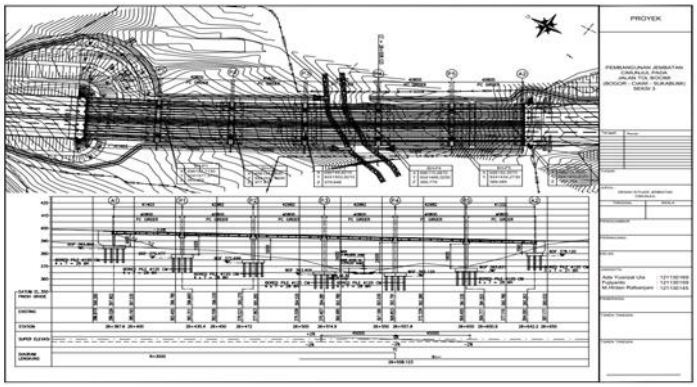

Figure 3 Cross and longitudinal section of the Cimunjul Bridge
Source: Design drawing obtained from the Bocimi Toll Road Section 3 project documentation

Volume Calculation

Work volume calculation is calculating the amount of work volume in one unit or work volume called cubic which is part of the work in one unit. Example of volume calculation on Column or Pier P1 job part 1

Calculation = Column or Pier
= Length x Width x Height
= 2 m x 2 m x 13.434
= 53.74 m3

Similar calculations were performed for bore pile, slab, and abutment work using the plan's dimensional parameters.

Calculation of Cost Budget Plan (RAB)

The Cost Budget Plan (RAB) is a calculation document that details all the cost needs for the construction of the Cimunjul Bridge on the Bogor-Ciawi–Sukabumi (Bocimi) Section 3 Toll Road. The RAB is compiled based on the volume of work contained in the design drawing, then multiplied by the unit price of work according to the latest Highway Work Unit Price Analysis (AHSP) standards. Through RAB, all components of construction work can be calculated systematically so that accurate, transparent, and accountable cost estimates are obtained.

An example of calculation on the work of the lower structure, namely Columns/Piers using the Cirebon Regency Highway calculation reference in 2025:

Volume of Work : 1,491.88 m3

Unit Price : IDR 2,852,479.54
Price/Fees Required : Volume x Unit Price
Total Price : 1,491.88 x 2,852,479.54 = IDR 4,255,552,191.55

CPM (Critical Path Method) Analysis

The Critical Path Method is used to determine the longest activity path that determines the total duration of the project. The results of the analysis show that the work of the lower structure (pier and abutment) is a critical activity that should not be delayed, as it will affect the schedule of girder installation and completion of the upper structure. For example, in the calculation of the duration of the Column/Pier work:

Volume of Work : 1,491.88 m3
Productivity Per Hour : 12.57 m3/h
Effective Work Time Per Day : 7 hours
Duration : 1,491.88 / (12.57 x 7)
= 16,953 m3/day ≈ 17 m3/day

S-Curve Analysis

The S curve is a graph that shows the relationship between the project implementation time and the cumulative progress of the work, both in terms of cost weight and volume. This graph is called the S curve because its shape tends to slope at the beginning of the project, then increase sharply in the middle stage, and slope again towards the end of the project. The manufacturing process begins with compiling a complete project work list with the order and schedule of implementation. After that, each job is weighted based on the percentage of cost or volume against the total project.

For example, in the calculation of determining the weight on the Column/Pier work:

Determining Weight:
= Price Per Job / Total Price x 100%
Determining the Weight of the Column/Pier Work:
= 4,255,552,191.55 / 190,985,225,558,795 x 100%
= 2.228210156 %

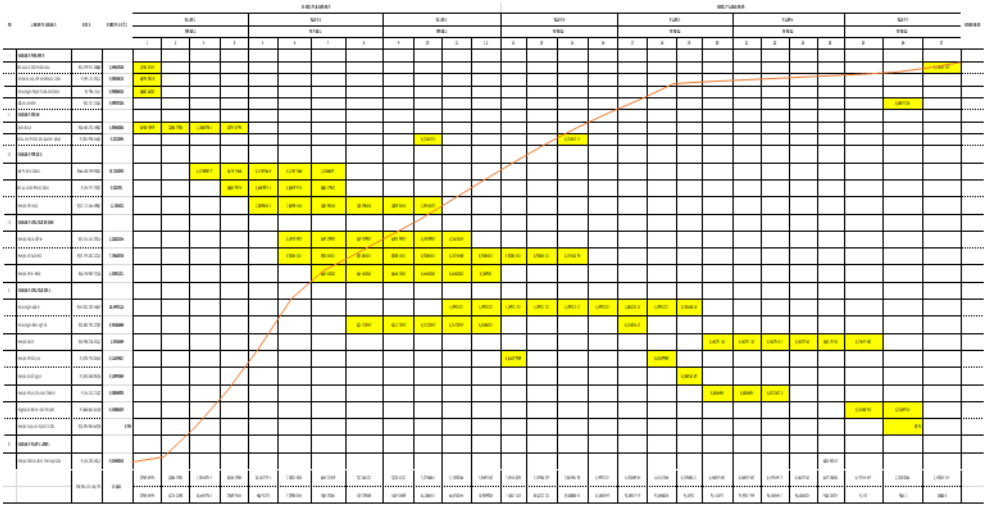

Figure 4. S Curve on the Cimunjul Bridge Construction Plan
Source : Calculation Results

CONCLUSION

This study concluded that constructing the Cimunjul Bridge required a budget of IDR 190,985,225,558.80 and 183 days of work, introducing novel findings on complex bridge construction using the 2025 Cirebon Regency Highways Work Unit Price Analysis (AHSP). Time and cost efficiency were achievable through meticulous planning and Critical Path Method (CPM)-based supervision. Recommendations included implementing digital monitoring systems for real-time progress and cost tracking, along with Microsoft Project for enhanced accuracy and completeness. For future research, integrating Building Information Modeling (BIM) with CPM could further optimize risk assessment and predictive analytics in similar large-scale Indonesian bridge projects.

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