

IDENTIFICATION OF PRECAST PARAPET WORK ACTIVITIES IN ELEVATED RAILWAY CONSTRUCTION

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ABSTRACT

Railway infrastructure development is very massive in Indonesia. Many projects have been constructing since 2013, such as the Mass Rapid Transit (MRT), Light Rail Transit (LRT), Double-Double Track (DDT), and High-Speed Rail (HSR). And all of these projects were design with elevated structures. When applying precast parapet panel technology in the MRT project elevated section, the contractor didn't have a reference for precast parapet work activities. Hence, it required new planning for its construction and took time. The project sample of this research was MRT Jakarta CP 103 Project. There were three stages in this research starting from documentation analysis, expert judgment, and respondent survey. There were 5 bridge construction experts and 30 respondents which were professional engineers asked for their recommendations and opinions. Descriptive analysis was applied to know the percentage of opinions. This research focuses on identifying precast parapet activities in elevated railway construction project. There are 14 activities that had been identified in this research, namely preparation, position survey, adjustment material installation, precast parapet panel shifting from trailer to the top of deck slab, precast parapet panel distribution, precast parapet panel installation, rebar parapet installation for concrete stitch, sealing work, concrete casting, formwork dismantling, and finishing. These activities will be very useful for similar precast parapet works in a future project.

Keywords: Work Activities; Precast Parapet Panel; Elevated Railway Project

INTRODUCTION

Railway infrastructure development is very massive in Indonesia. Many projects have been constructing since 2013, such as Mass Rapid Transit (MRT) Jakarta, Light Rail Transit (LRT) Jabodetabek & Palembang, Double-Double Track (DDT), and High-Speed Rail (HSR) Jakarta – Bandung. MRT Jakarta project was the milestone in railway infrastructure development in Indonesia, starting in 2013 and finish 2019 (PT MRT Jakarta, 2020). In 2017, The Indonesian government had released the accelerated infrastructure development rules which include the development of railway infrastructure throughout Indonesia (Setkab RI, 2017).

Currently, the railway infrastructures are built with the latest technology of elevated construction. The use of precast parapet in elevated constructions is still relatively new in Indonesia. Precast parapet panel technology was used for the first time in the MRT Jakarta CP 101, 102, and 103 Projects with elevated constructions. There was no reference to use this new technology hence it requires new construction planning and took time. Though, every project requires detailed activities that can guide the construction execution and can run effectively (Latief et al., 2019). It means that the detailing of work activities is very important for construction execution (Latief et al., 2019).

In construction, every activity will be executed by the project team to achieve

project goals (Rad, 1999), namely cost, quality, time, and safety. Hence, activities or series of tasks are very attached to a construction project and can not be separated from each other (Elsye, et al., 2018). Activities are defined by work breakdown structure or in other words, activities are generated by work breakdown structure (Elsye et al., 2018).

Base on the method statement of work that had been developed, the workflow of precast parapet panel construction work starting from a survey, material adjusting installation, precast parapet panel unloading, precast panel distribution, precast panel installation, and, stitch concreting (OSJ-JV, 2017). This workflow has to be broken down again because there are insert activities that were not shown. Therefore, it is necessary to identify detailed activities to be clear. Precast parapet panel installation is shown in Figure 1.

Activities in elevated constructions had been studied in some previous research. However, those only explained the work breakdown structure of precast girder erection in elevated road generally (Kurnia, et al., 2018). Furthermore, there were researches only explained PCI girder erection with the crane and launching gantry method (Saputra & Latief, 2020a; Saputra & Latief, 2020b). Those researches did not explain precast parapet work. Whereas, precast parapet panel will continue to be used in future elevated projects which will be constructed. This makes research on precast parapet work activities is very important and must be conducted immediately considering the benefits in the future. In the end, it is a novelty in the elevated construction project, especially in Indonesia.

To develop and complement previous research on elevated construction work

activities, the main focus of this research is precast parapet work activities identification in railway elevated construction. To be more focused, this research is limited only to the activities of precast parapet panel work on elevated construction, especially the railway project. This research is expected able to develop a previous standardized work breakdown structure and can be a reference for future similar precast parapet panel work package in railway elevated construction.

METHODS

Research Design

This research was designed as exploratory research that measures the opinions of experts and experienced respondents about the precast parapet panel work activities hence the results can be described as the basis for the implementation of construction in the site and further research. The approach applied was a quantitative approach with a survey.

Variables

The variables which will be studied in this research are work activities in precast parapet panel work for elevated railway construction project.

Stages of The Research Method

This research was designed in 3 stages to achieve the research objective (See Figure 2.). The first stage is to conduct documentation analysis to identify precast parapet panel construction sequences and activity. Furthermore, the experts were asked to validate the precast parapet panel activities that had been identified. This stage was called expert judgment (PMI, 2017). In the last stage, a survey was conducted of 30 experienced bridge engineers to collect their opinion about the detailed activities of precast parapet panel works that had

been identified. The detailed stages of research are shown in Table 1.

Questionnaire

The questionnaire was designed using the Guttman scale. It was used to know expert's and respondent's opinions by choosing "yes" or "no" options (Sugiyono, 2018). The questionnaire was distributed in two stages. In the first stage, the questionnaire was distributed to the experts. And the last stage, the questionnaire will be redeveloped and modified according to the expert recommendation and distributed to the respondents.

Project Sample

The project sample was used in this research was MRT Jakarta CP 103 Project Elevated Section. This project was chosen because precast parapet panel work in bridge structure was applied for the first time in Indonesia.

Experts and Respondents

The expert's requirements should have more than 10 years of working experience in bridge constructions, a bachelor's degree in education background, and should be professional engineers or academicians with minimum qualification as a project manager, site operational manager, and site engineering manager. The expert's profile is shown in Table 2. The respondent requirements should have more than 5 years working experience in bridge constructions, a bachelor's degree in educational background, and should be a minimum junior professional engineer.

Analysis Technique

Because this research is exploratory research, the data analysis technique used is descriptive statistical analysis. This analysis is used to determine the

percentage opinion of the experts and respondents regarding the precast parapet panel work activities.

After all, data is collected from experts and respondents then they are grouped, compiled and analyzed, and presented in tables.

RESULTS AND DISCUSSION

Expert Judgment Result

The analysis results show that there were 12 activities of precast parapet panel works that were validated by the experts. They were position survey, adjustment material installation, precast parapet panel shifting from trailer to the top of deck slab, precast parapet panel distribution, precast parapet panel installing, precast parapet panel fixing, rebar installation for concrete stitch, formwork installation for concrete stitch, sealing work, concrete casting, and formwork dismantling. The results of expert judgment are shown in Table 3.

The activities which were identified are validated by the construction expert in bridge engineering. The experts agree that the activities are valid with a total percentage are greater than 80% in each activity. Then the experts recommend adding "preparation" activity as the first sequence of work and "finishing" activities as the final sequence. This recommendation will be added to the next survey stage and data analysis.

Respondent Survey Result

Base on the analysis results, all of the respondents have 10 years of working experience. Most of them are engineers responsible for bridge superstructure work. Respondents with a master degree were 5 peoples, a bachelor degree was 22 peoples and a diploma degree were 3 peoples. The respondents were not only from Indonesia but also from Japan and

the Philippines. The respondent profiles are shown in Table 4.

The respondents agree that the activities in the precast parapet panel work with a total percentage are greater than 80%. It means that the activities which had been asked in the questionnaire were agreed upon by almost all respondents. There were 3 activities that had a percentage lower than 100%. They were precast parapet panel shifting from trailer to the top of deck slab (86.67%), precast parapet panel distribution (93.33%), and sealing work (83.33%). The detailed results are shown in Table 5.

Discussion

In project management, project activities are important to be identified. This can make a good project management implementation (Tozahro & Nursin, 2020). Because that has a function to achieve project goals (Rad, 1999) and minimize the constraints (Tozahro & Nursin, 2020). The project can be managed easily because of the activities identified at the beginning of the project (Yilmaz & Kanit, 2018). The activities are at level 5 of a work breakdown structure after the project name (level 1), work section (level 2), sub work section (level 3), and work package (level 4) (Kurnia et al., 2018; Pratita & Latief, 2018; Satrio & Latief, 2018; Al Farizi & Latief, 2018; Amini & Latief, 2018; Aryanto, et al.). Precast parapet panel works in this research case is at work package level or level 4. The precast parapet panel work package is structured and developed based on the activities identified at level 5. Identification of activities is also based on the selection of design and construction methods used because different designs and construction methods will generate different activities (Latief et al., 2018). In this study, the design used is the

precast parapet panel and the method used is the lifting crane method.

The analysis shows that there were 14 activities in precast parapet panel works. These activities are detailed and sequential activities based on the planned construction method, namely the lifting crane method. The activities start from preparation, position survey, adjustment material installation, precast parapet panel shifting from trailer to the top of deck slab, precast parapet panel distribution, precast parapet panel installing, precast parapet panel fixing, rebar installation for concrete stitch, formwork installation for concrete stitch, sealing work, concrete casting, and formwork dismantling, and the last sequence is finishing work.

The work breakdown structure is the basis of project management which is part of the scope management that will determine the successful project performance. It generates a detailed and complex level of work (Hidayah et al., 2018). Therefore, these identified activities are part of the development of the work breakdown structure and they are depicted at the lowest task level of the work breakdown structure tree diagram in Figure 3. The development of the work breakdown structure is started from level 4 (work package) and level 5 (work activity). According to the definition, work breakdown structure describes the task levels ranging from general works to specific works (PMI, 2017). This work breakdown structure has important functions as the basis for project scope management (Su, 2012), time and schedule management, human resources management, cost management, risk management, supervising, monitoring, and control (PMI, 2017). Thus, it is very useful for similar precast parapet works in a future project.

CONCLUSION

There are 14 activities that had been identified in this research, namely preparation, position survey, adjustment material installation, precast parapet panel shifting from trailer to the top of deck slab, precast parapet panel distribution, precast parapet panel installation, rebar parapet installation for concrete stitch, sealing work, concrete casting, formwork dismantling, and finishing. The activity identification results can be integrated into the work breakdown structure that had been developed and can be used as a reference for similar work in the future. The research result can be developed in future research in measuring cycle time, developing a safety plan, quality plan, standard operating procedure of precast parapet panel, and integrating with building information management (BIM).

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Appendix



Figure 1. Precast Parapet Panel Installation (OSJ-JV, 2017)

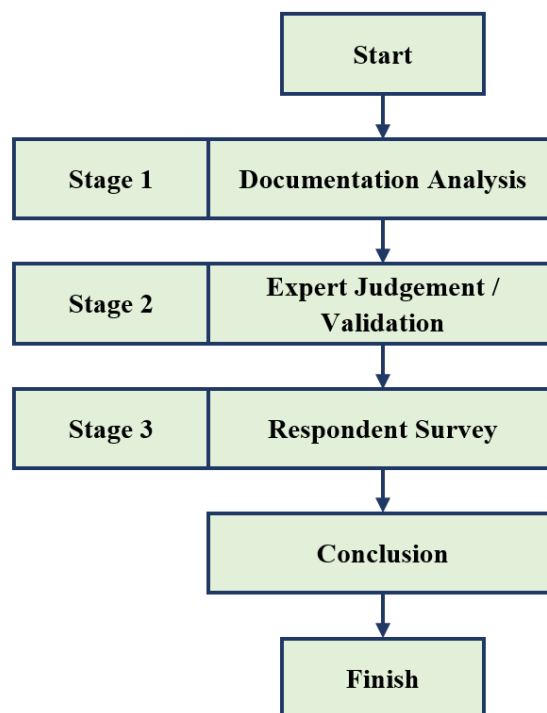


Figure 2. Research Flow

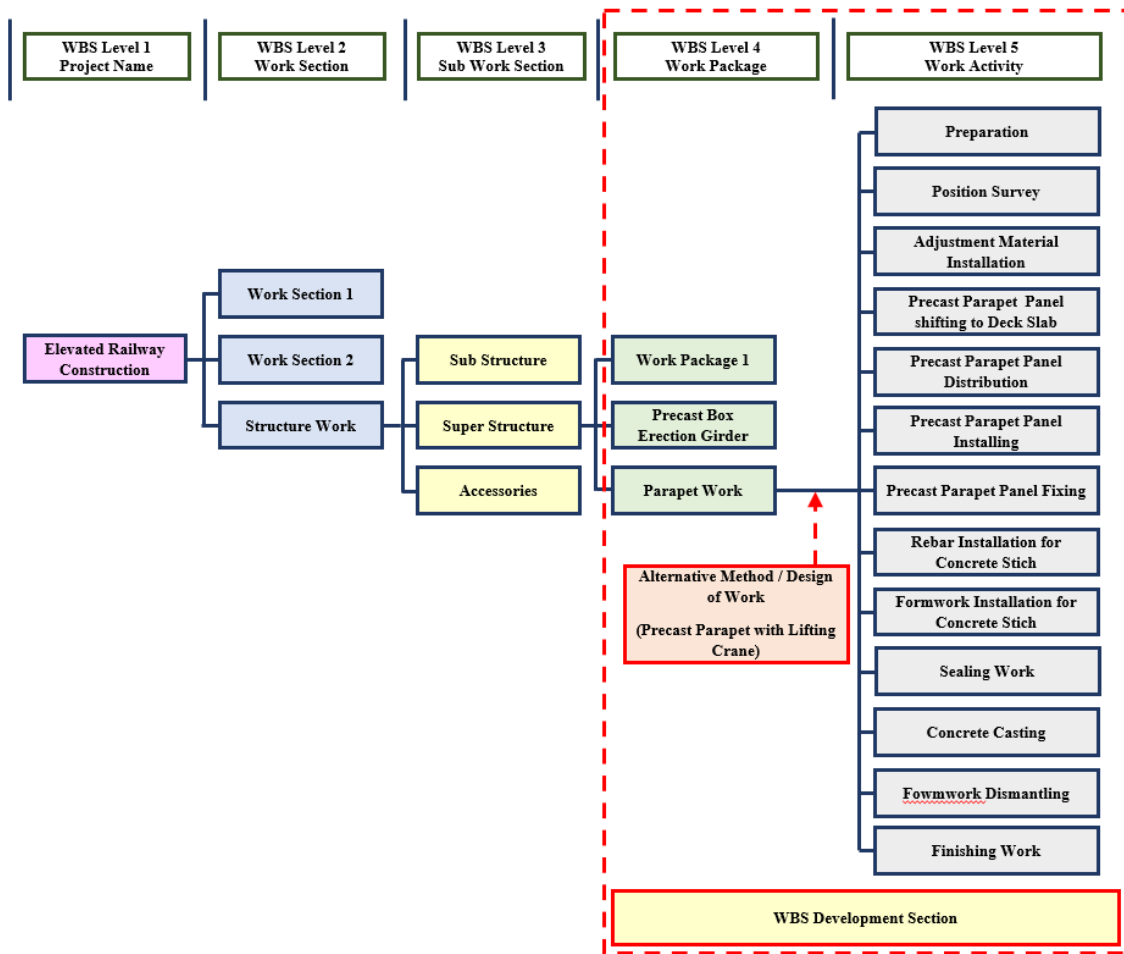


Figure 3. WBS Tree Diagram with Detail Activities of Precast Parapet Work

Table 1. Stages of The Research

Stage	Stage 1	Stage 2	Stage 3
Method	Documentation Analysis	Expert Judgement	Respondent Survey
Variables	Activities of Precast Parapet Work Installation		
Samples	MRT CP 103 Project	Construction Expert	Respondent
Questionnaire	No	Guttman Scale	
Analysis	No	Descriptive Analysis	

Table 2. Expert Profile

No	Expert	Working Experience	Position	Education	Country of Origin
1	Expert 1	30 Years	General Manager	Master Degree	Japan
2	Expert 2	30 Years	Project Manager	Master Degree	Japan
3	Expert 3	25 Years	Site Manager	Master Degree	Japan
4	Expert 4	17 Years	Chief of Engineer	Master Degree	Philippines
5	Expert 5	15 Years	Engineering Manager	Bachelor Degree	Indonesia

Table 3. Expert Judgement Results

No	Identified Activity	Expert Judgement		
		Yes	No	Conclusion
1	Position Survey	100.00%	0.00%	Yes
2	Adjustment Material Installation	100.00%	0.00%	Yes
3	Precast Parapet Panel Shifting from Trailer to Top of Deck Slab	100.00%	0.00%	Yes
4	Precast Parapet Panel Distribution	100.00%	0.00%	Yes
5	Precast Parapet Panel Installing	100.00%	0.00%	Yes
6	Precast Parapet Panel Fixing	100.00%	0.00%	Yes
7	Rebar Installation for Concrete Stich	100.00%	0.00%	Yes
8	Formwork Installation for Concrete Sticth	100.00%	0.00%	Yes
9	Sealing Work	80.00%	20.00%	Yes
10	Concrete Casting	100.00%	0.00%	Yes
11	Formwork Dismantling	100.00%	0.00%	Yes

Table 4. Respondent Characteristics

A	Experience	Total Sample
1	10 - 15 Years	13
2	16 - 20 Years	10
3	20 - 25 Years	5
4	> 25 Years	2
Total Sample		30
B	Position	Total Sample
1	Manager	5
2	Assistant Manager	4
3	Staff / Engineer	21
Total Sample		30
C	Education	Total Sample
1	Diploma Degree	3
2	Bachelor Degree	22
3	Master Degree	5
Total Sample		30
D	Country of Origin	Total Sample
1	Japan	4
2	Indonesia	21
3	Philippines	5
Total Sample		30

Table 5. Respondent Survey Results

No	Identified Activity	Survey Result		
		Yes	No	Conclusion
1	Preparation	100.00%	0.00%	Yes
2	Position Survey	100.00%	0.00%	Yes
3	Adjustment Material Installation	100.00%	0.00%	Yes
4	Precast Parapet Panel Shifting from Trailer to Top of Deck Slab	86.67%	13.33%	Yes
5	Precast Parapet Panel Distribution	93.33%	6.67%	Yes
6	Precast Parapet Panel Installing	100.00%	0.00%	Yes
7	Precast Parapet Panel Fixing	100.00%	0.00%	Yes
8	Rebar Installation for Concrete Stich	100.00%	0.00%	Yes
9	Formwork Installation for Concrete Stich	100.00%	0.00%	Yes
10	Sealing Work	83.33%	16.67%	Yes
11	Concrete Casting	100.00%	0.00%	Yes
12	Formwork Dismantling	100.00%	0.00%	Yes
13	Finishing Works	100.00%	0.00%	Yes