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# PROJECT PLANNING OF VIADUCT STRUCTURE IN LRT JAKARTA PHASE 1B ZONE 1

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***ABSTRACT***

The LRT Jakarta Phase 1B Zone 1 Velodrome – Manggarai construction project is a project owned by PT. Jakarta Propertindo (PERSERODA) which is located on East Jakarta, District Pulo Gadung and Matraman. This project consists of 103 piers with a length of 3,6 km. This project will be implemented in the middle of a densely populated road surrounded by high-rise buildings, schools, and a university with limited construction area. So that we need project planning for this project to determine the appropriate organizational structure, site layout, implementation method, quality and safety planning, implementation budget, implementation time. To create project planning there are some required data, such as shop drawing, work plan document and requirements, and DKI Jakarta unit price document 2023. The result of project planning that have been prepared are the organizational structure used is a functional type of organization, site layout consist of 10 temporary facilities and traffic management has 2 access doors, namely entrance and exit for each section, the implementation strategy uses zoning, Quality planning consists of Standard Operational Procedure (SOP), and For safety planning consists of K3L, organizational structure, Hazard Identification Risk Assessment and Risk Control (HIRARC), General Program, and K3 Supporting Equipment, Implementation Time 843 Calendar Days with a total implementation budget of Rp. 453.955.638.849,71.

**Keywords** : project planning, schedule, implementation method, cost, quality

**ABSTRAK**

Proyek konstruksi LRT Jakarta Tahap 1B Zona 1 Velodrome – Manggarai adalah proyek milik PT. Jakarta Propertindo (PERSERODA) yang berlokasi di Jakarta Timur, tepatnya di Kecamatan Pulo Gadung dan Matraman. Proyek ini terdiri dari 103 pier dengan panjang 3,6 km. Proyek ini akan dilaksanakan di tengah jalan yang padat penduduk dan dikelilingi oleh gedung-gedung tinggi, sekolah, serta universitas, dengan area konstruksi yang terbatas. Oleh karena itu, diperlukan perencanaan proyek untuk menentukan struktur organisasi yang sesuai, denah lokasi, metode pelaksanaan, perencanaan mutu dan keselamatan kerja, anggaran pelaksanaan, serta waktu pelaksanaan. Untuk membuat perencanaan proyek, dibutuhkan beberapa data seperti shop drawing, dokumen rencana kerja dan syarat-syarat, serta dokumen harga satuan DKI Jakarta tahun 2023. Hasil dari perencanaan proyek yang telah disusun meliputi: struktur organisasi yang digunakan adalah tipe organisasi fungsional, denah lokasi terdiri dari 10 fasilitas sementara yang perencanaannya dibagi menjadi 2 alternatif, dan manajemen lalu lintas memiliki 2 akses pintu, yaitu pintu masuk dan pintu keluar. Strategi pelaksanaan menggunakan metode zoning. Perencanaan mutu terdiri dari Prosedur Operasional Standar (SOP) dengan Rencana Pengujian Inspeksi (ITP), dan untuk perencanaan keselamatan terdiri dari K3L, struktur organisasi, SOP, Identifikasi Bahaya, Penilaian Risiko, dan Pengendalian Risiko (IBPRPR), Program Umum, serta Peralatan Penunjang K3. Waktu pelaksanaan adalah 843 hari kalender dengan total anggaran pelaksanaan sebesar Rp. 453,955,638,849.71

**Kata kunci**: perencanaan proyek, jadwal, metode pelaksanaan, biaya, mutu

## 1. INTRODUCTION

The Capital City of Jakarta is known for its dense population and high pollution. In order to improve the quality of public transportation and reduce congestion in Jakarta, the Jakarta Provincial Government built a public transportation called Light Rail Transit (LRT). LRT is a low-carbon and environmentally friendly transportation, so this transportation can be one of the modes of transportation to reduce carbon emissions in Jakarta.

In November 2022, there was Presidential approval regarding the construction of Jakarta LRT Phase 1B with the Velodrome to Manggarai route. With the Jakarta LRT Phase 1B Development Project (Velodrome - Manggarai), it is expected to increase the effectiveness of public transportation and support the development of city infrastructure as a whole.

This Phase 1B project will be implemented in the middle of a densely populated road surrounded by high-rise buildings, schools, and a university with limited construction area. So project work management is needed so that the work carried out does not disturb traffic and residents in the morning and afternoon. There will be construction of 103 piers with a length of 3.6 km. Due to ongoing projects that disrupt the comfort of the surrounding environment, the government has limited construction with a duration of 1080 calendar days. At the implementation stage, there are 3 aspects that can determine the success of a project, namely cost, quality, and time. Therefore, the Jakarta LRT Phase 1B Zone 1 Project requires a special study in the implementation of construction to avoid project delays amidst the dense roads around the project which can result in cost overruns. In addition, the quality used should not be ignored just because the work process is short.

Based on the problems above, in compiling this the author takes the title "PROJECT PLANNING OF VIADUCT STRUCTURE IN LRT JAKARTA PHASE 1B ZONE 1" to determine the organizational structure, site layout, implementation method and strategy, quality and occupational health safety plan, implementation time, and implementation budget for LRT Jakarta Phase 1B Zone 1 Project.

## 2. METHOD

There are several methods of data collection, including:
1. Location survey, Survey to the project location is intended to be able to see the conditions in the project field directly.
2. Interview, This interview is conducted with the project contractor to find out about the purpose of development, project background, project scope, implementation methods used, etc.
3. Literature study, this activity aims to find out related scientific theories and can support the topics that will be discussed in this thesis.

### 2.1 Researach Data

The data needed in this study are as follows:
a. Photos existing conditions of the project
b. Shop Drawing
c. Bill of Quantity
d. Work Plan and Document Requirements
d. DKI Jakarta Unit Price Document 2023

### 2.2 Research Analysis

Here are the steps of process the data to become Project Planning shown by flowchart below :

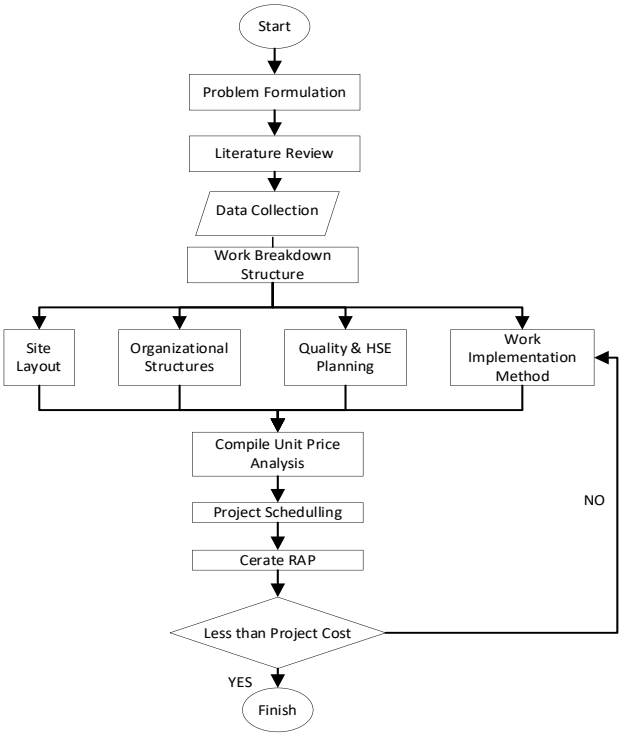


**Figure 1** Flow Chart for Preparing Project Planning
Source : (Personal Document)

## 3. ANALYSIS AND DISCUSSION

### 3.1 Organizational Structure

In the LRT Jakarta Phase 1B Zone 1 project, a functional type organizational structure is used because if there is a problem in the project, decision making can be done quickly according to their fields. Because staff members are grouped into specializations, such as administration, operations, engineering, and each staff has clear authority and responsibility. The following is a chart of the organizational structure of the LRT Jakarta Phase 1B Zone 1 Project.

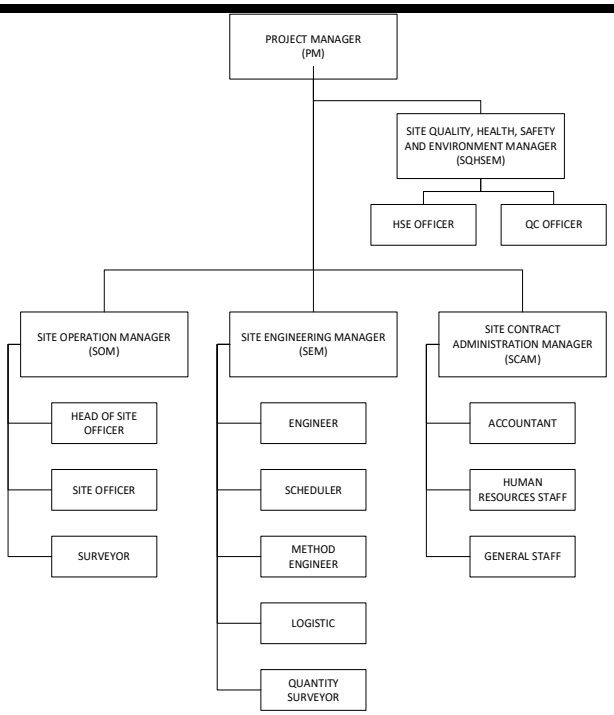


**Figure 2** Organizational structure
Source : (Personal Document)

### 3.2 Site Layout and Traffic Management

The site layout plan located in 3 different section based on strategy that implemented. In section 2 located at STA 1+700 precisely between P46 and P47, because the location is the midpoint in the project area. The HSE container is placed in the midpoint of the project area to facilitate workers in getting first aid. However, in sections 1 and 3 there are still implementing containers. The implementing containers in sections 2 and 3 are placed in the midpoint of the section area itself. If in section 1 it is in STA 0+500 precisely between P11 and P12, while in section 3, the implementing container is placed in STA 3+090 precisely between P82 and P83. The buildings built in the project area are temporary and can be flexibly moved anytime and anywhere. The project area is limited by an MCB fence, the MCB is also flexible. To determine the most optimal site layout for LRT Jakarta Phase 1B Zone 1 project, there are 2 alternatives that the author made. By comparing the calculation of Travel Distance and Safety Index. From the graph it can be seen that the one that is close to 0 means it shows the most minimum graph and the site layout that will be used. The following is a comparison table that can be seen in **Table 1** and a comparison graph can be seen in **Figure 3**.

**Table 1.** Total Amount of SI and TD

| Site Layout | Travelling Distance | Safety Index |
|---|---|---|
| Alternative 1 | 114706,923 | 655 |
| Alternative 2 | 113349,02 | 598 |

Source : (Personal Document)

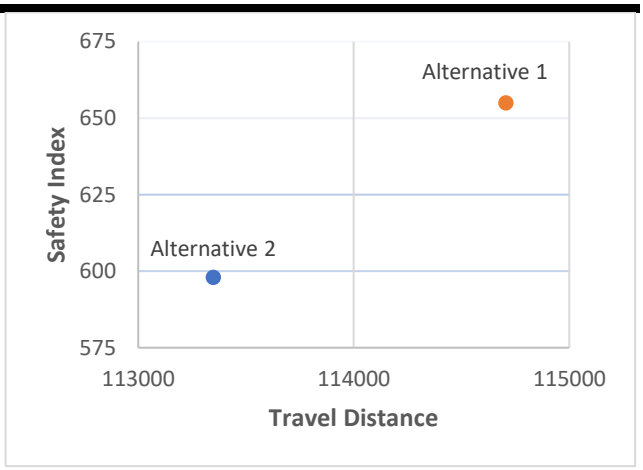


**Figure 3** Comparison graphs on Alternative 1 and 2
Source : (Personal Document)

From the comparison above, the site layout that has a traveling distance and safety index value close to the minimum number or close to 0 will be selected and used as the planning site layout, because the traveling distance and safety index values are the lowest close to the minimum number. So alternative 2 meets the 3E principle (Effective, Efficient, and Economical) because the spatial placement of the safety index and traveling distance comparison diagram that has the smallest value is alternative 2. For traffic management has 2 access doors, namely entrance and exit for each section. Here are the visualization of site layout and traffic management :

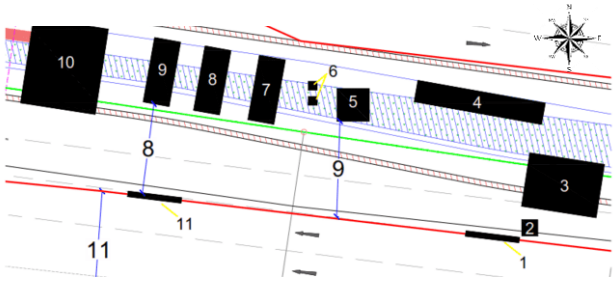


**Figure 4** Site Layout in Construction Area for Section 2
Source : (Personal Document)

Description :
— MCB Fence (Median Concrete Barrier)
1. Entry Access Gate
2. Guardhouse
3. Parking lot
4. Stockyard Material
5. Islamic Prayer Room
6. Toilet
7. Executor Container
8. HSE Container
9. QC Container
10. Heavy Equipment Parking Area
11. Exit Access Gate

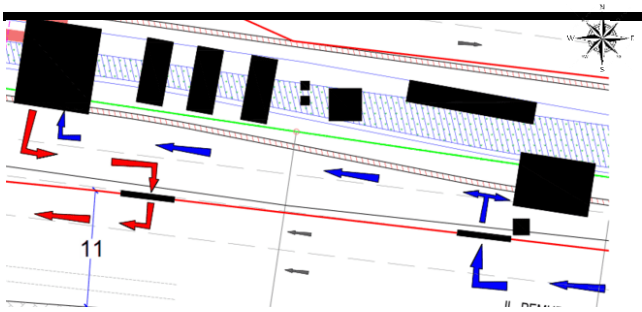


**Figure 5** Project Inflow and Outflow
Source : (Personal Document)

Description :
- MCB Fence (Median Concrete Barrier)
- Project area entrance directions
- Project area exit directions

### 3.3 Implementation Strategy and Method

The implementation strategy used zoning, by dividing into 3 areas or sections. With the divisions of P1-P35 along 1.24 km as section 1 (yellow area), P35 - P69 along 1.2 km as section 2 (blue area), and P69-P103 along 1.22 km as section 3 (green area). This approach helps minimize equipment idling and unnecessary formwork, while also improving the organization and efficiency of site operations.

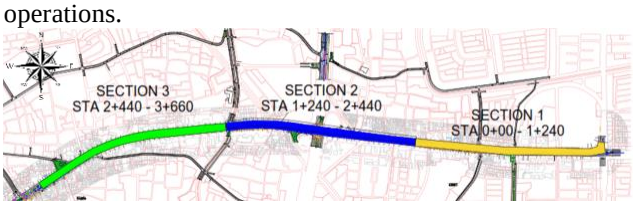


**Figure 6** Zoning Area for Project
Source : (Personal Document)

For implementation method, the work done from borepile – pilecap – pier – pierhead – girder - slabdeck. For borepile, pilecap, pier, pierhead, slabdeck using cast in-situ. While girder there are 2 method, using precast concrete girder and steel box girder.

### 3.4 Quality Control

Quality control planning includes control methods with all activities known as SOP (Standard Operating Procedure). The document is agreed upon by the contractor, consultant, and owner. The SOP document contains specifications and employer requirements. SOP is prepared as a guideline in conducting field work. SOP is a requirement that must be met in order to do something as expected, presented in the form of a checklist form that will be filled in by carrying out checklist inspection activities by the Quality Control team. The QHSE Division has a Quality Patrol program that is useful for quality control on the project, Quality Patrol is a quality control activity including monitoring to avoid problems and deviations. Here are the example, flowchart of quality planning for pier work.

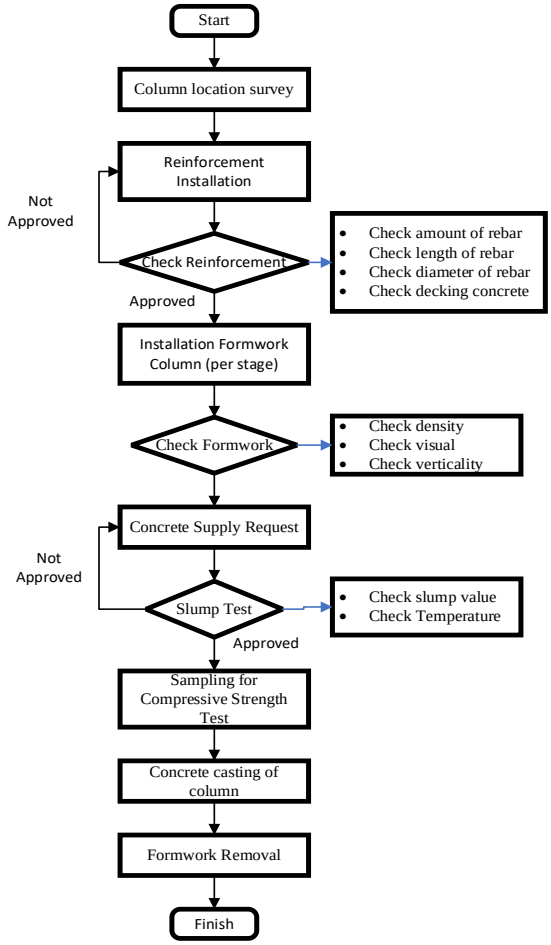


**Figure 7** Flowchart Quality Planning for Pier Work
Source **:** (Personal Document)

### 3.5 Occupational Health and Safety Plan (OHS)

The construction safety plan document is the implementation of a construction safety management system in the work environment that is made based on the scope of work and conditions in the field. This document is an effort, thought, and application to ensure the integrity and perfection of the physical and spiritual workers from work accidents that can occur in construction projects. The document consists of Construction Safety Objectives and Policy, Hazard Identification Risk Assessment and Risk Contol, OHS Organizational Structure. There are some program that are implemented in order to realizing a zero accident principle. Such as safety induction, safety patrol, safety card, safety morning, tool box meeting, and 5R. and also all of the work must be supported with OHS Equipment, such as safety signs, Personal Protective Equipment, Occupational Protective Equipment, and Emergency Responese Kit. Here are the conception of HIRARC table.

**Table 2**. HIRARC

| NO. | RISK DESCRIPTION | | | RISK LEVEL ASSESSMENT | | | | HIRARCHY OF CONTROL | RISK CONTROL |
|---|---|---|---|---|---|---|---|---|---|
| | JOB DESCRIPTION | HAZARD IDENTIFICATION (Hazard Scenario) | HAZARD TYPE (Accident Type) | C | L | S | RISK LEVEL | | |
| Preparation Work | | | | | | | | | |
| 1 | MCB Instalation | - Hit by material | - There was an incident that resulted in the administration of medical treatment | 2 | 3 | 6 | Medium-High | Elimination<br>Substitution<br>Engineering | Can't be removed<br>Can't be replaced<br>• Work methods and instructions<br>• Installation of barricades in the work area<br>• Site facilities placement |

*Source : Personal document*

### 3.6 Project Implementation Schedule Plan

In LRT Jakarta Phase 1B Zone 1 Project has a completion time of 835 days. The implementation of work starts on Monday to Saturday starting at 08.00 - 20.30 WIB with 2 break times at 12.00 - 13.00 WIB, 17.30 - 19.00 WIB. Scheduling with the process using the Microsoft Project 2021 application obtained a gant chart with critical path. The critical path consists of activities that do not have time leeway or are commonly called float/slack. Any delay in this activity will directly affect the project completion date. These are the visualization of S Curve at LRT Jakarta Phase 1B Zone 1 Project :

**Table 3.** S Curve

| No. | Job Description | % | Quarter | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | Preparation Work | 1% | 1% | | | | | | | | | |
| 2 | Boredpile Work | 31% | 3% | 3% | 3% | 4% | 3% | 3% | 4% | 3% | 3% | 1% |
| 3 | Pilecap Work | 12% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 0% |
| 4 | Pier Work | 13% | 1% | 1% | 1% | 1% | 1% | 1% | 2% | 1% | 1% | 0% |
| 5 | Pier Head Work | 7% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 1% | 0% |
| 6 | Precast Concrete Girder Work | 31% | 1% | 3% | 3% | 4% | 4% | 4% | 4% | 3% | 3% | 1% |
| 7 | Steel box Girder Work | 3% | 1% | 1% | 0% | 0% | | | 0% | 0% | 0% | |
| 8 | Slabdeck Work | 3% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| | Total | 100% | 10% | 11% | 11% | 11% | 11% | 11% | 11% | 11% | 11% | 3% |
| | Cumulative | | 10% | 21% | 32% | 43% | 53% | 64% | 75% | 86% | 97% | 100% |

Source **:** (Personal Document)

### 3.7 Implementation Budget Plan

In preparing a project implementation budget plan, Unit Price (HSP) data is required as the primary reference. This HSP data includes detailed information on the unit prices of various work components, such as material prices, equipment costs, and labor wages required to complete a job. The selection of HSP data must be adjusted to the project location because these prices can vary between regions. For the Jakarta LRT Project Phase 1B Zone 1, the 2023 Unit Price data for the Jakarta area is used as the basis for the calculation. By referring to the Bill of Quantity (BoQ) data from the Jakarta LRT Project Phase 1B Zone 1, the 2023 Jakarta Unit Price data, and the Unit Price Analysis (AHSP) from Bina Marga in 2024, the process of calculating the unit price analysis for each work item in the project can be carried out systematically and accurately. This calculation is a crucial step in ensuring that the prepared budget reflects real conditions in the field and complies with applicable standards.

Direct costs are costs incurred for the physical implementation of the project in the field. From calculation, the result of direct cost Rp. 446.544.486.557,71. Direct cost consist of calculation cost for preparation and structural work. Meanwhile, indirect cost that are not directly related to construction in the field, but these costs must exist and cannot be eliminated from the project. Indirect cost consist of Administration, Employee Salary Cost, Vehicle Operations, and Temporary Project Office Needed. The total for indirect cost is Rp 7.411.152.292,00. So the total of implementation budget plan for LRT Jakarta Phase 1B Zone 1 is Rp. 453.955.638.849,71.

**Table 2**. Recapitulation Cost

| No. | Job Description | Total price | % |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 1 | Preparation Work | Rp | 3.068.184.789,52 | 0,7% |
| 1 | Boredpile Work | Rp | 140.091.508.110,31 | 31,4% |
| 3 | Pilecap Work | Rp | 51.389.911.295,52 | 11,5% |
| 4 | Pier Work | Rp | 60.276.798.411,72 | 13,5% |
| 5 | Pier Head Work | Rp | 29.842.625.362,12 | 6,7% |
| 6 | Precast Concrete Girder Work | Rp | 137.279.629.117,30 | 30,7% |
| 7 | Steel Box Girder Work | Rp | 13.202.776.082,93 | 3,0% |
| 8 | Slabdeck Work | Rp | 11.393.053.388,29 | 2,6% |
| | **Total** | **Rp** | **446.544.486.557,71** | |
| | **Indirect Cost** | **Rp** | **7.411.152.292,00** | |
| | **Total Direct Cost and Indirect Cost** | **Rp** | **453.955.638.849,71** | |

*Source : Personal document*

## 4. CONCLUSION

In the preparation of the thesis entitled "Project Planning of LRT Jakarta Phase 1B Zone 1", several conclusions can be drawn as follows :

1. The most efficient and effective organizational structure for implementing the LRT Jakarta Phase 1B Zone 1 project is the functional project organizational structure. This is because, if any problems arise during the project, decision-making can be carried out quickly within each respective field. Staff members are grouped according to their specializations—such as administration, engineering, quality and health, and operations—with each member having clear authority and responsibility.
2. Site installation LRT Jakarta Phase 1B Zone 1 Project is arranged by considering the distance of the work because it is related to the implementation time, so the center of site installation located at section 2 STA 1+700 precisely between P46 and P47, because the location is the midpoint in the project area. The implementing containers in sections 2 and 3 are placed in the midpoint of the section area itself. If in section 1 it is in STA 0+500 precisely between P11 and P12, while in section 3, the implementing container is placed in STA 3+090 precisely between P82 and P83. For traffic management LRT Jakarta Phase 1B Zone 1 Project has 3 access gate located only on the south side of the project, because the traffic are crowded. Each access gate consist of entrance and quit access at 3 section.
3. The implementation strategy is divided into 3 areas or sections. With the divisions of P1-P35 along 1.24 km as section 1, P35 - P69 along 1.2 km as section 2, and P69-P103 along 1.22 km as section 3. This approach helps minimize equipment idling and unnecessary formwork, while also improving the organization and efficiency of site operations.
4. Quality control at LRT Jakarta Phase 1B Zone Project implemented based on Standard Operating Procedure applied in the form of Job Inspection checklist form.
5. For HSE control at LRT Jakarta Phase 1B Zone Project ,HSE implementation plan documents are made, namely HIRARC table, HSE organizational structure, HSE programs, and HSE supporting equipment.
6. Duration at LRT Jakarta Phase 1B Zone Project for 843 days, starting on October 30, 2023 and completed on December 16, 2025.
7. Total planned implementation budget at LRT Jakarta Phase 1B Zone Project are Rp. 453.955.638.849,71 (four hundred fifty-three billion, nine hundred fifty-five million, six hundred thirty-eight thousand, eight hundred forty-nine rupiahs and seventy-one cents**)**.

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