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PROJECT PLANNING OF THE CONSTRUCTION OF AK LABORATORY BUILDING STATE POLYTECHNIC OF MALANG

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ABSTRACT

The AK Laboratory Building at the State Polytechnic of Malang will function as a laboratory building and electrical engineering study program workshop building. This building has been built with one floor in the existing situation and will be rebuilt and planned to have 7 floors. In construction, especially laboratory buildings in the campus area requires optimal project planning to create projects that are effective, efficient, economical, and timely in the completion. Therefore, project planning is made in this thesis to obtain organized, and well-planned project. The AK Laboratory Building located at the State Polytechnic of Malang, in Malang City, East Java, Indonesia. The secondary data obtained are Detailed Engineering Drawings, Work Plan Documents, HSPK Malang City, Regulations and references from journals and books. In this thesis, the work reviewed is structural work starting from preparatory work, substructure work, and superstructure work starting from the 1st floor to the 7th floor and roof top. From the data collected, data processing is carried out in the form of determining Work Breakdown Structure, Organizational Structure, Project Site Installation, Strategy and Implementation Method, Implementation Schedule, Quality Control, Construction Safety Plan, and the Budget Plan. From data processing carried out, the general result is that the project implementation plan would last for 134 working days, with budget planning for the direct cost Rp 19.439.275.453,07 and the indirect cost is Rp 4.622.613.116,95, so that the total budgeted cost is Rp 24.061.888.570,02.
Keywords : project planning; construction management; project schedule plan; project budget plan

1. INTRODUCTION

Project planning failures often result in wasted time and money because of rushed approaches, leading to lengthy error correction through rework [2]. In construction, efficient project planning is necessary for laboratory buildings on campus. This ensures effectiveness, cost-effectiveness, and timely completion. Project planning also helps anticipate potential setbacks, damage, and hazards during construction. A Project Planning for the AK Laboratory Building at State Polytechnic of Malang will be analyzed for careful and optimal planning. The goal is to ensure effective and efficient completion of the construction according to expectations.

2. METHODE

The research stages begin with formulation of the problem to describe issues that need to be discussed and resolved in accordance with certain limits so that the topic of discussion does not widen. This research only reviews the structural elements of the building and no other elements such as architectural, mechanical, electrical, and plumbing. Then proceed with data collection in the form of primary data from the results of surveys or observations in the field, and secondary data such as data which is obtained from the planning consultant, regulations and standards that apply in the relevant area, and appropriate references. The steps in processing the data are as follows: analyze and present project descriptions, develop project organizational structures, establish site installation, arrange project implementation strategy and implementation method, analyze, and compile a project quality plan, arrange CSP (Construction Safety Plan), arrange hazard identification risk assessment and risk control, develop project scheduling, and count the project implementation budget[3]. The last stage, from the results of the analysis that has been carried out,

Project Planning Management for The Construction of AK Laboratory Building of State Polytechnic of Malang can be concluded.

3. RESULT AND DISCUSSION

Project Description

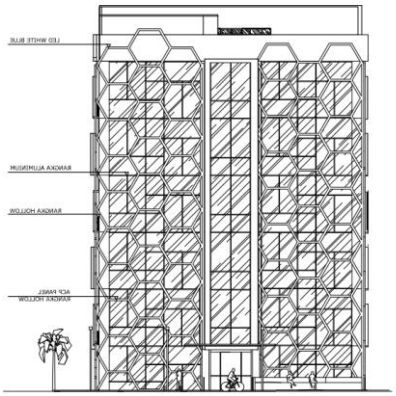

Figure 1. Front View of AK Laboratory Building

Project name : Construction of AK Laboratory Buildings State Polytechnic of Malang

Location : Campus of State Polytechnic of Malang Jl. Soekarno – Hatta No. 9, Jatimulyo, Lowokwaru, Malang City, East Java 65141.

Project owner : State Polytechnic of Malang

Planning consultant : CV. Chatur Pilar Hutama

Building width : 20 m

Building length : 60 m

Number of floors : 7 floors

Building total height : 31,10 m

Number of floors : 7 floors

Building total height : 31,10 m

Work Breakdown Structure

From the secondary data obtained from the project planner, a list of work items is obtained which is then compiled into a Work Breakdown Structure.

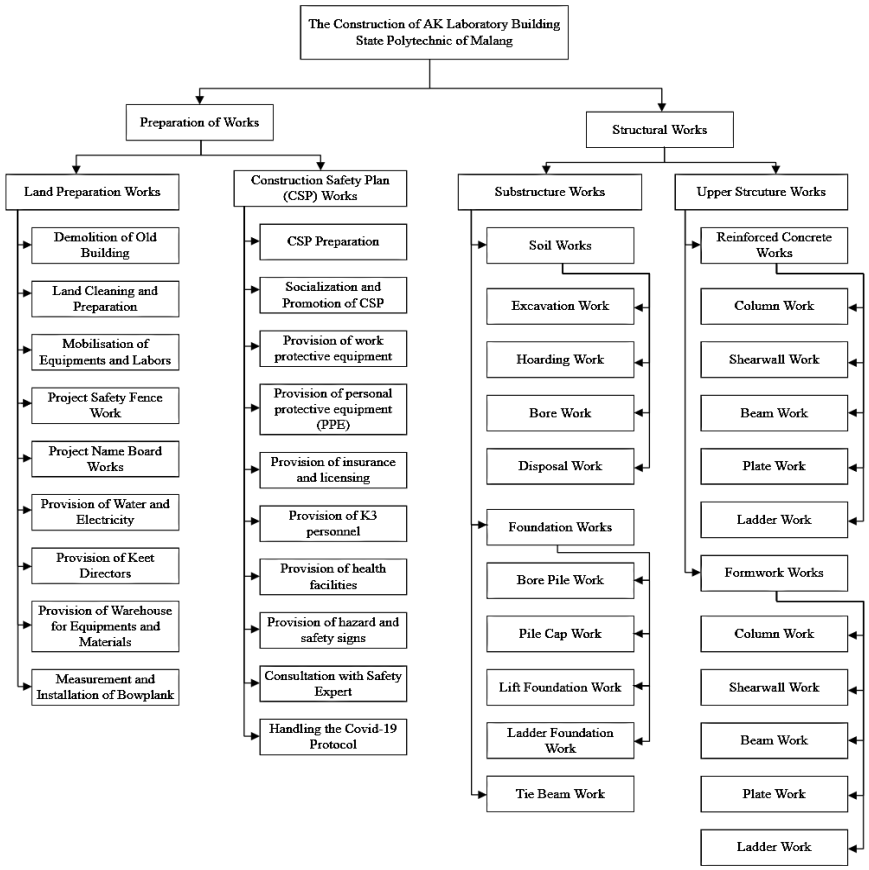

Figure 2. Work Breakdown Structure

Project Organizational Structure

In establishing the organizational structure of this project, it begins with item of works data, then identifies the needs for the management function of each job, then proceeds with grouping human resources based on the coordination

relationships between components. The following is the result of identifying the required management functions.

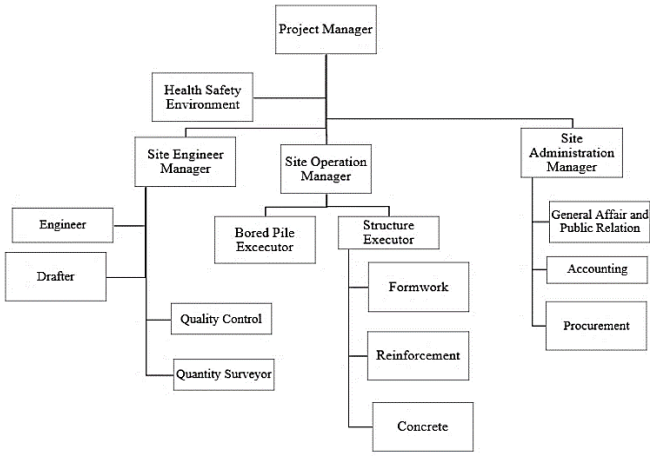

Figure 3. Project Organizational Structure

Project Site Installation

Site Layout Planning

Site layout planning considers several supporting facilities. The site layout planning of AK Building in State Polytechnic of Malang can be seen in the figure below.

Figure 4. Site Layout Planning of AK Laboratory Building

Explanation:

1. Main Gate
2. Second Gate
3. Security Site
4. Kit Director
5. Toilet
6. Labor House
7. Tool Stockyard
8. Material Stockyard
9. Wood Fabrication Site
10. Reinforcement Fabrication Site

Provisions:

1. All vehicles will enter and exit the project area using 1 entrance access according to figure 1.
2. Trucks transporting materials such as steel, concrete, wood, cement, nails, and paint enter through the main door and carry out Quality Control.
3. Material transport vehicles that have passed the QC then head to the loading and unloading area for material distribution either to the storage warehouse or to be used directly in the work area.
4. The loading and unloading area and Material Stockyard are located on a radar that can be reached by mobile cranes, making it easier to mobilize materials.

Implementation Strategy

Existing Building Demolition

For the selection of the applied method, the first thing to do is to determine the criteria for each method based on fundamental differences from the available methods. From the analysis results from the existing methods described in the table above, the top-down by machine method is the most appropriate.

Sub Structure Implementation Strategy

To efficient the time, the land is divided into 2 zones. Zone 1 is A1- A6 to D1-D6, while zone 2 is A7-A13 to D7-D13. Drilling is carried out in both zones simultaneously with the starting point and the drilling groove.

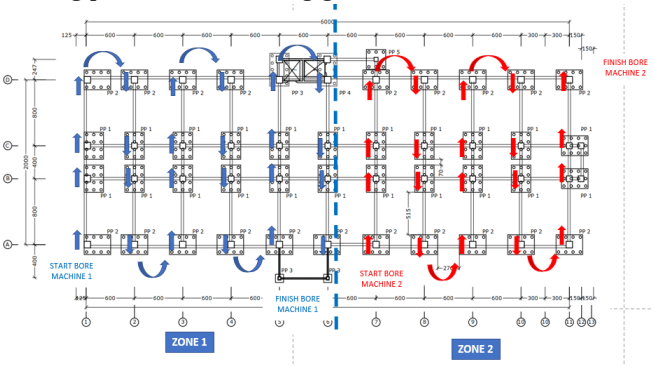

Figure 5. Drilling and Digging Strategy Schematic

Upper Structure Implementation Strategy

1. Zoning Method

On the project AK building construction, the work area is divided into two zones from the construction of the sub structure to upper structure. The work will complete zone 1 then zone 2 and continue the sequence upwards. The division of work zones can be seen in the following figure.

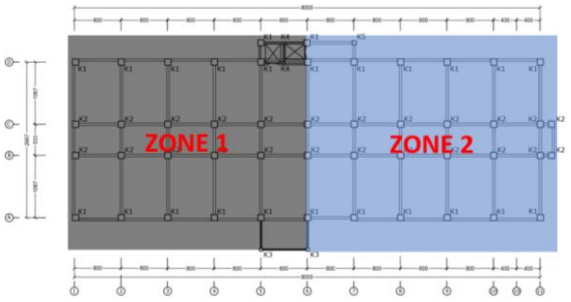

Figure 6. Zoning Method for Upper Structure Work

2. Sequence of Work for Upper Structure Strategy

The **bottom-up method** is appropriate for AK Building, State Polytechnic of Malang construction projects.

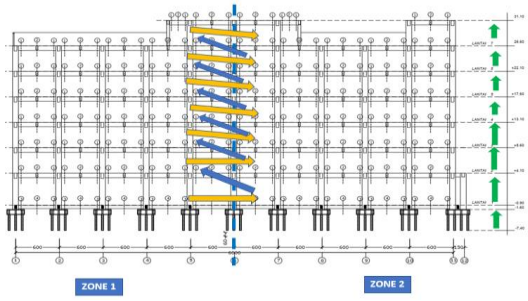

Figure 7. Bottom-Up and Zoning Strategy for AK Building

Concrete Casting Strategy

There are several casting methods that are commonly used, namely the precast method and the in-site method. For the selection of the applied method, the first thing to do is to determine the criteria for each method where the criteria are these criteria are arranged based on fundamental differences from the available methods. The selection is made according to the condition of the building and the results to be obtained. From the analysis results of the basic differences from the existing methods described in the table above, **the in-site method** is appropriate for AK Building, State Polytechnic of Malang construction projects. This method was chosen because the building is in an area which not large enough to store and erect precast concrete. Moreover, this building is located in the area of campus which requires minimizing the use of heavy equipment which is felt to cause disruption to learning and other campus activities.

Implementation Schedule

The AK Building of the State Polytechnic of Malang implementation is limited by the implementation time of 6 months, starting from 1 April 2023, and must be completed by the end of September. So that this building must be able to operate starting 1 October 2023. The determination of the duration of work is usually related to items of work and labour. The implementation of this project uses 6 working days in 1 week from Monday to Saturday with time in a day 8 hours of work at 08.00-12.00 with one hour for a break from 12.00-13.00 and starting work again from 13.00-17.00. Calculation of duration is carried out in two ways, the first one is the works which is handled by human labor, the coefficients are taken from in the latest regulations applied in Indonesia namely Permen PUPR No. 1 Year 2022. The second method is for work carried out using heavy equipment or machines, the duration calculation is carried out in accordance with the calculation procedure as stated in the Permen PUPR No. 1 Year 2022 according to the specifications and the number of tools used.

Scheduling is done using an auxiliary application in the form of Microsoft Project, with a scheduling result with a duration of **134 working days**. The appearance of the resulting scheduling is in the form of a gantt chart which can be seen below.

ID	Task Mo	Task Name	Duration	Start	Finish	Predecess
1		CONSTRUCTION OF AK LABORATORY BUILDING STATE POLYTECHNIC OF MALANG	134 days	Sat 01/04/23	Fri 22/09/23	
2		Land Preparation Works	17 days	Sat 01/04/	Sat 29/04/23	
10		Soil Works	31 days	Mon 10/04	Thu 25/05/23	9
27		Substructure Works	16 days	Wed 10/05	Mon 29/05/23	13
56		Upper Structure Floor 1	12 days	Sat 13/05/	Mon 29/05/23	29
57		Zone A	8,5 days	Sat 13/05/	Wed 24/05/23	29
73		Zone B	8,5 days	Fri 19/05/2	Mon 29/05/23	59
89		Upper Structure Floor 2	25,5 day	Fri 19/05/2	Wed 21/06/23	59
90		Zone A	17 days	Fri 19/05/2	Sat 10/06/23	59
116		Zone B	24 days	Sat 20/05/	Wed 21/06/23	92
142		Upper Structure Floor 3	32,5 day	Wed 31/05	Wed 12/07/23	121
143		Zone A	24 days	Wed 31/05	Sat 01/07/23	121
169		Zone B	24 days	Tue 13/06/	Wed 12/07/23	148
195		Upper Structure Floor 4	32,5 day	Fri 23/06/2	Wed 02/08/23	174
196		Zone A	24 days	Fri 23/06/2	Sat 22/07/23	174
222		Zone B	24 days	Tue 04/07/	Wed 02/08/23	201
248		Upper Structure Floor 5	32,5 day	Fri 14/07/2	Wed 23/08/23	227
249		Zone A	24 days	Fri 14/07/2	Fri 11/08/23	227
275		Zone B	24 days	Tue 25/07/	Wed 23/08/23	254
301		Upper Structure Floor 6	32,5 day	Fri 04/08/2	Tue 12/09/23	280
302		Zone A	24 days	Fri 04/08/2	Fri 01/09/23	280
328		Zone B	24 days	Mon 14/08	Tue 12/09/23	307
354		Upper Structure Floor 7	22,5 day	Fri 25/08/2	Wed 20/09/23	333
355		Zone A	19,5 day	Fri 25/08/2	Sat 16/09/23	333
381		Zone B	14 days	Mon 04/09	Wed 20/09/23	360
407		Upper Structure Roof Floor	10 days	Tue 12/09/	Fri 22/09/23	386
408		Zone A	5 days	Tue 12/09/	Sat 16/09/23	386
414		Zone B	5 days	Mon 18/09	Fri 22/09/23	413

Figure 8. Schedule from MS Project

Quality Plan

The Quality Plan is formed to provide Boundaries that control all project activities known as Standard Operating Procedures (SOP). The following is the beginning of quality control in the AK Building Construction Project.

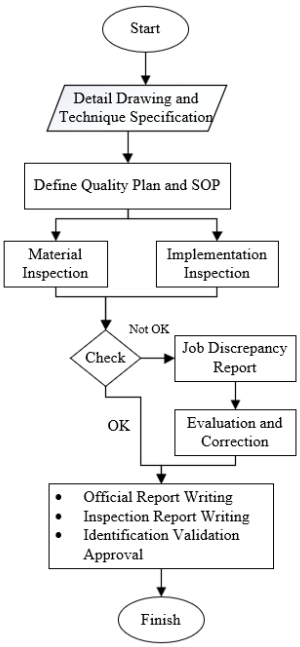

Figure 9. Quality Control Planning of AK Building Construction Flowchart

Detail drawing Inspection and Acceptance

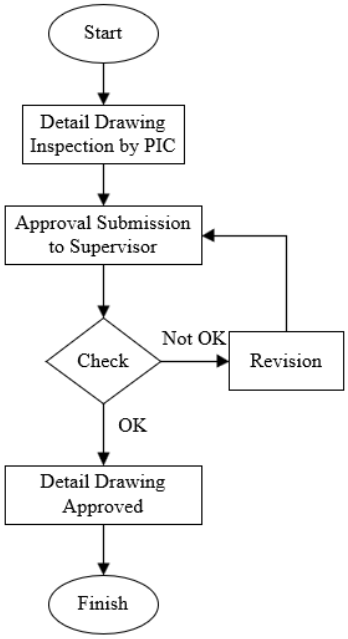

Figure 10. Detail Drawing Quality Control Flowchart

Materials Arrival Inspection

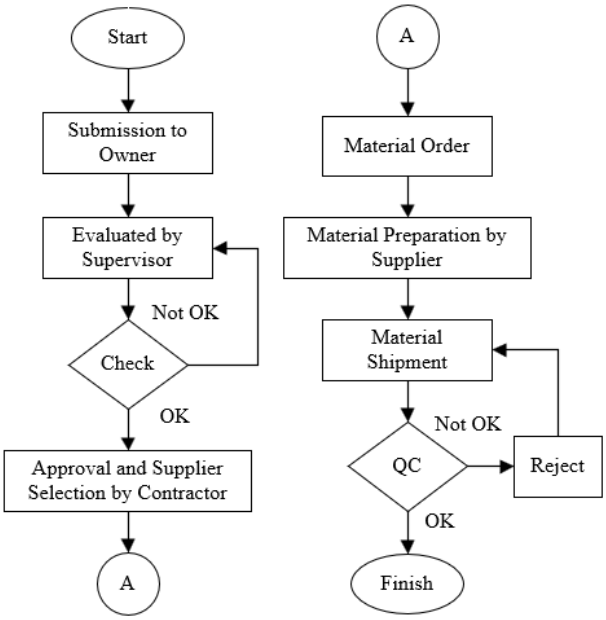

Figure 11. Materials Arrival Quality Control Flowchart

Steel Quality Inspection

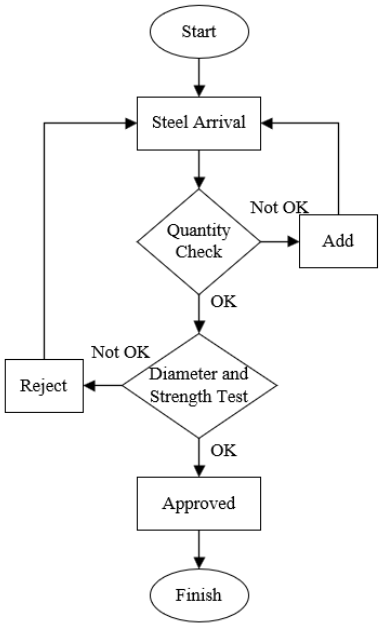

Figure 12. Steel Quality Control Flowchart

Reinforcement Work Inspection

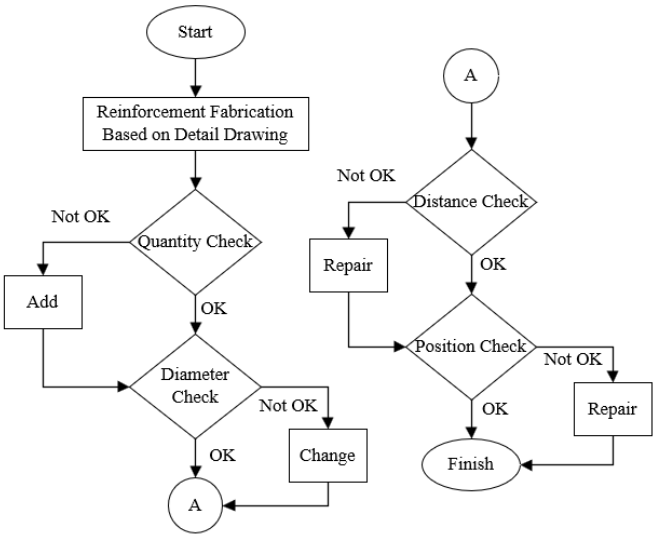

Figure 13. Reinforcement Work Quality Control Flowchart

Formwork Work Inspection

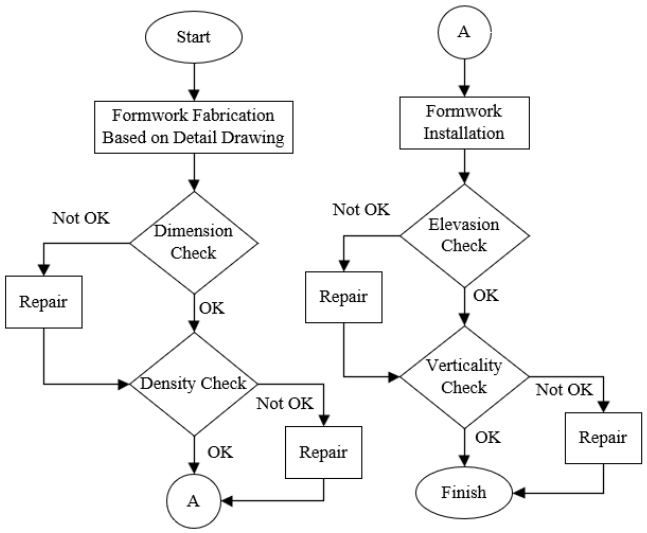

Figure 14. Formwork Quality Control Flowchart

Concrete Work Inspection

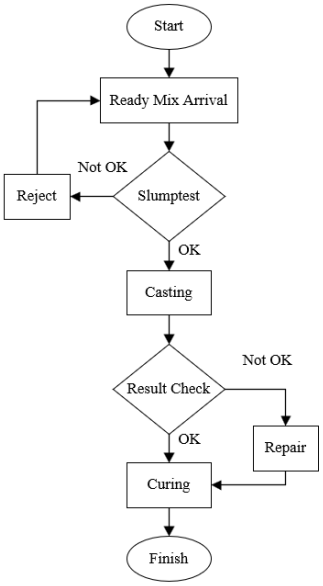

Figure 15. Concrete Quality Control Flowchart

Construction Safety Plan (CSP)

Hazard Identification Risk Assessment and Risk Control (HIRARC)

The following table is used to determine the value of the severity or impact of damage due to the risks posed.

Table 1. Value of Severity

Grade	Intensity
1	Rarely happening
2	Happens sometimes
3	Often occur

Based on table above, the Risk Level value can be calculated. Construction Risk Level is the result of multiplying the values the frequency of occurrence of Safety Construction Risk (P) with a severity value that is generated (A). The following is the formula for the Risk Level (TR):

$$RL = P \times A \quad (1)$$

Construction Safety Implementation

1. Collaboration with related agencies in the field

Collaboration with agencies related to K3 is very important, which is where the agencies in question are: depnaker, police and hospitals.

2. Construction Safety Organization

The legal basis for the establishment of an occupational safety and health organization is the Minister of Manpower of the Republic of Indonesia Number PER.04/MEN/1987 concerning Occupational Safety and Health Advisory Committee and Procedures for Appointing Occupational Safety Experts.

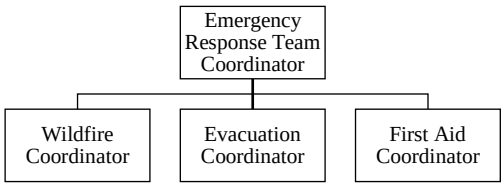

Figure 16. Construction Safety Organization

3. Construction Safety Implementation Programs

Use of appropriate technology and work methods to minimize hazards.

a. Safety Induction
b. Toolbox Meeting
c. Safety Patrol
d. Safety Supervisor

4. Emergency Procedures

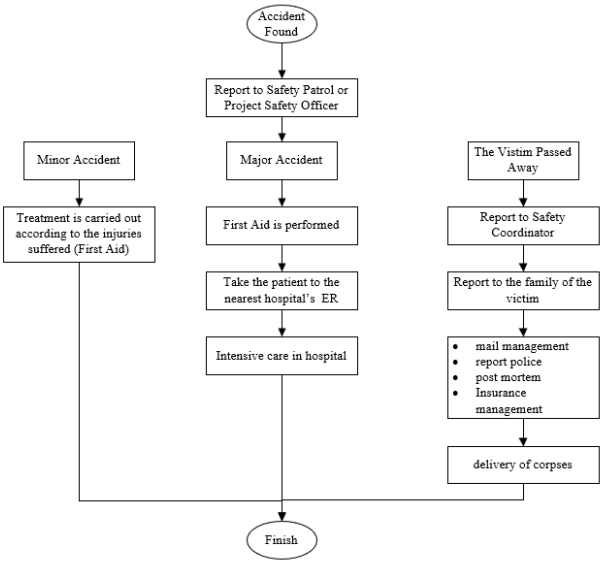

Figure 17. Emergency Procedures

5. Emergency Scenario
6. Construction Safety Equipment

   Construction Safety Equipment consists of Personal Protective Equipment (P.P.E), Project Safety Signs (Prohibition Signs, Warning Signs, Prerequisites Signs, and Help Signs).

Implementation Budget Plan

The Implementation Budget Plan of AK Building, Polytechnic State of Malang is calculated from the cost of labor, materials, and equipment needed in a project that is in accordance with the results of a price survey in the Malang City area in 2023.

Table 2. Implementation Budget Plan

Direct Cost

No	Work	Total Budget
1	Land Preparation Works	Rp214.573.244,39
2	Soil Work	Rp310.067.715,71
3	Substructure Work	Rp558.086.477,09
4	Upper structure Works	
4.1	Upper Structure Floor 1	Rp1.694.853.433,15
4.2	Upper Structure Floor 2	Rp2.789.009.245,18
4.3	Upper Structure Floor 3	Rp2.780.919.629,63
4.4	Upper Structure Floor 4	Rp2.780.919.629,63
4.5	Upper Structure Floor 5	Rp2.780.919.629,63
4.6	Upper Structure Floor 6	Rp2.780.919.629,63
4.7	Upper Structure Floor 7	Rp2.181.708.014,52
4.8	Upper Structure Roof Floor	Rp567.298.804,52
	Total Cost	**Rp19.439.275.453,07**

Indirect Cost

No	Work	Total Budget
1	Preparatory	Rp703.788.116,95
2	Directory	Rp212.625.000,00
3	Field Equipment	Rp248.000.000,00
4	Transportation	Rp42.450.000,00
5	Construction Safety Management	Rp1.900.000,00
6	Final Project Cost	Rp185.600.000,00
7	Employee Salary	Rp3.228.250.000,00
		Rp4.622.613.116,95
	Total Cost	**Rp24.061.888.570,02**

4. CONCLUSION

From the Project Planning for the Construction of the AK Building at the State Polytechnic of Malang, several conclusions can be drawn as follows:

1. The project under review is the construction of the Malang State Polytechnic AK Building.
2. WBS arranged in order for the work to be carried out.
3. Creating a linear organizational structure where superiors and subordinates connect directly. This organization type is used as it promotes clear responsibility flow and quick decision-making.

4. The Project Site Installation includes identifying temporary facilities such as director's office, security posts, warehouses, workers' houses, fabrication sites, and toilets. These facilities are placed strategically to ensure efficient, smooth, and safe operations. Traffic management involves identifying vehicle movement within the project area and planning access points, loading areas, and unloading areas with minimal waiting time and proper control.
5. The Strategy and Implementation Method used for the demolition of old buildings is the top-down by machine method, while for the substructure work, the strategy used is to divide the work into two zones that work simultaneously. For upper structure work, the strategy used is the bottom-up method with 2 zones to facilitate the implementation process based on the work area. The work starts from the work on the structure under the foundation to be continued sequentially upwards to the top floor structure in the form of work on the structure of columns, shear wall, stairs, beams, and plates.
6. The Implementation Schedule is made using MS Project with a total duration of **134 workdays.**
7. Quality control is done through a quality plan and standard operating procedures based on work plans and technical specifications. This plan refers to ISO 9001:2008 regulations.
8. The Construction Safety Plan includes HIRARC, HIRARC identification and risk control, and Construction Safety implementation program preparation.
9. The Budget Plan for AK Building Construction Project was obtained direct cost **Rp 19.439.275.453,07** and the indirect cost is **Rp 4.622.613.116,95**, so that the total budgeted cost is **Rp 24.061.888.570,02.**

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