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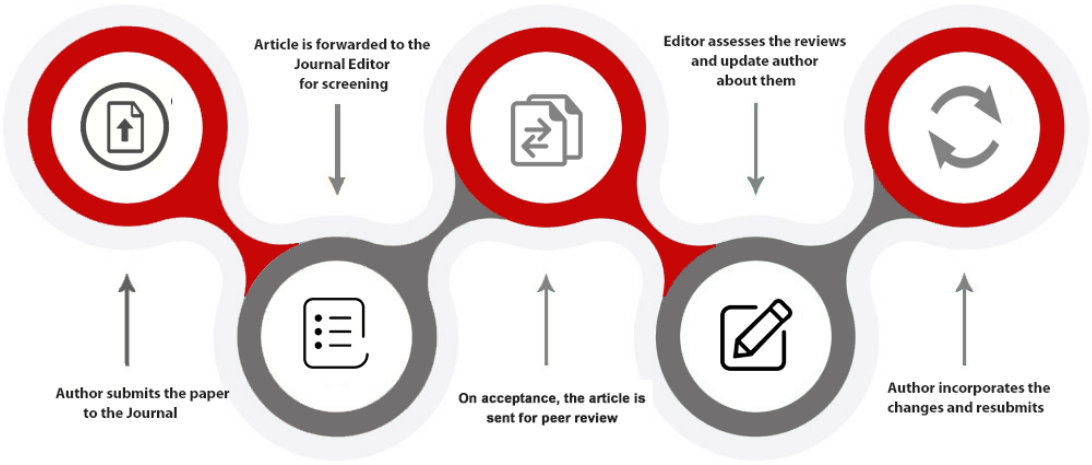

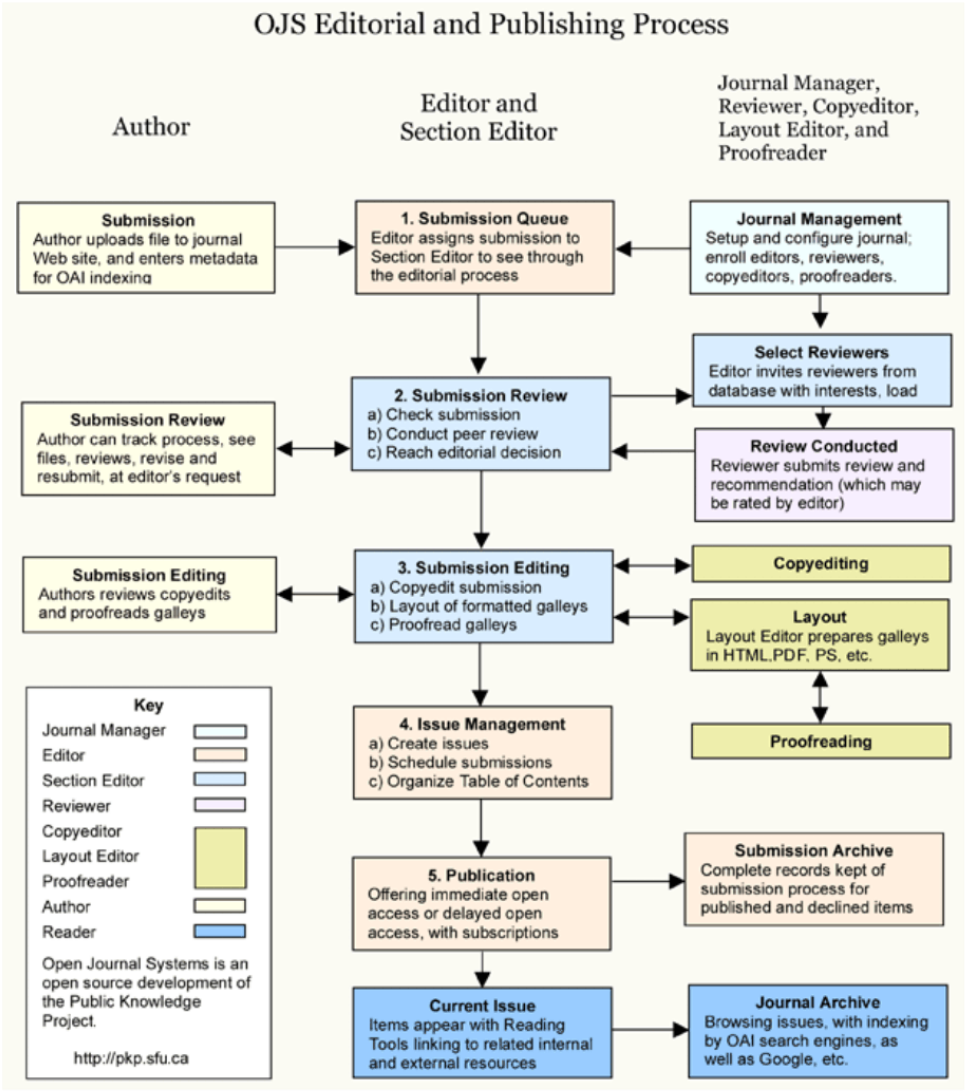

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Analysis of Management Services Modeling Flat Surabaya and the Impact on the Comfort of the Residents

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Abstract

In the era of globalization, the rapid development of development is followed by increasingly varied processes from planning, implementation, to building maintenance. Building maintenance is carried out to maintain, update and repair all building components in accordance with predetermined standards. However, increasing building construction is generally not accompanied by good maintenance. This study aims to determine the maintenance of Surabaya Flats. This research refers to the (*Settlements, Directorate General of Human Regulation of the Minister of Public Works Number: 24/PRT/M/2008 Concerning Guidelines for Building Maintenance and Maintenance, Ministry of Public Works*, 2008) concerning Guidelines for Building Maintenance and Maintenance. The research data was obtained by distributing questionnaires to the residents of the Flats with a total of 18 respondents. Data analysis was carried out using the mean and standard deviation methods to determine whether or not there were maintenance and maintenance activities in the Surabaya Flats building. Based on the results of the analysis, the maintenance division of the Surabaya Flats got a mean value of 0.888 (very good).

Keywords:
Buildings, Building Maintenance, Flats

1. Introduction

The MBKM research/Final Project for the Indonesian Innovation Talent Program for the 2021 Fiscal Year is entitled analysis of management services modeling of flats in Surabaya and its impact on occupant comfort. It focuses on solving community problems, especially the safety and security of urban workers. Flats stands for simple rental flats. The government built a multi-story building in a residential area and rented it out to underprivileged families with monthly payments. Flats are residential units used separately, where the ownership status is rental, with the primary function as a residence. The government builds it with the State or Regional Revenue and Expenditure Budget funds. In collaboration with the Ministry of Public Housing, the local government aims to provide decent housing for all Indonesian families, especially low-income people, who cannot yet buy a house. The Surabaya City Government controls 18 flats:

1. Wonorejo Flats on Jalan Raya Wonorejo Surabaya.
2. Penjaringansari II Flats on Jalan Penjaringansari Surabaya.
3. Randu Flats on Jalan Randu Agung Surabaya.
4. Tanah Merah Flat I Phase I on Jalan Tanah Merah Surabaya.
5. Tanah Merah Flats Phase II on at Jalan Tanah Merah Surabaya.
6. Penjaringansari Phase III on Jalan Penjaringansari Surabaya.
7. Grudo Flats on Jalan Grudo Surabaya.
8. Pesapen Flats on Jalan Pesapen Selatan Surabaya.
9. Jambangan Phase I Flats on Jalan Jambangan Baru Selatan Surabaya.
10. Siwalankerto Flats on Jalan Siwalankerto Selatan Surabaya.
11. Romokalisari Flats on Jalan Rusun Romokalisari Surabaya.
12. Bandarejo Flats on Jalan Raya Bandarejo Surabaya.
13. Gununganyar Flats on Jalan Gununganyar Tambak Surabaya.
14. Dukuh Menanggal Flats on Jalan Dukuh Menanggal XII Surabaya.
15. Keputih Phase I Flats on Jalan Keputih Tegal Timur Surabaya.
16. Keputih Phase II Flats on Jalan Keputih Tegal Timur Surabaya.
17. Tambak Wedi Flats on Jalan Tambak Wedi Lama Surabaya.
18. Jambangan Phase II on Jalan Jambangan Baru Selatan Surabaya.

Figure 1. Workforce and Construction Work of Flats in Surabaya

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The objective of the study is to:

1. How is the implementation of the maintenance of the Surabaya Flats building,
2. To know the physical condition of the Surabaya Flats building.

The benefits of implementing the MBKM Research/Final Project for the In(Dipohusodo, 1996)donesian Innovation Talent Program for the 2021 Fiscal Year are:

1. Completion of Research or Final Project,
2. To Analyze the management services modeling of flats in Surabaya and its impact on the comfort of residents.

Projects are organized efforts to achieve goals, objectives, and expectations using available funds and budgetary resources that must be completed within a certain period (Dipohusodo, 1996).

Work accidents are unwanted and even unexpected events that can occur in construction, industrial, or related projects, which cause losses such as property, time, and loss of life (Tarwaka, 2012).

Simple linear regression analysis is an analytical tool used to measure the influence between the independent variable (x) and the dependent variable (y) (Sugiyono, 2011).

2. Methodology

This activity starts on October 14, 2021, until November 30, 2021. It focuses on the output required by the Higher Education, Research, and Technology Ministry of Education, Culture, Research, and Technology, which is the availability of publications in international proceedings indexed as first author or author appropriate

Scope of activities carried out:

1. Collected data on 18 flats in Surabaya,
2. Distributed questionnaires to several apartments,
3. Performing the calculation of the data from the questionnaire using the Mean and Standard Deviation methods with the Microsoft Excel program application,

2.1. Respondent Data

The respondent's data is divided into three classifications: age, last education, and length of stay. From this classification, data about respondents are obtained as follows:

1. on Age

From the table below, it can be concluded that generally the residents of the flats are occupied by respondents aged 31-35 years and >36 years with a percentage of 44.4% or 8 people each. Respondents aged <25 years and aged 26-30 with the same percentage of 5.6% or 1 person each.

Table 1. classification by age

No	Age	N	Percentage
1	<25 years	1	5.6%
2	26-30	1	5.6%
3	31-35	8	44.4%
4	>36	8	44.4%
	Total		100%

2. Last education

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From the table below it can be concluded that generally the residents of the flats are occupied by respondents with the last education of elementary school with a percentage of 11.2% or 2 people, respondents with junior high school education with a percentage of 16.6% or 3 people, respondents with education the last is high school with a percentage of 44.4% or 8 people, and the last educated respondent is in college with a percentage of 27.8% or 5 people.

Table 2. classification by last education

No	Education	N	Percentage
1	SD	2	11.2%
2	SMP	3	16.6%
3	SMA	8	44.4%
4	Universities	5	27.8%
	Total		100%

3. Length of stay

From the table above, it can be concluded that generally the residents of the flats are occupied by respondents who have lived in the flats for 1-2 years with a percentage of 22.2% or 4 people, respondents who have lived for 3-4 years 8 people with a percentage of 44.4%, and respondents who occupy flats for more than 4 years 33.4% or 6 people.

Table 3. classification by residence time

No	Time Of Residence	N	Percentage
1	1-2 Years	4	22.2%
2	3-4 Years	8	44.4%
3	>4 Years	6	33.4%
	Total		100%

3. Results And Discussion

3.1. Questionnaire Results Implementation of occupational health and safety facilities

From the results of taking a questionnaire with 18 respondents from 18 flats, which means that each flat is taken one respondent with variable x is the question asked. Calculation of the questionnaire using Microsoft excel with the following results:

Table 4. questionnaire input results

responden	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1
2	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
3	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
4	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
5	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1
6	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
7	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
9	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1
10	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	0
11	1	1	1	1	1	0	1	0	1	1	1	1	0	1	0	1
12	1	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
13	0	1	0	1	1	1	1	1	1	0	1	1	1	1	1	1
14	1	1	0	1	1	1	1	1	0	0	1	1	1	1	1	1
15	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	0
16	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1	1
17	1	1	1	1	1	1	1	1	0	1	1	1	0	1	1	1
18	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1

3.2. Mean and Standard Deviation Calculation Results

Table 5. mean and standard deviation calculation results

No	Information	Mean	SD
1	Is the cleanliness of the walls and glass good?	0.888	0.323

2	Is there a maintenance officer assigned to control the cleanliness of the Flats?	0.666	0.485
3	Is the cleanliness of the floor/carpet surface good?	0.777	0.427
4	Do you think the condition of the door is good?	0.888	0.323
5	Do you think the condition of the ceiling is good?	0.944	0.235
6	Do you think the cleanliness of the curtains or curtains is good?	0.777	0.427
7	Do you feel comfortable about maintaining the Flats?	1	0
8	Do you think the quality of the air conditioner is good?	0.722	0.460
9	Do you think that the cleanliness of the window glass is good?	0.666	0.485
10	Do you think the cleanliness of the dirty water channels around the building is good?	0.833	0.383
11	Do you think the condition of the paint on the outside of the building is still good?	0.944	0.235
12	Do you think the cleanliness of the bathroom is good?	0.944	0.235
13.	Do you think the condition of the water faucet is good?	0.888	0.323
14	Do you think that the cleanliness of the sink, sitting toilet, squat toilet, urinal is good?	1	0
15	Do you think the condition of the frame is good?	0.888	0.323
16	Do you think the cleanliness of the bathroom walls is good?	0.888	0.323

From the results of this questionnaire, it can be seen that on average each question has a mean result of above 0.2 and it can be said that the Building Operation Maintenance & Management at the Rusunawa Building in Surabaya is quite good.

For officers, maintenance, data collection, the distribution of facilities is quite high for the figures from the results of this questionnaire, this is quite affecting also the residents or workers and managers of the flats. This affects the comfort of the residents.

The results above also show that the Rusunawa in Surabaya have paid attention to all the maintenance and cleanliness of the existing facilities, the cleanliness of the water channel is also a positive thing.

4. Conclusions and Suggestions

4.1. Conclusions

Based on the analysis and discussion of the data, the authors came to the conclusion that can be drawn from the study of management services in 18 Rusunawa modeling in Surabaya as follows:

1. Based on analysis of the data showed that the majority of subsidized apartments in Surabaya shows that the implementation of maintenance has been very good.
2. Based on the results of the analysis of the data, it shows that the officers who carry out maintenance on the facilities, observe conditions and routine checks have been going well in each rusunawa.

4.2. Suggestions

The suggestions in this study are the maintenance of Surabaya Flats to pay more attention to the cleanliness of the waterways and the smallest components, especially doors and windows to support the comfort of the residents and also the beauty of the Surabaya Flats.

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Biographies

Dimas Ade Pranata is a ninth semester undergraduate student at Narotama University, Surabaya with a civil engineering study program. Entered in 2017 and currently doing research for the final project.

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Journal indexed in SCOPUS, DOAJ, CROSSREF and GOOGLE, also until now as Vice Rector of Narotama University, Indonesia.

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Scheduling Analysis of the Grand Shamaya Apartment Basement Development Project in the Midst of a Pandemic Using the First Method

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Abstract

In planning and controlling a project, it is often faced with various obstacles, for example, there is a shortage of materials, errors in the work order. In this project there was a delay due to a pandemic which caused the project to be hampered which initially could run according to schedule but became not according to the specified schedule. To minimize the impact of risks that occurred, a project scheduling method was developed using a probabilistic duration, one of which was PERT (Program Evaluation and Review Technique). In this study, PERT (Program Evaluation and Review Technique) simulation was implemented which was implemented in the Grand Shamaya basement construction project based on the optimistic, pessimistic, and possible durations obtained from the survey results by the project management. PERT calculation using Microsoft Project 2013 software which produces an optimistic duration of 530 days, then for a possible duration of 535 days, a pessimistic duration of 551 days, and finally for a simulation result duration of 534.6 days. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%. The difference in the schedule for the basement construction project of the Grand Shamaya Surabaya apartment when compared to scheduling using the PERT (Program Evaluation and Review Technique) method is the length of duration and the probability of project completion. So the duration of the plan schedule for 535 days produces a probability of 53.19%.

Keywords:
Microsoft Project 2013, Microsoft Project 2013, PERT, Project Management, Project Scheduling,

1. Introduction

In project implementation, it often happens that what has been done does not go according to plan, for example the implementation of the Grand Shamaya basement apartment development project has experienced delays in its work due to PSBB (Large-Scale Social Restrictions) as a result of the COVID-19 pandemic that emerged in early 2020 A situation like this if it occurs in a work organization that has many activities, delaying the completion time in one activity will result in a delay in the completion time of the next activities. The more activities whose completion is not in accordance with the initial plan, the greater the total time required to complete the project (Retno Maharesi, 2002)

This is what underlies the use of the PERT (Program Evaluation and Review Technique) method in scheduling. Determining the duration of a project's activities using the PERT method is estimated by three estimation parameters, namely the fastest time (optimistic duration time), the longest time (pessimistic duration time) and the most likely time (most likely time).

Based on the description above, this final project will analyze project scheduling using the PERT method, with a case study on the construction of the Grand Shamaya apartment basement with a child contract value of 142 billion. By using the PERT method, it is hoped that it will simplify the scheduling process and be able to find out the fastest work that can be done to catch up with the PSBB.

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2. Literature Review

2.1. Project Scheduling

The schedule is the elaboration of project planning into a sequence of steps for implementing work to achieve goals. The time factor has been included in the schedule. A well-known method of constructing a schedule is network analysis, which depicts on a graph the relationships of the project work sequences. Jobs that must precede or be preceded by other jobs are identified in terms of time. This network is very useful for project planning and control (Iman Soeharto, 1997)

2.2. CPM Method (Critical Path Method)

According to Pardede (2014), the CPM method (critical path method) is a method using arrow diagrams in determining the critical path, so it is also called the critical path method. CPM uses one number to estimate the duration of a certain activity (deterministic). Here's the form of CPM:

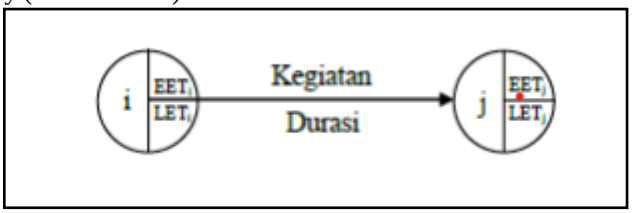

Figure 1. AOA (Activity On Arrow) Diagrams
(source: Husen, 2008)

2.3. PDM method

The Precedent Diagram (PDM) method was introduced by JWFondahl from Stanford University, USA in the early 1960s. Subsequently developed by the IBM company. PDM is a network that is generally rectangular in shape, while the arrows are only a guide for the activities concerned, and do not require dummy activities. In PDM a new activity can be started without waiting for the predecessor activity to be completed 100%.

2.4. PERT Method (Program Evaluation and Review Technique)

The PERT method is a way of planning with work networks that are connected with certain considerations. This method like CPM (Critical Path Method) requires several parameters, one of which is activity duration. Determination of activity duration in CPM refers to a fixed duration, meaning that it is enough to estimate one activity duration. The characteristics of the project cause the duration of the activity to be uncertain because the duration of the activity is influenced by various varying conditions. The PERT method assumes the duration of the activity as probabilistic (stochastic) because construction activities vary.

2.5. PERT Method Steps

The outline of the PERT and CPM methods according to (Stevens, 1990) almost the same in network management. The difference lies in determining the duration of the activity and the duration of the critical path. The outline of the PERT Method is as follows:

1. Determination of activities and their duration. PERT uses three assumptions for activity duration, namely to (optimistic time), tp (pessimistic time), and tm (most likely time).
2. Correlation of time with continuous distribution, and determine expected time (te), standard deviation (se), and variance (ve).
3. Expected time (te) is determined as the duration of the activity, then the critical path is searched as in CPM.
4. Determine the project duration of the critical path

Determination of to, tp, and tm is the first step of PERT, because these three time assumptions determine te. The three durations are assumed to be functions or generalizations of the beta distribution with the activity duration variable, which means that PERT duration is statistical data that does not go out of its distribution area. The beta distribution function is used as the basis for determining the duration (te) , standard deviation (se), and variance (ve) of PERT as follows:

$$te=((to+4m+tp))/6 \quad (1)$$

$$se=((tp-to))/6 \quad (2)$$

$$ve=((tp-to))/6⟧\ ^2 \quad (3)$$

Description:

te: expected Time	tp: pessimist time
to: optimistic Time	se:standard deviation
m: Most Likely	ve: variation

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3. Research Methodology

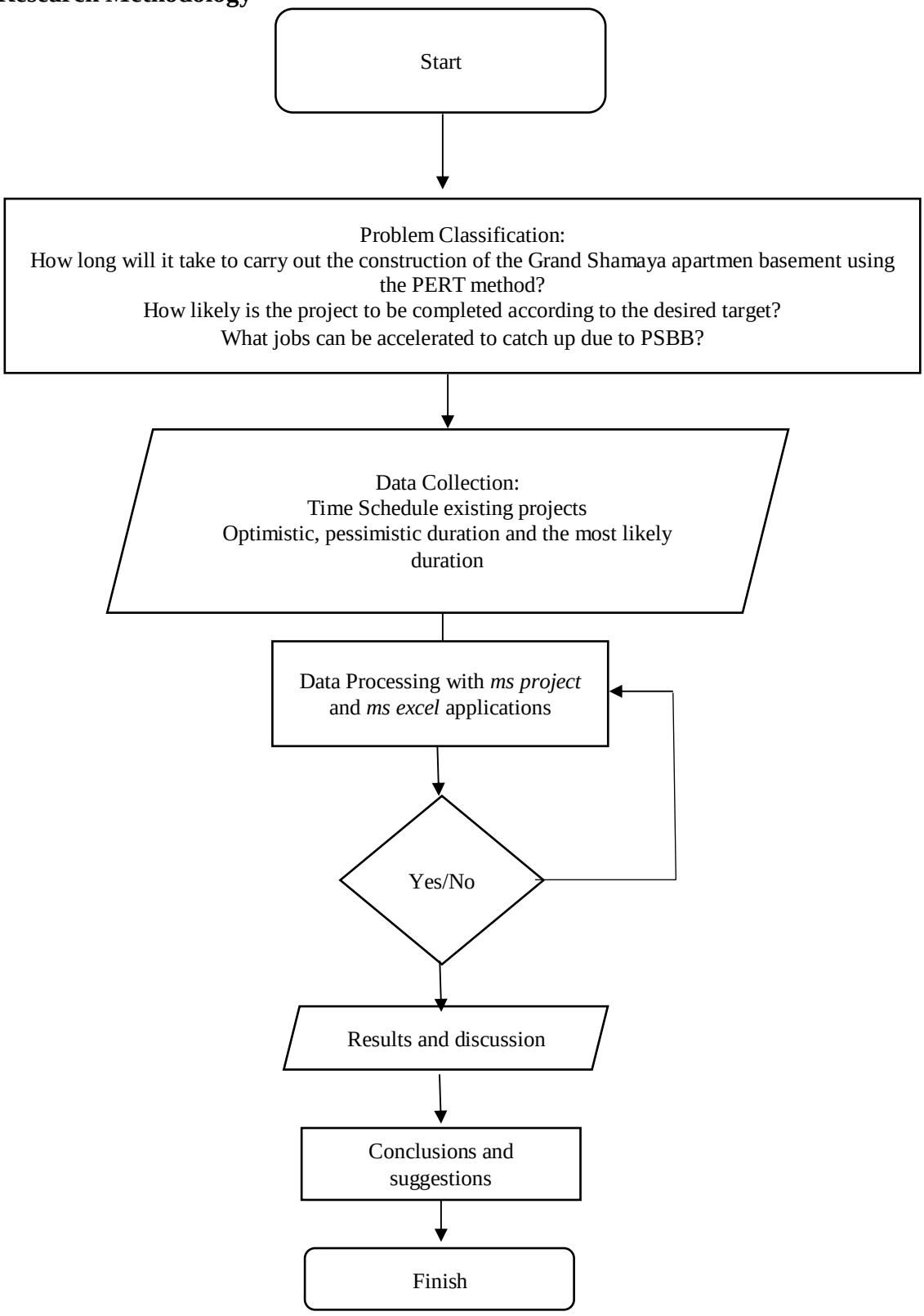

Figure 2 Research Flowchart

4. Results And Discussion

4.1. Research sites

The project site is located on Jl. Embong Sawo No.1, Embong Kaliasin, Kec. Tile, Surabaya City, East Java. The location of this apartment is very strategic because it is located in the middle of the city of Surabaya and around the office area.

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Figure 3 Grand Shamaya Apartment Project Location

4.2. Data analysis

The research data was taken from the grandshamaya apartment construction project which was the result of interviews with the project management. The data obtained are pessimistic duration (tp), optimistic duration (to), and possible duration (tm). Here's Table 1.

Table 1. Data optimistic time (to), most likely time (tm) and pessimistic time (tp)

No.	Job description	Duration		
		to	Tm	tp
A	Substructure WORKS			
1	EXCAVATION WORKS (PC RATE)			
	Basement 1 level -3,300 to +1,150	112	120	127
2	CUTTING OFF PILE HEAD			
	Main Bore Pile 1200mm	83	90	95
	TestPile&ReactionPileØ1200mm	174	180	183
	SecantPileØ1200mm	88	93	95
3	Reinforced Concrete Fc 35 Mpa			
	Beam - Basement 1	111	120	125
	Slab - Basement 1	111	120	125
4	Formwork			
	beam - Basement 1	111	120	125
	Slab - Basement 1	111	120	125
5	REBAR			
	Beam - Basement 1	281	292.5	300
	Slab - Basement 1	281	292.5	300
6	SECANT PILE JOINT SLAB			
	Hilti RE500 Epoxy incl. Drill Length=2m	111	120	127
	SIKASWELL- Basement 1	111	120	127
	SIKAFUCA - PC RATE - Basement 1	111	120	127
`	DEWATERING			
	Surface Dewatering	321	330	337
	Deep well Dewatering	321	330	337
B	ADITIONAL WORKS (PROVSUM)			
1	BORED PILE & KING POST	1	1.5	3
2	COUPLER (PROVSUM)			
	D22	1	1.5	3
	D25	1	1.5	3
	D32	1	1.5	3
3	CAPPING BEAM			
	Excavation	97	105	110
	Backfill	52	60	66
	Concrete Fc' 35 Capping Beam	211	225	234
	Concrete Fc' 35 Secant Pile add	211	225	234
	Demolished Capping Beam	9	15	20
	Formworks capping Beam	215	225	234

	Rebar	215	225	234
	Demolished Platform	123	135	144
4	STEEL ACCESS RAMP (PROVSUM)	9	15	20
5	FORMWORK SCAFFOLDING (PROVSUM)	128	135	140
C	VARIATION WORKS			
1	inclinometer	169	180	189
2	Sparring Capping Beam	19	30	40
3	Demolished Guidewall	49	60	70
4	Stampcold Coupler	23	30	35
5	Steel Strut	11	18	24
6	Floor Hardener	115	120	125
7	Gusette on King Post	115	120	125
8	Concrete for Column Head Shearwall B1	112	120	125
9	Fromwork for Column Head& Shearwall B1	112	120	125
10	Rebar for Column Head & Shearwall B1	112	120	125
11	wall beam calculation			
	Rebar	112	120	125
	Formwork	112	120	125
	Concrete	112	120	125

4.3. Determining the Expected Time Duration (Te)

After getting data on optimistic time (to), pessimistic time (tp), and possible time (tm). Then the next step is to determine the expected time duration (te). The expected duration can be calculated using the following formula:

te=((to+4.tm+tp))/6(4)

Calculation (te) for Basement 1 level work -3300 to +1150

Optimistic duration (to) = 112

Duration allows (tm) = 120

Pessimistic duration (tp) = 127

So,

te=((to+4.tm+tp))/6=((112+(4.120)+127))/6=719/6=119.8 (5)

4.4. Determining Deviation And Variance

After determining te the next step is to determine the deviation and variance. The formula used to calculate variance and deviation is as follows:

Standard Deviation (se) = (tp-to)/6

Variant (ve) = (se)^2

Calculations For Basement 1 Level Work -3,300 To +1,150

Optimistic duration (to) = 115

Duration allows (tm) = 120

Pessimistic duration (tp) = 125

Then, the standard deviation (se) = (tp-to)/6

= (125-115)/6 = 1.67

Variant (ve) = (se)^2

= 1.67⟧ ^2= 2.78

4.5. Project life based on PERT method

After determining te the next step is to determine the deviation and variance. The formula used to avoid From the probability curve can be seen:

1. The minimum value of the total project duration is 530 days
2. The mean value of the total duration is 535 days
3. The maximum value of the total duration is 551 days
4. The duration of project completion using a probabilistic method is 535 days with a contingency of 4 days.

From the distribution of project duration completion, the expected duration (td) at the 53.19% percentile is taken, which is 535 days. While the time contingency is taken from the 83.33% percentile minus the 53.19% percentile, which is 4 days. Taking this time contingency due to the 83.33% percentile where time has a high chance of occurrence. The calculation of variance and deviation is as follows:

4.6. Calculating Project Completion Probability

From the results of the analysis of the PDM network in the previous stage, it was obtained that a critical cross was obtained, so that we can see the age of the project and what activities are classified as critical activities. Furthermore, it can be used to determine the probability duration with the formula:

z=(Td-Te)/(Se LK)=

z=(534-534.6)/4.96=0.08

From the Appendix II table obtained: P (Z = 0.08) = 0.5319 = 53.19%

5. Conclusion

Grand Shamaya Apartment Basement can be concluded as follows:

1. From the results of probabilistic analysis, the project age is 535 days with a contingency of 4 days 53.19%
2. From the results of the above analysis, the critical activities in the project are:
    a. Basement excavation work level 1 -3,300 to +1,150
    b. Reinforced Concrete Fc 35 Mpa beam - Basement 1
    c. Formwork beam - Basement 1
    d. Steel Strut
    e. Floor hardener
3. In the PERT calculation above, the project age is 535 days, while the actual schedule is 598.5 days

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Biography

Bayu Arkan Pambudi,was born in Karawang City on August 21, 1999. The last child of three siblings. The author completed his education at the Ngagelrejo I State Elementary School Surabaya in 2011 and continued the Ipiems Junior High School until 2014. Then he continued his Ipiems High School until 2017 and enrolled at the Narotama University Surabaya College of Civil Engineering Study Program, Faculty of Engineering and Computer Science. During my time at school I was actively involved in organizations and in college I also took part in the Faculty Student Executive Board.

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Analysis of The Implementation of The Excavation Work of Blasting Stone in The Quarry For Rockfill Pile of The Beringin Sila Dam Construction Work Project Package-1 Sumbawa Regency, NTB.

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Abstract

Embankment dams based on the grain size of the embankment material used are divided into 2 types, namely rock filled dams and earth fill dams. The Beringin Sila Dam is a random and rock fill dam with an upright core which is in the process of being built by stockpiling materials such as stone, gravel, clay, and soil. Blasting is an activity of breaking up a material (rock) using explosives or the process of an explosion, in blasting one of the important things that must be considered is the fragmentation of rock resulting from blasting.

The method is carried out by observing the realization in the field and analyzing project data. The purpose of this study was to determine the productivity of heavy equipment, to analyze the realization costs of excavation and heap of blasted rock at the quarry location.

The results of this study indicate that the productivity of drilling tools for drilling tools, with the Crawler Rock Drill (CRD) tool, it gets 5 holes/hour, while with the Hydraulic Crawler Drill (HCR) it gets 4 holes/hour. Productivity of loading and unloading equipment on excavation work and blasting heaps of rock at the quarry location, with an average of 25 units of transportation equipment and 4 units of CAT 330 excavator as loading equipment. For loading equipment, the production yield is 41.40 m3/hour, while for transportation equipment the production yield is 6.62 m3/hour. The realization cost for excavation work and rock heap from blasting at the quarry location in July – September required a cost of Rp.11,124,373,500.00 including the cost of wages, materials, and tools.

Keywords:

Blasting, Cost Analysis, Heavy Equipment, Time Analysis, Work Efficiency.

1. Introduction

Infrastructure development in the city of Sumbawa Besar is growing along with the increase in the human population and technological advances.The construction of the Beringin Sila dam will provide many benefits for the surrounding community, including providing irrigation for existing 2400 ha and developing 1100 ha, providing 6 liters of raw water, 1 x 1400 kw of electricity, and the ability to reduce flooding by 90.37 m/sec.

Embankment dams based on the grain size of the embankment material used are divided into 2 types, namely rock-fill dams and earth-fill dams (Suyono Sosrodarsono 1981). The Beringin Sila Dam is a random and rock fill dam with an upright core. There are 6 zones within the main body of the Beringin Sila Dam, namely: waterproof core, fine filter, coarse filter, random, rockfill, and rip-rap.

The purpose of research on the Beringin Sila Dam Project is generally to evaluate the results of blasting and productivity of drilling tools for rockfill excavation work, evaluate blasting results as well as the productivity of transport and loading equipment in rockfill rockfill work, analyze the realization costs that exist in excavation work and stockpiled rock results. blasting at the quarry location, and knowing the technical and non-technical constraints that occur during the execution of work at the quarry location.

2. Methodology

Broadly speaking, the stages of this research are contained in the flow chart in the figure below:

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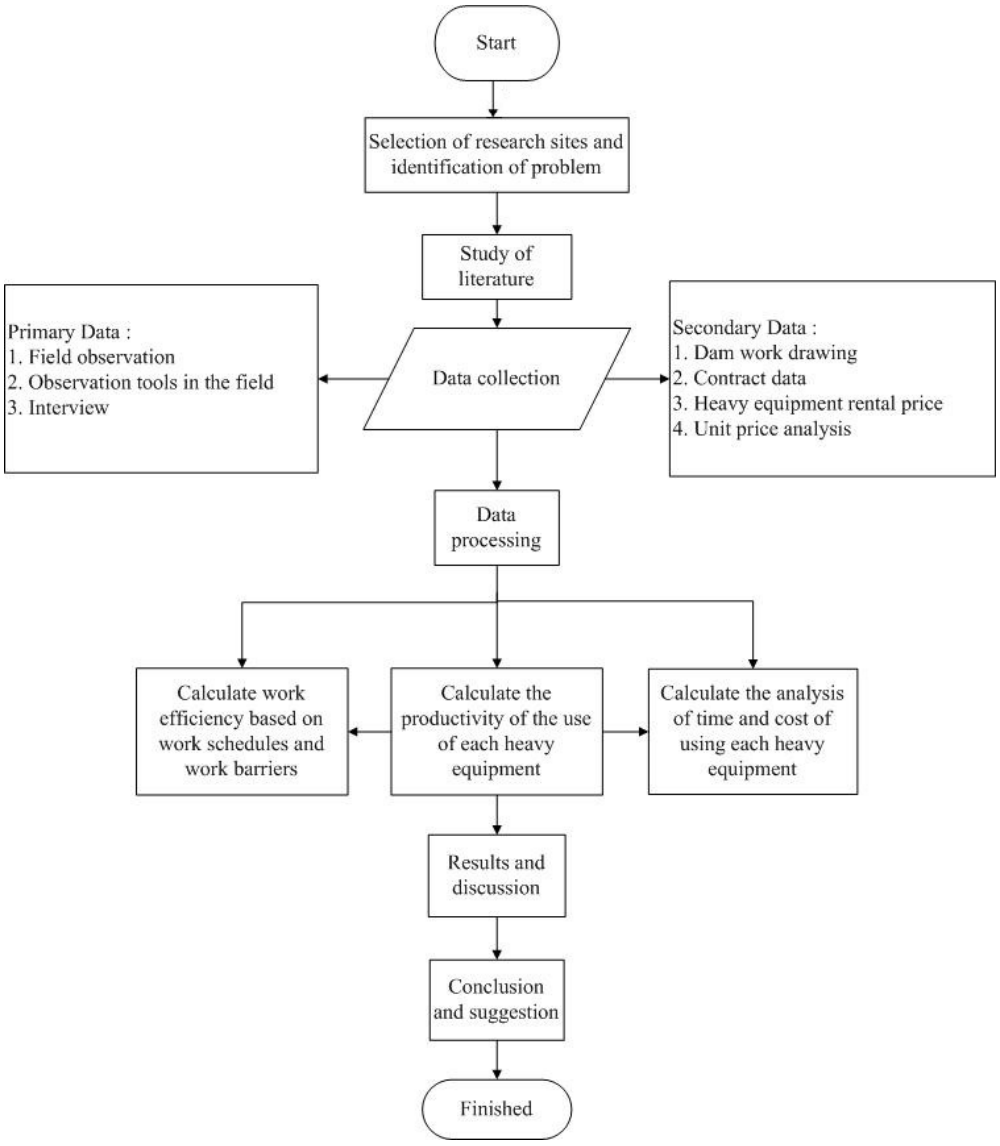

Figure 1. Research flowchart

3. Results and Discussion

3.1 Results

A. Work Efficiency

Work efficiency is the ratio between effective working hours and available working hours. Effective working hours are the number of working hours that are actually used for production activities. Effective working time can be calculated using the following formula:

$$\mathbf{We = Wt - (Wd + Wtd)}$$

Description :

We = effective working time
Wt = working time available
Wd = Total idle time
Wtd = total delay time

After obtaining the value of effective working time (We) then we can calculate the value of its work efficiency by using the following formula:

$$Work\ Efficiency = \frac{effective\ working\ time}{\text{working time available}} \text{ x } 100\%$$

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Table 1. Work Schedule for the Beringin Sila Construction Project Please

Work schedule	Description	Time (Hour)
08:00 - 12:00	Working time	4
12:00-13:00	Time off	1
13:00-17:00	Working time	4
17:00-18:00	Overtime	1
Total		9

On Friday, the lunch break starts from 11.30 – 13.30 so that the working hours are reduced to 8 hours. The average effective working hours will be:

= (9 * 6)hours/week + (8 * 1)hours/week
7days/week
= 8.86 hours
= 531.43 minutes

Table 2. Work Obstacles In Loading Equipment And Transport Equipment

Resistance		CAT-330 excavator (minutes/day)	Dump Truck (minutes/day)	Hydraulic Crawler Drill (minutes/day)
Suppressible barriers	Late start of shift	10	15	10
	Operator requirements	10	10	10
Total		20	25	20
Daily check by operator		10	10	10
Total		10	10	10
		30	35	30

B. Rock excavation work using the blasting method

Rock excavation work activities using the blasting method include blast hole drilling, charging, blasting and hauling blast results. Each activity requires a duration of time. To determine the time efficiency of rock excavation work using the blasting method in rock excavation work on the Beringin Sila construction project, please describe the analysis of the duration of time required for rock excavation work in the quarry area.

C. Loading Equipment Work Efficiency

Productive working time is the available working time in one day minus the amount of non-productive time.

Wke = Wkt –wht
=531.43 minutes – 30 minutes
= 501.43 minutes

So that the work efficiency of the loading tool can be calculated, namely:

Eff = (Productive working time / Available working time) x 100%
= (501.43 / 531,43) x 100 %
= 94.35%

D. Transport Equipment Work Efficiency

Productive working time is the available working time in one day minus the amount of non-productive time.

Wke = Wkt – Wht
= 531.43 minutes – 35 minutes
= 496.43 minutes

So that the work efficiency of the conveyance can be calculated, namely:

Eff = (Productive working time / Available working time) x 100%
= (496.43 / 531.43) x 100 %
= 93.41%

E. Loader Productivity

Calculation of the cycle time of mechanical devices is carried out by paying attention to the movement patterns of mechanical devices when carrying out their activities. The cycle time of loading equipment using the CAT 330D Excavator is the amount of time spent in one work series starting from taking the digging position until it is empty again to dig again.

The cycle time of loading equipment can be formulated as follows:

$$CT_m = \frac{Tm1 + Tm2 + Tm3 + Tm4}{60}$$

Description :
CTm = Cycle time / total cycle time of loading tools
Tm1 = time to fillpayload
Tm2 = time forswing charged
Tm3 = time forspill the load
Tm4 = time to swingblank
The calculation for the production of one loading tool is:
Qm = Nm(60/Ct) x Cm x F x sf xE, BCM/hour
Description :
Qm = Production capability of loading equipment (BCM/hour)
Nm = Number of tools (Unit)
Ct = Cycle time of loading equipment once loading (minutes)
cm = Standard capacity of loading tool bowl (m^3)
F = Fill factor (%)
E = work efficiency (%)
sf= *Swell factor*
Based on the data from the measurements in the field:
CAT 330D . Excavator Production
CTm = 1.47 minutes
Cam = 1.54 m3
F = 0.8
E = 94.35%
sf= 1.00
Nm = 1 Unit
Qtm = 47.33 m3/hour

So one loading tool with a bucket capacity of 1.54 m3 with a work efficiency of 94.35% can be produced at 47.33 m3/hour, while the production of loading equipment during the author's observations from September 2 to November 30 2019 on average production per hour is 41.40 m3/hour. The unit price in the RBP itself is for rock excavation work items with an hourly target blasting of 49.15 m3/hour. With the existing data, the target for the realization of the loading equipment has not yet reached the production target of the RBP unit price (Rachmayanti 2017).

F. Transport Equipment Productivity

The calculation of the cycle time of transportation means generally consists of the following time:
Time to set the position for loading
Time to charge
Time to transport cargo
Time to set the position to shed the load
Time to spill the load
Time to return to fill in the empty state
Cycle time for transportation means can be formulated as follows:
Cta = Ta1+Ta2 Ta3+Ta4 +Ta5 +Ta6
Description :
CTa = Total time of transportation means
Ta1 = Time to set the position to be charged
Ta2 = Time to charge
Ta3 = Time to transport the load
Ta4 = Time to set the position to shed the load
ta5 = Time to shed charge
ta6 = Time to return to be filled in an empty state
Calculations for the production of conveyances:

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Qa = Na (60/Ct) x Ca x sf x E , m3/hour
Description :
Q= Production capability of conveyance (m3/hour)
Na = Number of conveyances (units)
Ct = transportation time (minutes)
Ca = The capacity of the conveyance body (m3)
= nx Cam x F
n = Number of loading equipment buckets to fill the conveyance tub
Cam = Loading tool bowl capacity (m3)
F = Fill factor (%)
E = work efficiency (%)
sf= Swell factor
Based on the data from the measurements in the field:
Production of One Dump Truck Transport Equipment:

Cam	= 1.54 m3
N	= 5 Times
Fill Factor (F)	= 0.8
Tub capacity	= 6.16 m3
Swell factor	= 1
Work efficiency	= 93.41%
Total circulation time HD 465	= 36.95 minutes
Na	= 1 unit
Qta	= 9.35 m3/hour

The average loading capacity of a dump truck is 6.16 m3 with a work efficiency of 93.41%, the production is 9.35 m3/hour with an average circulation time of 36.95 minutes, while the realization of the production of one tool Transport during the author's observation from July 8 to September 30, 2021, the average production per hour is 6.62 m3/hour. For the unit price in the RBP itself, the item for the work of heaping stones with an hourly target of blasting is 15.92 m3/hour (Suryaputra 2009). With the existing data, the target for the realization of the transportation equipment has not yet reached the production target of the RBP unit price.(Lexy J. Moleong 2018)

G. Tool Work Alignment Factor

The factor of compatibility of loading equipment with transportation means can be calculated by the formula:

$$MF = \frac{Na \text{ x } CtL}{Nm \text{ x } CTa}$$

Na = Number of conveyances, unit
CtL = Circular time of loading tool to full, minutes
Nm = Number of loading tools, unit
Cta = Circular time of the conveyance, minutes
The work combinations between loading equipment and transportation equipment at the Quarry are:
Na = 25 units
Nm = 4 units
CtL = 7.37 minutes
CTa = 36.93 minutes
MF = (25 x 7.37) / (4 x 36.93) = 1.247

MF > 1 , it means that the loading equipment works 100%, while the transportation equipment works less than 100%, so there is a waiting time for the transportation equipment, this is because the production of the transportation equipment is greater than the production of the loading equipment so there is a condition that the loading equipment is busy in loading and unloading. the loading process while the conveyance is more waiting, so there is a waiting time for the conveyance as follows:

$$MF = \frac{Na \text{ x n x } CTm}{Nm \text{ x } CTa} \rightarrow Nm \text{ x } CTa \rightarrow Na \text{ x n x } CTm$$

$$\frac{Nm \text{ x } CTa}{Na} \triangleright CTm \text{ x n} \rightarrow CTm \text{ x n} \triangleleft \frac{Nm \text{ x } CTa}{Na}$$

From these equations after being equated because there is a lack of time, then added with WTm, the following equation is obtained:

$$WTm + (\text{CTm x n}) = \frac{Nm \text{ x CTa}}{Na}$$

So the waiting time for the conveyance:

$$WTm = (\text{CTm x n}) - \frac{Nm \text{ x CTa}}{Na}$$

$$= (1{,}47 \text{ x } 5) - \frac{4 \text{ x } 36{,}93}{25}$$

= 1,459 minutes

3.2 Discussion

A. Cost Analysis of Excavation and Pile of Blasting Stone

Evaluation of the cost of excavation and embankment work by comparing the realized operational costs (direct costs) with the planned costs in the RBP derived from unit prices. The unit price of work is needed to compare the actual and planned prices so that it is known whether the excavation and embankment work is profitable or detrimental (Nugraha 2018).

Operational costs are sourced from the analysis of blasting excavation work and downstream and upstream maindam rock piles in the field for 3 months. The unit price of work consists of:

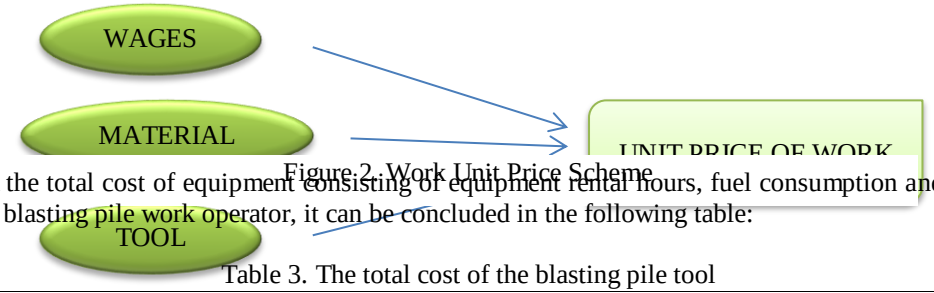

Figure 2. Work Unit Price Scheme

From the total cost of equipment consisting of equipment rental hours, fuel consumption and daily wage costs for the blasting pile work operator, it can be concluded in the following table:

Table 3. The total cost of the blasting pile tool

Month	Equipment Rental Fee (Rp)	Fuel Cost (Rp)	Operator Wage (Rp)	Total (Rp)
July	1,896,165,000	594,737,000	62,930,000	2,553,832,000
August	2,223,090,000	615,901,000	69,420,000	2,908,411,000
September	2,121,380,000	616,352,000	67,750,000	2,805,482,000

The total cost for the realization of excavated work items and blasted piles at the quarry location consists of the above costs, namely wages, materials and tools. The following table shows the actual cost of the embankment during the field observation period, which is approximately 3 months (Koesnaryo 1988).

Table 4. The total direct cost of the realization of the blasted stone heap

Month	Wages (Rp)	Materials (Rp)	Tools (Rp)	Total (Rp)
July	12,168,000	0.00	2,553,832,000	2,566,000,000
August	12,168,000	0.00	2,908,411,000	2,920,579,000
September	12,168,000	0.00	2,805,482,000	2,817,650,000
		Total		8,304,229,000

The total cost for the realization of the blasted rock pile for 3 months is Rp.8,304,229,000.

B. Analysis of Direct Costs of Excavation and Pile of Rock Based on RBP

The operational costs of a job on the project refer to the RBP costs, where the actual costs in the field will be compared with the RBP costs. The analysis of the cost of excavation and stockpiling of RBP is the product of the unit price in the RBP with the realization of production of excavation and rock heap in the field during the 3-month observation period (I 2018).

Table 5. Direct cost analysis of blasted rock excavation based on RBP

Month	Volume (m3)	Wages (Rp)	Materials (Rp)	Tools (Rp)	Total (Rp)
July	47162.5	209,825,963	354,520,513	1,108,790,375	1,673,184,013
August	71032.5	316,023,593	533,951,303	1,669,974,075	2,520,020,003
September	57915	257,663,835	435,347,055	1,361,581,650	2,054,650,455
			Total		6,247,854,470

Table 6. Analysis of direct cost of blasted heap based on RBP

Month	Volume (m3)	Wages (Rp)	Materials (Rp)	Tools (Rp)	Total (Rp)
July	17124.80	10,274,880	-	718,094,238	728,386,243
August	55316.80	33,190,080	-	2,319,599,374	2,352,844,771
September	57207.92	34,324,752	-	2,398,899,709	2,433,281,669
		Total			5,514,512,684

C. Comparison of Excavation and Rock Pile Costs Based on RBP and Resolution

Calculation of the direct costs of excavation and rock heap from the quarry based on the realization of the author's observations can be compared with direct costs with the unit price of work from the RBP price. The following table shows the total direct cost of excavation and rock embankment based on realization and RBP (Fathoni 2015).

Table 7. Total direct cost of excavation and rock filling based on realization

Month	Wages (Rp)	Materials (Rp)	Tools (Rp)	Total (Rp)
July	56.5600.00	104,279,0000.00	3,282,149,000.00	3,442,988,000.00
August	56.5600.00	150,525,500.00	3,716,613,000.00	3,923,698,500.00
September	56.5600.00	106,861,000.00	3,594,266,000.00	3,757,687,000.00
		Total		11,124,373,500.00

Table 8. Total direct cost of excavation and stockpiling based on RBP

Month	Wages (Rp)	Materials (Rp)	Tools (Rp)	Total (Rp)
July	220,100,842.50	354,520,512.50	1,826,884,613.40	2,401,570,255.70
August	349,213,672.50	533,951,302.50	3,989,573,449.40	4,872,864,773.70
September	291,988,587.00	435,347,055.00	3,760,481,359.36	4,487,932,124.28
		Total		11,762,367,153.68

The deviation of the direct costs of realization from the author's observations with the RBP price obtained is Rp. 637,993,654.

4. Conclusions and Suggestions

4.1. Conclusion

1) From the results of the analysis, it can be concluded that the productivity of drilling work, with the Crawler Rock Drill (CRD) tool, obtained 5 holes/hour, while with the Hydraulic Crawler Drill (HCR) it was obtained 4 holes/hour (Anugrah 2019).
2) From the results of the analysis, it can be concluded that the productivity of loading equipment and transportation equipment in excavation work and rock heaps resulting from blasting at the Quarry location, with an average number of transportation equipment as many as 25 units and 4 units of CAT 330 excavators as loading equipment. For loading equipment, the production yield is 41.40 m3/hour, while for transportation equipment the production yield is 6.62 m3/hour (Syauki 2018).
3) From the results of the analysis, it can be concluded that the actual cost of excavation and heap of blasted rock at the Quarry location in July – September requires a cost of Rp. 11,124,373,500.00 includes the cost of wages, materials, and tools (Hasibuan 2019).

4) From the results of the analysis, it can be concluded that the actual cost of excavation and embankment incurred is Rp. 11,124,373,500, it is said to have been effective because it is still below the planned cost (RBP) of Rp. 11,762,367,154 so that a deviation of Rp. 637,993,654.

4.2. Suggestion

1) There is an evaluation of the composition of the number of work tools used, so there is no waiting time for work tools.
2) The use of HCR as a drilling tool is more effective than using CRD, because the process of drilling on the CRD tool still uses human power when adding and removing drill piles.
3) The selection of the use of drilling tools for steep locations should use the CRD tool, while for drilling locations with gentle terrain using the HCR tool.
4) Repair of the access road from the quarry to the maindam must be carried out regularly, so that material production is not disturbed from the access road.

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Study on The Analysis of Kemayoran Drainage Channel, Kemayoran Urban Village, Bangkalan Sub-District, Bangkalan Regency

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Abstract

The success of development in Bangkalan regency is marked by the increase in housing and shops. The existence of changes in the spatial layout of Bangkalan city can increase surface runoff, causing roads and residential areas to experience puddles of water. The height of the flood inundation that occurs on average is at an elevation of 30 cm to 40 cm above the road surface. The Kemayoran drainage channel is an open channel, so the method used in this planning begins with a hydrological analysis which includes calculating the maximum daily rainfall at the study site for 10 years starting from 2011 to 2020, then calculating the design rainfall intensity using the Distribution method. Gumble, Normal Distribution, Log Normal Distribution, Log Pearson III Distribution, as well as a distribution match test was carried out to test whether the existing rainfall data matched the selected method. The suitability test used is the Chi-Square test and the Smirnov – Kolmogorov test. Next, an analysis of the planned flood discharge was carried out using the Rational method in which the calculation of the flow coefficient (C), the time of concentration (tc), and calculating the intensity of the rain was carried out. Furthermore, analysis of the discharge of the existing drain with the Manning formula is carried out to determine the maximum discharge capacity of the exhaust channel. From the calculation results, it is found that the planned discharge of the Kemayoran drainage channel for Q2 = 90,657 mm, Q5 = 116, 627 and Q10 = 133,627 mm, so that the results of these calculations indicate that the cross section of the xisting canal cannot accommodate the existing water The results obtained from the calculation show that, the existing channel cross section cannot accommodate the existing water discharge, so treatment is needed in the form of re-dimensioning the channel using a U-ditch with dimensions of 100,100,120.8 along 288 m, and using a trapezoidal stone pair with a channel width. 1.2 m and high 1.3 m long 872 m. In the short term, the handling of flooding and inundation that occurs in the Kemayoran drain can be done by normalizing the channel, so that the problem of flood inundation can be overcome for a return period of 2 years, 5 years, 10 years, 20 years and 50 years.

Keywords :
Design Discharge, Flood, Kemayoran Drainage Channel Capacity, U-ditch

1. Introduction

1.1 Background

Bangkalan regency is a district that has experienced significant development from year to year, the success of development in Bangkalan regency is marked by the increase in housing and shops, especially in Bangkalan city, it causes an increase in newcomers who move from rural areas to Bangkalan city.

With the change in the spatial layout of Bangkalan city, it will increase surface runoff, surface runoff is the flow of water flowing over the surface due to the full capacity of the soil infiltration, so that the water flow will flow to the storage location in this case the drainage channel.

Based on field observations, it is known that flood inundation is caused by the drainage channel on Soekarno-Hatta road not being able to accommodate flood discharges, sedimentation in several canal sections due to lack of maintenance and increasingly dense housing of residents, plus the condition of several canal sections that have narrowed cross-section so it is necessary there is improvement. The condition of the land contour in the area is relatively flat which results in slow water flow. The average flood inundation height is 30 cm to 40 cm, which causes roads and residential areas to experience waterlogging.

The current condition of the Kemayoran drainage channel is an old stone masonry channel that has started to break down, is shallow and there is a lot of narrowing of the channel cross section, this is because on

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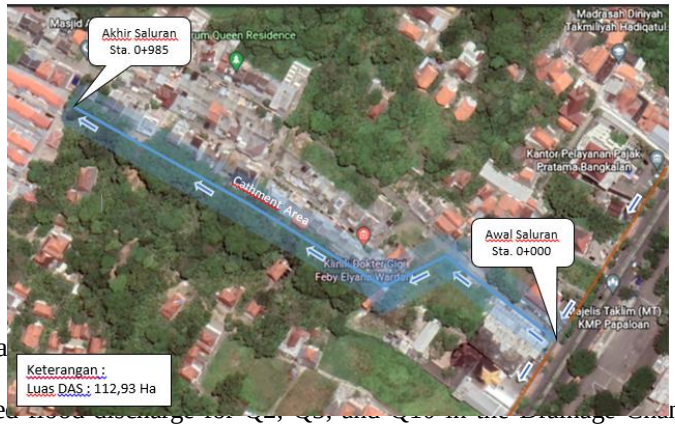
the right and left sides of the channel a lot of housing has been built, so it is necessary to normalize and rehabilitate the channel.

Map of the location of the Kemayoran drainage channel in the Kemayoran urban village, Bangkalan sub-district, Bangkalan regency along ± 985 m.



1.2 Formulation of the

Based on the resea can be described is as follows :

What is the planne nnel, Kemayoran urban village, Bangkalan sub-district?

What is the Existing Capacity of the Kemayoran Urban Village Drainage Channel in Bangkalan sub-district?

What are the dimensions of the Kemayoran urban village drainage channel in Bangkalan sub-district in the period of 2 years, 5 years, and 10 years?

2. Literature review

According to Sidharta, 1997, drainage is generally defined as a science that studies efforts to drain excess water in a certain context of use. Drainage is defined as the removal of surface water or groundwater from an area, either by gravity, by water pumps, or by channels. To solve problems related to drainage, it is closely related to hydrological analysis, especially the problem of rain as a source of water that will flow into the drainage system and runoff.

According to Soedibyo, 2003, the purpose of hydrological analysis is to calculate the water discharge for the calculation of the planned channel. Hydrological analysis was carried out in order to determine the validity of the data obtained, such as planned rainfall data, planned flood discharge, and other data. These data will later be processed to determine the planned discharge, so this hydrological analysis plays a very important role.

The design flood discharge must not be too large to avoid overflowing water which can cause damage to the building due to a flood greater than the design discharge.

2.1 Rainfall Plan

To get the amount of rainfall, the distribution method is used, while the purpose of using this method is to get the extreme value of the rainfall series. The method used is the Gumbel distribution method, the normal distribution method, the log normal distribution method, and the Pearson III log distribution method.

From the several distribution distribution methods, a distribution suitability test is then carried out to test whether the existing rainfall data is in accordance with the type of method chosen. The suitability test used is the Chi-Square test and the Smirnov – Kolmogorov test.

2.2 Plan Flood Discharge

One of the methods commonly used to estimate the peak flow rate (design flood discharge) is the USSCS Rational Method. This method is used for areas with drainage areas of less than 300 ha Suripin, 2004. The Rational Method was developed based on the assumption that the rainfall that occurs has a uniform and even intensity throughout the drainage area for at least the same as the concentration time (t_c), the mathematical equation of the Rational Method is as follows :

Q = 0,278.C.I.A, Where,

Q= Peak Discharge (m^3/sec)

C= Flow coefficient

I = Rain intensity (mm/hour)

A= Drainage area (km^2)

$I = \frac{R_{24}}{24}\left(\frac{24}{t_c}\right)^{2/3}$, Where,

I = Rain intensity

R24 = Rainfall

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t_c = Concentration time

2.3 Channel Capacity Analysis

Channel capacity is the maximum amount of discharge that can be passed by a channel section along the channel. The capacity of this channel is used as a reference to state whether the discharge that occurs can be accommodated by the channel in the existing condition without any overflow of water.

The amount of drainage channel capacity is determined based on the following. (Chow, C.W., Haddad, K.M. and Williamson, 1997) :

Qkap = A.v with $v = \frac{1}{n} . R^{2/3} . S^{1/2}$, Where,

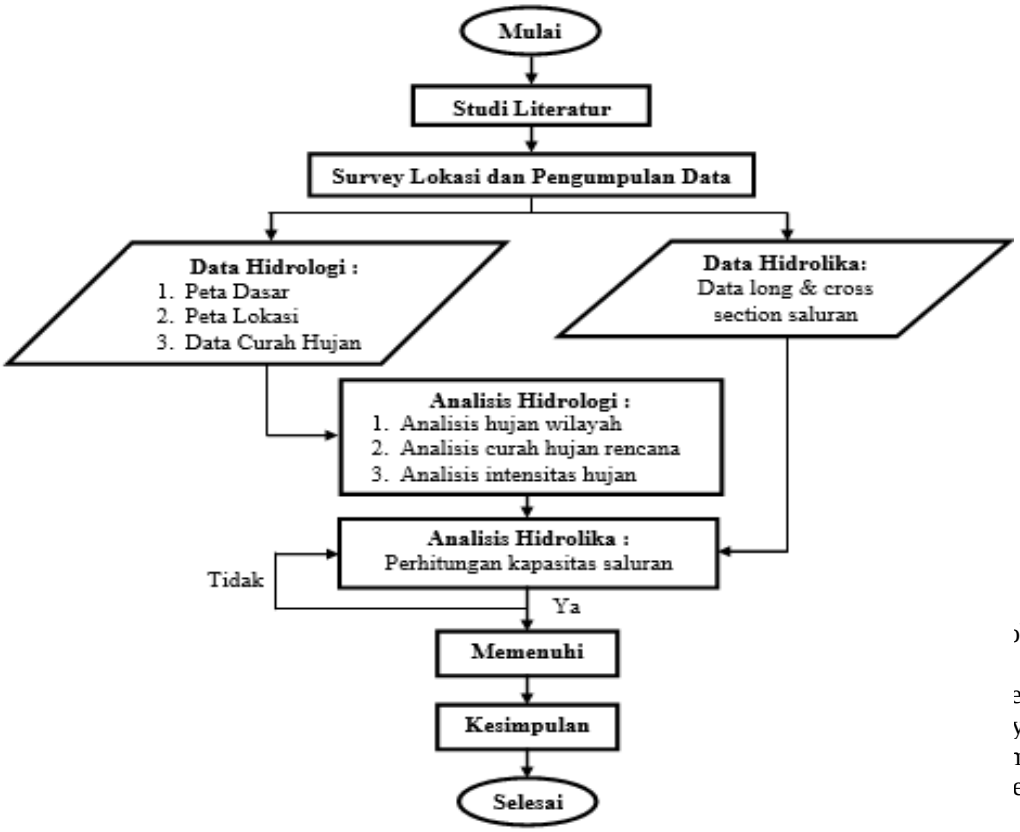
Qkap = Channel capacity (m^3/s)
A = Channel cross-sectional area (m^2)
V = Flow speed (m/s)
R = Channel hydraulic radius (m)
S = Channel slope
n = Manning Coefficient

The general calculation of flow velocity in the calculation of the 10 years return period is as follows :

$v = \frac{1}{n} . R^{2/3} . S^{1/2}$

3. Research Methodology

3.1 Research Flowchart



3.2 Study S

In th ...obtain accurate dat...

Prim... e data in question ... y and contour con... ments were carried ... every 50 m.

Secondary data is data obtained by researchers indirectly, the data is obtained from several sources or related agencies, the data in question are as follows:

Map data was obtained from several government agencies, including the Public Works and Spatial Planning (PUPR) department of Bangkalan regency and the Bangkalan district's Public Housing and Settlement Area (PRKP) department. The map required includes a base map that serves to determine the research location in the form of the position of buildings, roads and channels. Next is a land use map that serves to determine the runoff coefficient, as well as a drainage network map that functions to determine the direction of flow from tertiary, secondary, and primary channels around the research area. In addition, the author also took map data from the internet in this case through the google.earth application to find out where the channel is located.

Rainfall data obtained from the Public Works and Spatial Planning (PUPR) department of Bangkalan Regency in the field of Water Resources, daily rainfall data uses rain data for the last 10 years, starting from

2011 to 2020. This data is needed to calculate the planned rain height, rainfall intensity, and rain discharge plan in the calculation of hydrological analysis. The Kemayoran drainage channel has one rain station at the Bangkalan rain station, which is located in the Kraton urban village.

4. Results and Discussion

4.1 Research Result

The rainfall data used is the maximum daily rainfall at the St. Climatology station Bangkalan.

Table 1. Maximum Annual Rainfall Data

No.	Year	Bangkalan Station (mm)
1	2011	84
2	2012	62
3	2013	125
4	2014	86
5	2015	105
6	2016	120
7	2017	50
8	2018	110
9	2019	104
10	2020	100
n = 10		946
R Average		94,6

(Source : Department of PUPR Bangkalan Regency year 2020)

To get the amount of rainfall, four distribution methods are used, while the purpose of using these methods is to get extreme values from the rainfall series. The methods used include: Gumble distribution method, Normal distribution method, Log Normal distribution method, Log Pearson distribution method III, as well as the Fit Test.

With the following description:

1. Distribution Analysis Gumble Distribution Method

Table 2. Gumble Distribution Methode Calculation

No.	Year	X	Xbar	(X - Xbar)	$(X - Xbar)^2$	$(X - Xbar)^3$	$(X - Xbar)^4$
1	2011	84	94,6	-10,6	112,36	-1.191,02	12.624,77
2	2012	62	94,6	-32,6	1.062,76	-34.645,98	1.129.458,82
3	2013	125	94,6	30,4	924,16	28.094,46	854.071,71
4	2014	86	94,6	-8,6	73,96	-636,06	5.470,08
5	2015	105	94,6	10,4	108,16	1.124,86	11.698,59
6	2016	120	94,6	25,4	645,16	16.387,06	416.231,43
7	2017	50	94,6	-44,6	1.989,16	-88.716,54	3.956.757,51
8	2018	110	94,6	15,4	237,16	3.652,26	56.244,87
9	2019	104	94,6	9,4	88,36	830,58	7.807,49
10	2020	100	94,6	5,4	29,16	157,46	850,31
n = 10		946			5.270,40	-74.942,88	6.451.215,55

(Source : From Calculation Data)

2. Distribution Analysis Normal Distribution Method

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Table 3. Normal Distribution Methode Calculation

No.	Year	X	Xbar	(X - Xbar)	$(X - Xbar)^2$	$(X - Xbar)^3$	$(X - Xbar)^4$
1	2011	84	94,6	-10,6	112,36	-1.191,02	12.624,77
2	2012	62	94,6	-32,6	1.062,76	-34.645,98	1.129.458,82
3	2013	125	94,6	30,4	924,16	28.094,46	854.071,71
4	2014	86	94,6	-8,6	73,96	-636,06	5.470,08
5	2015	105	94,6	10,4	108,16	1.124,86	11.698,59
6	2016	120	94,6	25,4	645,16	16.387,06	416.231,43
7	2017	50	94,6	-44,6	1.989,16	-88.716,54	3.956.757,51
8	2018	110	94,6	15,4	237,16	3.652,26	56.244,87
9	2019	104	94,6	9,4	88,36	830,58	7.807,49
10	2020	100	94,6	5,4	29,16	157,46	850,31
n = 10		946			5.270,40	-74.942,88	6.451.215,55

(Source : From Calculation Data)

3. Distribution Analysis Log Normal Distribution Method

Table 4. Log Normal Distribution Methode Calculation

No.	Year	X	Log X	Log Xbar	(Log X - Log Xbar)	(Log X - Log Xbar)²	(Log X - Log Xbar)³
1	2011	84	1,9243	1,9606	-0,0363	0,0013	-0,000048
2	2012	62	1,7924	1,9606	-0,1682	0,0283	-0,004758
3	2013	125	2,0969	1,9606	0,1363	0,0186	0,002534
4	2014	86	1,9345	1,9606	-0,0261	0,0007	-0,000018
5	2015	105	2,0212	1,9606	0,0606	0,0037	0,000223
6	2016	120	2,0792	1,9606	0,1186	0,0141	0,001668
7	2017	50	1,6990	1,9606	-0,2616	0,0684	-0,017905
8	2018	110	2,0414	1,9606	0,0808	0,0065	0,000528
9	2019	104	2,0170	1,9606	0,0564	0,0032	0,000180
10	2020	100	2,0000	1,9606	0,0394	0,0016	0,000061
n = 10		946	19,6058			0,15	-0,02
Average			1,9606				
Standard Deviation					0,1275		

(Source : From Calculation Data)

4. Distribution Analysis Log Pearson III Distribution Method

Table 5. Log Perason III Distribution Methode Calculation

No.	Year	X	Log X	Log Xbar	(Log X - Log Xbar)	(Log X - Log Xbar)²	(Log X - Log Xbar)³
1	2011	84	1,9243	1,9606	-0,0363	0,0013	-0,000048
2	2012	62	1,7924	1,9606	-0,1682	0,0283	-0,004758
3	2013	125	2,0969	1,9606	0,1363	0,0186	0,002534
4	2014	86	1,9345	1,9606	-0,0261	0,0007	-0,000018
5	2015	105	2,0212	1,9606	0,0606	0,0037	0,000223
6	2016	120	2,0792	1,9606	0,1186	0,0141	0,001668
7	2017	50	1,6990	1,9606	-0,2616	0,0684	-0,017905
8	2018	110	2,0414	1,9606	0,0808	0,0065	0,000528
9	2019	104	2,0170	1,9606	0,0564	0,0032	0,000180
10	2020	100	2,0000	1,9606	0,0394	0,0016	0,000061
n = 10		946	19,6058			0,15	-0,02
Average			1,9606				
Standard Deviation					0,1275		

(Source : From Calculation Data)

4.2 Land Slope Analysis

The calculation of the slope of the land is needed in determining the time it takes for rainwater to reach the intended point. The slope of the soil is obtained by measuring the area of water drainage from the highest point to the intended final channel.

The slope of the land with the equation: $S = \frac{Ht-Ho}{0.9.L}$, earned value S = 0,00044

The concentration time for the drainage area can be described by the following equation :

$tc = \left(\frac{0,87.L^2}{1000.S}\right)^{0,385}$, earned value tc = 1,46 o'clock

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4.3 Rain Intensity

Rainfall intensity is the amount of rain expressed in height or volume of rain per unit time. The magnitude of this intensity is highly dependent on the duration of rainfall and the frequency of its occurrence.

Calculation of Rain Intensity can be formulated as follows : $I = \frac{R_{24}}{24}\left(\frac{24}{t_c}\right)^{2/3}$

4.4 Dirty Water Discharge Analysis

The amount of flood discharge is obtained from the sum of rainwater discharge and household wastewater discharge. Furthermore, the capacity of the existing canal is analyzed, whether it is able to withstand the peak flow rate from rainwater and household waste. If the channel is not able to withstand the current amount of discharge, it is necessary to plan the re-dimension of the existing channel.

The equation used to determine the Dirty Water discharge : $Q_{ak} = \frac{(Pn.q)}{A}$ with $Pn = Po.(1+r)^n$ and rainwater discharge : Qah = 0,278.C.I.A

The runoff coefficient (C) is the comparative value between the portion of the rain that forms direct runoff and the total rain that occurs under various conditions (Sidharta & Arief, 2013). The condition of the flow area around the Kemayoran Drainage Channel at this time has developed into a fairly dense residential area, so the flow coefficient is taken as C = 0,60.

4.5 Channel Capacity Analysis

Channel capacity is the maximum amount of discharge that can be passed by a channel section along the channel. This channel capacity is used as a reference to state whether the discharge that occurs can be accommodated by the channel in its existing condition without any overflow of water (Anggraini & Hendra, 2010).

The Manning coefficient that will be used for the calculation of the Kemayoran drainage channel design using a precast concrete surface is n = 0,014, and using a pair of plastered river stones is n = 0,017. The channel cross section used in the channel uses a channel with a rectangular cross section and a trapezoidal section with a slope of 1 : 2. The capacity of the drainage channel is determined based on the following. (Chow & Te, 1997)ss:

Qkap = A.v with $v = \frac{1}{n}.R^{2/3}.S^{1/2}$

Table 6. Channel Capacity Calculation Evaluation

Name Pice	b	h	w	S	n	R	v	A	Qkap
Channel	m	m				m	m/dt	m2	m3/dt
P.0 - P.3	1,00	1,00	0,30	0,0018	0,014	0,33	1,45	1,00	1,45
P.3 - P.15	1,20	1,30	0,30	0,0006	0,017	0,59	1,00	1,56	1,56

(Source : From Calculation Data)

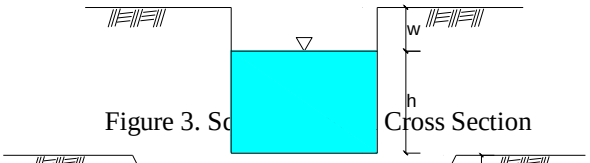

Figure 3. Sc Cross Section

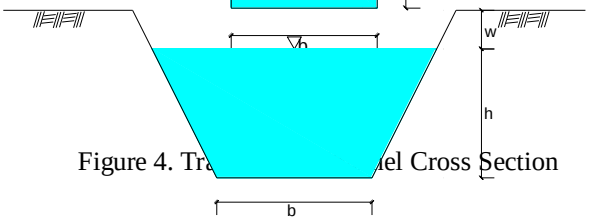

Figure 4. Tr iel Cross Section

Where,
b = Channel Base Width (m)
h = Water Level (m)
w= Guard Heigth (m)

5. Closing

5.1 Conclusion

1. The rainfall return period used in the calculation of this Final Project is the Log Pearson III method, with the planned rainfall value for the 2-year return period of 90,657 mm, for the 5-year return period of 116,627 mm, for the 10-year return period of 133,627 mm , for a 20-year return period of 154,982 mm, and for a 50-year return period of 170,822 mm.
2. Evaluation of the results of the Kemayoran Drainage Channel with the Qcap of the drainage channel P.0–P.3 is 1,45 m3/sec, the Qcap of the drainage channel P.3–P.15 is 1,56 m3/sec.
3. The need for channel cross-sectional dimensions, namely for drainage channels P.0–P.3 is B=1,00 m, H=1,00 m, and W=0,30 m, and for drainage channels P.3-P15 is B = 1,20 m, H = 1,30 m, and W = 0,30 m.

5.2 Suggestions

1. Channel repairs need to be carried out in all Kemayoran drainage channels because the channel capacity is no longer able to accept the discharge that occurs, in the short term the repair that can be done is to clean and normalize the drainage channel, because there is a lot of sediment that comes from mud and from community waste which can hinder the speed of water flow in the channel.
2. In repairing the 288 m long Kemayoran drainage channel, it is recommended to use precast concrete (U-Ditch) so that it is practical in implementation and the dimensions can be accurate, as well as a longer life of concrete.
3. For locations that cannot be reached when using precast concrete due to the installation of heavy equipment and because the location is already densely populated, it will be difficult for heavy equipment to enter the work site, so it is recommended to use a pair of plastered river stones with a mixture of 1 Pc : 4 Ps with a trapezoidal cross section.

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Analysis of The Causes of Delay Completion of Development Projects Workshop Facility - Bekb, Melak, East Kalimantan

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Abstract
Construction projects often suffer from poor performance in terms of execution time management. This is a problem that must be taken seriously. When a delay occurs in a project, there will be additional costs that must be incurred outside the contract and can cause losses for the parties involved, especially the construction contractor. Therefore, it is necessary to pay more attention to the delay in implementation time. The research method used in this research is descriptive quantitative by determining the research variables based on previous journals. Supported by the distribution of phase 1 questionnaires and phase 2 questionnaires which were distributed to 40 respondents related to the Facility Workshop development project located in Melak, East Kalimantan. The questionnaire analysis was assisted by the SPSS version 25 program. The analyzes used were Validity Test, Reality Test, Descriptive Statistical Analysis, Normality Test, Multiple Regression Test, T Test and F Test. From this study, the factors causing delays based on descriptive statistical analysis that meet the requirements of the T-test are material factors (X1), with the indicator "Incorrect material delivery schedule (X1.2)" then supported by the results of multiple linear regression analysis with coefficient positive regression, meaning that there is a significant effect between variables and project delays.

Keywords
BEKB Facility Workshop, Construction Projects, Project Delay Factors, SPSS

1. Preliminary
Construction projects often suffer from poor performance in terms of execution time management. This is a problem that must be taken seriously. When a delay occurs in a project, there will be additional costs that must be incurred outside the contract and can cause losses for the parties involved, especially the construction contractor. Therefore, it is necessary to pay more attention to the delay in implementation time.

Every construction project generally has a specific implementation plan and implementation schedule, when the project implementation should begin, when the project must be completed, how the project will be carried out, and how the resources will be provided. Making a plan for a construction project always refers to the estimates that existed at the time the schedule development plan was made, therefore problems can arise if there is a discrepancy between the plans that have been made and their implementation.

With these resource limitations, a careful and good planning is needed as a guide in implementing the project in order to use time efficiently. To achieve this goal, contractors, developers, and project owners have a project implementation schedule that can simultaneously control the implementation of the project itself.

2. Research Methodology
2.1. Research Location and Time
This research was conducted on a project built by PT. Gatralaras title in the Melak region, East Kalimantan. The project that will be the subject of this research is the construction of a Facility Workshop, which was carried out in 2018

2.2. Data Collection
The data collection required is primary data and secondary data. The primary data in this study were obtained directly from the respondents by distributing questions or questionnaires with the type of multiple choice questions Influential and Not Influential (Guttman Scale) and also with the choices of Strongly Undetermined (STM), Neutral /Don't Know (N/TT) Not Determine (TM), Determine (M), and Strongly Determine (SM) (Likert Scale).

Secondary data is a collection of data and information obtained from the literature and theories that have existed before. Then the previously available data will be used as hypotheses in the process of running this

research. Existing data or commonly called secondary data are obtained from literature books, journals, magazines, newspapers, and others.

2.3. Research Methods

In every research generally carried out with a "research method" so that every step to be taken can be carried out as expected, so that the research can be completed at the decision-making stage. The data analysis method used in this study consisted of five stages, starting with initial expert validation, followed by the distribution of a preliminary questionnaire or questionnaire 1, then distributing the main questionnaire to 40 respondents, then continued with data analysis using SPSS software and finally, expert validation. The tests that will be carried out in this SPSS application are Validity and Reliability Test, Descriptive Statistical Analysis, Normality Test, Multiple Linear Regression Analysis, T Test and F Test, in order to see the results that can be used as a reference in knowing the Causes of Project Delays which will later be reviewed. expert validation first to validate or check the results of the analysis of the delay in the construction of the Facilities Workshop located in Melak, East Kalimantan. The method used in analyzing the data is statistical data analysis.

3. Results and Analysis

3.1. Initial Expert Validation

That is the consultation/validation stage of the preliminary questionnaire containing 40 variables of project delay factors from various aspects to 3 experts. 1 academic expert from Mercubuana Kranggan University and 2 practitioner experts from the Engineering Manager at PT. Gelar Gatralaras.

Tabel 1. Expert Profile

No	Company / University	Degree	Work Experience	Notes
1	PT. Gelar Gatralas	S1	23 Years	Practicioner Expert
2	PT. Gelar Gatralas	S1	12 Years	Practicioner Expert
3	Univ. Mercubuana Kranggan	S2	> 10 Years	Academic Expert

Tabel 2. Intial Expert Validation Result

	Risk Variable	Expert Result			Conclusion
		P1	P2	P3	
X1	Material Factor				
X1.1	Material changes from, function and spesification	No	Yes	Yes	Take Effect
X1.2	Inaccurate material delivery schedule	Yes	Yes	Yes	Take Effect
X1.3	Damage to materials in storage	No	No	No	No Efect
X1.4	Inapproproate manufacturing of building materials	Yes	Ya	Yes	Take Effect
X1.5	Inaccurate time order	Yes	No	Yes	Take Effect
X1.6	Poor material and material management	Yes	No	Yes	Take Effect
X2	Skilled Labor Factory				
X2.1	Lack of Builders	No	Yes	Yes	Take Effect
X2.2	Lack of Workers	Ya	Yes	Yes	Take Effect
X2.3	Lack Of Handyman	No	No	No	No Efect
X2.4	Labor Ability	Yes	Yes	Yes	Take Effect
X3	Equipment Factor				
X3.1	Equipment breakdown	No	Yes	Yes	Take Effect
X3.2	Equipment availability	Ya	Yes	Yes	Take Effect
X3.3	Foreman or operator skills	Yes	No	Yes	Take Effect
X3.4	Equipment productivity	Yes	No	Yes	Take Effect
X3.5	Euipment management error	Yes	No	Yes	Take Effect
X4	Financial Factors				
X4.1	Availability of finance during implementation	Yes	Yes	Yes	Take Effect
X4.2	Fluctuations in the exchange rate of the rupiah agains the dollar	No	No	No	No Efect
X4.3	National economic situation (monetary crisis)	No	No	No	No Efect
X5	Owner Factor				
X5.1	Delay in land preparation	Yes	Yes	Yes	Take Effect
X5.2	Making job changes	No	No	Yes	No Efect
X5.3	Late payment by the owner’s choise	Yes	Yes	Yes	Take Effect
X5.4	Financial difficulties for the owner	Yes	Yes	Yes	Take Effect
X5.5	Design changes by owner	Yes	Yes	Yes	Take Effect
X6	Planning Consultant Factors				
X6.1	Lack of communication between the planner and the owner	Yes	Yes	No	Take Effect
X6.2	Preparation and shop drawing permission	No	Yes	Yes	Take Effect
X6.3	Poor planning	Yes	Yes	Yes	Take Effect
X6.4	Design error	Yes	Yes	Yes	Take Effect
X7	Supervisory Consultant Factors				
X7.1	Project inspection procedure	No	Yes	No	No Efect
X7.2	Preparation of work schedule and revision by supervisory	Yes	No	Yes	Take Effect
X8	Government Factor				
X8.1	Obtaining a permit from the government	No	No	Yes	No Efect
X8.2	Convoluted bureaucracy in project operations	No	No	Yes	No Efect
X8.3	Obtaining a labor permit	Yes	Yes	Yes	Take Effect

3.2. Preliminary Questionnaire

That is the preliminary questionnaire as a result of consultation / validation by 3 experts, where in this preliminary questionnaire the factors have been reduced to 39 factors. In this preliminary questionnaire, 10

respondents will fill out which aims at the trial stage, whether the respondents understand the project delay variable.

Tabel 3. Preliminary Questionnaire Variables

Delay Factor	Code	Risk Variables
Material Factor	X1.1	Material changes in form, function and specifications
	X1.2	Inaccurate material delivery schedule
	X1.3	Inappropriate manufacturing of building materials
	X1.4	Inaccurate time order
	X1.5	Poor material and material management
Skilled Labor Factors	X2.1	Lack of Builders
	X2.2	Lack of Workers
	X2.3	Labor Ability
Equipment Factor	X3.1	Equipment breakdown
	X3.2	Equipment availability
	X3.3	Foreman or operator skills
	X3.4	Equipment productivity
	X3.5	Equipment management error
Financial Factors	X4.1	Availability of finance during implementation
Owner Factor	X5.1	Delay in land preparation
	X5.2	Late payment by the owner's choise
	X5.3	Financial difficulties for the owner
	X5.4	Design changes by owner
Planning Consultant Factors	X6.1	Lack of communication between the planner and the owner
	X6.2	Preparation and shop drawing
	X6.3	Poor planning
	X6.4	Design error
Supervisory Consultant Factors	X7.1	Preparation of work schedule and revision by supervisory consultant while construction is in progres
Goverment Factor	X8.3	Obtaining a labor permit
Technical Factors	X9.1	Error in ground investigation
	X9.2	Geological problem
	X9.3	The condition of the water surface below the ground in the field
	X9.4	Changes in project site conditions
	X9.5	Failure in site investigation
Environmental Factor	X10.1	Social factors
	X10.2	Effect of rain on construction activities

3.2.1. Preliminary Questionnaire Results

Tabel 4. Preliminary Questionnaire Variables Results

CODE	RESPONDENT RESULT										DESCRIPTION QUESTIONNAIRE
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	
X1.1	4	5	4	5	4	4	4	4	4	5	UNDERSTAND
X1.2	5	5	4	4	4	4	5	5	4	5	UNDERSTAND
X1.3	4	3	3	5	5	4	5	4	4	5	UNDERSTAND
X1.4	4	4	4	4	4	4	4	4	5	4	UNDERSTAND
X1.5	3	4	3	4	5	4	5	4	4	5	UNDERSTAND
X2.1	4	5	4	3	4	5	4	4	5	4	UNDERSTAND
X2.2	4	5	5	4	5	5	5	4	4	5	UNDERSTAND
X2.3	3	4	3	5	5	5	4	4	4	4	UNDERSTAND
X3.1	5	5	4	3	4	5	4	4	4	5	UNDERSTAND
X3.2	5	4	4	4	5	5	4	4	4	5	UNDERSTAND
X3.3	3	2	3	4	4	5	4	4	4	4	UNDERSTAND
X3.4	3	2	3	4	3	5	4	4	4	4	UNDERSTAND
X3.5	4	3	5	4	5	5	4	4	4	5	UNDERSTAND
X4.1	5	5	5	4	4	5	4	5	5	5	UNDERSTAND
X5.1	4	5	4	5	4	5	4	4	4	4	UNDERSTAND
X5.3	3	4	3	5	5	5	4	2	4	4	UNDERSTAND
X5.4	3	4	3	5	5	5	4	2	4	5	UNDERSTAND
X5.5	4	3	3	5	4	5	4	4	5	5	UNDERSTAND
X6.1	3	5	3	5	4	4	4	4	4	5	UNDERSTAND
X6.2	5	5	4	5	5	4	4	4	5	4	UNDERSTAND
X6.3	3	4	4	5	4	4	4	4	5	5	UNDERSTAND
X6.4	5	4	4	5	5	4	3	5	4	5	UNDERSTAND
X7.2	4	3	4	3	5	4	4	4	4	4	UNDERSTAND
X8.3	3	3	3	4	5	4	4	4	4	5	UNDERSTAND
X9.1	2	3	2	3	5	4	5	4	4	5	UNDERSTAND
X9.2	2	2	3	3	5	4	3	4	4	5	UNDERSTAND
X9.3	3	4	4	3	5	4	4	4	4	5	UNDERSTAND
X9.4	4	5	4	3	5	4	4	5	4	4	UNDERSTAND
X9.5	4	5	5	4	5	4	4	5	4	4	UNDERSTAND
X10.1	3	3	5	4	4	4	4	3	5	4	UNDERSTAND
X10.3	3	3	5	2	3	4	3	4	5	5	UNDERSTAND

The results of the distribution of the preliminary questionnaire to 10 respondents, namely all the variables of the delay factors can be understood correctly by all respondents, which means that it can be continued to the stage of distributing the main questionnaire to 40 respondents.

3.3. Main Questionnaire

That is the main questionnaire which is in the same format as the preliminary questionnaire, the difference here is the number of respondents, and aims to obtain data that can be analyzed using SPSS software in order to find out which factors affect project delays.

The number of samples is calculated by the Slovin formula as follows:

$$n = \frac{N}{1 + N(e^2)}$$

n = Number of Samples
N = Total Population of BEKB Facility Workshop Project Staff e = Tolerance Limit (using 5% or 0.05)

$$n = \frac{45}{1 + 45(0{,}05^2)} = 40{,}44$$

Then obtained the number of respondents sample as much as 40 people.

3.3.1. Respondent Profile

The following is a recapitulation of 40 respondents who have filled out the main questionnaire.

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Tabel 5. Respondent Profile

No	ProfessionPosition	Degree	Work Experience	Gender	Age (Years Old)
R1	Staff Perencanaan Teknis	D3	< 5 years	Female	21-30
R2	Staff Enggineer	S1	< 5 years	Male	21-30
R3	Staff Enggineer	SMA	< 5 years	Female	21-30
R4	Staff Pengendali	D3	< 5 years	Female	21-30
R5	Quantity Surveyor	D3	< 5 years	Female	21-30
R6	Quantity Surveyor	S1	5 - 10 years	Female	21-30
R7	Quantity Surveyor	D4	5 - 10 years	Female	21-30
R8	Staff Enggineer	D3	< 5 years	Female	21-30
R9	Drafter	SMA	5 - 10 years	Male	21-30
R10	Supervisor	D3	< 5 years	Male	21-30
R11	Drafter	SMA	5 - 10 years	Male	21-30
R12	Drafter	SMA	5 - 10 years	Male	21-30
R13	Supervisor	SMA	5 - 10 years	Male	21-30
R14	Drafter	SMA	5 - 10 years	Male	21-30
R15	Electrical Engineer	D4	5 - 10 years	Male	21-30
R16	Arsitek	S1	5 - 10 years	Male	21-30
R17	Supervisor	D3	5 - 10 years	Male	21-30
R18	Pelaksana	SMA	5 - 10 years	Male	21-30
R19	Staff Enggineer	SMA	5 - 10 years	Male	31-40
R20	Site Manager	S1	10 - 15 years	Male	31-40
R21	Supervisor	S1	< 5 years	Male	21-30
R22	Staff Enggineer	SMA	10 - 15 years	Male	21-30
R23	Admin	SMA	< 5 years	Male	21-30
R24	Site Enginer Officer	SMA	10 - 15 years	Male	21-30
R25	Staff Enggineer	D3	< 5 years	Female	21-30
R26	Staff Enggineer	D4	< 5 years	Female	21-30
R27	Group Leader	D3	10 - 15 years	Male	21-30
R28	Drafter	D3	< 5 years	Female	21-30
R29	Quantity Surveyor	S1	10 - 15 years	Female	21-30
R30	Quantity Surveyor	D3	10 - 15 years	Female	21-30
R31	Quantity Surveyor	S1	< 5 years	Female	21-30
R32	Quantity Surveyor	S2	< 5 years	Female	21-30
R33	Group Leader	S1	20 - 25 years	Male	41-50
R34	Group Leader	S2	20 - 25 years	Male	>50
R35	Group Leader	S1	15 - 20 years	Male	31-40
R36	Staff Enggineer	S1	10 - 15 years	Male	31-40
R37	Site Manager	S1	15 - 20 years	Male	31-40
R38	Admin	S1	10 - 15 years	Male	31-40
R39	Admin	S1	10 - 15 years	Male	31-40
R40	Admin	S1	10 - 15 years	Male	31-40

3.3.2. Respondent Classification

The following is a classification of 40 respondents who have filled out the main questionnaire.

Tabel 6. Classification of Respondents Based on Education

No	Degree	Total
1	SMA	11 people
2	D3	11 people
3	D4	3 people
4	S1	14 people
5	S2	1 people

Tabel 7. Classification of Respondents Based on Work Experience

No	Work Experience	Total
1	< 5 years	14 people
2	5 – 10 years	12 people
3	10 – 15 years	10 people
4	15 – 20 years	2 people
5	20 – 25 years	2 people

Tabel 8. Classification of Respondents Based on Gender

No.	Gender	Total
1	Male	26 People
2	Female	14 People

Tabel 9. Classification of Respondents Based on Age

No.	Age	Total
1	21 - 30 tahun	14 People
2	31 - 40 tahun	12 People
3	41 - 50 tahun	10 People
4	> 50 tahun	2 People

3.4. Validity Test

This validity test was carried out using the SPSS Version 25 software. The purpose of the validity and reliability test was to determine the consistency of an answer. If the instrument used to obtain the data is valid, it means that the instrument can be used to measure what should be measured. Testing the validity of the data is used by using the corrected item total correlation using the r value from the table.

Tabel 10. Validity Test Results

Delay Factor	Code	Pearso Corelation	Table	Validity
Material Factor	X1.1	0,688	0,312	VALID
	X1.2	0,750		VALID
	X1.4	0,645		VALID
	X1.5	0,697		VALID
	X1.6	0,655		VALID
Skilled Labor Factor	X2.1	0,879		VALID
	X2.2	0,918		VALID
	X2.4	0,865		VALID
Equipment Factors	X3.1	0,702		VALID
	X3.2	0,852		VALID
	X3.3	0,645		VALID
	X3.4	0,684		VALID
	X3.5	0,716		VALID
Financial Factor	X4.1	1,00		VALID
Owner Factors	X5.1	0,591		VALID
	X5.3	0,909		VALID
	X5.4	0,807		VALID
	X5.5	0,738		VALID
Planning Consultant Factors	X6.1	0,768		VALID
	X6.2	0,649		VALID
	X6.3	0,650		VALID
	X6.4	0,709		VALID
Supervisory Consultant Factor	X7.2	1,00		VALID
Government Factor	X8.3	1,00		VALID
Technical Factors	X9.1	0,766		VALID
	X9.2	0,829		VALID
	X9.3	0,856		VALID
	X9.4	0,764		VALID
	X9.5	0,813		VALID
Environment Factor	X10.1	0,763		VALID
	X10.3	0,800		VALID

From the results of the validity test, it can be concluded that each indicator has a value of Corrected Item-Total Correlation > from the value of r-table = 0.312. So it can be concluded that all the indicators above can be declared valid..

3.5. Reliability Test

Reliability test was conducted to measure the level of consistency of a questionnaire. Determination of a questionnaire considered reliable or not is the result of the alpha value of the test results. To see the level of reliability based on Cronbach's Alpha value, it can be seen in the following table tabel :

Tabel 11. Reliability Level

Alpha	reliability level
0.00 s.d 0.20	less reliable
> 0.20 s.d 0.40	somewhat reliable
> 0.40 s.d 0.60	reliable enough
> 0.60 s.d 0.80	reliable
> 0.80 s.d 1.00	very reliable

The results of the reliability test can be seen in the following table :

Tabel 12. Reliability Test Results

No.	Variable	r Table	Cronbach's Alpha	N of item	Notes
X1	Material Factor	0,312	0,712	5	Reliable
X2	Skilled Labor Factors	0,312	0,864	3	Very Reliable
X3	Equipment Factors	0,312	0,771	5	Reliable
X4	Financial Factors	0,312	1	1	Very Reliable
X5	Owner Factors	0,312	0,793	4	Very Reliable
X6	Planning Consultant Factors	0,312	0,623	4	Reliable
X7	Supervisory Consultant Factors	0,312	1	1	Very Reliable
X8	Goverment Factors	0,312	1	1	Very Reliable
X9	Technical Factors	0,312	0,863	5	Very Reliable
X10	Environment Factors	0,312	0,363	2	Quite Reliable

The results of the reliability test obtained that Cronbach's Alpha value was on average more than the r table value on validity testing > 0.312. So it can be concluded that the instrument in this study is reliable or consistent.

3.6. Descriptive Statistical Analysis

Through descriptive statistical analysis, a brief overview will be obtained of the sub-factors causing delays that have the highest scale on the project as seen from the highest total score for each variable. The results of descriptive analysis will be presented in each variable.

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Tabel 13. Descriptive Analysis Results

Delay Factor	Kode	Mean	Median	Mode	Sum
Material Factor	X1.1	4.18	4.00	4.00	167
	X1.2	4.38	4.00	4.00	175
	X1.3	4.25	4.00	4.00	170
	X1.4	4.08	4.00	4.00	163
	X1.5	4.08	4.00	4.00	163
Skilled Labor Factors	X2.1	4.15	4.00	4.00	166
	X2.2	4.13	4.00	4.00	165
	X2.3	3.98	4.00	4.00	159
Equipment Factors	X3.1	3.95	4.00	4.00	158
	X3.2	4.03	4.00	4.00	161
	X3.3	3.95	4.00	4.00	158
	X3.4	3.83	4.00	4.00	153
Financial Factors	X3.5	4.03	4.00	4.00	161
	X4.1	4.33	4.00	4.00	173
Owner Factors	X5.1	4.20	4.00	4.00	168
	X5.2	4.15	4.00	5.00	166
	X5.3	4.15	4.00	4.00	166
	X5.4	4.35	4.00	4.00	174
Planning Consultant Factors	X6.1	4.05	4.00	4.00	162
	X6.2	4.18	4.00	5.00	167
	X6.3	4.25	4.00	4.00	170
	X6.4	4.30	4.50	5.00	172
Supervisory Consultant Factors	X7.2	3.98	4.00	4.00	159
Government Factor	X8.3	3.93	4.00	4.00	157
Technical Factor	X9.1	3.73	4.00	4.00	149
	X9.2	3.75	4.00	4.00	150
	X9.3	3.83	4.00	4.00	153
	X9.4	3.93	4.00	4.00	157
	X9.5	3.93	4.00	4.00	157
Environment Factors	X10.1	3.60	4.00	4.00	144
	X10.2	3.75	4.00	4.00	150

Based on the data above, the indicator that has the highest score is in the category of material factors for the X1.2 indicator, namely the inaccuracy of the material delivery schedule with a total score of 175 with an average value of 4.38, this concludes that based on descriptive statistical analysis, the most dominant factor The factor that caused the delay in the construction of the Workshop Facilities in Melak, East Kalimantan was the material factor (X1).

3.7. Normality Test

The Kolmogorov-Smirnov normality test is part of the classical assumption test. The normality test aims to determine whether the residual value is normally distributed or not. A good regression model is to have residualsthat are normally distributed.

Decision making basis :

The score given for the variable X statement is:

1. If the significance value is > 0.05 then the residual value is normally distributed.

2. If the significance value is < 0.05 then the residual value is not normally distributed.

Tabel 14. Kolmogorov-Smirnov Normality Test Results

One-Sample Kolmogrov-Smirnov Test		
N		40
Normal Parameters	Mean	.0000000
	Std. Deviation	.34367007
Most Extreme Differences	Absolute	.124
	Pasitive	.087
	Negative	-.124
Test Statistic		.124
Asymp. Sig. (2-tailed)		.125c

a. Test Normal distribution is

b. Calculated from data
c. Lilliefors Significance Correction

Based on the results of the normality test, it is known that the significance value is 0.125 > 0.05, so it can be concluded that the residual value is normally distributed.

3.8. Multiple Linear Regression Analysis

Linear regression analysis is a tool with several important applications. It is also a set of statistical procedures that are always used to explain the linear relationship between two or more independent variables (X1, X2,….Xn) and the dependent variable (Y).

This analysis is to determine the direction of the relationship between the independent variable and the dependent variable whether each independent variable is positively or negatively related and to predict the value of the dependent variable if the value of the independent variable increases or decreases. Multiple linear regression equation as follows :

Y' = a + b1X1+ b2X2 +…..+ bnXn
Information :
Y' = Dependent variable (predicted value) X1 and Xn = Independent variable
A= Constants (the value of Y' if X1, X2…..Xn = 0)
B= Regression coefficient (increase or decrease value)

3.9. T Test

The t-test was conducted with the aim of whether the independent variables individually affect the delay. In this study, the t-test was carried out using SPSS 25. Determination of the results of the t-test can be seen if the t-count value is greater than t-table, then the independent variables individually have an effect on project delay.

The following are the results of the validity test based on the variables :

1. Determining the Hypothesis
   Ho : Partially there is no significant effect between variable X and Variable Y.
   Ha : Partially there is a significant effect between variable X and Variable Y. Determining the level of significance
2. The level of significance using = 5%
3. Determining T count: based on the results of SPSS calculations.
4. Determine the T table
   The t distribution table is searched at = 5%: 2 = 2.5% (2-sided test) with degrees of freedom (df) nk-1 or 40-31-1 = 8 (n is the number of samples and k is the number of independent variables) .
   = t (α / 2 ; n – k – 1)
   = t (0,05/2 ; 40 – 10 – 1)
   = t (0,025 ; 29)
   = 2.045 (t table value)
5. Test Criteria
   Ho is accepted if t table > t count Ho is rejected if t table < t count

Tabel 15. T Test Analysis Results

Coefficients[a]						
Model		Unstandardized B	Coefficients Std. Error	Standardized Coefficients Betta	t	Sig.
1	(Constant)	.768	.644		1.193	.243
	TOTAL_X1	.167	.039	.661	4.240	.000
	TOTAL_X2	.081	.048	.272	1.682	103
	TOTAL_X3	-.022	.043	-950	-.506	.617
	TOTAL_X4	.1338	.101	.160	1.358	.185
	TOTAL_X5	-.062	.032	-.250	-1.940	.062
	TOTAL_X6	.049	.044	.172	1.116	.274
	TOTAL_X7	.169	.139	.206	1.209	236
	TOTAL_X8	-.062	.107	-.780	-.575	.569
	TOTAL_X9	-.068	.028	-.405	-2.433	.021
	TOTAL_X10	.008	.049	.021	.169	.867

a. Dependent Variable : Y

From the data above, it can be concluded that if the results of the t-test there are independent variables that partially have a significant effect on the dependent variable, namely X1 or in a variable manner, namely Material Factors (Material).

3.10. Uji F

The f-test was conducted with the aim of whether the independent variables jointly affected project delays. In this study, the f-test was carried out using IBM SPSS Statistics version 25. The determination of the f-test results can be seen if the f-count value is greater than the f-table, then the independent variables together have an effect on project delays:

Tabel 15. F Test Analysis Results

ANOVA						
Model		Sum of squares	df	Mean Square	F	Sig.
1	Regression	10.812	10	1081	6.871	.000[b]
	Residual	4.563	29	.157		
	Total	15.375	39			

a. Dependent Variable: Y
b. Predictor: (Constant), Total_X10, TOTAL_X7, TOTAL_X4, TOTAL_X5, TOTAL_X1, TOTAL_X8, TOTAL _X6, TOTAL_X9, TOTAL_X3

The following are the results of the validity test based on the variables :

1. Determining the Hypothesis
   Ho : There is no significant effect between X1, X2,….Xn together on project delays.
   Ha : There is a significant effect between X1, X2,….Xn together on project delays.
2. Determining the level of significance
   Significance level using = 5% (significance 5% or 0.05 is a standard measure that is often used in research)
3. Determine F count.
   From the output of IBM SPSS Statistics version 25, it can be seen that the f-count is 6,871.
4. Determine the F table
   By using the 95% confidence level, = 5%, and using the formula: f (k ; n - k) where n is the number of respondents and k is the number of independent variables.
   = f (10; 40-10)
   = f (10 ; 30)
   = f table 2,16 (table attached).
5. Test Criteria
   Ho is accepted if t table > t count.
   Ho is rejected if t table < t count.

6. Comparing calculated F with F table

The calculated F value > F table (6.871 > 2.16), then Ho is rejected.

Because F count > F table (6.871 > 2.16), then Ho is rejected, which means that the independent variables in this study jointly affect project delays. So from this case it can be concluded that X1, X2, X3….Xn together have an effect on Y.

3.11. Expert Validation

Validation of this stage is given to experts who are experienced in the field of building construction. This expert validation aims to find out and ask for expert opinions on how to deal with delays in known variables.

Tabel 16. Expert Validation Opinions

Opinion		
Expert Practitioner 1	Agree	There are several factors that cause delays in the arrivalof materials to the project site unfavorable environmental conditions, as well as the very long distance of material mobilization, approximately 5 hours drive Lack of stock of materials, far from the planned receipt, meaning that the request is not in accordance with the delivery
Expert practitioner 2	Agree	This happen because: Incorrect material selection error Lack of planning in ordering materials, resulting in delays in procurement Wrong choice of expendition and lack of monitoring during delivery
Academic Expert	Agree	The delay in the delivery of materials or raw materials is indeed a source of problems for project delays in general. Some materials can be anticipated for procurement, but there are no delays

Tabel 17. Expert Validation Suggestions

Suggestion	
Expert Practioner 1	1. planning for material orders can be done ahead of time 2. there should be no monopoly on purchasing materials, especially natural materials 3. sufficient and adequate means of mobility 4. request adjusted with delivery
Expert practioner 2	1. The use of materials that are ready in the field / on the market 2. orders are tried long before the implementation 3. monitor when delivery is carried out so that you can anticipate problems during delivery
Academic Expert	There are several material delays that can be anticipated by doing stock first (buffer strock)

4. Conclusion

From the results of the analysis and discussion of the problem formulation, the following conclusions are obtained :

1. Based on the results of questionnaires to 40 respondents and statistical analysis testing was carried out using the analytical method, from several variables causing delays in the Workshop Facilities construction project located in Melak, East Kalimantan, the most influential variable on the causes of delays, namely Material Factors (Material) (X1) with the indicator "Inaccurate schedule of delivery of materials (X1.2)" which is supported by the results of the calculation of the Descriptive Statistics analysis of the total value and mean value on the X1.2 indicator which has the largest result with a total value of 175 and a mean of 4.38, then supported by the results of multiple linear regression analysis with a value of 0.167 positive regression coefficient, meaning that there is a significant effect between variables and project delays.

2. Steps used to overcome the inaccuracy of material delivery schedule in a project is planning material ordering can be done far - far in advance. The use of materials that are ready in the field / on the market also makes it easier to find materials to be sent, as well as monitor when delivery is carried out in order to anticipate problems during delivery.

5. Suggestions

Based on the results of the analysis that has been carried out and the conclusions, it can be suggested as follows :

Construction service companies that will carry out the project, should pay attention to the problem of planning material procurement (schedulle, volume, etc.), so that delays in material delivery that occur in the project can be overcome. Planning and scheduling the procurement of appropriate construction materials includes planning the

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Analysis Management Risk of Extension Vasa Hotel Project Construction in Surabaya

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Abstrak

The complex and lengthy construction process can hinder the achievement of goals, especially for renovation projects that previously contained existing buildings. In the implementation of a construction project, there may be a risk that may be a risk that is greater than that detected or calculated by the company, if monitoring and control of the incident or situation is not carried out. Data collection was carried out by distributing questionnaires via google form and interviewing the parties involved in the project. The collected data will then be analyzed using probability impact analysis to determine the magnitude of the risk and factor analysis to determine the risk variables that have the most dominant influence on the development of the project. Risk assessment uses a Likert scale to determine the level of probability and impact. Furthermore, risk mapping is carried out to determine mitigation efforts for the dominant risk. There are 37 risk variables obtained in the results of interviews and literature studies. From this research, it is known that 1 risk is included in the criteria of low risk, 30 risks are included in the criteria of moderate risk (medium risk), and 6 risks are included in the criteria of high risk. The data is then projected into the risk treatment table so that the results are 1 acceptable risk, 30 unacceptable risk, 6 undesirable risks. Risk mitigation for the dominant risks that have been identified stems from location problems and difficult site access, implementation schedules that have to adapt to the operating hours of existing buildings, changed designs and material increases.

Keywords :
Construction projects, Factor analysis, Mitigation, Risk, Risk management.

1. Introduction

A construction project is not only a process of realizing development from a non-existent form into existence but can also be a process of improving an existing building. Many factors of uncertainty and other unexpected things often cause failure to achieve project goals/targets. The amount of risk that occurs depends on the type of work, technology and risk control efforts undertaken. Work accidents are accidents that occur due to work or when carrying out work on the project. Broadly speaking, work accidents are caused by two factors, namely human actions that do not meet work safety (unsafe act) and unsafe environmental conditions (Budiono S 2005).

1.1 Risk Management

Project management consists of two words namely “Management” and “Project”. Management in general is an effort to achieve a goal with minimal resources (efficient). Meanwhile, a project is a work plan with a certain achievement target that is completed within a certain time span. Management is an integrated process in which individuals as part of the organization are involved to maintain, develop, control, and run programs, all of which are directed at predetermined targets and continue over time (Dipohusodo 1996).

2. Methodology

This study uses a survey method in which there are two surveys, namely a preliminary survey by collecting data with interviews to get input and comments on factors that allow the occurrence of risk. As for the second survey, namely the actual survey by distributing questionnaires to respondents who are members of the Vasa Hotel Surabaya extension project. The purpose of the questionnaire distribution is to obtain results regarding the value of the frequency of work risks and the impact of risks that occur in the project.

Risk variables that often occur in projects are obtained from literature studies which will later be used as initial identification in the questionnaire that will be distributed.

Table 9 Risk Variable

No	Source of Risk	Variable
1	Environment	Natural disasters; Changes in the weather; Noise; Pollution; Public Opinion; Environmental impact (Godfrey, 1996)
		Fire; Collapse; Accident (Godfrey, 1996)
2	Contraktual	Availability of funds from the owner (Al Bahar & Crandal, 1990) and (Zhi, 1995)
		Misinterpretation of contracts (Kim & Bajaj, 2000)
3	Materials dan Equipment	Exchange rate; Bankruptcy (Godfrey, 1996) and (Kim & Bajaj, 2000)
4	Technical Implementation	Limited Land (Dharmika, 2014)
		Inappropriate work methods (Zhi, 1995)
		Design changes (Al Bahar & Crandall, 1990)
		Improper planning and estimation; Ignorance of project situation (Augustine et al, 2013)
5	Human Resources	Manpower and Resources (Dharmika, 2014)

3. Result And Discussion

3.1 Risk Identification

The risk identification process is carried out by distributing questionnaires to clarify, and find out whether the risk variables are relevant or not obtained from the results of the literature study on the project being reviewed.

3.2 Preliminary Survey

Based on the preliminary survey conducted, the results of the relevance test of risk variables will be obtained which in this study uses the Guttman scale, namely respondents are given questions whether they agree or not to the possibility of these risks in the project.

Based on the results of the survey to the respondents in table 2, it can be concluded that the risk variables obtained from the results of the literature study and interviews are relevant and can be distributed for the main survey.

Table 2 Calculation Results of Risk Variable Relevance Test

No	Variable	Agree	Don't Agree	Description
A. Technical Implementation				
X1	Mistakes in choosing work methods on renovation projects	25	1	ok
X2	Limited access to access for project activities.	26	0	ok
X3	Lack of coordination between consultants, contractors, owners, and hotel/mall operators	24	2	ok
X4	The movement of project vehicles in and out of the project site that can disturb hotel/mall guests	23	3	ok
X5	Mistakes of assumptions at the beginning of implementation	23	3	ok
X6	Difficult site location conditions	22	4	ok
X7	Projects that are hampered due to having to adjust to hotel/mall operating hours	21	5	ok
X8	There is a design change	25	1	ok
X9	The length of decision making from the consultant and owner	24	2	ok
X10	Incomplete design data	22	4	ok
X11	Unclear or incomplete design specifications	22	4	ok

X12	Unready/unapproved designs	24	2	ok
X13	Weak coordination with Subcontractors	18	8	ok
B. Human Resource				
X14	Unskilled workforce	21	5	ok
X15	Poor communication between workers	20	6	ok
X16	Lack of manpower	22	4	ok
X17	Low labor productivity	21	5	ok
X18	The occurrence of a work accident	22	4	ok
X19	Insufficient operator power	19	7	ok
X20	Inappropriate and incompetent selection of people in the project organizational structure.	20	6	ok
X21	Poor quality subcontractors	22	4	ok
C. Environment				
X22	Complaints from the community in the project environment	20	6	ok
X23	Natural disasters such as earthquakes, hurricanes, tsunamis, floods, landslides, volcanic eruptions.	21	5	ok
X24	Changes in weather are like sudden rain.	23	3	ok
X25	Increased noise and vibration during hotel construction or renovation	23	3	ok
X26	Unstable soil conditions	23	3	ok
X27	Security problems at the project site	21	5	ok
D. Materials and Equipment				
X28	Damage or loss of materials	22	4	ok
X29	Material price increase	22	4	ok
X30	Delay in delivery of materials from suppliers	23	3	ok
X31	Lack of material storage space	22	4	ok
X32	Damage to project equipment and equipment	25	1	ok
X33	Specifications of the work of subcontractors that are not in accordance with the contract	21	5	ok
E. Contractual				
X34	Incomplete documents	21	5	ok
X35	Late payment by owner	23	3	ok
X36	The ambiguity of the articles in the contract	14	12	ok

X37	Time estimation error	23	3	ok

3.3 Main Survey

After obtaining the relevant variables in the Vasa Hotel Surabaya Extension Development project, a main stage questionnaire survey was conducted to conduct a risk analysis. After the data from the questionnaire has been successfully collected, then the main survey results are analyzed using the Severity Index (SI) method.

Based on table 3, it can be concluded that there is 1 risk that is included in the low or minor risk criteria, 30 risk variables are included in the medium risk or medium risk criteria, and 6 risk variables are included in the high or high risk criteria. risk.

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Table 3. Risk Level Assessment

No	Variable	Probability	Impact	Risk Level	Risk Catagory
		P	I	(R = P x I)	
	A. Technical Implementation				
X1	Mistakes in choosing work methods on renovation projects	3	4	12	medium
X2	Limited access to access for project activities.	4	4	16	high
X3	Lack of coordination between consultants, contractors, owners, and hotel/mall operators	3	4	12	medium
X4	The movement of project vehicles in and out of the project site that can disturb hotel/mall guests	3	3	9	medium
X5	Mistakes of assumptions at the beginning of implementation	3	4	12	medium
X6	Difficult site location conditions	4	4	16	high
X7	Projects that are hampered due to having to adjust to hotel/mall operating hours	4	4	16	high
X8	There is a design change	4	4	16	high
X9	The length of decision making from the consultant and owner	4	4	16	high
X10	Incomplete design data	3	4	12	medium
X11	Unclear or incomplete design specifications	3	4	12	medium
X12	Unready/unapproved designs	3	4	12	medium
X13	Weak coordination with Subcontractors	3	4	12	medium
	B. Human Resource				
X14	Unskilled workforce	3	4	12	medium
X15	Poor communication between workers	3	3	9	medium
X16	Lack of manpower	3	4	12	medium
X17	Low labor productivity	3	4	12	medium
X18	The occurrence of a work accident	2	3	6	rendah
X19	Insufficient operator power	3	3	9	medium
X20	Inappropriate and incompetent selection of people in the project organizational structure.	3	3	9	medium
X21	Poor quality subcontractors	3	3	9	medium
	C. Environment				
X22	Complaints from the community in the project environment	3	3	9	medium
X23	Natural disasters such as earthquakes, hurricanes, tsunamis, floods, landslides, volcanic eruptions.	2	4	8	medium
X24	Changes in weather are like sudden rain.	3	4	12	medium
X25	Increased noise and vibration during hotel construction or renovation	3	4	12	medium
X26	Unstable soil conditions	3	3	9	medium
X27	Security problems at the project site	3	3	9	medium

	D. Materials and Equipment				
X28	Damage or loss of materials	3	3	9	medium
X29	Material price increase	4	4	16	high
X30	Delay in delivery of materials from suppliers	3	4	12	medium
X31	Lack of material storage space	3	3	9	medium
X32	Damage to project equipment and equipment	3	3	9	medium
X33	Specifications of the work of subcontractors that are not in accordance with the contract	3	3	9	medium
	E. Contractual				
X34	Incomplete documents	3	3	9	medium
X35	Late payment by owner	3	4	12	medium
X36	The ambiguity of the articles in the contract	3	3	9	medium
X37	Time estimation error	3	4	12	medium

3.4 Risk Mitigation

Risk mitigation can be used as input in dealing with risks that may occur. As the risk that is most likely to occur and cause a significant impact, in this study, risk mitigation was discussed with experienced respondents and several people who worked directly on the project as well as from several literature studies.

Table 4. Risk Mitigation

No	Variable	Risk Category	Mitigation Proposal
X2	Limited access to access for project activities.	high	Arrange site plans and appropriate flow patterns so as not to hinder implementation Conduct a preliminary site survey in order to ensure the condition of the project road access
X6	Difficult site location conditions	high	Conduct an initial site survey to be able to estimate the obstacles that will occur which can then be conveyed at the initial time of the tender
X7	Projects that are hampered due to having to adjust to hotel/mall operating hours	high	Coordinate between mall/hotel operations.
X8	There is a design change	high	Perform routine coordination of all project owners, contractors, and supervisory consultants (if any)
X9	The length of decision making from the consultant and owner	high	Provide options that can make it easier for owners to make decisions. Perform routine coordination with owner and consultant
X29	Material price increase	high	Place an order for materials in advance before the price increases as needed. Increase the number of suppliers that can be used as an option in order to get the lowest price.

The mitigation proposal above is only an input from the results of the risk assessment carried out and this study only describes the results of the analysis and mitigation efforts but is not followed up with monitoring of the risk control.

4. Conclusions

4.1 Conclutions

Based on the research that has been done, the following conclusions can be drawn:

1. In the Vasa Hotel Surabaya Expansion Project 37 risk variables were identified, originating from Technical Implementation, Human Resources, Environment, Materials and Equipment and Contractual.
2. From the research on the implementation of the Vasa Hotel Surabaya Expansion Project, the results obtained were 1 risk which was included in the low (low) risk or minor risk criteria, 30 risk variables were included in the medium risk criteria, and 6 risk variables were included in high risk criteria.

From the risk analysis, there are 6 dominant risks, these risks include:

1) Limited access to access for project activities
2) Difficult site location conditions
3) Projects that are delayed due to having to adjust to hotel/mall operating hours
4) There is a design change
5) The length of decision making from the consultant and owner
6) Increase in material prices

3. From the dominant risk that is most likely to occur and has a significant impact, risk control is carried out in several ways:
   7) Arrange site plans and appropriate flow patterns so as not to hinder implementationConduct a preliminary site survey in order to ensure the condition of the project road access
   8) Conduct an initial site survey to be able to estimate the obstacles that will occur which can then be conveyed at the initial time of the tender
   9) Coordinate between mall/hotel operations.
   10) Perform routine coordination of all project owners, contractors, and supervisory consultants (if any).
   11) Provide options that can make it easier for owners to make decisions.
   12) Perform routine coordination with owner and consultant
   13) Place an order for materials in advance before the price increases as needed.
   14) Increase the number of suppliers that can be used as an option in order to get the lowest price.

4.2 Suggestions

The suggestions that can be given from the results of this study are as follows:

1. Parties involved in similar projects can use the risks identified in this study, especially those that include dominant risks, as a reference in handling hotel renovation or expansion projects.
2. The parties involved in the renovation or extension project are advised to conduct an initial survey and also arrange the site plan as well as possible so that it does not become an obstacle during implementation.

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Analysis of the Impact of Worker Age on Behavioral Differences Occupational Safety and Health in Construction Ploso Jombang Bridge

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Abstract
The construction of the Ploso Bridge intends to connect access traffic road between Jombang on the north side and Jombang on the south side. The construction of the Ploso Jombang Bridge project, as in the construction of the bridges in general which give rise to various unintended consequences desire, among others, regarding aspects of occupational health and safety, occupational diseases and occupational diseases. This research has the aim of find out how much influence the age of workers has on behavior differences in health and work safety in the construction of the Ploso Bridge Jombang who has practiced the K3 system. The aims of this research are, 1) To recognize the impact of worker age on safety behaviour. 2) Use recognize the link between work experience and safety behaviour. 3) To identify the education level of workers with safety behavior. Collecting data in this research using questionnaires to the participants workers which include craftsmen and coolies, as many as 50 samples. based on because often work accidents in the field occur to craftsmen and coolies spearheading a construction project due to a work accident, with. After the results of the questionnaire have been filled in all then inputted into excel by making noun data. After that, the results can be compared workers for ages 17-30 years with workers 30-55 years old to measure there is a difference in safety behavior or not, by using tests predetermined test, In this analysis of the impact of worker age using Validity Test technique, Reality Test, Normality Test, Crosstab Test, F and Z . TEST

Keywords:
Age, Occupational Health and Safety, Ploso Bridge

1. Background
In the construction of the Ploso Bridge, it is intended to connect access road traffic between Jombang north side and Jombang south side. The existence of a bridge over the Brantas river which has sufficient function vital in overcoming congestion due to sufficient vehicle volume tall. The location of the new Ploso construction activity is about ±300m from the old ploso bridge and on the approach road on the north side (direction of Babatdan direction Gedek) with a length of ± 200m in the village of Rejoagung, Ploso sub-district, and on the south side (direction Jombang) with a length of ±258m in the village of Bedah Lawak, Tembelang district. Construction of the new Ploso bridge in addition to bringing changes to changes in the physical environment will also affect social conditions, vibration, noise and generation traffic.

In the construction of the Ploso Jombang Bridge project, as in the construction of bridges in general which gives rise to various consequences which is not desirable, among others, concerning aspects of health and occupational safety, occupational diseases and the effects of the work area. This research has the aim of knowing the effect of the age of workers on behavior behavior differences in occupational health and safety in bridge construction Ploso Jombang who has practiced the K3 system.

The effect of age on the occurrence of accidents is still being studied especially in terms of worker behavior, due to increasing age on workers, the behavior at work is getting better because they have sufficient work experience and more alert to work accidents.However, young workers are more concerned with first completion of work than safety, as a result safety is never pay attention at all, not only that, many workers have young people still don't really know how the machine works and safety (Helda, 2007).

Therefore, it is necessary to do research related to attitude work safety on age-based construction projects. In determination of the location of the project researchers sort out the Bridge Construction project Ploso which is located in Jombang because the project has implemented a system K3 management (Occupational Safety and Health).

The aims of this research are 1) To identify the impact of working age with safety behavior. 2) In order to recognize the relationship between work experience with safety behavior 3) To recognize education level of workers with safety behavior.

2. Literature Review

Work safety is a means to avoid work accidents, Meanwhile, disability and death are the result of work accidents according to Suma'mur (2009). while for Bambang (2002) Work safety is something related to equipment work or material and the method of processing it, the place of work and area.

For Mangkunegara (2009: 160) occupational safety and health is a situation that is guaranteed or protected from burden, destruction or loss at work. Work safety risks are angles from work areas that can cause fires, electric current concerns decapitation, injuries, contusions to the body, sprains, fractures, loss of organs, vision and deafness.

K3 Benefits for Workers or employees In the company's internal area, workers can understand the threats and risks of their profession, avoid the formation of work accidents, play a role in a precarious atmosphere, and perform their rights and obligations related to K3 regulations.

Benefits of K3 for companies or industry for industry, application of K3 always want maximum productivity in various circumstances. Financially, K3 helps reduce expenses, especially for the budget health and worker insurance. The problem of workplace accidents is increasingly becoming a concern in many industries in Indonesia, especially in the construction sector. A work disaster is a an event that cannot be predicted and can be predicted worried about the process of work activities that have been arranged and there are some Aspects that can cause disaster in a construction work are: aspects of humans, the environment and equipment (Santoso, 2004).

There are two causes of work accidents in construction projects, namely: triggers in a direct way and triggers in an indirect way. Trigger direct work accident, one of which is uncomfortable behavior (unsafe acts) and unsafe conditions. According to Anton and Thomas (1989) in Subing that unsafe acts are something activities attempted by individuals that can cause themselves or other people are harmed, on the contrary, the uncomfortable situation is a where is the condition of the work area that can cause accidents to employees worker.

For Notoatmodjo (2007) explains that behavior is one of the cultural perspective and culture has a valuable impact on behavior. Human behavior is a condition of a balance between the driving forces and holding strength. Kwick and Notoatmojo reported that Behavior is an action or behavior of a living thing that can be reviewed let alone can also be studied.

Based on the Regulation of the Minister of Manpower Number PER. 05/ MEN/ 1996 1996, the OHS Management System is part of a system management covering the structure of the institution, the way in which the project is implemented, implementation procedures and the work and resources used to development of a project and predetermined targets and efforts to make always maintain the OHS policy in controlling risks to workers.

3. Methodology

This research was carried out at the Ploso Baru Bridge construction project which located in Jombang, East Java. Due to the project has been running K3 construction management system (work health and safety).

In this study, data collection was carried out using survey techniques or questionnaire distribution (questionnaire). Questionnaire is a data collection technique which is done by giving some written questions to the respondents to be answered and the method used is a closed questionnaire (Sugiyono, 2014)

The number of samples used in the research is 50, which is addressed to porters or craftsmen who are in the bridge construction project The Ploso Jombang project. the following percentage obtained:

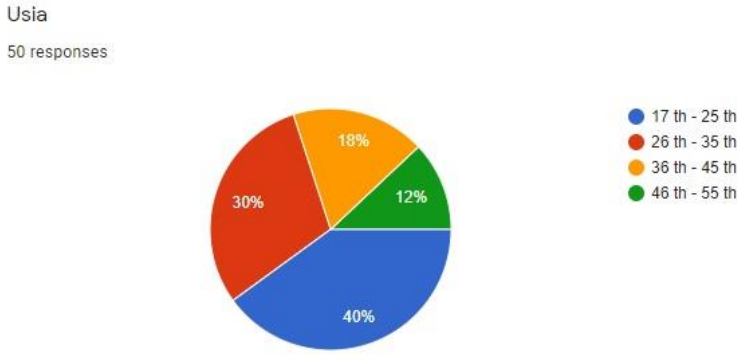

Figure 1. The Ploso Jombang project

The dominating workers in filling out this questionnaire are 17 years old - 25 yrs

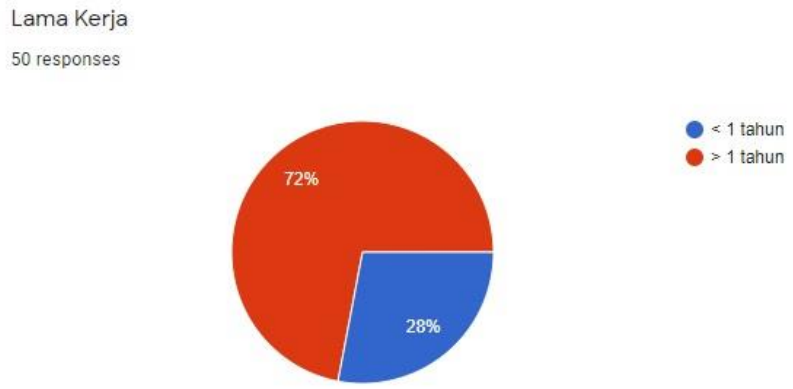

Figure 2. The dominating workers in filling

And most of the workers who are in the Project building project this ploso jombang bridge has more than 1 year of experience.

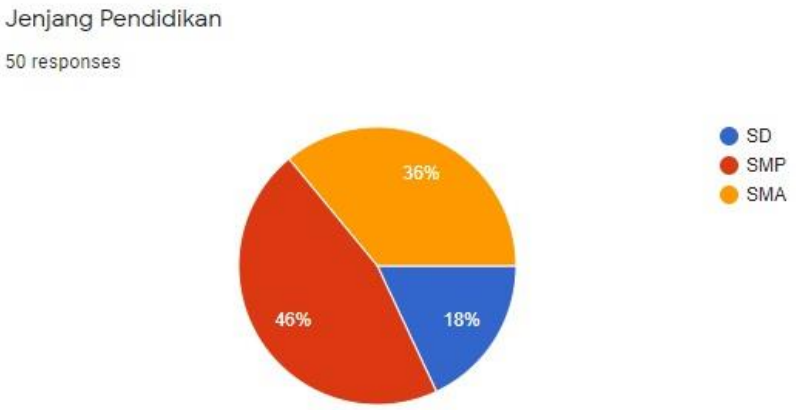

Figure 3. workers who are in the Project

As for the level of education, most of them are graduates or diplomas the last is junior high school.

After all the questionnaires are filled in, then they are inputted in excel with using noun data, which is between 1-5, then it is just inputted into SPSS and tested with validity test. So that you can check the questions asked valid or not. After the validity test, check gain with the reliability test to determine the consistency of the questionnaire.

The following standards for taking provisions in this validity test are: 1. if the value of r count > r table at 5% significance so that the data is valid. 2. If the value of r count < r table at 5% significance so that the data is not valid. The correlation value in the r table can be seen in the Corrected Item Total Correlation, the value of r table can be determined according to an equation such as: r table = sum respondents (n) – 2 = 50 – 2 = 48. And the value of r table with a level of significance of 5% then obtained = 0.2787

Table 1. Validity test result

No	Variable	r Count	R Table 5%	Information
	Use of PPE			
1.	X1.1	0.955	0.2787	VALID
2.	X1.2	0.959		
3.	X1.3	0.950		
4.	X1.4	0.910		
5.	X1.5	0.916		
	Regulations and Procedures			
6.	K3	0.748	0.2787	VALID
7.	X2.1	0.777		
8.	X2.2	0.782		
9.	X2.3	0.664		
10.	X2.4	0.602		
11.	X2.5	0.506		
12.	X2.6	0.508		
	X2.7			
	Working Environmnt			
13	X3.1	0.569	0.2787	VALID
14.	X3.2	0.672		
15.	X3.3	0.800		
16.	X3.4	0.835		
17.	X3.5	0.724		
18.	X3.6	0.690		
19.	X3.7	0.591		
	Regulatory Compliance			
20.	X4.1	0.725	0.2787	VALID
21.	X4.2	0.717		
22.	X4.3	0.555		
23.	X4.4	0.642		
24.	X4.5	0.498		
25.	X4.6	0.774		

Source : researcher analysis results, 2021

Measurement of reliability can be done by means of the Cronbach statistic test Alpha (α) with Cronbach alpha coefficient value > 0.60 then the variable can be said to be reliable

Table 2. Reliability test result

No	Variable	Cronabach Alpha Value	Information
1.	Use of Personal Protective Equipment	0.965 > 0.6	Reliability
2.	K3 Regulations and Procedures	0.762 > 0.6	Reliability
3.	Work Environment	0.819 > 0.6	Reliability
4.	Regulatory Compliance	0.711 > 0.6	Reliability

Source: results of the 2021 researcher analysis

Cross tabulation test or crosstab to analyze in tabular form which displays cross tabulation to identify and know. Is there a correlation or relationship between one variable and another variable? other. Where here will test about the level of education and work experience.

Table 3. The relationship of education to safety behavior

No	Study	Safety Behavior		Total
		≤ 30 Years	≥ 30 Years	
1.	Elementary School	2.88	3.7	6.58
2.	Junior High School	2.5	3.41	5.91
3.	Senior High School	3.12	2.9	6.02

Source: results of the 2021 researcher analysis

Table 4. The relationship of work experience to safety behavior

No	Work Experience	Safety Behavior		Average Total
		≤ 30 Years	≥ 30 Years	
1.	< 1 Years	3	3.2	6.5
2.	> 1 Years	3	3.5	7.1

Source: results of the 2021 researcher analysis

Normality test is a test carried out with the aim of assessing the distribution of data in a group of variables whether the data is normally distributed or not.

Table 5. Normality test results

No	Variable	asymp value. Sig (2-tailed)	Information
1.	Use of Personal Protective Equipment	0.326 > 0.05	Normal
2.	K3 Regulations and Procedures	0.519 > 0.05	Normal
3.	Work Environment	0.105 > 0.05	Normal
4.	Regulatory Compliance	0.112 > 0.05	Normal

Source: results of the 2021 researcher analysis

The F statistical test is used to determine the magnitude of the difference between several variants, whether the variance is homogeneous or not. By formula as follows :

Fbf = $\frac{sy^2}{sx^2}$ Information: F bf = Homogeneity Test, Sx = Age under 30 years, Sy = Age above 30 years old

Table 6. Test Results F (Homogeneity)

No	Variable	Box's M	Sig	Information
1.	Occupational Safety Behavior	6.519	0.198 > 0.05	Homogen

Source: results of the 2021 researcher analysis

The Z test is used to determine the significance level of the mean difference the mean of the two groups of an analysis is significant or not. Z test it uses the following formula:

Ztest = $\frac{\bar{x}1-\bar{x}2}{S\,\bar{x}1-\bar{x}2}$ $\qquad S\bar{x}1-\bar{x}2 = \sqrt{\frac{s1}{n1}+\frac{s2}{n2}}$

This Z test is intended to find out if there are differences in worker behavior based on the age factor, the results of the influence can be seen from the result z count > z table or z count < z table. For table z values in get -1.6772 with a significance level of 0.05.

Table 7. Test Result Z

No	Variable	Z Count	Sig Value	Z Table	Information
1.	Occupational Safety Behavior	-5.127	0.05	-1.6772	Different

Source: results of the 2021 researcher analysis

4. Conclusion

a. After doing research, distributing questionnaires and analyzing the results, so the following conclusions can be drawn: There is a very, very important influence on safety behavior work based on age with a value of z count : - 5, 127 < z table : - 1, 6772.
b. There is a link between work experience and safety behavior with P value : i0, 000 < 0.05

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