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Analysis of Accident-Prone Areas in North Jakarta (Case: Cakung – Cilincing Road)

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Abstract
Transportation is an important part of human life, which has the benefit of facilitating the movement of people and the transportation of goods. This study aims to determine and analyze the locations where accidents often occur along the Cakung - Cilincing road, North Jakarta and determine what factors cause accidents along this road. The research on the analysis of accident-prone areas used the observation method with the quantity data provided by the North Jakarta Police Traffic Unit through IRSMS data, and the survey method was carried out on roads with the recording of passing vehicles, followed by calculations according to MKJI 1997. The results of the study were the location coordinates of the locations that had the highest value Accident-prone, namely segment 3 at the coordinate point -6.140891 to -6.13712 with an AEK value of 80 which causes 6 deaths, 0 serious injuries, 1 minor injury, 5 objects losses, and Rp.13,200,000 material loss. The number of accidents at the coordinate point was 5 incidents. The value of material losses from accidents on Jalan Cakung Cilincing reached Rp. 92,900,000 for the last 4 years from 2016 - 2019. And research on road segment performance obtained LOS A with DS 0.06 in the morning, 0.06 in the afternoon, and 0, 07 in the afternoon.

Keywords
North Jakarta, Road Performance, Roads, Traffic Accidents, Transportation.

1. Introduction
A traffic accident is an event on the road which is unexpected and accidents involving a vehicle with or without other road users resulting in human casualties and/or property loss. (Undang-Undang Republik Indonesia Nomor 22 Tentang Angkutan Jalan Lalu Lintas, 2009). According to Ms Laura Sminkey (2018), from WHO.int reports from 180 countries, showing that worldwide the total number of road traffic fatalities has reached 1.25 million per year, with the highest road traffic death rates in low-income countries. According to Putra (2019) Traffic accidents are events that are difficult to predict when and where they occur. Accidents not only cause trauma, injury, or disability but can also result in death. Accidents are difficult to minimize and tend to increase with the increasing length of roads and the number of movements of the vehicle.

The National Police of the Republic of Indonesia noted that the number of traffic accidents in 2019 increased compared to 2018. Throughout 2019 the number of traffic accidents in Indonesia increased by 3%, but the number of victims who died decreased by 6% compared to 2018 (Ramadhan 2019).

In the North Jakarta area, the number of motor vehicle accidents in 2019 has increased quite drastically. Due to the large roads that usually have heavy vehicles moving along with motorbike and minibus users. Lack of attention from road users, especially motorbikes, to avoid blind spots. A Blind Spot is a condition when we cannot see objects around us. Various possibilities can occur including the danger of traffic accidents.

In an area, sometimes accident data is not recorded completely, due to the limited data they have, therefore a method is needed that can detect which areas are prone to accidents. So the authors researched and made this study to know the number of traffic accidents per kilometer using the UCL (Upper Control Limit) method, on Jalan Cakung Cilincing Raya, North Jakarta City.

2. Methodology
2.1. General Description
In this study, the following will explain and discuss research methods regarding how to survey and how to process the data to be used. The purpose of the survey was to obtain data which was then processed and know the characteristics of which locations were prone to traffic accidents on Cakung-Cilincing Road, North Jakarta. The following research locations are shown in Figure 1. Exactly located on Cakung Cilincing Road, North Jakarta City, DKI Jakarta.

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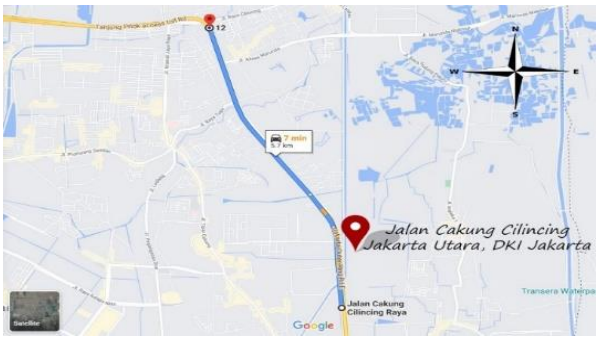


Figure 1. research location map

2.2. Data Retrieval

This accident data is secondary data obtained from the North Jakarta Police Traffic Unit, precisely from the IRSMS data, it is an accident data recording application developed by the POLRI that should be used as the basis for decision making and campaigning for road safety activities. Meanwhile, the data for the analysis of the performance of roads are taken directly by conducting a location survey as primary data followed by calculations according to the Indonesian Highway Capacity Manual (1997). The data required in the analysis of accident-prone areas and road performance analysis includes secondary data and primary data.

Secondary data includes:

a. Victim fatality data
b. Number of accident victims
c. Type of accident
d. Accident coordinates
e. Street name
f. The total value of material losses

Meanwhile, primary data includes:

a. The volume of vehicles passing Cakung Cilincing Road, North Jakarta
b. The side barriers that were around it
c. Geometric path

The tools used to retrieve primary data are:

a. Speed Gun is a tool used to measure the length of the road
b. Survey form to record the number of vehicles passing and what conflicts have occurred at the site
c. Counter is used to count the number of vehicles entering the road

2.3. Application of Methods

The data that has been obtained is then recapitulated according to the method used. Here the authors use the AEK method (Accident Equivalent Number) to calculate the analysis of accident-prone areas in North Jakarta. The method used also uses the observation method where the quantity data is taken from the authorized party, namely the North Jakarta Police Traffic Unit, which is then processed according to the Traffic Accident Data Collection Manual. As for the road performance data obtained using a survey method, namely the method of recording the number of vehicles passing Cakung Cilincing Road, North Jakarta, and followed by calculations according to the Indonesian Highway Capacity Manual (1997).

The sequence of data application for the analysis of accident-prone areas:

a. Know the fatality data for accident victims
b. Count the number of victims and losses
c. Categorizes the type of accident
d. Recapitulation which segments and coordinates of the accident occurred
e. Classify the accident segments that have been recapitulated
f. Calculating the segments that have been arranged using the AEK method
g. Making survey results of the completeness of safety indicators on the highway
h. Make a diagram of the results of AEK calculations

The sequence of data application for road performance:

a. Calculating the volume table for Cakung Cilincing Road, North Jakarta
b. Calculates the side barriers factor table
c. Calculates the adjustment factor variable table
d. Calculating the degree of saturation to find out LOS

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3. Result and Analysis

3.1. Analysis of Accident-Prone Areas

The data that has been obtained is formed into victim fatality data which can be seen in table 1

Table 1. Victim Fatality Data

The Date of Incident	Accident Rate	Victim			Number Of Victims	Material Loss
		MD	LB	LR		
13/02/2016 08:00:00	1	1	0	0	1	100,000.00
06/06/2016 07:00:00	1	1	0	0	1	100,000.00
21/06/2016 20:00:00	1	1	0	0	1	1,000,000.00
28/06/2016 10:00:00	1	2	0	2	4	200,000.00
23/08/2016 12:00:00	1	1	0	1	2	1,000,000.00
23/08/2016 15:00:00	1	1	0	0	1	-
05/09/2016 07:30:00	1	1	0	1	2	150,000.00
27/09/2016 16:30:00	1	2	0	0	2	2,000,000.00
28/09/2016 15:45:00	1	1	0	0	1	2,000,000.00
07/10/2016 16:40:00	1	1	0	0	1	200,000.00
05/11/2016 11:00:00	1	1	0	0	1	500,000.00
16/11/2016 06:00:00	1	1	0	0	1	50,000.00
28/12/2016 04:00:00	1	1	0	0	1	2,000,000.00
30/12/2016 09:30:00	1	1	0	0	1	2,000,000.00
08/02/2017 21:00:00	1	1	0	1	2	500,000.00
07/04/2017 04:30:00	1	1	0	0	1	-
08/04/2017 12:30:00	1	1	0	1	2	200,000.00
08/04/2017 19:30:00	1	1	0	0	1	3,000,000.00
18/04/2017 21:00:00	1	1	0	0	1	-
28/05/2017 16:45:00	1	1	0	0	1	1,000,000.00
03/09/2017 15:30:00	1	1	0	0	1	200,000.00
15/09/2017 13:30:00	1	1	0	0	1	200,000.00
22/09/2017 14:30:00	1	1	0	0	1	-
22/12/2017 16:45:00	1	1	0	0	1	500,000.00
09/02/2018 0:30:00	1	1	0	0	1	-
05/03/2018 14:30:00	1	1	0	1	2	500,000.00
26/04/2018 15:15:00	1	1	0	0	1	10,000,000.00
30/04/2018 17:30:00	1	1	0	0	1	1,000,000.00
01/06/2018 22:00:00	1	1	0	0	1	1,000,000.00
01/07/2018 22:30:00	1	1	0	0	1	300,000.00
14/07/2018 15:30:00	1	1	0	0	1	200,000.00
26/07/2018 19:00:00	1	1	0	0	1	100,000.00
03/08/2018 06:00:00	1	1	0	0	1	500,000.00
17/12/2018 23:30:00	1	1	0	0	1	-
17/03/2019 18:30:00	1	1	0	0	1	500,000.00
21/03/2019 02:00:00	1	1	0	0	1	500,000.00
23/03/2019 22:30:00	1	1	0	0	1	500,000.00

From the data above, 37 cases of accidents resulted in the death of the victim. Furthermore, accident data contains the types of accidents that occurred on Cakung Cilincing road from 2016 to 2019, which consists of six conflicts which can be seen in table 2.

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Table 2. Accident Type Data

No	Accident Type	Year				Total
		2016	2017	2018	2019	
1	Single	0	1	1	2	4
2	Front - Front	1	0	0	0	1
3	Front – Rear	9	5	6	1	21
4	Front - Side	1	0	0	0	1
5	Side - Side	0	1	1	0	2
6	Human Crashes	2	3	2	0	7

Based on the table above, the types of accidents that focus on the victims who died often occur in Cakung Cilincing road, North Jakarta. Namely the front-rear collision in 21 incidents and human crashes in 6 cases. After the accident type data, there is data on the number of victims who died and accident losses which can be seen in table 3.

Table 3. Data On The Number Of Victims And Losses

Year	Victim of MD	Number of Victims	Material Loss (Rp)
2016	16	16	11,300,000.00
2017	10	10	5,600,000.00
2018	10	10	13,600,000.00
2019	3	3	1,500,000.00
Total	39	39	32,000,000.00

In table 3 which focuses on the victims who died had material losses of Rp. 32,000,000.00 and the number of victims who died was 39 people. After that, there is data on the distribution of the coordinate segment. This data contains the coordinate segments on Jalan Cakung Cilincing, North Jakarta, stretching from the coordinate point -6.156.184 to -6.109.051 which is 5.7 km. Furthermore, the calculation of each segment uses the AEK method which has the following formula:

AEK = 12MD + 3LB + 3LR + 1K

Information:

a. MD : Pass Away
b. LB : Serious Injury
c. LR : Minor injuries
d. K : loss

After all segments are calculated, a table of the results of the AEK calculation is made which can be seen in table 4.

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Table 4. AEK Method Calculation Result Data

No	Segment		Highway Length (KM)	Victim				Material Loss (Rp)	AEK Value
	Early	End		MD	LB	LR	Object		
1	-6.156184	-6.145288	1,7	4	0	0	4	3,600,000.00	52
2	-6.145288	-6.140891	0,5	2	0	1	2	1,000,000.00	29
3	-6.140891	-6.137122	0,5	6	0	1	5	13,200,000.00	80
4	-6.137122	-6.133453	0,5	3	0	0	2	2,000,000.00	38
5	-6.133453	-6.129788	0,5	3	0	1	3	1,500,000.00	42
6	-6.129788	-6.126103	0,5	2	0	0	2	1,000,000.00	26
7	-6.126103	-6.122125	0,5	5	0	1	4	1,700,000.00	67
8	-6.122125	-6.117777	0,5	4	0	0	4	5,300,000.00	52
9	-6.117777	-6.113423	0,5	6	0	0	2	300,000.00	74
10	-6.113423	-6.109051	0,5	3	0	3	3	2,400,000.00	48

Based on table 4 above, there are 10 segments and it is found that accidents on Cakung Cilincing road, North Jakarta often occur at the coordinate points -6.117777 to -6.113423 with a total of 6 accidents and a total of 6 victims died. Followed by the coordinates of -6.140891 to -6.13712 with a total of 6 people who died and at this coordinate point, it becomes the point with the greatest total material loss from other coordinate points, reaching Rp. 13,200,000.00.. The following is a diagram of the results of calculations using the AEK method which can be seen in Figure 2.

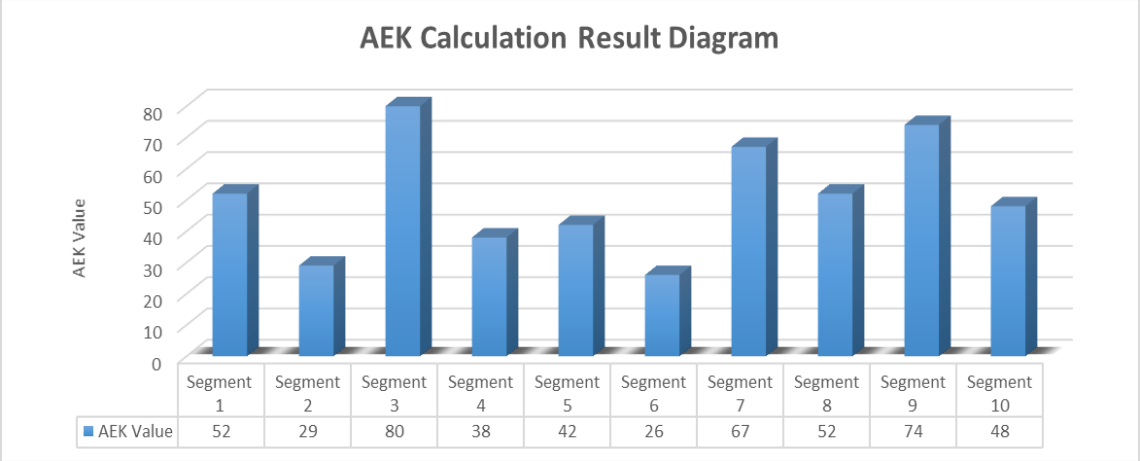


Figure 2. AEK Calculation Result Diagram

From table 4 or Figure 2 it can be concluded that segment 3 is an accident-prone area on Jalan Cakung Cilincing, North Jakarta, which has the highest AEK value among other segments, namely 80 with material losses reaching Rp. 13,200,000. So it is necessary to give special handling to suppress and minimize the occurrence of accidents in the area. After that make a table of safety indicators which can be seen in tables 5 and 6.

Table 5. Survey Data for Cakung Cilincing Road Safety Indicators, North Jakarta
Coordinates point -6.140891 to -6.13712

No	Safety Indicator	Completeness		information
		Y	N	
1	Road signs		√	There are no road signs in some areas and are blocked by several trees
2	Road markings		√	In this segment, there are no road markings and some markers that have lost their paint
3	Safety Fence / Sidewalk	√		There are sidewalks but not painted and dirty

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4	Road Damage		√	There are many roads with holes and cracks
5	Street Lighting	√		Some of the lights were on and some were dim

Table 6. Survey Data for Road Safety Indicators Cakung Cilincing, North Jakarta Coordinates point -6.117777 to -6.113423

No	Safety Indicator	Completeness		Information
		Y	N	
1	Road signs		√	The absence of warning signs and road signs
2	Road markings		√	There are no road markings
3	Safety Fence / Sidewalk	√		There are sidewalks but not painted and dirty
4	Road Damage		√	There are some concrete roads that are cracked and bumpy
5	Street Lighting		√	The lights were dim and some were not on

Based on the primary data table above, the coordinate points of -6.117777 to -6.113423 have the lowest weight for adequate facilities and have the potential to have a higher accident rate compared to segments -6.140891 to -6.13712 which relatively have a decent safety weight, although several things need to be fixed. And after conducting an in-person review several factors triggered accidents on Cakung Cilincing road.

1) Cakung Cilincing road, North Jakarta, is a national road that connects the city of East Jakarta with the city of North Jakarta so that it has an impact and creates a high level of mobility. Most of those passing through this road are heavy and large vehicles heading towards Tanjung Priok and industrial areas in the city of North Jakarta which is one of the cities in Indonesia that has the largest industrial and container areas, due to the presence of a port and container warehouse in the North Jakarta area. Therefore, many heavy vehicles are passing by in this area, around the Cakung Cilincing road there are no sufficient road markings or traffic signs and the lighting is minimal because the number of lights that go out in this area causes an accident rate between motorists and light vehicles. with heavy vehicles getting high on this track. This path is also known as the skull path because motorists or drivers on this route must always meet heavy vehicles who do not know where the actual route is. Here the author can see that the lack of road markings, street lighting, and traffic signs as well as the road conditions that are potholes and bumpy causes the accident rate on this route to be very high and dangerous.
2) In this lane, there are also several intersections, although most intersections have signaled there are still intersections that do not have a signal, and there are also factories where the exit or entry of heavy vehicles is not too much attention, such as sign lights for the entry or exit of heavy vehicles. This causes the Cakung Cilincing route to be very prone to accidents. Starting from heavy vehicles that go fast without speed limiting signs to roads with holes and cracks, the North Jakarta city government must pay attention to this route.

The North Jakarta Police Traffic Unit is aware that the Cakung Cilincing route is very prone to accidents. In a meeting between the author and one of the members of the North Jakarta Police Traffic Unit to discuss this route, the government and the police are working together to make a policy for the hours heavy vehicles pass at a certain time but this makes heavy vehicles pile up wishing to cross this route turning around looking for a route alternative. Therefore, the policy of enforcing certain hours is still insufficient to make drivers in this lane feel safe.

3.2. Road Section Performance

Geometric condition and facility data such as the following data :

1) Road width = 12 m
2) Side lane width = 4 m
3) Road type = 3 lanes / 1 direction
4) Road shoulder = existing
5) Drainage = existing
6) Road marking = no there is
7) Traffic signs = no there is

The data that has been obtained through the road survey under study is made into a vehicle volume table which can be seen in Table 7 as follows.

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Table 7. Vehicle volume

Cakung Cilincing Road North Jakarta									
Time	Hour	Vehicle			Total	Emp LV	HV	MC	Total
		LV	HV	MC	veh/hour	1	1.2	0.25	Pcu/Hour
Morning	08.00 - 08.15	25	25	68	118	25	30	17	72
	08.15 - 08.30	32	20	57	109	32	24	14.25	70.25
	08.30 - 08.45	40	34	46	120	40	40.8	11.5	92.3
	08.45 - 09.00	38	15	60	113	38	18	15	71
	Total	135	94	231	460	135	112.8	57.75	305.55
Afternoon	12.00 - 12.15	30	25	52	107	30	30	13	73
	12.15 - 12.30	35	27	42	104	35	32.4	10.5	77.9
	12.30 - 12.45	42	26	47	115	42	31.2	11.75	84.95
	12.45 - 13.00	56	15	48	119	56	18	12	86
	Total	163	93	189	445	163	111.6	47.25	321.85
Evening	17.00 - 17.15	44	22	65	131	44	26.4	11	81.4
	17.15 - 17.30	51	24	57	132	51	28.8	14.25	94.05
	17.30 - 17.45	48	19	59	126	48	22.8	14.75	85.55
	17.45 - 18.00	59	25	45	129	59	30	11.25	100.25
	Total	202	90	226	518	202	108	51.25	361.25

Side friction data is known from direct field surveys by observing the types of side friction events along the 200-meter road segment in the vicinity. Can be seen in table 8.

Table 8. Side Barriers

Cakung Cilincing Road, North Jakarta											
No	Type Side Obtacle	Pedestrian		Parking Stop Vehicle		Entry Exit Vehicle		Slow Vehicle		Total	Side Obtacle Class
	Time	PED Frek. Km/hour	0.5 Frek. Weight	PSV Frek. Km/hour	1 Frek. Weight	EEV Frek. Km/hour	0.7 Frek. Weight	SMV Frek. Km/hour	0.4 Frek. Weight	Frequency Weight	
1	Morning	36	18	78	78	190	133	202	80.8	309.8	M
2	Afternoon	19	9.5	116	116	142	99.4	199	79.6	304.5	M
3	Evening	23	11.5	129	129	207	144.9	123	49.2	334.6	M

.

After calculating the side resistance, the free flow velocity is calculated. Based on Indonesian Highway Capacity Manual (1997), The free-flow speed of a vehicle has the following equation:

FV = (FV_0+ FV_W) x FFV_{SF} x FFV_{CS}

FV_0 is the basic free flow velocity of a light vehicle (Km/Hour). for average speed the results are 57. FV_W is a type of Cakung Cilincing road, North Jakarta, which is 3 lanes 1 way with a lane width of 4 meters, based on Indonesian Highway Capacity Manual (1997), the free flow speed adjustment factor for a traffic lane width of 4 meters is 4 Km/Hour. FFV_{SF} is the free current resistance speed adjustment factor for the side resistance. The value of the side friction adjustment for the 3-lane 1-way road type with the category of kereb width is 1.5 m, then the value is 0,92. FFV_{CS} ber Based on the total population in the city of North Jakarta ± 2,349,351 million people according to the BPS City of North Jakarta in 2020 and the value of the factor based on the Indonesian Highway Capacity Manual (1997) is 1,00. From this data, the following free flow velocity calculations are obtained:

FV = (57 + 4) x 0,92 x 1,00

FV = 56,12 Km/Hour

After calculating the speed of free flow, a capacity table for Jalan Cakung Cilincing is made which can be seen in table 9.

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Table 9. Capacity of Cakung Cilincing Road

Variable	Cakung Cilincing Road Adjusment Factor	
C0	Divided Road (3 Lines) / 1 Way	4950
FCw	Wc = 12 m	1.08
FCsp	1 Way Street	1
FCsf	Medium Side Barriers, Width Between Kereb and Barriers on Sidewalks 1.5m	0.91
FCcs	Bekasi City residents = 2.349.351 person	1
C	Pcu/hour	4864.86

Then calculate LOS which can be seen in table 10.

Table 10. Level Of Service

Time	Q Pcu/Hour	C Pcu/Hour	Q / C Pcu/Hour	LOS
Morning	305.55	4864.86	0.06281	A
Afternoon	321.85	4864.86	0.06616	A
Evening	361.25	4864.86	0.07426	A

Based on table 10. Level of service on Wednesday 11 November 2020 it is known that in the morning, afternoon and evening it has a service level of A, which means that in high-speed free-flow conditions, the driver can choose the desired speed without a hitch.

4. Conclussion

Based on the results of the survey and analysis of accident data on the Cakung Cilincing road, North Jakarta, it can be concluded as follows:

1) In 2016 - 2019 the authors concluded that the 10 greatest value points were at coordinates -6.140891 to -6.13712 with an AEK value of 80. At these coordinates 6 people died, 0 serious injuries, 1 minor injury, loss of objects as much as 5, and material losses reaching Rp. 13,200,000.00
2) The types of accidents in the 4 years that caused the death toll were: front-back accidents reached 21 times, human crashes reached 7 times, single crashes reached 7 incidents, side - side crashes reached 2 times and front - crashes - front with front-side crash achieves 1 time.
3) The triggering factors for accidents include Lack of traffic signs, absence of road markings, lack of lighting, potholes and damaged roads, lack of appeals such as banners regarding the importance of traffic safety, insecure facilities for road users/pedestrians.
4) According to the survey results on Wednesday 11 November 2020, the performance of roads in the morning, afternoon and evening have service level A.

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Biography / Biographies

Widodo Budi Dermawan., Born at 2 Juli 1970. Universitas Katolik Parahyangan 1994, Refueling System in Soekarno Hatta Airport, MSCE, 1996 University of Wisconsin at Madison. A path-based multi-class dynamic traffic assignment model, research interest road safety, accident prediction model, intelligent transportation system, mengajar di UMB ; Transportation Engineering, Geometric Design

Muhamad Yuan Kelvin Fuadi.,Born in Sukabumi on August 12, 1999. He pursued his undergraduate degree in Civil Engineering Study Program at Mercu Buana University. He was a lecturer assistant in a pavement design

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course for 2 semesters and was a committee member in a Civil Engineering seminar. Now he is continuing his studies at Mercubuana University until he holds a bachelor's degree.

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Amar Mufhidin., He was born in Majalengka on 16 June 1991. He is lecturer of some program study : pavement planning, road geometric planning, and transportation planning. He earned his Bachelor Degree in civil engineer from Indonesian University of Education, and he earned his Master Degree in Civil Enginer with concentration in transportation from Bandung Institute of Technology. He has expertise certificate of road pavement from Lembaga Pengatur Jasa Konstuksi. And he is still active in road planning project in Indonesia.

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Response Analysis Of The Lower Structure Of Girder Bridge With Lead Rubber Bearing (LRB) And High Damping Rubber Bearing (HDRB) Due To Earthquake Excitation

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Abstract

Seismic isolation is a system to reduce seismic energy acting on the bridge by adding an object so-called base insulator. The purpose of this study is to obtain a comparison of dimension, damping ratio, and the lower structure response designed as a ductile component with High Damping Rubber Bearings (HDRB) and Lead Rubber Bearings (LRB). This study uses CSI BRIDGE 21 computer program. Earthquake forces analysis uses dynamic analysis with response spectra as final evaluation for the performance of lead rubber bearing and high damping rubber bearings and the load characteristics for bridges is following SNI 1725: 2016 and bridge design for earthquake load is following SNI 2833: 2016. The bridge performance is expected to no longer rely merely on the dimensions and stiffness of the pillars in response to earthquake loads, but also on LRB or HDRB as a structural device on bridge support by increasing the effectiveness of pillar stiffness in providing damping energy during an earthquake.

Keywords
base insulator, high damping rubber bearing, lead rubber bearing, Seismic isolation

1. Introduction

A bridge is an essential infrastructure that serves to connect two segments of road separated by obstacles, such as valley, river, ravine, irrigation and drainage channel, railroad, reservoir, and others to facilitate land transportation.

A natural disaster, like earthquakes, is one of the factors that can damage building structures. Indonesia is very prone to earthquakes due to its position on the encounter of the world's three main plates: Eurasia, Indo Australia, and Pacific. In early August 2018, an earthquake with magnitudes of 7 occurred in Lombok, West Nusa Tenggara. It proves that Indonesia has high potential and risk of earthquakes. This natural event caused a lot of damage to infrastructures, as happened to Tampes Bridge in Lombok that connects Bayan with Kayangan District, Lokok Duren Bridge that connects Kayangan and Gangga District, and LUK Bridge in Gangga District. Bridges generally get damaged in lower structures.

So far, building structural design is conventional as passive structures that only rely on stiffness and strength to bear gravity and earthquake loads. Therefore, structural performance are commonly judged by the stiffness and strength of the structure, and if it continues happen, the problem in near future is that high material demands will increase to produce a very stiff structure and eventually the construction cost will be more expensive. Technological development has created a lot of innovations that have brought positive changes in the construction world.

In recent years, base isolation has developed as a technology to design buildings and bridges in highly prone earthquake zones. The idea of base Isolation is to eliminate destruction and damage to buildings or bridges during an earthquake (Widodo *et al.*, 2003)

Based on SNI 2833-2016 regarding earthquake resistance design codes for bridges, for force-based design, where the structure is made to behave flexure to earthquake loads and the structure is allowable to get damaged in large earthquakes but not allowable to reach failure, is by determining the structural component points with the plastic hinges meet the detailing requirements in the regulations and also outside the plastic hinge to bear shear capacity. Based on the bridge structure characteristics, construction engineers can use one of three options for an earthquake design strategy, as follows:

Type 1: ductile lower structures with elastic upper structures.

Tipe 2: elastic lower structures with ductile upper structures.

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Tipe 3: elastic upper structure and lower structure with fusion mechanism on the surface between the upper and lower structures.

Base insulator types include High Damping Rubber Bearing (HDRB) and Lead Rubber Bearing (LRB). One of the bridges in Indonesia that uses Lead Rubber Bearing (LRB) is Kali Kenteng Bridge in Semarang-Solo Highway project. The bridge uses 2 LRB rows at the bottom of each girder with the system changed to a simple beam by a linked slab (Wahyuningsih Tri Hermani, 2019)

This thesis will analyze the comparison of Lead Rubber Bearing (LRB) and High Damping Rubber Bearing (HDRB) on Coal Hauling Road Bridge in Belayan River, Tabang, Kutai Kartanegara - East Kalimantan related to earthquake loads.

2. Methodology

The research method is an analytical method for the bridge structure modeling with base isolation referred to applicable regulations, like Indonesian National Standard (SNI).

This research method uses a case study analysis. Primary data collection in the form of site condition was conducted with a direct field survey by the team to the construction site and the survey results were compiled in a report. Secondary data in the form of topographic, vehicle types, and allowable loads are obtained from the project owner's archives.

The data that has been collected is then processed as material for a bridge design study, the process is pre-designed with modeling and after that a structural analysis is carried out. The results of the analysis will bereported as a form of conclusions in the study.

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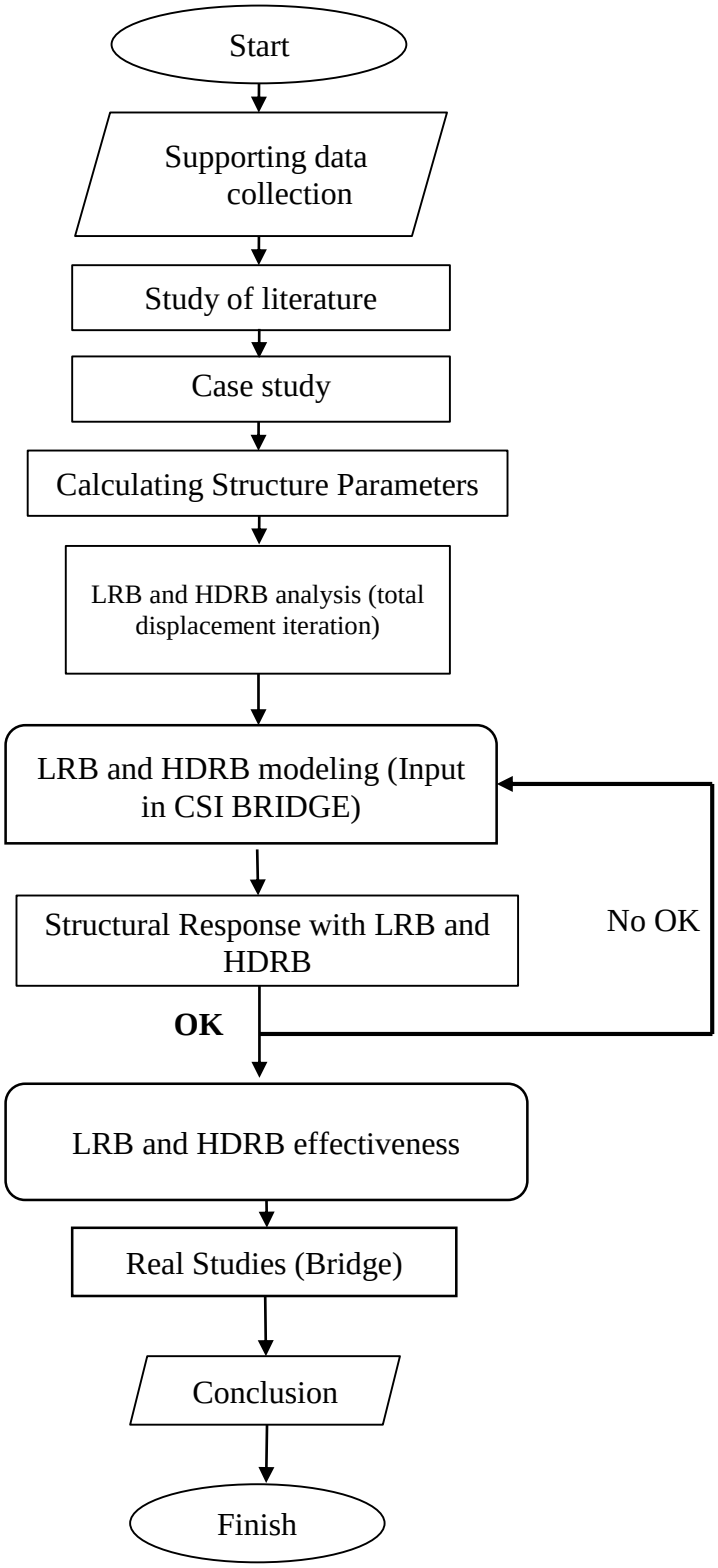


Figure 1 Research Flowchart (Flowchart)
Source: Research Data

Collection of supporting data such as:

a. Bridge profile data for building structures under the Kutai Kartanegara bridge
b. Design dimension data for Lead Rubber Bearing (LRB) and High Damping Rubber Bearing (HDRB)

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c. Relevant regulations according to SNI
d. Related books.

From this literature study, design criteria will be obtained which will be used in data processing.
Bridge Plans:

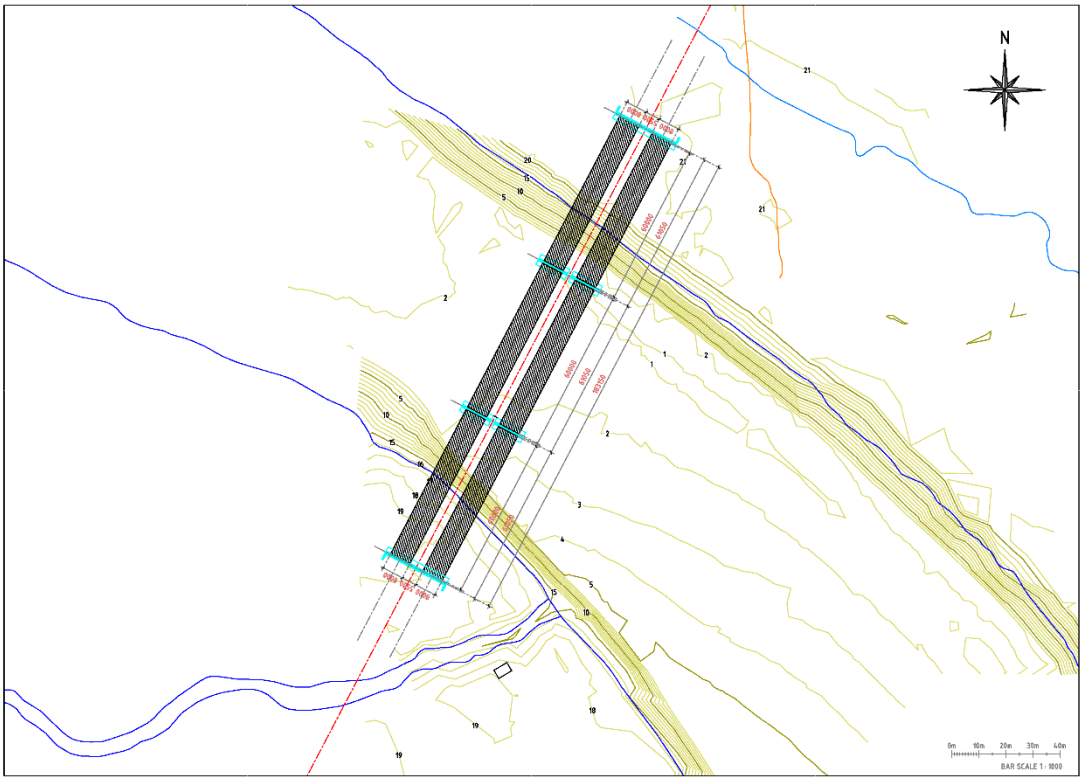


Figure 2. Bridge Plan Layout
Source: (Author's work)

This bridge has 2 spans with a continuous support with the structural model data as follows

Table 1. Data Model Structure

NO	Description Descriptio	Mod
1	Length of Span (L)	60 m
2	Pier height (H) m	8 m
3	Dim. Pierhead (b,h)	3 m x 1.7 m
4	Dim. Diafragma (w,t)	0.2 m x 0.015 m

The structure is a continuous span bridge whose length is 60m. A bridge that has 2 (two) pillars with a height (Hpier) = 8 meters. The bridge with a total concrete deck width of 8.5m, has 2 lanes with 3.5m width each and is equipped with 0.5m wide pedestrian access on both sides.

Is known:

1. Steel Grade SM 490 untuk U Girder (Fy = 345 Mpa)
2. Modulus of Elasticity (E_{beam}) : 4700*$\sqrt{Fc}$ = 4700 $\sqrt{30}$ = 25700000
3. Concrete Quality K350 untuk Pier, Deck : Fc' = 30 Mpa
4. Modulus of Elasticity (E_{pier}) : 4700*$\sqrt{Fc}$ = 4700 $\sqrt{30}$ = 25700000

3. Result and Analysis

The model in this study is an initial design of a bridge structure with a span length and pier height which will later represent the actual model of the bridge structure. In this stage, the model is given a load in accordance with the provisions in SNI 2833/2016 and SNI 1725 2016. This bridge is assumed to be an important bridge and is in a strong earthquake area so that the structural design must provide sufficient dissipation energy so that the bridge structure can still be used after the earthquake ends. . Bridge modeling, in this stage modeling is carried out with the help of the CSi Bridge 21 program.

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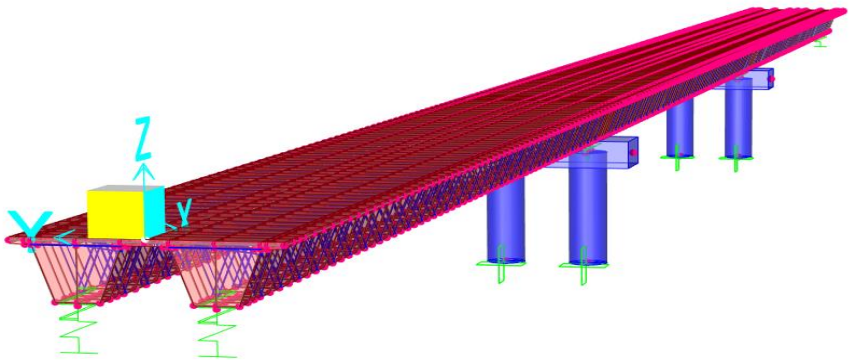
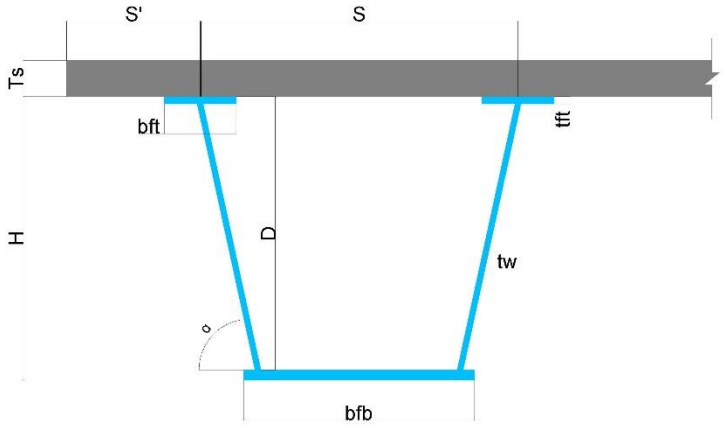


Figure 3. 3D Bridge Design

In the modeling of the girder structure it is modeled with U Shape Girder precast concrete With cross-sectional proportions:



Cross Proportion:

Figure 4. Cross-section of U girder

H = 2200mm	α = 71°
D = 2150mm	tf_t = 25mm
S = 2800mm	tw = 20mm
bf_t = 400mm	tf_b = 25mm

For strain and stress parameters modeling reinforcing steel for the purposes of curvature moment analysis refers to CALTRANS.

Table 2. Mechanical Properties of Steel

Property	Reinforcement Size	Parameter Grade 420	Parameter Grade 550
Minimum yield stress specification, f y	D10 s/d D50	420 MPa	550 MPa
Tensile stress, fu	D10 s/d D50	550 MPa	675 MPa

From the input of earthquake response spectrum data in Padang city with soft soil conditions using Csi Bridge 21 software. As shown in Figure 5 is a spectrum response spectrum in Padang city.

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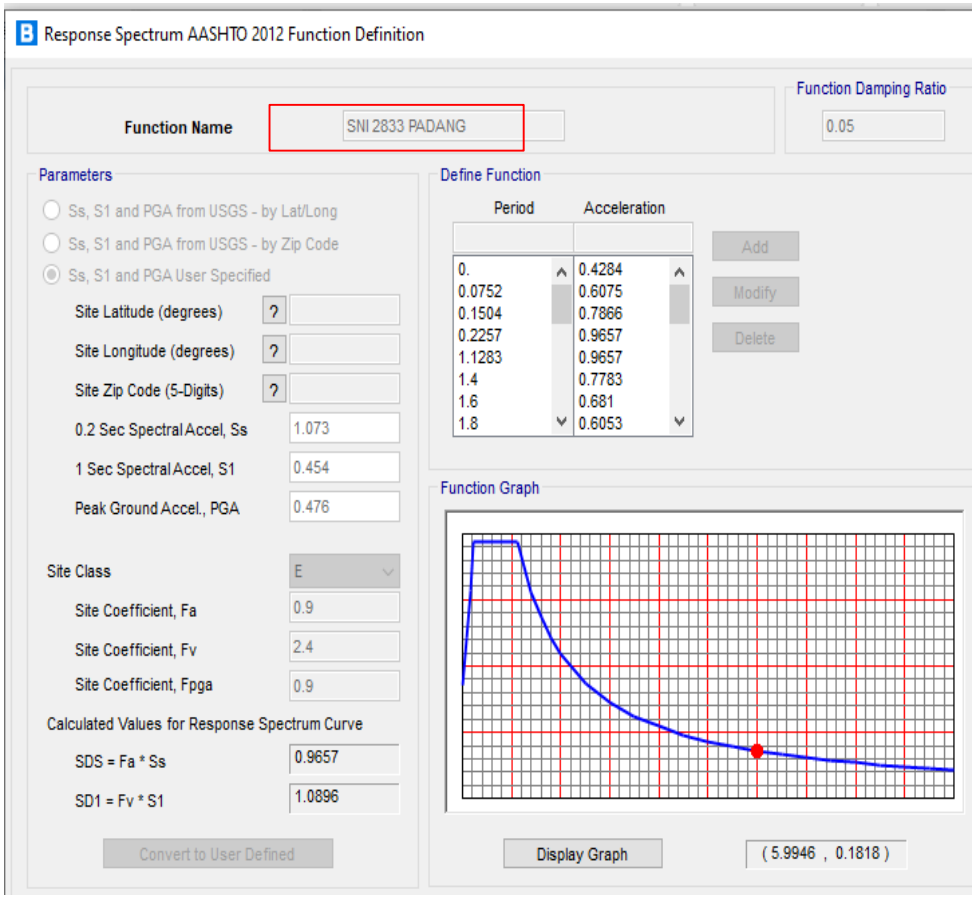
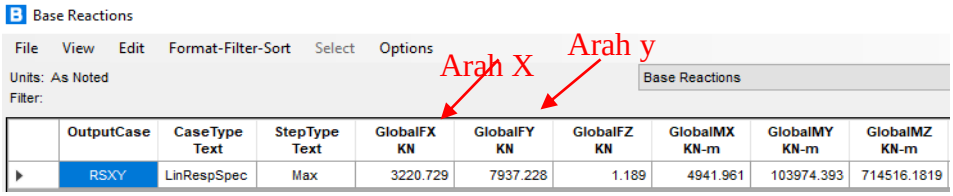


Figure 5. Response Spectra for the Padang city earthquake

Earthquake Base Shear Force

From the CSi Bridge output results, the base reaction due to the nominal earthquake is obtained, namely for the X or longitudinal direction of 3220,729 kN and the Y or transverse direction of 7937,228 kN as shown in Figure 6 for the X and Y directions.



	OutputCase	CaseType Text	StepType Text	GlobalFX KN	GlobalFY KN	GlobalFZ KN	GlobalMX KN-m	GlobalMY KN-m	GlobalMZ KN-m
▶	RSXY	LinRespSpec	Max	3220.729	7937.228	1.189	4941.961	103974.393	714516.1819

Figure 6. Output of Base Shear Force Due to Earthquake Load

In the loading analysis on the bridge structure model, a combination of loading with a factor scale is applied so that it can analyze in ultimate conditions or service conditions, as for the combination of loading The load combination used is based on SNI 1725: 2016 article 6.1. Table 3 shows the load combinations used are as follows

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Table 3. Combinations of Loads Used

Boundary Conditions	MS, MA	PL	EW_s	EU_n	EQ
KUAT I	γ_p	1.8	-	0.5/1.2	-
KUAT II	γ_p	1.4	-	0.5/1.2	-
EKSTRIM I	1.0	γ_{EQ}	-	-	1.0
LAYAN I	1.0	1.0	0.588	1.0/1.2	-
LAYAN II	1.0	1.3	-	1.0/1.2	-
LAYAN III	1.0	0.8	-	1.0/1.2	-
LAYAN IV	1.0	-	1.372	1.0/1.2	-

In CSi Bridge modeling, LRB is modeled in the form of general links at the upper and lower building structure placement boundaries.

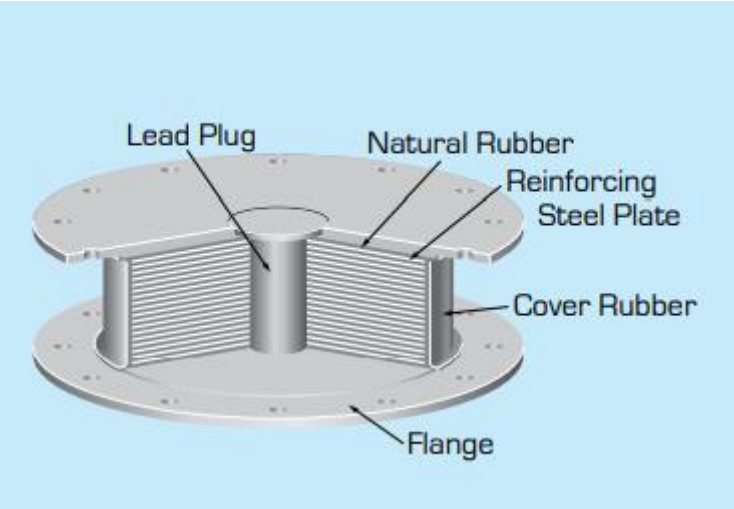


Figure 7. 3D Lead Rubber Bearing View
(Source: Bridgestone)

Lead Rubber Bearing modeling uses products from Bridgestone with the following dimensions

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Table 4. Section Properties LRB1100

Information	Size	Unit
Type	LRB1100	-
Diameter (D)	1100	mm
Bonded length parallel to traffic (a_b)	1050	mm
Bonded length perpendicular to traffic (b_b)	1050	mm
Rubber area (A_r)	848544	mm^2
Bearing height (h)	314.2	mm
Number of internal elastomer layer (n_p)	26	-
Thickness of reinforcement steel plate (t_p)	4.4	mm
Yield strength of reinforcement steel plate (f_y)	240	Mpa
Tensile strength of reinforcement steel plate (f_u)	370	Mpa
Number of internal elastomer layer (n_i)	25	-
Thickness of internal elastomer layer (h_{ri})	7.4	mm
Total Thickness of internal elastomer layer (h_{rti})	185	mm
Thickness of outer elastomer layer (h_{ro})	7.4	mm
Total Thickness of outer elastomer layer (h_{rto})	14.8	mm
Total elastomer thickness (h_{rt})	199.8	mm
Shear Modulus of elastomer (G)	0.385	Mpa
Bulk Modulus of elastomer (K)	3100	Mpa
Zone	A	Mpa

In modeling the LRB in the CSi Bridge program, several parameters are used. The LRB parameter is obtained through previous calculations. The table shows the LRB parameters for the abutments and bridge pillars.

Tabel 5 Rekapitulasi Parameter LRB pada CSI BRIDGE

Parameter	Pilar	Unit
Diameter (D)	1100	mm
High (H)	199.8	mm
Post yield stiffness (K_d)	1775.95	N/mm
Compressive stiffness (K_v)	5604536.027	K_N/m
Equivalent damping ratio (H_{eq})	0.306	-

The results of the analysis input from the CSi Bridge program are obtained as follows

Table 6. Comparison of the results of the Lead Rubber Bearing analysis

Diameter (D)	LRB900	LRB1000	LRB1100
Post yield stiffness (K_d)	1071.80 N/mm	1459.07 N/mm	1775.95 N/mm
Compressive stiffness (K_v)	3798530.40 kN/m	4611109.57 kN/m	5604536.027 kN/m
Equivalent damping ratio (H_{eq})	0.227	0.317	0.306

In the High Damping Rubber Bearing analysis, the calculation steps for the design parameters are the same as for lead rubber bearings referring to the provisions of the Specification for Seismic Isolation Design AASHTO LRFD Brigde-2017 and Guide Specification for Seismic Isolation Design, 2012. The design used in modeling is the circular type (Circular Bearing). As for the products themselves, using Bridgestone.

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Information	Size	Unit
Type	LRB1100	-
Diameter (D)	1100	mm
Bonded length parallel to traffic (ab)	1050	mm
Bonded length perpendicular to traffic (bb)	1050	mm
Rubber area (Ar)	848544	mm2
Bearing height (h)	314.2	mm
Number of internal elastomer layer (np)	26	-
Thickness of reinforcement steel plate (tp)	4.4	mm
Yield strength of reinforcement steel plate (fy)	240	Mpa
Tensile strength of reinforcement steel plate (fu)	370	Mpa
Number of internal elastomer layer (ni)	25	-
Thickness of internal elastomer layer (hri)	7.4	mm
Total Thickness of internal elastomer layer (hrti)	185	mm
Thickness of outer elastomer layer (hro)	7.4	mm
Total Thickness of outer elastomer layer (hrto)	14.8	mm
Total elastomer thickness (hrt)	199.8	mm
Shear Modulus of elastomer (Geq)	0.484	Mpa
Bulk Modulus of elastomer (K)	3100	Mpa
Zone	A	Mpa
Rubber Material	X0.6R	-

Table 7. Section Properties HDRB1100

Comparative Results Analysis of elastomeric bearing, Lead Rubber Bearing (LRB) and High Damping Rubber Bearing (HDRB). From the analysis using the CSI BRIDGE program, the comparison results of elastomeric bearing, lead rubber bearing (LRB) and high damping rubber bearing (HDRB) are as follows

Table 8. Comparative results of force analysis in elastomeric bearings, LRB and HDRB of pier 1 column

	ELASTOMERIC BEARING	LRB	HDRB
Pu	-2894.329 kN (Tarik)	2578.614 kN (Tekan)	1819.956 kN (Tekan)
M2 (Arah transversal)	7633.658 kN/m (R=3.5)	7741.043 kN/m (R=1.75)	9002.402 kN/m (R=1.75)
M3 (Arah Longitudinal)	12368.659 kN/m (R=2)	4357.447 kN/m (R=1.5)	5378.964 kN/m (R=1.5)
Gaya Geser Major (V2)	6850.372	4049.701	4796.751
Gaya Geser Minor (V3)	6850.478	4049.775	4796.542
Diameter (D	2 m	1100 mm	1100 mm
Jumlah Tulangan	122D25	79D25	101D25

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Table 9. Comparative results of force analysis in elastomeric bearings, LRB and HDRB of pier 2 column

	ELASTOMERIC BEARING	LRB	HDRB
Pu	-2836.21 kN (Tarik)	2637.579 kN (Tekan)	1877.697 kN (Tekan)
M2 (Arah transversal)	7880.403 kN/m (R=3.5)	7723.445 kN/m (R=1.75)	8984.264 kN/m (R=1.75)
M3 (Arah Longitudinal)	12357.427 kN/m (R=2)	4355.236 kN/m (R=1.5)	5376.227 kN/m (R=1.5)
Gaya Geser Major (V2)	6866.808	4058.438	4805.152
Gaya Geser Minor (V3)	6866.912	4058.512	4804.945
Diameter (D)	2 m	1100 mm	1100 mm
Jumlah Tulangan	122D25	79D25	101D25

Table 10. Comparison of LRB and HDRB

KOMPARASI	LRB	HDRB
Diameter (D)	1100 mm	1100 mm
Shear Modulus (G)	0.385 Mpa	0.484 Mpa
Post yield stiffness (K_d)	1775.95 N/mm	1294.15 N/mm
Compressive stiffness (K_v)	5604536.027 kN/m	5604536.027 kN/m
Equivalent damping ratio (H_{eq})	0.306	0.2203

4. Conclusion

1. The behavior of LRB (Lead Rubber Bearing) and HDRB (High Damping Rubber Bearing) is highly dependent on the load and working deformation. The main parameter that greatly influences the behavior of LRB and HDRB is the shear strain, where the shear strain that occurs in the LRB comes from axial force, shear deformation force and rotation.
2. LRB and HDRB are effective for carrying strong earthquake loads by allowing relatively large shear deformations compared to using elastomeric bearings.
3. LRB can be used as an insulator that can reduce earthquake forces where the effective damping is very dependent on the characteristic strength of the lead component. Meanwhile, the effective damping of HDRB really depends on the characteristic strength of the rubber.
4. From the study conducted, it was found that the effective damping ratio for LRB was 30.6% while for HDRB it was 22.03% for the same diameter of LRB and HDRB.
5. The damping ratio of the LRB (Lead Rubber Bearing) is greater than the damping ratio of HDRB (High Damping Rubber Bearing). So that the use of LRB is more effective than HDRB.

Recommendation

The suggestions that can be derived from this research are:

1. For more detail, the next study uses a non-linear time history analysis.
2. Hysteresis modeling for HDRB needs to be reviewed in more depth.
3. Calculate the draft cost budget to compare construction cost savings using LRB and HDRB.

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Evaluation Of Construction Project Time And Cost Control Based On Earned Value And Crash Project Method (A case study on the construction project of the State Junior High School 1 Surabaya)

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Abstract

Project development and how to control time and costs in the construction project of a public junior high school 1 Surabaya. This research was conducted with the aim of knowing and comparing the amount of duration and cost after acceleration by using the alternative Earned Value Analysis. The case study in this research takes the construction project of a public junior high school 1 Surabaya which is located in Surabaya. The data needed in this study include the S curve, recapitulation of project cost calculations, a list of budget plans (RAB), and a list of unit wage prices for workers. The research method used is to design network planning, calculate the cost variance and variance schedule for each activity that changes due to changes in the duration of implementation, acceleration of work duration, and determination of the optimum cost and duration due to the application of the Earned Value Analysis method. For the calculation of the variance Schedule on week 34 shows a positive result of Rp. 109,550,470. For the calculation of the cost variance from week 34 shows - Rp. 2,488,159. For the calculation of Estimate at completion (EAC) on week 34 of Rp. 6,663,998,229. For the calculation of Estimate temporary schedule, the evaluation week 34 experienced a delay of 53 days from the original schedule. So the work completion time is 233 calendar days

Keywords :
cost and schedule, Earned Value Engineering

1. Introduction

The concept of earned value is one of the tools used in project management that integrates cost and time. The concept of earned value presents three dimensions, namely the physical completion of the project (the percent complete) which reflects the cost absorption plan (budgeted cost), the actual cost that has been incurred or what is known as actua is called the earned value. Of the three dimensions, with the concept of earned value, it can be linked between cost performance and time derived from calculating the variance of cost and time (Fleming and Koppelman, 1994). Earned Value is able to present performance reporting, budget and remaining cost as well. The drawback is that the presentation is not graphic and is certainly not liked by practitioners in general. Lukas, (2008) there are four reasons why Earned Value analysis is not carried out, namely: undocumented requirements, incomplete requirements, not used or accepted WBS (Work Breakdown Structure), incomplete WBS.

The purpose of this research is how to implement EVA (Earned Value Analysis) in estimating the final time of project completion for each week, whether for 34 weeks of implementation is in accordance with the initial plan of the project schedule. In addition, to find out the project is experiencing delays and experiencing costs greater or less than the project budget plan.

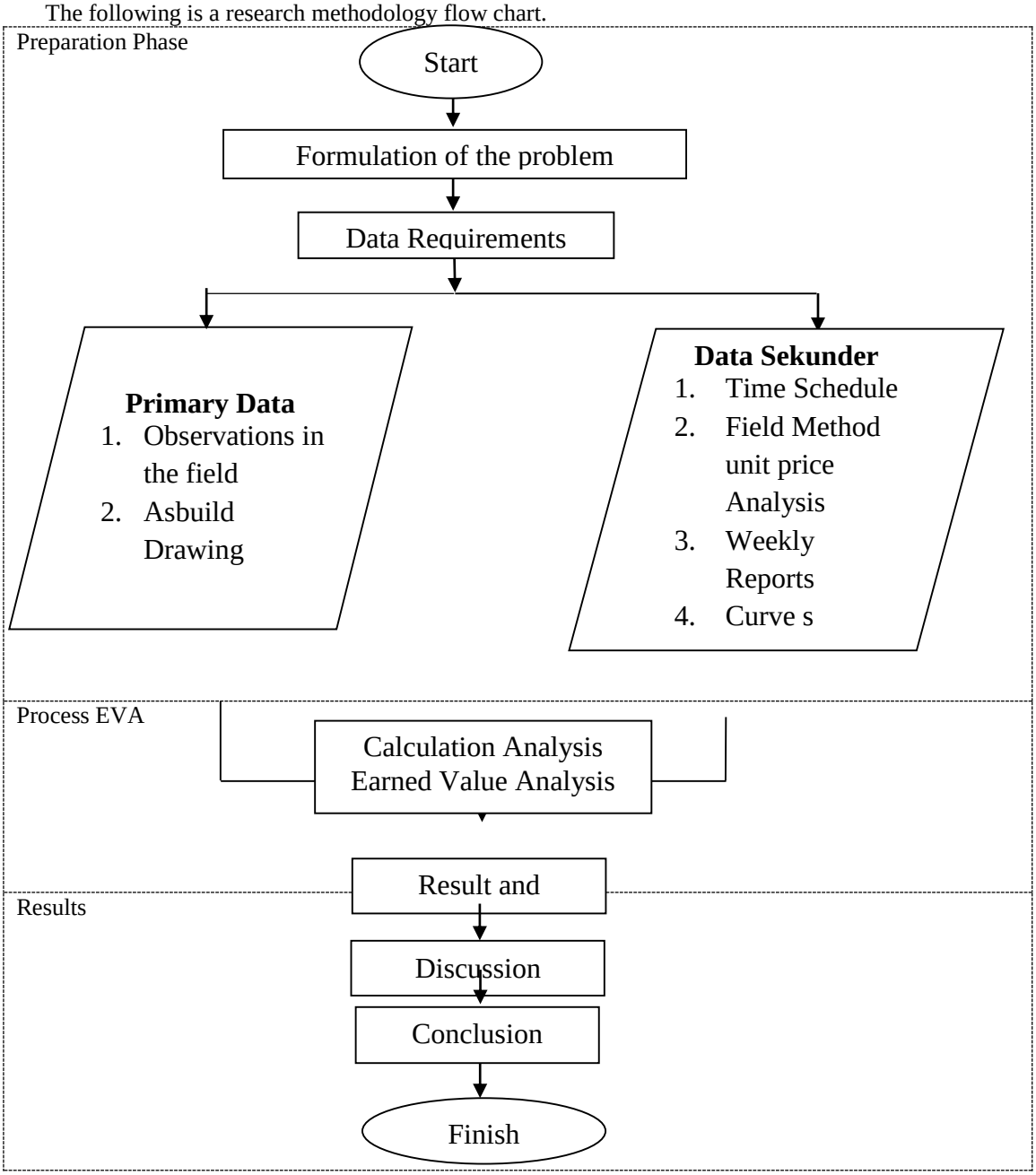
2. Research Methodology

Data obtained from PT. Mitra Karya Mandiri Jaya in the form of primary and secondary data. The method used in this research is descriptive qualitative research that describes the conditions of the project by analyzing existing data. Data analysis used analytical and descriptive methods. Analysis means that existing data are processed in such a way as to produce a conclusive conclusion. Meanwhile, the meaning of descriptive is to describe the problems that already exist or appear. The Concept of Value Results (Earned Value Analysis) examines the trend of schedule variants and cost variants over a period of time during the project. However, this study will only discuss time variants.

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2.1 Research Flowchart

The following is a research methodology flow chart.



Fugure 1. The following is a research methodology flow chart.

3. Discussion And Analysis

In accordance with the background of the writing of this final project, the concept of earned value is one of the tools used in project management that integrates cost and time. The concept of earned value presents three dimensions, namely the physical completion of the project (the percent complete), which reflects the cost absorption plan (budgeted cost), the actual costs that have been incurred or what is called the actual called earned value. So in writing this thesis, the author will take into account the concept of the value of the results in the construction of a project for junior high school 1 Surabaya.

3.1 Earned Value Analysis

Calculation of Variance Analysis and Result Value Concept, Using Microsoft Excel. PV (Planned value) and EV (Earned value) are calculated using data from weekly reports. The project for the construction of a state junior high school 1 surabaya was carried out within 34 weeks with a contract value of Rp. 6,661,509,141.00. There are 34 weekly reports which are reported every week for 34 weeks. One of the reports in the weekly report

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is work weight, namely the weight of the plan and the weight of work implementation. Planner weight and work execution weight function to determine the progress of project work.

3.2 Calculation of Earned Value Analysis

After knowing what earned value analysis is, the next step is to start the calculation steps using Microsoft Excel and primary and secondary data such as budget plans and time schedules that have been obtained from the Surabaya 1 Public Junior High School project. So one example of calculations from Earned Value analysis.

3.3 Budget Cost Of Work Schedule (BCWS)

The project's budget corresponds to an inventory of activities calculated based on a percentage of total costs, according to 34 weeks of field data. BCWS is calculated using the formula 2.1, namely: Result Value = (% completion) x (Budget).

Example of Calculation of BCWS on week 1 is as follows:
% Weight of the week 1 = 0.02%
Contract Value = Rp. 6,232,056,155.00
So that:
BCWS = (% completion) x (Budget).
= 0.020% x Rp. 6.232.056.155,00
= Rp. 1.558.014,00

Tabel 1. Budget Value Of The Cost Of Work Schedule Every Week

BUDGET VALUE OF THE COST OF WORK SCHEDULE EVERY WEEK							
WEEK	% PROFESSION	CONTRACT VALUE		PV		PV KOM (Rp.)	
1	0,03%	Rp	6.232.056.155	Rp	1.558.014	Rp	1.558.014
2	0,28%	Rp	6.232.056.155	Rp	17.387.437	Rp	18.945.451
3	1,51%	Rp	6.232.056.155	Rp	94.291.010	Rp	113.236.460

3.4 Budget Cost Of Work Performance (BCWP)

The yield value is the budgeted cost of the work completed by the executor, BCWP using the formula 2.1. Result Value = (% completion) x (Budget).

Example of Calculation of BCWP in week 1 is as follows:
% Implementation weight week 1 = 0.0034%
Contract Value = Rp. 6,232,056,155.00
So that:
BCWP = (% completion) x (Budget).
= 0.0034% x Rp. 6,232,056,155.00
= Rp. 211,890.00

Tabel 2. Budget Value Of Cost Of Work Performance Every Week

BUDGET VALUE OF COST OF WORK PERFORMANCE EVERY WEEK							
WEEK	% PROFESSION	CONTRACT VALUE		EV		EV KOM (Rp.)	
1	0,00%	Rp	6.232.056.155	Rp	211.890	Rp	211.890
2	0,03%	Rp	6.232.056.155	Rp	1.869.617	Rp	2.081.507
3	0,03%	Rp	6.232.056.155	Rp	2.118.899	Rp	4.200.406

3.5 Schedule Varians (SV)

The schedule variance is calculated using Equation 2.3. Schedule Variance (SV) = EV - PV or SV = BCWP - BCWS

Example of calculating SV at week 1 is as follows:
Value of Week 1 BCWP = Rp. 211,890
1st Week BCWS Value = Rp. 1. 558,014.04
So that:
Schedule Variance (SV) = EV (BCWP) - PV (BCWS)
= Rp. 211,890 - Rp. 1. 558,014.04
= Rp. -1,346,124.13
The results of the calculation at week 1 show negative results, so that at week 1 it is delayed.

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Tabel 3. Schedule Variants Value

Schedule Variants Value						
WEEK	EV KOM (Rp.)		PV KOM (Rp.)		SV(Rp.)	
1	Rp	211.890	Rp	1.558.014	-Rp	1.346.124
2	Rp	2.081.507	Rp	18.945.451	-Rp	16.863.944
3	Rp	4.200.406	Rp	113.236.460	-Rp	109.036.054

3.6 Cost Varians (CV)

The schedule variance is calculated using Equation 2.3. Cost Variance (CV) = EV - AV or SV = BCWP - ACWP.

Example of CV calculation in week 1 is as follows:

Value of Week 1 BCWP = Rp. 211,890

ACWP Value Week 1 = Rp. 209,000.00

So that:

Cost Variance (CV) = EV (BCWP) - AV (ACWP)

= Rp. 211,890.00 - Rp. 209,000.00

= Rp. 2,889.91

Calculation results on week 1 show positive results, so that on week 1 the costs are below the plan (Cost Underrun).

Tabel 4. Variants Cost Value Every Week

VARIANTS COST VALUE EVERY WEEK						
WEEK	EV KOM (Rp.)		AC		CV	
1	Rp	211.890	Rp	209.000	Rp	2.890
2	Rp	2.081.507	Rp	2.030.000	Rp	51.507
3	Rp	4.200.406	Rp	4.143.000	Rp	57.406

3.7 Estimate At Completion (EAC)

The estimated total cost of project completion is calculated based on the costs that have been completed subtracted from the EAC results or using formula 2.7, namely:

EAC = ACWP + ETC

An example of calculating the EAC in week 1 is as follows:

ACWP Value Week 1 = Rp. 209,000.00

Week 1 ETC Value = Rp. 6,146,849,823.53

Then:

EAC = ACWP + ETC

= Rp. 209,000.00 + Rp. 6,146,849,823.53

= Rp. 6,147,058,824

Tabel 5. Estimate Value At Completion Every Week

ESTIMATE VALUE AT COMPLETION EVERY WEEK					
WEEK	EV KOM (Rp.)	AC	CPI	ETC	EAC
1	Rp 211.890	Rp 209.000	1,0 1	Rp 6.146.849.824	Rp 6.147.058.824
2	Rp 2.081.507	Rp 2.030.000	1,0 3	Rp 6.075.814.311	Rp 6.077.844.311
3	Rp 4.200.406	Rp 4.143.000	1,0 1	Rp 6.142.741.273	Rp 6.146.884.273

3.8 Estimate Temporary Schedule (ETS)

Based on the contract for the construction project of the Junior High School 1 Surabaya building, the project work time is 180 days. The ETS calculation uses the formula 2.8 where:

ETS = (remaining time) / SPI

An example of calculating the ETS in week 1 is as follows:

SPI Value Week 1 = 0.14

Project Implementation Plan Time = 180 Days

Finish Time = 4 Days

Remaining Time = 180 Days - 4 Days = 176 Days

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So that:
Estimate temporary Schedule (ETS) = (Remaining Time) / SPI
= 176 / 0.14
= 1294,118
Completed Work Time = Implementation plan time - (ETS + End Time)
= 180 Days - (1294,118 days + 4 days)
= -1118,12 days
= -1118,12 days

Table .6 Cumulative Estimate Temporary Schedule (ETS)

Cumulative Estimate Temporary Schedule (ETS)							
1 WEEK	2 EV KOM(Rp)	3 EV KOM(Rp)	4 SPI	5 Plan Time	6 Time's up	7 Remaining time	8 ETS(Hari)
1	Rp 211.890	Rp 1.558.014	0,14	180	4	176	1294,12
2	Rp 2. 081.507	Rp 18.945.451	0,11	180	11	169	1538,20
3	Rp 4.200.406	Rp 113.236.460	0,04	180	18	162	4367,27

The project status when reporting (monitoring baseline) in June or week 14 shows the project performance is under budget, this is indicated by the positive CV (Cost Varian) indicator of Rp. 607,955.00 on the 14th week, between the difference in the value of the results (EV / BCWP) and the actual costs incurred (AC / ACWP). Project performance from this cost aspect can also be seen from the cost performance index indicator CPI = 1.0010> 1. Meanwhile, from the schedule aspect, it shows that project performance is delayed, this is indicated by the Schedule Variant (SV) which is negative at -Rp. 1,148,516.02000 between the difference in yield value (BCWP) and the planned budget (PV / BCWS). Project performance from this time aspect can also be seen from the schedule performance index (SPI) whose value is 0.455 <1. As in the table below.

Table 1.Project Performance Status at Week 14

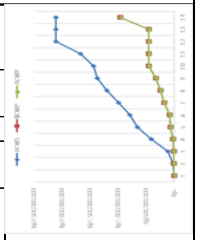
	Earned Value Method	Calculation	The calculation results	Information	S Earned Value Graph
I.	**Cost Parameters**				
1.	CV (Cost Variance) / Cost Variance	= BCWP - ACWP =Rp. 958.654.955,00 - Rp.958.047.000,00	= Rp. 607.955	= CV > 0, Cost Under run	
2.	Cost Performance Index (CPI)	= EV (BCWP) / CV (ACWP) =Rp. 958.654.955,00 - Rp.958.047.000,00	= 1,001	= CPI > 0, Cost Under run	
II.	**Time Parameters**				
1.	SV (Schedule Varians)	= EV (BCWP) - PV (BCWS) =Rp. 958.654.955,00 - Rp.2.107.170.975,00	= -Rp. 1.148.516.020	= SV < 0, Schedule Overrun	
2.	Schedule Performance Indeks (SPI)	= EV (BCWP) / PV (BCWS) =Rp. 958.654.955,00 - Rp.2.107.170.975,00	= 0,455	= SV < 0, Schedule Overrun	

Table 2. Estimated Cost and Time Required to Complete the Project

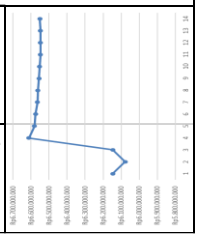
	Earned Value Method	Calculation	The calculation results	Information	S Earned Value Graph
I.	**Estimasi Biaya dan waktu minggu ke 14**				
1.	ESTIMATE AT COMPLETION (EAC)	= ((BAC – BCWP) / CPI) + ACWP = ((Rp. 6.555.544.827 - Rp. 211.889,91) / 1,01) + Rp.958.047.000,00	= Rp. 6.550.888.179	The estimated cost is less than the planned project budget of Rp. 6,555,544,827	
2.	Estimate Temporary Schedule (ETS)	= ((Total time - End time) / SPI) + Job Time = ((180 - 7) / 0.45) + 7	= 95 days or 13 weeks	The estimated time is faster than the project plan time, 180 days	

Figure 2.

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Table 7.Value Of Actual Cost For Work Performance Every Week

VALUE OF ACTUAL COST FOR WORK PERFORMANCE EVERY WEEK			
WEEK	BCWS	BCWP	ACWP
1	Rp 1.558.014	Rp 211.890	Rp 209.000
2	Rp 18.945.451	Rp 2.081.507	Rp 2.030.000
3	Rp 113.236.460	Rp 4.200.406	Rp 4.143.000
4	Rp 408.694.866	Rp 19.278.159	Rp 19.445.000
5	Rp 651.840.023	Rp 65.822.527	Rp 66.081.000
6	Rp 791.145.351	Rp 80.703.614	Rp 80.935.000
7	Rp 993.449.464	Rp 175.988.458	Rp 176.218.000
8	Rp 1.200.408.014	Rp 246.067.232	Rp 246.293.000
9	Rp 1.374.457.730	Rp 322.767.107	Rp 322.804.000
10	Rp 1.438.702.069	Rp 454.433.558	Rp 454.279.000
11	Rp 1.670.833.911	Rp 455.844.667	Rp 455.268.000
12	Rp 2. 107.107.975	Rp 455.844.667	Rp 455.268.000
13	Rp 2.107.107.975	Rp 455.844.667	Rp 455.268.000
14	Rp 2. 107.107.975	Rp 958.654.955	Rp 958.047.000
15	Rp 2.563.043.562	Rp 1.039.943.711	Rp 1.039.205.000
16	Rp 2.876.070.828	Rp 1.392.632.022	Rp 1.310.682.000
17	Rp 3.123.149.312	Rp 1.569.631.733	Rp 1.487.499.000
18	Rp 3.414.674.391	Rp 1.853.486.824	Rp 1.771.653.000
19	Rp 3.695.645.045	Rp 2.322.863.833	Rp 2.241.291.000
20	Rp 4.069.453.385	Rp 2.339.908.250	Rp 2.258.052.000
21	Rp 4.523.020.355	Rp 2.701.774.324	Rp 2.619.695.000
22	Rp 5.115.248.274	Rp 2.761.429.782	Rp 2.679.267.000
23	Rp 5.768.770.538	Rp 2.870.251.826	Rp 2.788.374.000
24	Rp 6.312.487.426	Rp 3.751.317.051	Rp 3.669.182.000
25	Rp 6.529.475.960	Rp 4.088.272.055	Rp 4.006.331.000
26	Rp 6.549.142.594	Rp 4.376.716.028	Rp 4.294.822.000
27	Rp 6.549.470.371	Rp 4.534.704.658	Rp 4.452.711.000
28	Rp 6.549.470.371	Rp 4.861.170.790	Rp 4.778.992.000
29	Rp 6.549.470.371	Rp 5.004.081.668	Rp 4.921.707.000
30	Rp 6.549.470.371	Rp 5.361.358.861	Rp 5.279.196.000
31	Rp 6.549.470.371	Rp 5.667.122.130	Rp 5.669.994.000
32	Rp 6.549.470.371	Rp 6.419.872.663	Rp 6.422.912.000
33	Rp 6.549.470.371	Rp 6.421.871.116	Rp 6.424.623.000
34	Rp6.549.470.371	Rp 6.659.020.841	Rp 6.661.509.000

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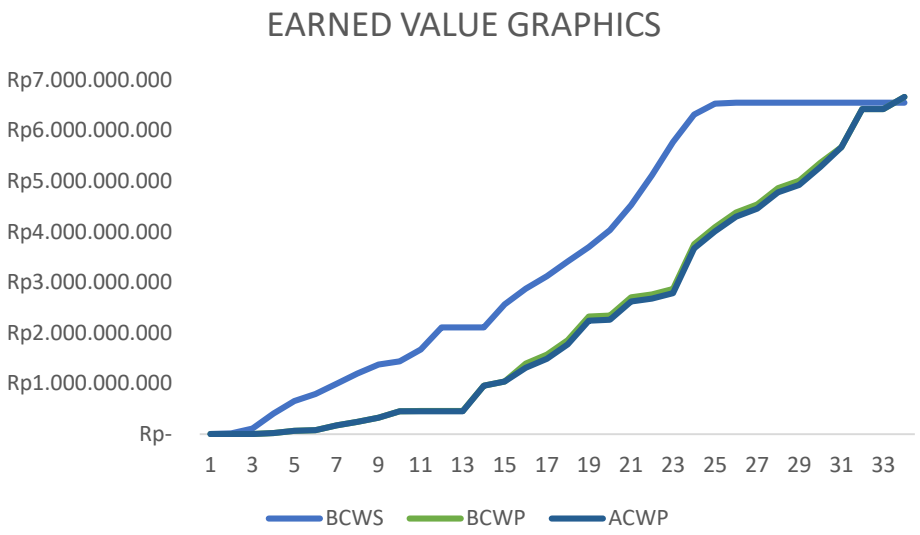


Figure 3.

4. Conclusions And Suggestions

4.1 Conclusion

Based on the analysis of the calculations that have been done, the things that can be concluded from this study are:

1. Earned Value Analysis can predict the cost and time of project completion well and can predict early in each reporting period if there is a deviation in cost and implementation time.
2. Evaluation of the Sechedule variance at week 1 shows a negative result of - Rp. 1.346.124 So that at week 1 there was a delay. Whereas at week 34 shows a positive result of Rp. 109,550,470 so that at week 34 experienced a speed.
3. Evaluation of Cost Variance at week 1 shows a positive result of Rp. 2.890 So that in week 1 experience lower costs. While at week 34 it shows - Rp. 2,488,159 so that at week 34 so it costs above budget
4. Cost Evaluation
   • Budget plan for building rehabilitation construction type B2 (SMP Negeri 1 Surabaya) is Rp. 6,661,509,000 (six billion six hundred sixty-one million five hundred and nine thousand rupiah)
   • Estimate at completion (EAC) cost at week 34 is Rp. 6,663,998,229
5. Evaluation of Time
   • The planned construction time for type B2 (SMP Negeri 1 Surabaya) is 180 calendar days
   • Estimate time of project completion or Estimate temporary schedule which is influenced by the implementation of project work. In the evaluation week 34 experienced a delay of 53 days from the original schedule. So the work completion time is 233 calendar days
6. Value of Results (Earned value) in this evaluation is the project work is delayed and costs higher than the budget

4.2 Suggestion

1. In the next research, acceleration can be done using the Crashing method, Earned Value Analysis, and can be compared using the Microsoft Project program so that the comparison between the three methods can be seen.
2. For subsequent research, other methods can be used so that comparisons can be made to accelerate and cost a project.
3. Subsequent research can carry out regular checks so that you can find out the duration of the project in order to know the changes in data precisely and accurately.

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Risk Analysis of Delay in The Construction Project
(in The Project for The Construction of A Public Junior High School 1 Surabaya)

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Abstract

The complex problems that existed during the Field Implementation in the SMP Negeri 1 Surabaya project at that time caused some work that was not as planned both in terms of time, quality and cost which resulted in overbudget and overtime. When experiencing overbudget and overtime, it is necessary to have good cost, quality and time management. Good management should not only be owned by the project owner. The length of time to complete the project has a big effect on the increase in the overall project cost. Therefore, daily, weekly and monthly progress reports are needed to report work results and completion times for each project work item. Furthermore, this work is compared with the completion time of the plan so that the completion time can be controlled for each period. This is because the construction of the building has a delay in time so that it can cause disruption in some field operations. The analysis that I have done is viewed from all of them (owner and contractor). This study uses the AHP (Analytical Hierarchy Process) research method because AHP is used to derive the ratio scale of several paired comparisons that are discrete or continuous. Other problems such as inconsistencies in planners, supervisors, executors, and other authorities in the field, namely lack of communication and late making decisions such as changes in design and changes in calculations that are in implementation and planning so that the project results in time and cost delays, and other problems. such as material calculations and others, there are also delays caused by delays in making decisions in implementation. Because of that, the project for the Public Junior High School 1 in Surabaya experienced delays in several jobs, namely the foundation, column, ladder, and beam work, which should have been done in 1-2 months to 3-4 months. In terms of implementation, such as lack of communication between planners, supervisors and implementers as well as other authorized officials, a good communication is needed. So that it does not cause so many problems and can reduce delays in terms of implementation in the field.

Keywords
AHP (Analytical Hierarchy Process), Delay Factors

1. Introduction

Delays in implementation of one activity in the project can cause delays in other activities. This has an impact on delays in completing a project as a whole. The delay is mentioned in Presidential Regulation No. 54 of 2010 articles 120 and No. 70 of 2012 article 120, namely goods / services providers who are late in completing work within the period stipulated in the contract, will be subject to a late penalty of 1/1000 (one thousandth) of the contract price for each day of delay, and do not exceed the amount of performance guarantee. The delay will also affect the termination of the employment contract as stated in Presidential Regulation No. 54 of 2010, namely PPK can 1. unilaterally terminate the contract if the penalty for late implementation of the work has exceeded 5% (five percent) of the contract value. construction service. Therefore, construction service companies need to identify factors that cause delays in the completion time, so that the project can run as planned.

The purpose of this research is to analyze the important factors that influence project delays using the Analytical Hierarchy Process method, to find out the factors that are the risk of delays in construction projects at Junior High School 1 Surabaya, to find out the dominant risk factors that cause construction project delays in the construction of State Junior High Schools 1 Surabaya, Knowing the risk mitigation carried out to minimize project delays.

2. Research Methodology

The method used in this research is descriptive and analytical methods. Analysis means that existing data are processed in such a way as to produce a conclusive conclusion. While descriptive means by describing the

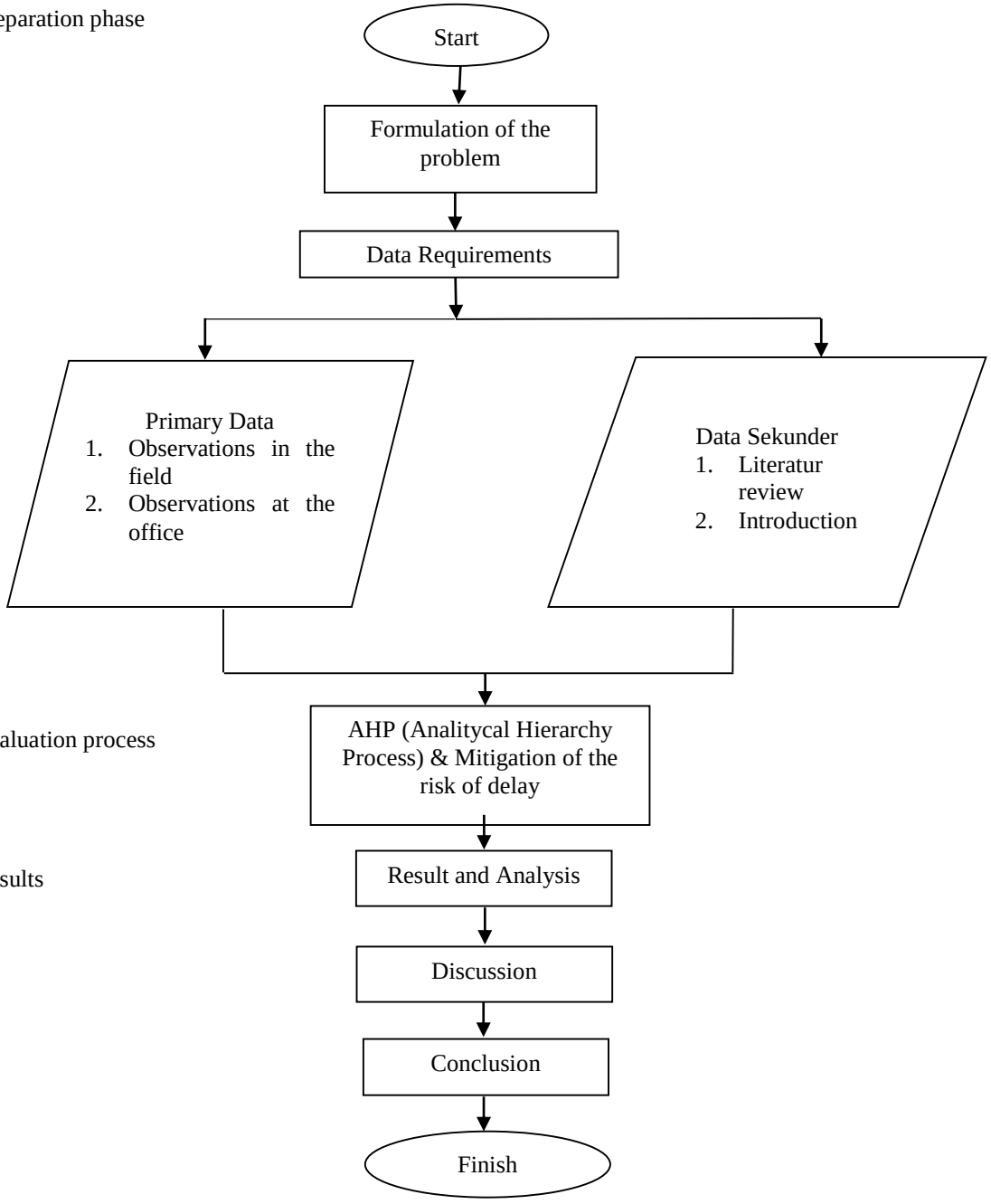
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problems that already exist or appear. Analysis of data using AHP (Analytical hierarchy process), namely the theory of measurement through a comparison matrix to get priority scale values. After getting a priority scale, the data is then discussed and conclusions drawn(Mustari & Rahman, 2012).

2.1. **Research Flowchart**

The following is a research methodology flow chart:

4. Preparation phase



5. Evaluation process

6. Results

Figure 1. Research Flowchart

3. Discussion And Analysis

In the AHP method, the criteria are arranged in a hierarchical form. The first analysis in this study is the calculation of the criteria weight using the AHP method. There are 3 work steps in using the AHP method, namely: looking for geomes, pairwise comparison matrix, and data normalization(Syah, 2014). In processing the data to determine the factors causing the delay, interviews were conducted with the research advisors in the related

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companies and the results of field observations so that 6 main factors were found to be the cause of delays in development projects. The factors causing the delay can be seen in the following table(Hassan, 2016).

Table 1. The factors causing the delay

Variable	Code	Information
Design drawing changed	X1	Change in the location of the material / equipment Change in material / equipment size Adding material / equipment components Old material production process
Procurement of materials is hampered	X2	Long duration of material delivery Poor material quality Size and specifications not on the market The product received is defective
Limited equipment	X3	Limited company entry Limited equipment Power outage Low efficiency of equipment The equipment is damaged
Worker limitations	X4	The number of workers is less Many employees are retiring Employee recruitment is limited Inadequate worker experience Accidents at work Lack of appreciation from the company An accident while going to work
Bad management	X5	Family problems Sudden permission Project licensing issues (legal) The plan schedule was not realized Poor coordination between owners, contractors, and consultants
Financial factor	X6	Job evaluation was not carried out Financial difficulties experienced by contractors Financial problems experienced by the owner Delay in payment processing Increase in material prices

3.1. Analytical Hierarchy Process (AHP)

After these factors are found, the next step is to conduct an AHP questionnaire which aims to rank the factors causing the delay.

3.2. Determining the Hierarchical Structure

In determining the maintenance strategy, first of all, we must first know what is meant by the AHP hierarchy. The AHP hierarchy is a propagating chart with the order of the top to the bottom chart, which are objectives, criteria, sub-criteria (if needed), and alternatives. The following is an explanation of the chart:

a. Purpose: The aim in processing AHP this time is to determine the factors causing the delay with the highest ranking.
b. Criteria and Sub-Criteria: Criteria and Sub-criteria are the basis necessary for an objective to affect the objective directly.

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c. Alternative: Alternative is a form of the lowest level that affects a criterion and indirectly affects the goal. Then it can be seen the form of AHP hierarchy consisting of Objectives, Criteria, and Alternatives which form the following chart:

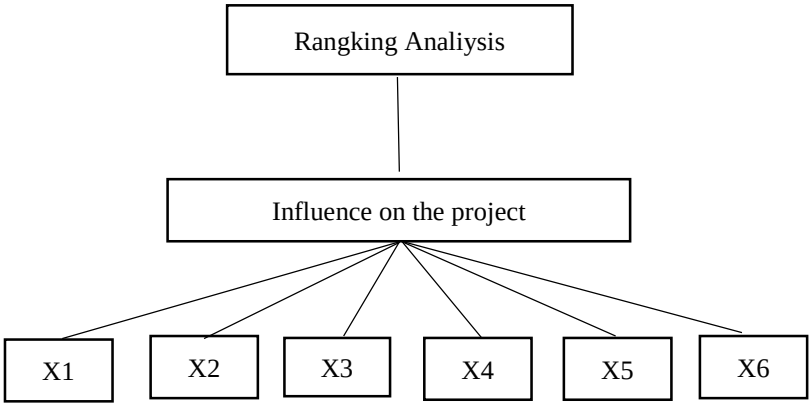


Figure 2. AHP Hierarchy

By looking at the AHP's goals, it only needs to include one factor, namely "Influence on the project" with the criteria in table 4.1 so that there are 6 factors that cause delays, which will be compared through questionnaires distributed to respondents.

3.3. Performs an Alternative comparison score

After the questionnaire data is obtained, the next step is to do a Pairwise Comparison comparing X1, X2, X3, X4, X5, and X6 to determine the size of the effect on the delays in the topside platform project. The amount of scoring on the questionnaire is described in table 4.3:

Table 2. Scale of weighting importance

Intensity of Interest	Definition
1	Both elements / alternatives are equally important
3	Element A is slightly larger than element B (Moderate)
5	Element A is greater than Element B (Strong)
7	Element A is clearly larger than element B (verystrong)
9	Element A is absolutely greater than element B (Extreme strong)
2, 4 ,6 ,8	The values between two adjacent balances

After processing the questionnaire data, a geomean is obtained with the values:
Source: Processed data

a. X1/X2=5,58
b. X1/X3=0,33
c. X1/X4=0,80
d. X1/X5=0,23
e. X1/X6=0,87
f. X2/X3=4,08
g. X2/X4=2,55
h. X2/X5=0,32
i. X2/X6=3
j. X3/X4=3
k. X3/X5=0,39
l. X3/X6=3
m. X4/X5=0,33
n. X4/X6=0,33

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Then the data above is formed in the following table 3. matrix:

Table 3. Pair Wise Comparison Matrix

	X1	X2	X3	X4	X5	X6
X1	1	5,8	0,33	0,80	0,23	0,87
X2	5,58	1	4,08	2,55	0,32	3,00
X3	0,33	4,08	1	3,00	0,39	3,00
X4	0,80	2,55	3,00	1	0,33	0,33
X5	0,23	0,32	0,39	0,33	1	3,00
X6	0,87	3,00	3,33	0,33	3,33	1
Total	8,81	16,53	11,80	8,02	5,28	11,20

i. Weighting Criteria

Weighting of the criteria is done by normalizing the matrix from the previous pair wise comparison matrix.

Table 4. Normalization Matrix

	X1	X2	X3	X4	X5	X6	amount	Weight normalization
X1	0,11	0,34	0,03	0,10	0,04	0,08	0.70	0,12
X2	0,63	0,06	0,35	0,32	0,06	0,27	1,69	0,28
X3	0,04	0,25	0,08	0,37	0,07	0,27	1,09	0,18
X4	0,09	0,15	0,25	0,12	0,06	0,03	0,72	0,12
X5	0,03	0,02	0,03	0,04	0,19	0,27	0,58	0,10
X6	0,10	0,18	0,25	0,04	0,57	0,09	1,23	0,21
								1,00

From the results above, then corrected by adding the total weight, namely 0.12 + 0.28 + 0.18 + 0.12 + 0.10 + 0.21 = 1, it can be concluded that the results of the above calculations are correct.

Based on the research results, the combined priorities of all respondents show that the main factor causing the delay in project completion is the method factor criteria, namely the procurement of material is hampered by a weight of 0.12 or equal to 28.09%. Then followed by the second factor, namely the financial factor with a weight of 0.21 or equal to 20.57%, the third priority is limited equipment with a weight of 0.18 or equal to 18.09%, the fourth priority is limited workers with a weight of 0.12 or the same. with 11.95%, then the fifth priority is changing the design image with a weight of 0.12 or equal to 11.67% and the sixth priority is bad management with a weight of 0.10 or equal to 9.63%.

4. CONCLUSIONS AND SUGGESTIONS

4.1. Conclusion

Based on the results of research using a cause-and-effect diagram approach and the AHP method regarding the evaluation of the factors causing the delay in the completion of a construction project at Junior High School 1 Surabaya, it can be concluded that:

1. There are 6 factors that influence the delays of the Junior High School 1 Surabaya project, namely changing design drawings, hampered material procurement, limited equipment, limited workers, poor management and financial factors.
2. The dominant or most dominant factor causing delays in the project of SMP Negeri 1 Surabaya is the material procurement is hampered with a weight of 0.12 or equal to 28.09%. Then followed by the second factor, namely the financial factor with a weight of 0.21 or equal to 20.57%, the third priority is limited equipment

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with a weight of 0.18 or equal to 18.09%, the fourth priority is limited workers with a weight of 0.12 or the same. with 11.95%, then the fifth priority is changing the design image with a weight of 0.12 or equal to 11.67% and the sixth priority is bad management with a weight of 0.10 or equal to 9.63%.

3. The risk mitigation carried out to minimize the occurrence of delays in the Junior High School 1 Surabaya project from each of the factors causing the delay are as follows:
    1) Procurement of materials is hampered
    That the procurement of materials is hampered due to errors in logistics and procurement of goods. In this case, it is necessary to analyze the timing of procurement and storage of goods in the warehouse. So that when the inventory runs out, the logistics department will immediately procure it.
    2) Financial factor
    In this case the marketing, financial and legal departments have to make observations from previous projects.
    3) Limited equipment
    In this case, it is necessary to collect data on the need for equipment to support the fabrication process. So that the company can find out the production capacity and can divide the work between sub contractors and vendors
    4) Worker limitations
    It is necessary to collect employee data to determine the welfare they experience. So that worker productivity is better.
    5) Design drawing changed
    This is common in construction projects, it's just that it requires cooperation from both parties so that when a design change occurs, the contractor can immediately provide a solution and the owner also immediately approves the change in the image.
    6) Bad management
    The marketing, legal and licensing departments need to be improved, because bad management can affect work in the field. Therefore it is necessary to make observations to find out deficiencies in subsequent projects.

4.2. SUGGESTION

4. For the contractor to pay more attention to material procurement. So in this case it is necessary to analyze the timing of procurement and storage of goods in the warehouse. this must be considered because if this problem occurs, it certainly causes losses in the form of, greater costs, longer time and less quality of a building.
5. For further research, researchers can use other criteria in accordance with other project delay objects. In addition to determining the priority factors for project delays, the AHP method can also be used to solve other multi-criteria problems that aim to support decision making. In addition, to reduce the subjectivity of respondents' assessments, especially to reduce inaccuracy and uncertainty of respondents in mapping their perceptions into numerical numbers, researchers can use other methods..

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Effect of Kandangan Pump House on Long Storage Diversi Gunungsari in Sememi

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Abstract

The Surabaya City Government has built a box culvert in the Gunungsari Diversi channel for the Sememi segment to Banjar Sugihan and the Kandangan pump house. The purpose of this study is to describe and analyze the operational impact of the Kandangan pump on the Sememi box culvert capacity.
Therefore, the Surabaya City Government built the Sememi box culvert as a long storage in the primary channel of the Gunungsari diversion in order to reduce inundation as well as function as a road that can overcome congestion in the area. The Surabaya City Government has also built a Kandangan pump house as an outlet rather than a long storage at the Gunungsari version. The reduction of inundation and congestion can increase the wheels of the economy which have a global impact on cities around Surabaya as well as a smoother access road for the people in West Surabaya to the middle of the city.

Keywords:
Drainage, Long Storage, Box Culvert, Pump House, Flood.

1. Introduction

1.1. Research Background

Inundation is an event when an area is filled with water because there is no drainage that breaks the water out of the area (Achmad Sobirin, 2007). Inundation often occurs in the West Surabaya area. In the last few years, Sememi Village, Benowo Sub-district has never been spared from waterlogging. The area of Kelurahan Sememi Surabaya has a lower contour than the area in the south, namely Lakarsantri Village, so that when it rains with high intensity, water from higher areas in the south will go straight to Sememi and cause puddles at some points.

Infrastructure development such as box culverts is one solution to overcoming inundation and flooding in West Surabaya. Sememi area, Benowo is one of the connecting routes to West Surabaya with Gresik City and Jalan Lintas Krian, Sidoarjo. In overcoming the congestion and inundation problems that occurred in West Surabaya, the Surabaya City Government constructed a box culvert in the Gunungsari Diversi channel, Sememi segment to Banjar Sugihan and the Kandangan pump house. The purpose of this study was to describe and analyze the operational impact of the Kandangan pump on the Sememi box culvert capacity.

Therefore, the Surabaya City Government built the Sememi box culvert as a long storage in the primary channel of the Gunungsari diversion in order to reduce inundation as well as function as a road that can overcome congestion in the area. The Surabaya City Government has also built a Kandangan pump house as an outlet rather than a long storage at the Gunungsari version.

Reducing inundation and congestion can increase the wheels of the economy which have a global impact covering cities around Surabaya as well as a smoother access road for people in West Surabaya to the middle of the city.

1.2. Problem Formulation

1) What is the planned flood discharge included in Sememi's long storage?
2) What is the existing capacity, the capacity of the Sememi Box Culvert long storage and the Kandangan primary channel?
3) How is the operation of the Kandangan pump house with the Sememi long storage that has been built?

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2. Literature Review

Based on the results of research conducted by (Cahyaningsih et al., 2016) which conducted research on long storage planning to implement a short-term flood control system that aims to slow down the peak flood time so that the flood discharge does not come simultaneously and will provide a flood reduction effect in the downstream and as water storage for the surrounding area.

Based on the results of research conducted by (Rahmananta, 2017). The downstream area of Kali Kandangan around Tambak Langon road, Asem Rowo District, is often inundated by floods, both from tides of sea water and rainwater that cannot flow into the river due to the relatively flat topography of the area. In addition, there have been changes in land use from ponds and waters to industrial areas so that the impermeable land increases.

To overcome this problem, a boezem will be planned to temporarily accommodate rainwater runoff when the elevation of the Kandangan river is higher and its disposal system. The return rain period used is 10 years and the assumption of 4 hours of rain. By using a rational method to calculate the volume of boezem required. Flood tracking to ascertain what pump capacity and door dimensions are required for the exhaust system.

The results of the planning resulted in a flood discharge in the Kali Kandangan sub-watershed of 9.42 m3 / second so that it requires an area of 30762 m2 with a depth of 3 meters. Boezem is equipped with a 2 pump exhaust system with a capacity of 1.05 m3 / s each and 2 doors with dimensions of 1 meter x 0.6 meter.

3. Research Method

3.1. Data Source

The data used in this study were sourced from the reports of the relevant contractors and consultants as well as from the relevant Dinas. In addition, literature study is also carried out by collecting and studying books, reports, journals and other literature related to the titles discussed in this study as well as data resulting from field surveys and interviews with communities around the research location which are more or less needed. as reference.

3.2. Research Methodology

Rainfall calculation using:

Algebra Average Method

Formula : $\overline{R} = {}^{1}\!/_{n}\left(R_1 + R_2 + \ldots\ldots + R_n\right)$

The Thiessen Polygon Method

Formula : $W = \dfrac{A_i}{A_{total}}$

Calculation of the distribution of rainfall using:

Gumbel Method

Formula : $P(X \le x) = e^{(-e)^{-y}}$

Pearson Log III

Formula : $P(X) = \dfrac{1}{(a)\Gamma(b)}\left[\dfrac{X-c}{a}\right]^{b-1}.e^{-\left[\frac{X-c}{a}\right]}$

Normal

Formula : $P(X) = \dfrac{1}{\sigma\sqrt{2\pi}}.e^{-\frac{1}{2}\left[\frac{X-\mu}{\sigma}\right]^2}$

Normal Log

Formula : $P(X) = \dfrac{1}{(\log X)(S)\left(\sqrt{2\pi}\right)}.\exp\left\{\dfrac{1}{2}\left(\dfrac{\log X - \overline{X}}{S}\right)^2\right\}$

Rainfall calculation plans use:

Rational Method

Formula: Q = 0.278. C. It. A

Weduwen method

Formula: Qn = α. β. q_n. A

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Formula: Qi = α. β. A .qt
Channel capacity calculation using:
Pump Capacity Calculation
Formula: Q = A. V
Calculation of pump capacity using:
Pump Analysis
Formula: Qp = Qmax - [(2x Qmax x Vt) / ntc] ^ 0.5

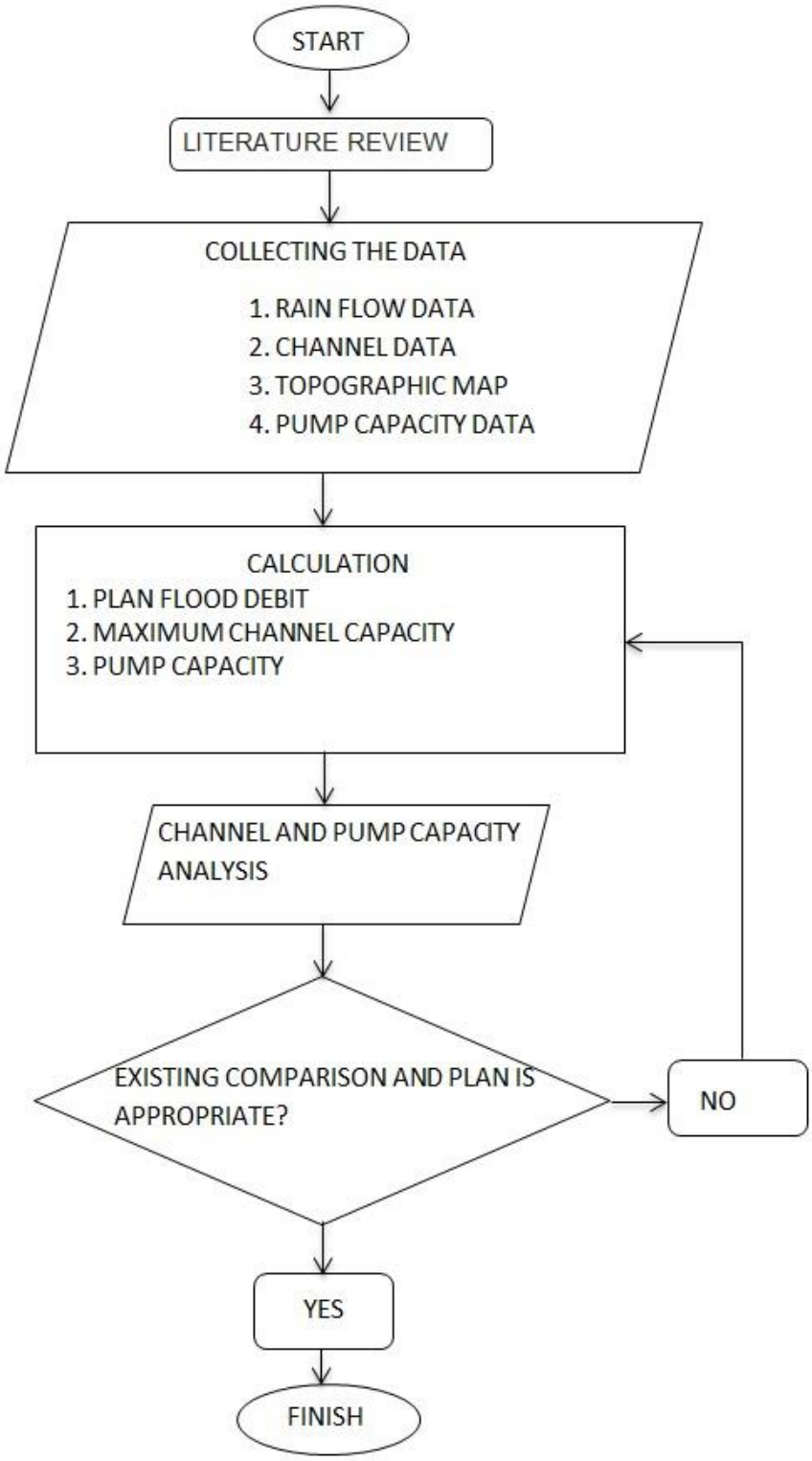


Figure 1. Data Flow Diagram

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4. Result And Discussion

Tabel 1. Kandangan Station Rainfall Data

No	Year	Maximum Rainfall (mm)	
		Kandangan Channel	Average
1	2008	5,18	5,18
2	2009	5,76	5,76
3	2010	8,63	8,63
4	2011	5,58	5,58
5	2012	4,47	4,47
6	2013	6,46	6,46
7	2014	5,54	5,54
8	2015	5,01	5,01
9	2016	9,89	9,89
10	2017	4,85	4,85
N= 10	∑ R =	61,36157613	

(Source: Calculation results from the Meteorology, Climatology and Geophysics Agency)

Tabel 2. Analysis of the planned discharge capacity

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Tertiary Channel Dimensions	I channel	n	Channel Width m	Channel Height m	A m2	P m	R	V m/sec	Q exist m3/sec	Q2 Plan m3/sec	Analysis
Klakahrejo Channel	0,0038	0,011	0,70	1,00	0,70	2,70	0,259	2,2785	1,5950	2,5644	Not oke..!!
Bandarrejo Channel	0,0012	0,011	1,00	1,00	1,00	3,00	0,333	1,5232	1,5232	2,2261	Not oke..!!
Kandangan Channel	0,0092	0,011	0,40	0,60	0,24	1,60	0,150	2,4576	0,5898	3,8605	Not oke..!!
Accumulated Total Tertiary Channel Discharge									3,7080		
Primary Channel Dimensions	I channel	n	Channel Width m	Channel Height m	A m2	P m	R	V m/det	Q exist m3/det	Q10 Plan m3/det	Analysis
Box Culvert Channel Builded Diversion Gunungsari, Sememi Side	0,00005	0,013	7,60	3,50	26,60	14,60	1,822	0,7809	20,7725	2,7444	oke..!!
Natural Existing Channel Diversion Gunungsari	0,0012	0,027	5,62	1,35	7,59	8,32	0,912	1,2070	9,1611	9,7963	Not oke..!!
Secondary Channel Dimensions	I channel	n	Channel Width	Channel Height	A	P	R	V	Q exist	Q5 Plan	Analysis
			m	m	m2	m		m/det	m3/det	m3/det	
Bringin Channel	0,00090	0,027	5,00	1,50	7,50	8,00	0,938	1,0658	7,9935	1,7825	oke..!!
Primary Channel Dimensions	I channel	n	Channel Width m	Channel Height m	A m2	P m	R	V m/det	Q exist m3/det	Q10 Plan m3/det	Analysis
Box Culvert Channels Manukan Builded	0,00061	0,013	3,50	3,20	11,19	9,90	1,13	2,0570	23,0241	4,8786	oke..!!
Primary Channel Dimensions	I channel	n	Channel Width m	Channel Height m	A m2	P m	R	V m/det	Q exist m3/det	Q10 Plan m3/det	Analysis

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Box Culvert Channels Babat Jerawat Builded	0,00013	0,013	7,60	3,50	26,60	14,60	1,82	1,3083	34,8013	5,8634	oke..!!
					that enter the Sememi Channel 40%				13,9205		
Primary Channel Dimensions	I channel	n	Channel Width	Channel Height	A	P	R	V	Q exist	Q10 Plan	Analysis
			m	m	m2	m		m/det	m3/det	m3/det	
Kali Kandangan Channel	0,0002	0,027	7,00	2,50	17,50	12,00	1,46	0,7401	12,9511	4,2293	oke..!!

Table 3. Total Debits Accumulated in Sememi Channels

Channel	Debit (Q)
Klakahrejo Channel	1,5950
Bandarrejo Channel	1,5232
Kandangan Channel	0,5898
Box Culvert Channels Babat Jerawat Builded	13,9205
Q Total	17,6285

Table 4. The accumulated amount of debit that was accommodated in the Kali Kandangan channel

Channel	Debit (Q)
Box Culvert Channels Gunungsari Diversion Sememi Side	17,6285
Bringin Channel	7,9935
Box Culvert Channels Manukan Builded	23,0241
Q Total	48,6462

(Source: Calculation Results)

Table 5. Analysis of channel capacity

Channel	Q Existing	Q In	Analysis
Box Culvert Channels Gunungsari Diversion Sememi Side	20,7725	17,6285	oke..!!
Natural Existing Channel Diversion Gunungsari	9,1611	17,6285	not oke..!!
Kali Kandangan Channel	12,9511	48,6462	Not oke..!!

(Source: Calculation Results)

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Table 6. Proposed calculation of dimensional change if normalization or further development is carried out.

Tertiary Channel Dimensions	I Channel	n	Channel Width m	Channel High m	A m2	P m	R	V m/det	Q Existing m3/det	Q2 Plan m3/det	Analysis
Klakahrejo Channel	0,0038	0,013	1,00	1,20	1,20	3,40	0,353	2,3682	2,8418	2,5644	oke..!!
Bandarrejo Channel	0,0012	0,013	1,20	1,50	1,80	4,20	0,429	1,5239	2,7431	2,2261	oke..!!
Kandangan Channel	0,0092	0,013	1,00	1,20	1,20	3,40	0,353	3,6788	4,4146	3,8605	oke..!!
Primary Channel Dimensions	I saluran	n	Effective Channel Width m	High Effective Channel m	A m2	P m	R	V m/det	Q Existing m3/det	Q In m3/det	Analysis
Kali Kandangan Channel	0,0002	0,027	11,00	4,50	49,50	20,00	2,48	1,0530	52,1218	48,6462	oke..!!

(Source: Calculation Results)

5. Conclusion And Suggestions

From the results of the analysis in this final project, it can be concluded that:

1. The cause of flooding in the Sememi area is the capacity of the existing natural Gunungsari Diversion Primary channel of 9.1611 m3 / second unable to accommodate the planned flood discharge of 9.7963 m3 / second plus the accumulation of the planned discharge of the tertiary channel of 3.7080 m3 / seconds leading to the primary channel of Gunungsari Diversion.
2. Flood control solution by constructing Box Culvert Diversi Gunungsari upstream Sememi to Kandangan outlet according to Q10 calculation of 20.7725 m3 / second is still able to accommodate flow from tertiary channels and part of Acne Bladder channels whose accumulation is 17.6285 m3 / second .

The operation of the Kandangan pump house on the existing long storage can be said to be sufficient for the current accumulated pump capacity of 9.75 m3 / second, but after the construction of the Sememi box culvert to Acne Babat and Manukan to Banjar Sugihan, the accumulated discharge is 48, The resulting 6462 m3 / s cannot be used up with the existing pump

Suggestions

To deal with the inundation that is working in the upstream area of Sememi and downstream of the Kandangan River, the following efforts should be made:

1. It is necessary to maintain and normalize the Kandangan river in order to obtain maximum capacity.
2. The construction of the Culvert Diversi Box with a large capacity and serves as a long storage for the Gunungsari Diversion before entering the Kandangan river.
3. Providing socialization to the community around the long storage flow so that they do not throw garbage into the river or the Culvert Box channel.
4. Construction of a village tertiary channel leading to the Sememi Channel, with concretization (u-ditch) so that a safe storage channel does not occur in the upstream area of the Sememi Channel.
5. Optimizing the operation and rejuvenation as well as increasing the capacity of the Kandangan pump in order to help reduce the discharge from the Diversi channel.
6. Developing Boezem upstream and downstream of the Kandangan river in order to obtain temporary storage that can reduce flood discharge in the upstream Kandangan river.

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Sustainable Climate Approach and in Context of Environment Economy: A Classical Analyze Matters.

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Abstract

In the worldwide world, the climate has become a scant asset. Since the economy is tied in with adapting to asset shortage, the climate and the economy are interconnected. Then again, it is additionally evident that the economy, which types both confident and negative outwardness, effects the environment. Hence, it is unconceivable to imagine handling ecological issues from the out of the economy. Today, there are some monetary movements, for example, increasing use reliant on spending middles, city reestablishment, fast public growth, and so on one method of tackling the economy is to assurance that the expenditures and compensations of natural events are adjusted. While it is hard to appraise the expenditures and rewards, there is a developing interest for this to occur before monetary movement. Monetary and usual goals are frequently seen as opposing. It is putative that a choice must be made amongst one and the additional, and this can't be talented concurrently. To alteration this discernment, certain actions must be occupied at both the community and international levels. Now, a real usual review is important consistently to assurance a green economy. In this investigation, we drive look at what has been complete on the earth as to the green economy. In this specific circumstance, we will take a gander at what we need to do in Turkey as far as enactment.

Keywords:
Climate, economy , environment, environmental economics ,Sustainable climate

1. Introduction:

1.1The connection between the economy and the climate

1.1.1. Ideas of financial matters and climate

The economy is a finished action that addresses human issues. However long the economy upholds these exercises, it should guarantee that the assets are utilized for limitless requirements. Since gentleman's supplies are boundless, however the work and crops that address those issues are in each circumstance scant and limited. Since the jumble amongst "supplies" and "produce benefits" that address these issues exists in shaped or young networks, industrialist or collectivist, this is known as the "rule of lack." And.pdf http://though the economy satisfies its fundamental capacity, which is to address human issues, it produces positive and negative externalities.

While the climate is a part that makes interest in the budget with its possessions, it is likewise the decency of outlines that are prejudiced by the negative outwardness of the reduced. In this manner, the cozy joining between the low-cost and the temperature prompts the budget dealing with the temperature, which has a limited basis.

As a rule, the climate is where human networks and different day to day routines sweat their lives and utilize regular assets. Distinctive ID for the climate resembles flows; The climate is the amount of physical, synthetic and social factors that straightforwardly or in a roundabout way influence human exercises and living things at some random time (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009)

Regardless context-oriented climate it is utilized in, the idea of climate for the most part underlines "being in the middle and being outside the middle." Therefore, the not really set in stone rather than a middle and in this sense; it is an "outer" wonder (ÖZET 2017)

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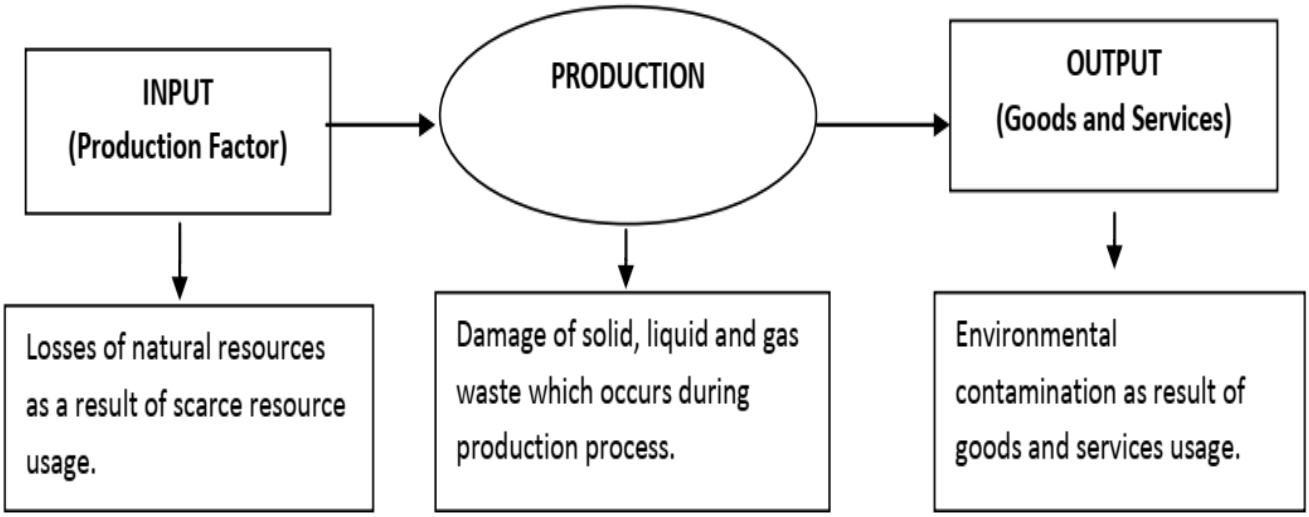


Figure 1: Business – Relationship of the regular habitat

Source by: (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009), Işletme-Doğals' Çevres' Ilişkilerinins' Mali Tablolars' Aracılığıyla Raporlanması ve Denetimi, SPK Yayınları,P.31

Though the climate is an apparent outside wonder impacted through the formation of the conception series – work and harvests – it is additionally an incredible idea that joins fabricating issues – efforts. In this wisdom, the environment gives input information to the family and is impacted thru the outer components ended by the budget. Today, the two administrations and states are examining the boundless regular assets that the microclimate stretches as a commitment to the budget. Accordingly, ecological expenses are as of now being ready to limit both deliberate requests and legitimate arrangements.

In this sense, the green economy can be characterized as; "A particular subsector of the economy where ecological issues are seen according to a financial viewpoint, a promise to the budget with the safety of the weather and even possessions and the way contamination is limited.

Nowadays, contrasted with the past, the green economy has gotten progressively critical to guarantee the nonstop movement of the economy, completed by scant assets, and furthermore because of the wide idea of the climate, which remembers both the effect for the economy with its variables of creation and on the outside components of the economy. So; as Al-Yor, VP of the United States and furthermore a natural subject matter expert, says, "the ancient contention that the climate and the budget are in struggle is truly obsolete."

1.2 The Antiquity of the Environmental Economics

There are contrasts amid customary financial aspects and neoclassical ways to deal with financial aspects of natural issues. While in traditional financial aspects amount was thought of, in neoclassical financial aspects quality was additionally considered. As indicated by traditional market analysts like J.B. Say and Adam Smith, normal possessions are depicted as free products and are disallowed from monetary inspection. A. Pigu, a neoclassical business analyst, brought a natural idea into monetary investigation and along these lines established the framework for ecological financial matters.

A. Marshall is the main name that adds to the financial investigation of ecological issues. As per Marshall, market failures are at the foundation of the defilement. Also, Keynes, who was quite possibly the main financial experts in his last term, has made a stage for conversation right up 'til the present time about the outer elements of contamination that are or alternately are not addressed by market components (Yıldırım U.; Marin M. C. 2004)

2. Natural Environmental Issues

The natural expenses of the economy make ecological issues. There are excessively close and two-sided relations concerning monetary turn of proceedings and environmental issues. Fiscal progress is an aim, and biological issues are expected for its decision. The ecological issue normally incorporates every one of the disservices experienced in natural qualities (water, air, soil, and so on) because of human exercises. In this unique situation, the primary issue that rings a bell is a "contamination issue" (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009)

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Contamination is a debasement that harms the normal soundness of the climate and addresses catastrophic starts to live things since of filthy air, grimy aquatic and disordered waste transported about by the formation cycle to address human issues (ÖZET 2017)

There have been significant changes in the regular symmetry of setting and earth progression since of the use of fuel offshoots delivered into the air by ozone harming substances of the Industrial Revolution. So; "A dangerous atmospheric deviation" is another huge ecological issue that is the normal consequence of monetary exercises that discover an advertisement as a worldwide impression and are branded as "in the growth of normal fevers in the nations, loads and air noticed reliably".

2.1. The Real Draw Backs of Environmental Pollutions

Contamination is the idea of the natural issue. Albeit the reasons for contamination are presented to such countless variables, three primary titles are; Development and Mechanization Yrd.Doç.Dr.Murat ESMERAY and TANÇ (2009). Fact be told, these 3 fundamental titles have an association with one additional on a circumstances and logical results premise. For instance, expanding tension on the populace prompts unlawful movement and, in this unique circumstance, to city growth, so industrial development occurs to assurance monetary dynamism.

Nowadays, quick populace growth and since of development and the related urbanite alteration and development have expanded the environmental expenses of the budget. Exactly, with the explanations behind such municipal change projects and an alteration in client located practices, like spending middles, it was in development without the arrival of development structures, so ecological harm expanded at a similar degree or at the most elevated rate. It is likewise dicey that's the promise of these growths to the budget, aside from their ecological damage. Maybe probably the best illustration of this is; the enormous arenas worked for the 2014 FIFA World Cup in Brazil. It has been censured for its "utilization and delivery" the executives. In accordance with the development business in 2014, the Athens Olympics turned into a monetary downturn for Greece and its ecological harm.

2.2. Ways to Deal with taking Care of Environmental Issues

2.2.1. Public Methodologies

The industrialized nations have effectively finished the course of industrialization, while the non-industrial nations have picked the way of industrialization prior to completing a course of change from horticulture to manufacturing. Accordingly, this rapid and unrestrained mechanization has honest disapproving influences on the environment. together industrialized and agricultural nations, the economy is applying natural pressing factors, so lately the idea of climate has given need among the issues.

The best way to deal with tackling environmental issues is to position of these mechanisms that are causing the subject. This choice is everything except "reasonable"; it's essentially "revolutionary." Rational arrangements can be taken care of as; Sustainable turn of events, money saving advantage investigation, natural effect appraisal and different methodologies (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009).

2.2.2. Feasible Development - Sustainability

The economy is at the core of "feasible turn of events" to dispose of the adverse consequence happening the climate. It is feasible to brand the depiction of "Economic Growth" as shadows; The arrangement of the present lifetime and the advancement of things to come through the foundation of a harmony among man and nature without hazard of harm to normal assets and the cognizant shielding of the utilization of assets. also, there is a wide agreement that's this implies that's monetary exercises must follow: the reasonable utilization of sustainable normal assets, the insurance of biological system qualities and capacities, preservation of organic variety, objective of contamination emanations underneath basic (digestion) limits and anticipation of irreversible harm to the climate and nature.

Supportability works both to limit the deficiency of ecological harm to the economy and to reuse that misfortune back into the economy. In this sense, nature-accommodating assembling innovations and the accessibility of proficient and useful advances will be required. In this way, the utilization of environmentally friendly power bases has become important in the regular part of the formation series to enhance to "natural maintainability".

Perhaps the best perfect has been Sverige in that the weather is being brought once more into the economy in the space of maintainable turn of events. Sweden's top of all nations for reusing, sun-oriented energy and significantly more economical practices and one nation keeps up with quite a bit of its requirement for warming from trash, begun bringing in squander from this is closest neighbor Norway. Truth be told, there are around eighty thousand tons of left-over smuggled from Norway.

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In this intelligence, manageability is the idea that basically should be applied step by step to make a loop in the economy and stop the dynamic fixing of the climate. We additionally guarantee feasible turn of events, while our current circumstance can be switched. The natural financial aspects more on account of the ecological cognizance, the objective creates; "... to secure, to push ahead and to utilize it over and over

2.2.2. Money Saving Advantage Examination

Money saving advantage examination is a genuinely very much evolved technique for deciding the net return of the undertaking throughout a given timeframe. the lone change required is the consideration of ecological expenses or advantages. (Duta.m 2003)

To utilize money saving advantage investigation as a natural arrangement, the effects of the venture on the climate ought to be utilized as information. At the end of the day, it should be determined as a proportion by something the profit from cash and a beneficial outcome on the speculation, and as a denominator, thusly, by adding the outpourings and adverse consequences of the venture by the speculations made, and afterward concurring that the relationship to the denominator is the "money saving advantage proportion". By utilizing this proportion, both harmless to the ecosystem ventures and issues at the arranging stage can be kept away from.

Although cash surges (costs) can be determined somewhat comparable to natural harm, incomes can't be determined as far as sure effect on the climate. This makes the relevance of the methodology very troublesome (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009).

Notwithstanding its known constraints, advantage and-cost investigation can be a vital method to reliably acclimatize heterogeneous data that is viable with acceptable dynamic. Whenever done right, it tends to be of extraordinary advantage to authorities as they attempt to lay out ecological objectives and goals.

2.3. Natural Effect Appraisal

The climate should be given a lawful reason for decreasing the pressing factor applied on it by industrialization. To increment both the financial advancement of nations and the nature of the climate, the "Ecological Impact Assessment" is a global idea that has discovered a spot.

An ecological effect appraisal is a methodology that dissects the impacts of a movement where it has an immediate or aberrant, positive or adverse consequence on the climate during its lively stage. It is moreover a way to contract with differentiate voting minimization arrangements that can be produced using the unfriendly impacts of the act. The report, recognized as the natural effect evaluation (EIA) approach, ought to be ready prior to settling on venture choices to forestall and recognize the possible ecological effect of the speculation. This is designated; "Natural Influence Valuation Account" or just as an EIA's account (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009).

Although the way to deal with natural effect evaluation is like the other way to deal with taking care of ecological issues – the money saving advantage examination – in the direction of the positive and negative parts of natural speculations, it is a more complete methodology. Since it isn't compulsory with this way to deal with utilize the number for all information, it is additionally simpler to utilize (Yrd.Doç.Dr.Murat ESMERAY and TANÇ 2009).

2.4. Environmental Law

With this, the ubiquity of natural law has additionally kept on expanding under current conditions. The assurance and improvement of the climate, the foundation of rules, both to forestall contamination and to make up for harm, to make assets for this load of guidelines and to suggest sanctions, remain all inside the extent natural law.

2.5. Government Strategy

Contamination brought about by the bad outwardness of a budget can be addressed in a well-working evaluating outline. On the off accidental that a valuing outline is presented, cleaner innovations will be advanced, and the expenses of contamination will be genuinely conveyed.

However, even a well-working business sector framework can stay lethargic to decrease contamination. For reasons unknown, the assignment of the public economy as an answer for forestall contamination, which has the option to utilize monetary arrangement instruments and approaches, for example, charges and additionally endowments, is starting to fall.

2.6. Worldwide Regulations

It is unavoidable to work for nations that tackle natural issues. Be that as it may, the work done all throughout the planet requires nearer participation between the gatherings and would, obviously, be seriously animating. This worldwide collaboration in the field of ecological insurance has been brought out through twofold or multilateral shows on global natural law.

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In such manner, the main worldwide natural approach was presented as UNEP, trailed by a United Nations meeting in Stockholm in 1972.

Notwithstanding the Kyoto Protocol of 1997, a solitary structure for fighting an Earth-wide temperature boost and environmental change, which are one of the serious issues within recent memory, is likewise a significant worldwide ecological guideline.

All the while, which starts with UNEP and proceeds under the Kyoto Protocol, some significant arrangement alternatives have been distinguished, including lessening petroleum product utilization, creating environmentally friendly control bases to assurance the essential vigor and the effective use of liveliness. The consumption of new advances, and advances specifically, has-been additional plan choice to help states that have not yet over development events (Yıldırım U.; Marin M. C. 2004)

3. Commitment to the Natural Appraisal of the Environmental Economics

Record should likewise be taken of natural checking, which will add to the green economy. The fundamental component of ecological observing centers, obviously, on natural issues and means to work on the climate, which is both the current public assistance and the most significant of things to come for the entirety of mankind and guarantees practical use.

Starting here of view, the outer review part for the country, the Court of Auditors, has significant undertakings to act in surveying the utilization of a public source.

3.1. Sorts of Natural Reviews

Since it is realized that the administration of the arrangement of ecological issues was standard, which can be given both in public and worldwide laws and arrangements – Court of Auditors inside the structure of the assistance "Lawfulness Audit" for natural insurance and advancement. In this regard, the Court of Auditors can seek after consistence with global natural laws and deals as a community basis.

If the use of environmental possessions (air, aquatic, earth, and so on) and their effect on use are appropriately recorded, a "monetary review" on natural issues may likewise be conceivable.

With the "execution review" way, this is done through observing in natural projects, the ecological effect of different projects, ecological administration frameworks as well as ecological security arrangements. This has led to another idea called "4 E", which likewise incorporates cost-adequacy, effectiveness, proficiency and the climate as the reason for the "execution review".

Conclusion

Financial matters and climate were viewed as two unique ideas that supplant a similar level in trouble. It is putative that a choice must be made amongst one and the additional, and this can't be talented concurrently. Yet, the significance of public and worldwide work to change this methodology is developing.

In this sense, security should be made, in view of economies dependent on the ecological field, both at public and worldwide level. Furthermore, financial approaches should be produced that don't think about ecological issues as a characteristic outcome of monetary exercises and that consider the climate and its worth.

Positive two-sided relations between the economy and the climate can be guaranteed through manageable turn of events. It should in this manner target naturally strong economies: eco-impacts. Therefore, clean, nature-accommodating innovations are liked, and in case toxins are yet present, they should be reused.

Additional highlight brand well known naturally practical economies (eco financial matters) is that; Economists and preservationists. Just financial specialists and preservationists cooperating can expand on their future today (Yıldırım U.; Marin M. C. 2004)

Notwithstanding the manageable advancement approach, the money saving advantage investigation approach ought to be utilized to foster a compelling natural arrangement dependent on the negative externalities of financial exercises.

Be that as it may, while populace development influences urbanization and industrialization, just as nations' monetary and ecological issues, it additionally causes an increment in worldwide natural issues. Hence, it is; Perhaps the strategy of populace control ought to develop all throughout the planet to act as an illustration of the present China. As per Violence; The biosphere is relied upon to consume more than nine million individuals by 2085, and quite a bit of this development comes from agricultural nations in Africa. So; Geer contends that "fruitfulness the board" is expected to address a scope of worldwide improvement issues, including environment activity.

Likewise, ecological harm is brought about by urbanization and designs brought about by the normal result of populace development and inside relocation. Hence, to diminish the effect of ecological harm, a sound and adjusted urbanization strategy should be set up, and this arrangement should be carried out by guaranteeing

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maintainability. The entire of the upcoming, nationals, existing creatures and the temperature should be careful (AKYEL R. 2013)

One of the primary details that lead to environmental subjects is that proficiency isn't given the meaning happening and utilization movements, fair as in the allotment of assets and the utilization of advancements. Innovation in this manner assists non-industrial nations with zeroing in on a proposed arrangement.

Ecological observing must likewise be viewed as a successful device for tackling natural issues and in this manner requires the collaboration of more than one of the gatherings under the watchful eye of the Law court of Auditors

Moreover, the significance of carrying out a data and moderate natural arrangement is verifiable. While natural guidelines make an optimistic commitment to the budget by making new commercial rates, they can likewise be an impetus for nations to guarantee communication between the economy and the climate. What's more, once more, says Al-Eur; "We can work on our economy and make a huge number of good new positions in the event that we foster new innovations that can assist us with tidying up the climate

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Influence of Waste Marble Powder and Waste Granite Powder on the Mechanical and Durability Performance of Concrete

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ABSTRACT

Industries produces large amount of marble and granite waste powder. These wastes are of two types, one of them is wet form which is impure form because it mixes with soil. And the other one is in powder form which is the pure form of marble waste and granite waste. These wastes are dumped in to the open land which cause serious environmental issues such as land problem, water problem and other deterioration. We can use these wastes to overcome environmental issues. Moreover, we can use these wastes in concrete to reduce construction economy. Waste marble powder, when we use in concrete, gives us good result in mechanical and durability characteristic of concrete. We used marble powder and granite powder with limited replacement of cement at 0%, 5%, 10% to check the performance of concrete in its mechanical and durability characteristics. This thesis describes a detailed experimental study on concrete's tensile strength and compressive strength and concrete water absorption. Better outcomes were obtained at 5-10% replacement of cement with these wastes. Concrete's durability and mechanical characteristics were improved by increasing waste granite with limited replacing of cement up to 10%. Determined Results show that a little content of marble dust and waste granite powder with limited replacement of cement will lower construction economy, reduce the cement quantity and gives better results in compressive strength

Keywords:
Compressive Strength , Marble dust , Split Tensile Strength, Water Absorption, Waste Granite powder

1. Introduction

1.1. Background Study

All over the world most used material in construction industries are concrete. Concrete is mostly used and its target is strong and durable structure. For low-cost concrete manufacturing, it will be long lasting and defendable Jain, Sancheti, and Gupta (2020). It has been recorded that several waste marble powders are generated during quarrying process. If we use the marble dust and granite dust in concrete to better its characteristics also, we can reduce environmental pollution like water pollution sand pollution etc. Marble dust can use in the limited replacing with cement V. M. Sounthararajan and A. Sivakumar (2013). Marble dust with limited replacing of cement show result of concrete mechanical characteristics, determined that up to 75% are helpful for concrete and satisfy for production of concrete.

Marble Powder is used for beautiful lock and also some marble fill work in construction and it provides pleasant looks to building so it is almost everywhere used so its powder can be easily found. 10% marble with limited replacing of cement with most suitable with all durable and mechanical properties. Chemically, Marbles are crystalline rocks composed predominately of calcite, dolomite or serpentine minerals P. V. G. Pathan and P. M. G. Pathan (2014). We mix marble powder with cement or synthetic resins to make counters, building stones, sculptures, floors and many other things fir building's decoration. The concrete containing Diatomite to 5% show only 3% increase in strength compared with the controlled sample while for the same percentage the compressive strength was increased up to 26% after 28 days S. U. Khaliq, K. Shahzada, B. Alam, F. Bilal, M. Zeb, and F. Akbar (2016). Some things were noticed if marble powder was added with partial replacement of cement, it did not affect the final setting time of concrete. We replace marble powder with partial replacement of cement for making high strength, the coarse and fine aggregate particles themselves must be strong, which are the main important constituents in concrete Williams .C, P, and Kala .T (2008) Soomro et al. (2021). Adding marble powder with partial replacement of cement to concrete is reduce shrinkage, and low-cost concrete Vijayalakshmi, Sekar, and Ganesh prabhu (2013).

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2. Research Methodology

Particle size base on ASTM C136 for fine and coarse aggregate, specific gravity for fine and coarse aggregate (SSD base), water absorption for coarse and fine aggregates and moisture content for both aggregates. Mix design for M-15 were prepared. ACI211.1-91 used for preparing of mix design. After preparation of mix design, M-15 concrete were made with desired quantity of cement with limited replacing of marble and granite powder, fine, coarse aggregate, and water for nine cubes of 150x150x150 mm3 for nine types mixes for 7, 14 and 28 days for concrete compressive strength were obtained. Same as for cylinder for tensile strength, M-15 concrete were made with desired quantity of cement with limited replacing of marble and granite powder, fine, coarse aggregate, and water for nine cubes of 150x300 mm3 for nine types mixes for 7, 14 and 28 days for concrete tensile strength were obtained. For water absorption, we put out our samples from water and measure its wet weight and put our sample in oven for 24 hours and measure its dry weight for calculate the water absorption. The cubes water samples divided into two parts for curing purposes. Cube Sample "A" were cured in fresh water and Cube sample "B" were cured in salt water Two curing tanks were prepared for salt water. These tanks contain 10g sodium chloride per liter water and one tank for fresh water. After preparing our curing tank we demolded our samples and place in the fresh water and NaCl solution. Lastly, each cube was test using Universal Testing Machine (UTM) at curing time and compressive strength were recorded. Same as tensile strength, each cylinder was test using Universal Testing Machine (UTM) at curing time and tensile strength were recorded.

2.1. Mix Design

It is ingredients of proportion that produce workable concrete and it is suitable for durability and mechanical property of concrete at suitable cost. Concrete Quality: Concrete mix design are very useful to gain good strength, durable concrete, similar and impermeable structures deciding related ingredients proportions of concrete keep in mind fresh concrete are achievable. Cement Economy Utilization: High rate of cement design mix to secure cement amount and lower cement contentment and give results in low hydration heat and also gives low shrinkage cracks.

2.2. Sieve Analysis

In Pakistan construction industry, the method used for analysis of sieve and lab tests ASTM and BS and many more, we used these methods for distribution of aggregates.

2.3. Fine and Coarse Aggregate sieve analysis

Fine aggregates analysis for were determined by ASTM C136.

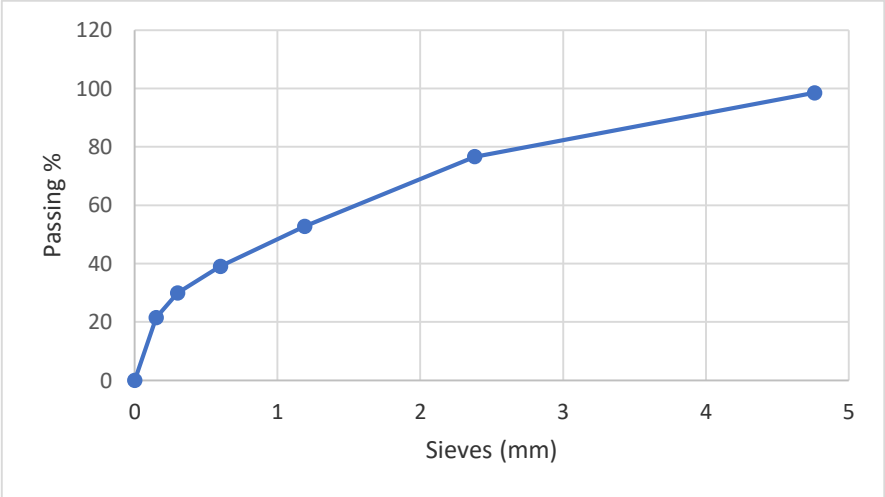


Figure 1. Fine Aggregate Sieve Analysis

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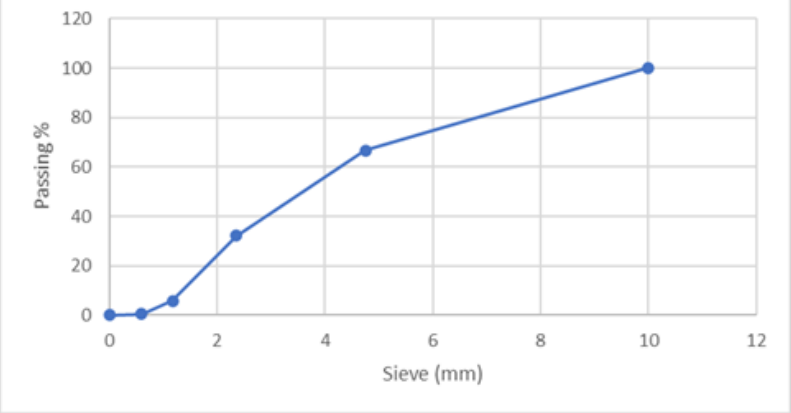


Figure 2. Coarse Aggregate Sieve analysis

2.4. Properties of Cement

The cement used in these experiments are (OPC) 53 Grade. Cement Soundness (IS: 4031) are 4mm (L2 = 12, L1 = 8). Consistency of Cement (ASTM C 187-98) are 30.9%. The initial setting time were recorded are 92 minutes and the last setting time were recorded are 214 min.

Table 1 Properties of Cement

Specific gravity of Fine Aggregate	2.62
Specific gravity of Coarse Aggregate	2.58
Water Absorption of Fine Aggregate	0.80
Water Absorption of Coarse Aggregate	4.406
Moisture Content of Fine aggregate	6.45
Moisture Content of Coarse aggregate	1.26

Table 2 Replacement levels

Sr. No	Replacement (%)	
	GP	MP
1	0	0
2	0	5
3	0	10
4	5	0
5	10	0
6	5	5
7	5	10
8	10	5
9	10	10

2.5. Quantity of NaCl (sodium chloride) Used for curing purpose

Concrete cubes mixes using in clean water also rehabilitate by use of clean water also concrete cube mixes by using salt water and cured in salt water. The quantity of salt for one liter of water are usual for mixing and curing purpose. We use 62.5 liters of water for curing in salt water. So, the quantity of salt used for curing for one sample is 69.44 g.

Table 3 Quality of NaCl used for curing purpose

Concentration of NaCl salt (g/L)	Amount of salt used for curing (g)
0	0
10	625

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3. Results and Discussion

3.1. Results

3.2. Results for Compressive Strength BS 4550-3.4:1978

The results for concrete compressive strength in addition of granite powder and marble dust with limited replacing of cement. Tables and graph are shown.

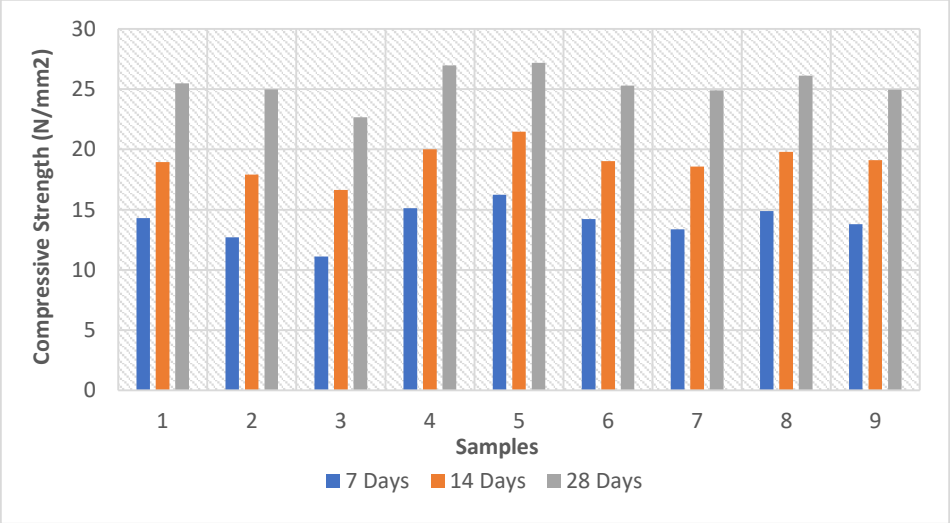


Figure 5. Results of Compressive Strength

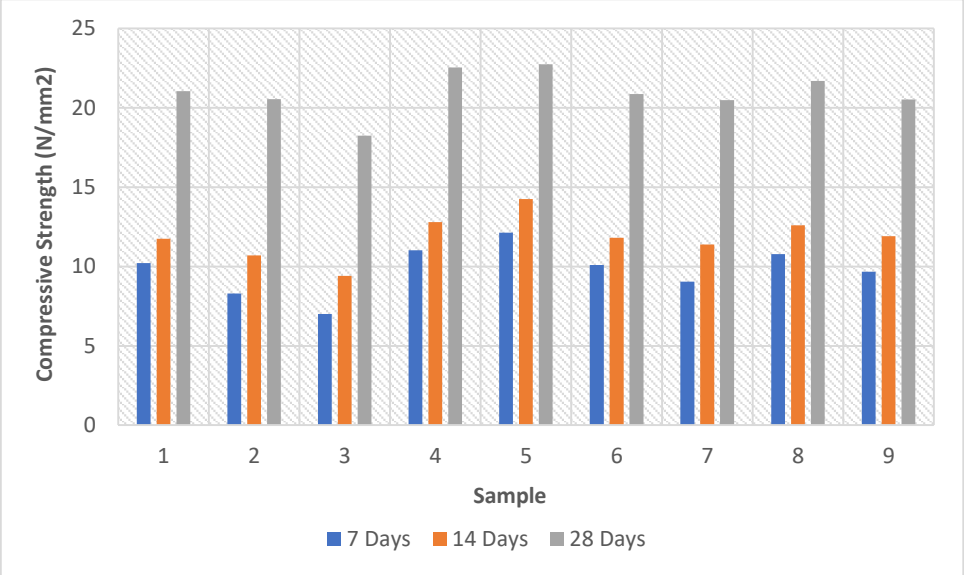
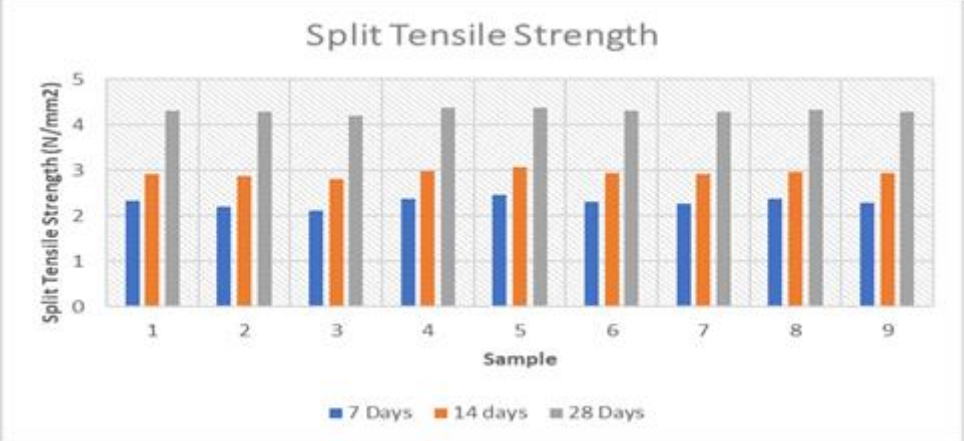


Figure 6. Results of Compressive Strength cured in NaCl Solution



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Figure 7 Results for Split Tensile Strength

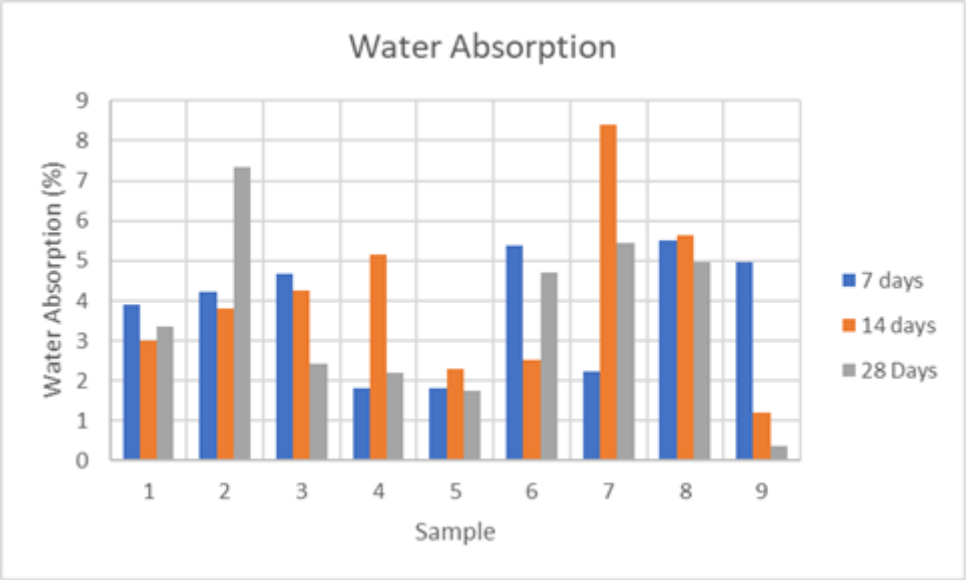


Figure 8 Results for Water Absorption

3.3. Conclusion & Recommendations

Researchers have investigated the ideas on effect of the waste granite dust and waste marble dust with partial replacement of cement on concrete's compressive strength, concrete's compressive strength cure in NaCl solution, split tensile strength and water absorption of concrete. This research was conducted with different partial replacement of cement with waste granite dust and waste marble dust (0%GP 0%MP), (0%GP 5%MP), (0%GP 10%MP), (5%GP 0%MP), (10%GP 0%MP), (5%GP 5%MP), (5%GP 10%MP), (10%GP 5%MP), (10%GP 10%MP) and samples which were cured in NaCl solution at NaCl concentration 10 gram per litre. Concrete cubes were tested at 7, 14 and 28 days. The following conclusions are determined:

i. The concrete compressive strength which was cured in fresh water is higher than those samples which were cure in salt water.
j. Also, the concrete tensile strength with partial replacement of cement with granite dust 5% and 10% are higher than the other partial replacement of cement with marble dust and mixes of granite dust and marble dust at 7, 14 and 28 days.
k. The concrete compressive strength with replacement of cement with granite dust and waste marble dust (5% GP 0%MP), (10%GP 0%MP), (10%GP 5%MP%) gives high compressive strength than the simple concrete and the other partial replacement with granite dust and marble dust at 7, 14 and 28 days.
l. At water absorption test partial replacement with granite dust at 5% and 10% gives low water absorption than ither partial replacement with cement at 7 days. So, similarly at 14 days, partial replacement with granite dust and marble dust (10% GP 0%MP) and (10%GP 10%MP) gives low water absorption than the other partial replacement with cement. Similarly at 28 days, partial replacement of cement with granite dust and marble dust (5%GP 0%MP), (10%GP 0%MP) and (10%GP 10%MP) gives very low water absorption than the others partial replacement of cement.
m. The salt water reduces the concrete strength because salt water has chlorides and sulphates.

3.4. Acknowledgment

Our primary thanks to Allah (subhanahuwata'ala) for health and energy, for giving us fortitude and perseverance, and for beautifying our lives with supportive colleagues throughout our time as bachelor students. We are glad Allah gave us means to recognize his presence in our lives and implement his final guidance. Our humble thanks to our parents for every imaginable kind of support and prayers. They supported us and took care of us through thick and continued to support us throughout in every part of our life. No words of us are enough to show our gratitude to them. We wished to express our deepest gratitude to our supervisor Engineer Shafi Ullah for his constructive criticism, support, and patience through thick and thin times in crafting this report. In the end we would like to thank all the individuals who provided emotional support and invaluable assistance during the study.

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