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Reducing Construction Cost of Fuel Tank Cap. 3000 KL Concrete Foundation using *Concrete Admixture Cane & Carrot Option* (*Molasses & Daucus Carota*)

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Abstract

Infrastructure Management & Project is an investment implementation function based on the budget written in RKAP of each period. The investments carried out are spread in each work location from Sabang to Merauke Island of Indonesia. Based on the pareto diagram analysis, the main cause for the high construction cost of Fuel tank was the High Construction Cost of Fuel Tank Foundation. To overcome this problem, Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) is determined as alternative solution of Common Concrete Foundation. By applying this alternative solution, the Quality of Fuel Tank Cap. 3000 KL Concrete Foundation increased by 51,3% (K-300 equivalen 24,9 Mpa to K-450 equivalen 37,674 Mpa) Compressive Strength. Concrete Admixture Cane & Carrot Option can Reducing Construction Cost 5,54% too. In addition, the acceleration of the work of Construction of Fuel Tank Cap. 3000 KL Concrete Foundation is as much as 21 Calendar Days.
This innovation has been endorsed by an external party, PT Surveyor Indonesia, PT. Sucofindo and Institut Teknologi Bandung. Replication has been carried out for the Pier III Construction Project in Fuel Terminal Baubau.

Keywords: Fuel Tank Concrete Foundation, Construction Cost, Concrete Admixtures, Molasses, Daucus Carota

Introduction

Referring to the Key Performance Indicator (KPI) of Infrastructure Management & Project, investment realization (finance) and investment realization (physical) are the cascading KPIs with the most dominant weights. In fulfilling the target realization, the obstacles often arise due to various problems. The pareto analysis is shown in Fig. 1. below.

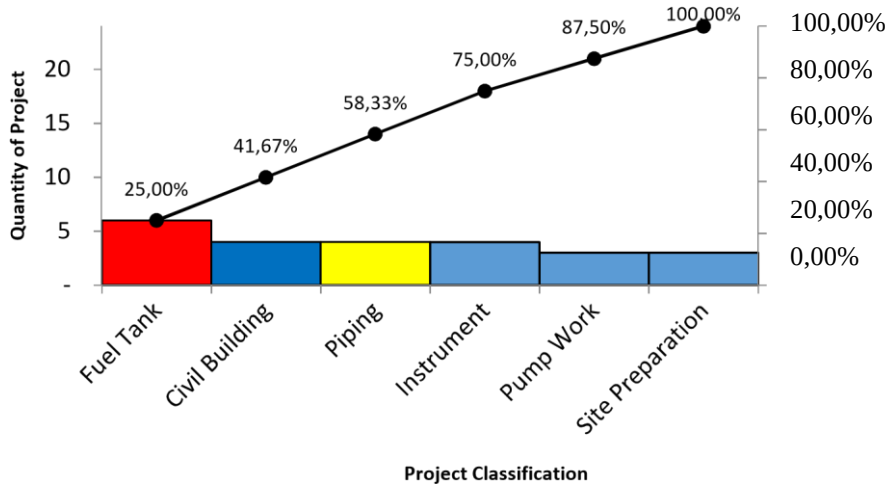
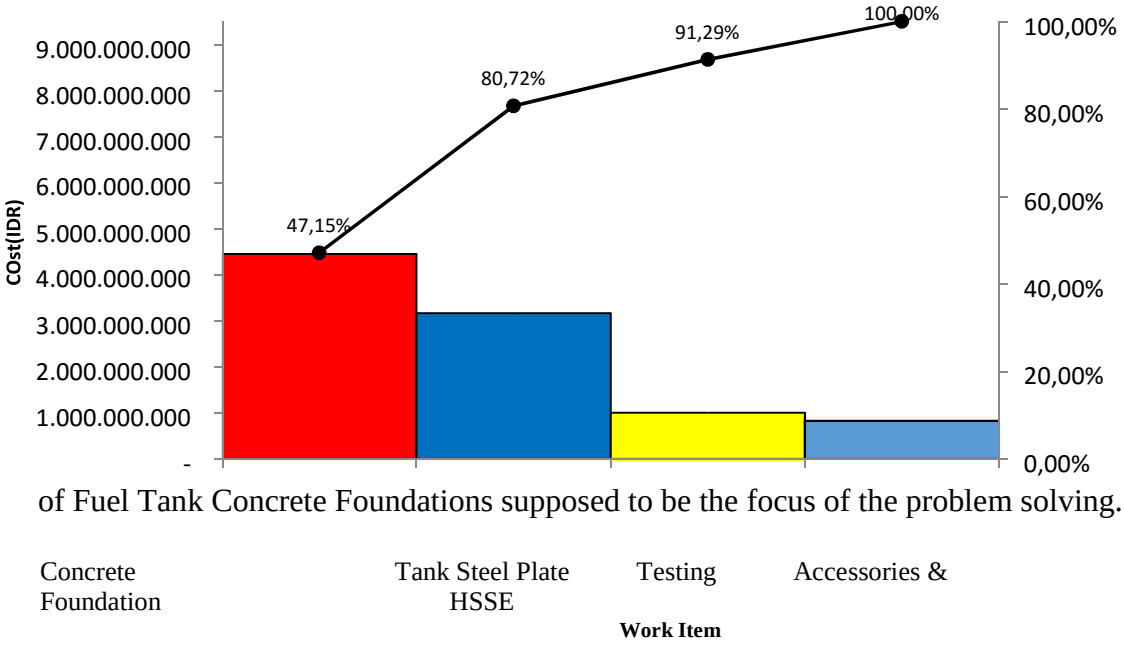


Fig. 1. Pareto for Project Cost

The problem that has the most significant financial impact, namely the "Buildup of Fuel Tank" project with a financial impact of IDR 9.438.396.910. In the construction phase, the Construction Cost of Fuel Tank Concrete Foundations are determined as the main focus of the research due to its status as critical path project. The Construction Cost of Fuel Tank Concrete Foundations made the highest cost of IDR 4.450.366.354. By doing so, the Construction Cost



of Fuel Tank Concrete Foundations supposed to be the focus of the problem solving.

Fig. 2. Pareto for the Construction Cost of Fuel Tank Concrete Foundations

Followed by using cause and effect analysis, there are 4 (four) potential root cause which are: There Aren't Additive Subtitute Material (A); High Cost of Batching Plant (B); High Cost of

Manpower (C). and High Cost of Material as Per SNI (Standard Nasional Indonesia) (D). According (Fig. 3), point A has the highest value to be the root cause.

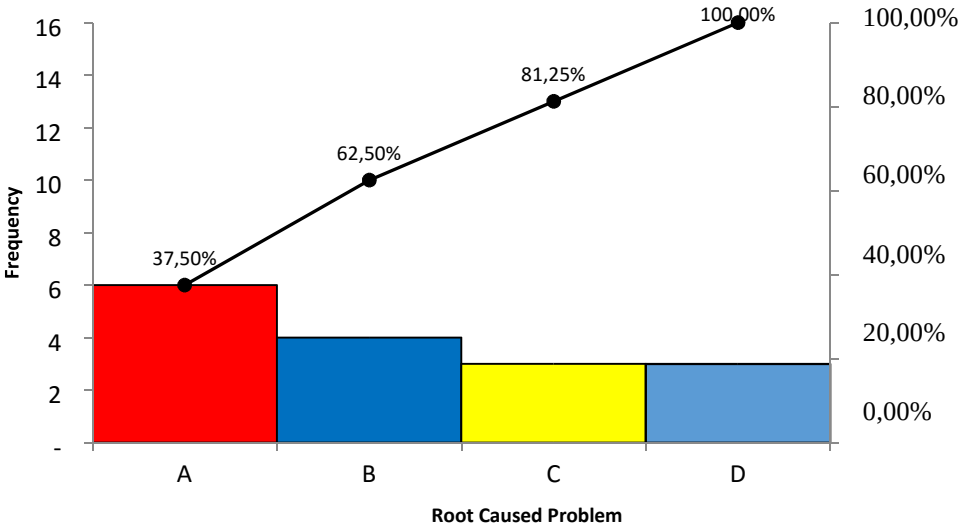


Fig. 3. Pareto for Root Cause

Analysis

With the The High Construction Cost of Fuel Tank Concrete Foundations Problem, we have 3 (three) alternative solution that can reduce High Construction Cost. The choosing of alternative solution can be seen in Table 1. Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) is chosen due to Low Effort High Impact of Implementation.

Table 1. Choosing an Alternative Solution

Root Cause	Alternative Solutions	Cost Estimate	Duration Implementation	Low Effort High Impact	Chosen Solution
The High Construction Cost of Fuel Tank Concrete Foundations	Using Commercial Chemical Additive	High	Fast	Low Effort High Impact	Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota)
	Using Higher Quality of Fuel Tank Concrete Foundations	Low	Slow	High Effort Low Impact	
	Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota)	Medium	Medium	Low Effort High Impact	

Before this research conducted, the implementation of Fuel Tank Concrete Foundations Pertamina always uses conventional Concrete Foundation Refer as per SNI (Standard National Indonesia). The first use of Concrete Admixture Cane & Carrot Option (Molasses & Daucus

Carota) was carried out in the Infrastructure Management and Project in Pertamina because it cannot be found on the KOMET portal for similar innovations. In addition, the uniqueness of Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) are utilizing local raw materials and contributing to the utilization of micro enterprises in the area and also Daucus Carota and Molasses waste is a natural and environmentally friendly material that is abundant in Indonesia so it has a replicability value.

Trial and Error System

Trial and error obtanied after we conduct sample test as shown in table 2. Test conducted in Balai Besar Bahan dan Barang Teknik (B4T) Kementrian perindustrian Republik Indonesia, Bandung.

Table 2. Test Result of Sample

Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota)		Compressive Strength (Mpa)
A (% Mass compare with cement)	B (kg)	
0,03	0,5	31,92
0,1	0,5	37,75
0,3	0,5	37,75
0,5	0,5	26,09

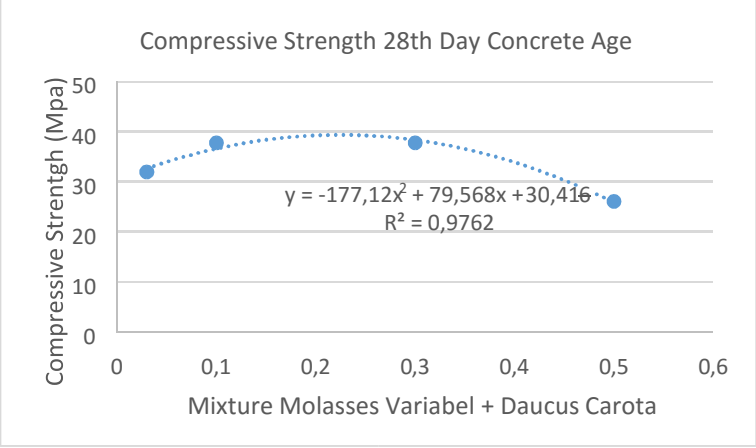


Fig. 4. Trendline Compressive Strength 28th Concrete Age

As per table 2 and fig. 4 shown that optimal compressive strength can be obtained from formula:

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= 0,22

Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) have an optimum Compressive Strength in 28th days age of concrete with composition 0,22 % mass molasses base on mass cement and 0,5 kg/m3 base on volume concrete.

From the trial and error results obtained on the Table 3, Trial 3 process is the most effective process for making Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota).

Table 3. Trial and Error Admixture Cane

No.	Trial & Error	Trial 1	Trial 2	Trial 3
1	Storage Method	Glass Bottle (Difficulty in storage handling, Expensive)	Anaerob Plastic Sealed (Easy leakaged, difficulty in storaging handling)	Plastic Bottle, (Effective)
2	Brix Pol	<80,75% (less effective)	>87,2% Expensive	80,75%-87,2% (effective)
3	Spesific Gravity	<1,4275 Hard to found in market	>1,4275 Expensive	1,4275 Optimal
4	Dosage in Concrete Mixture Design	0,1% mass of cement in concrete (less effective)	0,3% mass of cement in concrete (less effective)	0,22% mass of cement in concrete (effective)

Table 4. Trial and Error Admixture Carrot

No.	Trial & Error	Trial 1	Trial 2	Trial 3
1	Storage Method	Dry waste (decreasing compressive strength)	Liquid waste (fast decaying)	Pollen form (successful, easy to store, last longer, anaerob)
2	Processing Method	Manual Miling (takes longer and exhausting)	Small milling (takes longer)	Large milling (effective)
3	Drying Temperature	ambient temperature (slow dry)	100 ^{0}C (broken nano fiber)	75-80 ^{0}C (effective)
4	Dosage in Concrete Mixture Design	<5 gr/m3 as per Concrete Volume (less effective)	>5 gr/m3 as per Concrete Volume (less effective)	5 gr/m3 (effective)

Result and Discussion

Data after implementation shown in Table 5. is based on the News on the Field of Fuel Tank Cap. 3000 KL Concrete Foundations on Fuel Terminal New Tegal.

Table 5. Before After Implementation Comparison Root Caused Problem

Root Cause		Rank	Existing			After the Implementation		
			Frequency	%	% Cum	Sum	%	% Cum
A	There are no Additive Subtitute Material	**1**	**6**	37,50%	37,50%	**0**	**0**	**0**
B	High Cost of Batching Plant	**2**	**4**	25,00%	62,50%	4	57,14%	57,14%
C	High Cost of Manpower	**3**	**3**	18,75%	81,25%	0	0	57,14%
D	High Cost of Material as Per SNI (Standard Nasional Indonesia)	**4**	**3**	18,75%	100,00%	3	42,86%	**100%**
Total			**3,7495**	**100%**		**7**	**100%**	

Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) can solve root caused problem A (There are no Additive Subtitute Material) & B (High Cost of Manpower). In the other hand, it can't solve root caused B (High Cost of Batching Plant Concrete) and (D) High Cost of Material as per SNI because at commercial stage, it take more effort to bring innovation to that mass production and changed SNI.

Data after implementation for Quality of Fuel Tank Cap. 3000 KL Concrete Foundations on Fuel Terminal New Tegal shown in Table 6.

Table 6. Quality of Fuel Tank Cap. 3000 KL Concrete Foundations

Quality of Concrete (project design) kg/cm2		Concrete Mixture SNI 7394-2008 (kg)				Cacaroto (kg)		Result (kg/cm2)			
		Portland Cement	Sand	Gravel	Water	A	B	Day 7th	Day 14th	Day 21th	Day 28th
Batch 1	300	413	681	1021	215	0,22	0,50	307,71	349,40	376,3855	454,8193
Batch 2	300	413	681	1021	215	0,22	0,50	305,30	347,83	388,4337	456,0241
Batch 3	300	413	681	1021	215	0,22	0,50	295,66	371,93	392,0482	456,6265
Batch 4	300	413	681	1021	215	0,22	0,50	302,53	337,35	376,3855	445,6627
Batch 5	300	413	681	1021	215	0,22	0,50	312,05	343,98	400,4819	456,3855
Average	300										453,9036

Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) can increase Quality (Compressive Strength) Fuel Tank Cap. 3000 KL Concrete Foundations on Fuel Terminal New Tegal from 275 kg/cm^2 to 454 kg/cm^2 equivalent to 51,3%.

As per table 6 shown that Quality of Concrete in project design achieved in day 7th. It means in 7th day foundation of fuel tank could be loaded by steel fuel tank plates. Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) can accelerate project 21 Calender days compared with conventional Concrete that in days 28 could be loaded by steel fuel tank plates.

Data after implementation for Construction Cost of Fuel Tank Cap. 3000 KL Concrete Foundations on Fuel Terminal New Tegal shown in Table 7.

Table 7. Construction Cost of Fuel Tank Cap. 3000 KL Concrete Foundations

Concrete Type	Cost (IDR) / m3	Efficiency
K-300 + Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota)	1.169.257	5,54%
Beton K-450	1.234.059	

As per table 6 shown that Construction Cost of Fuel Tank Cap. 3000 KL Concrete Foundations on Fuel Terminal New Tegal can be reduced 5,54%.

Summary

Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) can be used as an alternative to Conventional Concrete because they achieve the Quality Cost & Delivery targets as targeted in this innovation. The results showed that:

1. Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) were considered able to reduce Construction Cost of Fuel Tank, especially in the Concrete Foundation Cost.
2. Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) were considered able to increase quality (Compressive Strength of Fuel Tank Foundation)
3. Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) were considered able to Accelerate project because could be loaded after 7th days age of concrete.

The application of innovative Concrete Admixture Cane & Carrot Option (Molasses & Daucus Carota) has received testimony from internal management and External Stakeholder.

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