

Analysis Of The Dominant Factors For Delays In Foundations At The Semantok Dam

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Abstract:

Background: Work on the secant pile foundation at the Semantok Dam was targeted to be completed in 120 days starting from February to May 2021, but the implementation experienced delays which impacted on other works to be delayed to 150 days. PT. PT. Brantas Abipraya (Persero) on the Semantok Dam project in completing a project must be followed up immediately to avoid the same case in future projects. Project delays must be resolved immediately by finding the root cause of the problem. By knowing the root causes of the delay, it is possible for the company to evaluate and anticipate what things are causing the problem of delays so that these things don't happen again in the next project.

Materials and Methods: The research begins with formulating the problem and research title supported by a literature review. After that, the research concepts and hypotheses were determined which became the basis for choosing the right research method. To find out the problems causing delays, interviews with project leaders and supervisors in the field were carried out using the FGD Brainstorming method. The collected data was analyzed using fishbone and 5W+1H. Furthermore, a discussion of these findings is carried out to find out the causes of the delay in the work of the secant pile foundation at the Semantok Dam. From the results of this analysis, it is known that steps for improvement, implications, conclusions, and suggestions for secant pile work in the Semantok Dam.

Conclusion: Based on the research conducted by the author regarding the analysis of delays in secant pile foundation work at the Semantok Dam Project, it can be concluded that the dominant factors causing delays in secant pile foundation work at Semantok Dam are Man, Warehouse, Machine factors.

Key Word: fishbone diagram, why-why analysis, Management

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I. Introduction

The purpose of the dam foundation is that the soil stress that arises as a result of the dam's own weight, water pressure, earthquake forces, and loads that work does not exceed the carrying capacity of the dam foundation soil at the bottom or on the left and right banks of the dam. In addition, the purpose of the dam foundation is that water seepage that arises under the dam foundation and in the dam abutments does not exceed the established limits.

The character of the soil at the location of the Semantok dam foundation is soil with tuff sand, using boring grouting is not the choice of geologists, several trials have been carried out as a substitute for boring grouting such as using the Diaphragm Wall Method, but this method requires quite a long work time and always occurs collapse of the excavation, so that method is not used and try to use the haling wall foundation method with secant pile.

The barrier wall with the secant pile wall method is one of the dam foundation methods with cut-off walls. A secant pile wall is a spherical parallel wall construction made by digging/drilling and filled with plastic concrete which binds/interlocks one another to form a tight and impermeable wall.

Secant pile drilling using full / double casing designed for straightness of the drill hole and stability / preventing the excavation of the foundation layer of the Semantok dam in the form of brittle sandstone. The outer casing pipe diameter is 880 mm and the inner diameter is 780 mm. The casing pipe is temporarily installed and will be removed to the design depth before the casting process until after the plastic concrete is placed.

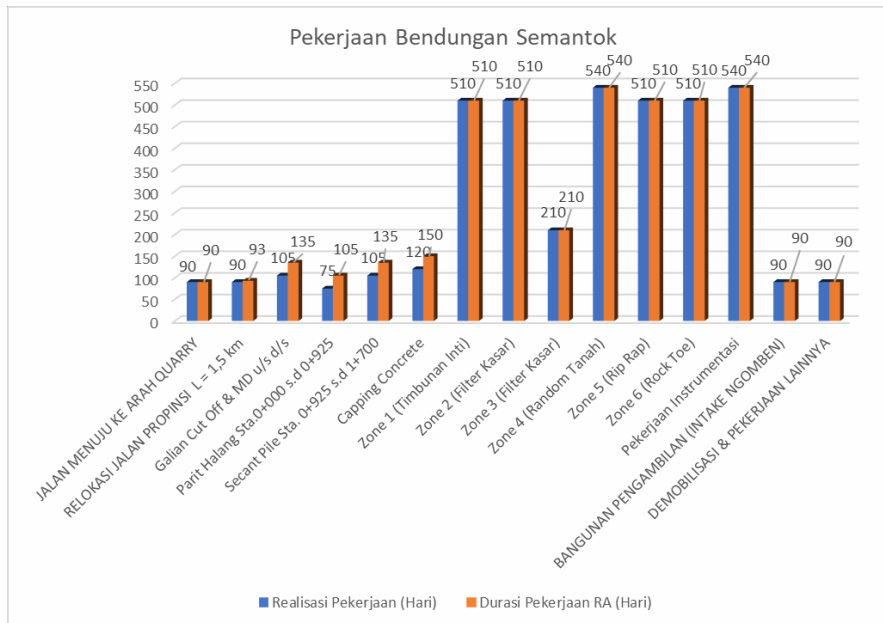


Fig 1 :Duration of Project Implementation at Semantok Dam
Source: PT Brantas Abipraya data (2022)

From Figure 1 above, it can be seen that the work on the secant pile foundation at the Semantok Dam was targeted to be completed in 120 days starting from February to May 2021, but the implementation experienced delays which impacted other works to be delayed to 150 days.

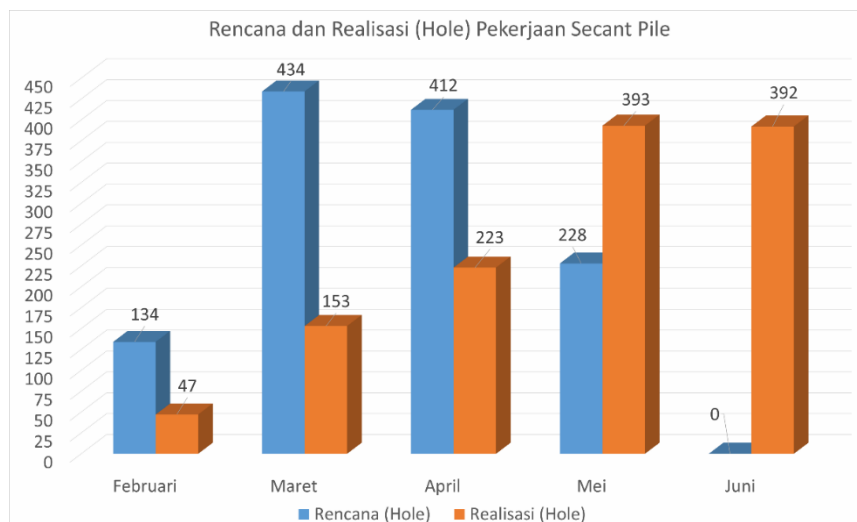


Fig 2 :Plan and Realization (Hole) of Sectant Pile Work
Source: PT Brantas Abipraya data (2022)

PT. PT. Brantas Abipraya (Persero) on the Semantok Dam project in completing a project must be followed up immediately to avoid the same case in future projects. Project delays must be resolved immediately by finding the root cause of the problem. By knowing the root causes of the delay, it is possible for the company to evaluate and anticipate what things are causing the problem of delays so that these things don't happen again in the next project.

II. Material And Methods

The research method according to Sugiyono (2013) is a scientific way to obtain valid data with the aim of discovering, proving and developing knowledge so that the results can be used to understand, solve and anticipate problems. The research was conducted to analyze understanding and examine obstacles as well as examine the effect of applying the CPM scheduling method in the Accessibility Work Continuation project on

work time. This research is quantitative descriptive. The descriptive method is a method used to analyze data by describing or describing the data that has been collected as it is without intending to make general conclusions or generalizations according to (Sugiyono, 2013). While quantitative research is a research method based on the philosophy of positivism, used to examine certain populations or samples, sampling techniques are generally carried out randomly, data collection uses research instruments, data analysis is quantitative or statistical in nature with the aim of testing established hypotheses (Sugiyono, 2013). Explanatory research is research that is used to obtain data from certain places, but researchers carry out treatments in collecting data, for example distributing questionnaires, tests, interviews and so on (Sugiyono, 2013). data analysis is quantitative or statistical in nature with the aim of testing established hypotheses (Sugiyono, 2013). Explanatory research is research that is used to obtain data from certain places, but researchers carry out treatments in collecting data, for example distributing questionnaires, tests, interviews and so on (Sugiyono, 2013). data analysis is quantitative or statistical in nature with the aim of testing established hypotheses (Sugiyono, 2013). Explanatory research is research that is used to obtain data from certain places, but researchers carry out treatments in collecting data, for example distributing questionnaires, tests, interviews and so on (Sugiyono, 2013).

The research begins with formulating the problem and research title which is supported by a literature review. After that, the research concepts and hypotheses were determined which became the basis for choosing the right research method. To find out the problems causing delays, interviews with project leaders and supervisors in the field were carried out using the FGD Brainstorming method. The collected data was analyzed using fishbone and 5W+1H. Furthermore, a discussion of these findings is carried out to find out the causes of the delay in the work of the secant pile foundation at the Semantok Dam. From the results of this analysis, it is known that steps for improvement, implications, conclusions, and suggestions for secant pile work in the Semantok Dam

Research variable

Research variables are anything in any form determined by researchers to be studied so that information is obtained about it, then conclusions are drawn (Sugiyono, 2009). This study focuses on analysis that aims to determine the causes of work delays and find out the critical path in the work schedule.

Research variables can be explained in the following table:

Table 1 : Research variable

Variable	Method	Dimensions	Data Type	Scale of Measurement and Data Collection Techniques
Project Delay Factor	<i>Fish Bone Analysis</i>	<i>Man</i>	Primer	The ratio measurement scale obtained from interviews with PM, SOM, SEM, SM, Project Staff
		<i>Warehouse</i>	Primer	The ratio measurement scale obtained from interviews with PM, SOM, SEM, SM, Project Staff
		<i>Machine</i>	Primer	The ratio measurement scale obtained from interviews with PM, SOM, SEM, SM, Project Staff

Data collection technique

In collecting data in this study will be used to solve the problems obtained so that the data must be accurate and reliable. In a scientific research, data collection methods are intended to obtain materials that are relevant, reliable and accurate. Research instruments are tools that are selected and used by researchers in their activities to collect data so that these activities become systematic and easy. For data collection in this study using the following techniques:

1. Interview

Esterberg, in Sugiyono (2012: 231) defines the interview as follows: "a meeting of two persons to exchange information and ideas through questions and responses, resulting in communication and joint construction of meaning about a particular topic". An interview is a meeting of two people to exchange information and ideas through question and answer, so that meaning can be constructed in a particular topic. Esterberg, in Sugiyono (2012: 233) suggests several types of interviews, namely structured interviews (researchers already know with certainty what information will be obtained so that researchers prepare research instruments in the form of written questions whose alternative answers have also been prepared), semi-structured interviews (implementation of interviews is more free ,

Based on the above understanding, the researcher conducted interviews by way of discussion or question and answer to several informants consisting of the Project Manager, Site Operation Manager, Site Engineering Manager, Site Administration Manager, Site Manager, and staff to get the causes of delays in work during work.

Interviews will lead to informants who directly touch and have policies on the time control management process that has been carried out and will be carried out during the implementation of the work.

Population and Sample

The population used in the research object is a project owned by PT Brantas Abipraya with a sample of the Semantok Dam Project. The sampling technique used in this study was a purposive sampling technique. The subjects/informants in the study were agency personnel related to the object of the Secant Pile Foundation Work at the Semantok Dam.

III. Result and Discussion

Object of research

The research object is the Secant Pile Work which is the Foundation of the Dam. The location of the research object was carried out in the Semantok Dam Development Project which is located in the North Nganjuk region, precisely in Tritik Village and Sambikerep Village, Rejoso District which are areas that always experience drought during the dry season but during the rainy season always experience flooding due to overflowing rivers in the upstream section, namely in Mount Pandan and the Kendeng Mountains area as well as the condition of the clay soil type that dominates this area causes a lack of regional intensity.

Project Data

The research begins with collecting data obtained by the author in the field, and through interviews. The interview method is carried out directly or in writing to the informant. The resource persons included the Site Engineering Manager, Site Manager, Quality Control, Executor of the Semantok Dam Development Project. Other data includes total volume of work, number of man power on secant pile work, work schedule, method of secant pile work, duration of implementation, work equipment used during work, cost of carrying out work, constraints that occur in the field, photos of work, total duration of work.

General Schedule of Semantok Dam Works

Based on the work schedule for the 2021-2022 Semantok Dam, the secant pile work was completed within 4 months, starting from February to May 2021 which is the critical work limit, because the Capping Concrete work and the Dam Piling work must be carried out in May 2021.

Table 2 : Semantok Dam Work Schedule

NO	Uraian Pekerjaan	Sisa Pekerjaan Bobot (%)	Tahun Anggaran 2021												Tahun Anggaran 2022												
			Musim Hujan			Musim Kemarau						Musim Hujan			Musim Kemarau						Hujan						
			2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12		
1	JALAN MENUJU KE ARAH QUARRY - Pengambilan Material Zone 4 - Pengalihan Jalan Warga (Sta.0+700)	5.243																									100%
2	RELOKASI JALAN PROPINSI L = 1,5 km - Galian MD Sta.1+050 - 1+200 (Jalan Eksisting)	0.437																									
3	PEKERJAAN MAIN DAM a. Galian Cut Off & MD u/s d/s b. Parit Halang Sta.0+000 s.d 0+925 c. Secant Pile Sta. 0+925 s.d 1+700 d. Capping Concrete e. Timbunan Maindam - Zone 1 (Timbunan Inti) - Zone 2 (Filter Kasar) - Zone 3 (Filter Kasar) - Zone 4 (Random Tanah) - Zone 5 (Rip Rap) - Zone 6 (Rock Toe) f. Pekerjaan Instrumentasi	9.743 0.476 7.322 3.472																									50%
4	BANGUNAN PENGAMBILAN (INTAKE NGOMBEN)	0.661																									
5	DEMOBILISASI & PEKERJAAN LAINNYA																										0%

Secant Pile Work Delay Analysis

Collection This data is done by measurement direct observation in the field and by interviewing relevant stakeholders

IV. Discussion

Data on delays was obtained through discussions and interviews through FGD (Focus Group Discussion) together with the Project Manager, Site Operation Manager, Site Engineering Manager, Site Administration Manager, Site Manager and staff. The steps of the analysis carried out using primary data are as follows:

1. Defining and selecting existing problems to determine the goals to be achieved
2. Measuring the problems that have been defined by collecting and analyzing the data obtained
3. Verify measurements and look for all possible causes using (Brainstorming) Fishbone diagrams

4. Analyze by identifying and finding the root of the problem using the 5 Whys
5. Conduct a Root Cause Analysis to find the root of the problem
6. Determine and plan and improve the 5W + 1H steps
7. Supervise, measure performance to find out the results of achievement
8. Make a final report, determine standard solutions and determine the next Performance Improvement Plan.

Focus Group Discussion (FGD)

In digging deeper into the problems that occur, information/opinion of each worker is needed and trying to discuss the best solution, an open discussion is held between the team, as follows:



Fig 3: FGD with the Project Leader
Source: Internal Shot Results (2022)

Fishbone Diagram Analysis (Brainstorming)

Fishbone diagram analysis (Brainstorming) aims to find all possible causes through FGD. Common problems began to be grouped and focused in more detail and depth to trace the root causes of the problems.

Based on the interviews obtained as well as the results of field observations and direct discussions with informants from the Project Manager, Site Operation Manager, Site Engineering Manager, Site Administration Manager, Site Manager, and staff, the parameter factors that influence the occurrence of these losses are taken, namely:

1. Man (Human/Operator/technical worker/daily worker)
2. Warehouse (Material arrangement, drilling location, site plan)
3. Machine (Accessories, drilling tools)

Of the 3 main factors causing delays in the secant pile foundation work above, the researchers explored information to find out the causes and reasons. The results of the interviews are summarized in the following Fishbone Diagram:

The parameter factors that have been described are presented in the form of a causal diagram in Figure below:

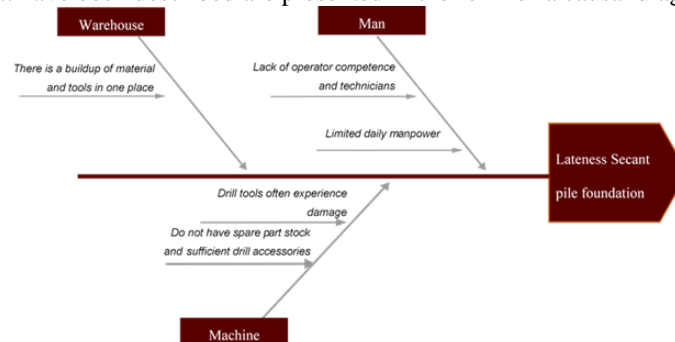


Fig 4 : Fish Bone Diagram
Source : Processed Interview Data (2022)

From the Fishbone Diagram analysis, the results of the FGD discussion in the Brainstorming process found the main causes by writing down the causes that might occur in groups of main causes. Then the sub-causes in the main cause group are selected which have the most significant influence on the delay in the secant pile foundation work as follows:

1. Man : - Lack of competence of operators and technicians
-The number of daily power is limited
2. Warehouse : -There is a buildup of materials and tools in one place
- 3.Machine : -Drill tools are often damaged
-Not having sufficient stock of spare parts and drill accessories
-Less drill tools

Furthermore, these significant causes are analyzed further to find the root cause of the problem in each existing loss by asking 5 times a technique called Five Whys or 5 Whys to find out the main cause. As attached in the following table:

Table 3 : Why Why Analysis on the Main Factors of Delay in the Secant Pile Foundation

Problem	Why 1	Why 2	Why 3	Why 4	Why 5	Corrective action	Preventive measure
Lack of competence of operators and technicians	Minimum skills and experience in the Dam	The qualifications of equipment operators and technicians are not appropriate to the field	There is no Refreshment Training for Operators and Technicians				what: Refreshment Training Operators and technicians where: Operations and Equipment Section when: once a year who: Site Administration Manager & HC How: Carry out Refreshment Training for Operators and technicians
Man :	Limited amount of daily power	Not yet done hiring competent workers	Lack of workforce planning	Financial cash flow is not good		Conduct regular HR recruitment	what: Create a workforce action plan & Recruitment of workforce where: At every secant pile location when: Periodically who: Site Administration Manager & HC How: Make an action plan for the number of workers needed & carry out recruitment of workers
Warehouse :	There was a buildup of materials and tools in one place	The drilled secant pile foundation is not old enough	The layout of drill tools and materials is random	Lack of planning and work site action plans		Opening new land for drilling locations to prevent accumulation	what: Work area plotting planning where: At every secant pile location when: Beginning of work who: Site Engineering Manager

Problem	Why 1	Why 2	Why 3	Why 4	Why 5	Corrective action	Preventive measure
							How: Make a mature work implementation action plan
	Drill tools are often damaged	Full day tool operation	Lack of routine maintenance and repairs			Routine maintenance when not in use	what: Lack of routine maintenance and repairs where: Drilling machine parts and crane services when: Continue operation who: Site Operation Manager and Equipment How: Perform routine maintenance every month
Machine :	Not having sufficient stock of spare parts and drill accessories	Lack of material requirements planning				Procure and replace damaged spare parts	what: Lack of material requirements planning where: Tools and Procurement Section when: Beginning of work who: Site Operation Manager and Procurement How: Procurement and replacement of damaged spare parts
	Less drill tools	The initial contract uses 2 sets of drill tools	The production plan for 2 tools does not match the daily production realization	Lack of planning and action plan tools			what: Make a mature action plan and add a set of drilling tools where: Tools and Procurement Section when: Beginning of work
Problem	Why 1	Why 2	Why 3	Why 4	Why 5	Corrective action	Preventive measure
							Who: Site Operation Manager and Equipment How: Make realistic plans and increase the drill tool set

Based on the table above Why-why analysis regarding the fishbone diagram found several factors causing delays in secant pile foundation work. The reasons/details of the factors causing the delay are as follows:

1. Man

- Lack of knowledge/competence of operators and technicians regarding the operation of secant pile drilling tools, especially on dam projects, operators lack control over the terrain with incorrect drilling techniques, so the drill bit is often stuck in the foundation which results in delays in processing time and damages the structure

of the dam foundation. Plus the lack of understanding of technicians in efforts to repair equipment that is experiencing breakdown. This can result in longer repair work times. Moreover, if the breakdown that occurs requires major repairs, this will require technicians from the vendor.

- The number of daily workers is limited, the process of drilling and casting secant pile foundations requires quite a large number of daily workers, starting from the preparation stage, ironing and casting of the guide wall, installation of the first casing pipe, drilling in the first casing, installation of the second casing pipe, drilling in the casing secondly, cleaning casing, installing oscillators, installing tremi, installing gutters, and casting piles requires at least 5 people for 1 tool, but the reality in the field is that daily manpower is limited, there are no competent replacement daily workers, with large work areas and more than one the number of daily power tool sets is less, thus affecting progress in the field.

2. Warehouses

- In the warehouse factor, there is a buildup of materials and tools in one work area, where the secant pile foundation is already in place drilled and cast are not old enough to carry out drilling work. Planning the location of the drill points is random and poorly controlled so that the tool cannot move to other areas resulting in delays in drilling and casting work. For drilling a primary point to a secondary point, it must be at least 7 to 14 days old, then drilling can be done on a secondary point.

3. Machine

- Drilling tools are often damaged, due to the absence of routine maintenance and the tools are used full day resulting in damage to the drilling tools which hinders the work of secant pile foundation drilling.

- Not having sufficient stock of drill spare parts and accessories, due to a lack of planning for the need for goods resulted in the required spare parts not being available in the field which had an impact on hindering the progress of work in the field.

- Available drill tools are lacking, with damage and maintenance of available tools so as to carry out progress in the field optimizing tools that can still operate, even though the target for secant pile work per day reaches 14 piles per day. By using 2 sets of drilling tools per day only reached 4 piles per day. So that the set of tools available in the field does not balance the target plan per day.

V. Proposed Improvements

The repair plan to be carried out is as follows:

1. Conduct refreshment training for operators and technicians
2. Make an action plan for the number of workers needed & carry out recruitment of workers
3. Make an action plan for implementing a mature work area
4. Perform routine equipment maintenance every month
5. Procure and replace damaged spare parts
6. Planning realistic tool requirements and adding drill tool sets.

Safe

1. Lack of operator competency and technician skills which is the root of the problem that causes delays in secant pile work at the Semantok Dam. The solution that can be done is to carry out Refreshment Training for Operators and technicians, which aims to improve operator competency and technician skills.

2. The absence of a plan or action plan for the number of workers needed is one of the causes of delays in work in the field. Realization in the field in 1 set of tools there are only 5 people using 2 sets of tools, which means the number of workers per day is only 10 people.

B. Warehouse

1. Piling up of materials and tools in one place is one of the causes of delays in secant pile foundation work in the field due to a lack of work area plotting planning. The solution that can be done is to make a mature work implementation action plan.

C. Machine

1. Drilling tool damage is one of the causes of delays in secant pile foundation work in the field due to the absence of routine maintenance. The solution that can be done is to schedule routine maintenance every month so that the machine on the drill is not constrained during use

2. Not having sufficient stock of drill spare parts and accessories is one of the causes of delays in secant pile foundation work in the field due to a lack of planning for material requirements. From the results of the researchers' observations, the number of available casings at the site was lacking, the drill could not drill to the next point because all the casings were still in use and still waiting for casting, so the tools could not produce optimally.

Then the oscillator tool available cannot serve the total number of drilling points, casting is carried out alternately because the oscillator tool to lift the casing when casting and the verticality test tool is only available one unit while the number of points to be cast is very large.

VI. Conclusion

Based on the research conducted by the author regarding the analysis of delays in secant pile foundation work at the Semantok Dam Project, it can be concluded that the dominant factors causing delays in secant pile foundation work at Semantok Dam are Man, Warehouse, Machine factors. Where is the Man Factor, namely the lack of competence of operators and technicians due to the absence of refreshment training, the number of daily workers is limited because they have not carried out regular HR recruitment. The Warehouse factor is the accumulation of materials and tools in one place due to a lack of work area plotting planning. The machine factor, namely the drill tool is often damaged due to lack of maintenance and routine repairs, does not have sufficient stock of drill spare parts and accessories due to lack of planning for the needs of goods, Drilling tools are lacking due to a lack of planning and tool action plans. Corrective actions that must be carried out are Man: Carrying out refreshment training for operators and technicians, making an action plan for the number of workers needed & conducting workforce recruitment. Warehouse: Make an action plan plotting a mature work implementation area. Machine: Perform routine maintenance every month, procure and replace damaged spare parts, make realistic plans and add drill sets.

Based on the research that has been carried out by the author regarding the work of secant piles at the Semantok Dam, the authors provide suggestions for both readers and for further researchers and contractors, including the following:

1. In carrying out work, especially critical items, it is better to always evaluate the realization of the plan and immediately follow up on problems related to the failure to achieve daily realization so that the completion of the work is according to the expected target.
2. The work plan and the number of tool sets needed to be used in the next similar project must be carefully calculated before being implemented so that the realization is achieved according to the target plan.
3. In selecting Vendors or Subcontractors, especially in the use of heavy equipment, make sure the subcontractor procures new equipment or according to the specifications so that the equipment used has maximum performance
4. Risk Management (ManRisk) for the next project should be improved so that the gap between the plan and the realization is monitored and evaluated every day.

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