

RISK ANALYSIS OF THE MEMPAWAH-SUNGAI DURI NATIONAL ROAD RELOCATION DEVELOPMENT PROJECT IN WEST KALIMANTAN USING THE BOW TIE ANALYSIS METHOD

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ABSTRACT

The National Road Relocation Development Project in Mempawah, West Kalimantan, functions as a substitute for a national road that will later be affected by the construction of the Kijing International Port in Mempawah Regency, West Kalimantan Province. Current conditions in the field have found several problems that impede the achievement of progress, which poses several risks. This study aims to analyze the highest level of risk from several identified risks. This is why it is important to conduct a risk analysis study on the National Road Relocation Project. This research method uses a qualitative and quantitative approach, starting with the identification of risks in similar projects, then proceeding to test the relevance of risks that may occur and the impact of those risks. Data collection methods were carried out by distributing questionnaires, conducting focus group discussions, and conducting interviews. Furthermore, quantitative analysis was carried out with response scenarios and Bowtie analysis. The results of this study identified the six highest risks: conditions and field data not in accordance with the design, design changes during the project, land for work that has not been acquired, bad weather disturbances, cost overruns, and material price increases. Contingency costs incurred amount to Rp. 15,757,472,740, or 8.34% of the project value, which is Rp. 188,909,724,300.

Keywords: *risk analysis, international port, national road relocation, Mempawah-Sungai Duri*

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INTRODUCTION

Indonesia is one of the largest archipelagic countries in the world and for the success of government programs related to sea highways, this is why the role of ports in Indonesia is very important. The existence of a port can facilitate trading activities and mobility between islands and even between countries. Seeing the importance of infrastructure development in sea transportation modes, PT. Pelabuhan Indonesia as a stakeholder here is building the Kijing Terminal which is located in Mempawah Regency, West Kalimantan Province, which supports sea transportation, especially in the waters of the Malacca Strait and the South China Sea.

The construction of the Kijing Terminal resulted in the national road connecting Pontianak City and Singkawang precisely on the Sungai Duri-Mempawah Road Section being cut off due to the impact of port support facilities. port in general (Gambut, 2015; Yolanda Saraswati & Widodo, 2021).

The process of implementing this national road relocation project starts with land acquisition, followed by a design process carried out by a planning consultant appointed by the Ministry of Public Works and Public Housing through the West Kalimantan Province National Road Implementation Office as the user of this road when construction is complete (Bastori & Sriyana, 2020; Nata et al., 2016). Furthermore, an auction process was carried out which was carried out openly and online by PT Pelindo Indonesia, after the auction process was completed, the winner was appointed PT Wijaya Karya Persero Tbk (Rozi et al., 2022).

The Sungai Duri – Mempawah National Road Relocation Project in West Kalimantan consists of 5.6 Km of New Road Works, Stone River Channel Works, Box Girder Works, and Bridge Works. In carrying out this work there are risks that arise, these risks can arise from external and internal. The internal risk itself is related to the increase in the price of fuel oil, in this case, industrial diesel fuel, and the price of oil asphalt as raw material. For external risks, namely land acquisition, community social impacts, and changes in design by owner.

Risk management planning is one of the keys to success in achieving the goals and objectives that have been set. Risk management is very important for construction activities in minimizing losses and increasing profitability. The possibility of risks occurring must involve several parties with fair compensation (Kartam & Kartam, 2001). Risk management in construction projects is very important to ensure that the project is completed on time and on budget (Nguyen et al., 2014). One of the efforts to carry out risk management is by representing the magnitude of the impact of risk in unit costs and including it in a cost component which is commonly referred to as contingency cost sender (Rosani et al., 2020).

The use of formal risk analysis in construction services is generally still very low. The lack of formal risk analysis on the possibility of risks occurring will result in project failure or material and non-material losses. This is what underlies the need for risk analysis in the implementation of the Mempawah-Sei Duri National Road Development project.

METHOD

Data Collection

Data collection methods are used to determine the extent to which the level of understanding of researchers to the material under study.

Primary data is data obtained from the first source, namely from individuals or individuals, can be in the form of interviews and filling out questionnaires or questionnaires as well as from data owned by the company (Umar, 2011). Besides that, it can also be done by discussion or focus group discussion (FGD). This questionnaire will later be distributed to respondents among officials of PT Pelindo Solusi Logistik and the Construction Management Team of PT. Wijaya Karya Persero (Tbk).

The questionnaires distributed focused on the implementation of risk management and the benefits to be gained by implementing risk management. With the questionnaire, it is expected to obtain information about the risks that occur and the benefits of risk management to deal with these risks. The questionnaire aims to gain relevance between the results of previous research and the risks that might occur to be followed by FGDs and interviews. An FGD is needed to ascertain whether there are still undetected risks for this study. The FGD method that will be used is the Delphi Technique. This method uses two different sessions, namely the first session as the formulation of the problem and the second session regarding the summary or confirmation related to the previous session. The FGD participants in this study were the Coordinator of the Construction Sector of Pelindo Solusi Logistik and the MK and Kasi Team from PT. Wijaya Karya Persero (Tbk)

This study uses initial identification cited from previous research as outlined in Table 1. The results of the risk identification were compiled which would later be used as an initial reference used as questionnaire content. This initial identification is quoted from (Dang et al., 2017; Hamzaoui et al., 2015; Kartam & Kartam, 2001; Lokobal et al., 2014; Perera et al., 2009).

Table 1. Risk Identification Results

NO	RISK VARIABLES	SOURCE
I	PERMISSION	
R-1	Regulations and difficulties in obtaining permits	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
R-2	Land for work has not been acquired	(Dang et al., 2017; Perera et al., 2009)
R-3	Tender delay	(Dang et al., 2017)
R-4	Coordination of relocation of existing facilities	(Dang et al., 2017)
II	INITIAL DESIGN	
RF - 5	Image control process	(Dang et al., 2017; Perera et al., 2009)
RF - 6	Insufficient discrepancy between soil and survey data	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 7	Internal RAB calculation error	(Dang et al., 2017)
RF - 8	Project scope definition	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 9	Initial delivery of engineering products	(Dang et al., 2017)
RF - 10	Engineering productivity	(Dang et al., 2017; Lokobal et al., 2014)
RF - 11	Engineering resource requirements	(Dang et al., 2017; Hamzaoui et al., 2015; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 12	The design review duration is quite long	(Kartam & Kartam, 2001; Lokobal et al., 2014)
RF - 13	Design changes during the project	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 14	Specifications that are less detailed and less accurate	(Dang et al., 2017)
RF - 15	Design mismatch with implementation	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 16	Lack of availability of experts for technical problems	(Hamzaoui et al., 2015)
RF - 17	Frequent re-design / re-work	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 18	The occurrence of cost overrun (Claim)	(Dang et al., 2017; Kartam & Kartam, 2001; Perera et al., 2009)
RF - 19	Detailer/designer experience	(Dang et al., 2017; Hamzaoui et al., 2015; Lokobal et al., 2014; Perera et al., 2009)
RF - 20	Estimated BQ (Variation Order)	(Dang et al., 2017; Hamzaoui et al., 2015; Lokobal et al., 2014; Perera et al., 2009)

NO	RISK VARIABLES	SOURCE
		al., 2009)
III	PROCUREMENT AND EQUIPMENT	
RF - 21	Critical and difficult equipment and bulk materials	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 22	Changes in specifications that affect work	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 23	Inappropriate material and equipment procurement schedule	(Dang et al., 2017; Lokobal et al., 2014)
RF - 24	Lack of information about the vendor company	(Dang et al., 2017)
RF - 25	There was an increase in the price of materials	(Dang et al., 2017; Hamzaoui et al., 2015; Lokobal et al., 2014; Perera et al., 2009)
RF - 26	Error in estimating the procurement budget	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 27	Damage or loss of purchased materials/equipment	(Dang et al., 2017; Lokobal et al., 2014)
RF - 28	Delay in the arrival of critical equipment that hinders other work	(Kartam & Kartam, 2001; Lokobal et al., 2014)
RF-29	Lack of construction support facilities	(Dang et al., 2017; Lokobal et al., 2014)
RF-30	Project site security	(Dang et al., 2017; Kartam & Kartam, 2001)
IV	CONSTRUCTION	
RF - 3 1	Lack of qualified supervisors	(Dang et al., 2017)
RF - 3 2	Human work safety (accident, death) during construction	(Dang et al., 2017; Lokobal et al., 2014)
RF - 3 3	Contractor experience in carrying out similar projects	(Dang et al., 2017; Perera et al., 2009)
RF - 3 4	Lack of availability of human resources	(Dang et al., 2017; Hamzaoui et al., 2015; Lokobal et al., 2014)
RF - 3 5	Lack of quality work	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 3 6	Availability of bulk materials	(Dang et al., 2017)
RF - 3 7	Availability of construction tools and materials	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 3 8	Existing facilities _	(Dang et al., 2017)
RF -39	Quality control and Quality Assurance	(Hamzaoui et al., 2015)
RF - 4 0	The level of progress of work in the field	(Kartam & Kartam, 2001)

NO	RISK VARIABLES	SOURCE
RF - 4 1	Conditions and field data do not match the design	(Hamzaoui et al., 2015; Perera et al., 2009)
RF - 4 2	Improper construction method	(Kartam & Kartam, 2001)
RF - 4 3	Timeliness of project implementation	(Kartam & Kartam, 2001; Perera et al., 2009)
RF - 4 4	Timely payment of contractors to suppliers/subcontractors	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 4 5	Implementation of Environmental Safety and Health	(Hamzaoui et al., 2015; Lokobal et al., 2014; Perera et al., 2009)
RF - 4 6	Effects of the Covid 19 Pandemic	(Lokobal et al., 2014)
RF - 47	Certain party intervention during construction	(Hamzaoui et al., 2015; Lokobal et al., 2014)
RF - 48	Temporary work stoppage due to residents' protests	(Dang et al., 2017; Lokobal et al., 2014)
RF - 49	Weather disturbances that cause delays in project execution	(Dang et al., 2017; Lokobal et al., 2014)
RF - 50	The occurrence of force majeure / force majeure	(Hamzaoui et al., 2015)
RF - 5 1	Lack of qualified supervisors	(Dang et al., 2017)
RF - 5 2	Human work safety (accident, death) during construction	(Dang et al., 2017)
V	PROJECT MANAGEMENT	SOURCE
RF - 5 3	Increase in costs due to the addition of material	(Dang et al., 2017; Hamzaoui et al., 2015; Perera et al., 2009)
RF - 5 4	Decrease in margin due to increase in material prices	(Dang et al., 2017; Perera et al., 2009)
RF - 5 5	cash flow not according to plan	(Hamzaoui et al., 2015; Kartam & Kartam, 2001; Lokobal et al., 2014)
RF - 5 6	Escalation Clause	(Dang et al., 2017; Hamzaoui et al., 2015)
RF - 5 7	Arrangement of work sequences (sequencing)	(Dang et al., 2017; Hamzaoui et al., 2015)
RF - 5 8	Delayed Work Schedule	(Dang et al., 2017; Kartam & Kartam, 2001)
RF - 5 9	Main equipment planning	(Kartam & Kartam, 2001)
RF -60	Availability of resources	(Dang et al., 2017)
RF -61	Commitment to schedule	(Hamzaoui et al., 2015; Perera et al., 2009)
RF -62	Project management experience	(Hamzaoui et al., 2015)

NO	RISK VARIABLES	SOURCE
RF - 6 3	Project control procedures	(Hamzaoui et al., 2015)

Research Data Analysis

Measuring the probability level indicator is calculated by measuring the value of the possibility of a risk occurring which can be seen in Table 2, while finding out the value of the impact of risk can be seen in Table 3. Each indicator uses a scale of one to five numbers. Number one indicates the value of the smallest risk impact and value five indicates the biggest risk impact. This risk probability criterion refers to Siswanto's research (Larson et al., 2006).

Table 2. Risk Probability Assessment

Level Risk	Mark Variable	possibility Incident	Probability Criteria
A	5	Almost Certain	Risks that are almost certain to occur, with a probability value of >85% or always occur in every condition
B	4	Very likely	Risks that are likely to occur, with a probability value of 60% to 85% or very might happen
C	3	Enough Maybe	Risks that are equally likely to occur and not occur, with a probability value of 40% to 60%, or occur in certain conditions
D	2	Little Chance	Risks that are unlikely to occur, with a probability value of 20% to 40% or so sometimes happen
E	1	Seldom	Risks that are almost certain not to occur, with a probability value of 0% to 20% or rarely happening

Table 3. Assessment of the Impact of Risk on Costs

Level Risk	Mark Variable	Level Impact	Cost Factor
A	5	Very Tall	The impact that occurs causes an increase fee >20%
B	4	Tall	The impact that occurs causes an increase 10 – 20% fee
C	3	Currently	The impact that occurs causes an increase 5 – 10% fee
D	2	Low	The impact that occurs causes an increase fee <5%
E	1	Very Low	The impact that occurs does not cause significant increase in costs

Table 4 . Level of Approval and Evaluation for Average Index Analysis

Index flat- average (x)	$1 \leq x < 1.5$	$1.5 \leq x < 2.5$	$2.5 \leq x < 3.5$	$3.5 \leq x < 4.5$	$4.5 \leq x < 5$
Mark rounding	1	2	3	4	5

The results of the probability assessment will be used to determine the risk level of each risk. The method used is probably the impact grid from the Qualitative Risk Matrix – AS/NZS Table 5.

Table 5. Risk Level Determination Matrix

Possibility	Impact (Consequences)				
	<i>Very low</i>	<i>Low</i>	<i>Medium</i>	<i>Tall</i>	<i>Very high</i>
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>
Almost Certain	M	H	H	H	H
Most likely	M	M	H	H	H
Little Chance	L	M	M	H	H
Impossible	L	L	M	M	H
Very impossible	L	L	L	M	M

The matrix criteria for determining the level of risk are as follows:

1. High risk is shown in the red block with the letter H (high). This risk is an unacceptable risk. This risk has an influence on strategy and high activity. Therefore it is necessary to carry out a risk response in order to reduce the risk criteria to be accepted or tolerated.
2. Medium risk is shown in the yellow block with the letter M (moderate). This risk is a tolerable risk. This risk has an influence on strategy and activity is moderate. However, efforts need to be made to reduce the level of risk to the level As Low As Reasonably Practicable (ALARP).
3. Low risk is shown in the green block with the letter L (low). This risk is an acceptable risk. This risk has an influence on strategy and low activity. However, monitoring must still be carried out so that it does not increase higher.

Risk Response

Risk response is the process of developing options and following up to increase opportunities and reduce threats related to activity/project objectives. Risk response planning aims to place risk sources based on their priorities, include resources and activities owned based on cost limits, schedules, and project management plans as needed. Risk response is carried out through interviews (interviews) then the interview data is processed through qualitative methods. In addition to the risk response interview, this also uses Bow Tie Analysis (BTA). The BTA technique is to provide a helicopter view of the logic of several risk event scenarios

and help provide a simple visual explanation of the relationship of risk events to their causes and consequences.

Calculation of Contingency Costs

Calculation of contingency costs are costs used to anticipate existing risks. In general, contingency costs in estimated project costs are determined based on intuition and previous project experience, bearing in mind that the time for preparing tender documents is quite short, so it is not possible to systematically analyze the risks involved in a project and evaluate the potential impacts associated with risks and uncertainties.

The steps in detail estimation are:

1. Break down the project into cost centers. Cost is a sub-element of the project that will incur costs. Costs incurred in connection with the use of resources such as materials, labor, equipment, etc., both in the form of physical and non-physical
2. Estimated quantity required for each cost center. For physical ones, quantity take-off (QTO) is usually done. For non-physical is calculated using suitable parameters, such as risk with collateral.
3. The calculated quantity is then priced according to the data obtained, for example from historical data, suppliers, catalogs, etc.

Contingencies are made to prevent project risks, which have been identified and which have not been known (Wardhana et al., 2014).

RESULTS AND DISCUSSION

The risk variable from the preliminary survey cannot be determined as the research variable used, because the variable needs to be verified whether the variable is in accordance with the research object. In addition, there was very little input from respondents for the new risk variable.

The questionnaire given to each respondent was then filled in and the results returned to the researcher. The risk variable is declared to have relevance to the research object project if at least one respondent gives a "Yes" rating. This accommodates all relevant variables so that no risk identification is left behind. Based on the results of the preliminary survey recapitulation, it was found that out of the 63 risk variables, 62 variables had relevance. For this reason, the results of the preliminary survey were verified through an offline focus group discussion (FGD).

Out of the 6 risk categories and 62 risk variables resulting from the preliminary survey, an agreement was obtained through the FGD forum to divide into 3 categories namely Engineering, Implementation, and Project Management. For risk variables, there is a combination of several variables into one variable with a new variable name because the causes and effects are almost the same.

The FGD outcome risk variable which is determined as a research variable is then tested to see how likely it is to occur and how big the impact is. Testing is done by distributing the main questionnaire to the respondents. The results of the questionnaire recapitulation are shown in Table 6.

Table 6. Questionnaire recapitulation results

No	Risk Variable	Probability Value		Impact Value	
		Average	Integration	Average	Integration
I	TECHNIQUE				
R1	Conditions and field data do not match the design	3,11	3.00	3,67	4.00
R2	Image control process	2.56	3.00	2,22	2.00
R3	The insufficient discrepancy between soil and survey data	2.67	3.00	3,33	3.00
R4	Internal RAB calculation error	2,22	2.00	2,33	2.00
R5	Project scope definition	2.00	2.00	2.00	2.00
R6	Initial delivery of engineering products	2.44	2.00	2.67	3.00
R7	The design review duration is quite long	3,33	3.00	3,33	3.00
R8	Design changes during the project	3,33	3.00	3.89	4.00
II	IMPLEMENTATION				
R9	Land for work has not been acquired	3.89	4.00	3.78	4.00
R10	Coordination of relocation of existing facilities	3.00	3.00	3,33	3.00
R11	Changes in specifications that affect work	2.78	3.00	3.00	3.00
R12	Inappropriate material and equipment procurement schedule	2,33	2.00	2,33	2.00
R13	Delay in the arrival of critical equipment that hinders other work	2.67	3.00	2.78	3.00
R14	Human work safety (accident, death) during construction	1.67	2.00	1.78	2.00
R15	Availability of construction tools and materials	2.00	2.00	2.00	2.00
R16	Quality control and Quality Assurance	1.89	2.00	2,33	2.00
R17	The level of progress of work in the field	2.56	3.00	2.78	3.00

No	Risk Variable	Probability Value		Impact Value	
		<i>Average</i>	<i>Integration</i>	<i>Average</i>	<i>Integration</i>
R18	Timeliness of project implementation	2,22	2.00	2,33	2.00
R19	Timely payment of contractors to suppliers/subcontractors	2.67	3.00	2,33	2.00
R20	Certain party intervention during construction	1.78	2.00	1.89	2.00
R21	Temporary work stoppage due to residents' protests	2,33	2.00	2,33	2.00
R22	Weather disturbances that cause delays in project execution	3,33	3.00	3.56	4.00
R23	Delayed Work Schedule	2.89	3.00	3,44	3.00
R24	Commitment to schedule	2.67	3.00	2.89	3.00
III PROJECT MANAGEMENT					
R25	Project control procedures	2,33	2.00	2.44	2.00
R26	Frequent re-design / re-work	2,11	2.00	2.44	2.00
R27	The occurrence of cost overrun (Claim)	3,44	3.00	3.56	4.00
R28	Increase in costs due to the addition of material	2.89	3.00	3,33	3.00
R29	Decrease in margin due to increase in material prices	3,44	3.00	3.56	4.00
R30	Escalation Clause	2.44	2.00	2.89	3.00
R31	There was an increase in the price of materials	3,44	3.00	3,40	3.00
R32	Error in estimating the procurement budget	2,11	2.00	2,11	2.00

Table 7 . Plotting of Risk Variables in the Probability Impact Grid.

Possibility	Impact (Consequences)				
	Very low	Low	Medium	Tall	Very high
Almost Certain					
Most likely				R9,	
Little Chance		R2,R19,	R3,R7,R10,R11,R13,R17,R23,R24,R28,R31	R1,R8,R22,R27,R29,	
Impossible		R4,R5,R12,R14,R15,R16,R18,R20,R21,R25,R26,R32	R6,R30,		
Very impossible					

Based on Table 7, there are 6 risk variables in the risk level group which are at a high level or intolerable, which means the risk is unacceptable, 14 risk variables in the risk level group which are at the medium level, which means the risk is still acceptable but needs to reduce the level of risk and 12 risk variables in the risk level group which are at the lowest or acceptable level, meaning that these risk variables can be accepted without any mitigation steps being taken.

For risks that fall into intolerable or unacceptable areas, a risk response must be carried out that can reduce the level of risk until the risk is acceptable, namely at least up to the ALARP level. Meanwhile, at the ALARP level, a response or mitigation needs to be carried out so that it can reduce the level to acceptable risk, but with the criteria the cost of mitigation must be smaller than the benefits obtained. To determine the risk response at the 6 high risks it was carried out by FGD and the results can be seen with the help of the Bow Tie Analysis method for each risk. The following is an explanation of the discussion of high risks in this work, namely the conditions and field data are not in accordance with the design (R1)

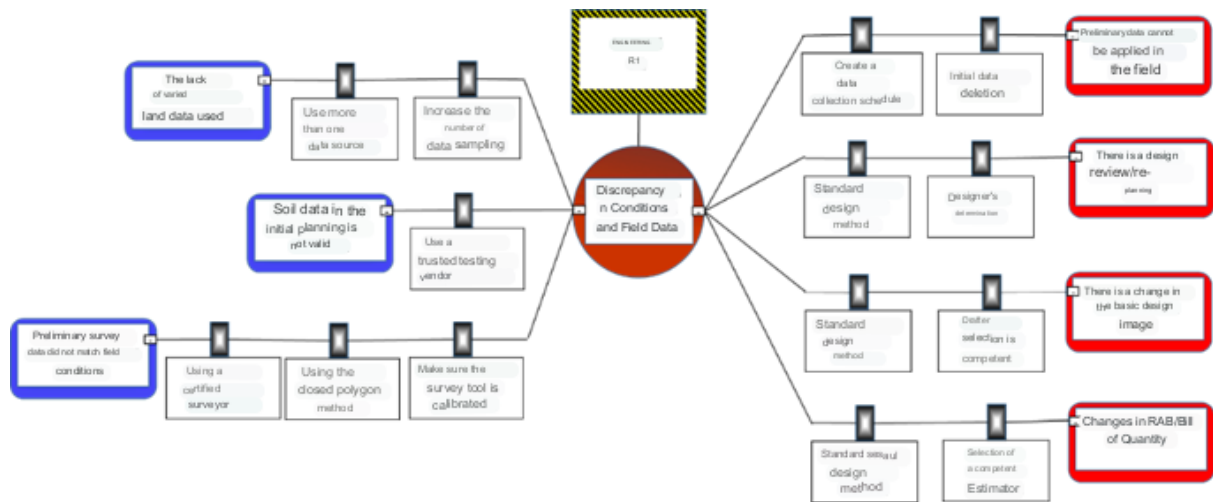


Figure 1. Bow Tie Analysis of conditions and field data not in accordance with the design (R1)

During the process of handing over the data prior to the tender, there was no specific mention of land conditions and field data. The tender participants themselves are not given the opportunity to carry out land surveys or investigations because the land has not been 100% completed. This is what causes implementation there are several problems such as incompatibility of survey data and soil conditions.

The risk response costs that must be incurred include taking additional sonder data, and settlement plate data to assist planners used in the planning process. In addition, risk response costs also arise from adding surveyors and providing competent measuring instruments

The implication that this risk has occurred, the most felt effect is the planned land subsidence data of 15 cm per year, after joint observations at several observation points obtained data of 45 cm per year and differences in outlet elevations at the end of the canal. From this basis, the project owner must make a review step (review design) because it can affect the target service life of the road that has been set and can cause structural failure if the initial planning data is still used. The study by (Dang et al. 2017) in their research also found the risk of errors in data processing has a major impact on the project so that a review must be carried out before the project is implemented. According to (Aryandi & Widyastuti, 2015; Faqih, 2018), the risk of land investigation data being incomplete or not in accordance with the field is high risk.

The process now being carried out is monitoring data collection on a regular basis. After this risk response is carried out, a residual risk appears that is unlikely to occur, namely accuracy in inputting survey data, accuracy in reading settlement plate data and interference by tools or humans on the settlement plate. This is anticipated from the start by policy makers and can be minimized as early as possible.

For other risks, namely design changes during the project (R8), land for work that has not been acquired (R9), weather disturbances that cause delays in project work (R22), cost overruns (Claim) (R27), decreased margins due to rising material prices (R29) performed the same method to analyze his risk response.

From the description of the discussion of the 6 highest risks, the calculation of contingency costs for each risk is obtained which will later be added up to get the percentage of contingency

costs to the overall project cost. Calculation of the total contingency costs uses the single value method referring to (Wardhana et al., 2014). From the sum of the contingency costs for this project, a value of Rp. 15,757,472,740 or 8.24% of the total contract value of Rp. 188,909,724,300.

CONCLUSION

The results of the discussion that has been done before, it can be concluded as follows: The risks that have been identified and have the highest risk in the technical scope are "Conditions and field data not in accordance with the design", and "Design changes during the project". In the implementation scope the highest risks are "Land for work has not been acquired" and "Weather disturbances causing delays in project work". While in the scope of Project Management the highest risk is "The occurrence of cost overruns (Claim)", and "Decreased margins due to rising material prices".

Responses to risk variables "Conditions and field data do not match the design" are carried out by mitigation, "Design changes during the project" are carried out by transfers, "Land for work has not been acquired" are carried out by transfers, "Weather disturbances that cause delays in project work" is done by mitigation, "The occurrence of cost overrun (Claim)" is done by mitigation and "Decreased margin due to increase in material prices" is done by mitigation. The contingency costs required to anticipate possible risks that may occur are Rp. 15,757,472,740 obtained from the single value calculation or 8.24% of the project value, which is Rp. 188,909,724,300. There is a risk response that does not require a special fee but the documents are contained in the contract clause.

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