BACHELOR THESIS & COLLOQOIUM – ME 141502

RISK ASSESSMENT OF SHIP REPAIR SCHEDULING

RIZKY RIZALDY NANDIANSYAH
NRP 04211441000019

SUPERVISORS :

Dr. Eng. M. Badrus Zaman S.T M.T
Nurhadi Siswantoro S.T M.T

DOUBLE DEGREE PROGRAM
DEPARTMENT OF MARINE ENGINEERING
FACULTY OF MARINE TECHNOLOGY
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA
2018

BACHELOR THESIS & COLLOQUIUM – ME141502

RISK ASSESSMENT OF SHIP REPAIR SCHEDULING

Rizky Rizaldy Nandiansyah
NRP. 04211441000019

Supervisors :
Dr. Eng. M. Badrus Zaman, ST., M.T.
Nurhadi Siswantoro ST., M.T

DOUBLE DEGREE PROGRAM
DEPARTEMENT OF MARINE ENGINERING
FACULTY OF MARINE TECHNOLOGY
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA
2018

"This page is intentionally left blank"

APPROVAL FORM

RISK ASSESSMENT OF SHIP REPAIR SCHEDULING

BACHELOR THESIS

Submitted to Comply One of The Requirement to Obtain a Bachelor Engineering Degree
on
Marine Operation and Maintenance (MOM)
Bachelor Program Department of Marine Engineering
Faculty of Marine Technology
Institut Teknologi Sepuluh Nopember

Prepare by :
RIZKY RIZALDY N
NRP. 04211441000019

Approved by Supervisor :

Dr. Eng M. Badrus Zaman, ST., M.T ( )

Nurhadi Siswantoro ST,. M.T ( )

"This page is intentionally left blank"

APPROVAL FORM

RISK ASSESSMENT OF SHIP REPAIR SCHEDULING

BACHELOR THESIS

Submitted to Comply One of The Requirement to Obtain a Bachelor Engineering Degree
on
Marine Operation and Maintenance (MOM)
Bachelor Program Department of Marine Engineering
Faculty of Marine Technology
Institut Teknologi Sepuluh Nopember

Prepare by :
RIZKY RIZALDY N
NRP. 04211441000019

Approved by
Head of Department of Marine Engineering

Dr. Eng. M. Badrus Zaman., ST., MT.
NIP. 197708022008011007

"This page is intentionally left blank"

DECLARATION OF HONOR

I hereby who signed below declare that:

This final project has written and developed independently without any plagiarism act. All contents and ideas drawn directly from internal and external sources are indicated such as cited sources, literatures, and other professional sources.

Name	: Rizky Rizaldy Nandiansyah
Student Number	: 04211441000019
Final Project Title	: Risk Assessment of Ship Repair Scheduling
Department	: Marine Engineering

If there is plagiarism act in the future, I will fully responsible and receive the penalty given by ITS according to the regulation applied.

Surabaya, July 2018

Rizky Rizaldy Nandiansyah

"This page is intentionally left blank"

RISK ASSESSMENT OF SHIP REPAIR SCHEDULING

Name : Rizky Rizaldy Nandiansyah
Student Number : 04211441000019
Department : Marine Engineering
Supervisors : Dr. Eng M. Badrus Zaman, ST., M.T.
Nurhadi Siswantoro ST., M.T.

ABSTRACT

Shipyard is one of the most important element in shipping industry for carrying out a job as building and repairing ship. Indonesia is one of the country that improve its maritime sector, based on data from ministry of industry in 2015 there is 250 shipyard in Indonesia and the ministry of industry also predicting that the number will keep increasing in order to maintain the demand on shipbuilding and ship repair industry, parallel to number of shipyard, the number of ship repair demand is increasing. In fact, in indonesia 40% of ship repair project is delayed every year. In global cases, 30% of large construction project is delayed with extended time 10%-30%. That mean the ship repair project in Indonesia is very risky to be delays.

FMEA is one of the method in risk assessment to assess the risk using qualitative approach, from FMEA we can know how critical the risk is and how to mitigate it.

The purpose of this thesis is developing recommendation for shipyard to get the best schedule, and not get the risk on delays in ship repair in this case is PT Adiluhung Saranasegara.

The Result shown that The delay on Ship Repair Project in PT.Adiluhung Sarana Segara using Schedule Risk Delay Software is 5 days maximum Delay from the Designated Delay Dates. And The highly impact cause of the Delays is Bad Weather Condition and Worker accident.

Keywords: scheduling, risk assessment, project management

"This page is intentionally left blank"

PREFACE

Alhamdulillahirobbil 'alamin. All praise and glory to Almighty Allah (Subhanahu Wa Taalaa) who gave the courage and patience to accomplish this bachelor thesis. Peace and blessing of Allah be upon last Prophet Muhammad (Peace Be upon Him).

This bachelor thesis report entitled: "Risk Assessment of Ship Repair Scheduling" in order to fulfill the requirements to obtaining the bachelor degree program at Marine Engineering Department, Faculty of Marine Technology, Institut Teknologi Sepuluh Nopember Surabaya.

The author realizes that carry out this thesis will be difficult without all supports and helps from various parties. Therefore, the author would like to give special thank to all people who has help the author for completing this bachelor thesis, among others:

1. To my parents, Mr Sunanto, Mrs. Suhariningsih and also my lovely sisters (Dita and Tyas) who always give endless amount of love, encouragements and prayers to the author.
2. Mr. Dr. Eng. Muhammad Badrus Zaman, ST., MT. as the Head of Marine Engineering Department.
3. Mr.Ir. Aguk Zuhdi M.Fathallah,.MEng.,Ph.D. as Author's Lecturer Advisor and Head of Bachelor Degree Program
4. Mr. Dr.Eng M Badrus Zaman S.T M.T. as Author's Thesis Supervisor I and Secretary of Bachelor Degree Program in Marine Engineering Department for excellent guidance and support during the process writing this thesis.
5. Mr. Nurhadi Siswantoro. as Author's Thesis Supervisor II who has giving an advice and knowledge to help the author finish this bachelor thesis.
6. Mr. Ir. Dwi Priyanta, M.SE. as the head of MOM Laboratory who has giving advice and guidance during thesis proposal.
7. Mahdania Ratri Paramitha who always support the author in every conditions.
8. MERCUSUAR '14 , Marine Double Degree '14 and Great amounts of friends that can't be mentioned for the assistance and support.

The author will really appreciated for every advice, suggestion and idea from all parties for this bachelor thesis correction and improvement in the future. Hopefully, this bachelor thesis can be advantageous for all parties especially in the field study of maritime.

Surabaya, July 2018

Author

TABLE OF CONTENTS

CHAPTER I
INTRODUCTION

1.1 Background

Shipyard is one of the most important element in shipping industry for carrying out a job as building and repairing ship. In maritime industry itself, ship repair is become 2nd most important aspect, approximately 40% of the operation costs in a marine shipping organization is attributable to maintenance[1]. That mean, ship repair is too important to deny.

Indonesia is one of the country that improve its maritime sector, based on data from ministry of industry in 2015 there is 250 shipyard in Indonesia and the ministry of industry also predicting that the number will keep increasing in order to maintain the demand on shipbuilding and ship repair industry[2], parallel to number of shipyard, the number of ship repair demand is increasing.

In fact, in indonesia 40% of ship repair project is delayed every year[3]. In global cases, 30% of large construction project is delayed with extended time 10%-30%[4].

PT adiluhung saranasegara is one of the national shipyard in Indonesia provided ship repair and ship building services. Based on the previous research, in 2015 there is 25% ship repair delays in shipyard in surabaya. That means, almost halve of the ship repair demand in shipyard in surabaya is Delayed. Also based on research of mangolloi M siallagan, there is 24% respondend from ship owner says that the ship repair in this shipyard is not ontime.

---

[1] Alhouli, yoseh mohammed 2011 *Development of Ship Maintenance Performance Measurement Framework to Assess the Decision Making Process to Optimise in Ship Maintenance Planning*, The University of Manchester for the degree of PhD in the Faculty of Engineering and Physical Sciences, England page 19

[2] Kementerian industry Indonesia 2014

[3] *kementerian perhubungan Indonesia 2012*

[4] Assaf,S.A & Al-Hejji,S 2006 *Causes of delay in large construction projects. International journal of project management*

Although the shipbuilding industry is characterized as high-risk, there are only limited applications of risk management incorporated into the various production processes.Since formal risk analyses have not been implemented commonly in the shipbuilding industry, this study represents an effort to assess the risk assessment process within Indonesian shipyards using PT adiluhung as a case study. We noted that the majority of ship repairs are delayed to various degrees beyond their anticipated completion dates.

Delays in ship repair project have many causes. One of the identified causes is the project management and planning. The project scheduling including human, material, reusable resource and facilities is a very complex task. Poor resource assignment, keeps workers waiting for the prerequisite activities, causes fluctuation of workloads resulting in expensive overtime-work, and may cause delay in delivery[5]. Many different techniques and tools, e.g. Guntt chart, Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT), have been developed to support an improved project planning. These tools are used seriously by a large majority of project managers to identify critical activities and calculate the minimum time required for project completion[6]. CPM identified as the most important method in project management in efficient ways to complete the project requirement. Due to the problem above it is possible to asses the risk of delay in ship repair project terms of reducing the delays.

1.1 **Statement Problem**

Based on the description of background above, there are three statement problems ;

1. How to get the Critical Path activities on Ship Repair of KM. Dharma Kartika III ?
2. How to Assess the Risk of Ship Repair Scheduling of KM. Dharma Kartika III?

[5] Khodakaram salimifard,gholamreza jamali, and sarah behbahaninezhad 2012, *resolving resource conflicts in a ship repair project. International journal of modeling and optimization vol 2. No. 5 october 2012*

[6] Samira zareei, 2018 *project scheduling for constructing biogas plant using critical path method*

3. How to Response to the Risk that occur in Ship Repair scheduling of KM. Dharma Kartika III ?

1.2 Research Limitation

There are limitation in this thesis :

1. The Ship Data is from KM.Dharma Kartika III from PT. Adiluhung Sarana Segara
2. Normal Duration is come From Ship Repair list and the author convert it into Gantt Chart

1.3 Research objective

The objectives to be obtained in this thesis are :

1. To get the Critical Path activities on Ship Repair of KM. Dharma Kartika III ?
2. To Assess the Risk of Ship Repair Scheduling of KM. Dharma Kartika III?
3. To Response to the Risk that occur in Ship Repair scheduling of KM. Dharma Kartika III ?

1.4 Deliverable

1. To understand the method of assessing the risk of delay in ship repair project, and what cause the delays.
2. Give the shipyard information about the risk of delays in ship repair project of KM. Dharma Kartika III.

CHAPTER II
LITERATURE REVIEW

2.1 Problem Overview

Indonesia is one of the country that improve its maritime sector, based on data from ministry of industry in 2015 there is 250 shipyard in Indonesia and the ministry of industry also predicting that the number will keep increasing in order to maintain the demand on shipbuilding and ship repair industry[7], parallel to number of shipyard, the number of ship repair demand is increasing.

In fact, in indonesia 40% of ship repair project is delayed every year[8]. In global cases, 30% of large construction project is delayed with extended time 10%-30%[9].

PT Adiluhung Saranasegara is one of the national shipyard in Indonesia provided ship repair and ship building services. Based on the previous research, in 2015 there is 25% ship repair delays in PT adiluhung Saransegara. That means, almost halve of the ship repair demand in PT Adiluhung Saranasegara is Delayed. Also based on research of mangolloi M siallagan, there is 24% respondend from ship owner says that the ship repair in this shipyard is not ontime.

Delays in ship repair project have many causes. One of the identified causes is the project management and planning. The project scheduling including human, material, reusable resource and facilities is a very complex task. Poor resource assignment, keeps workers waiting for the prerequisite activities, causes fluctuation of workloads resulting in expensive overtime-work, and may cause delay in delivery[10]. Many different techniques and tools, Many approach and method use assess the risk of ship repair delays. One of it is FMEA, FMEA now use to identify the risk in project management, FMEA can reduce the risk of project management problem like delays in schedule, cost, and man power that can bring problem to project.

Due to the problem above it is possible to asses the risk of delay in ship repair project terms of reducing the delays.

---

[7] Kementerian industry Indonesia 2014

[8] *kementerian perhubungan Indonesia 2012*

[9] Assaf,S.A & Al-Hejji,S 2006 *Causes of delay in large construction projects. International journal of project management*

[10] Khodakaram salimifard,gholamreza jamali, and sarah behbahaninezhad 2012, *resolving resource conflicts in a ship repair project. International journal of modeling and optimization vol 2. No. 5 october 2012*

2.2 Project Management

Project Management is application of knowledge, skills, tools, amd technique to project activities to meet project requirement. Project management is accomplished through the use of such as : inititating, planning, executing, controlling, and closing.

The term project management is sometimes used to describe an organizational approach to management of ongoing operations. This approach, more properly called management by projects, treats many aspects of ongoing operations as project to apply project management techniques to them. Although an understanding of project management is critical to an organization that is managing by project. Knowledge about project management can be organized in many ways. [11]

2.3 Maintenance In Project Management

Maintenance time management is identifying and documenting the specific activities that must be performed to produce the deliverables and sub-deliverables identified in the WBS (work breakdown structure). It also has a time schedule:[12]

- Activity definition
- Activity sequencing
- Activity resource estimating
- Activity duration
- estimating Schedule development
- Schedule control

2.3.1 Activity definition

Activity definition involves identifying and documenting the specific activities that must be performed to produce the deliverables and sub-deliverables identified in the work breakdown structure (WBS). It is divided into three main parts:[13]

- Input:
  1. WBS
  2. Scope statement

[11] PMBOK Guide,2000,PMBOK,Project Management Institute, INC, USA page 15

[12] PMBOK Guide, 2000, PMBOK, Project Management Institute, Inc., USA, page 36.

[13] PMBOK Guide, 2000, PMBOK, Project Management Institute, Inc., USA, page 67

3. Historical information Constraints

- Assumption
  1. Expert judgement
  2. Tools and techniques: Decomposition Templates
- Output:
  1. Activity list
  2. Supporting detail WBS update

2.3.2 Activity sequencing

Activity sequencing involves identifying and documenting interactivity logical relationship. Activities must be sequenced accurately to support later development of a realistic and achieveable schedule. The parts are:[14]

- Input:
  1. Activity list
  2. Product description
  3. Mandatory dependencies Dicretionary
  4. Dependencies External
  5. Dependencies Milestones
- Tools and techniques:
  1. Precedence diagramming method (PDM)
  2. Arrow diagramming method (ADM)
  3. Conditional diagramming method Network templates
- Output:
  1. Project network diagram Activity list update

2.3.3 Activity resource estimating

Estimating schedule activity resource involves determining what resource (human, equipment, or material) and what quantities of each resources will be used, and when each resources will be available for maintenance project activities. The parts are:[15]

- Input:
  1. Enterprise environmental factors
  2. Organizational process assets

[14] PMBOK Guide, 2000, PMBOK, Project Management Institute, Inc., USA, page 68.

[15] PMBOK Guide, 2000, PMBOK, Project Management Institute, Inc., USA, page 71

3. Activity list
4. Activity attributes
5. Resource availability
6. Maintenance management plan

- Tools and techniques:
  1. Expert judgement
  2. Alternatives analysis
  3. Published estimating data
  4. Project management software Bottom-up estimating
- Output:
  1. Activity resource requirements Activity attributes update
  2. Resource breakdown structure Resource calendar
  3. Requested changes

2.3.4 Activity duration

Activity duration estimating is the process of taking information on project scope and resources, and then developing duration for input to schedule. The estimate is often progressively elaborated, and the process consider the quality and avalibility of the input data. The parts are:[16]

- Input:
  1. Activity
  2. list
  3. Constraints
  4. Assumption
  5. Resource requirement
  6. Resource capability
  7. Historical information

2.3.5 Schedule evelopment

Schedule development means determining start and finish dates for maintenance project activities. If the start and finish dates are not realistic, then the maintenance project is unlikely to finish as schedule.[17]

[16] PMBOK 2000, Project management institute,USA

[17] PMBOK 2000, Project management institute,USA

2.3.6 Schedule Control

Schedule control is concerned with influencing the factors that create schedule changes to ensure that changes agreed upon, determining that the schedule has changed, and managing the actual changes when and as they occur.[18]

2.4 Risk Assessment

Risk assessment is the determination of quantitative or qualitative estimate of risk related to a well-defined situation and a recognized threat (also called hazard). *Quantitative risk assessment* requires calculations of two components of risk *(R)*: the magnitude of the potential loss *(L)*, and the probability *(p)* that the loss will occur. An acceptable risk is a risk that is understood and tolerated usually because the cost or difficulty of implementing an effective countermeasure for the associated vulnerability exceeds the expectation of loss. "Health risk assessment" includes variations, such as the type and severity of response, with or without a probabilistic context.

In the engineering of complex systems, sophisticated risk assessments are often made within safety engineering and reliability engineering when it concerns threats to life, environment or machine functioning. The agriculture, nuclear, aerospace, oil, rail and military industries have a long history of dealing with risk assessment. Also, medical, hospital, social service and food industries control risks and perform risk assessments on a continual basis. Methods for assessment of risk may differ between industries and whether it pertains to general financial decisions or environmental, ecological, or public health risk assessment.

[18] PMBOK 2000, Project management institute,USA

2.5 Project Risks

Effectiveness and quality to the risk identification process. This publication recommends the use of a risk breakdown structure (RBS), where risks are classified under the following groups: Technical, External, Organizational, and Project Management.[19] Examples of RBS's for different types of projects are described in more detail in Hillson author states that a RBS is a powerful aid to risk identification, assessment, and reporting; the ability to roll-up or drill-down to the appropriate level provides new insights into overall risk exposure on the project. The following table, for example, classifies project risks for the construction Design industry.

It is recognized that construction industry operations are plagued by risk[20], however often risk has not been dealt adequately, resulting in poor performance with increased costs and time delays. An important step in managing risk is the risk assessment process, where risks that affect the project are identified and then categorized. According to the PMBOK risk categories provide a structure that ensures a comprehensive process of systematically identifying risk to a consistent level of detail and contributes.

Figure 2.1. Project Risk in Table

LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3
Project risk	Environment	Statutory	Planning approval delay
			Legislation changes
			Ecological constraints
			…etc…
	Industry	Market	Increase in competition
			Change in demand
			Cost/availability of raw materials
			…etc…
	Client	Client team	Client representative fails to perform duties
			No single point of contact
			Client team responsibilities ill-defined
			…etc…
		PM team	Inadequate project management controls
			Incorrect balance of resources & expertise
			PM team responsibilities ill-defined
			…etc…
		Targets	Project objectives ill-defined
			Project objectives changed mid-design
			Conflict between primary & secondary objectives
			…etc…
		Funding	Late requirement for cost savings
			Inadequate project funding
			Funds availability does not meet cashflow forecasts
			…etc…
		Tactics	Brief changes not confirmed in writing
			Change control procedure not accepted
			Unable to comply with design sign-off dates
			…etc…
	Project	Team	Poor team communication
			Changes in core team
			Inadequate number of staff
			…etc…
		Tactics	Cost control …
			Time control …
			Quality control …
			Change control …
		Task	Site…
			Design…

[19] PMBOK

[20] Flanagan and Norman 1993

2.6 Schedule Risk Analysis

Project schedules can be displayed in a variety of ways such as Gantt charts, bar charts, and network diagrams. The later is considered as the most adequate in the construction industry since it shows the project activities and their precedence relationships and any constraints that affect their start and finish times. The determination of the project duration is subjected to the individual activity durations and the network structure. The Critical Path Method (CPM), developed in the late 1950s by DuPont Inc., is largely used for determining the minimum completion time for a project as well as the start and finish times of each activity The critical path represents the sequence or path of activities that take the longest to complete, and all activities along this path are termed critical activities. The length of the critical represents the minimum project duration. CPM however, conveys a sense of certainty in the estimation of activity and project duration.[21] CPM assumes that the duration of activities are deterministic, therefore themestimated project duration is deterministic. This assumption implies that activity 36 durations can be estimated with certainty, which is not realistic as we have discussed in previous sections. The following figure presents an example of a small project network where activity durations and precedence relationships are shown. This example will be used to explain the rationale of schedule risk analysis throughout this section.

[21] Moder et al. 1983.

2.7 Qualitative Project Risk Analysis

Qualitative approaches in project risk analysis are very popular among project management practitioners due to their easy implementation and communication of results to other project participants. After the identification of potential risks a "risk register" is created. The general procedure first assesses qualitatively the probability of occurrence of each risk and then its consequences on project performance.In a similar way the consequence of certain risk on project schedule, cost and technical Once the occurrence probability and consequences of each risk are scored they can be mapped into a matrix where the importance of each one can be evaluated.

For example, risks that fall in the upper right area of the matrix are the ones to be considered critical and need to be investigated in order to avoid undesirable results on project performance targets; conversely, risks mapped in the lower left area of the matrix are less critical. The benefits of this methodology are visible for risk prioritization and communication; however, it is limited when assessing and planning for consequences in terms of money and time. A qualitative analysis is an important input for quantitative risk analysis.[22]

2.8 Primavera Project Management

Primavera Project Management is one of the software that used to plan the project, this software can plan your project from schedule, resource number, cost and calculate the risk of the project.

Primavera also integrated with oracle, one of the biggest database company in the world, oracle primavera is one of the most easily recognized and usefull tool in effective project management. Primavera Project Management give unparalled control, monitoring, and insight to planners, Project managets, Schedulers, and any other who are involved in a given project.

In this case, the author are making the WBS, the list of normal duration and the CPM using Primavera Project Management.

[22] Cooper and Broadleaf Capital International. 2005; Project Management Institute 2004; Smith and Merritt 2002.

2.9 Primavera Risk Analysis

Oracle's Primavera Risk analysis provide many features for ensuring comprehensive risk analysis, mitigation and management in a project.

Primavera risk analysis step to analyse the risk. The first step is providing risk register, the risk register is any type of register that can happen and disturb the schedule of a project, that can make the project finish date in uncertainty. The type of risk in risk register is using qualitative approach to list any risk that can happen in the project, the risk is come from brainstorming with the expert and the historical risk that ever happen on that activities.

The second step is to calculating risk analysis using advanced monte carlo cost and schedule analytic. To calculate the risk with many possibility that can happen in one project.

The final step is reporting the risk analysis and also the project managers can give the risk mitigation in the primavera risk analysis and risk response to conduct the analyze and simulation the difference between before mitigation and after mitigation result in risk analysis.

Primavera risk analysis also provided distribution graph, to analyse the result of the risk analysis and the simulation to compare one risk analysis to other, from the graph also can see the other aspect of the project like costs, resources.

Primavera can provide the risk score based on project managers, in this case the authors have discussed with the expert about risks scores. The impact scores and probability scores is based on discussed with expert. The list of impact score and probability score can be seen in **Table 2.1** and **Table 2.2**

Table 2.1 Impact Index in Schedule Risk analysis

Impact Index	Impact Rating	Description
1	Very Low	<=1 day
2	Low	>1 day
3	Medium	>2 day

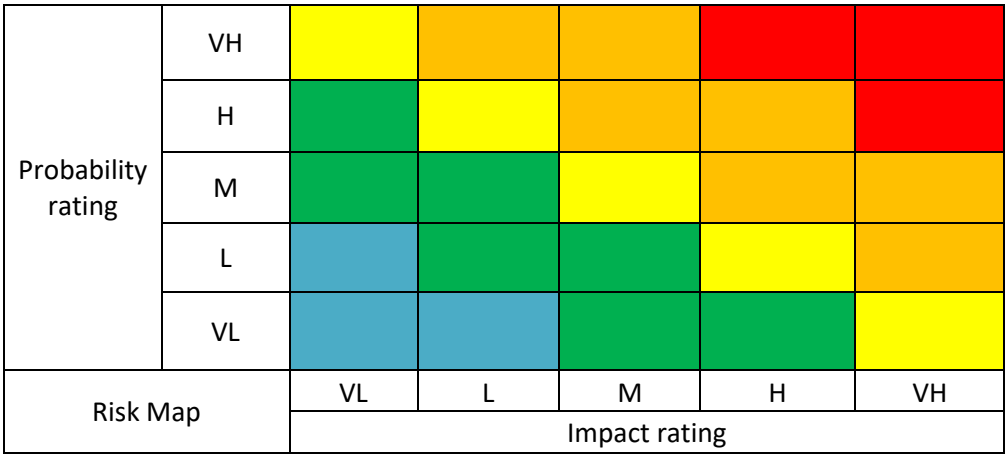
4	High	>3 day
5	Very High	>3 day delay

Table 2.2 Probability index in Schedule Risk analysis

probability index	probability rating	probability
1	Very Low	<10%
2	Low	10% - 30%
3	Medium	31% - 50%
4	High	51% - 70%
5	Very High	>70%

Also, in Primavera Risk analysis the Project Managers can provide the risk matrix type, in this case the authors also discussed with the expert about the risk matrix and the risk score, the type of risk matrix that used in this project can be seen in **Figure 2.2**

Figure 2.2 Primavera Risk Analysis Risk Matrix



CHAPTER III
METHODOLOGY

3.1 Flowchart Methodology

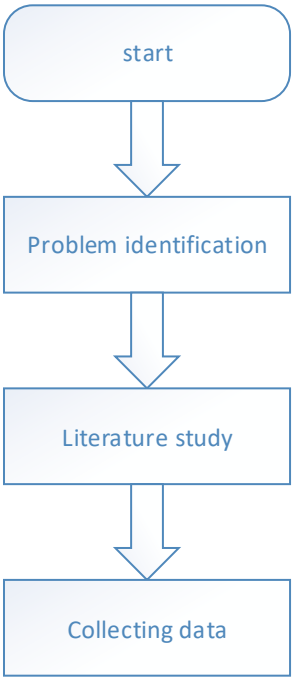


Figure 3.1 Methodology FlowChart

3.2 Definition

3.2.1 Statement of Problems

This step is a first step to conduct the thesis. In this step, the existing problem is identify by question and collect information regarding existing problem. The thesis contents is come from the statement of the problems and also the main objective of this thesis can be found in this step.

3.2.2 Study of Literature

Study of literature is rise after understanding the statement problem. In this step, the author search references and information that support the completion of thesis. Various literature topics is needed for deep understanding about the problem and its solution. To complete this step, the author need to be done by reading national or international papers, journals, thesis, media and also literature books.

3.2.3 Collecting Data

Collecting data is gathering the research resource in shipping company, in this case is PT adiluhung saranasegara. In

this thesis the data that will provided is : the ship repair schedule in this case is KM.Dharma Kartika III, and interview and sharing with expert

3.2.4 Define The Critical Path Of The Schedule

After collecting data from PT adiluhung saranasegara, the Data then processed by Primavera P6 to define the critical path of the schedule to find where the activities is critical.

3.2.5 Determining The Risk Of The Schedule

After Define the critical path of the schedule, the next step is assess the risk of the critical path of the schedule to find what activities have the low risk of the activities and what activities have the very high risk

3.2.6 Developing Risk Response Plan

Developing response plan to get the action to mitigate the risk, the response plan also shared with the expert of how to mitigate the critical risk from the schedule.

3.2.7 Conclusion

The author made the conclusion from all the process on assess the risk of ship repair project scheduling of KM. Dharma Kartika III

CHAPTER IV
DATA ANALYSIS AND DISCUSSION

4.1 Identification of Data Research

Availability of data is important thing to complete this research. From the *Chapter III* already explained that the first thing to do in this research is data collection. The required data will be explained as follows:

1. The ship repair schedule and the information from PT.adiluhung management This data is used as the basis of the object of research in the stages of identification of risk that will occur that using FMEA to identification the risk.
2. Shipyard worker interview to gather the information for the Probability Rating and Consecuence Rating.
3. The ship data and schedule for next repair the data is come from KM.Dharma Kartika III.

4.2 Identification of Research Object

KM.Dharma Kartika III is newly build vessel by PT Dharma Lautan Utama. The vessel is occurrence annual survey in PT adiluhung saranasegara in july 2018, the ship is using BKI classificiation.

In this thesis, author use KM.Dharma Kartika III Repair List as object to change to Schedule or gantt chart, the duration and time of the schedule is based on interview with expert in PT adiluhung and the historical data from existing Annual Survey of KM Dharma Kartika III.

The specification of KM.Dharma Kartika III is explained below :

Length Over All	:	71.82 M
Breadth	:	14.70 M
Height	:	4.10 M
Draft	:	3.10 M
Goss Tonnage	:	2,624 ton

4.3 Ship Repair Normal Duration of KM.Dharma Kartika III

Analyzing time for normal Duration of the project is based on repair schedule of KM.Dharma Kartika 3 and repair list that have been agreed by PT. Adiluhung and ship owner.

Based on the schedule, the date of the ship repair of KM. Dharma Kartika 3 is from 11 july 2018 to 24 july 20148 2018. The activities work breakdown structure can be seen in **Figure 4.1.**

And the list of the activities of KM Dharma Kartika III annual survey is listed in **Table 4.1**

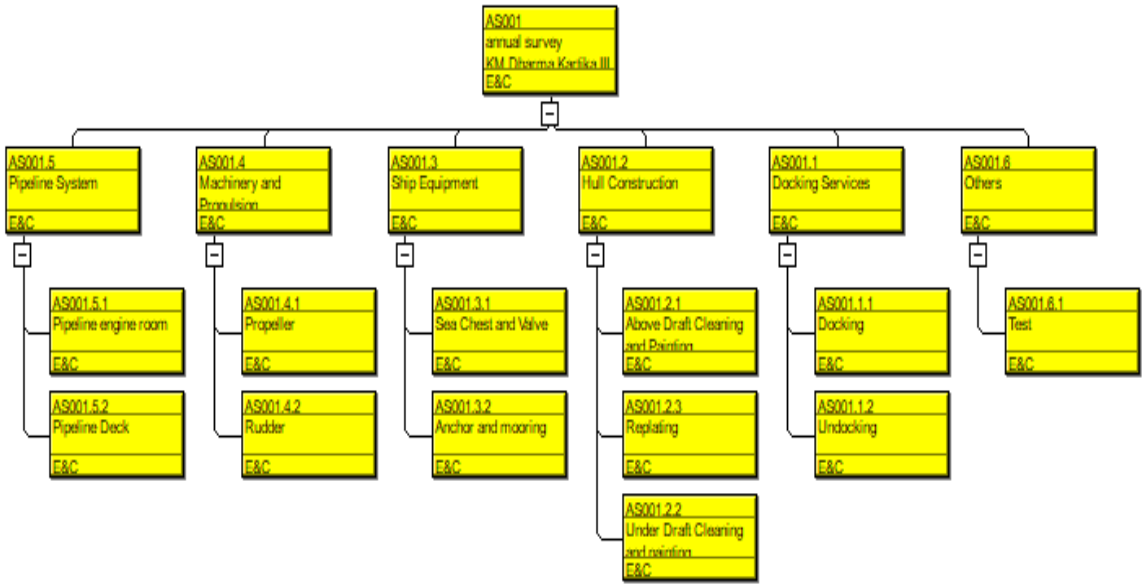


Table 4.1 KM.Dharma Kartika III activities schedule

Task_code	Task_Name	Start_date	End_date
Activity ID	Activity Name	(*)Start	(*)Finish
A1000	TugBoat Service	11-Jul-18	11-Jul-18
A1020	Docking Assist	13-Jul-18	13-Jul-18
A1030	Docking for UnderwaterLine Inspection report	13-Jul-18	19-Jul-18
A1040	Scrapping	13-Jul-18	14-Jul-18
A1050	cleaning using freshwater	14-Jul-18	14-Jul-18
A1060	Sweepblasting	14-Jul-18	15-Jul-18

Task_code	Task_Name	Start_date	End_date
A1070	Spotblasting	15-Jul-18	16-Jul-18
A1080	AC 1 Painting	16-Jul-18	17-Jul-18
A1090	AC 2 Painting	17-Jul-18	18-Jul-18
A1100	AF Painting	18-Jul-18	19-Jul-18
A1120	Waterjet Cleaning	14-Jul-18	14-Jul-18
A1130	Sweepblasting	15-Jul-18	15-Jul-18
A1140	Spotblasting	16-Jul-18	16-Jul-18
A1150	AC Painting	17-Jul-18	18-Jul-18
A1160	Finish Bootop Painting	18-Jul-18	19-Jul-18
A1170	Plate Fender Painting	18-Jul-18	19-Jul-18
A1180	Draft Mark and Primsoll Mark painting	19-Jul-18	19-Jul-18
A1190	Ultrasonic Test	14-Jul-18	14-Jul-18
A1200	Sweepblasting efek check, welding check (Class Recommendation)	15-Jul-18	16-Jul-18
A1210	uninstalling Zinc Anodes	14-Jul-18	14-Jul-18
A1450	Kotak laut dilaksanakan perawatan, dibersihkan, dicat 1 x AC, 1 x AF. (cat sup. Owner)	14-Jul-18	16-Jul-18
A1460	Strainer kotak laut dan lubang sea chest	14-Jul-18	16-Jul-18
A1470	Katub laut dilepas, dibersihkan, diskur, bagian yang rusak diganti baru, dicat 1 x AC dan 1 x AF	14-Jul-18	15-Jul-18
A1490	Cek visual kondisi blade propeller saat naik docking (Rekondisi blade bila bengkok / rusak).	14-Jul-18	17-Jul-18
A1500	Ukur clearance shaft propeller kanan kiri, ganti bantalan & repair sleeve shaft bila hasil clearance jelek	13-Jul-18	13-Jul-18
A1510	Cek kondisi AVK Seal dan inflitable seal shaft propeller kanan kiri bila bocor / rusak	14-Jul-18	14-Jul-18

Task_code	Task_Name	Start_date	End_date
	ganti baru.		
A1520	Pemasangan carbon brushter shaft propeller kanan kiri	15-Jul-18	16-Jul-18
A1530	Ukur clearance poros kemudi (dibuatkan laporan)	13-Jul-18	13-Jul-18
A1540	penggantian seal apabila mengalami kerusakan / bocor (seal supply owner)	17-Jul-18	18-Jul-18
A1550	Repipe pipa pengisian BBM (posisi dalam cerobong blower kiri) uk. Ø5" x1720x2flend	14-Jul-18	16-Jul-18
A1560	Repipe pipa ekspansi pendingin air tawar UK uk. Ø2" x 6000 x 2 flend, sch 40 Seamless	14-Jul-18	17-Jul-18
A1570	Repipe pipa tekan Bilge Pump	14-Jul-18	17-Jul-18
A1590	Repipe Pipa hawa heelling tank kiri	14-Jul-18	17-Jul-18
A1600	Pemasangan instalasi baru pipa FWP Ballast (plane B)	14-Jul-18	17-Jul-18
A1610	Pembuatan pipa sounding FW Tank kanan (pipa SS)	18-Jul-18	19-Jul-18
A1620	Pembuatan pipa pembuangan baru di gangway kanan Ruang Panggung	18-Jul-18	20-Jul-18
A1630	Pelancaran pipa cuci rantai jangkar kanan kiri uk. Ø 2" x 1500 x 2 elb x 2 flend x sch 40 Seamless	18-Jul-18	20-Jul-18
A1640	Penggantian tiang talang air penegar gangway kanan kiri uk. Ø3½" x 1500 mm, sch 40 Seamless	18-Jul-18	21-Jul-18
A1650	Penggantian tiang talang air penegar gangway kanan kiri uk. Ø3½" x 1500 mm, sch 40 Seamless	18-Jul-18	21-Jul-18
A1670	Perawatan & pengujian sistem	14-Jul-18	18-Jul-18

Task_code	Task_Name	Start_date	End_date
	kekedapan Rampdoor haluan, buritan & samping		
A1680	Perawatan & pengujian sistem kekedapan seluruh pintu kedap, manhole & small hatch	18-Jul-18	22-Jul-18
A1690	TugBoat Service	24-Jul-18	24-Jul-18
A1700	Undocking Assist	20-Jul-18	20-Jul-18
A1720	Repipe pipa hydrolis winch buritan kiri uk. Ø1½" x 1800 x 2 elb x 2 flend, sch 80 Seamless	21-Jul-18	23-Jul-18
A1730	Repipe pipa isap Bilge Pump	14-Jul-18	17-Jul-18
A1740	Repipe pipa pembuangan trimming belakang yang keropos	18-Jul-18	20-Jul-18
A1750	Modifikasi penambahan flend pipa drainase & hydran gangway kiri Ruang Panggung Ø 4½"	18-Jul-18	20-Jul-18
A1760	Perawatan / lancarkan pipa drainase Kamar mandi pria Ruang Lesehan	20-Jul-18	21-Jul-18
A1770	Pemasangan tiang penyangga atap talang depan Kamar cleaning service	21-Jul-18	23-Jul-18
A1780	Katub laut dilepas, dibersihkan, diskur, bagian yang rusak diganti baru, dicat 1 x AC dan 1 x AF	18-Jul-18	19-Jul-18
A1790	Jangkar dan rantai jangkar kiri direntang, dibersihkan, dilancarkan swivel dan sacklenya, dicat	14-Jul-18	16-Jul-18
A1800	Jangkar dan rantai jangkar kiri direntang, dibersihkan, dilancarkan swivel dan sacklenya, dicat	19-Jul-18	19-Jul-18
A1810	Kotak rantai jangkar kiri dilaksanakan perawatan cat uk.	16-Jul-18	17-Jul-18

Task_code	Task_Name	Start_date	End_date
	2000 x 1500 mm		
A1820	Installing Zinc Anodes	19-Jul-18	19-Jul-18
A1830	Replate plate BGA dengan hasil UT dibawah 6.4 mm / Sesuai hasil UT (Rekomendasi OS/BKI)	14-Jul-18	19-Jul-18
A1840	Replate plate keel dengan hasil UT dibawah 8.4 mm / Sesuai hasil UT (Rekomendasi OS/BKI)	14-Jul-18	19-Jul-18
A1850	Replate plate BGA fr. 79-80 lajur keel (sekat antara FW Tank & FO Tank) deformasi uk 700x1200x14mm	14-Jul-18	19-Jul-18
A1860	Replate plate fender haluan yang deformasi uk. ½ x Ø8" x 1000 x sch.40	14-Jul-18	16-Jul-18
A1870	Replate / penambahan nut las plate fender buritan kanan yang retak 260 mm x 2 layer	14-Jul-18	16-Jul-18
A1880	Replate/tambah nut las plate fender bawah rampdoor samping fr.15 - fr.25 kanan 3500 mmx2 layer	14-Jul-18	16-Jul-18
A1890	Pembuatan stopper winch tros buritan kanan yang keropos	17-Jul-18	17-Jul-18
A1900	Replate plate bordes & pondasi winch tros buritan kanan yang keropos	18-Jul-18	18-Jul-18
A1910	Replate plate bordes winch spring haluan kanan uk 570 x 1200 x 5 mm	18-Jul-18	19-Jul-18
A1920	Replate plate geladak bawah pintu Ruang Panggung kanan uk 2100 x 350 x 8 mm	18-Jul-18	19-Jul-18
A1930	Perawatan pelancaran Dumping stopper blower forepeak kanan kiri macet	18-Jul-18	18-Jul-18

Task_code	Task_Name	Start_date	End_date
A1940	Pembuatan/tambah tempat pijakan untuk lempar tali buangan buritan kanan uk 1500 x 800 x 8 mm	23-Jul-18	24-Jul-18
A1950	Perbaikan pondasi H beam winch haluan kanan kiri	12-Jul-18	16-Jul-18
A1960	Dilaksanakan NDT engsel rampdoor haluan, buritan, & samping dan dibuatkan laporan	14-Jul-18	14-Jul-18
A1970	Dilakukan Sweep Blasting plate bawah Rampdoor haluan, buritan dan samping	18-Jul-18	18-Jul-18
A1980	Dicheck efek sweeepblasting, check nat las plate girder membujur dan melintang gading2 Rampdoor, -	18-Jul-18	18-Jul-18
A1990	Replate plate rampdoor samping yang retak uk 650 x 1200 x 10 mm	18-Jul-18	19-Jul-18
A2000	Setting ulang level pin engsel Rampdoor haluan & rampdoor samping	12-Jul-18	18-Jul-18
A2010	Replate dinding lambung haluan kiri yang keropos / lubang uk 350 x 1200 x 8 mm	14-Jul-18	15-Jul-18
A2020	Penggantian cincin lashing yang sudah patah	14-Jul-18	15-Jul-18
A2030	Perbaikan cover cerobong cardeck kanan yang rusak terkena kendaraan uk 1500 x 1500 x 4 mm	14-Jul-18	15-Jul-18
A2040	Pembuatan tutup scupper got baru	14-Jul-18	15-Jul-18
A2050	Buatkan tutup & engsel untuk pipa hawa fr. 71 kanan kiri	17-Jul-18	18-Jul-18
A2060	Penggantian jendela site schotle lambung kanan kiri	22-Jul-18	23-Jul-18

Task_code	Task_Name	Start_date	End_date
	yang keropos (supply owner)		
A2070	Replate langit langit cardeck fr. 104 - fr. 109 kanan uk 750 x 2500 x 8 mm (korosif/fitting)	18-Jul-18	20-Jul-18
A2080	Replate langit langit cardeck fr. 48 - fr. 57 kiri (eks doubling) uk 750 x 3500 x 8 mm	18-Jul-18	20-Jul-18
A2090	Replate langit langit cardeck fr. 35 - fr. 38 kiri uk 750 x 2000 x 8 mm (korosif/fitting)	18-Jul-18	20-Jul-18
A2100	Replate langit langit cardeck fr. 83 - fr. 84 kiri uk 750 x 600 x 8 mm (korosif/fitting)	18-Jul-18	20-Jul-18
A2110	Replate langit langit cardeck fr. 59 - fr. 67 kiri uk 750 x 3500 x 8 mm (korosif/fitting)	18-Jul-18	20-Jul-18
A2120	Replate langit langit cardeck fr. 40 - fr. 45 kiri (eks doubling) uk 750 x 3000 x 8 mm	21-Jul-18	23-Jul-18
A2130	Replate langit langit cardeck fr. 24 - fr. 27 kiri uk 750 x 1800 x 8 mm (korosif/fitting)	21-Jul-18	23-Jul-18
A2140	Replate langit langit cardeck fr. 12 - fr. 15 kanan uk 750 x 1800 x 8 mm (korosif/fitting)	21-Jul-18	23-Jul-18
A2150	Replate langit langit cardeck fr. 45 - fr. 53 kanan uk 750 x 3500 x 8 mm (korosif/fitting)	21-Jul-18	23-Jul-18
A2160	Replate langit langit cardeck fr. 55 - fr. 60 kanan uk 750 x 3000 x 8 mm (korosif/fitting)	21-Jul-18	23-Jul-18
A2170	Pembuatan talang air baru Kamar mandi gangway kiri uk 700 x 1600 x 8 mm	14-Jul-18	17-Jul-18
A2180	Rekondisi talang air lambung kanan kiri uk 200 x 6000 x 8 mm	17-Jul-18	20-Jul-18
A2190	Cleaning & Perawatan	14-Jul-18	16-Jul-18

Task_code	Task_Name	Start_date	End_date
	pengecatan FW Tank fr. 80 - fr. 90		
A2200	Cleaning Perawatan & pengecatan Ballast Tank fr. 90 - fr. 108	17-Jul-18	19-Jul-18
A2210	Perawatan sweepblasting & pengecatan Trimming Tank buritan kanan kiri	20-Jul-18	23-Jul-18

4.4 Determining Critical Path

After Determining relationship between activities, the next step is to determining the critical path of each activities, to identify the critical path it can be helped by using the primavera project manager. This program can help to arrange work breakdown and details of each activities. Based on Primavera scheduling the result of scheduling can be seen what activities is critical to the project that can cause the delay. The list of critical activities can be seen below :

Table 4.1 critical activities of the schedule

Activities section name	Duration
Docking servies	1 days
Above draft cleaning and painting	6 days
Under draft cleaning and painting	7 days
Sea chest and valve maintenance	5 days
Anchor and mooring maintenance	5 days
Propeller maintenance	4 days
Rudder maintenance	5 days
Engine room pipeline maintenance	9 days
Deck pipeline maintenance	6 days
Test	8 days

Table 4.2 above determining the activities that can be quicken to reach the designated finish dates. The reason that the activities is critical because :

1. Critical activities can be quicken without jeopardizing the finish dates of the project. And disturbing the designated network planning
2. The critical designated network planning cant be completed if the critical activities is not completed, that means if critical activities is late then the entire project is late.

4.5 Schedule delay Risk assessment

The schedule delay risk is analyse based on probability and consecuence of the activities

4.5.1 Determining Impact

The worst impact that can happen to the project finish dates must be identified and reviewed when analyse the consecuence. The consecuence data must be the impact to the schedule project delay.

The Impact criteria that used in this thesis is reviewed and approved by the production division in the shipyard based on the duration of the delay that can affect the project in every activities section on the **Table 4.3** is the Impact criteria based on delays impact.

4.5.2 Determining probability

The probability is the qualitative answer of how many the risk event occur in the activity that cause the activities delay.

On **Table 4.4** the description about probability criteria of the delay risk, the probability criteria is based on the previous researcher and approved by the production division of the shipyard.

Table 4.3 consecuence criteria to schedule delays

Impact Index	Impact Rating	Description
1	Very Low	<=1 day

2	Low	>1 day
3	Medium	>2 day
4	High	>3 day
5	Very High	>3 day delay

Table 4.4 Probability criteria to schedule delays

Probability index	Probability rating	Probability
1	Very Low	<10%
2	Low	10% - 30%
3	Medium	31% - 50%
4	High	51% - 70%
5	Very High	>70%

4.5.3 Risk Assessment

After get the consecuence criteria and probability criteria, then the next step is to get the probability and consecuence score for every activity section that included critical path.

The risk assessment score is based on interview with the shipyard worker after asking for the consecuence of the schedule delays and the probability the risk happen to that activity section. On this **Table 4.5** is the risk assessment result.

4.5.4 Risk analysis

After getting the consecuence rating and probability rating, then plotting the consecuence rating and probability rating of the each activity section critical path to risk matrice that shown in the **Figure 4.1** based on Primavera Risk Analysis.

Table 4.5 Risk Register Rating From Primavera Risk Analysis

Risk			**Pre-mitigation**				
ID	**Type**	**Title**	**Probability**	**Schedule**	**Cost**	**Performance**	**Score**
Risk 1	Threat	Bad Weather Condition	L	VH	N	N	24
Risk 2	Threat	Lack of Material	M	M	N	N	10
Risk 3	Threat	Lack of equipment	L	L	N	N	3
Risk 4	Threat	New to System design	L	M	N	N	6
Risk 5	Threat	Worker Accident	L	VH	N	N	24
Risk 6	Threat	Pipeline Design	M	M	N	N	10
Risk 7	Threat	Lack of worker	L	M	N	N	6
Risk 8	Threat	Delays in Material from owner	L	M	N	N	6

Figure 4.1 Schedule Risk Matrix

Probability rating	VH					
	H					
	M					
	L					
	VL					
Risk Map		VL	L	M	H	VH
		Impact rating				

Aftering getting the risk score, then plotting the risk score to risk matrix In Primavera Risk analysis determine which activities have high risk to give the risk response, and developing the simulation in

Primavera Risk analysis to determine the delay date. The matrix can be configured in Primavera Risk analysis, the plotting result can be seen in **Figure 4.2** and the highest risk is on Bad Weather condition and Worker Accident with score 24.

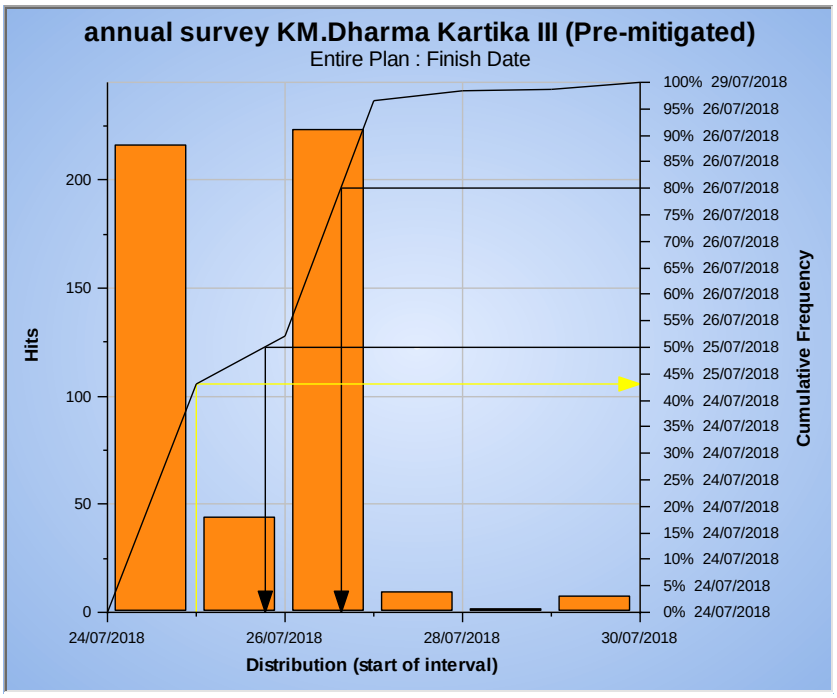
Figure 4.2 Schedule Risk Matrix plotting example

From the Figure above can be seen that the register is plotting based on th risk score, the score is mainly on medium level that colored by yellow, and only 2 activities have very high risk criticality that colored on red.

4.6 Simulating Risk Register to Schedule

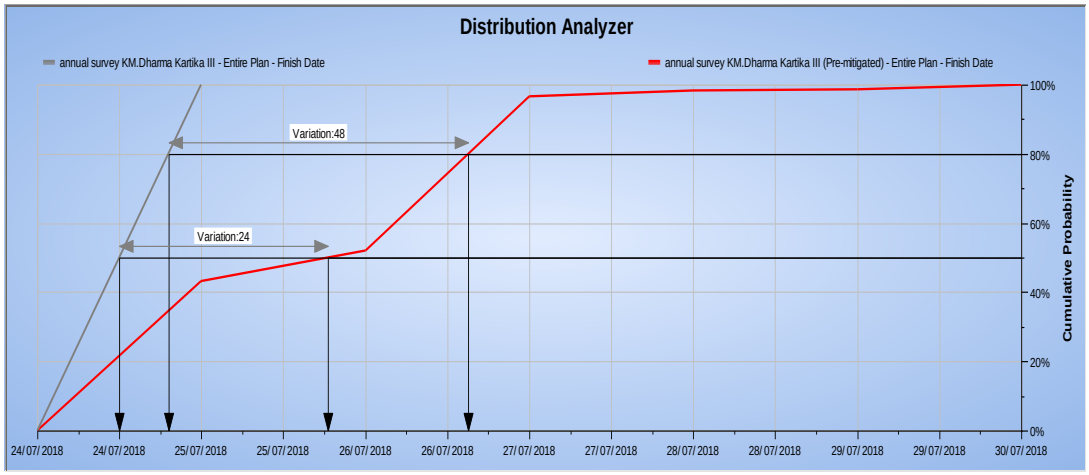
The plotting result can be seen in to see if the project is delayed or not based on the risk register that been analyse by the author, the plotting result can be seen in **Figure 4.3**

Figure 4.3 Plotting result on Primavera Risk analysis



The Result show that The minimum Delay time of the project is on 24 july it means no delay and the maximum delay time of the project is 29 july the graph result is based on schedule data and risk register probability rating and impact rating.

Figure 4.4 Distribution analyzer between actual date and risk date



4.7 Mitigation on Risk Activities

Mitigation is action to reduce the Risk, in this case to reduce the Schedule delay Risk, the mitigation types is based on interview an discussion with the shipyard worker, the list of mitigation action can be seen in **Figure 4.4**

Figure 4.5 Mitigation action and response on Primavera Risk Analysis

	Pre-Mitigation (Data Date = 11/07/2018)				Mitigation	
Title	Probability	Schedule	C	Performance	Response	Title
Bad Weather Condition	L	VH	N	N	Avoid	increase manpower and workhour
Lack of equipment	L	L	N	N	Accept	increasing workhour
New to System design	L	M	N	N	Reduce	increasing knowledge and workhour
Worker Accident	L	VH	N	N	Reduce	increase Safety aspect for the worker
Pipeline Design	M	M	N	N	Reduce	increase manhour and man power
Lack of Material	M	M	N	N	Transfer	3rd party supplier

4.8 Simulating Schedule post Mitigating

After Committing the Mitigation Response to the Risk, the Primavera Risk analysis software also calculating the post mitigating effect on the risk, the post mitigating result can be seen in **Figure 4.5**

Figure 4.6 Post Mitigation effect on Risk Register

		Pre-Mitigation (Data Date = 11/07/2018)					Mitigation			Post-mitigation				
T/O	Title	Probability	Schedule	C	Performance	Score	Response	Title	Total Cost	Probability	Schedule	C	Performance	Score
T	Bad Weather Condition	L	VH	N	N	24	Reduce		$0	L	L	N	N	3
T	Lack of Material	M	M	N	N	10	Transfer		$0	L	VL	N	N	2
T	Lack of equipment	L	L	N	N	3	Reduce		$0	L	VL	N	N	2
T	New to System design	L	M	N	N	6	Reduce		$0	VL	M	N	N	2
T	Worker Accident	L	VH	N	N	24	Reduce		$0	L	VL	N	N	2
T	Pipeline Design	M	M	N	N	10	Reduce		$0	L	VL	N	N	2
T	Lack of worker	L	M	N	N	6	Transfer		$0	VL	VL	N	N	1
T	Delays in Material from owner	L	M	N	N	6	Reduce		$0	VL	L	N	N	1

After Committing the post mitigation effect on risk register, the next step is to analyzing the post mitigation effect using Primavera Risk analysis. The mitigation action and score are based on brainstorming with expert and the worker in PT.Adiluhung Sarana segara. The Analyzing result can be seen in **Figure 4.6**

Figure 4.7 Project Schedule Simulation after Mitigation Process

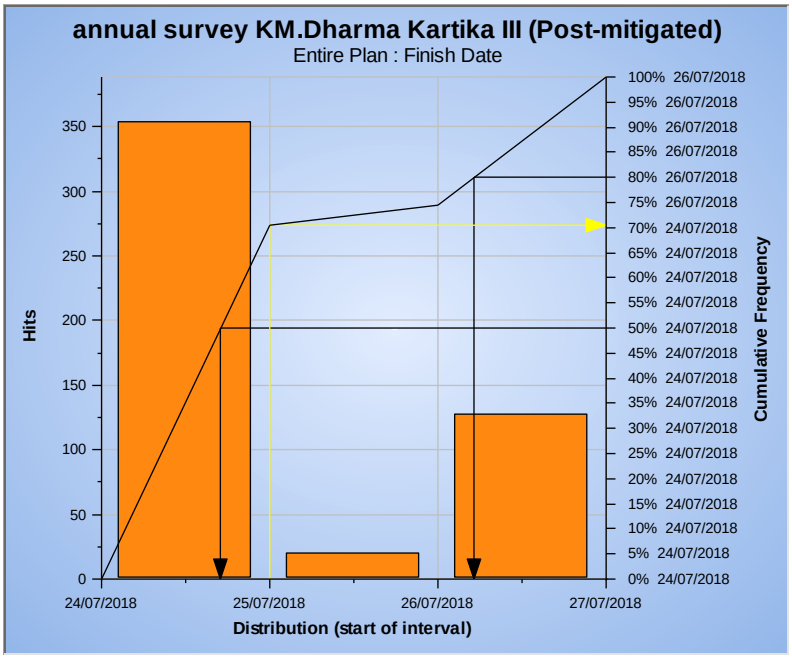
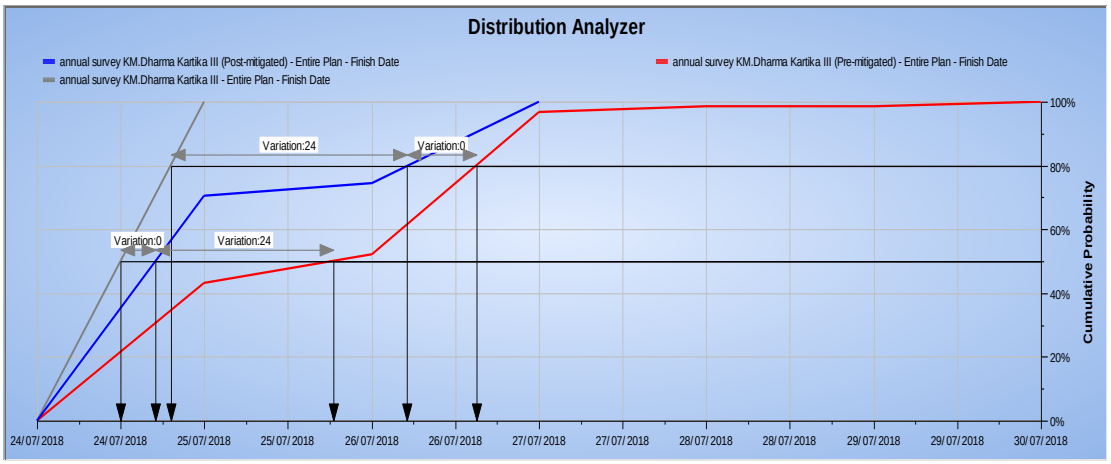


Figure 4.6 shown that, the maximum delays date of the schedule on the deterministic is a little higher from the pre-mitigation, the deteriministic point is on 65% compared to Pre-mitigation which is on 40%. And the maximum delays days Is 3 day earlier than the pre-mitigating date.

4.9 Comparing Schedule pre-Mitigating to post-Mitigating

The purpose of mitigation is to decrease the risk effect and probability, and to analyze the mitigation process in primavera risk analysis is success or not, the Primavera Risk analysis can also simulating the analysis the Schedule Risk pre Mitigation and Post Mitigation, the result can be seen on **Figure 4.7** below.

Figure 4.8 Project Schedule Simulation pre-Mitigation compare to Post-Mitigation



CHAPTER V
CONCLUSION

5.1 Conclusion

After Committing the Research, from Processing the data and the Interview with the expert, then the author have the conclusion that :

1. The Critical Path of the Ship Repair Project of KM. Dharma Kartika III is 73 activities
2. 2 Main Risk Registers of KM.Dharma Kartika III ship Repair Project that included in High Risk is :
    a. Bad Weather Condition
    b. Worker Accident
3. The response to the Risk that Occur on the Ship Repair project Of KM.Dharma Kartika III is :
    a. Increasing the Manpower
    b. Increasing the WorkHour and doing Overtime

5.2 Suggestion

The Suggestion that given by the author after Committing this Research is :

1. The Gantt chart of the Ship Repair Schedule Project should be made before the Project commited, to measure the end date of the project easier
2. The Risk Rating should be asked to 2 expert or more from the shipyard, to ensure that the risk rating is Right

REFERENCES

Alhouli, yoseh mohammed 2011 *Development of Ship Maintenance Performance Measurement Framework to Assess the Decision Making Process to Optimise in Ship Maintenance Planning*, The University of Manchester for the degree of PhD in the Faculty of Engineering and Physical Sciences, England page 19

Kementerian industry Indonesia 2014

kementerian perhubungan Indonesia 2012

Assaf,S.A & Al-Hejji,S 2006 *Causes of delay in large construction projects. International journal of project management*

PMBOK Guide,2000,PMBOK,Project Management Institute, INC, USA

AUTHOR'S BIOGRAPHY

AUTHOR BIOGRAPHY

Rizky Rizaldy N, born on January 27th 1996 in Sidoarjo , East Java. The third family of the third siblings from a couple Mr. Sunanto and Mrs. Suhariningsih. Author finished several formal education started from SDN Pepelegi 1 sidoarjo, SMP negeri 12 Surabaya, and SMAN 16 Surabaya, after graduated from high school in SMAN 16 Surabaya, author continued his study in Double Degree Program, Department of Marine Engineering, Faculty of Marine Technology, Institut Teknologi Sepuluh Nopember (ITS) with Hochscule Wismar. During his study at the university, the author actively participating in social activities such as ITS Mengajar For Indonesia 2015 as a teacher in probolinggo, FTK Mengajar 2016 as a head of FTK Mengajar Program in Surabaya, ITS Mengajar for Indonesia 2016 as a head of ITS Mengajar for Indonesia 2016 in Tuban and ITS Mengajar for Indonesia 2017 as a program supervisor. The author also actively organizes the vice chairman of ITS Education Care Center (IECC) – BEM ITS 16/17. The author takes the Marine Operational and Maintenance (MOM) as study of interest.

Phone/WA : 082138576992
Email : rizkyrizalzal@gmail.com