

# Analysis of Occupational Safety and Health (OSH) for Floor Plate Workers Vehicles and Parapet Walls (Barriers) on Road Construction Projects Flexible Pavement Collector JLLB (Sememi – Tambak Oso Wilangun, Surabaya)

Jenny Caroline<sup>1</sup>, Gunawan<sup>2</sup>, Bayu Tri Atmojo Putro<sup>3</sup>

<sup>1,3</sup>*Institut Teknologi Adhi Tama Surabaya*

<sup>2</sup>*Universitas Muhammadiyah Surabaya*

**Abstract:** The large number of all jobs, not all work accidents cause injuries, but there are also those that result in damage to materials, equipment, environment, management. In this case work accidents that result in injuries are of particular concern in order to reduce the number of fatalities due to work accidents. This study aims to identify the causes of an accident in a process of work activities in the construction sector. Identification of the level of accident risk is measured from the aspect of impact, chance of occurrence and detection is carried out using the risk priority number (RPN) method, while identification of potential causes of accidents is carried out using the fault tree analysis (FTA) method. The results of the RPN analysis found that the risk of work accidents is the highest that ever happened to PT.X, namely in the process of repairing parrapet walls (barriers). Furthermore, using questionnaire tools it was found that the type of accident that occurred in the work process was infection inhalation of iron dust in the lungs. Then by using Delphi tools an agreement was obtained potential causes of lung infection accidents Then by using the Delphi tool an agreement was obtained on the potential causes of lung infection accidents by inhalation of iron dust in the activity of repairing parrapet walls (barriers) which were then compiled using the FTA method so as to produce 16 combinations of causes accident.

**Keywords:** Accident, Delphi, FTA, Risk, RPN

## I. INTRODUCTION

The rapid development of the construction industry apart from providing profits can also give rise to risk, the possibility of a work accident will be one of the causes of cessation or cessation of construction activities [1]. Vehicle floor plates on highway flyovers are part of the construction structural elements that support/carry live and dead loads and transmit them to the gilder and then to the lower structure of the bridge. Bridge floor plates require channels or decks Drain to drain rainwater quickly. Therefore, the surface of the floor plate is sloped by 2% to the left and right of the road edge. The floor plate is supported by a longitudinal girder (Gilder) and reinforced with transverse girders (Diaphragms)[2]. So with the construction of a plate flyover bridge The street floor must also contain parapet wall construction items which are shaped structures barriers/barriers which are commonly used on buildings, roofs, roads and structures others aim to protect the road boundary in the event of a traffic accident. Shaped structure barriers/barriers which are commonly used on buildings, roofs, roads and structures others aim to protect road boundaries in the event of a traffic accident [2][1]. Method for analyzing the risk of work accidents in previous research using FMEA and FTA. Meanwhile, this research focuses on risk analysis for vehicle floor plates and walls parrapet (barrier) uses RPN and FTA. The difference between risk analysis is the method FMEA is qualitative and RPN is semi-quantitative. The aim of this research is to analyze risk the most critical work accidents and controlling the risk of work accidents on floor plate work vehicles and parrapet walls (barriers).

## II. MATERIALS AND METHOD

### 2.1. Construction Methods for Vehicle Floor Plates and Parapet Walls (Barriers)

One-way slab method In reinforced concrete buildings, one of the available and convenient types of flooring is the case of plate beams (girders). Where the front view of the plate is supported by two adjacent columns both sides and two girders at both ends. One side plate is a plate that is twice as long load [3]. In reinforced concrete buildings, a common and basic type of floor is type condition of the beam plate (girder). Where the surface of the plate is bounded by two adjacent blocks on both sides and two girders at both ends. One-way plates are plates that are twice as long greater than the burden[4]. Barrier (Parapet) is a structural part of a road bridge that is installed on the side edge along the span of the bridge which functions as a safety barrier

for the width of the road, and is also a protective construction in the event of a traffic accident. Parapets are usually equipped with backing pipes and has the function of supporting pillars on the edge of toll road bridges. This is needed for Maintaining the safety and security of bridge users, barriers are also useful as road dividers designed as permanent construction. The support pillar has a function in the technical aspect of the bridge namely the placement and backing pipe[5].

**2.2. Occupational Safety and Health (OSH)**

Occupational Safety and Health (OSH) is an effort to protect workers at all times in safe and healthy or prime condition when carrying out an activity in the form of work carried out in the workplace and also for other people who enter the workplace or resource area the production process can be carried out safely and efficiently in use [6][7]. Safety and Occupational Health (OSH) is all activities to guarantee and protect workers through efforts or efforts to prevent work accidents and occupational diseases in construction work. In accordance with the In this explanation, there are several factors that influence Occupational Safety and Health (OSH) [8].

**2.3. Work Accident**

A work accident is defined as an accident that occurs in a workplace work and also accidents that occur in the process of traveling from home to the work location or vice versa and occupational diseases that occur in the work environment. Basically work accidents occur because there is a cause. The incidence of work accidents is influenced by several causal factors in it [7]. The logic of work accidents can be illustrated guided by the existence of these factors which are related to the causal chain (H.W Heinrich, 1931) namely in the form of the Domino Theory Model [9].

**2.4. Risk of Work Accident**

Risk is the possibility of an incident occurring that could interfere with achieving goals organizations that occur during a certain period[10]. The definition of risk is the possibility of something occurring incidents that can disrupt the achievement of organizational goals that occur during a certain period [5]. The personnel benefits seen in each cycle will vary greatly from case to case other. Participants in risk identification activities are as follows: project manager, project team members, risk management team (if assigned), customer, subject matter experts from outside the project team, managers other projects, stakeholders, and risk management experts. While these personnel often become key participants for risk identification, all project personnel should be encouraged to identify risks potential [10].

**2.5. Method**

This research began with identifying risks for several vehicle floor plate jobs and parapet walls (barriers) that have been validated by the construction project contractor first Flexible Pavement Collector Road, West Outer Ring Road (JLLB). The data then determines savority, occurrence, detection values for each potential failure mode that has been analyzed, retrieval data using a questionnaire. The respondents of this research are Assistant Manager, SHE Supervisor (Field Executive), health, safety, environmental team, officer (HSEO). Taking respondents as The sample uses purposive sampling. Analysis using RPN (Risk Priority Number) and FTA (Fauld Tree Analysis). RPN is the product of Severity, Occurance, Detection. The severity, occurrence and detection values are as in Tables 1, 2 and 3 [11]. The RPN value is used to determine work that is a priority scale in mitigation actions carried out, while for analysis of the causes of work accidents the FTA method is used.

Table 1. Saverity Rating Scale

Level	Impact	A Result of Injury
10	Loss of life or change the life of an individual	Death of several individuals
9		Individual death
8	Has a big impact on individuals so they no longer participate in activities	Need serious treatment and causes permanent disability
7		Treated for more than 12 hours with ruptured blood vessels, severe memory loss, major losses, etc.
6		Hospitalized for more than 12 hours, broken bones, displaced bones, frostbite, burns, difficulty breathing and temporary memory loss, falls/slips
5	The impact received at the medium level (individuals only 1 to 2 days	Sprains, broken hands, cramps
4		Minor burns, lacerations, frostnip

3	without participating in activities) The impact at a mild level	Blisters, heatstroke, mild sprains, minor slips
2	(individuals can still participate in activities) Does not cause an impact (the individual does not experience a felt impact)	Sunburn, bruises, light cuts, scratches
1		Exposed to splinters, stung by insects, bitten by insects

Table 2. Occurrence Scale

Probability of Event	Incidence Rate	Score
Very high and unavoidable	>1 in 2	10
	1 in 3	9
High and occurs frequently	1 in 8	8
	1 in 20	7
Intermediate level and sometimes occurs	1 in 80	6
	1 in 400	5
Low and relatively rare	1 in 2000	4
	1 in 15000	3
Very low and almost non-existent	1 in 150000	2

Table 3. Detection Scale

Detection	Possibility of Detection	Rank
Almost impossible	No controller detects	10
Very rarely	Current controllers are very difficult to detect the form and cause of failure	9
	Current controllers are very difficult to detect the form and cause of failure	8
Very low	The ability of the control tool to detect the form and cause is very low	7
Low	The control tool's ability to detect form and cause is low	6
Medium	The ability of the control device to detect the shape and cause of the medium	5
A bit high	The ability of the control device to detect medium to high forms and causes	4
High	The ability of the control device to detect form and cause is high	3
Very high	The ability of the control tool to detect form and cause is very high	2
Almost certain	The control device's ability to detect the form and cause is almost certain	1

### III. RESULT AND DISCUSSION

Respondent profile for Assistant Project Manager, length of service ± 10 years, Technical Staff SHE Supervisor Engineering (Field Implementer) project length of service ± 10 years, K3 Staff HSEO officer team ± 15 year. All respondents have experience in carrying out highway and flyover bridge construction. Determining the level of severity (S), the possibility of occurrence (O), and Detection (D) is obtained through various processes with various knowledgeable parties in identifying work accident risks regarding injuries, illnesses, social and psychological disasters as well danger to machinery or equipment. Severity is the level of severity of failure used in order to obtain a severity value that occurs in each failure that appears on work. Meanwhile, Occurrence is the level of occurrence used for failure to occur in an accident risk means getting a value of the level of events that occur at work.

While Detection is the level of capability to detect or monitor (potential work accidents) which can occur in every risk failure that exists on the project. The results of these three variables is the average of the perceptions of the three respondents. Multiplication of these three variables generate RPN (Risk priority number). Results of RPN calculations in the Flexible Road Construction project Pavement Collector JL Continued Construction of JLLB ( Sememi – Tambak Oso Wilangun Surabaya ) such as Table 4. The highest

RPN values occur in the work of reinforcing parapet walls (barriers) with risks work accident in the form of lung infection inhaled by iron dust with an RPN value of 170.45. These risks are analyzed with the FTA method. The results of analysis using the FTA method obtained 16 minimum cut sets as in Table 5. Table 4. RPN Values for Vehicle Floor Plates and Barrier Walls.

Table 4. RPN Value for Vehicle Floor Plate and Parapet Wall (Barrier) Work

Work Item	Average Severity Level (S)	Responsidence	
		Average Occurance Level (O)	Average Detection Level (D)
<b>CASTING VEHICLE FLOOR PLATES</b>			
<b>Job Preparation</b>			
The pipe/hose/clamp fell due to the control being secured and the worker's control straps below it being weak	5,00	4,33	4,33
Falling from a height (casting the road floor plate) of the bridge	6,33	4,67	4,67
<b>Installation of iron anchors</b>			
Falling from a casting height in a high position (worker)	5,33	4,00	4,67
Falling material (workers below)	6,00	5,33	5,00
<b>The above floor plate casting work uses a concrete pump</b>			
Truck/concrete pump slides down, the ground drops, crashes/rolls over	4,67	4,67	4,67
People below were splashed with cement during work	5,33	3,67	4,00
The pipe/hose/champfer fell due to the control being secured insufficiently and the worker's control being tied underneath	4,67	4,33	4,00
<b>Housekeeping / work completed</b>			
Stuck, tripped	5,67	5,00	5,00
<b>REMOVAL OF BARRIER WALLS (PARAPET)</b>			
<b>Preparation for opening work, preparing stands/iron</b>			
The tip of the iron stand was scratched	5,33	4,67	6,00
Inhalation of iron dust	6,00	5,33	5,33
<b>Cutting/shaping stands/reinforcing iron using cutting tools/iron bending tools</b>			
Hand/finger caught by metal cutting tool	5,33	4,33	5,00
Caught in the rebar bending machine	5,00	4,33	4,33
Exposed to cutting grinding rotation	4,33	4,00	4,00
Exposed to sparks / iron roar from the cutting grinder	4,67	3,67	4,00
<b>Unite the cut reinforcement</b>			
Exposed to sparks during the welding process	4,33	3,67	4,00
Exposed to an oxygen cylinder explosion / acet	5,67	5,00	4,00
<b>Housekeeping / work completed</b>			
Pierced by iron	5,33	6,00	5,00
Stuck, tripped	5,00	5,67	4,67
<b>BARRIER WALL (PARAPET) CASTING</b>			
<b>Barrier casting work</b>			
Hit by heavy equipment while positioning	3,67	6,33	4,33
The mixer truck overturned, the ground was unstable	3,67	3,33	4,33
Worker pinched his hand while casting	4,00	6,33	5,00
<b>Housekeeping / work completed</b>			
Stuck, tripped	4,00	5,67	5,00

Based on Table 5. Control is needed in the form of mitigation for each basic failure event and it is necessary to know the person responsible for the risk of accidents if a work accident occurs. Job Safety Analysis (JSA) is a form of analysis technique that is applied to recommend hazards that exist in a worker's job and obtain targeted controls that are useful for reducing the risk of work accidents.

Table 5. Minimal Cut Set Lung Infection Inhalation of Iron dust

Code	Minimal Cut Set
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1	Lack of education
2	Lack of experience
3	Lots of thoughts/problems
4	Joking while working
5	Lack of Safety and Health training
6	There are no signs
7	Limited safety and healthy members
8	Limited monitoring time and area
9	Limited work area
10	Closed work area
11	Extreme hot temperatures
12	Radiation exposure
13	Don't understand self-protection
14	There is no tool manual available
15	Not functioning optimally
16	Lack of maintenance

#### IV. CONCLUSION

Based on these results and analysis, it can be concluded that the results of the brainstorming show that there are 10 types of work and 22 high risks that cause work accidents, the most dominant accident risk priority is in the work of fixing parapet walls (barriers) with the risk of inhaling iron dust with a value of RPN = 170.45 , There are 4 factors that cause the risk of accidents, namely human factors, technical factors, management factors, and environmental factors, of these four factors there are 16 basic events and risk control analysis using JSA from 16 basic events there are 37 work accident risk mitigation strategies.

#### ACKNOWLEDGEMENTS

The author would like to thank the Assistant Manager of PT. X as manager of the JLLB Collector's Flexible Pavement Road Construction Project (Sememi – Oso Wilangun Surabaya) in supporting and assisting this research.

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