



Study of Factors Causing Accidents of Loading Vehicles onto Crossing Vessels at Merak Port

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Abstract. In December 2022, at almost the same time, the same type of accident occurred at Merak Port, Cilegon City, namely an accident when loading a vehicle just as it was about to enter the ship. To prevent such accidents from happening again, this research aims to determine the factors that influence vehicle loading accidents onto ferry boats at Merak Harbor and to find out strategies to minimize the occurrence of vehicle loading accidents onto ferry boats at Merak Harbor. The method used in this research is method Analytical Hierarchy Process (AHP) with the apps uper decisions version 2.10 to determine the level of importance of factors that dominate the occurrence of vehicle loading accidents on boarding vessels at Merak Harbor. Based on the calculation resultsAnalytical Hierarchy Process(AHP) using the applicationsuper decisionversion 2.10, it is known that the facility factor or vehicle factor to be loaded onto a ferry is the dominant factor causing accidents when loading vehicles onto a ferry at Merak Harbor with a score of 0.345 followed by overloading (0.684) as the dominant factor in the vehicle sub- criteria. This is followed by human factors (0.322), natural factors (0.274), and infrastructure factors (0.057). In line with this, excess dimensions (0.25) are the second factor causing accidents in the vehicle sub-criteria. Thus, the strategy offered to minimize the occurrence of accidents when loading vehicles onto ferry boats at Merak Harbor is to sterilize vehicles.Over Dimension and Over Loading(ODOL) at Merak Harbor, Cilegon City.

Keywords: Causal Factors; Loading Accident; Analytical Hierarchy Process (AHP); Overload; Advantages of Dimensions.

1 Introduction

There have been two car accidents that fell into the sea during the process of loading vehicles onto ferry boats at Merak Harbor in the same month, namely on Friday 23 December 2022 during the process of loading vehicles onto KMP. Shalem at Pier II of Merak Harbor with a chronology of events based on a presentation by the Banten Regional Police through the Head of Public Relations of the Banten Regional Police, namely at 22.00 WIB at the KMP. Shalem widened so that the side ramp was no longer attached to the ship, which resulted in a Daihatsu minibus with 2 passengers falling into the sea.

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Minibus passengers were evacuated shortly after the car crashed. The next car evacuation will be carried out on Saturday, December 24 2022.

Furthermore, on Thursday, December 29 2022, the Ministry of Transportation (Kemenhub) through the Directorate General of Land Transportation confirmed that there had been an accident when a truck fell into the sea during the process of loading vehicles at KMP. Labitra Karina at Pier V (five), Merak Harbor. The Director General of Land Transportation said that during loading, at 20:30 WIB the truck loaded with approximately 20 tons got stuck in the bow ramp door. After checking, the truck had a broken AS. Evacuation failed to be carried out using a tow truck. After being stuck for approximately 2 hours, the truck plunged into the sea at 23.36 WIB on 28 December 2022. Apart from the bad weather conditions, there were suspicions that the truck was Over Dimension and Over Loading (ODOL) due to the truck axle breaking.

With the occurrence of repeated accidents with similar types of accident cases in the same month, this is the background of the author's interest in raising the title "Study of Factors Causing Accidents in Loading Vehicles onto Ferrying Vessels at Merak Harbor" to analyze the factors causing accidents loading vehicles onto crossing vessels in Merak Harbor. Merak Harbor. Apart from finding out the factors that influence accidents when loading vehicles onto ferry boats at Merak Harbor, this research aims to find out strategies to minimize the occurrence of similar accidents at Merak Harbor.

2 Method

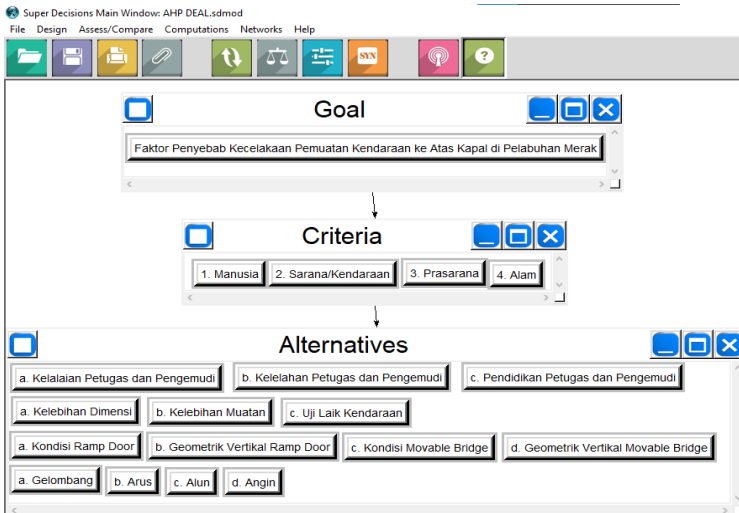
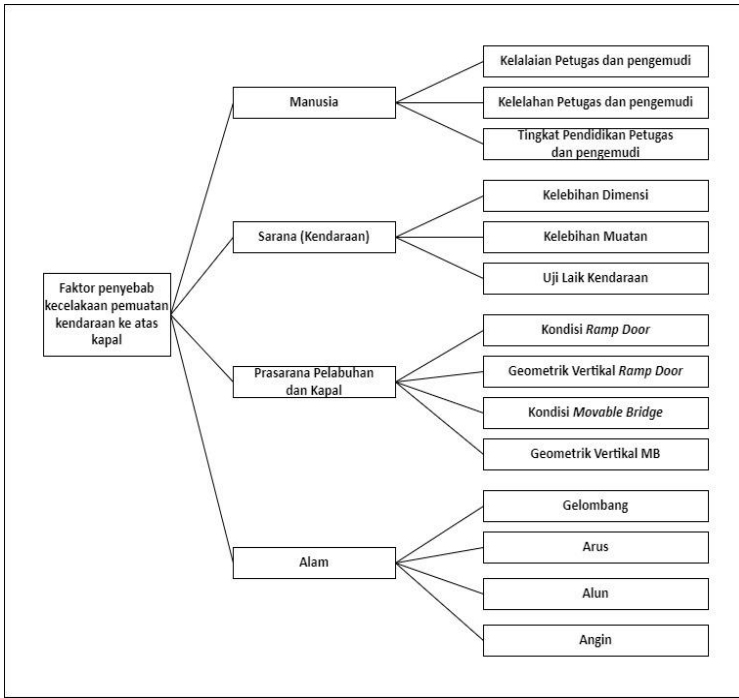
This research is quantitative descriptive. Quantitative descriptive is a technique for providing a picture or description of an activity as clearly as possible without any treatment of the object to be studied based on statistically processed numbers (Susriyanti et al., 2019). The research method used is the Analytic Hierarchy Process (AHP) method. AHP is a measurement theory through pairwise comparisons and relies on expert judgment to derive a priority scale (Saaty, 2008).

In this study, vehicle loading accidents on boarding vessels at Merak Harbor are defined as the dependent variable (y). Meanwhile, the independent variable (x) consists of factors that cause accidents which will be identified through the hierarchical structure of the Analytical Hierarchy Process (AHP).

3 Results and Discussion

3.1 Data Presentation

Literature studies and interviews by experts produced 4 (four) criteria consisting of human factors, facility factors (vehicles), infrastructure factors and natural factors. Furthermore, these 4 criteria are further divided into 14 (fourteen) sub-criteria. The AHP structure of the factors causing accidents when loading vehicles onto ferry boats at Merak Harbor is the first step in determining conclusions in this research, which is then included in the super decisions version 2.10 application to simplify the process of calculating the AHP value with the following display:



3.2 Data Analysis

After the comparison matrix results from the geometric average calculation have been obtained, calculations using the Super Decisions version 2.10 application are carried out to

determine the importance weight and ranking of each element. So the data attached is produced in the table below along with the results of the consistency test calculations.

Cluster	Element	Priority Cluster	Rank	CR value	Not
Criteria	1. Human	0.32244746	2	0.017178698	CONSISTENT
Criteria	2. Vehicle	0.345389344	1		
Criteria	3. Infrastructure	0.057681063	4		
Criteria	4. Nature	0.274482133	3		
Alternative	a. Officer and Driver Negligence	0.494237102	1	0.000309553	CONSISTENT
Alternative	b. Officer and Driver Fatigue	0.417773297	2		
Alternative	c. Officer and Driver Education	0.087989601	3		
Alternative	a. Advantages of Dimensions	0.250958815	2	0.012968938	CONSISTENT
Alternative	b. Overload	0.684368086	1		
Alternative	c. Vehicle Worthiness Test	0.0646731	3		
Alternative	a. Condition Ramp door	0.453529787	1	0.015452282	CONSISTENT
Alternative	b. Vertical Geometric Ramp door	0.07574753	4		
Alternative	c. Condition Movable bridge	0.231668773	3		
Alternative	d. Vertical Geometric Movable bridge	0.239053911	2		

Cluster	Element	Priority Cluster	Rank	CR value	Not
Alternative	a. Wave	0.174446496	3	0.026405305	CONSISTENT
Alternative	b. Current	0.15123113	4		
Alternative	c. Alun	0.328893197	2		
Alternative	d. Wind	0.345429178	1		

3.3 Discussion

From the results of the calculations in the analysis points above, it is found that the facility factor or vehicle factor that will be loaded onto the ferry is the dominant factor causing accidents when loading vehicles onto the ferry at Merak Harbor with a score of 0.345 followed by overloading (0.684) as the dominant factor in sub-vehicle criteria. This is followed by the criteria for human factors (0.322), natural factors (0.274), and infrastructure factors (0.057). In addition, after overloading became the dominant factor,

excess dimensions (0.25) became the second factor causing accidents in the vehicle sub-criteria.

The impacts of ODOL (Over Dimensions Over Loading) vehicles according to Rajendra & Vaza (2022) include:

- [1]. Damage to road, bridge and port infrastructure.
- [2]. The need for infrastructure maintenance costs increases. In line with this, state losses due to damaged roads were recorded at up to Rp. 43 billion (Simatupang et al., 2020).
- [3]. Decreased level of road traffic safety which causes traffic accidents.

Apart from that, accidents when loading vehicles onto ships can also occur because cargo is one of the internal factors of ship stability (Amanda & Febriansyah, 2022). In line with this, from KNKT records, several accidents were found in which ODOL vehicles were one of the factors contributing to ship accidents. Some of these accidents include the sinking of KMP. Windu Karsa in Kolaka Waters, 27 August 2011, sinking of KMP. Rafelia 2 in the waters of the Bali Strait, March 4 2016, ran aground and KMP sank. Lestari Maju in the waters of the Selayar Strait, July 3 2018, the KMP ramp gate was broken. Nusa Putra, Merak, 27 December 2018, Sinking of KMP. Bili, Sambas River, February 20 2021, Sinking of KMP. Yunicee in the waters of the Bali Strait, June 29 2021, and the last incident was the capsizing of the KMP. Satya Kencana III, at Kumai Harbor, 19 October 2022. Apart from disrupting ship stability, ODOL vehicles can cause a tendency for ship loading to exceed the maximum draft line resulting in various disruptions to ship operations including maneuvering (especially during bad weather) and increasing the possibility of incoming waves into the ship.

- [4]. With excessive load on the vehicle, this can cause the components to become fatigued, resulting in the vehicle experiencing damage to vehicle components and shortening the life of the vehicle. There is at least 51 (fifty one) cases of damage to vehicle components in the form of broken axles and trucks breaking down occurred at Merak Port starting from July 2022 to January 2023.
- [5]. Injustice in the business of transporting goods.
- [6]. Traffic jams due to accidents and road damage will harm many parties in the form of time, transportation costs and emotional disturbances. This is caused by a decrease in the quality of transportation services due to a slowdown in vehicle speeds due to decreased speed, increased operational costs due to long travel times and vehicles breaking down quickly (Antono, 2022).

In fact, many regulations have been established to deal with this ODOL vehicles include the following:

- [1]. Law Number 22 of 2009 concerning Road Traffic and Transportation.
- [2]. Government Regulation Number 55 of 2012 concerning Vehicles.
- [3]. Government Regulation Number 74 of 2014 concerning Road Transport.
- [4]. Minister of Transportation Regulation Number 115 of 2016 concerning Procedures for Transporting Vehicles on Ships.

- [5]. Regulation of the Minister of Transportation regarding Number 133 of 2015 concerning Periodic Testing of Motor Vehicles.
- [6]. Regulation of the Minister of Transportation Number PM 134 of 2015 concerning the Implementation of Weighing of Motor Vehicles on Roads.
- [7]. Minister of Transportation Regulation Number 27 of 2016 concerning Regulation and Control of Vehicles Using Aviation Transport Services.
- [8]. Minister of Transportation Regulation Number 33 of 2018 concerning Motor Vehicle Type Testing.
- [9]. Director Regulations General Relations Land no. SK.736/AJ.108/DRJD/2017 concerning Technical Guidelines for Carrying Out Weighing of Motorized Vehicles on Roads.
- [10]. Regulation of the Director General of Land Transportation Number KP.4294/AJ.510/DRJD/2019 concerning Guidelines for the Normalization of Ranmor, Trailer and Attached Trains.
- [11]. Circular Letter Number 21 of 2019 concerning Supervision of Goods Cars for Overloading Violations (Overloading) and/or Oversize Violation (Over Dimension).
- [12]. Letter of the Minister of Industry Number 872/M-IND/12/2019 concerning Policy Zero Over Dimension Over Load (ZeroTOOTHPASTE).

Furthermore, the government has also made several efforts to realize ODOL-free vehicles, including:

- [1]. In 2017 the ODOL-free policy was launched, and it was agreed that the association requested a postponement to 2018.
- [2]. In 2018, an agreement between K/L and the Association was reached, then ODOL-free socialization was carried out, service improvements at UPPKB (weighbridges), and accreditation of the Motor Vehicle Weighing Implementation Unit (UPPKB) were carried out.
- [3]. In 2019 the government prohibited BUMN from using ODOL vehicles, prohibited APMs (Brand Holder Agents) from displaying and selling ODOL vehicles, designing the 2019-2021 toothpaste-free action, tolerance of overloading for basic and important materials, cutting off over-dimensional vehicles, legal processing of over-dimensional violations, letter from the Minister of Industry regarding the postponement of the ODOL-free policy.
- [4]. In 2020, a meeting was held between the Minister of Transportation, the Minister of Public Works and Spatial Planning (PUPR), and industry associations who agreed on ODOL-free 2023, ODOL-free implementation on the Jakarta-Bandung toll road, ODOL-free implementation at the Merak-Bakauheni and Ketapang- Gilimanuk, Law Enforcement P21 Article 277 of the Criminal Code.
- [5]. For 2021-2022, a system will be established enforcement and cross-logistics network development, system integration development, establishment bank databases drivers, improving the quality of roads and bridges, MoU between the Minister of Transportation, the Minister of Industry, the Minister of Public Works, the Minister of Trade and the National Police Chief.

However, based on an analysis of seven weighbridges in Indonesia in 2018, it was recorded that 75% of operator behavior resulted in overloading violations, even 25% were related to violations where the load exceeded 100 percent (Simatupang et al., 2020). Furthermore, from 12 to 30 December 2020, 437 vehicles were weighed by the Ministry of Land Transportation, which found that 19 of them had over dimensions. In line with this, a survey of ODOL vehicles was also carried out at Merak Port starting from May 11 2023 to June 13 2023, there were around 238 ODOL vehicles with an average of types IVb, Vb and VIb entering Merak Port and even being loaded onto ships. crossing.

Therefore, there are several strategies offered in this research to realize ODOL vehicles at Merak Port in order to minimize accidents when loading vehicles onto ferry boats based on the results of observations in the field, including:

- [1]. Formation of awareness of strict compliance with regulations by all groups the public, including service users, does not only apply to regulators as supervisors.
- [2]. Carrying out outreach or work meetings between regulators, operators and distributors who use goods transportation services to form awareness and commitment to Law Enforcement P21 Article 277 of the Criminal Code.
- [3]. Supervisors should align their sense of tolerance with firmness in implementing applicable rules.
- [4]. Weighing before loading as stated in Minister of Transportation Regulation Number 115 of 2016 concerning Procedures for Transporting Vehicles on Ships must be carried out precisely and firmly.
- [5]. Added features to the Ferizy application in the form of types of cargo and amount of cargo according to what is being carried. Apart from dealing with overloading, This can be data on the ship's manifest which is the responsibility of the ship's captain.



Figure 1. Vehicle weight stated on the ticket shows 0 kg and There is no information on the type of cargo being transported

- [6]. Build a holding terminal (sterilization terminal) for goods vehicles before entering Merak Port to carry out sterilization of ODOL vehicles which are equipped with digitized weighbridges and integrated with automatic gates. System usage-ticket which is equipped with information on the total weight of the load which should not exceed the value of the weighbridge scale results, if the load is more

than that attached to thee-ticketthen the door latch cannot open and the vehicle owner must reduce the load. As well as ongate equipped with a maximum height bar adjusted to the vehicle class to limit excess vehicle dimensions.

4 Conclusion

4.1 Conclusion

- a. Based on calculation resultsAnalytical Hierarchy Process(AHP) using the applicationSuper Decisionversion 2.10 shows that the facility factor (vehicles to be loaded onto the ferry) is the dominant factor causing accidents when loading vehicles onto the ferry at Merak Harbor with a score of 0.345 followed by overloading (0.684) as the dominant factor in the vehicle sub-criteria. This is followed by human factors (0.322), natural factors (0.274), and infrastructure factors (0.057). Apart from that, after overloading became the dominant factor, excess dimensions (0.25) became the second factor causing accidents in the vehicle sub-criteria.
- b. The strategy that can be implemented to minimize the occurrence of accidents when loading vehicles onto ferry boats at Merak Harbor is to sterilize vehiclesOver Dimension and Over Loading(ODOL) at Merak Harbor, Cilegon City.

4.2 Suggestions

The suggestions for implementing the ODOL vehicle sterilization strategy at Merak Harbor, Cilegon City include:

- a. Carry out outreach or work meetings between regulators, operators and distributors who use goods transportation services to form awareness and commitment to Law Enforcement P21 Article 277 of the Criminal Code.
- b. Increase strictness in supervision and implementation of weighing before loading as stated in Minister of Transportation Regulation Number 115 of 2016 concerning Procedures for Transporting Vehicles on Ships.
- c. Added features to the Ferizy application in the form of types of cargo and amount of cargo according to what is being carried.
- d. Build a holding terminal (sterilization terminal) for goods vehicle before entering Merak Port and require strict supervision of vehicles experiencing Over Dimension and Over Loading (ODOL).

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