Analyzing the Impact of the Automation Train Protection Implementation in Indonesia

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ABSTRACT

The Indonesian railway industry has grown dramatically in the past five years, with network and track length expected to triple by 2030. This is due to increasing railway demand. The Indonesian National Rail Network has averaged 350 million passengers per year for the past decade. The 2015 high was 450 million, and the 2020 low was 200 million. The Republic of Indonesia has improved its infrastructure, especially trains. MRT Jakarta, LRT Jakarta-Bogor-Depok-Bekasi, Jakarta-Bandung high-speed rail, and conventional long-distance train in Sumatera, Makassar to Pare-Pare in Sulawesi Island are among the recent railway projects in Indonesia. In contrast, Indonesian rail safety systems fail to meet rail demand. There is no proper rail safety system exists for the national mainline network. The Indonesian mainline railway uses the Grade of Automation 0, with the train driver as the main controller. This country has several railway accidents, which frequently to cause fatality. Indonesian rail accidents include collisions, derailments, train slips, and natural disasters. Indonesia had 15.62 train-km fatalities per thousand-kilometer railway in 2017. The US had 725.4 railway fatalities per billion km in 2000–2009, whereas the EU had 353.1 in 2006–2009. The rate of train accidents in Indonesia is higher compared to other countries. Accordingly, the improvement of rail safety is essential to support national mobility. One promising direction to reduce this fatality is through the Automatic Train Protection System. This technology has kind of like several benefits, such as controlling and maintaining the train speed during operation. The most basic version of this system can provide audible and visual warnings to train drivers when they approach certain signals. If the driver does not respond to these warnings and the train continues to move in dangerously, the automatic train protection can automatically apply the brakes to stop the train. Installing an automatic train protection system is expected to reduce the number of accidents caused by human error and improve the overall performance of the rail network. This study finds that there is a significant reduction in the number of rail accidents by implementing the Train Automatic Protection in Indonesian Railways. The benefit is not only reducing the number of accident costs but also the non-monetized aspects.

Keywords: Indonesian Rail; Automatic Train Protection (ATP); rail safety; accident cost; rail accident.

INTRODUCTION

Rail safety is essential in rail operational activities. Commonly, the railway industry accommodates the movement of enormous people and goods. Hence, the performance of rail safety for crucial on people lives and business activities. The train accident tends to be fatal. Once the fatalities happened, it takes a certain amount of time and resources to get back the train on schedule again. When an accident occurs on the railroad, delays are unavoidable; significant amounts of work is being expended to reduce their occurrence and the ensuing disruption of services (Network Rail, 2023). While train accidents occur infrequently, their consequences are often severe (Read, 2019). The occurrence of significant railway accidents across the globe, including those leading to the loss of several lives, includes notable incidents such as the Ladbroke Grove collision in the United Kingdom in 1999, the Waterfall disaster in Australia in 2018, the Chatsworth catastrophe in California, United

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States, in 2008, and the derailment in Santiago de Compostela, Spain. Accordingly, such mitigation has been developed to minimise the rail accident.

Indonesia railway industry has expanded significantly during the previous five years, with the network and track length set to double by 2030 (Iridiastadi, 2021). This condition caused by the high demand for the railways itself. The average number of passengers for the past ten year on the National Rail Network in Indonesia is around 350 million passenger p er year. The highest is around 450 million in 2015, while the lowest point is 200 million in 2020 (Ministry of Transportation of Republic of Indonesia, 2020). Accordingly, the government of the Republic of Indonesia boost its infrastructure, particularly in railways. Recently, several ongoing railway projects in Indonesia: Mass Rapid Transit (MRT) Jakarta, Light Rail Transit (LRT) Jakarta-Bogor-Depok-Bekasi, Jakarta-Bandung high-speed rail, and conventional long-distance train in Sumatera, Makassar to Pare-Pare in Sulawesi Island (Saputra, 2022).

In 2013, Evans mentioned that such automatic train protection has been developed, in the UK and European Countries it was called 'Automatic Train Protection', while in the USA it was called 'Positive Train Control' (PTC). The automatic train protection system prevented many accidents related to the train driver errors (Evans, 2007; Pachl, 2021). Andrew W Evans in 2014 also discover that the number of accidents was decreased after the installation of the ATP. It is shown that the number of signals passing at danger (SPAD) accident has been null since 2002 period. Similar with the number of ATP-preventable accidents, it was also zero since 2002 until 2019 time period.

In 2014, Wijaya Irawan has analysed the implementation of ATP in Indonesian case, however the study was not analysing the rail accident that can be prevented by implementing the ETCS Level 1.

RESEARCH METHODS

Materials

The diagram below describes general process of this research works. Initial condition is capturing the existing rail accidents in Indonesia, then define which accidents that can be prevented by the Automatic safety system. On the right side of the chart, there are benefits from the implementation of this system, and following by the appraisal from this implementation. Therefore, this diagram illustrates the essential process parts of this research.

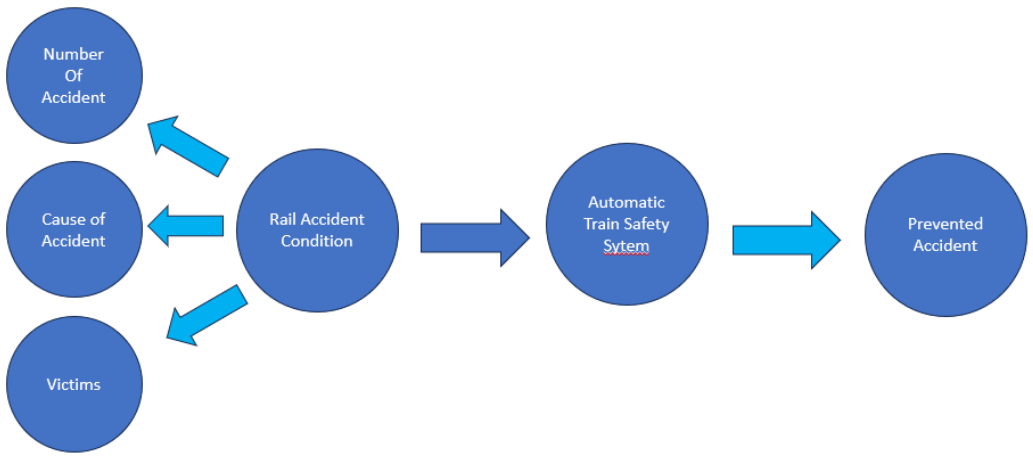

Figure 1. Analyzing the Impact of Implementation of Automatic Train Safety System (Author's own work)

Research methods can be described in the form of research steps and procedures, but can also be displayed in the form of a flow chart or flow chart. Depending on the research needs supported by appropriate strategies and steps to realize the research objectives. The novelty raised in the research is described in the form of a flow chart which will make it easier for readers to analyze the research

process more quickly. The accuracy in determining the strategy in the flow chart will provide direction for the type of research that supports it. Figure 1 shows an example of a flow chart with an arrow pattern.

Methods

This research uses secondary data. Secondary data is a term used to describe data that is easily accessible and available to the public (Cambridge Dictionary, 2020). There exists a possibility in which the data may not have been collected with the intention of addressing the precise research inquiries, but rather for an alternative objective (UCL, 2023). The existing rail accident data will be used on this dissertation. Furthermore, sets of relevant literature, government manual, report, and other articles also being included to support the findings and recommendations.

Data Analysis

This research uses secondary data. Secondary data is a term used to describe data that is easily accessible and available to the public (Cambridge Dictionary, 2020). There exists a possibility in which the data may not have been collected with the intention of addressing the precise research inquiries, but rather for an alternative objective (UCL, 2023). The existing rail accident data will be used on this dissertation. Furthermore, sets of relevant literature, government manual, report, and other articles also being included to support the findings and recommendations.

RESULT AND DISCUSSION

Recent condition of Indonesian Railway Safety, Signalling System and Communication

The trend of rail accident in Indonesia can be seen on the diagram below. In 2004 the number of accidents was 128, and dropped became 91 and 102 in 2005 and 2006 respectively. In 2007 the number case was significantly increased became 140 rail accidents per year. Furthermore, between 2007 until 2014, the number of accidents was decreasing progressively, while in 2015 it became 70 accidents per year, double from the number of accidents in 2014. In 2016 there were significant improvements in rail safety the number of accidents per year became 15 accidents per year. This condition was constant for 2 years, until 2017. In 2018, the number of accidents became 16 accidents per year, then the trend shows there were 11 and 18 accidents in 2019 and 2020 respectively. This number is high compared to other countries. For instance, in Malaysia, which close to Indonesia in terms of the location, there is no rail accidents happened from 2018 until 2020 (Shahrir & Manan, 2021).

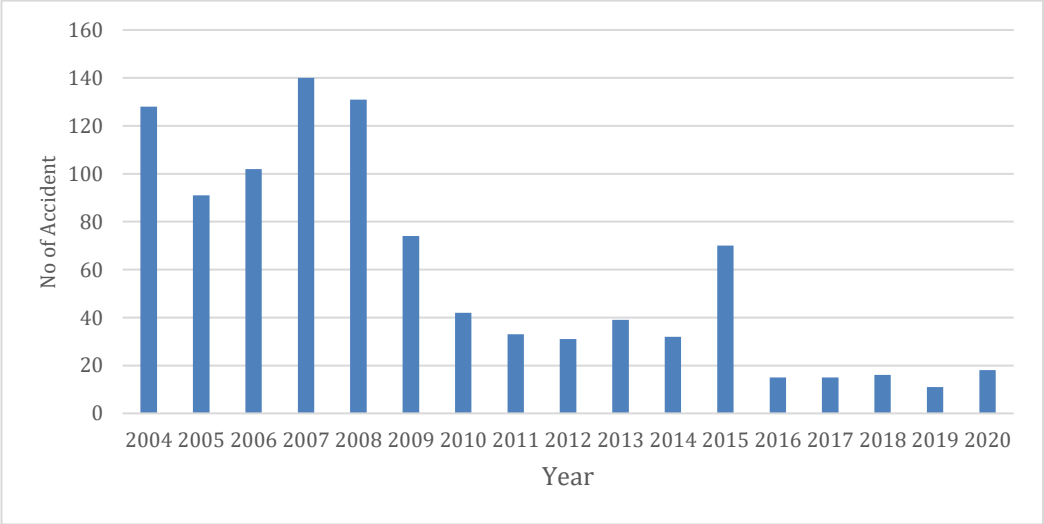

Figure 2. Train Accident in Indonesia in 2004 to 2020 (Ministry of Transport of Republic of Indonesia, 2022)

Safety Intervention Impact of Automatic Train Protection Implementation

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There are several types of rail accident that could be prevented as the result of automatic train safety system installation. The automatic train safety system has been proven able to cover: train passing signals at danger, over-speeding or failing to stop train, train collision, and derailments which caused by human error (Evans & Verlander, 1995; Connor & Schmid, 2023). Interestingly, on several rail accidents report the National Transportation Safety Committee (NTSC) of Indonesia explicitly suggested that in the future the automatic train protection is necessary to avoid such accidents.

There are 14 rail accidents that could be prevented by using the automatic train protection system in Java Island, Indonesia. The NTSC already suggested to use the automatic train protection system in 6 rail accidents report. The number of fatalities from these accidents were also significant, 88 fatalities.

CONCLUSION

In conclusion, this study points out three findings: 1) Indonesian railways are growth rapidly, both for passenger and freight services. The government has dominant involvement on the development of railways in Indonesia, 2) there are several rail accident casualties in Indonesia: train collision, derailment, natural disaster, and overturned. The general automatic train protection system offers improvements in rail safety by eliminating many forms of driver error that may result in signal passing at dangers (SPADs) and overspeed. However, there are other types of rail accidents casualties which could not be prevented by this system. Accordingly, such collaboration with other interventions are essential, 3) the automatic train safety system is essentially important to reduce the number of rail fatalities accident in Indonesia. It is able to improve the performance of rail safety but also increase the capacity and average speed of the rail operation, which has been proven in developed countries.

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