

ASSESSING THE EFFECTIVENESS OF RAILWAY OPERATIONS IN SRI LANKA

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ABSTRACT - Railway transportation is one of the most common public transport modes in Sri Lanka. There are 167 main railway stations and 153 smaller railway stations located throughout the country. The objective of this study is to observe the effectiveness of railway operations in the Sri Lankan railway network in terms of safety and passenger satisfaction and identify possible countermeasures to improve the efficiency of the current operations. The railway network belongs to the Western province is considered for the study. Accident data at level crossings and along the railway line such as passengers falling off the platforms, slipping on stairs, etc. are collected through inventories of the respective agencies including the socio-economic factors associated with the victims, geometry-related factors at the accident location, causes for accidents, etc. Data on passenger experience such as punctuality, delays, hygiene, comfortability, etc. and socio demographic factors of passengers are collected through a questionnaire survey. Significant factors that influence accidents are determined using statistical methods, and passenger experience and perspectives are analysed to obtain the level of satisfaction in a 5-point scale. Countermeasures are proposed to improve the safety and the level of satisfaction of passengers that improves the overall quality of rail transportation.

Keywords: Railway operations; Safety; Passenger satisfaction; Questionnaire survey; Planning and management.

1. INTRODUCTION

Railway transportation is an important infrastructure for the current economic and trade development worldwide [1]. In Sri Lanka, railway system is one of the most common modes of public transportation among local passengers and tourists. The Railway Department of Sri Lanka operates both passenger and freight services. There are 167 main railway stations in Sri Lanka while having 153 sub railway stations around the country [2]. According to the annual reports of the Central Bank of Sri Lanka, the Department of Railways provides a quality, standard and a satisfied service to passengers [3]. However, World Bank reports provide a negative impression on the existing railway operations in the country. However, passengers face common problems in travelling such as poor conditions on trains, delays in arrival, high demand in peak hours and lack of maintenance [4]. Therefore, it is essential to evaluate the efficiency of the current railway operations and observe factors that affect the effectiveness of the rail transportation.

According to the literature, many factors affect the quality and effectiveness in rail transportation. One of them is safety issues [5]. Safety records of railway passengers during 2006 – 2016 in Sri Lanka reflect that the most external injuries have been caused by accidents compared to suicides, and the majority of deaths have been caused by multiple injuries [6]. There are two main causes for railway accidents [7]. They are human errors (carelessness of passengers) and system errors (poor maintenance in trains, problems in railway tracks, signal, and communication errors). Train failures, weather conditions, passenger demand in peak hours and railway accidents cause delays in daily operations. A study conducted in China has observed several factors to improve the safety of railways such as safety operation in the trains, railway track maintenance, and improving the signal system [8]. In addition, a study conducted in Indonesia has concluded that the railway industry has low resources making it difficult to implement safety measures [9]. These studies give an idea about how safety affects railway effectiveness over the world. Colombo Fort and Maradana railway stations

are the main two railway stations in the Sri Lankan railway network based on capacity, demand in peak hours, and number of routines per day. However, the majority of trains arriving to these railway stations are recorded as delays and rarely some trains arrived on the scheduled time [10]. Satisfaction of passengers is one of the key indicators that reflects the effectiveness of the existing railway operations. Service quality maintenance is also a critical factor to be considered to evaluate the effectiveness of railway operation. It will directly affect the satisfaction of passengers also. To provide a quality service in railway operation, it is important to maintain the quality of railway infrastructure, platforms, rest rooms, canteens, personal hygiene and facilities for basic needs of passengers.

2. MATERIALS AND METHODS

2.1. Description of Data

The railway network belongs to Western Province and is evaluated for the efficiency of current railway operations. In this study, two main parameters will be evaluated, and they are passenger satisfaction and safety conditions. Accident data for the last 5 years (2018 – 2022) is collected from relevant police stations and passenger satisfaction will be evaluated using a questionnaire survey.

2.2. Methods of Analysis

Safety evaluation is done by using the existing data on railway accidents that happened and they are categorized separately based on the accident type, location, severity, and cause for accidents. To analyse the collected data, a multiple linear regression model is performed in the SPSS software. Also, the level of passenger satisfaction is expressed through a 5-point scaling method under different factors. For example, each response is scaled in the range which varies from “very satisfied level” to “very dissatisfied level”.

3. RESULTS

The expected outcome of this study is to observe the effectiveness of current railway operations in the view of passenger satisfaction and safety. An index which reflects the effectiveness of rail transportation in Sri Lanka is the ultimate goal. In addition to that, identification of significant factors affecting the safety and the satisfaction of passengers is a key contribution of this study. Based on the results of the regression model, possible countermeasures are proposed to improve the quality of the railway operations in the country. A pilot study was conducted within a selected section from Maradana to Moratuwa to observe the productivity of collecting data in this railway segment and the results obtained from that study are mentioned below.

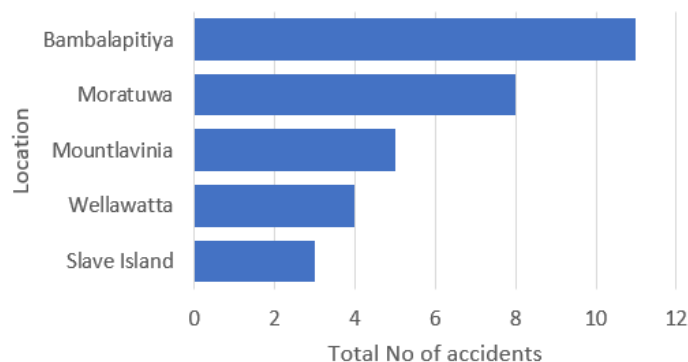


Figure 1. Results of pilot study

This study is ongoing research and expected results will be available soon.

4. CONCLUSION

In conclusion, this research determines the effectiveness of railway operations in Sri Lanka based on different factors. Initially, significant factors related to safety and passenger satisfaction are identified through statistical analysis methods, and an index is developed to derive the effectiveness of railway operations of a particular railway segment. The methodology is expanded to multiple railway segments and segments that require improvements are identified. Also, the effectiveness of different railway segments is compared based on the developed relationships. The findings of this study will be useful in planning railway infrastructure and maintaining the existing facilities.

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REFERENCES

1. Niu, Y., Xiao, F., Zhang, N. & Sadeghi, M., (2022). Transportation Efficiency of Railway Operation Enterprises [Preprint]. In Review. <https://doi.org/10.21203/rs.3.rs-2316597/v1>.
2. Sri Lanka Railways, (2022). Station Details. Available at; http://www.railway.gov.lk/web/index.php?option=com_content&view=article&id=165&Itemid=191&lang=en.
3. Central Bank of Sri Lanka, (2014). Annual Report 2014 | Central Bank of Sri Lanka, Available at; <https://www.cbsl.gov.lk/en/publications/economic-and-financial-reports/annual-reports/annual-report-2014>.
4. Perera, R.A.S.A. & Bandara, A.B.D.M., (2016). THE IMPACT OF RAILWAY TRANSPORT SERVICE QUALITY ON PASSENGERS' SATISFACTION; A STUDY BASED ON KANDY RAILWAY STATION, Proceeding of International Conference on Contemporary Management-2016 (ICCM-2016), 678-692.
5. Zhai, W., Zhao, C., Xia, H., Xie, Y., Li, G., Cai, C. & Song, X., (2014). Basic scientific issues on dynamic performance evolution of the high-speed railway infrastructure and its service safety, *Scientia Sinica Technologica*, 44(7), 645-660.
6. Paranitharan, P. & Perera, W. N. S., (2018). Deaths on rail roads: A study from Colombo North Teaching Hospital, Sri Lanka, *Sri Lanka Journal of Forensic Medicine, Science & Law*, 9(2), 10.
7. Baysari, M. T., McIntosh, A. S. & Wilson, J. R., (2008). Understanding the human factors contribution to railway accidents and incidents in Australia, *Accident Analysis & Prevention*, 40(5), 1750-1757.
8. Hu, Q., Tan, M., Lu, H., & Zhu, Y. (2018). A rough set-based measurement model study on high-speed railway safety operation.
9. Iridiastadi, H. (2016, September). Railway operations and safety in Indonesia: a descriptive study
10. Damsara, K.D.P. & Sirisoma, R.M.N.T., (2019). Analysis of Punctuality in Railway Transportation; Coastal Railway Line, Sri Lanka, Annual Sessions of IESL, The Institution of Engineers, Sri Lanka, 389-394.