

**DEVELOPMENT OF HEAVY VEHICLE  
CHARACTERISTICS MODEL USING  
WEIGH IN MOTION AT JAMBATAN  
SULTAN ABDUL HALIM  
MUÁDZAM SHAH**

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**Master in Construction Management**

**UNIVERSITI TEKNOLOGI MARA**

**JULY 2024**

## ABSTRACT

This study investigates the characteristics and trends of heavy vehicle traffic, particularly overloaded vehicles, on the Jambatan Sultan Abdul Halim Mu'adzam Shah (JSAHMS) bridge in Malaysia. Utilizing weigh-in-motion (WIM) data collected from 3 Sites over 31 months of data, the research analyses traffic composition, axle load range distribution, and the relationship between heavy vehicle volume and overload occurrences. Findings reveal distinct traffic patterns on weekdays and weekends, with significant variations in heavy vehicle percentages across locations. Statistical analyses, including ANOVA and Duncan's test, confirm these differences. The ANOVA analysis reveals that there are statistically significant differences in the mean counts of heavy vehicles between the Sites. The high F-value and the very low p-value ( $< 0.001$ ) suggest that the Sites means are not equal and the variation between Sites is significantly greater than the variation within Sites. This implies that the different Sites are affecting the total numbers of heavy vehicle. Based on the Duncan test results, we can conclude the Site 1 has the highest average number of heavy vehicles and is significantly different from Site 2 and Site 3. Regression models establish correlations between total traffic and heavy vehicle numbers, aiding in predicting future trends. Additionally, the study proposes a monitoring framework for JSAHMS, focusing on Sites with higher overload occurrences, to enhance enforcement and mitigate infrastructure damage caused by overloaded heavy vehicles. This research provides valuable insights for transportation planning, infrastructure management, and policy development, addressing the critical issue of overloaded heavy vehicles in Malaysia.

**Keywords:** Weigh-in-motion (WIM), Overloaded heavy vehicles, Traffic composition, Axle load distribution, Monitoring framework, Jambatan Sultan Abdul Halim Mu'adzam Shah (JSAHMS)

## ACKNOWLEDGEMENTS

I would like to express my gratitude to Allah S.W.T. for all the blessings that can complete my Master's Project. Special thanks to all parties involved in helping to complete this study. Thank you to my first supervisor, Ts. Syahrul Fithry bin Senin and second supervisor Dr. Siti Hafizan binti Hassan for all the guidelines and support to work harder and also any advice, criticism, supervision and support that has been given. Also, appreciation to Prof. Madya Ts. Dr. Ahmad Zia Ul-Saufie Mohamad Japeri for guidelines in SPSS Statistic Analysis and all of the UiTM lecturer that involve in Master of Science in Construction with Business Management program. Finally thank you to my lovely wife, Prof. Madya Dr. binti , parents, and family for supporting and loving me. May Allah bless you all.

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# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of Study

This study focuses on the Jambatan Sultan Abdul Halim Mu'adzam Shah to investigate the extent of overloaded heavy vehicle usage, their traffic patterns, and the specific vehicle types involved. This information is crucial for developing targeted monitoring and enforcement strategies to protect the bridge's infrastructure and ensure its long-term viability.

#### 1.1.1 Penang Second Bridge / Jambatan Sultan Abdul Halim Mu'adzam Shah (JSAHMS)

Launched under the 9th Malaysian Plan, the Penang Second Bridge Project is not only providing an alternative route linking Penang Island and the Mainland, but also a catalyst for the socio-economic development and growth in the Northern Corridor Economic Region (NCER).

On 1 March 2014, after a little over five years in the making, the bridge was officially opened by YAB Dato' Sri Mohd Najib bin Tun Abdul Razak, the Prime Minister of Malaysia and was aptly named Jambatan Sultan Abdul Halim Mu'adzam Shah. The bridge opened its door to the public at the stroke of 1:00 am on 2 March 2014.

The bridge's overall length is 24km with 16.9km is the length of the marine bridge over the water. It is linking Batu Kawan on the Mainland to Batu Maung on the island and it is currently the second longest bridge in Southeast Asia. Jambatan Sultan Abdul Halim Mu'adzam Shah will not only provide an alternative route for the people to commute to Penang Island from the Mainland and vice versa. The bridge is also a catalyst for the socio-economic growth and development in Penang, especially in the vicinity of Batu Kawan. Figure 1.1 shows the photo of JSAHMS.