

**INVESTIGATION ON THE RELATIONSHIP BETWEEN SAFETY FEATURES AND
SAFETY RATING: A CASE STUDY ON MALAYSIAN NATIONAL CAR**

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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**This report is submitted
In fulfillment of the requirement for the degree of
Bachelor of Mechanical Engineering**

Faculty of Mechanical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

JULY 2019

DECLARATION

I declare that this project report entitled “Investigation On The Relationship Between Safety Features And Safety Rating: A Case Study On Malaysian National Car” is the result of my own work except as cited in the references

Signature :

Name :

Date :

APPROVAL

I hereby declare that I have read this project report and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering.

Signature :

Name of Supervisor:

Date :

Signature :

Name of Co- Supervisor:

Date :

DEDICATION

To my beloved mother and late father

ABSTRACT

ASEAN NCAP is an organization that evaluate the safety rating of the car. There are two protocol system used by ASEAN NCAP which are 2012-2016 protocol system and 2017-2020 protocol system. The difference between both protocol are the used of single rating for 2012-2016 protocol system and overall rating for 2017-2020 protocol system. Safety rating is being given by ASEAN NCAP based on crash test of the car. Safety features of the car is divided into two categories which are active safety and passive safety. This rephrase focused on passive safety only (airbag and seatbelt). This research is focused on Malaysian national car only. Three selected models of national car that have used 2012-2016 protocol system have been used in this research for calculation in the first objective. As mentioned, there is no calculation has been done before on the three selected models using the 2017-2020 protocol system. In Malaysia, there is no study about the effectiveness of safety features on national car and awareness of safety in passenger vehicles. The correlation between safety features and safety rating of the Malaysian national car will be proved. The first objective was to calculate a new safety rating point for three selected models of national car using 2017-2020 protocol system of ASEAN NCAP. The second objective was to evaluate the effectiveness of safety features on Malaysian national car and awareness on safety in passenger vehicles based on regulation body, safety features and safety rating. The final objective was to analyze the relationship between safety features and safety rating of national car. Therefore, to correlate the actual and new safety protocol by ASEAN NCAP, analytical method was used based on the Offset Deformable Barrier (ODB) values obtained from actual crash test on the selected car models. Then, to measure the effectiveness and awareness of safety on Malaysian national car, a customer survey was developed and have been sent to 515 respondents. The overall results obtained, vehicles safety rating based on new protocol increase for Model 3 and same for Model 1 and 2. The safety features equip in the vehicle models influence the safety rating of the car. Based on the customer survey, shows that male and young drivers tend to know about the regulation body compared to female and old drivers. The survey also shows that female and young drivers have more knowledge and awareness on safety features and safety rating rather than male and old drivers. In conclusion, the relationship between safety features and safety rating have correlation based on the calculation and equip features in the car.

ABSTRAK

ASEAN NCAP adalah organisasi yang menilai penarafan keselamatan kereta. Terdapat dua sistem protokol yang digunakan oleh ASEAN NCAP iaitu sistem protokol 2012-2016 dan sistem protokol 2017-2020. Perbezaan antara kedua-dua protokol adalah penggunaan penarafan tunggal untuk sistem protokol 2012-2016 dan penilaian keseluruhan untuk sistem protokol 2017-2020. Penarafan keselamatan disediakan oleh ASEAN NCAP berdasarkan ujian kemalangan kereta. Ciri-ciri keselamatan kereta terbahagi kepada dua kategori iaitu keselamatan aktif dan keselamatan pasif. Penulisan ini memberi tumpuan kepada keselamatan pasif sahaja (beg udara dan tali pinggang keledar). Kajian ini hanya tertumpu kepada kereta kebangsaan Malaysia sahaja. Tiga model kereta nasional Malaysia yang telah menggunakan sistem protokol 2012-2016 telah digunakan dalam penyelidikan ini untuk tujuan pengiraan dalam matlamat pertama. Seperti yang dinyatakan, tidak ada perhitungan yang dilakukan sebelum ini pada tiga model terpilih yang menggunakan sistem protokol 2017-2020. Di Malaysia, tiada kajian mengenai keberkesanan ciri keselamatan pada kereta kebangsaan dan kesedaran mengenai keselamatan kenderaan penumpang. Hubungan antara ciri keselamatan dan penarafan keselamatan kereta kebangsaan akan dibuktikan. Objektif pertama adalah untuk mengira titik penarafan keselamatan baru bagi tiga model kereta nasional terpilih yang menggunakan sistem protokol 2017-2020 ASEAN NCAP. Objektif kedua adalah untuk menilai keberkesanan ciri keselamatan kereta kebangsaan Malaysia dan kesedaran tentang keselamatan kenderaan penumpang berdasarkan badan organisasi, ciri keselamatan dan penarafan keselamatan. Objektif akhir adalah menganalisis hubungan antara ciri keselamatan dan penarafan keselamatan kereta kebangsaan. Oleh itu, untuk mengaitkan protokol keselamatan sebenar dan baru oleh ASEAN NCAP, kaedah analisis telah digunakan berdasarkan nilai Offset Deformable Barrier (ODB) yang diperolehi daripada ujian kemalangan sebenar pada model kereta terpilih. Kemudian, untuk mengukur keberkesanan dan kesedaran mengenai keselamatan kereta kebangsaan Malaysia, tinjauan pelanggan telah dibangunkan dan telah dihantar kepada 515 responden. Keputusan keseluruhan diperolehi, penarafan keselamatan kenderaan berdasarkan peningkatan protokol baru untuk Model 3 dan sama untuk Model 1 dan 2. Ciri-ciri keselamatan melengkapkan dalam model kenderaan mempengaruhi penarafan keselamatan kereta. Berdasarkan kaji selidik pelanggan, menunjukkan bahawa pemandu lelaki dan muda cenderung mengetahui tentang badan organisasi berbanding pemandu wanita dan tua. Tinjauan ini juga menunjukkan bahawa pemandu wanita dan muda mempunyai lebih banyak pengetahuan dan kesedaran mengenai ciri keselamatan dan penilaian keselamatan daripada lelaki dan pemandu lama. Kesimpulannya, hubungan antara ciri keselamatan dan penarafan keselamatan mempunyai korelasi berdasarkan pengiraan dan melengkapkan ciri-ciri dalam kereta.

ACKNOWLEDGEMENT

I would like to express my deepest appreciation to my supervisor Dr. Muhd Ridzuan Bin Mansor from Universiti Teknikal Malaysia Melaka, for giving me this opportunity to do final year project with him. He never hesitated to give me advice and guidance whenever I confronted problems. I am thankful for his patience and advice while leading me in this project.

Secondly, I would like to thank my cooperative supervisor Ir. Dr. Khairil Anwar Bin Abu Kassim from ASEAN NCAP, for always supporting me and gave me opportunity to learn something new about the automotive industry. He had spending his time to guide me. He would share his knowledge in the field of automotive industry with me and guide me to do this research.

I would like to thank my housemates for giving me their support, patience and encouragement. Finally, I would like to thank my family for their support.

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LIST OF ABBREVIATIONS

FIGURE	TITLE
ABS	Antilock Breaking System
AOP	Adult Occupant Protection
ASEAN NCAP	New Car Assessment Program For Southeast Asean
BST	Blind Spot Technology
COP	Children Occupant Protection
CRS	Children Restraint System
ESC	Emergensity Stability Control
EuroRAP	The European Road Assessment Program
FIA	Federation International Automobile
GLOBAL NCAP	Global New Car Assessment Program
HIC	Head Impact Criteria
HPT	Head Protection Technology
MIROS	Malaysian Institute Of Road Safety Research
MoU	Memorandum Of Understanding
ODB	Offset Deformable Barrier

PC3	Provisional Crase Crash Centre
SATs	Safety Assissts Technologies
SBR	Seatbelts Reminder
WHO	World Health Organization
ANOVA	Analysis of Variance

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CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia is the third largest vehicles market nation in the Southeast Asia (Focus2Move, 2015). Due to the high use of vehicles, the rate of accidents also increases from day to day (Beh, 2016). To overcome the problem of road accidents from happening and also to reduce the risk of death and serious injury, The New Car Assessment Program for Southeast Asia or known as ASEAN NCAP has been established. ASEAN NCAP jointly established by the Malaysian Institute of Road Safety Research (MIROS) and Global New Car Assessment Program (Global NCAP) in New Delhi, India on 7 December 2011 (Abu Kassim, 2018).

The objective of ASEAN NCAP to raise motor vehicle safety standards in the region and encourage a market for safer vehicles (Abu Kassim et al., 2017). It is an organization that evaluates the crashworthiness of a certain car variant. The crash test was held at the MIROS Provisional CRASE Crash Centre (PC3), Japan Automobile Research Institute (JARI), Australian CRASHLAB (ANCAP) and Korean KATRI (KNCAP). ASEAN NCAP has conducted the first crash test in 2011. There were seven (7) cars were tested and three (3) of them were Malaysian National Cars.

During the first crash test of ASEAN NCAP, the Malaysian national cars have received a relatively low star rating compared to other cars. However, the rating of Malaysian national car ratings has increased from generation to generation. This has shown a positive improvement by Malaysian manufacturing. In this research, three latest car models of Malaysian national car have been used to investigate the improvement of star rating. This study is to identify the safety features that have been added to the model's car causing the safety rating of the car's model increase.

Safety features can be divided into two categories which are active safety and passive safety. This rephrase focused only on passive safety features which help to reduce injuries when a crash cannot be avoided. Passive safety features are important as to keep the driver and passengers protected within the vehicle from various crash forces which a body structure absorb crash kinetic energy. Airbags and seatbelts are the most importance things of passive safety in car system (DekraOnTheSafeSide, 2018).

ASEAN NCAP has produced 2011-2016 Protocol System which separate rating for Adult Occupant Protection (AOP) and Child Occupant Protection (COP). The star rating will be given based on point scoring of AOP and COP. Meanwhile, in the year 2017, a new protocol system, 2017-2020 Protocol System has been introduced and it is a single rating system. The new protocol system is more severe than the old one since it has includes 50% overall rating for AOP (Ahmad et al., 2010).

1.2 Problem Statement

The car is a wheeled motor vehicle used for transportation. Along with time, many cars have been used in Malaysia whether locally-made or car imported from abroad. Most of the cars that have been manufactured have been equipped with safety features to make sure that the cars are safe to use. Back then, safety features are not really concern by Malaysian. But, after the establishment of the New Car Assessment Programme for Southeast Asian Country (ASEAN NCAP), peoples get more concern about the safety features (Eusofe & Evdorides, 2017).

The ASEAN NCAP have two protocol system which is 2012-2016 Protocol System and 2017-2020 Protocol System. All the three latest Malaysian National Cars Model have used 2012-2016 Protocol System and have shown a positive improvement of the safety rating. In Malaysia, the calculation has never been done on Malaysian national car using 2017-2020 protocol system. Therefore, the researcher wants to calculate the new safety rating of the three models using the 2017-2020 Protocol System since the new protocol is more severe than the old one (Ahmad et al., 2010).

Safety features is one of the most important things in vehicle system (Hung & Yazdanifard, 2015). In an article published by the Monash University Accident Research Center, Safety features are emphasized especially for newly released cars (Koppel et al, 2013). The study shows how important safety features are related to consumer's car purchasing. However, in Malaysia, there has been no study made yet on the Malaysian national car model and awareness of safety. The researcher will reviewed about the effectiveness of safety features on Malaysian national car and awareness of safety based on regulation bodies, safety features and safety rating. This study also assess Malaysian national car user experience by safety features.

The study on the relationship between safety features and safety rating ASEAN NCAP has been studied in Malaysia (Md. Isa et al., 2016). The study was conducted on all of the vehicles user in the Klang Valley area and not specific to one model. Furthermore, the study is not limited to specific age and more focus on those aged 25 to 30 years only. Therefore, this study will be focused on young drivers of Malaysian national car users.

1.3 Objectives

The main objectives of this research are:

- i. To calculate a new Safety Rating point for three selected models of Malaysian National Car using 2017-2020 protocol system of ASEAN NCAP.
- ii. To evaluate the effectiveness of safety features on Malaysian National Car and awareness of safety in passenger vehicles based on regulation body, safety features and safety rating.
- iii. To analyze the relationship between Safety Features and Safety Rating of Malaysian National Car.

1.4 Research Scope

This project focused on the passive safety system of Malaysian national car models. The safety rating of the Malaysian national car will be calculated based on a new protocol system. This study will focus on a new protocol system which calculate 50% overall rating of AOP point. The value of AOP points includes a frontal impact test and side impact test. Frontal impact test has four section which contributes the maximum four (4) point four each division that is Neck, Chest, Head and, Knee. This study will be used on chest deflection value only which can calculate manually. The value of chest deflection from old protocol system will be used to insert in new protocol system. Old protocol system used 22mm to 50mm while the new protocol system used 22mm-42mm which is more severe. Then, in this study also will be formulated questionnaire and analyze the data. This study will focused on young drivers of Malaysian national car user that aged between 18 to 25 years old. All the data will be evaluated based on user feedback.

1.5 Significant of Study

For this study, the researcher hope the safety rating point value is still the same or increase if using the new protocol system and shows a positive improvement. In addition, researcher also hope to prove that the safety features will affect safety rating. With this study, researcher hope that Malaysians will be more concern of safety features and can choose a safer vehicle in the future. Furthermore, user feedback is crucial to improve the Malaysian national car for the future. Last but not least, the NCAPs emphasizes safety features important for all vehicles since it can reduce the road accidents and also can give users the opportunity to choose a safer car by having the safety rating of the car.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In Malaysia, there are many categories of industry existed. Meanwhile, the automotive industry is one of the most important industry that bring a lot of advantages to country (MITI, 2014). The automotive industry is divided into three scopes which is production, research and development and design. Research and development are classified into five scope which are aerodynamic, material, safety, structure, and control system. Safety is divided into two categories namely safety features and safety rating. Under safety features, there are two parts where they are active system and passive system. The overview of research on safety in automotive industry is shown in Figure 2.1.

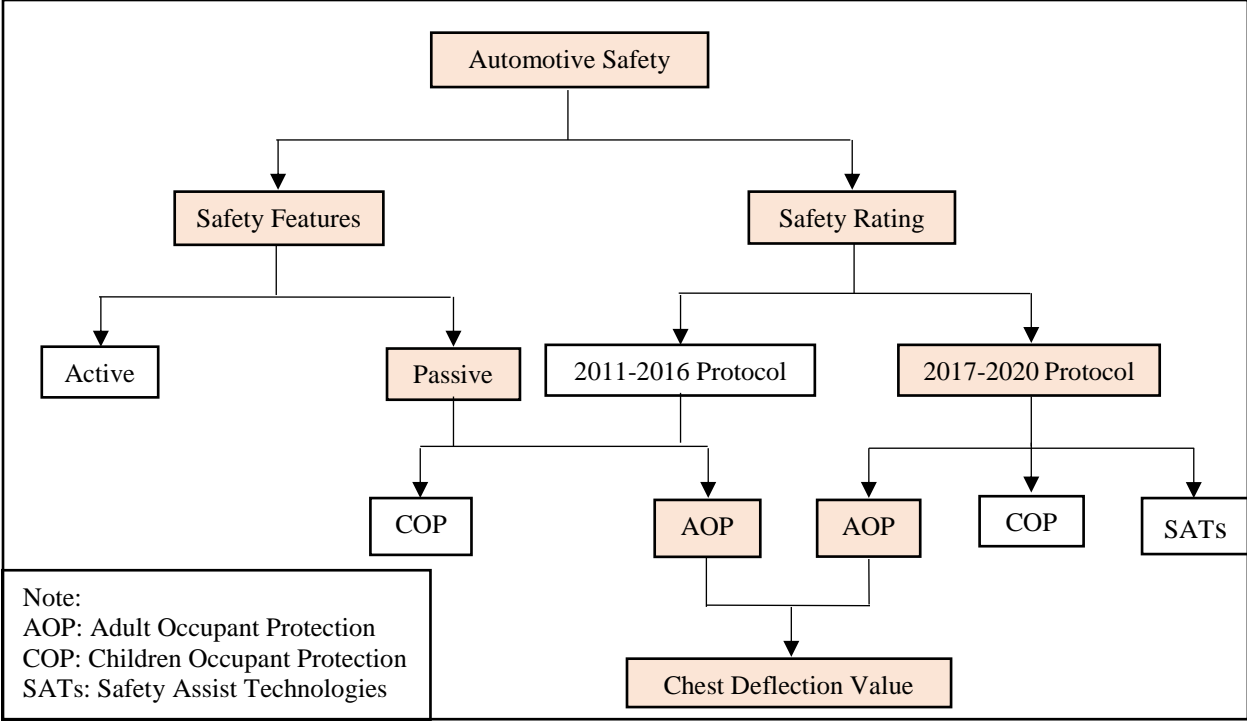


Figure 2.1 Overview of research on safety in automotive industry

2.2 Safety Rating

New Car Assessment Program for Southeast Asia or known as ASEAN NCAP is an automobile safety rating programme jointly established Malaysian Institute of Road Safety Research (MIROS) and Global New Car Assessment Programme (Global NCAP) during the Federation International Automobile (FIA) in New Delhi, India on 7 December 2011 (Abu Kassim, 2018). Establishment of ASEAN NCAP is to raise safety standard towards the vehicles among Asian country (Abu Kassim et al., 2017).

During earlier establishment, ASEAN NCAP had introduced the 2012-2016 protocol system which single rating for both Adult Occupant Protection (AOP) and Children Occupant Protection (COP). In the year 2016, a new protocol system had been released which is 2017-2020