

**THE ROLE OF ROAD SAFETY INSPECTION
TOWARDS ENSURING FORGIVING ROADS IN
MALAYSIA**

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FORGIVING ROADS IN MALAYSIA

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ABSTRAK

Kemalangan biasanya disebabkan oleh kelajuan kenderaan yang tidak terkawal, keadaan jalan yang buruk dan pemanduan yang tidak bertanggungjawab, seperti memandu secara melulu dan dalam keadaan mabuk. Jurutera awam mesti memberi perhatian kepada setiap ciri jalan untuk menguruskan cabaran ini. Selepas pembinaan, keselamatan jalan raya mesti dijaga. Pengangkutan dan pembangunan di Malaysia menjadi lebih sengit dan canggih berbanding sebelum ini, sebahagiannya hasil daripada pertumbuhan penduduk dan peningkatan pemilikan kenderaan. Ini menjadikan keselamatan jalan raya sebagai isu yang mencabar. Penyelidikan kajian ini untuk memahami peranan Pemeriksaan Keselamatan Jalan Raya (RSI) dalam memastikan jalan yang selamat di Malaysia. Projek ini membandingkan garis panduan RSI ditubuhkan oleh Institusi Penyelidikan Keselamatan Jalan Raya Malaysia (MIROS) dengan Persatuan Jalan Raya Dunia (PIARC), melaksanakan RSI secara langsung di tapak yang dipilih, dan menganalisis perspektif pengguna jalan untuk menentukan kepentingan RSI di Malaysia. Secara keseluruhannya, kajian penyelidikan menunjukkan garis panduan oleh MIROS lebih sesuai digunakan terutamanya di Malaysia kerana ia mesra pemula dan kaedah pemeriksaan diterangkan secara terperinci. Selain itu, RSI di kawasan pemeriksaan menunjukkan kecacatan pada jalan raya yang boleh dipinda dengan mengikut langkah-langkah pembaikan yang dicadangkan. Selain itu, perspektif responden tentang keselamatan jalan raya di kawasan yang diperiksa sepadan dengan analisis daripada RSI yang dijalankan di tapak seperti keperluan memasang lampu jalan, mengecat semula tanda jalan dan banyak lagi. Oleh itu, RSI mempunyai peranan yang relevan untuk memastikan jalan raya di Malaysia memaafkan kerana dapat memahami keadaan jalan raya yang dilihat oleh pengguna jalan raya dan menilai keselamatan keadaan tersebut dapat mengurangkan potensi kemalangan jalan raya.

ABSTRACT

Accidents are commonly constructed by many reasons such as uncontrolled vehicle speed, poor road conditions, and irresponsible driving, such as reckless driving and drunk driving. A civil engineer must pay attention to every road feature to manage these challenges. After construction, the safety of the roads must be maintained. Transportation and development in Malaysia are becoming more intense and sophisticated than ever, partly as a result of population growth and increase in vehicles ownership. This makes road safety a challenging and complex issue. This study research attempts to understand Road Safety Inspection's (RSI) role in ensuring forgiving roads in Malaysia. This project compares the RSI guidelines established by the Malaysian Institute Road Safety Research (MIROS) with The World Road Association (PIARC), executes RSI hands-on at the selected site, and analyses the road user's perspective to determine the significance of RSI in ensuring forgiving roads in Malaysia. Overall, the research study shows that the guidelines by MIROS are more suitable to be used especially in Malaysia because it is beginner-friendly as the methods of inspection are explained in detail. In addition, from the RSI conducted on the inspection area, there are a few flaws on the road that can be amended by following the remedial measures suggested. Moreover, the respondents' perspective on road safety in the inspected area matches with the analysis from RSI conducted on the site like the need to install streetlights, repaint the road markings, and, more. Therefore, Road Safety Inspection (RSI) has a role that is relevant to ensuring the roads in Malaysia is forgiving as it can understand the conditions of the road that is viewed by the road users and evaluate the safety of the condition can reduce the potential of road accidents.

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LIST OF ABBREVIATIONS

1. Gross Domestic Product (GDP)
2. Institute of Engineers Malaysia (IEM)
3. International Road Assessment Program (iRAP)
4. Jabatan Kerja Raya Malaysia (JKR)
5. Malaysian Guidebook for Traffic and Road Safety Audit (METRA)
6. Malaysian Institute Road Safety Research (MIROS)
7. Raised Reflective Pavement Marker (RRPM)
8. Road Safety Audit (RSA)
9. Road Safety Inspection (RSI)
10. The Royal Malaysian Police (RMP)
11. The World Road Association (PIARC)
12. World Health Organizations (WHO)

CHAPTER 1

1.0 INTRODUCTIONS

1.1 Background

Road safety has a lot of concerns that receives attentions but the solutions are less addressed adequately, despite the fact that it is a major cause of many human lives being sacrificed on the road. Road safety is a measure carried out by the government to decrease risk of a crash caused by road misconduct, which might have an impact on Malaysia's aim of obtaining forgiving roads. In essence, forgiving roads are an important road safety philosophy because they aim to lessen the harm and damage caused by traffic collisions.

Forgiving roads is a design concept that creates roadways that are tolerant of driver errors (Toth, 2006). Limiting the impact force that can cause catastrophic injuries is a crucial feature of forgiving roads. Equally crucial is the monitoring of crash mechanisms that can result in grave consequences (The Road Safety Toolkit, 2021). These include all forms of rollovers, falls from great heights, being pierced by sharp objects, and immersion in bodies of water.

According to the World Health Organization (WHO), annually roughly 1.3 million people are killed in road accidents, and between 20 and 50 million more are injured, with many becoming disabled as a consequence of their injuries (World Health Organization, 2021). Aside from that, there is an economic issue, with data claiming that road traffic accidents cost most countries 3% of their gross domestic product (GDP). These losses result from the expense of treatment as well as the loss of work for people who are dead or incapacitated as a result of their injuries. As a consequence,

implementing the concept of forgiving roads is critical since it will save lives and minimize the amount of government's expenditures on road safety concerns.

To reduce the risk of accidents, it is necessary to carry out a strategy to improve road safety using existing methods. In this research, an existing proactive assessment approach that is not yet widely implemented in Malaysia will be studied which is Road Safety Inspection. Road Safety Inspection (RSI) is a systematic, on site review, conducted by expert(s), of an existing road or section of road to identify hazardous conditions, faults and deficiencies that may lead to serious road crash (PIARC, 2007).

Upon narrowing the issue to achieve Forgiving Roads in Malaysia, Road Safety Inspection (RSI) can be considered as one of the remedies to complement Road Safety Audits (RSA). Road Safety Inspection (RSI) should be viewed as a possible solution to achieve Malaysia's goal to lessen the likelihood and severity of an accident in Malaysia, identify elements that may contribute to accidents, and improve safety conditions of the roads based from the inspection results.

1.2 Problem Statement

In general, the aim of Road Safety Inspection (RSI) is to detect possible problems so that countermeasures may be implemented to reduce the likelihood of an accident occurring and to ensure more forgiving roads (PIARC, 2007). From Figure 1.1, there are countries that are implementing RSI in their road safety alongside other type of road safety assessment like United States of America, United Kingdom, Australia and more (Marizwan, 2019).



Figure 1.1: Countries Coloured in Yellow implements RSI (Marizwan, 2019)

In Road Safety Inspection (RSI), there are several characteristics that will be inspected including road purpose, cross-section of the road, traffic signing, marking and lighting, and others. Traffic Signing, Marking, and Lighting is the key areas that will be focused in this research project because it is a component that transmit information to road users to avoid accidents and travel safely. These key areas might be the source of crash in a particular road segment due to its inadequacy or illegible traffic signing, marking and lighting.

The importance of these key areas can be learnt as many of these incidents occur as a result of drivers failing to stop or control their vehicles the way they should due to the poor condition of Road Marking, Signage, and Lighting. Hence, this research is being carried out to investigate the extent to which Road Safety Inspection (RSI) can be applied in Malaysia to accomplish the aims of Forging Roads in Malaysia.

1.3 Objectives

The purpose of this research is to determine the practical level and implementation for Road Safety Inspection (RSI) in Malaysia to meet the aims of Forgive Roads in Malaysia, particularly for the Traffic Signing, Marking, and Lighting.

The objectives of this research are as follows:

1. To compare the guideline of Road Safety Inspection (RSI) between Malaysian Institute Road Safety Research (MIROS) and The World Road Association (PIARC).
2. To carry out Road Safety Inspection (RSI) activities based on Malaysian Institute Road Safety Research (MIROS) Guideline.
3. To compare between the risk of crashes from the perspectives of the road users with the Road Safety Inspection (RSI) analysis.

1.4 Scope of Work

The scope of work for this research starts by determining the inspected site. The scope of work for this research starts by determining the inspected site. The chosen road segment is along the Jalan Klang-Sabak Bernam exactly 100m within the location of $3^{\circ}09'25''$ N $101^{\circ}19'46''$ E as shown in Figure 1.2.

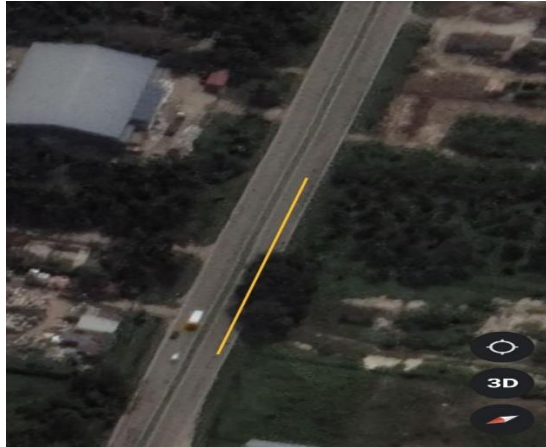


Figure 1.2: 100m of the Inspected Area

In this research project, there are few parameters that should be known while conducting the research. The first parameter is the road geometry and infrastructure. This is due to understand the type of road as well as road function which is important as safety of the road segment can be evaluated only if this parameter exists. Next important parameter is the road infrastructure deficiencies because most of the time the road infrastructure became main factor which causes road accidents. Hence, this parameter is needed to determine the safety of the road segment. Then, the important parameter that will relates the Road Safety Inspection (RSI) with the perspective of road users is the risky behaviour and exposure of road users which is the key of the research as it can be used to understand the role of Road Safety Inspection (RSI) by evaluating the potential of RSI in understanding the perspective of road users.

The significance of this study is due to the fact that the current road environment has a significant impact on the annual increase in road crashes. This is because the roads were built and planned a few decades or years ago for a fleet of slower cars and fewer traffic. The present road infrastructure and components may become obsolete as a result of technological advancements and new technical requirements; therefore, replacement is required. Since it is claimed that RSI is extremely cost-effective, which entails saving

human lives every year on a road segment that has been inspected, thus means that the benefit of RSI would be far greater than the actual cost of an after-crash.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Road Accidents and Road Fatalities in Malaysia

According to two types of crash data collected in Figure 2.1 by The Royal Malaysian Police (RMP) and The Malaysian Institute Road Safety Research (MIROS), the number of road accidents in Malaysia has grown over these years (2010-2019) meanwhile the number of fatalities as shown in Figure 2.2 has seen some reduction during these period. As observed from the data, this is a critical issue since the number of traffic accidents is growing year after year that will affects the goal of achieving Forgiving Roads in Malaysia.

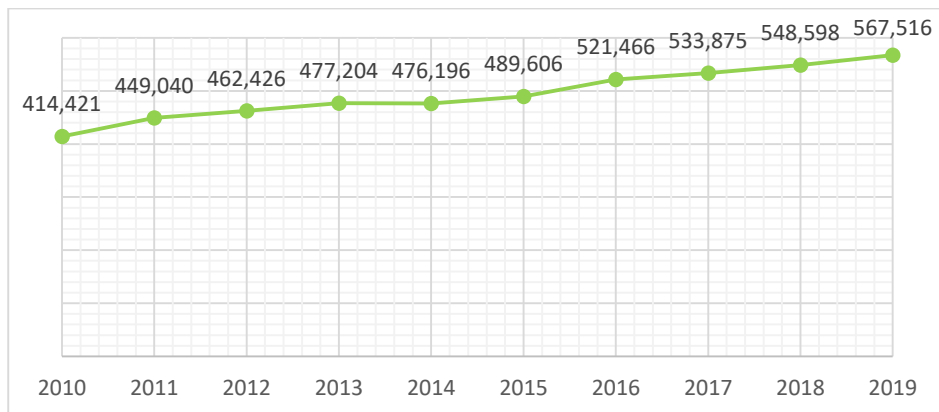


Figure 2.1: Malaysia Road Accidents 2010-2019 (Ministry of Transport Malaysia, 2019)

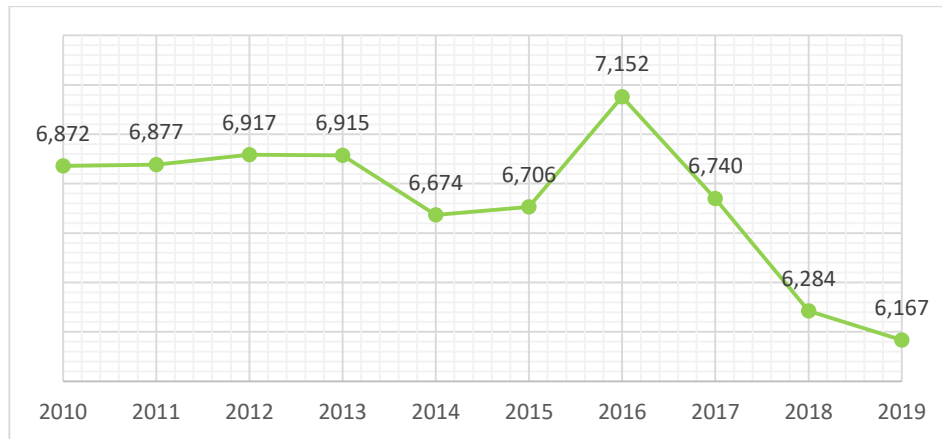


Figure 2.2: Malaysia Road Facilities 2010-2019 (Ministry of Transport Malaysia, 2019)

2.2 Forgiving Road

One of the key issues of this dramatic increase for the high rate of this type of accidents is the lack of forgiving roadsides. The forgivingness of the environment and of road users is defined as injury limitation through a forgiving road environment and in the meantime, an anticipation of road user behavior (Lakušići, 2014).

A forgiving road is defined as a road that is designed and built in such a way as to interfere with or block the development of driving errors, but also to avoid or mitigate negative consequences of driving errors, allowing the driver to regain control and either stop or return to the travel lane without injury or damage. This idea is applied to roads that have the necessary means to minimize damage and danger in case of an accident. It is applied most effectively on conventional highways in case the vehicle should run off the road. If this happens, these roads make it easier for the vehicle to get back on the road (On the Road Trends – Together we move the world, 2019).

2.3 Road Safety Assessment

A comprehensive analysis of all types of accidents should be followed by identification of factors and causes of road accidents (Pulyanova *et al.*, 2019). Accidents should be analyzed from the systemic point of view, and factors determining or accompanying the accidents should be classified according to the complex properties. The Malaysian government has undertaken many Road Safety Assessments in order to attain the aim of forgiving roads. The current practice of road safety assessment by road authorities, according to the Institute of Engineers Malaysia (IEM), is divided into two categories: proactive assessment and reactive assessment (The Institution of Engineer Malaysia (IEM), 2018)

2.4 Proactive Assessment and Reactive Assessment

A proactive assessment approach to road safety implies not depending primarily on death or injury to discover road safety issues (The Institution of Engineer Malaysia (IEM), 2018). Proactive assessment has two components: Road Safety Audits (RSA) and iRAP. The reactive assessment technique, on the other hand, is an evaluation of the safety of a road network based on the number and severity of accidents that occur on the road (Chatterjee and Mitra, 2019). In addition, there are two components in reactive assessment: the High Crash Concentration Section (Blackspot) and the Risk Map. This two types of assessment is the pillar of road safety in Malaysia for now.

2.4.1 Road Safety Audit

The Road Safety Audit (RSA) is an independent, thorough systematic and technical safety examination linked to the design features of a road infrastructure project (Marizwan, 2019). RSA is also a modern system that consists of good quality and safety control of roads and services for road maintenance and operation (Baklanova *et al.*, 2021). Road Safety Audits (RSA) at the project design stage, before any construction starts, screen the designs on paper for any safety issues (PIARC, 2007). It is a formal process best conducted by an independent auditor that involves all stages from planning through early operation. This will allow identifying and eliminating errors at the stage of signing documents (Baklanova *et al.*, 2021).

Methods of auditing typically consists of accident data analysis, meetings and field visits, checklist writing, and reviewing relevant documents (drawings, background, plans and so on). Nowadays, as driving simulators have advanced continuously, researchers have proposed a Virtual Road Safety Audit at an initial stage (Jun, Go and Yeom, 2021).

2.4.2 International Road Assessment Program (iRAP)

International Road Assessment Program (iRAP) informs about the present status of the road system, the level of road safety, ideas for improving current conditions, and the return on investment for each improvement. It is one of the methods to reduce the risk of accidents that should not be underestimated because traffic accidents are predictable and can be prevented (Setyarini and Edison, 2022).

The iRAP Star Rating and Safer Roads Investment Plan provides help and guidance to assess road user risk and improve the safety of road infrastructure (Rogers, 2017). The guidance document builds on the experience is designed to assist users with the implementation phase shown on the right of the process diagram in Figure 2.3.

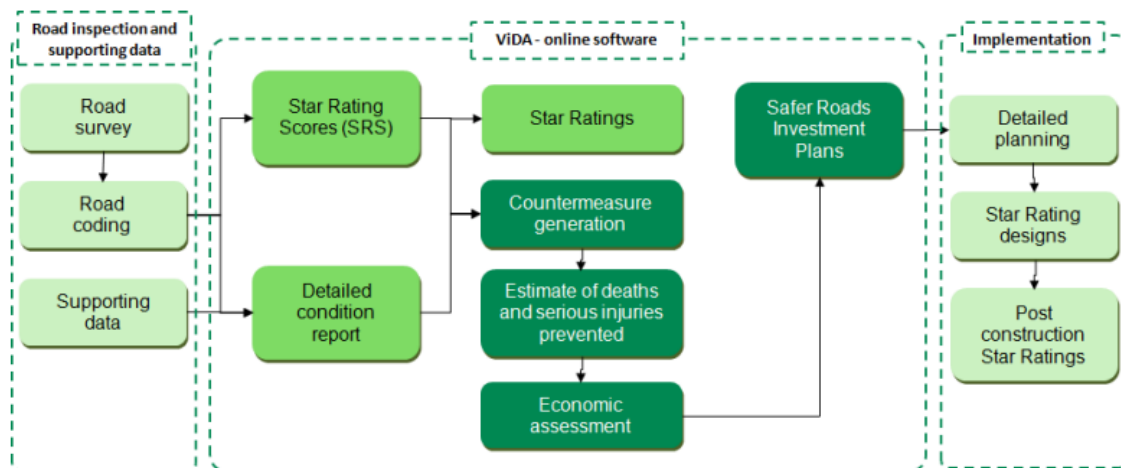


Figure 2.3: The iRAP Star Rating and Safer Roads Investment Plan process diagram (Rogers, 2017)

The iRAP Star Rating is an objective measure of the likelihood of a road crash occurring and its severity. The focus is on identifying and recording the road attributes which influence the most common and severe types of crash, based on scientific evidence-based research (Rogers, 2017). In this way, the level of road user risk on a particular road section or network can be defined without the need for detailed crash data.

2.4.3 Blackspot Analysis

Blackspot is a method for identifying, analyzing, and ranking parts of the road network that have been in operation for more than three years and have had a high number of overall accidents in relation to traffic flow (Marizwan, 2019). Basically, the treatment of individual sites at which accidents are clustered are called Blackspots (Indian Institute of Technology, 2020). The process of eliminating or improving accident black spots in a road network is composed of several activities, as illustrated in the Figure 2.4.

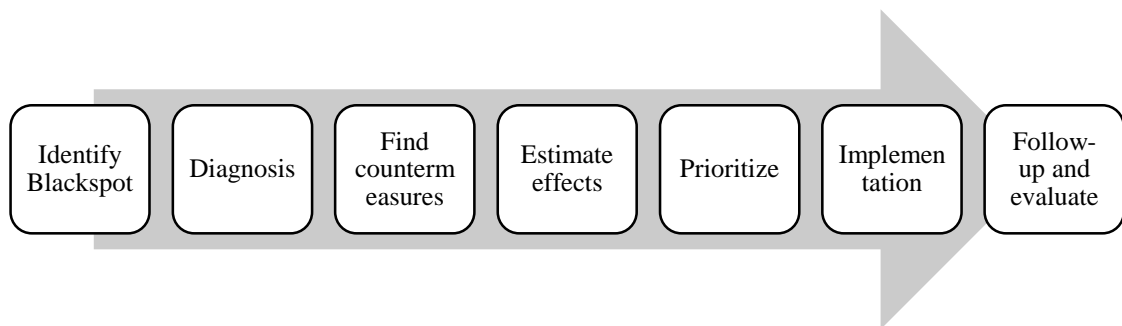


Figure 2.4: Process of Improving Blackspots in a Road Network (Indian Institute of Technology, 2020)

According to Accident Analysis and Prevention (2008), the assessment of Blackspots have important implications on resource allocation and strategies for future road safety investment because traffic patterns and road usage change over time that will cause new Blackspot to emerge (Meuleners *et al.*, 2008). Hence, evaluation of Blackspot is important in order to reduce number of crash.

2.4.4 Risk Map

Risk Map is a method that identifies, quantifies, and prioritizes hazards that may interfere with the interaction of road users, vehicles, and the road environment. The aim of risk mapping is to arrive at a clear set of action plans that improve risk management controls in areas where these are necessary and help the management of resources to eliminate or reduce the impact of these risks (Sikdar, 2016). The process of Risk Map is shown in Figure 2.5 which is based on historic crash data. With detailed crash and traffic data, risk can give objective assessment of the fatal and serious injury accidents in the network, which actually captures the combined risk of the interaction of all road users with the road environment.

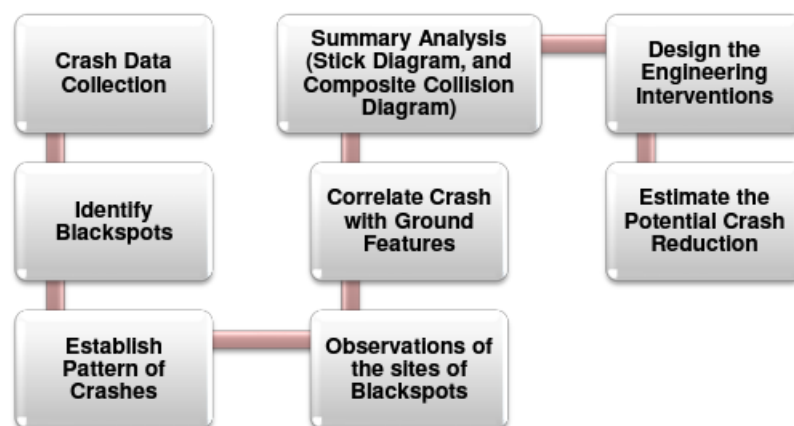


Figure 2.5: The process of Risk Mapping based on historic crash data (Sikdar, 2016)

2.5 Road Safety Inspection (RSI)

According to World Road Association (PIARC, 2007), Road Safety Inspection (RSI) is a systematic, on-site review, conducted by road safety experts of an existing road to identify hazardous conditions, faults and deficiencies that may lead to serious accidents. Road Safety Inspection (RSI) needs to be carried out by an independent person or team with experience in road safety work, traffic engineering, or road design who are not involved in the maintenance of the road. This in turn will lead to reduction in costs associated with accidents, to individuals, families and society.

Road Safety Inspection (RSI) consists of three main steps which are in-office preparations that includes collecting information on the road, on-site visiting which acts as the core activity of the inspection, and drafting a report with detailed description of the inspection on the road or road segment (UNECE, 2018). As remedial action is not a part of Road Safety Inspection (RSI) itself, however, implementation of measures is an important issue to ensure the effectiveness of the procedure. Hence, to be more effective treatment must be identified and implemented as a result of Road Safety Inspection.

2.6 Road Safety Characteristics Analyzed in Road Safety Inspection (RSI)

There are few guidelines of Road Safety Inspection (RSI) that can be referred, such as guideline by The World Road Association (PIARC) and Malaysian Institute Road Safety Research (MIROS). The guidelines have a unique structure in respect of the road characteristics to be checked and analyzed as shown in Table 2.1.

Table 2.1: Road Characteristics analysed in RSI

1.Function	2.Cross Section
3.Alignment	4.Intersections
5.Public and Private Services	6.Vulnerable Road User Needs
7.Traffic Signing, Marking and Lighting	8.Roadside Features

2.6.1 Road Function

For this characteristic, the function of the road must be described as well as the type of vehicles and its traffic flows. This is to make sure whether the road is suitable for the role it plays or does it have mixed functions (PIARC, 2007). In addition, we can gain information about the appropriate speed limit, impacts from land development and whether there are vulnerable road users separated.

2.6.2 Cross Section

The cross section design elements of a road consist of travel lanes, shoulders, cross slopes, median, roadside barriers, kerbs, sidewalks and side slopes (PIARC, 2007). The design of cross section elements is governed by the selected design standard. Designed in line with the road alignment, and adequate cross section of a road ensures the safety of road users besides an efficient traffic operation. The characteristics of cross-sectional elements are important in highway geometric design because they influence the safety and comfort (Prof. Tom V., 2019). The road elements such as kerb, shoulders, carriageway width etc. should be adequate enough for smooth, safe and efficient movement of traffic. In Road Safety Inspection (RSI), it focuses on some of the critical areas in a road safety audit on operational roads pertaining to the design of the cross section (Malaysian Institute Road Safety Research (MIROS), 2011).

2.6.3 Road Alignment

Road Alignment is one of the most important geometric elements in road design as it consists of the horizontal and vertical layouts of a road, the design of which is governed by the selected design speed (Malaysian Institute Road Safety Research (MIROS), 2011). They are to be designed to complement each other as poor design in the road alignment would have effects on the safe operation of a road. An inefficient combination of horizontal and vertical alignment may lead to road safety problems, even when the horizontal and the vertical alignment are separately correct and according to guidelines (European Commission, 2021).

The Road Safety Inspection (RSI) focuses on some of the critical areas in a road safety audit on operational roads pertaining to the design of the road alignment. Improving the alignment and sight conditions of a road makes it easier to plan driving, because the path of the road and other road users are more easily visible. Another aim of an effective road alignment is to increase mobility, by improving horizontal and vertical curves as well as gradients, which lead to significant reductions in speed.

2.6.4 Intersections

Intersection is one of the most important components of roads and traffic flow which is the node that realizes route change (NamGung et al., 2020). According to Malaysian Guidebook for Traffic and Road Safety Audit (METRA), there are two type of intersection which are Unsignalized Intersection and Signalized Intersection. Unsignalized Intersections are the most common intersection type. Poor unsignalized intersections may affect the entire road network in the area. This inspection is particularly done based on the intersection spacing, layout, visibility, auxiliary lane, roundabout, condition of the road surface and vulnerable road user (Malaysian Institute Road Safety Research (MIROS), 2011). Meanwhile, at the signalized intersection, Traffic Signals play an important role in improving the safety of an intersection, where conflicting movements run concurrently and cause undue accident risks (Malaysian Institute Road Safety Research (MIROS), 2011).

2.6.5 Public and Private Services

Public and Private Services like service, rest areas and public transport are inspected during Road Safety Inspection (RSI). The sufficient space and acceleration or deceleration lanes into the Service and Rest Areas is inspected including the accessibility to control other services such as schools, hospitals, supermarket, restaurants and more (PIARC, 2007). Parking, loading facilities and public transport facilities such as tramlines, bus stops, and their position relative to traffic lights should also be examined during RSI. Public transport is a shared passenger transportation service which is available for use by the public. The main aim of this characteristics is to make sure the services are adequately protected including the needs of their passengers.

2.6.6 Vulnerable Road User Needs

The main goal of this characteristic that will be analyzed in Road Safety Inspection (RSI) is to make sure the needs of pedestrians, cyclists and scooter or motorbike riders been taken into account (PIARC, 2007). Normally, pedestrian are classified as a vulnerable road users due to their lack of protection and direct interaction with the vehicle in the event of crash. Thus, it is important to provide pedestrian infrastructures in order to minimize the risk of being involved in a vehicle-pedestrian crash. The safety of pedestrian in general, pedestrian in parking areas and adjacent to development areas and crossing areas are the scopes captures in the Road Safety Inspection (RSI) (Malaysian Institute Road Safety Research (MIROS), 2011).

Meanwhile, motorcyclist are also in the category of vulnerable road user. As motorcycle lane are desirable to segregate motorcyclist from the main traffic for safety reasons. Hence, in the guidelines of Road Safety Inspection (RSI), it is focused on auditing both exclusive and non-exclusive motorcycle lane, motorcycle shelter and tunnel or underpass.

2.6.7 Roadside Features

The roadside features has become an important aspect of traffic management as they manage the obstacles that are near the roadside that could pose a problem (PIARC, 2007). According to Malaysian Guidebook for Traffic and Road Safety Audit (METRA), the ideal roadway should be entirely free of any roadside obstructions and other hazardous conditions. In the inspection, clear zone distances, road safety barrier, median barrier and crash attenuator where providing clear zone is not practical are presented (Malaysian Institute Road Safety Research (MIROS), 2011).

2.6.8 Traffic Signing, Marking and Lighting

Traffic Signing, Marking and Lighting is basically visual aid at the road. Visual aid is visual graphic placed on the road to guide or warn road users upon navigating the road (Malaysian Institute Road Safety Research (MIROS), 2011). Traffic signing plays an important role in reducing traffic accidents especially in road or road segment that involve intersection with traffic lights or speed humps (Hussein, 2013).

Road signs should be located in proximity to speeding reduction road sign. However, the traffic signs must be clear and visible to allow observers to see all vehicle occupants. There are three basic types of traffic signs which are sign that give orders, sign that warn and signs that give information (Great Britain. Department of Transport., 2007).

As part of the traffic control plan, road markings form on the traffic surface has the aim to provide visual guidance for road users. Road Marking has become a common element of road infrastructure and one of the basic low-cost safety measures (Great Britain. Department of Transport., 2007). Road markings is highly important especially on urban roads and intersections as they promote road safety and bring out smooth and harmonious flow of traffic along guided paths of travel (UTTIPEC, 2009). In addition, road marking is also used to convey certain regulation, information or warning that cannot be known by road users unless it is made effectively known to the road users. There are few elements of road marking that are checked in the inspection that includes longitudinal lines, transverse lines, pedestrian crossing, stop line, lane marking, yellow box, chevron marking, word marking and others.

Lighting provides a number of important benefits as it can be used to promote security and safety for drivers, riders and pedestrians. Driving in night-time is more dangerous if the street have poor lighting status (Ward *et al.*, 2005). Pedestrians and vulnerable road users also suffers from poor lighting conditions in the road.

2.7 Road Accidents Due To Traffic Signing, Lighting and Marking

There are numbers of accidents occurred in Malaysia due to Traffic Signing, Marking and Lighting. For example, there were accident cases in Merak, Sungai Petani where accidents often occurs due to the poor street lighting that causes road users especially vulnerable road users like motorcyclists crashes on wild animals crossing the street (Sinar Harian, 2021). In addition, a driver was seriously injured as a result of hitting the barrier wall as shown in the Figure 2.6 although there were caution and warning signs about one kilometer before the road was closed with barrier due to poor lighting.



Figure 2.6: Among the concrete wall barriers installed during roadblocks during the period of the Movement Control Order (Sinar Harian, 2021)

Many drivers have voiced their concerns about poorly lit roads, particularly the Lebuhraya Kajang-Seremban (Lekas) and the Seremban-Port Dickson stretch. These routes can make it feel as though you are driving through a dark tunnel, which may be why so few motorcyclists use them at night, as shown in Figure 2.7. Due to the low number of vehicles on the road at night, a small number of road users reported being abandoned in pitch black while waiting for assistance after their vehicles were involved in accidents. The Malaysian Highway Authority (LLM) responded that having complete street lighting on the road would be expensive and impractical despite the demands of the road users for the highway operators to install streetlights to encourage more users to be safe on the road (Star Carsifu, 2012).



Figure 2.7: Experience of Driving Along the Lekas Highway (Star Carsifu, 2012)

At Klang, the road surface markings on the Jalan Teluk Pulai Bridge has faded markings which makes it difficult for road users to navigate on this stretch especially at night. Most drivers using Jalan Teluk Pulai, which branches out to Jalan Sungai Bertih, find it challenging to navigate their vehicles safely because they cannot see the road lines. Further down, the right and left lanes split off into different directions. Hence, the road users especially vulnerable road users like motorcyclists, cyclists, and pedestrians have to be on their guard when using Jalan Teluk Pulai because faded or missing road markings have increased risks of mishaps occurring. Therefore, the road users demanded the Klang Council to repaint the faded road markings which was responded by MPK Engineering Department director Zamri Othman said the road markings would be redone as soon as possible.

In short, the element of Traffic Signing, Marking and Lighting have devastating impact on the safety of the road according the experiences of the road users and the analysis of the road accidents that happens in Malaysia. Hence, an alternative is need to keep on track the condition of these elements on the road regularly like Road Safety Inspection (RSI).

CHAPTER 3

3.0 RESEARCH METHODOLOGY

3.1 Methodology Framework

The methodology framework shown in Figure 3.1 describes the flow of the inspection and questionnaire conducted on the selected inspected area. In this case, the selected inspected area is along Jalan Klang-Sabak Bernam road which is selected due to the suggestion by Selangor Public Works Department (JKR) in Selangor by referring to the limited data analysis for Blackspot in 2022 at the Selangor state as shown in Appendix C.

The importance of selecting a suitable site to conduct research study is to ensure that the selected road has various types of road elements that can be inspected using RSI. This is because. This study can tackle high coverage of the Road Safety Inspection (RSI) elements during analysis which is the parameters of this study. In addition, by selecting a road segment that is accidents prone area, the hazardous condition of the road is identified and the countermeasures are given.