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ORIGINAL ARTICLE

# Malaysian Road Traffic Crash Data: Where Do We Stand Now

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**ABSTRACT** – Statistically around the world, the number of people killed on the roads are approximately 1.3 million. A road traffic crash is not only a global pandemic that kills more than a million people per year but has also become a major public health concern in most countries, including Malaysia. With consistent standardized collection and management of data, these data will provide beneficial and accurate insight for trends monitoring future time series prediction and ultimately, reliable review of currently implemented programmes. In Malaysia, the Royal Malaysian Police (RMP) involves primarily of collecting road crash data, along with the routine traffic management and enforcement activities. To complement that, Malaysia is amongst the very few countries in ASEAN which possess its own research-based road crash investigations. This is as the effort in evidence-based approach to tackle road safety issues. Inputs from the in-depth research-based investigation are reported to policymakers and relevant authorities/industries which significantly assist in the development of safety countermeasures. To manage the data is a challenging task especially when it involves multiple agencies with different focuses, requirements and countless bureaucracies. Nevertheless, future understanding and potential efforts in consolidating these data pools will further enhance the national crash database as well as open new dimensions of the Malaysian crash database.

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*Data richness*

## INTRODUCTION

Road traffic crash has been identified as a global phenomenon that has killed more than a million people a year, including Malaysia. Additionally, it has also become a major public health concern in many countries. Every year, over one million lives are taken because of traffic accidents, with more than 30 times that number suffering non-fatal injuries [1]. What is more worrying, is that despite efforts being put into reducing the number of fatalities and injuries from road accidents, the number of casualties has kept increasing in most parts of the globe [1], where Malaysia is of no exception. With approximately 30 million inhabitants, Malaysia is one of the highest at-risk countries, according to three internationally comparable indexes: deaths per 10,000 registered cars, 100,000 population, and 1 billion VKT (Vehicle Kilometre Travelled) [2]. This is portrayed by the sub-7,000 annual fatalities that have never demonstrated a significant drop over the years.

World Health Organization (WHO) has reported, road traffic accidents continue to be a major public health concern on a global scale, or at regional and national levels. One of the key elements in improving road safety under the United Nations Decade of Action for Road Safety 2011–2020 issued by the Commission for Global Road Safety is pertaining to road safety data management. The previous study used an interesting metaphor in describing the different tiers as '3-5-2' in a typical football strategy (Zulhaidi & Khairil Anwar, 2013). The comparison refers to 3 as the high-income countries or the 'Forwards', 5 denote the middle-income countries or the 'Midfields' while 2 refers to the low-income countries also referred to as the 'Defenders' [3].

The two countries (the 'Forwards') with the smallest nations by land area (Brunei and Singapore) have the lowest number of road fatalities and index (per 100,000 population). Moreover, they are very close to "zero fatalities" target in road safety. For the 'Midfields', the four countries are the most populated in the top 20 world's most populated countries excluding Malaysia, are regarded as the Big 5" in ASEAN's automotive market. Furthermore, according to WHO 2010 data, road fatalities from these five countries contributed to 93% of ASEAN's total death toll whereby most fatalities involved VRU's: especially two- and three-wheelers [3]. Nevertheless, the remaining three countries (Laos, Cambodia and Myanmar) possessed rather low death figures (between 700 and 2,500). This is due to the nature of their economic conditions and with no domestic car industry, the rapid rise in motorization vehicle volume may be unlikely significant compared to the mid-tier countries.

Road crashes rate in ASEAN are relatively high in certain countries where currently they are all above the global annual average of 17.4 per 100 000 people (ITF,2020) [4]. Around 90% of worldwide road collisions occur in low- and middle-income nations, while road traffic injuries continue to be a concern in high-income countries. Improving road safety in Southeast Asia will also aid in meeting the aims established by the United Nations Decade of Action for Road

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Safety 2011–2020 and the Sustainable Development Goals (SDGs), which included road safety and sustainable transportation goals. In ASEAN, the ten countries can be classified into three categories, referring to their socioeconomic status based on the Income Level (Gross National Income). The previous study has investigated the macro situation of road safety situations in these countries with a specific perspective on New Car Assessment Program (NCAP) contributions towards their performance [4]. Vulnerable road users (VRUs) which include motorcyclists, cyclists, and pedestrians are the main categories of road users in the region and are the highest-fatality groups in most of the countries, except for Brunei and Myanmar.

The Decade of Action's epoch between the years 2011 until 2020, the scenario to be achieved is that the rising trend of road deaths worldwide is stopped and reversed along with the increase in activities on the national level to meet the target. While global cooperation and frameworks for road safety will be enhanced internationally, initiatives are made to be more focused. The Safer Vehicles pillar focuses on the global deployment of passive and active security on vehicle safety technologies. This was applied through a combination of important global standards, user information systems, and incentives to boost new technology adoption. The Decade of Action highlighted a range of concrete actions aiming to achieve the mission under ASEAN NCAP which represents Operation No. 2 on the Safer Automobiles Pillar, i.e., introducing new automotive appraisal systems to extend the availability of automotive safety performance consumer knowledge in all regions of the world [5].

According to a previous study, Malaysia has pioneered a focused approach to car safety by instituting an accident rating programme known as the New Car Assessment Programme (NCAP). To encourage automotive safety, this two-pronged programme was designed for both customers and car manufactures. Thus, the main objective of this programne is to offer ASEAN customers with additional information on the degree of safety for automobiles in a comprehensive and often comprehensible manner. Therefore to consider the manufacturer's attempt to generate safer performance before buying the car so the cars can protect consumers from road accidents [6].

## RELATED WORK

In Malaysia, there are two types of road crash data collection, one by the Royal Malaysia Police (RMP) Traffic Division and the latter by the Malaysian Institute of Road Safety Research (MIROS) for research-based investigations, whereby both have countrywide coverage. RMP investigation was conducted on-the-spot, which fulfill legal purposes based on the Road Transport Act of 1987 including all collision severity levels, thus covering a broader scope and larger data pool. The crash information will then be filled into a dedicated form known as the Pol27 consisting of 99 variables in total.

In road crash data collection, the Royal Malaysia Police (RMP) plays a major role besides the routine traffic management and enforcement activities [11]. Malaysia is amongst the very few countries in ASEAN which possess its own research-based road crash investigation as one of the numerous efforts in evidence-based approach to tackle road safety issue [12]. The regulation and investigation of road traffic in Malaysia is stipulated under the 1987 Law 333 Road Transport Act (RTA) 1987; or known as Act 333. Under this act, road crashes are described as "An accident or incident that causes any person, property, vehicle, structure nor animal damage and injury". Malaysia road traffic authority-based investigation has a sequential flow which is crash data collection and recording. In Act 333, all the road traffic crashes are required to be reported to the RMP, and an investigation will be conducted at the crash scene the JSPT *(Jabatan Siasatan dan Penguatkuasaan Trafik).*

In the event of a road crash, the driver of the involved vehicle and, if there is more than one vehicle, the driver of any such vehicle shall report the event to the nearest police station traffic department. This should be done as soon as reasonably possible and, in any event, within twenty-four hours (24 hours) from the time of the accident (Section 52(2), Act 333). For fatal cases, the Investigating Officer (IO) will receive the case for recording and investigating. further investigation.

For non-fatal cases, the investigation and recording will be handled by an Assistant Investigation Officer. Through the introduction of the Malaysian Institute of Road Safety Research (MIROS), a new spectrum of road crash investigations have been made present in Malaysia. In addition to the authority-based investigation conducted by the RMP which covers a larger continuum of crashes and of more generic fields, the MIROS model was more issue-specific, focusing on the elements of vehicular, road design, and human behaviour.

The main objective of an in-depth crash investigation utilizing a research-based approach is to discover specific contributing factors of a crash and resulting injuries [7]. The investigation results will then be reported to policymakers, relevant authorities, and industries. From this, the development of countermeasures with regards to minimizing human and economic impact from road crashes will be conducted [8]. MIROS conducted the research-based study to identify crash and injury elements inclusive of human, engineering, and environmental aspects. The in-depth investigation is conducted by certain criteria, namely crashes which involve minimum of three fatalities, crashing that accidents involving commercial vehicles, and crashes with mass causalities and concerning national interest. Up to 2019, MIROS has been collecting more than 1000 cases based on some criteria and the focus has changed to localized crashes. Research-based investigations are performed on the spot or retrospectively depend on the level of the case. The level of a research-based crash investigation is conducted in three levels: base, intermediate and in-depth [9]. MIROS is a statutory body under the Ministry of Transport (MOT) that was established by the Malaysian government in the year 2007, which aim to serve in leading an organization that conduct research and development works pertaining to road safety in Malaysia. To propose effective interventions regarding to road safety, MIROS not only concentrate on high-impact research but also on on-

field operations including real-world in-depth crash investigation studies. The investigations are conducted based on an evidence-based approach and technical analysis, in contrast to other road crash investigations conducted in Malaysia. The aspect of the investigations is multidisciplinary, comprising of in-depth inspection on road design and environmental factors, vehicle exterior and interior damage, and on occupant safety and injury mechanism [13-15]. This information is essential to determine the contributing factors of the investigated crashes. It also acts as a focal point for an accident database, which offers relevant information on evaluating the success of road safety programmes, developing hypotheses for future areas of road safety, and supporting recommended interventions based on real-world data.

Although MIROS investigations cover all types of road crashes throughout Malaysia (including Sabah and Sarawak), there are still 400,000 reported crashes a year on the nationwide scale [2]. MIROS has outlined a screening or scope criterion before making the decision to conduct an investigation i.e., involving three or more fatalities, perceived as high profile cases (such as involving important figures in the country), cases requested by the police (RMP), and other reasons where the decision-makers thought are deemed necessary to investigate [10]. These criteria are kept dynamic to cater to current needs. Another category of cases is the MOT National Inquiry Cases, also known only as inquiry cases, which are classified as such when the number of casualties is too high (usually involving buses) or cases involving multiple vehicles.

Crashes investigated by MIROS were reconstructed based on information gathered from a post-crash vehicle and site inspection through physics laws and theories analysed using specific computer programs. The computer programs are for the purposes of vehicle damage analysis, impact simulations, and crash animations. Ultimately, the findings can identify important causal factors in a particular crash such as the use of seat belts, kinematics of vehicle movement, vehicle speed, vehicle structural integrity, and injury factors involved (injury mechanism). A Crash Reconstructionist team, consisting of two or three members are sent to an accident scene to gather physical data and evidence with permission from the Investigation Officer (IO) of RMP, which is the main authority handling the case. Case identification is conducted through media monitoring and the information is verified by the authority in charge. Generally, the investigation is conducted retrospectively within a two to three days period, but for inquiry cases specifically, the investigation team normally attends to the case on the same day. The whole process of investigation works conducted by MIROS is certified by the International Organization for Standardization (ISO) 9001 shown in Figure 1.

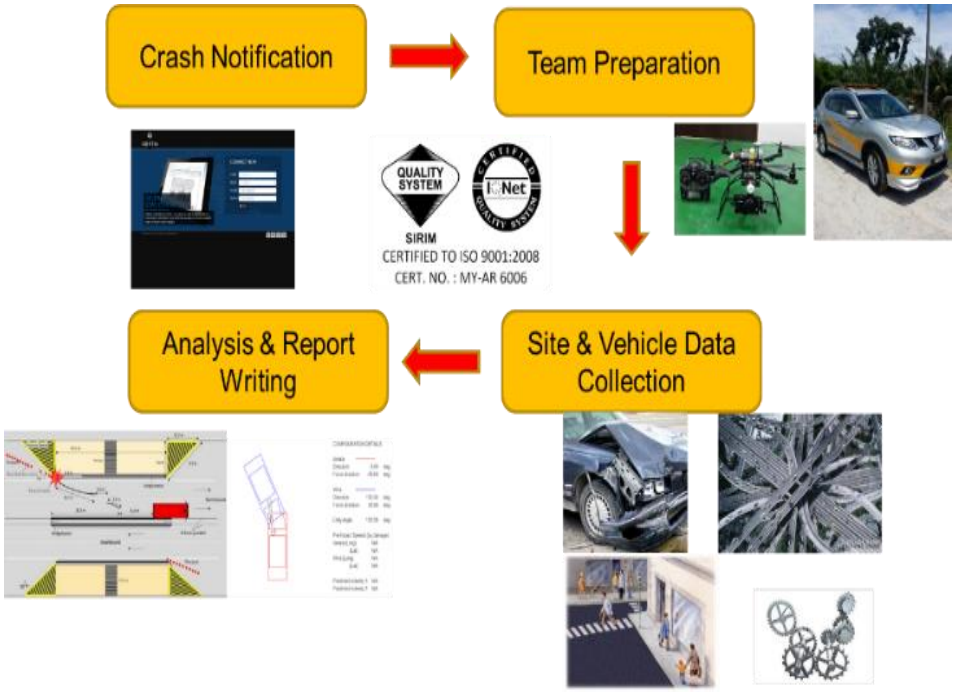


**Figure 1.** General Process of MIROS Research-based Investigations

MIROS crash investigation findings are not simply utilised just to suggest future prospective study, but also act as indicators for high-impact initiatives and baselines for new national policies aiming to improve road safety. Several national policies related to road safety have been implemented since 2007, as a result from the investigation findings. Among the prominent ones were the adoption of United Nations Regulation (UNR) for buses into the Malaysian vehicle approval framework. This was specifically linked to the superstructure and seat anchorage, with nationwide upgrading of crash barriers along roads' network from Test Level (TL) 2 to TL 3, the introduction of Safety, Health and Environment (SHE) Code of Practice for commercial vehicles and the implementation of rear seatbelt for passenger cars (refer Figure 1). The findings of the investigations are published in technical reports in the form of specific case investigation reports which are classified as restricted documents and statistical reports which are publicly assessable.

Other than serving as the base for the application of new safety policies, many other countermeasures apart from policymaking were implemented as the result of the investigation findings and recommendations. The in-depth crash investigation MIROS is conducted by MIROS are for specific purposes ranging from academic, technical, and systemic views to provide or suggest countermeasures, among others. The outcome of the analysis by MIROS will be channelled to a specific organization, department, or ministry as the proposal for countermeasures. These interventions involve multiple agencies and stakeholders from various backgrounds and practices. For example are the road authority, government ministerial level, non-governmental agencies, and private sectors. Nonetheless, these multidisciplinary interventions by various agencies possessed a similar aim; which is to improve safety requirements of the infrastructure and services related to transportation safety in the country.

## EXPERIMENTAL RESULTS

When discussing Malaysian road crash data, it is well known that the main source of reference is the one collected by the RMP (authority-based approach). This is due to the nature of the crash investigation operation by RMP as it involves a large spectrum of coverage regarding the number of crash cases in Malaysia. As mentioned above, all crash cases need to be reported to the RMP as the main authority in handling road traffic crashes. Failure to report these cases will result in the inability to proceed with the subsequent procedures on medical and insurance claims. This resulted in more than 400,000 reported crashes annually from the RMP database. From a case-by-case point of view, the RMP crash data consisted of a total of 92 variables; covering aspects from the general information of the crash up to the injury details of the occupants involved. As the main purpose of this investigation approach is mainly to identify the perpetrator in a crash from a drivers' point of view, these data set mainly focuses on general variables of the crash itself. Namely, these include general information such as the location, road environment, animal involvement, vehicle and driver information, as well as the details of the passenger and pedestrian. Once identified under the current legal process, the person shall undergo processes of litigation inclusive of receiving traffic summonses and penalties under the RTA (Act 333).

On the other hand, MIROS sets of crash data are obtained from its research-based investigation which brings an additional dimension to the national road crash data availability. As it aimed to search for answers on how to improve the situations and avoid the same nature of events from recurring again, this was identified through crash and injury factors identification and safety recommendations. This was purposely done in a scientific and technical style. For that reason, the gathered information from the research-based approach is more detailed. The crash variables collected via this approach are relatively in-depth with more than three-fold of the number of variables (more than 300 variables per case). Moreover, it possesses more than just on-the-surface degree information. Among others information availability on vehicle dynamics and kinematics, pre-crash travelling speed and impact speeds, details of internal contacts and information on a systemic defect were found upon investigations to be unoffered by the authority-based investigations. With this in-depth knowledge, researchers, investigators, and policy makers may understand the crash thoroughly, which may provide the opportunity for potential research studies on specific areas, ensuring the proposed safety recommendations are backed with scientific evidence. thus sound and justified. The general comparison of crash data variables between the two approaches are shown in Table 1.

**Table 1.** Crash Data Comparison between Different Approach in Malaysia

| Variables | Authority-based | Research-based |
|---|---|---|
| General Information | | |
| General case information (location, time, day, weather, lighting conditions) | ✓ | ✓ |
| Crash location (km, adjacent areas, GPS coordinate) | ✓ | ✓ |
| Casualties information | ✓ | ✓ |
| Occupant general details (age, gender, license conditions, employment) | ✓ | |
| Crash narrative | ✓ | ✓ |
| Sketch diagram | ✓ | ✓ |
| Road Information | | |
| Road details (measurements, class, carriageway, speed limit) | ✓ | ✓ |
| Pavement details (types, conditions, road markings) | ✓ | ✓ |
| Details of crash barriers & pavement (types, detail measurements) | | ✓ |
| Types of pavement defects | ✓ | ✓ |
| Types of intersection | ✓ | ✓ |
| Vertical alignment | ✓ | ✓ |
| Gradient height at crash site (min, max & average) | | ✓ |
| Horizontal alignment | ✓ | ✓ |
| Radius of curvature, super elevation | | ✓ |
| Vehicle Information | | |

| | | |
|---|---|---|
| Role of vehicles in configurations (impacting & impacted) | | ✓ |
| Details of vehicle involved (types, usage) | ✓ | ✓ |
| Areas of vehicle damage | ✓ | ✓ |
| Damage profiles (damage type, damage width, height, location) | | ✓ |
| Intrusion details | | ✓ |
| Vehicle structural conditions (defects type, measurements) | | ✓ |
| Tyre details | | ✓ |
| Tyre defects | ✓ | ✓ |
| Helmet & seatbelt wearing | ✓ | ✓ |
| Types of helmet & seatbelt application | | ✓ |
| Internal contacts (e.g., loading on seats, evidence of contacts on components) | | ✓ |
| Details of survival space | | ✓ |
| Airbags deployment | | ✓ |
| Other details of safety device (e.g., CRS availability, type, application) | | ✓ |
| Physical evidence & marks (e.g., on airbags, seatbelt webbing, buckle) | | ✓ |
| Occupant seating details | | |
| Details Kinematics | | |
| First impact configurations | ✓ | ✓ |
| Vehicle movement during impact | ✓ | ✓ |
| Pre impact vehicle movement and locations | | ✓ |
| Post impact vehicle movement and locations | | ✓ |
| Details of vehicle kinematics (e.g., types of movement, number of rolls | | ✓ |
| Secondary impact configurations | | ✓ |
| Post-crash vehicle kinematics | | ✓ |
| Pre-crash vehicle speed | | ✓ |
| Impact speed and energy | | ✓ |
| Principle direction of force | | ✓ |
| Collisions deformation classification | | ✓ |
| Details of occupant ejection | | ✓ |
| Injury Details | | |
| Injury severity | ✓ | ✓ |
| Injured body regions | ✓ | ✓ |

As explained earlier, RMP crash database is the main source of the country's road crash data by virtue of its coverage while MIROS in-depth crash data provides more detailed information of a crash and its issues. This phenomenon thus provide the capacity for an evidence-based approach for future related policies and interventions. These are the two renowned sources when talking about the Malaysian crash database which is often referred to in this moment of time. However, in a broader sense, there are various other sources of information that could contribute to the richness of road crash information in the country as depicted by Figure 2.

Having said that, these sources are indeed portraying a different set of ideology with regard to the aims and criteria set for their data gathering. These sources are either limited to a certain types of involvement or function of the involved stakeholders or even exclusively owned by private entities. For example, as mentioned by Zulhaidi et. al. [12], the involvement of the Fire & Rescue Department (JBPM) is only based on certain conditions e.g., the occurrence of fire, victims trapped in a severely damaged vehicle, and vehicle carrying hazardous material. Moreover, the highway concessionaires which own the tolled highways also execute their own crash investigations, in which interested parties can request for the data upon official request and subject to approval by their management [12]. Other potential sources also come from the insurance companies/association, and other government departments which specific roles e.g., The Department of Chemistry and Ministry of Health.

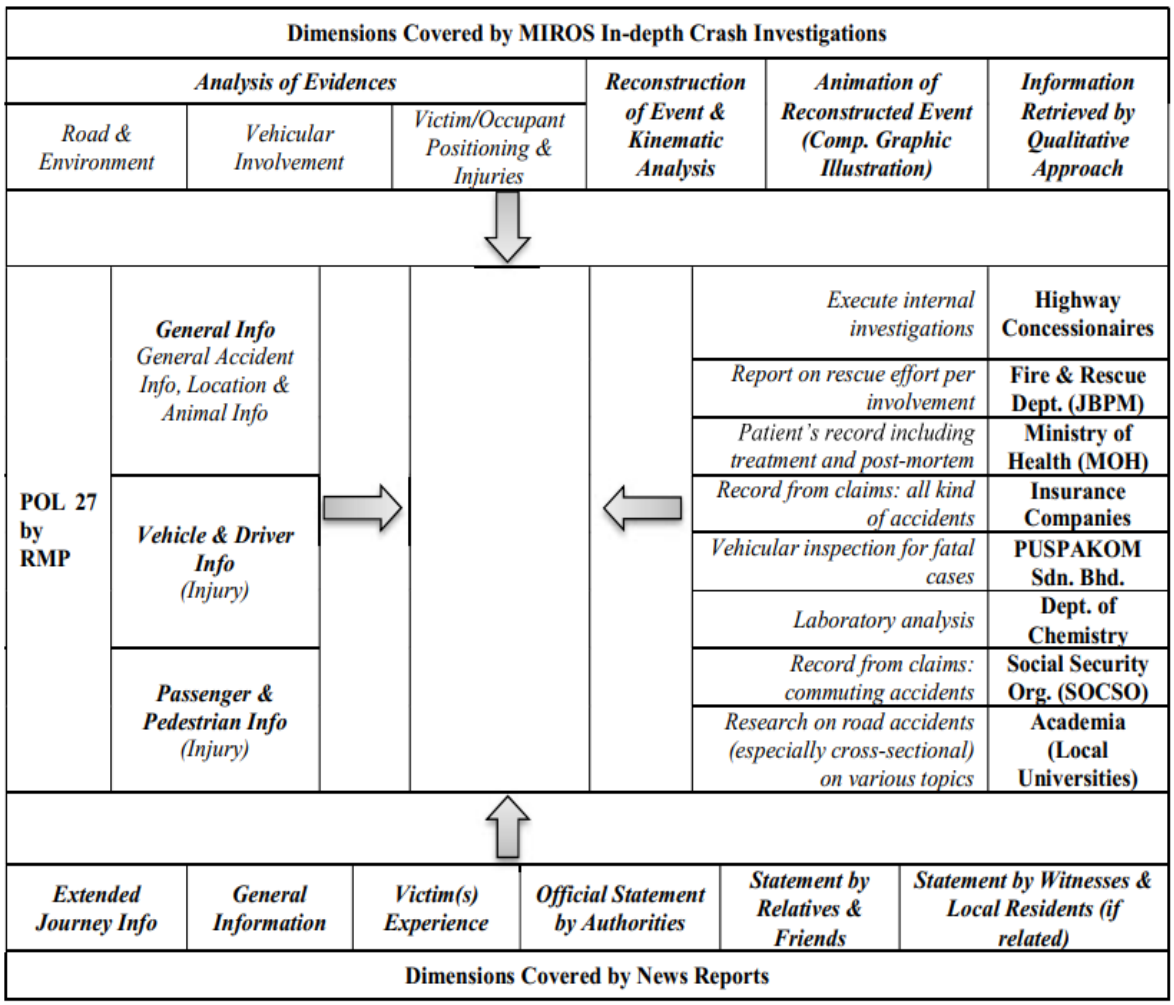


**Figure 2.** Current dimension in Malaysian road crash data

Both datasets are currently being kept in separate databases and have not been integrated, namely the Malaysian Road Accident Database System (MROADS) for the RMP data and the Crash Investigation and Reconstruction Database (CIRD) for the MIROS in-depth investigation data. Both databases were developed and managed by MIROS. Apart from the two databases, another database was recently established by MIROS in 2020 comprising of various data i.e., on vehicle registrations and traffic volumes retrieved from other relevant government agencies such as Public Works Department (PWD) and Road Transport Department (RTD). This database is known as MIROS Secondary Data Recording System (M-SEDARS). Currently, the information is kept by MIROS and is used for government and academics purposes upon request. Furthermore, there are also other types of databases that relate to road crash data but are solely administered and managed by focal agencies i.e., vehicle registration database by the RTD and the Trauma Registry that will be developed by the Ministry of Health (MOH).

## CONCLUSION

This study highlighted the current situation of Malaysian road crash data and provided a thorough explanation and comparison platform between the two investigations/data collection methods performed in Malaysia.

The first and second part of this review has provided a narrative on the role of crash data in Malaysia and ASEAN. Additionally, this study has also explained on the concepts of crash data collection conducted worldwide. The third part had discussed on the authority-based approached conducted by the mostly referred crash data pool, which is the RMP, focusing on the aims and the outputs of the investigation. The fourth part clarified on the new dimension offered by MIROS in-depth crash data and how the qualitative approach had helped MIROS to come up with relevant safety interventions through its crash reconstruction and scientific evidence-based method. The fifth section has analysed the contents of the data pool with side-by-side comparisons of the overall variables gathered using the two approaches.

There are opportunities to further increase the richness of current crash data through consolidating other potential data sources which are limited to certain types of involvement or functions by a stakeholder of the data thus worth to be explored. Incorporating subsequent types of data focus pertaining to road crash to the national crashes data pool will further enhance the national crash database and open for a new dimension of the Malaysian crash database.

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