

# Private Vehicle Roadworthiness in Malaysia from the Vehicle Inspection Perspective

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**Abstract** – Vehicle defect is one of the contributing factors of road mishaps, although the magnitude of the problem is less prominent compared to human behaviour or road environment factors. What is more important is that this technical problem may find a more direct solution as opposed to human behavioural issues. This study aims to discuss common vehicle defects that probably contribute to road crashes by using Periodical Technical Inspection (PTI) database as the basis. Data was analysed to determine common failures of private passenger vehicles based on selected inspections and vehicle types. At this stage, only voluntary and routine inspections were scrutinized. In addition, this study is able to predict the probability of a vehicle failure by using information from the database. From such an analysis, it was found that the two most common private passenger vehicle defects were worn out tire (or lack of tread) and structural integrity. It was also found that vehicles sent for voluntary inspection have a higher probability of failure compared to those sent for routine inspection.

**Keywords:** Vehicle defect, roadworthiness, periodical technical inspection, road accident, road safety

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## 1.0 INTRODUCTION

Over the years, the number of motor vehicles on the road has been steadily growing especially in developing regions. Such a growth, however, has inevitably contributed to the undesirable surge in global road traffic casualties (WHO, 2015). In Malaysia, the number of registered private vehicles (mainly passenger cars) has escalated beyond 12 million units; charting an annual growth rate of approximately 6 percent (RMP, 2015). Correspondingly, involvement of private vehicles in road crashes is also on the rise; although still behind the number of road accidents involving motorcyclists which remains the country's most prominent road safety issue. In addition, recent research by Sarani & Hashim (2014)

revealed that vehicles aged between 0 to 2 years old represent the highest proportion in terms of involvement in road crashes as well as fatalities.

To date, inspection of private vehicle roadworthiness in Malaysia has been done on a voluntary basis, as opposed to commercial vehicles that are mandated to undergo periodical inspection once in every 6 months. Figure 1 compares the involvement of private and commercial vehicles in road crashes in the recent 10-year period. In 2015, over 600,000 private vehicles were involved in road crashes (a leap of about 40 percent from 2006), which was 6 times higher compared to commercial vehicle crash involvements.



\* Private passenger vehicles consist of cars, SUVs, and MPVs

**Figure 1:** Trend of vehicle registration growth and involvement in road crashes

Many researchers have identified three major factors contributing to road crashes, namely human, vehicle as well as road and environment. Additionally, various studies have revealed that human or driver factor accounts for over 90 percent of all fatal and injury cases, thus prompting human-related issues to gain traction among the research fraternity (e.g. Cuerden et al., 2011; DfT, 2010). On the other hand, unsafe vehicles are likely to be the contributing factor in less than 5 percent of all traffic related crashes and have attracted little attention (Treat et al., 1977; Petridou & Moustaki, 2000). As such, this study aims to fill this gap and will explore the vehicular perspective, in which *unsafe vehicle can be considered as having malfunction or deterioration of the vehicle system or component that can potentially lead to road crash*. Here, vehicle defects are commonly associated with vehicle service age; whereby as the service age increases, the probability of components or system to fail becomes higher and therefore increasing the likelihood of road crash involvement (DEKRA, 2005).

## 1.1 Vehicle Defect in Road Crashes

It is difficult to determine whether vehicle defect is a contributing factor in road crashes as the evidence can only be established by conducting in-depth crash investigation and analysis. In addition, such in-depth crash analysis may not be able to provide a solid or conclusive result due to certain inevitable presumptions and uncertainties as opposed to the method to ascertain what causes bodily injuries.

In-depth crash investigation conducted by Treat et al. (1977) found that vehicle factor contributed 12 to 25 percent of road accidents and 50 percent of the investigated vehicles were aged 13 years and above. Furthermore, many research concluded that older vehicles are prone to road crashes due to defects (Vaughan, 1992; Treat et al., 1977; Motoring Directions, 1998; Al-Ghaweel et al., 2009; Akloweg et al., 2011). Although several studies have attributed crashes to mechanical defects (Conroy et al., 2008; Moodley & Allopi, 2008; Hoque & Hasan, 2006); the figure is rather insignificant – with less than 10 percent as reported by Taneerananon et al. (2005), Van Schoor et al. (2001) and Rechnitzer et al. (2000). Thus, to minimize the effect of vehicle defects, there is a need for a check-and-balance system. It should also be highlighted that vehicle owners (private and business owners or companies) are the ones responsible for their vehicle periodical maintenance, whereas the responsibility for vehicle inspection falls on the government.

## 1.2 Vehicle Roadworthiness Inspection in Malaysia

Periodical maintenance and vehicle roadworthiness inspection are crucial for the safety of drivers, occupants and other road users. For the latter, there is a rule on periodical inspection, such as the *Motor Vehicle Rules (Periodical Inspection, Equipment & Inspection Standard) 1995* which compels the category of goods vehicles, public service vehicles and driving school vehicles to undergo periodical inspection at vehicle inspection center. During this periodical inspection, the motor vehicles will go through a process to confirm their vehicle registration number, engine number and chassis number. If necessary, the vehicles are measured and weighed according to the approved Vehicle Technical Plan. Moreover, they need to be further inspected through safety testing which involves physical inspection, side slip test, brake test, speedometer test, lighting system test, exhaust emission test and noise emission test.

However, private vehicles are only required to undergo inspection before registration; with the procedures being different compared to commercial vehicle inspection. The Road Transport Act 1987 does not compel private vehicles to undergo periodical inspection at vehicle inspection center. Because of the situation, the roadworthiness level of in-use private vehicle cannot be ascertained thus making it difficult to penalize or ban unfit in-use private vehicles from being on the road. This further supports the need to review and explore private vehicle roadworthiness situation in Malaysia in the hope to find important key results for policy making. To achieve this end, the Periodical Technical Inspection (PTI) data was utilized for this study.

## 2.0 METHODOLOGY

This section explains the source of data used in the analysis, and elaborates the way the descriptive analysis and probability model were developed.

### 2.1 Data

Data from a reliable source was used for analysis in this study. The roadworthiness data was acquired from the country's PTI service known as PUSPAKOM (*Pusat Peperiksaan Kenderaan Berkomputer*). The data consist of roadworthiness inspection results (Pass and Fail) of private vehicles for the 2010-2015 period. The data also include both periodical and voluntary checks on several private vehicles types, which had been sent to PUSPAKOM centers for roadworthiness inspection.

### 2.2 Descriptive Analysis

Descriptive analysis was conducted on the overall PTI dataset to identify patterns and trends for the inspections and failures with respect to the selected vehicle types. Next, the frequencies were analysed for the failure area/part of passenger private vehicles and comparison was made between mandatory (routine) and voluntary inspections. However, only data for 2013-2015 period were utilized for this frequency analysis. This is due to the limited number of voluntary inspections, which only became a commonplace from 2013 onwards. In this study, the passenger private vehicle type refers to a vehicle either for commercial (company) or private (individual) use as mentioned above. In addition, analyses were carried out using the IBM SPSS Statistics software.

### 2.3 Probability Model

Subsequently, logistic regression was carried out to analyse the probability of inspection failure for the routine and voluntary inspection according to vehicle types. In estimating the parameters of the logistic regression, the method of maximum likelihood is used (Kutner et al., 2005). This method suits the data well since the outcome of inspection will always be categorical, namely "Pass" or "Fail". A simple calculation was derived to ascertain the vehicle age. All vehicles that came for inspection from 2013 to 2015 were extracted from the system. Logistic regression analysis was later conducted using the IBM SPSS Statistics software.

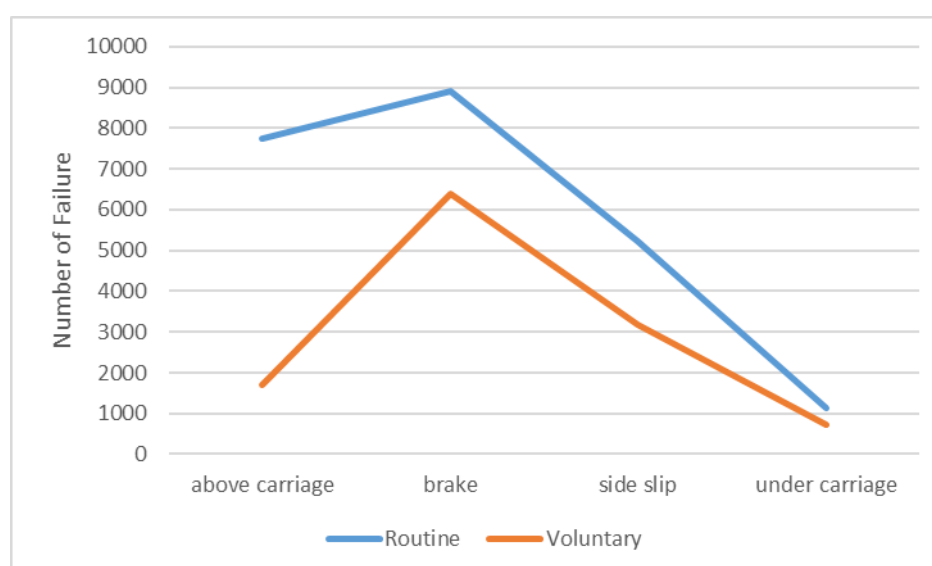
## 3.0 RESULTS

Table 1 shows the overall statistics of routine and voluntary inspections carried out at PTI for the selected vehicle types (cars, SUVs and MPVs). The result shows that the number of vehicles undergoing routine inspection in the 6-year period (2010-2015) exceeded 1.5 million units (about a quarter of a million each year). In contrast, only 27,926 units were voluntarily inspected since the introduction of PTI in 2012 (with an average of 7,000 units each year in the 4-year period, or 11,900 units a year in the 2-year period as the number seemed to increase and stabilize). Moreover, the result also shows that the passing rate for routine inspection was about 75 percent each year. Compared to voluntary inspection, the passing rate was rather low, which was approximately 61 percent each year. It is to be noted that the voluntary inspection data was only available from 2012 and onwards.

**Table 1:** Routine and voluntary vehicle inspection at PTI for year 2010-2015

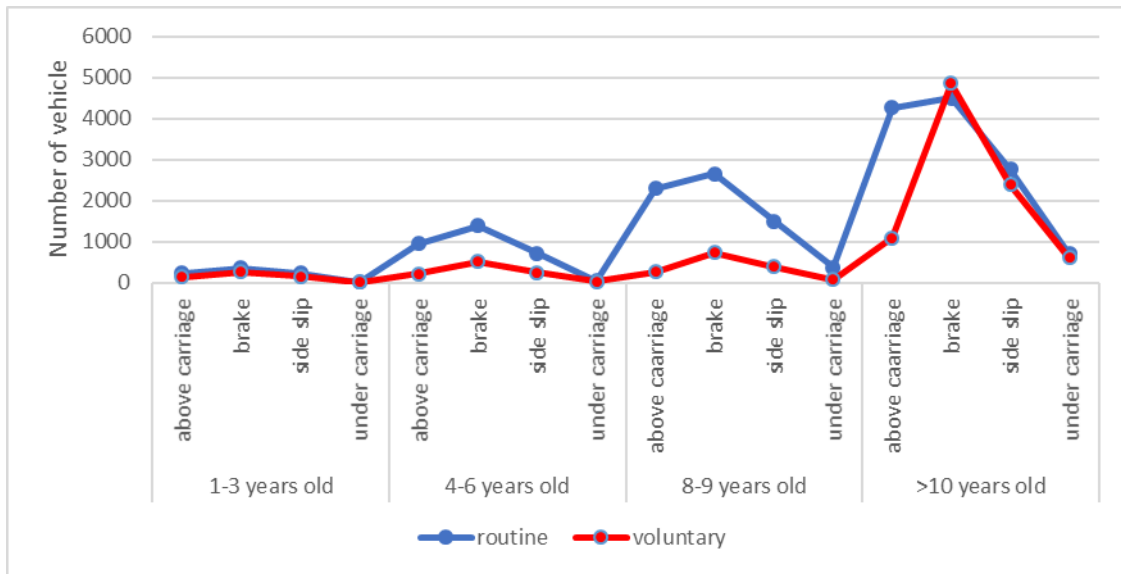
Inspection	Total Inspection (% failure during first visit)					
	2010	2011	2012	2013	2014	2015
<b>Routine</b>	253,176 (24.6)	257,315 (24.5)	256,495 (23.6)	255,531 (24.2)	246,737 (24.4)	245,804 (24.5)
<b>Voluntary</b>	0	0	33 (39.4)	4,145 (34.9)	11,737 (37.9)	12,011 (38.1)

The following Figure 2 shows the number of failures according to the type of inspections at four critical check points: (1) **above carriage**; (2) **brake**; (3) **side slip**; and (4) **under carriage**. The analysis only used data from 2010 to 2012. Brake system failures were the most common problem encountered in both type of inspections, involving about 8,900 routine-inspected vehicles and 6,300 voluntary-inspected vehicles. This is followed by side slip and above carriage inspection. Under carriage failures were the least significant among all the four categories. It is also to be noted that a vehicle will be classified as “Failed” if it has just one failure among the checked items.

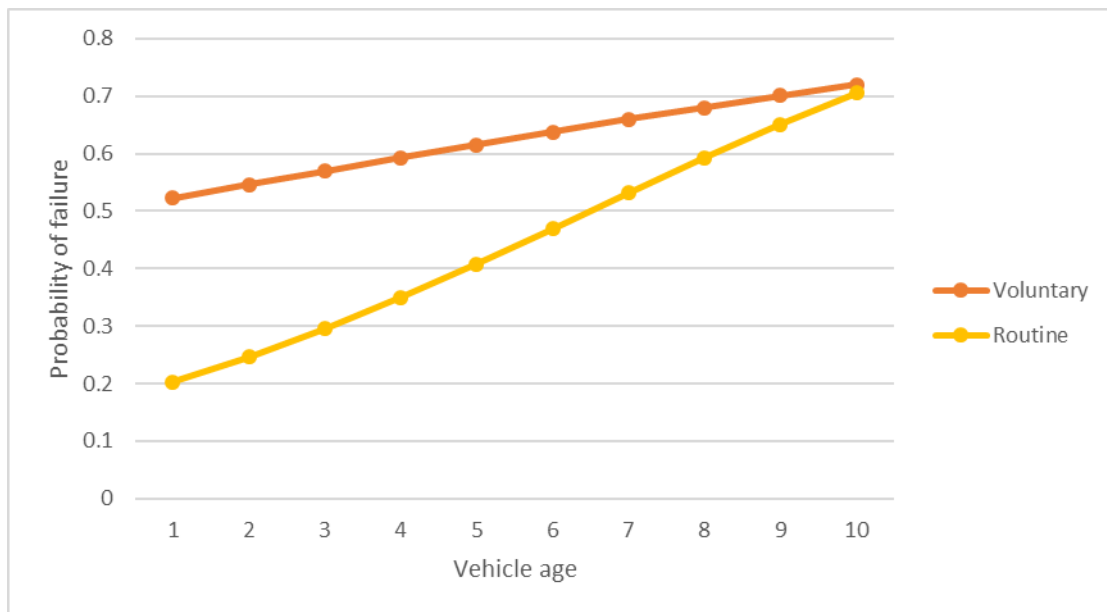


**Figure 2:** Frequency of failure for critical check points by type of inspection

Further analysis was carried out on the PTI inspection result to compare the failure rate for critical check points for both type of inspections with regards to the vehicles’ age group. Figure 3 below shows the trend of failure of each critical check point tallies with the increment of vehicle age for both type of inspections. In this perspective, it can be deemed that brake system failures became more prominent as the vehicles aged – a glaring result for vehicles of more than a decade old. For voluntary inspection, the trend of failures based on these four critical check points were more pronounced for vehicles over ten years old, particularly with regard to brake and side slip.



**Figure 3:** Frequency of failures of four critical check points by age group



**Figure 4:** Probability of failure for cars in both voluntary and routine inspections

Furthermore, Figure 4, as shown above, illustrates the probability of failure for cars in both voluntary and routine inspections according to their age. It is to be noted that this analysis had overlooked both SUVs and MPVs due to insufficient data. The probability function was developed using the logistic regression model and it was found that increase in the probability of failure is proportionate to the age of vehicles. Also, the probability is higher at the early stages among vehicles sent for voluntary inspection compared to those undergoing routine inspection. It is to be noted that commercial vehicles are scheduled for routine inspection once a year for the first two years, and once in every six months after the second year.

#### 4.0 DISCUSSION

Based on the above results, most vehicles experience problems with the brake system, followed by the above carriage. With regard to the above carriage, several critical components may have contributed to the failure, namely tires, lighting, body/paint work and the vehicle upper body. This finding is parallel to other studies such as by DEKRA (2005) and Cuerden et al. (2011) which found that tires and brake system defects were the most common components that contributed to road crashes. DEKRA of Germany indicated that the braking system defects were the most frequent cause of road crashes (45 percent), followed by running gear defects (23.5 percent) and tire defects (22 percent) (DEKRA, 2005). Meanwhile, it was estimated that about 2 percent of fatal crashes in the Great Britain were due to vehicle defects, in which the tire and brake system problems were listed as the main culprits (Cuerden et al., 2011).

Moreover, the result shows that the probability of failure is higher among newer vehicles in voluntary inspection, and the following points include the potential reasons for such a trend:

- (i) New vehicles are required to abide by the scheduled preventive maintenance at authorized service centers (SC) in order to be eligible for vehicle warranty scheme. The braking system, for example, is usually checked through visual inspection and thus there is no performance-based evaluation for this particular item. This is because almost all SCs do not have the related testing facilities.
- (ii) Users probably possess little knowledge of vehicle performance and lacking awareness about the deterioration of performance, e.g. tire condition and braking performance (Mohd Jawi et al., 2012).
- (iii) A considerable number of vehicle users usually send their vehicle to general workshops (even if the vehicle is still under warranty), thus exposing them to substandard repairing or maintenance work, i.e. not in accordance with proper procedure or installing substandard parts (Mohd Jawi et al., 2012; Abdul Wahab et al., 2017).

In Malaysia, the demand for new cars is fairly stable with around half a million units sold each year in recent years (Mohd Jawi et al., 2017b). Such a high demand for new vehicles means that the vehicle population will keep growing. This also suggests that urbanization issues including congestion and pollution, especially in big cities such as Kuala Lumpur, will see no signs of improvement if no proper plan or stringent policy is implemented. As of 2017, the end-of-life vehicle (ELV) policy is yet to be realized and the roadworthiness issue as discussed here is closely related to ELV and safety (Mohd Jawi et al., 2017a).

The National Automotive Policy (NAP) 2009 hoped to address this issue; but it was put on the back burner following strong protest by the general public due to the vehicle age limit. In NAP 2014, the Voluntary Vehicle Inspection Programme (VVIP) was included with the main objective to ensure desirable roadworthiness level of private vehicles (the level of acceptance can be measured by the figures in Table 1) (MITI, 2014; Mohd Jawi et al., 2017a). Moreover, there are various references to determine the first inspection after the

start of vehicle usage. For example, most European countries start the first inspection after the third year of vehicle use (CITA, 2007).

In the ASEAN region, only three countries have mandated the vehicle roadworthiness inspection, namely Vietnam (after 2 years of operation), Singapore (after 3 years) and Indonesia (after 15 years) (Clean Air Asia Center, 2016). In Malaysia, VVIP can be seen as the catalyst and part of the private vehicle inspection, in order to materialize future ELV policies to ensure better vehicle roadworthiness and safety level. Besides the inspection at PTI, roadside inspection – which normally requires only visual assessment of the vehicle condition whilst being stationary – involving related enforcement agencies is vital to increase awareness and compliance among vehicle owners.

## 5.0 CONCLUSION

Without a doubt, unsafe vehicles pose serious safety risks to drivers and other road users. It is therefore very important to ensure and determine the roadworthiness level of both private and commercial vehicles on the road. This paper has highlighted the concern on vehicle roadworthiness level in Malaysia by using PTI data. The data revealed that the failure rate of vehicles sent for voluntary inspection is higher compared to those undergoing routine inspection. Among all the four critical check points, brake failure had the highest occurrence in both type of inspections. The Voluntary Vehicle Inspection Programme (VVIP) may be just a small step before it can be fully incorporated in the system. More studies are therefore needed in an effort to find the anticipated holistic ELV solution for the country.

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