**ORIGINAL ARTICLE**

# CAR USERS' AFTERMARKET BEHAVIOUR IN KLANG VALLEY: A SPECIAL FOCUS ON AUTO TINTING

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## ABSTRACT

*This paper aims to contribute to the understanding of automotive tinting popularity among car users in Malaysia. While comfort (heat and glare) and security stand among the main reasons behind the popularity, there is however, some notable safety arguments about the automotive tinting. The prevailing regulation on auto tinting, which is dubbed as "outdated and unfair", had caused public uproar about the permissible limit in terms of Visible Light Transmission (VLT). The results from the most recent survey on automotive consumerism are used in the discussion, together with two previous MIROS' studies i.e. on weather issues and the auto tinting consultation report to the Ministry of Transport Malaysia (MOT). The highlights, among others, were about the aftermarket behavior among car users in Klang Valley. Out of 265 respondents, approximately 70% of them had done the tinting to their current (main) car with the declared mean and maximum cost of MYR 780.81 and MYR 4,000.00, respectively. Also, the result has supported that the auto tinting together with the tires are the most popular aftermarket items for modification and retrofitting among the car users.*

***Keywords**: auto tinting, Visible Light Transmission (VLT), aftermarket behavior, comfort*

## INTRODUCTION

The regulations on car's roadworthiness and crashworthiness in Malaysia is mainly governed by the Ministry of Transport (MOT) through its main arm in the Land Division, the Road Transport Department (RTD)[1]. The main activity of RTD in that particular matter is the Vehicle Type Approval (VTA) exercise, which is conducted on all vehicle models – including passenger cars – before they can be legally sold in the market in compliance with the Road Transport Act and Road Transport Rules.

In a bigger picture, the VTA exercise can be seen as the main controller of roadworthiness and crashworthiness quality of vehicles entering the new car market. The regulations in VTA today is highly influenced by the United Nations Regulations (UN Regulations; formerly known as UNECE Regulations)[2]. Other than that, RTD through its Automotive Engineering Division also enforces other regulations on private vehicle modification such as car body kits (spoiler, side skirt and aerofoil), "upgrading" to larger rims and tires, etc.

Also, certain modifications are totally prohibited such as the retrofitting of High-intensity Discharge (HID) lights and the installation of tinted window or tinted film that is over the permissible limit. Nevertheless, the enforcement on auto tinting has recently challenged by the car users as well as the auto tinting industries in Malaysia. The Malaysian Institute of Road Safety Research (MIROS), which is another agency under the Ministry of Transport (MOT), had been given the task to review the relevancy of the prevailing auto tinting regulations.

Thus, this paper aims to highlight why the automotive tinting is becoming more common among the road users in Malaysia based on the previous research and consultation exercise by MIROS, and to analyse the recent result from a survey among car users in Klang Valley with regard to their aftermarket modification and retrofitting preferences.

### *Study I at a Glance – Weather Issues*

A study was conducted in 2008-2009 by MIROS through a research cluster coined as the Weather-related Road Accident Preventive Program (WRRAPP) to mainly investigate the effect of weather elements towards road safety in Malaysia[3]. Conceptually, weather elements such as rainfall (precipitation), fog, wind, temperature and sunlight will affect either a "moving vehicle" or the robustness of vehicles (as a whole or partially) and road structures against the enduring weather effects.

This is mainly viewed from the engineering measures – based on the three E's interventions (Engineering, Enforcement, and Education)[4]. For example, a "moving vehicle" during rain will greatly need the windscreen wiper to sweep the raindrop and the demister to help the removal of mist on the rear windscreen. The roads also have

the similar ability to counter rainfall effect by helping drainage ability through the peak at the road's horizontal centre i.e. the road crown. The vehicles and roads too are exposed to the long-term effects of weather conditions, especially to the presence of water. Water may cause the corrosion of metal parts in cars[5], as well as damaging the road pavement in the form of delamination (weakening wearing and binder course joints) and cracking (exposure to high moisture)[6].

Moreover, the main focus of the study was dedicated to the effect of rain due to several factors e.g. rain is more "visible" as a hazard to road users and the high frequency of rain explained by the dry spell period (shorter dry spell period largely outnumbered the longer spell)[3]. The accident data during the study compared two different databases, which respectively belong to the Royal Malaysian Police (RMP/PDRM) and the operator of Malaysia's longest tolled highway, PLUS. The former can be considered as the country's official accident record (nationwide scale) but suffered from underreporting issue on weather status, and the latter is only for high speed traffic and secluded environment. However, both databases showed that most accident cases happened during fine weather and followed by rain, with windy (mentioned in Malay terms in Police's POL. 27 as "*angin kuat atau lintang"*) and foggy (mentioned as "*berkabus"*) are far too low and perhaps disputable based on how the classification was made.

Since the accident record cannot be relied upon to specifically pinpoint the magnitude of the temperature and sunlight effects, the researchers need to heavily consider the auto tinting issue from the perspective of the users. Malaysia receives abundant sunlight at around six hours per day and the temperature in the country is fairly consistent with the annual variation just under 3 degrees Celsius (e.g. daytime ranging from 27 to 32 degrees Celsius). Though there are variations in the abovementioned figures due to temporal and spatial factors, the weather can be relatively considered as hot and sunny most of the time. Ironically, the fine days that are recorded as "normal" or "non-adverse weather" are the time when the majority of road accidents occurred (between 70% and 90%)[3].

Therefore, road safety stakeholders should consider the glaring effect of sunlight and temperature – a bright day can also mean a hot day – especially at noon and the afternoon. Based on the study's review[3], high temperature may cause fatigue and deteriorate driving performance in many ways, and driving a vehicle during "normal" day can also be dangerous since both sunlight and temperature effects may materialize concurrently. This include the more acute situation during sunrise and sunset when the sun is low (low sun) and the rays shine directly into the eyes of the motorists.

*Study II at a Glance – Consultation Exercise on Auto Tinting*

The previous study by MIROS (2009) did mention about the growing popularity of auto tinting in Malaysia since it can supposedly protect car users from heat and sunlight as well as adding more looks to the vehicles. However, as mentioned earlier, the public has challenged the authorities (RTD) recently about the prevailing regulation on auto tinting[7], which is dubbed as "outdated and unfair". MIROS has been given the task to provide relevant inputs to mainly the Ministry of Transport (MOT) and RTD in the year 2015, based on road safety, ergonomics and public perception views[7].

It is known that the installation of tint film, which mostly took place in the aftermarket period, is not only caters heat and glare issues but also becoming a significant safety and security concerns. The arguments, among others, are about the need of higher contrast condition for MPV (Multi-purpose Vehicle) and SUV (Sports Utility Vehicle) that mostly are having see-through luggage compartment (by default) and also the use of over-spec tint film by high-profile individuals (VIP) for security reasons[3].

The prevailing law specifies the permissible limit for auto tinting, which is technically referred to as the Visible Light Transmission (VLT), at 70% for the front windscreen (FWS) and 50% for the rest of the windows i.e. side windows (SW) and rear windscreen (RWS)[8]. The VLT value is referred to the percentage of solar visible light, or daylight, transmitted through a glazing system that broadly means the lower the VLT percentage, the darker the tint.

For comparison, the VLT regulations differ between countries from completely illegal to variable limit among vehicles' or cars' windows (FWS, SW and RWS). For example, Belarus made auto tinting fully illegal while certain countries made it illegal for FWS as well as for the first window[7], which presumably to allow clear driver's view on the lateral vehicles and hazards as well as the view of both the side and rear view mirrors.

Ideally, high VLT level is preferred in driving since visual cues are primarily responsible for approximately 95% of driving-related inputs[9]. The low VLT auto tinting can create visual and conspicuity problems especially in low-contrast condition i.e. during twilight and at night. Many studies support the low VLT condition as safety precautions[7], and extra concerns are put on the elderly drivers. In addition, a clear view by other

road users – especially pedestrians, cyclists and motorcyclists (the Vulnerable Road Users - VRUs) – is vital for them to exploit the see-through windows for traffic cues[10]. On the other hand, heavily tinted windows may create security concerns to the enforcement officers as proved by a study that most of the public respondents (81%) were not able to recognize objects in heavily tinted cars – a situation that is comparable to the situation when enforcement officers are detecting weapons, contrabands or threatening acts[11,12].

Furthermore, the consultation exercise also conducted three evaluations on the auto tinting: (1) the effect of auto tinting on thermal comfort; (2) the status of VLT compliance; and (3) public perception on auto tinting. The first study used Perodua Myvi, which is one of the best selling cars in the country, to measure the cabin temperature under the hot and sunny weather at an open car park. Certain conditions were met in order to maximize the rate of vehicle heating such as the dark car colour, vehicle orientation to the sun direction[13] and limiting the ventilation. The result of the experiment, which was demonstrated by four different VLT variations for front windscreen (FWS), side windows (SW) and rear windscreen (RWS), showed that the auto tint on all samples had filtered visible light element but had minimal cooling effects despite the variations of VLT values. This also means that the total solar energy rejection between the samples were not that significant despite having different VLT combinations among the windows/screens.

The second evaluation involved a random inspection on VLT compliance at several parking lots around the town of Kajang in Selangor using a calibrated RTD's VLT tester. Out of 73 volunteered participants, 60% of the cars did not complied with front windscreen VLT limit and 50% of the other windows did not complied with the specified VLT limit (50%). The overall violation rate was at a staggering figure of 71%, which was calculated if at least one of the windows had violated the current VLT permissible limit.

The third evaluation was a self-administered survey involving a thousand respondents, who must possess driving license in order to participate in the survey. The majority of the respondents (72.5%) had their vehicles installed with the tint film and the top three reasons why they did so were: (1) hot weather (67.8%); (2) security reasons (25.3%); and (3) reducing glare (20.9%). In addition, only 24% of the respondents were fully aware of the existing VLT limit for all windows and 69% knew the penalty value for violating the said law. In sum, their motivation to spend on the auto tinting is largely attributed to the comfort issue with the temperature and also the sunlight.

## METHODS

The data used in the following analysis originated from a recent study by MIROS under the automotive consumerism subject. This study is derived from the "automotive ecosystem" research cluster that was started back in 2011, which was largely inspired by the implementation of the revised National Automotive Policy (NAP) in 2009. The data was collected through a cross-sectional self-administered survey among the drivers in Klang Valley for a period of approximately a year i.e. from June 2015 to June 2016.

The eligible respondents were defined as those who owned cars and must be residing or commuting in the Klang Valley conurbation. The catchment area is better defined as the Greater KL (Kuala Lumpur) according to the 2010 Economic Transformation Programme (ETP), however, the term Klang Valley was still used during the survey to avoid confusion among the respondents (when checking their eligibility). There are three possible ways of commuting pattern in the Klang Valley or Greater KL: (1) heading towards the city centre; (2) heading outside the city centre; and (3) travel between areas/towns in the Klang Valley. The word "commuting" was added to the definition of samples since it is known that a substantial number of people who are driving in Klang Valley on a daily basis are residing in the nearby states e.g. Perak, Pahang, Negeri Sembilan and Melaka.

The survey contains six sections with a total of 12 sub-sections that asked the respondents about their demography and ownership of car(s), travel/commuting pattern, cost of vehicle ownership (CVO), knowledge and awareness on maintenance and aftermarket, perception and involvement in road accidents, and the end-of-life vehicle (ELV) initiative. It was a fairly lengthy questionnaire and required a situation whereby the respondents had ample time to answer the survey. The researchers had identified five suitable approaches for the study i.e. at public places, offices, industrial areas, schools (teachers/staffs) and car clubs. This also explains why it took almost a year to gather a total of 500 responses at the end of the research project.

Nevertheless, few sub-sections had suffered a considerable amount of missing data. This was attributed to several reasons such as the respondents had skipped the relatively longer table to be filled and never came back to that sub-section (particularly in the car modification and retrofitting sub-section) and some of them did not really aware of certain items in the

survey since anything about cars are their spouses' responsibilities. Some of the respondents also needed extra attention due to unfamiliarity with the formal or technical terms in automotive. For example, they did not know that the discount for insurance if no claim is made is called the NCD/NCB (No Claim Discount/Benefit), and the "odometer reading" is actually referred to the distance travelled by a vehicle as displayed on the car's instrument panel.

Thus, due to the abovementioned discrepancies, only 265 responses were obtained and considered for further analysis with regard to the modification and/or retrofitting sub-section in the survey. The sub-section is mainly asking for the cost for each suggested items. The responses that contain the comment such as "could not remember" and "FOC" (free of charge; being part of the car purchasing deal) were omitted in the analysis. Also, as mentioned earlier, the aim is to highlight the users' preferences in modification and retrofitting during the aftermarket period, as well as their willingness in spending for those items.

## RESULTS

From a total of 265 respondents, 190 or 71.7% of them were males and 231 or 87.2% were Malays. The mean age was 33.7 years, with the range was between 18 and 58 years old. In terms of the car status, the majority of the respondents' cars were bought as new (188 or 70.94%), and the rest were bought as used car (71 or 26.79%) or imported-refurbished unit (6 or 2.26%) (better known as the "re-con" or "re-cond" car).

On average, the respondents spent around MYR 3,033 for their overall modification or retrofitting in their cars, and the range was between MYR 100 and MYR 21,800. Based on Figure 1, the majority of the respondents (186 or 70.19%) had installed the tint film in their cars, and followed by the change of tires (152) and rims (74). It is also worth to note that a total of 28 respondents declared the combined tire and rim replacement cost perhaps based on their deals with the tire workshops. If the "tire and rim" figure is to be counted separately, the total count for "tire" only will be 180 and the total count for "rim" will be 102.

The other items that received almost similar attention by the respondents were the engine related parts or the whole engine systems (63), brake systems (61), body kits (e.g. spoiler, side skirt and aerofoil) (58), suspension systems (51), and exhaust systems (40). The rest of the items were those related to the transmission systems (29), seats (25) and lighting systems (25).

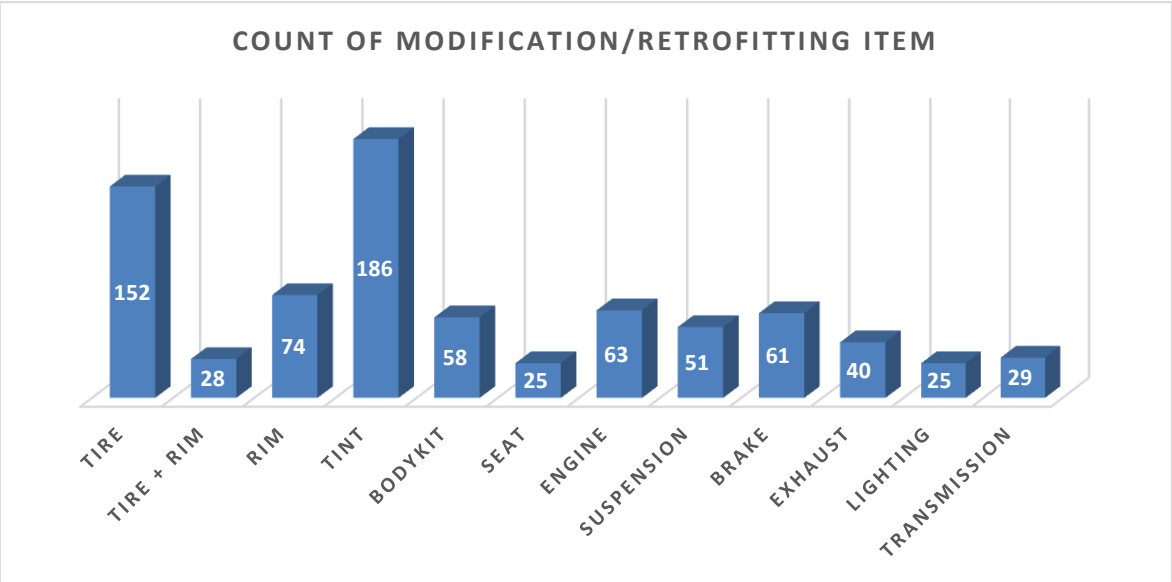


**Figure 1 - Count of modification and retrofitting item**

Table 1 describes the spending details of each item related to modification or retrofitting. The main focus is on the average amount of money spent by the respondents, in which the mean cost for adding the tint film was MYR 780.81. The maximum amount was MYR 4,000 and the minimum amount was MYR 50.00. Higher values were also observed for tires and rims, body kits, engines and suspensions. Figure 2 shows the gross values that the respected respondents had spent on modification or retrofitting for their cars. The items that are topping the chart were tire, auto tinting and engine (more than MYR 100,000.00).

These findings, however, can be considered as a preliminary investigation in the subject of discussion since there is no further details asked beyond the price. Thus, the result can only be used as an indicator to a deeper study in the

future. For example, we do not know what they were actually bought – only a part of the system, an accessory or a solid/full part or system.

**Table 1 – Spending details on each modification/retrofitting items**

| Items | Spending in Malaysian Ringgit (MYR) | | |
|---|---|---|---|
| | Min | Mean (n) | Max |
| Tire | 480.00 | 1,129.08 (152) | 3,200.00 |
| Tire & Rim | 600.00 | 1,182.14 (28) | 4,000.00 |
| Rim | 300.00 | 1,160.81 (74) | 2,500.00 |
| ***Tinting*** | ***50.00*** | ***780.81 (186)*** | ***4,000.00*** |
| Body kit | 100.00 | 1,393.26 (58) | 5,000.00 |
| Seat | 50.00 | 557.00 (25) | 2,000.00 |
| Engine | 80.00 | 2,041.75 (63) | 12,000.00 |
| Suspension | 60.00 | 1,043.53 (51) | 3,600.00 |
| Brake | 50.00 | 442.13 (61) | 3,000.00 |
| Exhaust | 50.00 | 620.50 (40) | 1,800.00 |
| Lighting | 20.00 | 345.20 (25) | 1,000.00 |
| Transmission | 80.00 | 393.45 (29) | 1,000.00 |

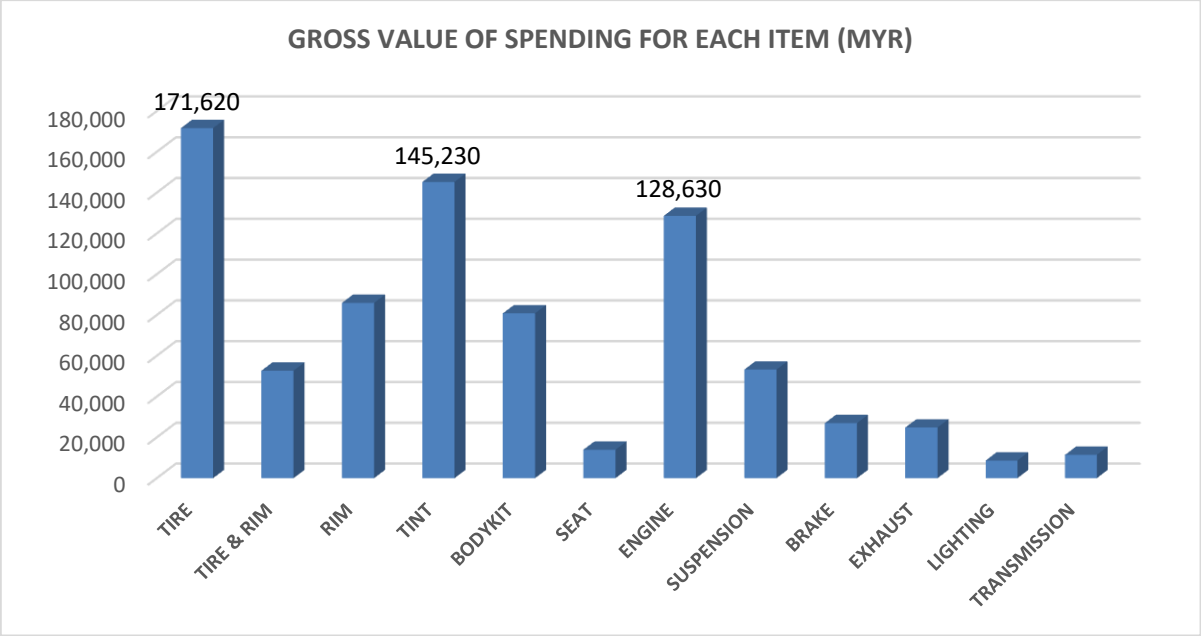


**Figure 2 – Gross value of spending for each item**

## DISCUSSION

First of all, one of the notable observations from the recent study findings is that the rate of car users installing the automotive tint film is fairly consistent with the earlier MIROS' finding during the consultation exercise in 2015 i.e. at around 70%[7]. The difference is that the recent result had been derived from a total of 265 respondents while the 2015 result had been concluded from one thousand sampled respondents. These results anyhow proved the high level of popularity of auto tinting among the car users.

Economically speaking, the result can also explain the magnitude of the aftermarket business and proved that auto tinting is one of the sought-after items among the car users. Additionally, the willingness to spend for auto tinting can be considered "fairly high" and this made the auto tinting business are among the most lucrative and sustainable. Users are also moving towards the so-called premium brands,

with the likes of *3M*, *V-Kool*, *Raytech*, *Huper Optik*, *Llumar*, *Suntek*, *Solar Gard*, *Global*, *Johnson*, *Madico* and *ASWF* had established in the market.

Moreover, one of the main issues brought by the industries and discussed by the relevant experts is about the final or combined VLT value after the tint film has been installed, in which the default screen or window at the manufacturing stage had already came with certain VLT value for both wind/rear screen and side window. This matter has been thoroughly discussed by the standard committee and yet to be finalized. The basis of the work is according to the **UN Regulations No. 43** i.e. UN R43 (*Uniform provisions concerning the approval of safety glazing materials and their installation on vehicles*), **ISO 9050** (*Glass in building - Determination of light transmittance, solar direct transmittance, total solar energy transmittance, ultraviolet transmittance and related glazing factors*), as well as the **Road Transport Act 1987** (APJ 1987). Additionally, the industry need a solid conclusion not only for the said issue but also on the revised VLT regulations for their business strategies and other related matters.

The revised VLT figures, as announced by the RTD, involved the rear windscreen (RWS) and other than the front side window (SW)[14]. The FWS is maintained at 70% VLT, as well as the front SW at 50% VLT[6]. The VLT limit for RWS and other SW is set at 30% from the 50% level. According to a report, RTD came to the decision after considering many related factors and benchmarking with many other countries' prevailing regulations[8].

Nevertheless, the most important thing to consider is about the users and how the relevant stakeholders are being sensitive to the issue. Hypothetically, the increased popularity and availability must be due to some valid reasons. As mentioned earlier, the users attributed their need for auto tinting to the hot and sunny weather, and nowadays it is safe to say that the majority of car users in the country consider auto tinting is a "must" to counter the heatwave.

## CONCLUSION

This paper, in general, attempts to provide an insight about the increased popularity and availability of auto tinting in Malaysia. This issue is not only about the challenge by the users toward the Visible Light Transmission (VLT) regulation set by the authorities, but also with regard to entire interaction and chain effects in the car aftermarket behaviour and business. The discussion is primarily based on two previous MIROS studies (weather issue and consultative exercise to MOT), and the recent study findings had supported that auto tinting is one of the sought-after items among the users and the willingness to spend on it is fairly high.

## ABBREVIATIONS

VLT-Visible Light Transmission, VTA-Vehicle Type Approval, MYR-Malaysian Ringgit

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## COMPETING INTERESTS

There is no conflict of interest.

## REFERENCES

1. Zulhaidi, M.J. Mohd Hafzi, M.I. Syazwan, S.M. Hafeez, A.A. Anwar. A.K. & Wong, S.V. New Car Assessment Program for Southeast Asian Countries (ASEAN NCAP)–A new paradigm shift in the ASEAN automotive ecosystem. *Journal of the Eastern Asia Society for Transportation Studies* 2013; 10:29-44.

2. Aqbal Hafeez, A. Zulhaidi, M.J. Yahaya, A. Mohd Syazwan, S. & Fazli, Y. *Malaysian Vehicle Assessment Programme PROTON EXORA–A 4-Star MPV in Safety*. MER 09/2012. Kuala Lumpur: MIROS; 2010.

3. Zulhaidi, M.J. Mohd Hafzi, M.I. Rohayu, S. Wong, S.V. & Ahmad Farhan, M.S. *Weather as a Road Safety Hazard in Malaysia-An Overview*. MRev 03/2009. Kuala Lumpur: MIROS; 2010.

4. Andrey, J. Mills, B. & Vandermolen, J. *Weather Information and Road Safety*, Paper Series No. 15. Toronto: Institute for Catastrophic Loss Reduction; 2001.

5. Hamzah, E. & Kanniah, M. Corrosion Behaviour of Low Carbon Steel Sheets for Car Bodies. *Jurnal Mekanikal 2005*; 19:57-70.

6. Abdul Karim, J. *Road Infrastructure Development in Malaysia*. Kuala Lumpur: Public Works Department; 2008.

7. Mohd Hafzi, M.I. Maslina M. Mohd Khairudin, R. Aqbal Hafeez, A. Azhar, H. Mohd Syazwan, S. Nor Fadilah, S. Rabihah, I. & Wong, S.V. *A study on automotive tint glazing in Malaysia*. MRR No. 159. Kuala Lumpur: MIROS; 2015.
8. Malay Mail Online. *New car windscreen, window tint regulation from Nov 1*. Available from:http://www.themalaymailonline.com/print/malaysia/new-car-windscreen-window-tint-regulation-from-nov-1 (accessed 25 May 2016)

9. Shinar, D. & Schieber, F. Visual Requirements for Safety and Mobility of Older Drivers. *The Journal of the Human Factors and Ergonomics Society* 1991; 33(5):507-19.

10. Proffitt, D.R. Joseph, J.E. Bhalla, M. Durgin, F.H. Bertamini, M. Lynn, C.W. & Jernigan, J.D. *External Viewing of Vehicle Contents Under Varying Window Tinting and Illumination Conditions*. Final Report No. VTRC 95-R3. Virginia: Virginia Transportation Research Council; 1995.

11. Proffitt, D.R. Jernigan, J.D. Lynn, C.W. & Parks E.B. *The Effects of Motor Vehicle Window Tinting on Traffic Safety and Enforcement*. A Report to the Governor and General Assembly in Response to Senate Joint Resolution 293. Virginia: Virginia Transportation Research Council; 1993.

12. Virginia State Police. Report on Sun Screening Material on Motor Vehicles. A Report to Virginia State Government. Virginia: Virginia Department of State Police; 1988.

13. Jasni, M.A. & Nasir, F.M. Experimental Comparison Study of the Passive Methods in Reducing Car Cabin Interior Temperature. In: *Proceedings of the International Conference on Mechanical, Automobile and Robotics Engineering* (ICMAR, Penang) 2012; 229–233.

14. Hafriz Shah. *New window tint rules to be enforced from now on – offenders to be fined up to RM2,000 or six months jail*. Available from: http://paultan.org/2016/02/18/new-window-tint-rules-to-be-enforced-from-now-on-offenders-to-be-fined-up-to-rm2000-or-six-months-jail/ (accessed 3 June 2016)