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Motorist Compliance Level Towards Pedestrian Crossing in University Campus

(Tahap Kepatuhan Pemandu Kenderaan Bermotor terhadap Lintasan Pejalan Kaki di Kampus Universiti)

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ABSTRACT

A pedestrian crossing is a facility designated for pedestrians to cross a road in groups, so that they can be seen by the motorists. Pedestrian crossing is also used by them to cross safely across a flow of vehicular traffic. However, accidents still occur among pedestrians even though there are provisions for pedestrian crossing facilities. The purpose of this research is to identify the level of motorists' compliance towards pedestrian crossing at Universiti Kebangsaan Malaysia (UKM) which is located in Bangi, Selangor. This research involved 326 respondents among motorists and pedestrian that comprised of UKM's undergraduate and postgraduate students. This research aims to measure and analyse the level of compliance and the importance of motorists, pedestrian, facilities and maintenance factors using the Importance Performance Analysis (IPA) method. The data were analysed by using the Statistical Package for Science Social (SPSS) 22. The results of IPA were divided into four quadrants where some of the factors must be improved by UKM's authority and some must be maintained. From the IPA analysis, it was concluded that the street lightings must be improved and upgraded by UKM's management as the attribute lies on Quadrant 2 where Quadrant 2 represents the attributes that need to be prioritised, so that accidents between motorists and pedestrians can be avoided.

Keywords: Pedestrian crossing; motorist; Universiti Kebangsaan Malaysia; importance performance analysis

ABSTRAK

Lintasan pejalan kaki adalah kemudahan yang ditetapkan untuk pejalan kaki untuk melintas jalan dalam satu kumpulan, supaya mereka dapat dilihat oleh pemandu kenderaan bermotor. Lintasan pejalan kaki juga digunakan untuk menyeberang dengan selamat di seluruh aliran lalu lintas kenderaan. Tetapi kemalangan yang melibatkan pejalan kaki masih sering kali berlaku walaupun kemudahan lintasan pejalan kaki disediakan. Tujuan kajian ini adalah untuk mengenal pasti tahap pematuhan pemandu kenderaan bermotor terhadap pejalan kaki di UKM yang terletak di Bangi, Selangor. Kajian ini melibatkan 326 responden di kalangan pemandu dan pejalan kaki yang terdiri daripada pelajar siswazah dan pascasiswazah UKM. Kajian ini bertujuan untuk mengukur dan menganalisis tahap pematuhan dan kepentingan faktor pemandu, pejalan kaki, kemudahan dan penyelenggaraan menggunakan kaedah Analisis Prestasi Berkepentingan (IPA). Data dianalisa menggunakan perisian Pakej Statistik untuk Sains Sosial (SPSS) 22. Hasil analisis IPA akan dibahagikan kepada empat kuadran yang beberapa faktor yang harus diperbaiki oleh pihak berkuasa UKM dan beberapa faktor di antaranya mesti dikekalkan. Dari analisis IPA, ia menyimpulkan bahawa lampu jalan perlu ditambah oleh pihak pengurusan UKM kerana attribut ini berada di dalam Kuadran 2 di mana Kuadran 2 mewakili atribut-atribut yang perlu diberikan keutamaan, maka kemalangan antara pemandu dan pejalan kaki dapat dielakkan.

Kata kunci: Lintasan pejalan kaki; kenderaan bermotor; Universiti Kebangsaan Malaysia; analisis prestasi berkepentingan

INTRODUCTION

Walking is one of the basic travelling modes that are being used by humans to move from one destination to another. It also benefits the human health. However, most pedestrians are exposed to danger especially at a place with high number of vehicles. Sharif (2012) stated that the increasing number of vehicles increases accidents involving pedestrians. It was reported that the rate of death involving pedestrians was about 562 deaths in one year (JKJR 2013). This value ranked pedestrians as the third highest under road accident death (JKJR 2013). Based on Jabatan Kerja Raya Malaysia (2016), the speed limit that is being enforced when a vehicle approaches a pedestrian crossing is 30 km/h. Based on the data obtained from WHO (2004), pedestrians have a 90% chance of surviving a collision when the impact speed is 30 km/h or less, but the likelihood of survival falls to less than 50% when the impact speed is 45 km/h or more, and is only 20% when the impact speed is 64 km/h or more.

There are other factors that the pedestrian involves in accidents such as, avoiding the provided facilities such as zebra crossings and signalised crossings (Zainudin 2013). The data show that most pedestrians lack awareness for their safety. Other factors are the pedestrian receives less attention from motorists as they are careless. Ismail et al. (2015) stated that driver's behaviour is a main factor that leads to road accidents. Paulo and Peter (2018) stated that the pedestrian crossing facilities which are not in a good condition will cause accidents. Therefore, it is necessary to analyse pedestrian crossing characteristics and improve its existing design especially in the research location which is in UKM to prevent accidents among UKM students and staff. Based on Jabatan Kerja Raya Malaysia (2016), a campus is categorised as school zone where campus student movements are regular.

The students walking activities and the presence of irregular traffic are the main reasons speed limitations are implemented. The tolerance of the human body to absorb crash energy should not exceed 30 km/h, therefore the school speed limit will reduce accidents and fatalities (Jabatan Kerja Raya Malaysia 2016). There are several steps to avoid accidents between pedestrians and motorists such as providing pedestrian crossings like zebra crossing, pelican crossing, signalised crossing, flyover and speed bumps (Huang & Cynecki 2000). Thus, this study was conducted in UKM with the aim to identify the level of compliance among UKM students that include both motorists and pedestrians' views. In addition, this study intends to identify reasons of non-compliance from both of them towards pedestrian crossing facilities that are being provided by UKM.

METHODOLOGY

This study used survey questionnaire method to measure the level of compliance of motorists towards pedestrian crossings in UKM. The data was collected from both primary and secondary sources. According to Ismail (2013) and Dawood et al. (2015), the survey study has some benefits such as it can provide large samples within a short time. This study was conducted in UKM which is located in Bangi, Selangor where the distance is about 35 km from Kuala Lumpur and the location area is about 1100 hectare. There are 13,896 undergraduate students, 10,071 graduate students and 1689 foreign students. For this research, the data was collected only from local undergraduate and postgraduate students. By using the Slovin's formula stated in Equation (1), 326 students were needed as respondents for this research. Therefore, a structured questionnaire was used to solicit information from both undergraduate and post-graduate students. The research data taken from the respondents were collected from the questionnaires which were composed based on the Likert's model that has five optional answers and range of grade from 1 to 5. Then, the data were analysed using Statistical Package for Science Social (SPSS) 22 (Blaikie 2003; Ismail & Zakaria 2014).

Slovin's formula is shown in Equation 1:

$$n = N/(1+N\,(e)^2) \quad (1)$$

where,

n = Number of sample;
N = Total population;
e = Error tolerance.

The calculation for the total of 23,967 undergraduate and postgraduate students and 5.5 percent of the error of tolerance is 326 respondents. The performance was measured by using the same set of attributes so that the level of compliance can be directly compared for each attraction via the Importance Performance Analysis, IPA plot (or grid). This IPA was introduced by Martilla and James in 1977 to measure the relationship between customer perception and product or service quality enhancement priority, known as the quadrant analysis (Brandt 2000). The IPA is commonly used in assessing performance and important attributes especially in transportation areas (Chou et al. 2011; Chou et al. 2012; Ding 2012).

The main process in IPA is positioning the vertical and horizontal axes on the grid (Martilla & James 1977). Azzopardi and Nash (2013) and Tonge and Moore (2007) agreed that different positioning of the intersection in grid will produce different results while Martilla and James (1977) stated in their study that there are three ways in deciding the position of the intersection which are using the mean, median and middle positions.

For this research, the IPA was used to show information related to service factors, which was to determine students' satisfactions by knowing their level of compliance. The IPA model was divided into four quadrants where the performances are on the x-axis and the importance is on the y-axis. Each quadrant had its own explanation regarding analysis importance and performance of matric. The IPA model is shown in Figure 1. There are also specific questions for motorised vehicles only which were analysed by using a pie chart. The respondents were only required to tick 'yes' or 'no' answers regarding questions on factors that affect the motorists to give way to pedestrians using the pedestrian crossing.

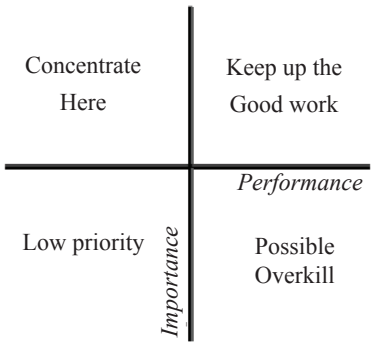

FIGURE 1: Division of quadrant of IPA

The followings are explanations for each of the quadrant (Brandt 2000):

First Quadrant, "High Leverage" (high importance and performance): Factors which are located in this quadrant are considered as supporting factors for customer satisfaction. Thus, the managerial party is obliged to ensure a good maintenance of its institution's performance.

Second Quadrant, 'Priority to Improve' (high importance, low performance): Factors which are located in this quadrant are considered by customers as essential factors, but the current situation is still not satisfying enough. Thus, the managerial party is obliged to allocate qualified resources to improve the performance of those various factors.

Third Quadrant, "Ignore" (low importance and low performance): Factors which are located in this quadrant have low satisfaction level and are considered not too important for customers. Thus, the managerial party does not need to prioritised or pay attention to those factors.

Fourth Quadrant, "Resource Allocation" (low importance and high performance): Factors which are located in this quadrant are considered not too important. Thus, the managerial party needs to allocate resources related to those factors towards other more prioritised factors, for instance the second quadrant.

RESULTS AND DISCUSSION

RESPONDENT'S BACKGROUND AND INFORMATION

There were 112 male and 214 female respondents who answered the questionnaires where 213 of them were undergraduate students while the remaining 113 were post-graduate students. Most of the respondents were below 24 years old (57.7%). From the 326 respondents, 96 (29.4%) of them were using cars, 86 (26.4%) walked, 77 (23.6%) rode motorcycles and 67 (20.6%) were taking bus as their mode of transportation. All of the respondents were from different faculties. 293 (89.9%) respondents realised about the pedestrian crossing while 33 (10.1%) of them were not. This was considered good because most of them knew about the existence of the facility that was provided by the management as shown in Table 1.

TABLE 1. Demographic of respondents

Category		N	%
Gender	Male	112	34.4
	Female	214	65.6
Age	20-24	188	57.7
	25-29	85	26.1
	30-34	33	10.1
	35 and above	20	6.1
Level of study	Degree	213	65.3
	Higher degree	113	34.7
Faculty	FKAB	61	18.7
	FPI	50	15.3
	FST	49	15.0
	FEP	26	8.0
	FPEND	54	16.6
	FTSM	24	7.4
	FSSK	42	12.9
	FUU	20	6.1
Mode of transport use	Walking	86	26.4
	Car	96	29.4
	Motorcycle	77	23.6
	Bus	67	20.6
Aware the existing of pedestrian crossing	Yes	293	89.9
	No	33	10.1

IPA ANALYSIS

Table 2 and Figure 2 show the relationship of the mean value of importance and compliance level of motorist and pedestrian towards the pedestrian crossing provided in UKM. IPA depends on the respondents' perceived importance of the services provided and attributes performance of those facilities (Matzler et al. 2010). Based on the IPA chart in Figure 2, the factors that are related to the level of importance and the level of compliance may be grouped in each quadrant by using mean value for both levels. In this study, two scales were used which were the importance and compliance of students towards the pedestrian crossing facilities in UKM. The minimum value of the scale is 1 that represents factors that are very less important for respondents and also the respondents' dissatisfaction with the provided facilities. The maximum scale value is 5 that represent the factors that are very important for respondents and the factors that are very satisfied by the respondents.

Quadrant 1 – the factors that lie on Quadrant 1 are, motorist must stop if there is pedestrian using the pedestrian crossing (Attribute 1), motorist slow down their vehicle when approaching pedestrian crossing (Attribute 3) and number of zebra crossings provided (Attribute 4). Based on the study done by Martilla and James (1977), Quadrant 1 is for high leverage factors which are the factors that have high importance and performance value. The action of stopping the vehicles when a pedestrian is crossing the road is very important in order to avoid occurrence of accidents. The best ways to reduce the chances of accidents, the motorists are encouraged to slow down their vehicles when approaching pedestrian crossings. Plus, the speed limit for driving in campus area is 30 km/h which is the speed limit that is being enforced for school area. This quadrant shows the attributes are considered important by the respondents and the pedestrian crossings provided satisfies the respondents. So, the factors involved in this quadrant need to be maintained by the management for continuing satisfying the students (Brandt 2000).

Quadrant 2 – the attribute that lies on this quadrant is the quality of streetlights (Attribute 6). The results showed that the attribute has high level of importance value for the respondents, but the performance of the pedestrian crossings provided was at low level where it complied with

the requirement of Quadrant 2 (Martilla & James 1977). This factor is considered important by respondents, but was not fulfilled by the management and not satisfying the respondents. Therefore, these attributes became UKM management's main priorities for improvement. The improvement that can be done is to increase the installation of street lightings along the road in UKM especially at areas that have high accident potential such as at corner zones and intersections. This effort not only can reduce accidents but can avoid various kinds of crime occurrence. With the lighting system upgraded, the students will feel safer and comfortable when using the roads.

Quadrant 3 – speed of vehicle less than 30 km/h which is for campus area (Attribute 2) and number of speed bumps before and after the pedestrian crossing (Attribute 7) are factors that lie on Quadrant 3. The action of driving below the speed limit will help in reducing the occurrence of accidents where the drivers and pedestrian are aware of their surroundings when the drivers are aware of the pedestrians crossing the road and the pedestrians are aware of the vehicles that are coming towards them. Speed bumps are very important to reduce the vehicles' speed where speed bumps will obstruct the smoothness of vehicle flow. So, it is very suitable to install before and after the pedestrian crossing to allow pedestrians to cross the road safely. These factors are considered not too important and already being submissive or satisfied by students (Brandt 2000). Therefore, there is no need to improve it and it can be ignored (Martilla & James 1977).

Quadrant 4 – the number of signboards near the pedestrian crossing (Attribute 5) is the only attribute that lies on Quadrant 4. Martilla and James (1977) stated that Quadrant 4 were used for resource allocation. This quadrant shows factor that has low importance towards respondents but the management provides high performance for the factor (Brandt, 2000). Therefore, it shows that UKM's management do not require increasing the number of signboards at the sidewalk because the study showed that the motorist realised the existence of signboards at sidewalk. The management needs to give attention towards the factors that need more priorities especially the factors that are located on Quadrant 2.

TABLE 2. Mean value of importance and the level of compliance

No.	Factor	Statement	Importance (Score mean)	Level of satisfaction (Score mean)
1.	Motorist vehicle	Motorist must stop if there is pedestrian using the pedestrian crossing	4.46	3.51
2.		Speed of vehicle less than 30 km/h (campus area)	3.88	3.09
3.		Motorist slow down their vehicle when approaching pedestrian crossing	4.38	3.39
4.	Facility	Number of zebra crossing	4.38	3.53
5.		Number of signboard near the pedestrian crossing	4.22	3.46
6.	Maintenance	Quality of the streetlight.	4.62	3.08
7.		Number of speed bump before and after the pedestrian crossing.	3.9	3.28
		Total mean	4.26	3.33

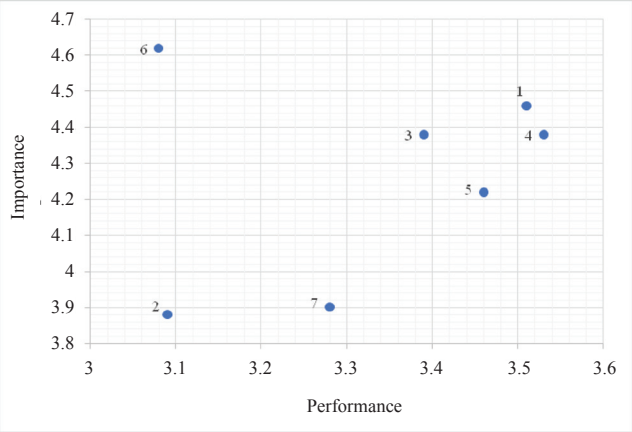

FIGURE 2. Importance performance analysis quadrant

MOTORISED PERCEPTION ANALYSIS

Figure 3 until Figure 6 show the analysis for motorised respondents only. It is only a simple question which only provides the options of 'Yes' or 'No' and the number of respondents who answered this question was 163. For Figures 3 and 4, it is good that there were more respondents said that they noticed the presence of pedestrians and the existence of crossings. However, 11 respondents gave different answers. Both criteria are important for motorists to reduce the speed of vehicles as they notice the presence of pedestrians and the existence of pedestrian crossings. For Figure 5, it is considered good as the majority of them said that it is important for motorists to give way to pedestrians who want to cross. This is to reduce waiting time for pedestrians to cross the road and to prevent accidents to occur when pedestrians hesitate to cross the road. While for Figure 6, the majority of them said that the factor of dark road conditions during

the night makes them hard to see the pedestrians. UKM must improve the street lightings to prevent accident occurrence.

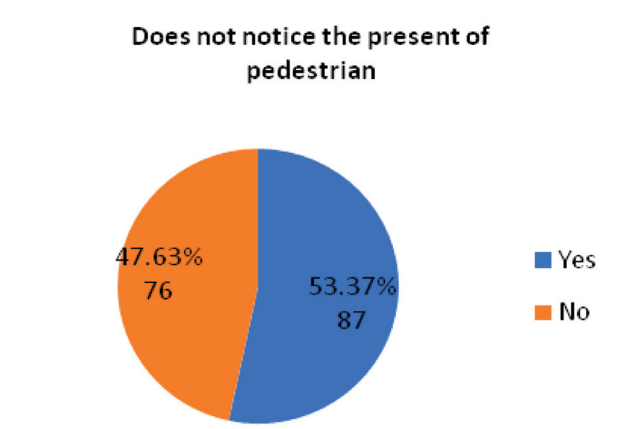

FIGURE 3. Factor of does not notice of the present of pedestrian

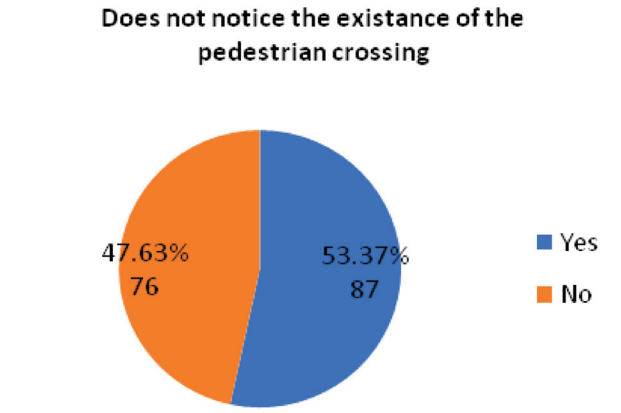

FIGURE 4: Factor of does not notice the existence of pedestrian crossing

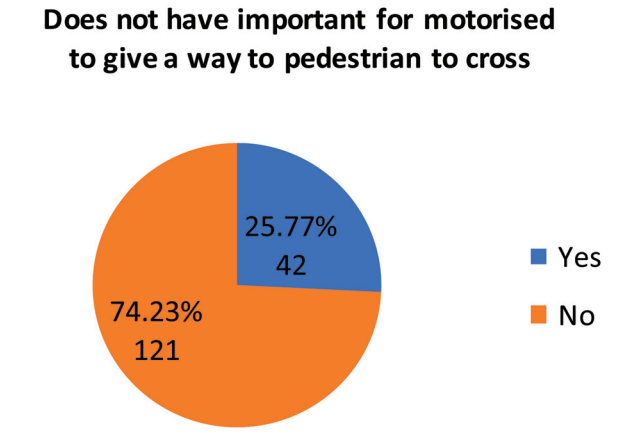

FIGURE 5. Factor of does not have important for motorised to give a way to pedestrian to cross

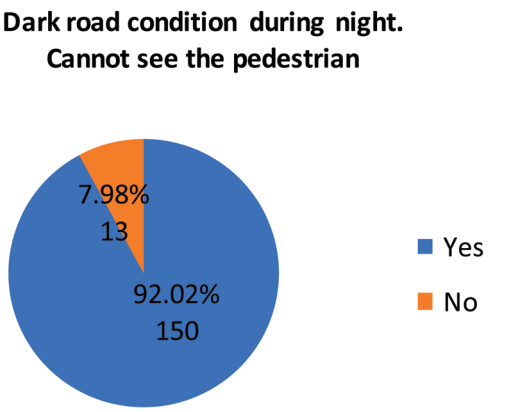

FIGURE 6. Factor of dark road condition during night. Cannot see the pedestrian

CONCLUSION

In conclusion, this study aimed to measure and analyse the level of compliance and the importance of motorists, pedestrians, facilities and its maintenance factors using the IPA method. The pedestrians are facing high accident risk especially accidents between them and motorists. Therefore, it is important to follow the rules of pedestrian crossing either for the pedestrians or motorists. From the IPA analysis, the street lightings must be improved and upgraded by UKM's management as the attribute lies on Quadrant 2 where Quadrant 2 represents the attributes that need to be prioritised. This action is important to avoid accidents between motorists and pedestrians.

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REFERENCES

Azzopardi, E. & Nash, R. 2013. A critical evaluation of importance performance analysis. *Tourism Management* 35: 222-233.

Blaikie, N. 2003. Analyzing quantitative data: from description to explanation. *Applied Statistics* 96-105.

Brandt, D. R. 2000. An 'outside-in' approach to determining customer driven properties for improvement and innovation. White Paper Series 2.

Chou, J. S., Kim, C., Kuo, Y. C. & Ou, N. C. 2011. Deploying effective service strategy in the operations stage of high-speed rail. *Transportation Research Part E: Logistics and Transportation Review* 47(4): 507-519.

Chou, J. S., Tserng, H. P., Lin, C. & Yeh, C. P. 2012. Critical factors and risk allocation for PPP policy: comparison between HSR and general infrastructure projects. *Transport Policy* 22: 36-48.

Dawood, S. A. A., Borhan, M. N. & Rahmat, R. A. 2015. Pemodelan kesediaan pelajar beranjak kepada berbasikal di UKM. *Jurnal Kejuruteraan* 27: 95-102.

Ding, J. F. 2012. Assessment of customer relationship management for global shipping carrier-based logistics service providers in Taiwan: an empirical study. *WSEAS Transactions on Systems* 11(6): 198-208.

Huang, H. F. & Cynecki, M. J. 2000. Effects of traffic calming measures on pedestrian and motorist behaviour. *Transportation Research Record 1705* 00-044(0): 26-31.

Ismail, A., Yi, G. S. & M. Zain, M. K. I. 2015. Study in driver's behaviour relationships to reduce road accidents in Puchong, Selangor Darul Ehsan. *Jurnal Kejuruteraan* 27: 81-85.

Ismail, A. & Zakaria, S. 2014. Development of bicycle shift models in Universiti Kebangsaan Malaysia campus. *Jurnal Kejuruteraan* 26(2014): 69-76.

Ismail, R. 2013. *Metodologi Penyelidikan Teori dan Praktis*. Bangi: Penerbit Universiti Kebangsaan Malaysia.

Jabatan Kerja Raya Malaysia. 2016. Guidelines for Selection of Speed Limit, Kuala Lumpur.

Jabatan Keselamatan Jalan Raya Malaysia (JKJR). 2013. Keselamatan pejalan kaki. http://www.jkjr.gov.my/en/jkjr-negeri/perak/1480-keselamatan-pejalan-kaki.html [24 October 2017].

Martilla, J. A. & James, J. C. 1977. Importance-performance analysis. *The Journal of Marketing* 41(1): 77-79.

Matzler, K., Sauerwein, E. & Heischmidt, K. 2003. Importance-performance analysis revisited: The role of the factor structure of customer satisfaction. *The Service Industries Journal* 23(2): 112-129.

Paulo, R. A. & Peter, J. 2018. Estimating preferences for different types of pedestrian crossing facilities. *Transportation Research Part F* 2: 222-237.

Shariff, N. 2012. Private vehicle ownership and transportation planning in Malaysia. *International Conference on Traffic and Transportation Engineering* 64-68.

Tonge, J. 7 Moore, S. A. 2007. Importance-satisfaction analysis for marine-park hinterlands: a Western Australian case study. *Tourism Management* 28(3): 768-776.

WHO. 2004. World report on traffic injury prevention. Geneva, World Health Organization.

Zainudin, S. 2013. Bicara Isnin: 530 pejalan kaki maut. Sinar Online. http://www.sinarharian.com.my/nasional/bicara-isnin-530-pejalan-kaki-maut-1.172068 [6 June 2017].

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