KEMENTERIAN PENDIDIKAN TINGGI

JOJAPS

eISSN 2504-8457

POLITEKNIK MALAYSIA PORT DICKSON

Journal Online Jaringan COT POLIPD (JOJAPS)

Circle Lock Delineator

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Abstract

Improving road safety is a major agenda of our country in order to reduce the rate of road accidents. Hence, providing safe road environment by providing clear and continuous guidance to road users are of paramount importance. Delineator is a traffic control device that has been used to provide continuous guidance to road users. However, the delineator is often damaged as a result of being hit by vehicles or due to vandalism. The process of changing a defective delineator to a new unit is quite costly and time consuming. As a result, the function of the device is less effective. Therefore, the aim of this project is to create a delineator base that can facilitate the process of replacing a defective delineator unit to a new one, called the circle lock delineator. Circle lock delineator consists of three components. The first component is permanently assembled into the surface of the road. The second component is connected to first component using a circle lock connection. The third component is the connector, screwed to the second component. Therefore, the delineator post can easily being plug into the connector. This product is manufactured in three separate components to facilitate the changing of damaged components. Therefore, the undamaged components can continue to be used, thereby saving on maintenance costs. Additionally, by using this product, the time required to change delineator post can be significantly reduced. This product has the potential to be applied in Highway Maintenance work.

Key-word: road safety, delineator, highway maintenance.

1. Introduction

The rate of road accidents in Malaysia is among the highest in the world (Akmal, 2016), involving a loss of RM9 billion with a rate of 19 people killed every day (JKJR, 2014). Based on the conducted study by JKJR (2014) it was found that most death accidents occurred primarily on federal roads (34.1%) and state roads (29.6%) this is due to the poor road condition. This was supported by another study conducted on 3700km Malaysia road networks, it was found that in term of safety most Malaysia road networks were rated with 1 or 2 stars only. The low ratings were due to poor road design, poor safety protection against road hazards and lack of facilities for road users (JKJR, 2014). Moreover, in MIROS study based on 2011 conducted data, 13.2% road accidents that occurred in Malaysia were contributed due to road condition factors. Due to these concerns, the Ministry of Transport has made road safety issues as an important agenda that need to be addressed in an integrated manner in order to reduce the road accidents (JKJR, 2014; JKJR, 2016).

Providing a safe road environment for road users is one of major function of road and traffic engineering. One of the finding in the research conducted by Akmal (2016) shows that the highest percentage of road accidents in Malaysia usually occurring between 4 pm to 10 pm. Gaca and Kiec (2013) also found that the risk of accident during dark time was 60% higher than daylight. This was because of the poor lighting conditions especially at night, dusk and dawn time. Safety risk among road users increased significantly during dark time due to wrong perception, lack of driving skills, and lack of focus (Gaca & Kiec, 2013).

The Road Safety Plan of Malaysia 2014-2020 has been outlined and the foundation of the framework was based on the 5 strategic pillars of road safety management, safer road and mobility, safer vehicles, safer road users, and useful post-accident management. Under the second strategic pillar of safer road and mobility Malaysia aims to achieve 6 outcomes including risk reduction for motorcyclists, pedestrians and car occupants. Among the recommended programs that been proposed to achieve the outcomes are to improve the road lighting and to encourage the use of traffic control devices on the road.

Traffic control devices have long been used to improve the safety of road surroundings. Post-mounted delineator (PMD) is one of the traffic control device used to provide long-distance visual guidance to road users for night trips (Schumann, 2000), it helps to accentuate the outline edges of the roadway and critical hazardous locations. A good long distance visual guide allows drivers to predict the road situation ahead of them, and would enable them to plan for a more safe driving condition.

However, PMD's are often damaged due to been hit by vehicle or vandalism. This will resulted to more frequent maintenance works and costly (Schumann, 2000). Among the efforts that have been done to reduce maintenance costs were to use flexible PMD units, and to use retro reflective stickers to replace the prism button. Besides that, accumulation of dirt and aging also will reduce the PMD's performance. Studies have found that this problem can reduce the night vision between 30.5m to 305m. Due to this, the PMD needs to be upgraded with a new build method that is easy to be installed and maintain. Therefore, the purpose of the project is to produce a PMD base using a circle-lock connection method.

The objectives of this project are to;
1. produce a PMD base using a circle lock connection technique,
2. observe the installation time taken to assemble the PMD on the circle lock base,
3. identify user's perceptions toward the use of the circle lock delineator.

2. Methodology

Circle lock delineator consists of three separate components made of Teflon (PTFE). The first component of the base is permanently assembled into the road surface. While the second component is connected to the base using a circle lock. The third part, the connector is screwed to the circle-lock. Using the above method the post delineator can be mounted to the connector easily. This product was produced in three separate components to make it easy to be replaced by changing only, the damaged part when it is necessary.

Teflon (PTFE) was selected as a building material for this product because it has good resistance towards temperature (melting temperature 327 ^{O}C), weather and is considered as high chemical resistance material too. Besides that, the material also has low friction resistance, good electrical and heat insulator, as well as having good flexibility. Additionally, PTFE's mechanical properties can be enhanced by adding other materials such as fiberglass, carbon, graphite, molybdenum disulphide, and bronze. Generally, reinforced PTFE with added materials mentioned above help to retain good chemical properties and temperature resistance, can improve mechanical strength, stability and low wear resistance. In addition, if the post delineator is accidently detached from the connector, the flexible nature of PTFE expected not to cause any harm to road users, especially cyclists and motorcyclists.

The delineator base was the first component in the construction of the circle lock delineator with the dimensions as shown in Figure 1. The delineator base was permanently installed onto the road surface or suitable place (Figure 2). The top surface of the base is flush with the surface of the road.

The second component was the *circle lock* component with the dimensions as shown in Figure 3. The use of the *circle lock* connection method allows this second component to connect to the delineator base easily and quickly.

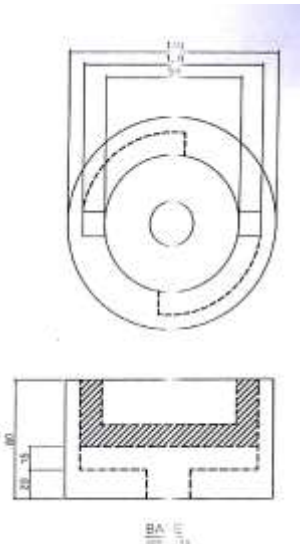

Figure 1: Base

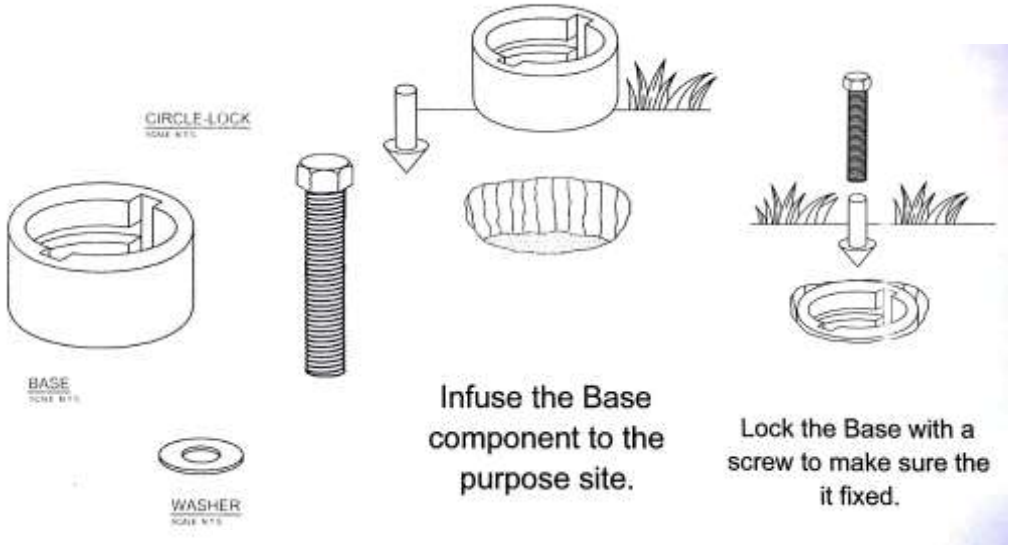

Figure 2: Installation of delineator base

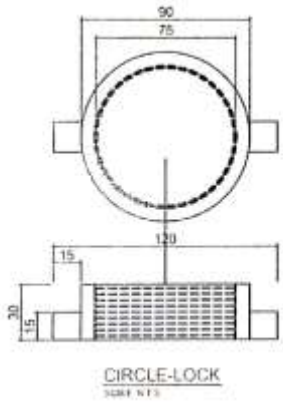

Figure 3: Circle lock

Then the third component was the connector part that has the dimensions as shown in Figure 4. This component was connected to the circle lock component using the screw connection method (Figure 5). The Delineator post was mounted on the top of the connector through plug-in procedure which can be setup easily and quickly (Figure 6). Figure 7 shows the whole installation of PMD using the circle lock delineator method.

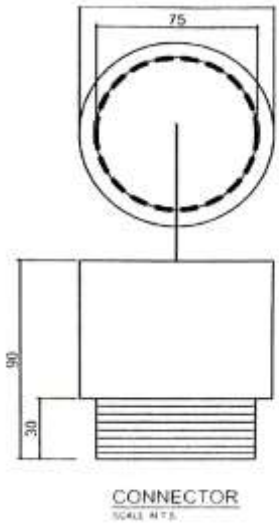

Figure 4: Connector

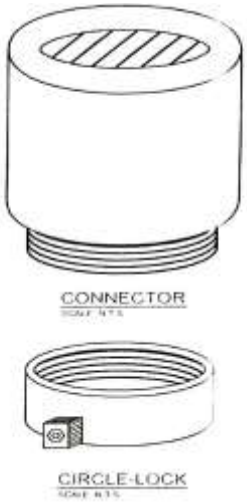

Figure 5: The screw method is used to attach the connector to the circle lock.

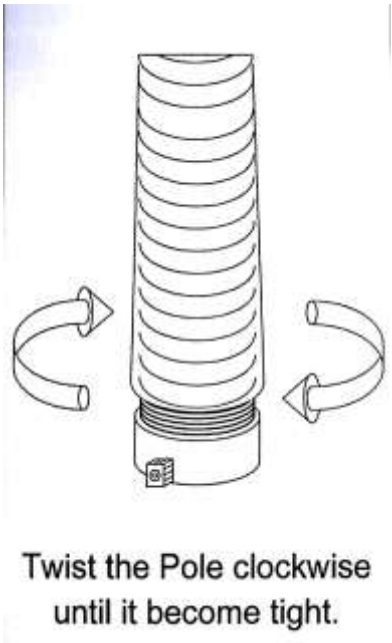

Figure 6: Delineator post is easily installed to the connector section.

Figure 7: Installation of circle lock delineator

The delineator and the circle lock delineator product sample were installed at the test site. All equipment for installing both delineators were provided. The times taken to install both delineator types were then observed. Finally, a survey was conducted to obtain direct feedback from respondents. The feedback obtained is going to be used to improve the quality of product sample.

3. Findings and discussion

The findings show that the time taken to install the two delineators were 46% time saving, compared to the conventional delineator. Result of the findings is as shown in Table 1.

Table1: Delineator installation period test

	Installation timing (minute)			Average timing (minute)
	Test 1	Test 2	Test 3	
Conventional delineator	2.49	2.43	2.38	2.43
Circle lock delineator	0.58	0.58	0.58	1.71
			Time saving	1.12

Feedbacks from 20 respondents on the use of the circle lock delineator were obtained. Respondents were contractor (1 person), JKR staffs (6 persons) and polytechnic lecturers (13 persons).

Table 2: Min Score of Respondents' Perception towards Using Circle-Lock Delineator

No	Statements	Min Score
1.	The height of the circle lock delineator is appropriate	3.71
2.	Delineator is flexible	3.94
3.	Installation process of delineator is easy	3.82
4.	Easy maintenance and save time	4.06
5.	Suitable to be used on the road	4.12
6.	Has good durability	4.24
7.	Suitable to be installed anywhere	3.82
8.	Easy to be seen at night	4.12
9.	Safe to be installed	3.82

In general, most respondents averagely agree with the advantages shown by the circle lock delineator.

4. Conclusion

Circle lock delineator was designed to facilitate the maintenance process of road traffic control devices. It was made from three separate components to enable the maintenance of specific damaged part, been managed easily. Through this the cost spent for maintenance can be reduced and more saving can be done.

Test result also found that the installation of the circle lock delineator was not complicated and save time. Circle lock delineator has the potential for future production. However there is still room from improvement, hopefully innovation on the circle lock delineator building materials could be cheaper and have better durability will be discovered.

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