



Road Shoulder Leveling Equipment

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Abstract

Shoulder of the road is an important component in the construction of a road. The function of road shoulder is to drain water from the road surface. This will cause road surface lasts longer and does not endanger road users. The road shoulders have three categories. The categories are concrete or bitumen, gravel or crushed stone and weed. Every category has the different of slope. The slope for road shoulder from concrete or bitumen is 2-6%. Then, the gravel and crushed stone is 4-6%. Lastly, the slope of weed is 6%. Road Shoulder Leveling Equipment can measure the slope by referring to the three levels of the plates indicating the type of slope limit: 2 % for concrete, 4 % to 6 % for gravel and grass slopes. It also has water scale that shows the accuracy of the road shoulder slope. Inaccurate gradient will lead to more problems in road pavement. This tool serves as a tool to measure the road shoulder slope according to Public Works Department Standard. The authorities do not need to set up the surveying tool to get the right gradient of road shoulder. Road Shoulder Levelling Equipment is suitable to measure the road slope gradient. It is durable, easy to carry, easy to use, space-saving storage and easy storage. Time, cost and labor can be reduced at the same time can help the Department of Public Works and contractors to improve the quality of road construction and maintenance.

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Key-word: - Measurement Tool, Road Shoulder, Road Maintenance

1. Introduction

Road shoulder is road reserve on the edge of a road or highway. Generally, it is cleared of any type of vehicle; however, if an emergency or vehicle breakdown, the driver can switch to the shoulder of the road to get out of the flow of traffic safely. The shoulders are also useful as a measure to avoid accidents by providing space for the driver if the vehicle is shifted to the side of the front failed to switch to the proper lane as a result of loss of control. Emergency vehicles such as ambulances and police cars can also use the shoulder of the road to stronger recommend congestion on the main routes. The road shoulder is also known as the emergency lane.

The degrees of slope shoulder set vary according to the type of concrete slope of 2% to 4% to 6% slope of gravel and grass slopes. Design gradient inappropriate will lead to a lot of trouble if you do not follow the standards set. The shoulders are inclined to endanger other road users. Previously, there were no tools to measure the slope of the road shoulder. With the Road Shoulder Leveling Equipment, the slope gradient of the road shoulder can be accurately measured regardless of whether rural roads or federal roads.

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1.1 Problem Statement

There had been no special tools to measure the slope of road shoulder Department of Public Works just use the leveling tool to measure the slope of the road shoulder. The most common problem is the slope of the shoulder is not exactly measure without using a special tool. To build the shoulder of the road, the contractor usually only used excavators (JCB) for digging and leveling the ground. Employees then only roughly estimate the percentage gradient of the road shoulder. This scenario requires more labor to operate it. Therefore, there is a need to provide a device for measuring the slope of the road shoulder.

2. Literature Review

Road shoulder is the road reserve on the edge of a road or highway. In general it is emptied of any type of vehicle however, in the event of an emergency or vehicle breakdown, the driver can switch to the shoulder of the road to get out of the traffic flow safely. The road shoulder is also useful as a measure to avoid road accidents by providing space for the driver turned to the side if the vehicle from front failed to switch to the proper lane due to loss of control. Emergency vehicles such as ambulances and police cars can also use the shoulder of the road to encourage congestion on major routes. Thus, the road shoulders also known as the emergency lane.

2.1 History

Road shoulder is a continuous path element. The cross-section of the road, road shoulder position is located at the side of the road. Road shoulder or emergency lanes usually narrow than a normal traffic lane. For roads with low levels of geometry, there is often no road shoulder, if there were, it consists of unpaved gravel. Therefore, there are times when the road shoulder of the road shall be so soft and not suitable in times of emergency when the vehicle from front to avoid the loss of control. For reasons of safety, emergency lane not only paved highway built along but also built on some major roads.

For roads with high levels of geometry, as the emergency lane paved main street. To save costs, there are times when no emergency lanes paved in accordance with the same thickness as the main lanes, given the emergency lane is only used in emergency only. Road shoulder is important in geometric way to fulfill functions such as: -

- a) Provide space for the vehicle to stop in the event of an emergency or for a purpose.
- b) As an emergency room to the vehicle to avoid an accident
- c) Increased visibility can improve the level of safety.
- d) Load roads can be improved and give a uniform speed.
- e) For the construction of the security fence (Guard rails).
- f) As a support structure for supporting the road surface.

Road shoulder width should be according to the conditions that allowed the not too narrow or there is a sharp bend. Shoulder width road is too narrow or inadequate along a section of road causing drivers tend to drive the vehicle in the middle of the road. This in turn resulted in the flow of traffic to slow because the vehicles had to reduce speed when at odds with the vehicle from the front at close range.

According to standard 'Lembaga Lebuhraya Malaysia' (LLM), a minimum width of road shoulders in normal conditions is 3.0 m and 2.5m of paved shoulder width. Usually, the shoulder of the road should be steeper to accelerate surface water drainage. In general, the cross slope above the road side traffic lane cross slope for a rougher surface texture.

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Road shoulder construction can also be made using the grass, crusher run, and soil or pavement grass. Land leveled the same level with the edge of the road and then planted with grass to a certain distance for effective self-draining water. In addition, to make the road shoulder, there should be a gradient must be road shoulders. There are three types of material to the surface of the road shoulder or bituminous concrete, gravel or crushed stone and weed.

2.2 Categories Of Road Shoulder

The road shoulder has three categories. The categories are concrete or bitumen, gravel or crushed stone and weed. Every category has the different of slope. The slope for road shoulder from concrete or bitumen is 2-6%. Then, the gravel and crushed stone is 4-6%. Lastly, the slope of weed is 6%.

2.3 Function Of Road Shoulder

The road shoulder has many functions. The function is in the event of an emergency or breakdown, a motorist can pull into the hard shoulder to get out of the flow of traffic and obtain an element of safety. Besides that, emergency vehicles such as ambulances and police cars may also use the shoulder to bypass traffic congestion. Then, active traffic management, used on busy multi-lane roads, may allow 'hard shoulder running' by general traffic at reduced speeds during periods of high traffic volumes. In some places a 'Bus bypass shoulder' may be provided which allows bus services to pass stationary traffic. Furthermore, shoulders, especially paved or hard shoulders provide additional space should a motorist need to take evasive action or need to recover control of their vehicle before a run-off-road collision occurs. In some urban areas, shoulders are used as travel lanes during peak commuting hours. Shoulders may provide space for bicyclists to ride out of vehicle traffic in areas without sidewalks, pedestrians may walk on shoulders. On curbed roadways, shoulders move the gutter away from the travel lanes which reduces the risk of hydroplaning, and reduces splash and spray of storm water onto pedestrians using an adjacent sidewalk. Shoulders move water away from the roadway before it can infiltrate into the road's subbase, increasing the life expectancy of the road surface. Lastly, shoulders provide structural support of the roadway.

2.4 Material to make the Road Shoulder Leveling Equipment



Fig 2.1 Aluminium

JALAN NEXTBASE

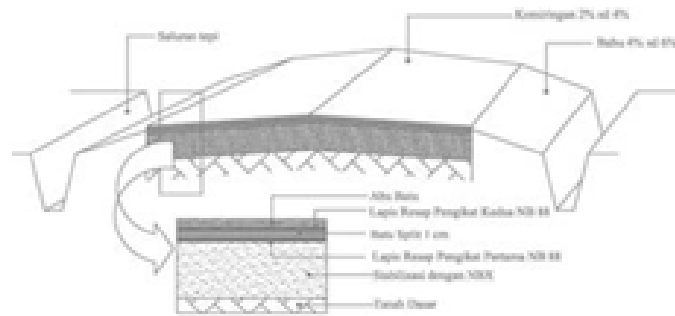


Fig 2.2 JKR standard inclination of road shoulder

Table 2.1 Type Of Surface And Shoulder Cross Slope

<i>Type of surface</i>	<i>Roadside cross slope (%)</i>
Bituminous or concrete	2-6 %
Gravel or crushed stone	4-6%
Grassy	6%

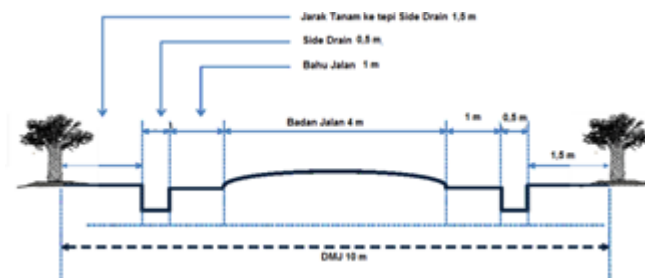


Fig 2.3 Length of road shoulder

3. Methodology

This study requires a method of understanding in advance Public Works Department (JKR) Standard, Type or surface and shoulder cross slope and length of road shoulder. After using Road Shoulder Leveling Equipment on site data were collected using questionnaire form.

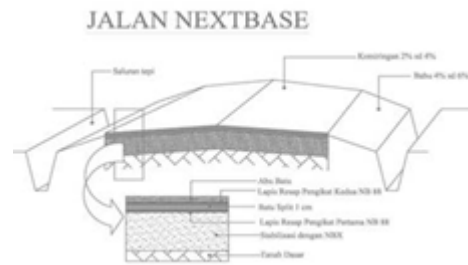


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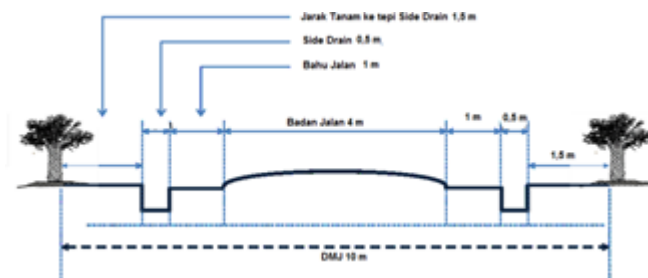


Fig 2.3 Length of road shoulder

3.1 Design Of Product Road Shoulder Leveling Equipment



Fig 3.1 Top View Design

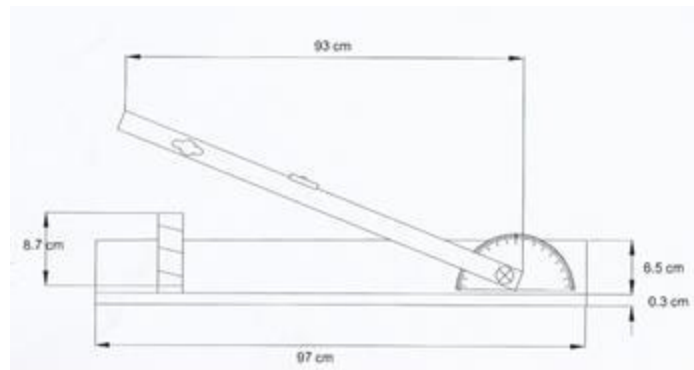


Fig 3.2 Rear View Design

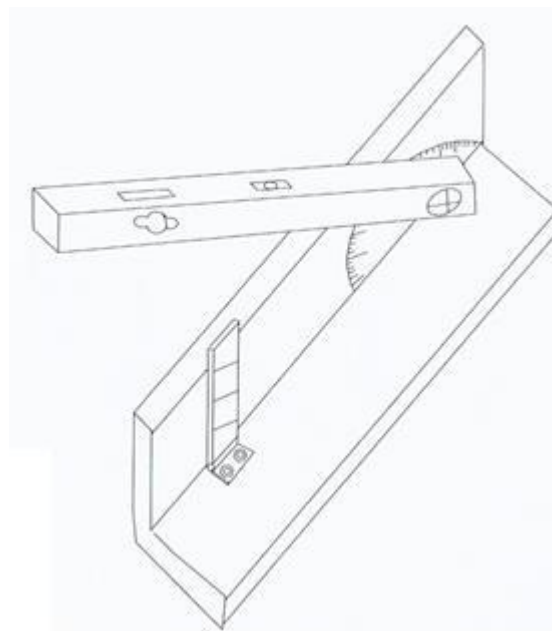


Fig 3.2 3D Design

3.2 Maintenance Site On The Road Shoulder At Jalan Pagoh, Tekam



Fig 3.3 Site in clearing process



Fig 3.4 Product testing on site

4. Data & Analysis

After testing on site, 15 questionnaires were distributed among workers and road maintenance contractors. The majority of the respondents are a man which has work experience between 1 to 20 years.

4.1 Collecting Data

The questionnaires was carried out to ensure that all items can be collected to be analyzed in terms of suitability, measuring accuracy, user friendly, time saving, safety, and weight compatible, easily store and easy to carry.

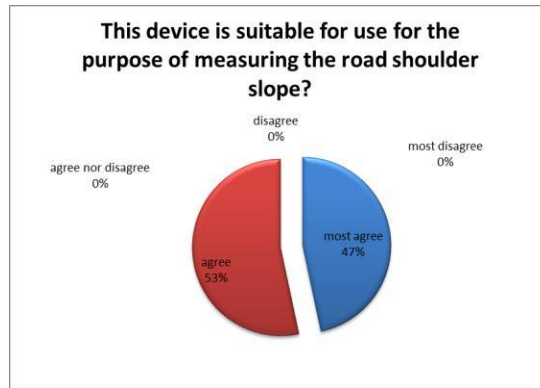


Fig 4.1 Measuring suitability using Road Shoulder Leveling Equipment

Figure 4.1 show that 47% most agree and 53% agree that Road Shoulder Leveling Equipment is suitable for measuring the road shoulder slope.



Fig 4.2 Measuring accuracy using Road Shoulder Leveling Equipment Chart

Figure 4.2 show the measuring accuracy of road shoulder slope by using Road Shoulder Leveling Equipment. There are 21% most agree, 33% of agree and 46% neither agree nor disagree.

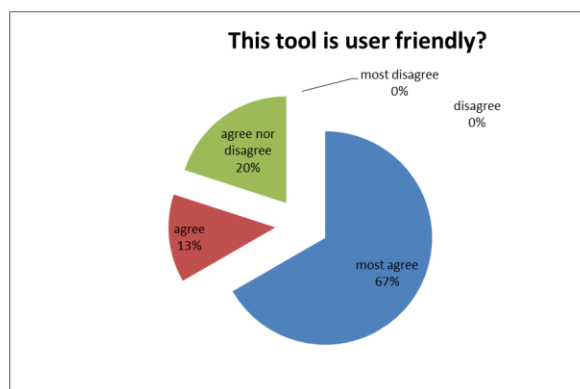


Fig 4.3 User Friendly using Road Shoulder Leveling Equipment Chart

In Figure 4.3, 67% of the respondent is most agreeing that the Road Shoulder Leveling Equipment is user friendly, there are 13% of the respondents agrees and 20% neither agree nor disagree.

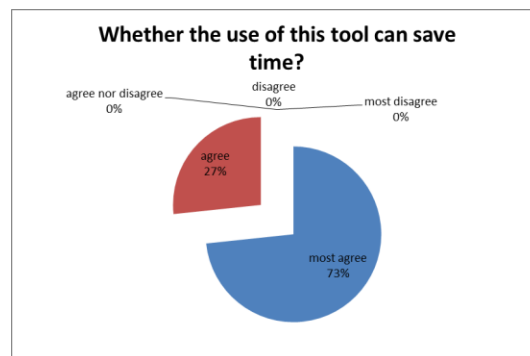


Fig 4.4 Time saving using Road Shoulder Leveling Equipment Chart

Figure 4.4 shows that there are 73% respondents most agree and 27% agree that Road Shoulder Leveling Equipment can save time in measuring the road shoulder slope.

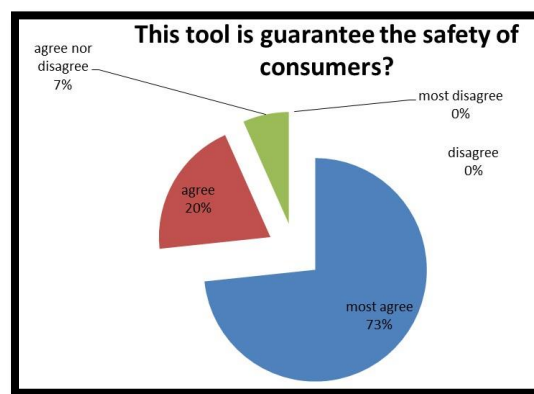


Fig 4.5 Safety Guarantee using Road Shoulder Leveling Equipment Chart

In Figure 4.5 show 73% most agree, 20% agree and 7% agree or disagree that Road Shoulder Leveling Equipment is guarantee the safety of consumers who using it.

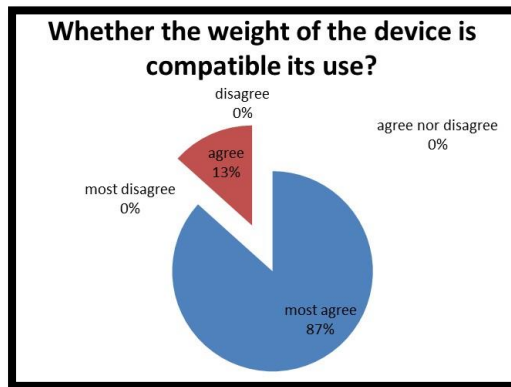


Fig 4.6 Weights Compatible using Road Shoulder Leveling Equipment Chart

Figure 4.6 shows Road Shoulder Leveling Equipment weight is compatible with its use. There are 87% most agree only 13% are agree.

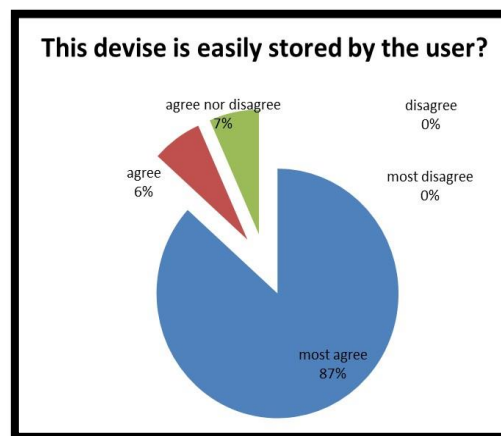


Fig 4.7 Easily Store Road Shoulder Leveling Equipment Chart

Figure 4.7 shows that 87% most agree that Road Shoulder Leveling Equipment is easy to store. 6% agree and 7% neither agree nor disagree.

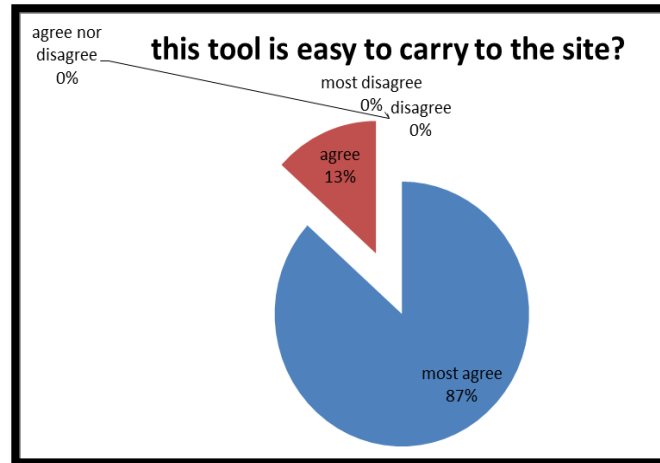


Fig 4.8 Easy Carry Road Shoulder Leveling Equipment Chart

Figure 4.8 shows that 87% most agree that Road Shoulder Leveling Equipment is easy to carry to the site and only 13% agree.

5. Conclusion

Potential Road Shoulder Leveling Equipment can measure the slope by referring to the three levels of the plates indicating the type of slope limit 2 % for concrete, 4 % to 6 % for gravel and grass slopes. It also has water scale that shows the accuracy of the road shoulder slope. Inaccurate gradient will lead to more problems in road pavement. This tool serves as a tool to measure the road shoulder slope according to Public Works Department Standard (JKR). The authorities do not need to set up the leveling tool to get the gradient of road shoulder compare to using surveying tool. Road Shoulder Leveling Equipment is suitable to measure the road slope gradient. It is durable, easy to carry, easy to use, space-saving storage and easy storage.

In additional, using Road Shoulder Leveling Equipment can also be used as a teaching aid in learning and teaching to students. It also can be used to reduce dependence on surveying equipment which is quite difficult to make borrowing, limited tolls, expensive and extra maintenance. Nowadays, education base on practicality is more appropriate to use.

Reference

- Mohamed, A. H. (2000). *Asas ukur kejuruteraan*. Penerbit UTM.
- Masirin, M. I. M., Mohamad, N. A. B., & Samsuddin, N. B. (2014). analysis of road infrastructural audit (RIS) along Jalan BatuPahat-Kluang Malaysia: A case study. In *Proceeding of International Integrated Engineering Seminar, Batu Pahat* (p. 6).
- Arahan Teknik (Jalan) 2C/85. Manual on Traffic Control Devices: Temporary Sign And Work Zones Control (1985). Jabatan Kerja Raya Malaysia
- Arahan Teknik (Jalan) 2002 Guidelines for Inspection & Testing of Road Works Jabatan Kerja Raya Malaysia
- Nota Teknik (Jalan) 20/98 Design Review Checklist for Road Projects. Jabatan Kerja Raya Malaysia
- Nota C4302 Kejuruteraan Jalan Raya & Pengangkutan. Politeknik Malaysia
- Robinson, R., Danielson, U., & Snaith, M. S. (1998). *Road maintenance management: concepts and systems*. Macmillan International Higher Education.

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Zamzuri, A. K. (2012). *Modification of Slope Maintenance Program Along FT59, Jalan Tapah-Cameron Highland, Perak* (Doctoral dissertation, Universiti Teknologi Malaysia).

Suraji, A., & Sulistio, H. (2010). Model kecelakaan sepeda motor pada suatu ruas jalan. *Jurnal Transportasi*, 10(1).

TAJUDDIN, N. B. A. (2018). EFFECT OF TRAFFIC VOLUME AND SHOULDER WIDTH TOWARDS CRASH CASES AT JALAN KUANTAN BYPASS.