

EVALUATION OF SKIDDING PERFORMANCE
OF ASPHALT SURFACE USING
GRIPTESTER AND BRITISH SKID PENDULUM DEVICE

NUR-UL BALQES BINTI MD. ZAID

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University Technology Malaysia

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AL FATIHAH to my beloved late father, Hj. Md Zaid bin Hj. Abu Sujak

Specially dedicated to my beloved husband Alvy Bartholomeus Philip, mother Saadiyah binti Hj. Adnan , wonderful children Nur Alryana Dian, Alqid Dayni, Nur Alyssa Casissy, Aldiq Sopiad, Nur Atrycca Sandra, and all my friends.....

“Thanks a lot for your invaluable support and caring”.

“Our loves never ends..... In Shaa ALLAH.....”

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ABSTRACT

Good road means comfort for road users. The texture of road surface is very important for road users, to prevent road accidents from happening. If seen in highways, many tools are used to measure the slip road surface. Tools such as the British Pendulum and Grip tester are often used to test the slip road surface. These tools are the traditional tools and modern equipment, where by different way application, but with a purpose of which is to measure the slip road surface. The main objective of this study is to find relationship between British Pendulum and Griptester, and to develop evaluation model to predict the grip number using British Pendulum value. However, tests conducted by these two tools are only done on one type of surface material composed of ACW 20. This test was done at locations of the Expressway in Selangor and State Road in Melaka. Both of these tools are used for each location, after the data obtained from these tests are plotted to see the difference or relationship between these two devices. The analysis from this study indicates a very weak correlation. r^2 value plotted from these two sites are below 0.19. The study recommends further investigation on more testing on different types of surfaces to improve the understanding on the correlation between the British Pendulum Value and Grip Number.

ABSTRAK

Jalanraya yang baik memberikan keselesaan kepada pengguna jalanraya. Tekstur Permukaan jalanraya yang baik adalah penting untuk kegunaan pengguna jalan raya, bagi mengelakkan kemalangan jalanraya daripada berlaku. Jika dilihat dilebuh-lebuh raya, banyak alatan yang digunakan untuk mengukur tahap kegelinciran permukaan jalanraya. Alatan seperti *British Pendulum* dan *Griptester* sering didengari digunakan untuk menguji tahap kegelinciran permukaan jalanraya. Kedua-dua alat ini adalah alatan tradisional dan alatan moden, dimana aplikasi atau cara kerja alatannya berbeza, tetapi dengan satu tujuan iaitu untuk mengukur tahap kegelinciran permukaan jalanraya. Objektif utama kajian ini adalah untuk mencari perbezaan atau perkaitan alatan *British Pendulum* dan *Griptester* melalui penerbitan satu formula yang dapat digunapakai sebagai pekali dengan nilai bacaan *Griptester*. Walaubagaimanapun ujian yang dilakukan oleh dua alatan ini hanya dilakukan pada satu jenis permukaan yang bahannya terdiri daripada *ACW 20*. Lokasi ujian ini dilakukan di atas permukaan jalan *Express Way* sekitar Selangor dan jalan negeri di sekitar Melaka. Kedua-dua alatan ini digunakan untuk setiap lokasi, setelah itu data yang diperolehi daripada ujian ini diplotkan untuk melihat perbezaan atau perkaitan antara dua peralatan ini. Perkaitan yang amat lemah didapati dengan becaan r^2 kurang daripada 0.19. Pelbagai jenis permukaan jalanraya dicadangkan sekiranya kajian lanjut dijalankan bagi memahami dengan lebih mendalam perkaitan antara *British Pendulum* dan *Griptester*.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Road has played an important role in the trade and transportation system throughout the world, and it became rapid increase in the pavement infrastructure development in Malaysia. Gazette under Federal Roads Ordinance is usually roads linking the state capitals, airports, railway stations and ports. Currently, Malaysia has more than 80,300 km roads. The road is divided into three main categories namely toll expressway (1,700 km), federal roads (17,500 km) and state road (61,100 km) and the life spans are between 10 to 15 years (Zakaria and Hassan, 2005). Local authority road (city mall, municipal or local council) or kampung (district office) road is depending upon jurisdiction and normally maintained by responsibility local authority (Haron, 2004).

Various testing and environment factors can affect the skid resistance. Understanding the factors that exist is important when trying to relationship the result from different devices (Wallman and Astrom, 2001). There are many devices used to measure skid resistance based on different surfacing material. However for this paper, two devices namely Griptester (Figure 1.0) and British Pendulum Tester (Figure 1.1) are used to find relationship between and value effect.

Skid resistance can be determined by a number of pieces of equipment, all are measuring the frictional resistance of rubber material (vehicle tire) over the road surface. One of the long standing devices is the manually operated British Pendulum which has a small rubber foot (75 X 25 mm) attached to a pendulum that swings over the road surface. The frictional resistance is measured against a scale attached to the equipment.

Table 1.0 : Zones of skid resistance demand (Austroads, 2011)

Generic Zone	Recommended minimum level of testing
1. Low skid resistance demand	Process monitoring (e.g. network laser texture surveys or visual analysis as a minimum)
2. Medium skid resistance demand	Targeting testing (e.g. portable and towed devices such as British Pendulum, Griptester, ROAR as a minimum)
3. High skid resistance demand	Network monitoring (e.g. SCRIM – where coast effective – portable and low devices as a minimum)
4. High density urban	SCRIM or Griptester for inaccessible sites.

Other more recent and automated devices use tires that rotate at rates less than that of the tires of the vehicle they are attached to, resulting in a braking or sliding action. The braking rate may be fixed or varied and the tire may be straight or set at an angle. Recording of test result is now automated allowing for greater quantities of data to be collected and more easily analyzed. Testing can be done using smooth or treaded tires, but for better and more consistent result the smooth tire is preferred. Automated testing within the Transport Services Division utilizes a Griptester.



Figure 1.0 : Griptester Device



Figure 1.1 : British Pendulum Device

Sub-grade, sub-base, road base and the surfacing which consist of binding course and wearing course is generally the road pavement structure classified. The wearing course is the exposed top most layer that provides the travel path, skid resistance, safety and comfort to the road user. Categories of bitumen pavements involved in this study is Asphaltic Concrete Wearing 20 (ACW 20).

1.2 Background of Study

Skid resistance refers to the frictional properties of the road surface measured using a specified device under standardized conditions (Design Manual For Roads and Bridges Volume 7). According to Buatos et al. (2004), road agencies usually use different devices to compare friction measurement. Based on previous research, most of the studies focused on friction measurement and the correlation between road friction and traffic safety. Some of them correlate with the devices that are unfamiliar in Malaysia with a known device like the British Pendulum.

1.3 Problem Statement

Skidding continues to be a factor in the tendency for accident to take place, more especially when the road surface is wet. Different data might be obtained by the use of different measuring tool slippage. It involves the tradition tool British Pendulum and Griptester as the tools of modern. Griptester method involves high cost compare British Pendulum, this study was conducted to get the relationship between British Pendulum and Griptester.

1.4 Objective of Study

This study objective was to find relationship between British Pendulum and Griptester, and to develop evaluation model to predict the grip number using British Pendulum value.

1.5 Scope of Study

The study investigated the different devices between British Pendulum and Griptester of the various bituminous surfaces in Malaysia, that include flexible pavement ACW 20. The study involves field survey on this pavement surface in Selangor and Melaka. The study investigated two devices data test to get relationship between these two devices.

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