# Micro asphalt SCRIM / griptester correlation study

Ellis, R., Slate, D., & Woodward, D. (2009). Micro asphalt SCRIM / griptester correlation study. In E. Santagata (Ed.), *Unknown Host Publication* (Vol. 2, pp. 751-758). Politecnico di Torino.
http://tris.trb.org/view.aspx?id=899185

Link to publication record in Ulster University Research Portal

**Published in:**
Unknown Host Publication

**Publication Status:**
Published (in print/issue): 01/01/2009

**Document Version**
Publisher's PDF, also known as Version of record

**General rights**
Copyright for the publications made accessible via Ulster University's Research Portal is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**
The Research Portal is Ulster University's institutional repository that provides access to Ulster's research outputs. Every effort has been made to ensure that content in the Research Portal does not infringe any person's rights, or applicable UK laws. If you discover content in the Research Portal that you believe breaches copyright or violates any law, please contact pure-support@ulster.ac.uk.

Download date: 24/07/2024

# Micro asphalt SCRIM / griptester correlation study

R. Ellis & A. Slate
*Gulf Laboratories, Doha, Qatar*

D. Woodward
*University Of Ulster, Jordanstown, Northern Ireland*

ABSTRACT: This study compares the measurement of skid resistance using GripTester and SCRIM carried out in September 2005 on a micro asphalt trial site on a major route in the South East of England. A comparative assessment of skid resistance measurement techniques using SCRIM, GripTester and pendulum was carried out. The principle aim was to determine whether the 2005 TRL SCRIM / GripTester correlation applied to micro asphalt. This was important as this type of surfacing had not been assessed during the 2004 TRL correlation study and the GripTester was being used to evaluate the early and mid-life performance of the different micro asphalt road trial test sections. The study set out to determine relationships between the two methods, as well as measure skid resistance using the two main methods available in the UK i.e. SCRIM and GripTester. Further objectives were to determine whether micro asphalt skid resistance values plot in a similar trend to the surfaces assessed during the 2004 TRL SCRIM / GripTester correlation survey. It has resulted in the first full-scale micro asphalt road trial in the UK to assess differing aggregates in the provision of wet skid resistance. This trial has allowed the development of micro asphalt early life skid resistance to be studied for the first time in detail over a two year period. The trial also facilitated the first UK SCRIM / GripTester skid resistance measurement correlation study for micro asphalt.

## 1 INTRODUCTION

Micro asphalt is a combination of nominal 6mm aggregate, bitumen emulsion, Ordinary Portland Cement (OPC), water and additive. This is mixed cold and applied in-situ by a purpose-built paver as a thin layer, the process meets many of the ideals of sustainable highway construction. The primary function of a highway surfacing is provision of an adequate level of wet skid resistance, as poor wet skid resistance has been linked to high accident rates on the road network. The British and European standard test for assessing aggregate skid resistance is the Polished Stone Value (PSV) test (BS EN 1097-8:1999). A full scale road trial was installed on a class A road in the South East of England. This was critical to assessing the performance of the different aggregates / mixes under trafficking. This then led to a collaborative investigation with The Transport Research Laboratory (TRL) to determine whether the established relationship between SCRIM (BS 7941-2: 1999) and GripTester (BS 7941-2, 2000) was relevant for micro asphalt materials. Research has proven that smaller sized aggregates (i.e. 2.8mm-6.3mm) have the ability to provide acceptable levels of early and long life skid resistance especially when laid as a micro asphalt type material. This however is due not so much to the PSV of the aggregate but the aggregates ability of retention of angularity, (Ellis, R: 2007).

## 2 EQUIPMENT & METHODOLOGY

The skid resistance equipment used in this study was a Transport Research Laboratory owned SCRIM machine, Highways Agency owned and loaned to TRL Mark II GripTester and University of Ulster Mark II GripTester. The TRL SCRIM machine carried out five test runs from the lay by at The Forstal start of the micro asphalt, to the Boarshead Roundabout and back to the lay by. Each test run was approximately 7000m in length. These long test runs are referred to in this study as long test runs. The Highways Agency Mark II GripTester was on loan to TRL for evaluation purposes. The TRL tow vehicle did not have an offset tow bar to enable measurement in the inside wheel path. The University of Ulster Mark II GripTester tow vehicle was a Citroen Berlingo van fitted with an off- set tow bar that allowed the measuring wheel of the GripTester to run in the inside wheel path for all test runs. The University of Ulster Berlingo van was driven by Dr. David Woodward and used to tow both GripTesters. The test speed was maintained at 50km/h with the aid of an in-car NAVMAN satellite navigation system. Water was applied to the road surface at a rate of 10.4l/min from a 250 litre water bag. A long test run similar to the TRL SCRIM long run was carried out using both GripTesters. A further four short test runs concentrating on the four micro asphalt test sections at the Boarshead Roundabout end of the trial site were also carried out using both GripTesters. These short GripTester test runs are referred to this report as short test runs. It had been hoped to carry out sand patch and laser measurement of texture depth, however this was not possible as the road surface was too wet on the day of testing.

## 3 WEATHER CONDITIONS

The road was not dry for the skid resistance testing. It had been raining the night before and on the morning of the test. A persistent light rain fell during the morning when the SCRIM and GripTesting took place. The rain stopped at midday with the road gradually drying towards mid afternoon.

## 4 LONG TEST RUN SCRIM DATA

The SCRIM data was reported by TRL as Speed Corrected (SC). Figure 1 plots the TRL SCRIM data in terms of chainage, starting at The Forstal, driving south towards the Boarshead Roundabout and returning north to The Forstal. Also plotted is the location of 12 Marker Locations used during the SCRIM surveys. These are detailed in Table 1. Figure 1 details the marker locations relevant to the chainage.

Table 1. Marker locations used during TRL SCRIM surveys.

| Marker | Event |
|---|---|
| 1 | Speed sign |
| 2 | Traffic island |
| 3 | Traffic island |
| 4 | Traffic island |
| 5 | Traffic island |
| 6 | Roundabout in |
| 7 | Roundabout out |
| 8 | Traffic island |
| 9 | Traffic island |
| 10 | Traffic island |
| 11 | Traffic island |
| 12 | Speed sign |

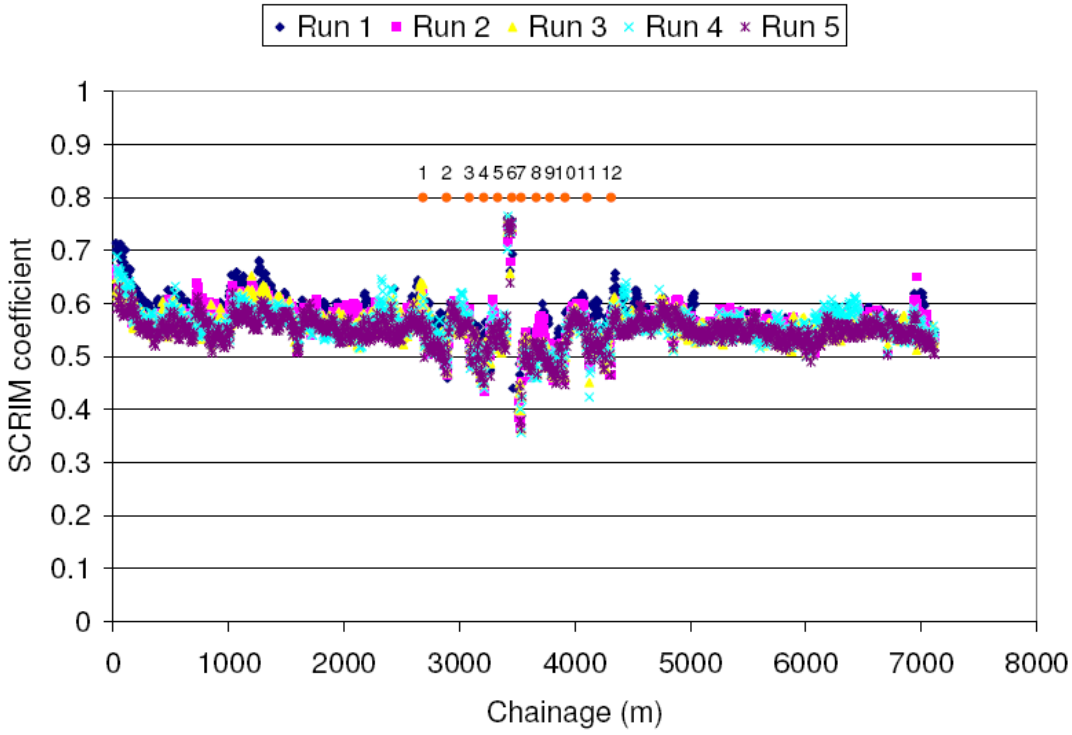


Figure 1. Plot of TRL SCRIM long test run data starting at The Forstal to Boarshead Roundabout and return.

Table 2 shows the average Speed Corrected SC value for each of the five SCRIM long test runs. Each long test run average is the average of approximately 1400 individual values measured over 5m intervals for the 7000m test run. Table 2 shows the five average values to be very similar with the overall average speed corrected SC being 0.56.

Table 2. Average speed corrected SC values for SCRIM long runs.

| | Run 1 | Run 2 | Run 3 | Run 4 | Run 5 | Overall average |
|---|---|---|---|---|---|---|
| Average speed corrected SC | 0.57 | 0.56 | 0.56 | 0.56 | 0.55 | 0.56 |

## 5 LONG TEST RUN GRIPTESTER DATA

The GripTester data was reviewed and GripNumbers removed from further analysis where the speed was not within the range 50 +/-5km/h or the water flow rate was 10.4+/2 l/min. This related to initial acceleration to the test speed and going around the Boarshead Roundabout. Table 3 shows the average GripNumber for the long test run carried out by each GripTester. Similar to the SCRIM data, the GripTester long test run average is the average of approximately 1400 individual values measured over 5m intervals for the 7000m test run. Table 3 shows that the average GripNumber for both GripTesters was 0.69.

Table 3. Average GripNumber for UU and HA / TRL GripTester long test runs.

| | Run 0946<br>UU GripTester | Run1030<br>HA / TRL GripTester |
|---|---|---|
| Average GripNumber | 0.69 | 0.69 |

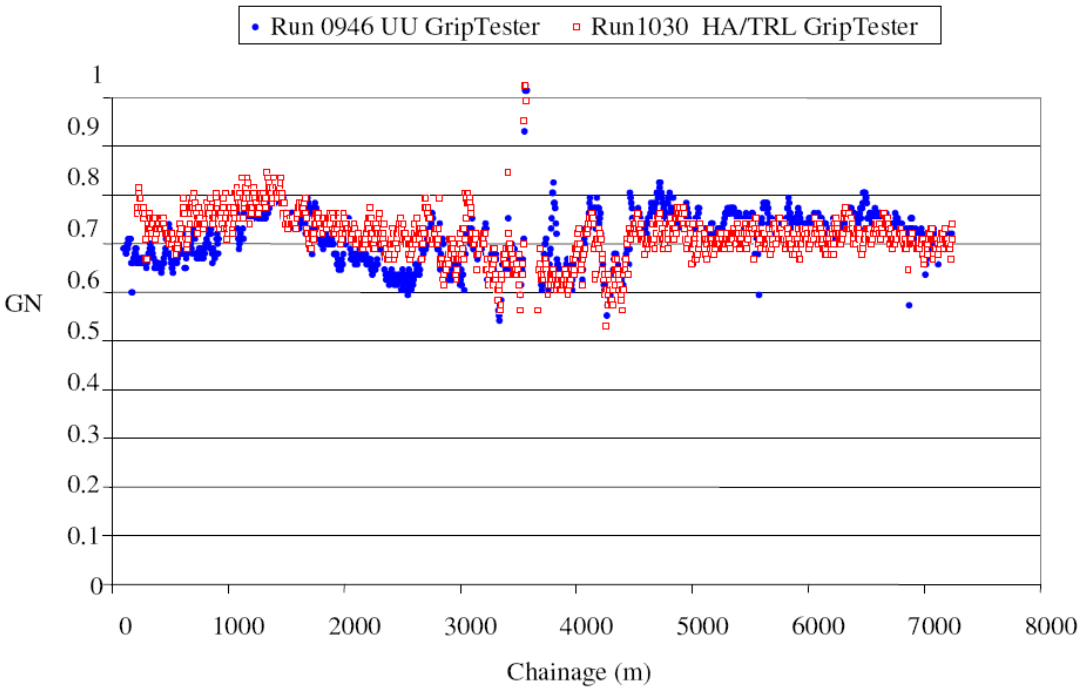


Figure 2. Plot of UU and TRL/HA GripTester long test run data starting at The Forstal to Boarshead Roundabout and return

## 6 CORRELATION OF LONG TEST RUN DATA WITH 2004 TRL SCRIM / GRIPTESTER DATA

Table 4 summarises the mean SCRIM and GripTester results from the 2004 correlation trial of SCRIM and Mark II GripTester held at TRL on 21st April. This shows the data obtained from the 7 TRL test sections that were assessed during the correlation study. A micro asphalt type surface was not included in the 2004 correlation study. This data gives the following equation:

$$SCRIM = 0.85 \times GripNumber,\ R^2 = 0.97 \text{ (original correlation data)} \quad (1)$$

Table 4. Summary of 2004 correlation data and micro asphalt average long run data.

| | | Mean GripNumber | SC from mean of all SCRIMs |
|---|---|---|---|
| Data taken from 2004 correlation | TRL section 21 | 0.65 | 0.56 |
| | TRL section 22 | 0.69 | 0.55 |
| | TRL section 23 | 0.58 | 0.43 |
| | TRL section 24 | 0.08 | 0.10 |
| | TRL section 25 | 0.78 | 0.70 |
| | TRL section 27 | 0.81 | 0.70 |
| | TRL section 28 | 0.82 | 0.71 |
| Micro asphalt data from A26 trial | Average long run | 0.69 (HA / TRL GripTester)<br>0.69 (UU GripTester) | 0.56 |

The data from Table 4 is plotted in Figure 4 and shows the $R^2$ value to be 0.97. Also included in Table 4 is the average SCRIM and GripTester data obtained for the micro asphalt surfaces during the long test runs. Figure 4 is an amendment of Figure 3 with the micro asphalt SCRIM and GripTester long test run data superimposed. It can be seen that addition of the micro as-

phalt data set has virtually no effect on both the equation and the $R^2$ value. The amended correlation equation incorporating the micro asphalt data obtained from the trial is:

$$SCRIM = 0.84 \times GripNumber,\ R^2 = 0.97 \text{ (with long test run data)} \quad (2)$$

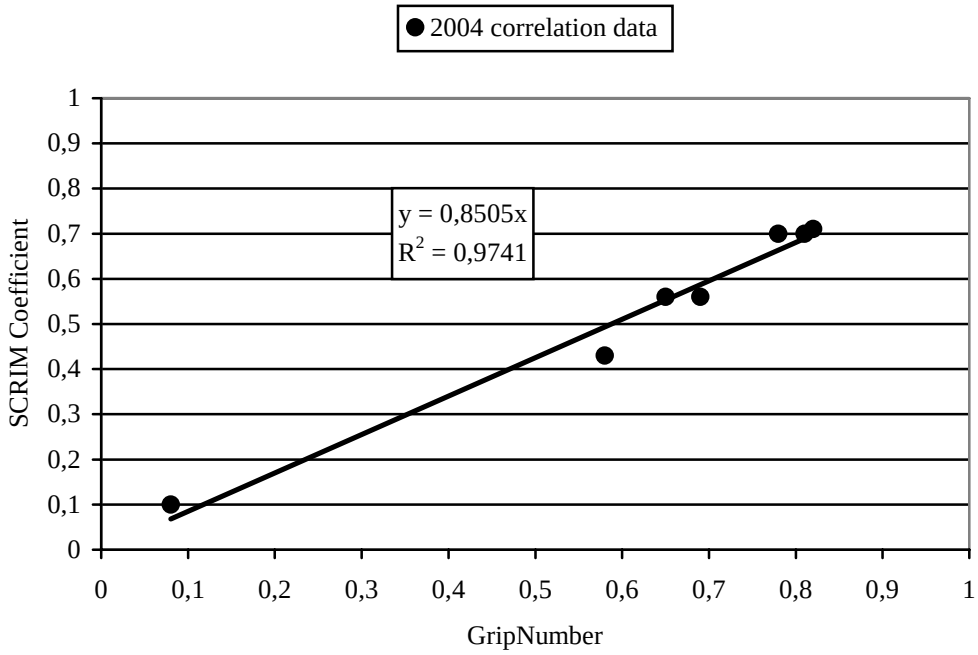


Figure 3. Data taken from 2004 SCRIM / GripTester correlation report.

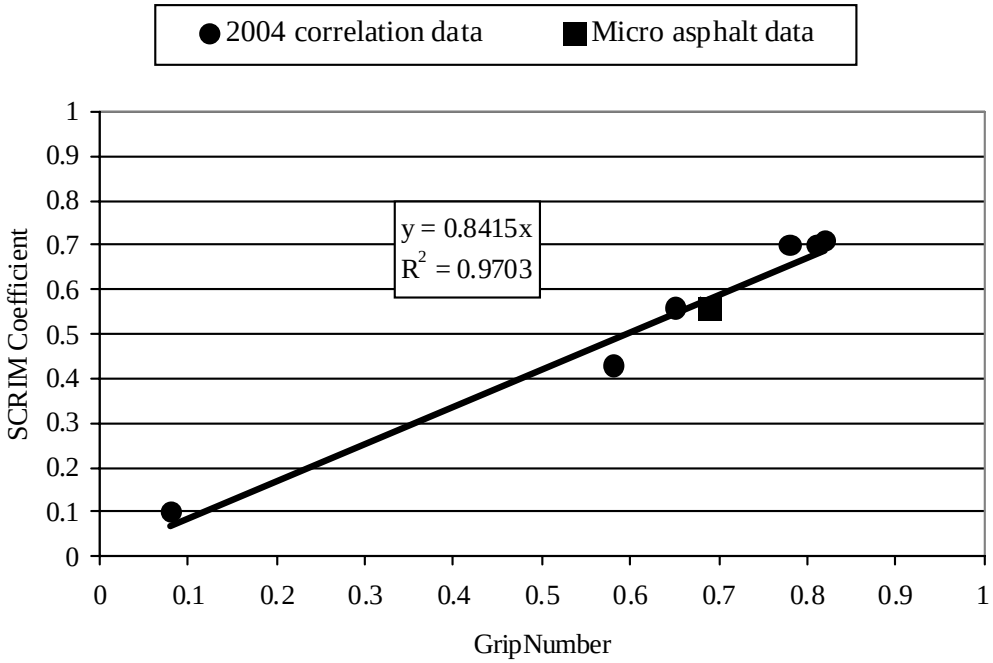


Figure 4. Data taken from 2004 SCRIM / GripTester correlation report with addition of micro asphalt trial long test run test data.

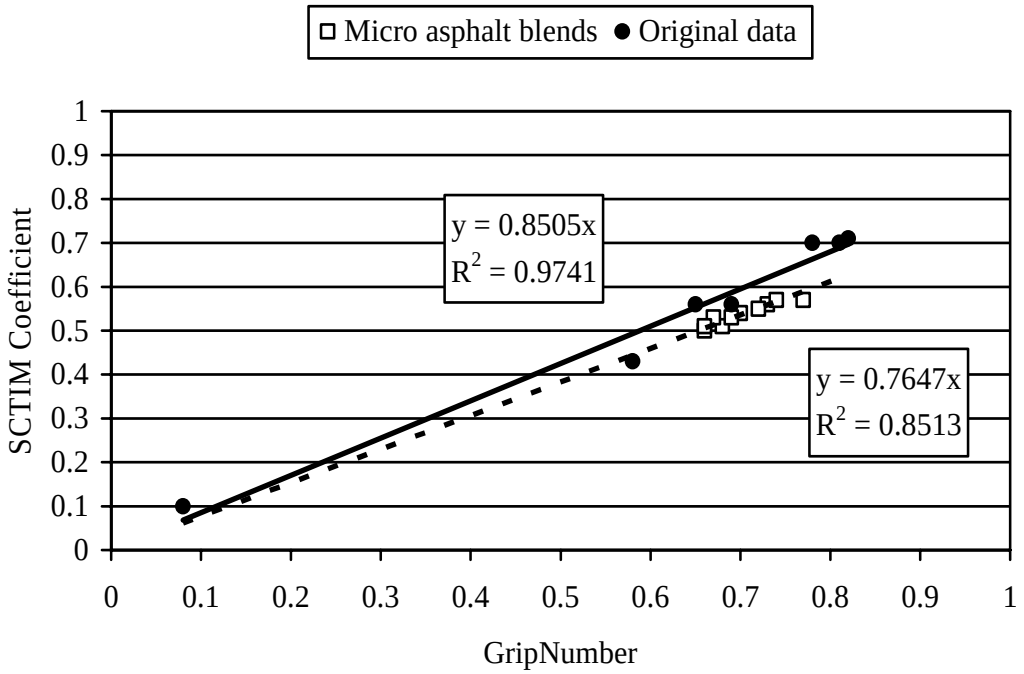


Figure 5. SCRIM and GripNumber data for each of the five micro asphalt blends.

## 7 CORRELATION OF A26 SHORT TEST RUN DATA WITH 2004 TRL SCRIM / GRIPTESTER DATA

Figure 5 is an amendment of Figure 4 based on the short test run SCRIM and GripTester data. It can be seen that this has little effect on both the equation and the $R^2$ value. The amended correlation equation based on the short test run data obtained from the A26 trial is:

$$SCRIM = 0.83 \times GripNumber,\ R^2 = 0.95 \text{ (with short test run data)} \quad (3)$$

## 8 COMPARISON OF SCRIM COEFFICIENT AND GRIPNUMBER FOR INDIVIDUAL MICRO ASPHALT TEST SECTIONS

A comparison of the SCRIM Coefficient and GripNumber for individual test sections is shown in Table 5.

Table 5. Comparison of SCRIM Coefficient and GripNumber for individual micro asphalt test sections.

| Test Section | SCRIM Coefficient | GripNumber |
|---|---|---|
| Southbound | | |
| GF2 | 0.56 | 0.73 |
| Mix 4 | 0.54 | 0.70 |
| Mix 3 | 0.57 | 0.74 |
| Mix 2 | 0.51 | 0.68 |
| Mix 1 | 0.53 | 0.69 |
| Northbound | | |
| GF2 | 0.57 | 0.77 |
| Mix 4 | 0.53 | 0.67 |
| Mix 3 | 0.55 | 0.72 |
| Mix 2 | 0.50 | 0.66 |
| Mix 1 | 0.51 | 0.66 |

## 9 CONCLUSIONS

The skid resistance of five different micro asphalt mixes was determined using the two main methods available in the UK i.e. SCRIM and GripTester. All of the micro asphalt mixes have SCRIM values that exceed the investigatory levels given in Table 4.1 of HD28/04. Analysis of the data allowed relationships to be evaluated between the two methods. It was found that micro asphalt skid resistance values plot in a similar trend to the surfaces assessed during the 2004 TRL SCRIM / GripTester correlation survey. This was proven using data from both the long and short test run analysis.

The variation in skid resistance for the five micro asphalt test sections measured using two methods is summarised in Table 6. This shows how each test section was ranked depending on test method and direction. Direction appears to have a small affect on the results. Table 6 shows that the SCRIM and GripTester methods have ranked the different surfaces in exactly the same order. It should also be pointed out that both the GripTester and SCRIM was averaging skid resistance over a 5m distance.

Table 6. Summary of data and rankings for individual micro asphalt test sections.

| Test Section | SCRIM Coefficient | Ranking | GripNumber | Ranking | Ranking | Total ranking score |
|---|---|---|---|---|---|---|
| MA 1 | 0.56 | 2 | 0.73 | 2 | 4 | 8 |
| Mix 4 | 0.54 | 3 | 0.70 | 3 | 3 | 9 |
| Mix 3 | 0.57 | 1 | 0.74 | 1 | 1 | 3 |
| Mix 2 | 0.51 | 5 | 0.68 | 5 | 5 | 15 |
| Mix 1 | 0.53 | 4 | 0.69 | 4 | 2 | 10 |
| MA 1 | 0.57 | 1 | 0.77 | 1 | 5 | 7 |
| Mix 4 | 0.53 | 3 | 0.67 | 3 | 4 | 10 |
| Mix 3 | 0.55 | 2 | 0.72 | 2 | 1 | 5 |
| Mix 2 | 0.50 | 5 | 0.66 | 4.5 | 2 | 11.5 |
| Mix 1 | 0.51 | 4 | 0.66 | 4.5 | 3 | 11.5 |

## REFERENCES


BS 7941-2: 1999. *Methods for measuring the skid resistance of pavement surfaces* – Part 1: Side way force coefficient routine investigation machine, London: BSI.

BS 7941-2: 2000. *Surface friction of pavements* – Part 2: Test method for measurement of surface skid resistance using the GripTester braked wheel fixed slip device. London: BSI.

BS 812-114: 1989. *Testing aggregates - Part* 113: Method for determination of polished-stone value, London: BSI.

ELLIS., R., 2007. *A study of the effect of aggregate on the wet skidding resistance of micro asphalts*, Thesis (PhD). University of Ulster.

GRIPTESTER – *SCRIM Correlation Report 2004*. Copies available by contacting customservice@findlayirvine.com or by writing to Findlay Irvine Ltd, Bog Road, Penicuik, Midlothian EH26 9BU. Tel. 01968 671200.

HIGHWAYS AGENCY, 2004. *Design manual for road and bridges*. Volume 7 pavement design and maintenance, section 3 pavement maintenance assessment, part 1 skidding resistance. London: TSO, HD28/04.