



the ukpms user manual
Volume 3: Machine Data Collection for UKPMS
Chapter 11: GripTester

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1. Preamble

This Chapter is intended to provide a brief overview of the GripTester and its use, specifically within UKPMS. It also directs the reader, where appropriate, to other Chapters of the UKPMS User Manual and/or other references for more detailed information.

2. Introduction

Chapter 6 of Volume 3 of the UKPMS User Manual provides an overview of the frictional properties of road surfaces and describes the use of the Sideways-Force Coefficient Routine Investigation Machine (SCRIM) for the measurement of skid resistance. The GripTester is an alternative device (to SCRIM) for measuring skid resistance within UKPMS.

The GripTester is a three wheeled device that is (normally) towed behind a vehicle. A braking force is applied to one of the wheels and this is processed to generate a GripNumber (GN) – which is a measure of the skid resistance offered by the road surface. This methodology differs to SCRIM (see Chapter 6 of Volume 3 of the UKPMS User Manual). As such the results from the two measurement techniques are not interchangeable. However, correlations have been established which enable GripTester results to be converted to equivalent SCRIM values (and vice versa).

3. Background

The GripTester has been used for highway and airport applications since the 1980s. These devices are commercially available from a range of sources.

A comparison between the measurements obtained from the GripTester Mark 1 and SCRIM was undertaken at the Transport Research Laboratory (TRL) in 1993 and a correlation was established. Further developments resulted in the production of the GripTester Mark 2 – for which it is claimed that the precision and repeatability of results is significantly better¹. A further trial was undertaken at TRL in April 2004 and a new correlation with SCRIM values was established¹.

These correlations enabled highway authorities to link GripTester results with the threshold values contained within HD 28/04 of the Design Manual for Roads and Bridges (Volume 7, Section 3, Part 1).

The use of the GripTester for routine measurement and monitoring is advocated within the CSS Guidance Note “*Skidding Resistance*” (May 2005). This guidance note formed the basis for the summary of “*Skidding Resistance*”

¹ “*Report on Correlation of SCRIM with the Mark 2 GripTester Trial at TRL*” Jacobs Babbie, Glasgow (2004)



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Survey Requirements” contained within “*Well Maintained Highways – Code of Practice for Highway Maintenance*” (UK Roads Board, Issue No. 5.6, May 2005).

Wider acceptance of the GripTester was gained via its inclusion within the “*International Experiment to Compare and Harmonize Skid Resistance and Texture Measurements*” conducted by PIARC in 1992². This enabled GripTester results to be correlated with threshold values of the International Friction Index (IFI).

In 2004, the GripTester was included in the list of permitted surveys for UKPMS and included in the HMDIF specification.

4. Test Principle

For a full description of the test method, reference should be made to BS7941; Part 2: 2000 “*Methods for measuring the Skid Resistance of Pavement Surfaces. Test method for measurement of surface skid resistance using the GripTester braked wheel fixed slip device*”, BSI.

The GripTester is a three wheeled device that is (normally³) towed behind a vehicle. Two of the wheels are located on a single, driven axle. The third, measuring, wheel (which has a smooth tyre) is set parallel to the other two wheels and the road surface in front of it is wetted by a controlled flow of water. The measuring wheel is connected to the driven axle by a geared mechanism that causes it to rotate at a slower rate than the other two wheels and this generates a braking force.

The horizontal and vertical forces acting on the wheel are continuously monitored. The ratio of these forces is used to calculate a GripNumber (GN) – which is related to the wet skid resistance of the road surface.

In towing mode, the GripTester can operate within a speed range of 30 to 130km/h. The usual speed for highway testing is 50km/h. Special temporary traffic management measures are not normally required for its safe use.

² “*International Experiment to Compare and Harmonize Skid Resistance and Texture Measurements*”, PIARC, 01.04.T, Cedex, France – Published 1995

³ The GripTester can be pushed by hand on a pre-wetted road surface for small area surveys.



5. Test Considerations

Reference should be made to Chapter 6 of Volume 3 of the UKPMS User Manual for guidance on:

- Test Networks.
- Site Categories and Investigatory levels.
- Survey Methods.

5.1 Choice of Measuring Device

The methods for measuring skid resistance via SCRIM and GripTester are significantly different and the results are not interchangeable. The CSS recommends that:

- The same type of measuring device is used consistently across an authority's network.
- Once chosen, the type of device is not frequently changed.

5.2 Correlation with SCRIM

Skid resistance standards have been developed by establishing the relationship between skid resistance and accident risk at different types of site. An Investigatory Level is a limit above which the skid resistance is assumed to be satisfactory. Investigatory Levels are defined in terms of Characteristic SCRIM Coefficient (CSC). Reference should be made to Chapter 6 of Volume 3 of the UKPMS User Manual for further details.

Correlation values have been established to enable GripNumbers to be compared with Investigatory Levels. These correlation values differ according to whether a Mark 1 or Mark 2 GripTester is used. Only official, published values should be used for this purpose.

It is normal practice to convert Investigatory Levels from SCRIM to equivalent GripNumbers. This approach reduces the scope for error.

Table 1 is an adaptation of the Investigatory Levels provided within HD 28/04 (DMRB, Volume 7, Section 3, Part 1). In this example, for a Mark 2 GripTester, a conversion factor of 0.85 is used to relate GripNumbers to SCRIM results.

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Site Category and Definition		Investigatory Level at 50 km/h								
		SFC	0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
		GN	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.76
A	Motorway									
B	Dual carriageway – non event									
C	Single carriageway – non event									
Q	Approaches to and across minor and major junctions, approaches to roundabouts									
K	Approaches to pedestrian crossings and other high risk situations									
R	Roundabout									
G1	Gradient 5 – 10 % longer than 50m									
G2	Gradient > 10% longer than 50m									
S1	Bend radius < 500m – dual carriageway									
S2	Bend radius < 500m single carriageway									

Sources:

- HD 28/04 (DMRB, Volume 7, Section 3, Part 1, Table 4.1)
- “Report on Correlation of SCRIM with Mark 2 GripTester Trial at TRL” Jacobs Babbie, Glasgow (2004).

Notes:

Reference should be made to Chapter 4 of HD 28/04 and, in particular, the notes to Table 4.1 (of HD 28/04) for guidance on interpretation.

Key:

	Investigatory Levels that will generally be used for trunk roads carrying significant traffic levels.
	Investigatory Levels that will be appropriate in low risk situations, such as low traffic levels or where the risks present are well mitigated and a low incidence of accidents has been observed.

Table 1 Site Categories and Investigatory Levels



6. GripTester HMDIF

Table 2 provides an example of the file structure and content of a GripTester HMDIF file that would be produced by a Contractor.

```
HMSTART ukPMS 001 " " , \
TSTART;
SURVEY\ TYPE,VERSION,NUMBER,SUBSECT,MACHINE,XSPUSED;
SECTION\ LABEL,SNODE,LENGTH,SDATE,EDATE,STIME,ETIME;
THRESHLD\FTXSECT,FTSCHAIN,FTECHAIN,FTSDATE,FTNUM,PIFIND,SCODE;
OBSERV\DEFECT,XSECT,CHAIN,ECHAIN;
OBVAL\PARM,OPTION,VALUE,PERCENT;
TEND\7;
DSTART;
SURVEY\ GRIP,,12,10M,GT290,F;
SECTION\ A244/1213,050182S,100,211104,211104,,;
THRESHLD\CL1,0,50,,0.65,D,S1;
THRESHLD\CL1,50,60,,0.41,D,C;
THRESHLD\CL1,60,70,,0.59,D,G2;
THRESHLD\CL1,70,100,,0.53,D,Q;
OBSERV\GPN,CL1,0,10;
OBVAL\33,,0.43,V;
OBSERV\GPN,CL1,10,20;
OBVAL\33,,0.49,V;
OBSERV\GPN,CL1,20,30;
OBVAL\33,,0.49,V;
OBSERV\GPN,CL1,30,40;
OBVAL\33,,0.60,V;
OBSERV\GPN,CL1,40,50;
OBVAL\33,,0.61,V;
OBSERV\GPN,CL1,50,60;
OBVAL\33,,0.57,V;
OBSERV\GPN,CL1,60,70;
OBVAL\33,,0.56,V;
OBSERV\GPN,CL1,70,80;
OBVAL\33,,0.54,V;
OBSERV\GPN,CL1,90,100;
OBVAL\33,,0.53,V;
DEND\26;
HMEND\35;
```

Table 2 Example GripTester HMDIF