



the ukpms user manual
Volume 3: Machine Data Collection for UKPMS
Chapter 6: SCRIM

Document Information

Title (Sub Title)	The UKPMS User Manual Volume 3: Machine Data Collection for UKPMS Chapter 6. SCRIM
Product Number	UKPMS Manual_03_06
Author	Chris Walsh
Description	The UKPMS User Manual Machine Data Collection for UKPMS - SCRIM

Document History

Version No	Status	Author	Date	Changes from Previous Version
01	Draft	CW	22.07.05	First release for internal review
02	Draft	CW	25.07.05	Second release for external review
03	Draft	CW	09.08.05	Third release incorporating external reviewers' comments

UKPMS Support Office
Chris Britton Consultancy
#4 Howard Buildings
69 - 71 Burpham Lane
Guildford
Surrey
GU4 7NB

www.ukpms.com

Email: support@ukpms.com
Phone: +44 (0)1483 405027
Fax: +44 (0)1483 452264



Contents

1. Preamble.....	6/3
2. Introduction.....	6/3
3. Background.....	6/3
4. Test Principle.....	6/4
5. Test Considerations	6/5
5.1 Test Network.....	6/5
5.2 Site Categories and Investigatory Levels	6/5
5.3 Survey Method	6/6
5.3.1 Mean Summer SCRIM Coefficient Method.....	6/6
5.3.2 Single Annual Survey Method	6/6
5.3.3 Annual Survey with Benchmark Method.....	6/7
6. Processing of Test Results	6/7
7. SCRIM HMDIF	6/7



1. Preamble

This Chapter is intended to provide a brief overview of SCRIM testing 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

Skid resistance is the term used to describe the frictional properties of a road surface under measurement. The maintenance of adequate levels of skidding resistance on running surfaces is an important aspect of highway maintenance, and one that contributes significantly to network safety. The Sideways-Force Coefficient Routine Investigation Machine (SCRIM) is one of the standard devices used for measuring and monitoring skid resistance within UKPMS (the other being the GripTester- see Chapter 11).

3. Background

When monitoring road surfaces for safety reasons, engineers are interested in replicating conditions in which skid resistance is low. Conventional theory suggests that the skid resistance of a road surface is reduced when it is wet.

The skid resistance of a wet road is related to the texture of the road surface at two levels; microtexture and macrotexture. At low speed, the skid resistance of a road is dependant upon the microtexture of the aggregate particles at the surface. This property is necessary for vehicle tyres to penetrate films of water on the surface of the road and achieve sufficient contact. It is important at all traffic speeds but is seen to predominate up to 50km/h. At speeds above 50km/h, skid resistance is more dependant upon the overall texture of the road surface and its ability to disperse water from between the vehicle tyre and the road surface. This ability is provided by the macrotexture of the road surface. Microtexture is the main component measured by SCRIM.

Skid resistance is not a constant, and varies throughout the course of the year. This is termed “seasonal variation”. During the winter months, roads are predominantly wet and as a consequence the main form of detritus that is able to accumulate on the surface is grit. The action of traffic grinds the grit into contact with the road surface. This abrasive action increases the texture of the road surface and causes its skid resistance to rise. Conversely, during the summer months, roads are comparatively dry and the detritus on the road is mainly dust. The action of traffic causes this dust to polish the road surface and hence the skid resistance reduces.



the ukpms user manual

Volume 3: Machine Data Collection for UKPMS

Chapter 6: SCRIM

To provide an indication of the lowest available skid resistance under normal conditions, SCRIM testing is carried out within a season that extends from 1st May through to 30th September.

As well as seasonal variations, other factors which can affect the measured value of skid resistance include:

- Ambient temperature
- Surface temperature
- Test Speed
- Weather Conditions
- Traffic Flow

The sensitivity of skid resistance measurements provided by SCRIM to these factors is reduced by following a standardised test procedure (see Section 4).

Reference should be made to HD 28/04 (Design Manual for Roads and Bridges, Vol.7, Section 3, Part 1) for further details on skid resistance and the principles behind SCRIM. The CSS issued a guidance note on “*Skidding Resistance*” in May 2005 to summarise the actions Local Authorities should take to implement the advice contained within HD 28/04. This guidance note formed the basis for the summary of “*Skidding Resistance Survey Requirements*” contained within “*Well Maintained Highways – Code of Practice for Highway Maintenance*” (UK Roads Board, Issue No. 5.6, May 2005).

4. Test Principle

For a full description of the test method, reference should be made to BS7941; Part 1: 1999 “*Methods for measuring the Skid Resistance of Pavement Surfaces. Side-ways Force Coefficient Routine Investigation Machine*”, BSI.

The SCRIM is a road-going vehicle with an additional fifth wheel. The additional wheel is mounted mid-chassis in line with the nearside wheeltrack and a measured load is applied to it. The wheel is angled at 20 degrees to the direction of travel of the vehicle and is fitted with a smooth rubber tyre. The road surface in front of the wheel is wetted by a controlled flow of water. As the vehicle travels forward, the loaded wheel is caused to slide across the road surface. The force generated by the resistance to sliding is related to the wet skid resistance of the road surface.

The ratio of the force developed at right angles to the plane of the test wheel (i.e. the Side-ways Force) to the load on the wheel is the Side-ways Force Coefficient (SFC). The mean SFC value is normally computed for section lengths of 10m and processed to derive a Characteristic SCRIM Coefficient (CSC). This is an estimate of the underlying skid resistance once the effect of seasonal variations has been taken into account.



Since the SCRIM does not normally require traffic management, it must travel at the prevailing traffic speed. On motorways and dual carriageway all purpose trunk roads where the posted speed limit is greater than 50mph, the target test vehicle speed is 80km/h (49.7m/h). On all other roads, or where a SCRIM is being used without dynamic vertical load measurement, the target test vehicle speed is 50km/h (31.1m/h). The safety of the SCRIM operator and other affected road users takes priority at all times. Where target test speeds cannot be maintained, corrections to the recorded skid resistance are possible provided that they are collected within the speed range of 25 to 85km/h (15.5 to 52.8m/h).

For multiple lane carriageways, the most heavily trafficked lane should be surveyed. Generally, this is Lane 1.

5. Test Considerations

5.1 Test Network

Local Authorities should determine which roads are to be subject to SCRIM testing. This could be determined from the network's maintenance hierarchy (or alternatively by road classification) and should include consideration of traffic flow and accident risk. The network to be tested would normally be included within a Local Authority's Highway Management Plan.

5.2 Site Categories and Investigatory Levels

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 assigned based on broad features of the road type and geometry (i.e. the Site Category) plus specific features of the site including accident and traffic statistics.

If a section of road is found to have a level of skid resistance at, or below, a predetermined Investigatory Level then a detailed site investigation is instigated. Local Authorities must assign a Site Category and Investigatory Level to each section of the road network. Table 4.1 in HD 28/04 provides ten Site Categories with associated Investigatory Levels.

With the exception of roundabouts and Site Categories less than 100m in length, Investigatory Levels are typically applied to the mean CSC within 100m averaging lengths.

The Code of Practice for Highway Maintenance states that Investigatory Levels should be reassessed whenever a significant change to the network is made, for example the installation of traffic lights, a pedestrian crossing or a roundabout. Furthermore it says that the Investigatory Levels for the full



network should be reviewed every three years or as a result of a risk assessment.

Survey Method

Local Authorities can choose between three methods of survey included within HD28/04:

- Mean Summer SCRIM Coefficient Method.
- Single Annual Survey Method.
- Annual Survey with Benchmark Method.

5.3.1 Mean Summer SCRIM Coefficient Method

This method requires three separate surveys of the same stretch of road be undertaken between May and September (incl.) within the same year. The resultant Mean Summer SCRIM Coefficient (MSSC) values take account of seasonal variations in skid resistance (see Section 3). However, Authorities are only required to monitor one third of their network each year using this method. This means that the network is only tested on a three year cycle.

Variations in skid resistance from one year to the next are to be expected. By monitoring skid resistance on a three-year cycle it is possible that permanent reductions in the skid resistance of a particular section (as a result of, say, changing traffic flow patterns) could go undetected for a considerable period. This could result in an unacceptable increase in accident risk during this time. Transient changes in skid resistance may also be evidenced when monitoring over long periods of time. Particularly hot or wet summers can result in uncommonly low values of MSSC across the road network. The distorting effect that such weather can have on the recorded MSSC values may not be apparent when compared against trend data with three year gaps. This could cause Local Authorities to undertake unnecessary investigations and intervention treatments.

Local Authorities must now decide whether to continue with the MSSC method or adopt one of the two new test methods introduced by the publication of HD28/04 described below.

5.3.2 Single Annual Survey Method

The Single Annual Survey method is advocated by the Code of Practice for Highway Maintenance. This regime requires a survey of the whole of the network annually. Over the course of a three year test cycle, each length of the road network is tested during early summer, mid summer and late summer. The Characteristic SCRIM Coefficient (CSC) is then calculated from the previous three year measurements. This approach reduces sensitivity to seasonal variations and can detect changes in the skid resistance on an annual basis.



5.3.3 Annual Survey with Benchmark Method

The Annual Survey with Benchmark method requires the whole of the network to be tested once in every year. Benchmark sites are selected and tested three times each year throughout the testing season. The results from the Benchmark sites are then used to reduce the seasonal variations in skid resistance for the results from the rest of the network.

6. Processing of Test Results

The SFC measured by SCRIM is known as the SCRIM Coefficient (SC). On completion of a survey SC shall be corrected for a number of factors:

- Speed - Measurements collected within the speed range of 25 to 85 km/h shall be corrected to a standard speed of 50km/h.
- Equipment – An “Index of SFC” is applied to all measurements to maintain consistent levels of SC whilst equipment and monitoring techniques are developed.

(Under normal UK conditions, the influence of the temperature of the road will be comparatively low. HD28/04 stipulates a minimum air temperature of 5°C for testing and states that above this, temperature correction is not required).

The corrected SC values are then used to calculate CSC or MSSC according to which of the three survey methods (Section 4.3) are used. Reference should be made to Annex 3 of HD28/04 for further details.

7. SCRIM HMDIF

Table 1 provides an example of the file structure and content of a HMDIF file that would be produced by the SCRIM Contractor. For the purpose of HMDIF files, CSC and MSSC are interchangeable.



the ukpms user manual
Volume 3: Machine Data Collection for UKPMS
Chapter 6: SCRIM

```
HMSTART ukPMS 001 " " ; , \
TSTART;
SURVEY\OWNER,TYPE,VERSION,NUMBER,SUBSECT,MACHINE,PREPROC,SVC,XSPUSED;
SECTION\NETWORK,LABEL,SNODE,LENGTH,SDATE,EDATE,STIME,ETIME;
THRESHLD\FTXSECT,FTSCHAIN,FTECHAIN,FTSDATE,FTNUM,PIFIND,SCODE;
OBSERV\DEFECT,VERSION,XSECT,SCHAIN,ECHAIN;
OBVAL\PARM,OPTION,VALUE,PERCENT;
TEND\7;
DSTART;
SURVEY\LA,SCRIM,1,14,10M,D437W,SKID,1,F;
SECTION\UKPMS,UKPMSA244/1213,050182S,60,210693,210693,,;
THRESHLD\CL1,0,50,210693,0.6,D,H1;
THRESHLD\CL1,50,60,210693,0.35,D,C;
THRESHLD\CR1,0,60,210693,0.35,D,C;
OBSERV\SFC,1,CR1,0,10;
OBVAL\12,,0.44,V;
OBSERV\SFC,1,CL1,0,10;
OBVAL\12,,0.49,V;
OBSERV\SFC,1,CL1,10,20;
OBVAL\12,,0.48,V;
OBSERV\SFC,1,CR1,10,20;
OBVAL\12,,0.46,V;
OBSERV\SFC,1,CR1,20,30;
OBVAL\12,,0.48,V;
OBSERV\SFC,1,CL1,20,30;
OBVAL\12,,0.48,V;
OBSERV\SFC,1,CR1,30,40;
OBVAL\12,,0.47,V;
OBSERV\SFC,1,CL1,30,40;
OBVAL\12,,0.46,V;
OBSERV\SFC,1,CR1,40,50;
OBVAL\12,,0.45,V;
OBSERV\SFC,1,CL1,40,50;
OBVAL\12,,0.41,V;
OBSERV\SFC,1,CR1,50,60;
OBVAL\12,,0.45,V;
OBSERV\SFC,1,CL1,50,60;
OBVAL\12,,0.39,V;
DEND\31;
HMEND\40;
```

Table 1 – Example SCRIM HMDIF