

Skid Resistance Policy

November 2011

DOCUMENT TITLE: Skid Resistance Policy						
DOCUMENT OWNER: Asset Manager – Scott Tompkins						
DOCUMENT LOCATION: S:\AssetManagement\General Asset Management\POLICIES & GUIDANCE\Skidding Resistance Policy						
Website:						
Rev 3	Revisions 12/09/11	JCB/AT	AT	ST	LCM	19 th March 2012
Rev 2	Final	AT	KH	ST		
Rev 1	1 st Draft	AT	KH			
Revision	Purpose Description	Originate	Checked	Review	Authorised	Date

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1. Introduction

- 1.1 The purpose of this document is to define a skid resistance policy for Gloucestershire. The design and maintenance of adequate levels of skidding resistance is an important aspect of asset management and contributes significantly to the safe usage of the network.
- 1.2 This policy will identify the practice and procedures adopted by Gloucestershire Highways from the guidance that is currently available and local experience. This will relate to the collection of condition data, the analysis and subsequent interpretation of the data, and the implementation of appropriate measures to improve network safety.

2. Skid Resistance

- 2.1 Skidding resistance can be defined as the measurement of the road surface friction under controlled conditions. This term refers to measurements of friction made on wet roads unless stated otherwise. These measurements are used to monitor the road surface and assess any need for maintenance against established criteria and practices. They cannot be directly related to the friction available to a road user when making a particular manoeuvre at a particular time on the same road.
- 2.2 Road surfaces in the County may be one of two distinct types, positively textured or negatively textured: Negative texture surfaces are those in which the surface is generally smooth but has voids or hollows. Tyres grip the surface by pressing down into the voids, unlike 'positive texture', in which the aggregate protrudes from the surface and presses into the tyres.

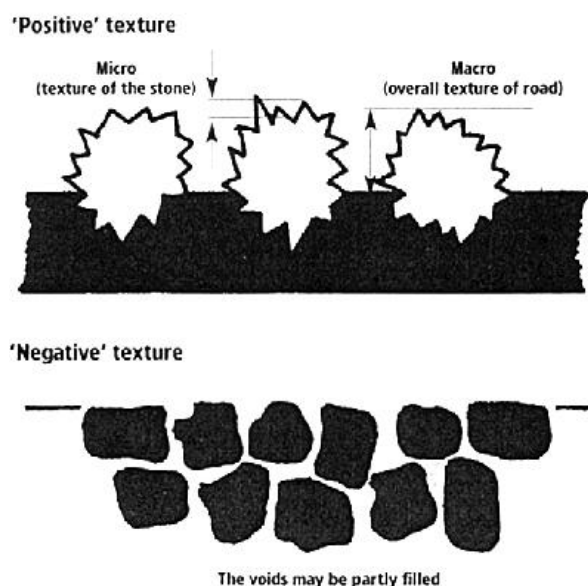


Figure 2.2: The difference between macro- and micro-texture and between positive and negative texture (after Walsh (2000). "Out of the skidpan..." Surveyor pp12-15, 9 November 2000)



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- 2.3 The skidding resistance of the road is measured indirectly using one of a number of testing devices that pass over the road surface, The high speed (>40kph) skidding resistance of the road is also a function of the macrotexture of the road surface
 - 2.4 The relative resistance of roadstone to polishing by traffic is measured under controlled laboratory conditions in the Polished Stone Value (PSV) Test. The relative resistance of roadstone to abrasion by traffic is measured under controlled laboratory conditions in the Aggregate Abrasion Value (AAV) test. PSV and AAV requirements for new road surfaces are detailed in the GCC Surface & Structural Maintenance Policy.

3. Objectives

- 3.1 Identify potential wet-skidding related collision sites and apply appropriate measures to reduce the risk of such collisions.
- 3.2 Investigate the skidding resistance at reported collision sites involving wet-skidding and take appropriate measures to remedy the situation where found necessary.

4. Current Guidance

- 4.1 The current Highways Agency standard for the management of skidding resistance is HD28/04, volume 7 of the Design Manual for Roads and Bridges. This guidance was developed for, and is provided for use on the Trunk Road network of England, Scotland, Northern Ireland and Wales, it is considered to be the default policy for the management of skidding resistance on a local authority network if no local policy is in place. A CSS (County Surveyors Society) technical note published in May 2005 provides more relevant guidance for local authority roads. The principle of HD28 is to broadly equalise the risk of skidding accidents across the network by providing a level of (wet road) skid resistance that is appropriate to each location. A key part of the Standard is therefore to identify locations where a greater level of friction is likely to reduce the risk of skidding accidents.
- 4.2 It is recognised that there can be issues associated with the “early life” skidding resistance of newly laid asphalt surfaces. Management of these surfaces is currently addressed in Interim Advice note IAN 49/03, this guidance was again issued for the UK trunk roads network.
- 4.3 Interim Advice Note 98/07 provides guidance to facilitate the effective application of the Skid Resistance Policy (HD28/04) by the Highways Agency and its Service Providers.



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- 4.4 The County Surveyors Society (CSS) guidance note on how HD28/04 can be implemented on local roads is summarised in Section 9.8 of the code of practice for Highway Maintenance – Well-maintained Highways.
 - 4.5 HD 36/06 (volume 7 of the Design Manual for Roads and Bridges) provides a table to enable the highway engineer to select a PSV appropriate to the traffic loading and site category. This table however is derived from studies undertaken on Trunk Roads rather than on roads that are representative of a rural county network. It is therefore reasonable to assume that the PSV requirements in HD36/06 may be over-specified.

HD36/06 states:

“On an existing site, if the life that has been achieved by the aggregates, the skid resistance and the skidding accident rate have all been satisfactory, then the continued use of the same aggregate source, albeit with a lower PSV (than that given in Table 3.1) may be considered.”

Thus local experience with lower PSVs performing adequately can be encompassed within an effective skidding policy.

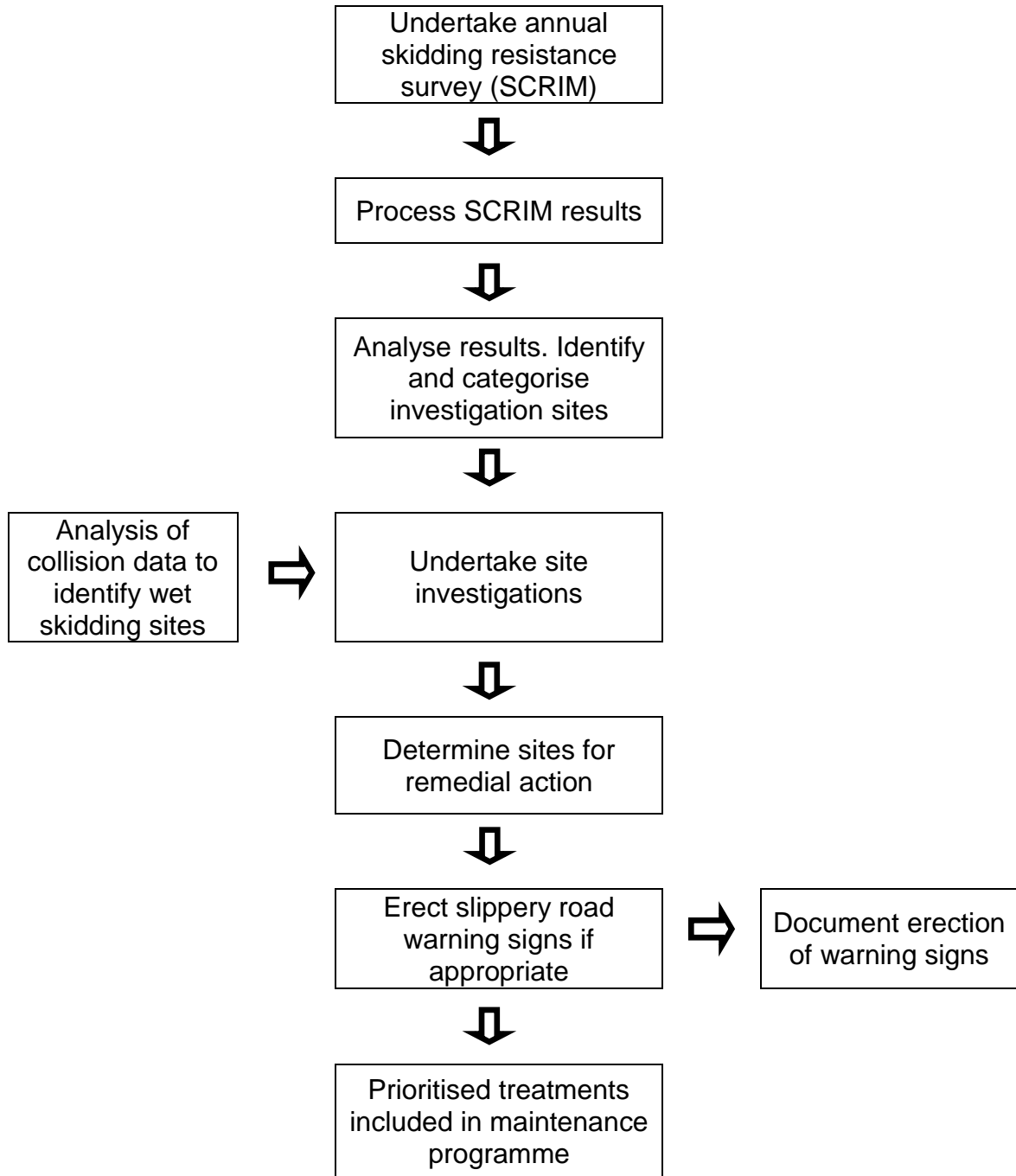
Gloucestershire has a significant number of roads where lower PSV stone has successfully performed with respect to wet skidding accident records and this experience has led to the creation of the modified ‘PSV Table’ included in the GCC Surface & Structural Maintenance Policy.

5. Operation

- 5.1 In Gloucestershire skid resistance testing is carried out annually on the network defined in Appendix A.
- 5.2 The procedures for making and interpreting skid resistance measurements will be in accordance with HD 28/04 Chapter 2.

A summary of the overall process is shown below:

Process for making and interpreting skid resistance measurements





6. Network

- 6.1 The Gloucestershire network tested are roads assigned a hierarchy value of 2 (Strategic) or 3a (Main Distributor), as defined in section 8.8 of Well-maintained Highways. This currently (October 2011) equates to 1223 lane kms of carriageway and comprises all Principal roads and B class roads with significant traffic flows. See appendix 1 for a map and listing of the existing network.
- 6.2 The network hierarchy will be reviewed annually prior to the survey commencing and any changes identified will be incorporated as necessary.

7. Test Equipment

- 7.1 The annual routine skidding resistance testing of the network will be undertaken using SCRIM (Sideway-force Coefficient Routine Investigation Machine). The SCRIM survey will be undertaken in accordance with the requirements of HD 28/04 and the contractor will be accredited to ISO 9001.
- 7.2 Road condition data is routinely collected by the SCANNER surveys that are carried out annually on the classified network. This data will be used during the site investigation process once specific sites have been identified.
- 7.3 On occasion, localised areas of the network may be tested using the Griptester 2 machine to determine if there is a deficiency in skidding resistance

8. Method of Survey

- 8.1 SCRIM surveys are currently undertaken annually from 1st May to 30th September. The survey year is split into three seasons - Early (1st May to 20th June), Middle (21st June to 10th August) and Late (11th August to 30th September). For the past three years the surveys in Gloucestershire were undertaken during the following seasons;

2008	Late season survey
2009	Early season survey
2010	Mid season survey

- 8.2 During these years, the MSSC (Mean Summer SCRIM Co-efficient) values were calculated by the Annual Survey with Benchmark Method. This method allows a single run survey to be undertaken with survey data also collected from benchmark sites during each of the three seasons. This benchmark data was used to correct the main survey for seasonal variations.



- 8.3 By 2011, full network survey data had been collected during each survey season of the proceeding three years. This historic data now enables CSC (Characteristic SCRIM Co-efficient) to be derived using the Single Annual Survey Method. This survey method is more preferable to others as it allows between year variations in the survey data to also be taken into account when calculating the CSC. The survey regime will now continue in the following cyclical manner;

2011	Late season survey
2012	Early season survey
2013	Mid season survey
2014	Late season survey

9. Investigatory Levels

- 9.1 The investigatory level (I.L.) represents a level of wet skidding resistance, given in terms of an Equilibrium SCRIM Co-efficient value, above which the risk of a wet skidding accident is no higher than the baseline wet skidding accident risk for the network (typically that of single carriageway non-event sections). The higher the CSC value, the greater the measured skidding resistance. The risk of a wet skidding accident is certainly more pronounced at sites such as bends, gradients, junctions and pedestrian crossings; hence these locations are assigned higher I.L.'s. The method for the calculation of the Equilibrium SCRIM Coefficient (ESC) is given in HD28/04 Annex 3.
- 9.2 To set an investigatory level, a site category is initially selected that is considered most appropriate to the road layout at any given part of the network. This category is then assigned the relevant investigatory level from the table below. This table is derived from table 4.1 from HD 28/04 chapter 4 and the initial investigatory levels assigned to the Gloucestershire County network are shown in dark grey. These investigatory levels are at the lower end of the ranges applicable to Highways Agency maintained roads (with the exception of category Q). Category Q has been subdivided, with Q1 (approaches to and across minor and major junctions) being set to the lower IL range and Q2 (approaches to roundabouts) adopting the mid range IL value.
- 9.3 Should local circumstances dictate, (i.e. increased risk to the road user) a higher IL may be assigned to specific sites and this is indicated by light grey shading. Additionally, for certain categories, a lower than default IL may be appropriate in low risk situations such as low traffic levels or where the risks present are well mitigated and there is a low incidence of accidents. Lower IL's are indicated by red shading in the following table. In both instances, a revised IL will only be justified by low incidence accident records and following a local risk assessment.

Table 9.2 Investigatory Levels

Site category & definition		Investigatory Level at testing speed of 50km/h (Duals 50mph+ tested at 80kph)							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
B	Dual carriageway non-event								
C	Single carriageway non-event								
Q1	Approaches to & across minor and major junctions,								
Q2	Approaches to roundabouts								
K	Approaches to pedestrian crossings & 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								

- Site categories G and S will be determined from the geometric data collected by the SCANNER vehicle. Categories will only be assigned should the feature exist for more than 20 metres.
- S1 and S2 categories will only be applied to roads with a speed limit of 50mph and above.
- Only one site category can be assigned to each site. If more than one category applies, then the higher investigatory level will be selected or, if they are both equal, then the one highest up the table.
- The categories assign to the network will vary in length depending on the nature of the site. Q and K will typically start 50 metres before a feature, (such as a junction or pedestrian crossing), unless local circumstances justify extending or reducing this distance.

9.4 Investigatory levels will be reviewed every three years. A review will also be undertaken when a significant change to the network is made, for example the provision of a new junction, the construction of a new roundabout or the installation of a new pedestrian crossing.



10. Site Investigations

- 10.1 Once the annual survey is completed, the results will be processed to determine the parts of the network where the CSC is at or below investigatory level (I.L.). This is achieved by comparing the derived CSC value with the assigned investigatory level. Only sites that have test results at or below the I.L. (i.e. are SCRIM deficient) shall initially be considered for further investigation.
- 10.2 Where such instances exist, a prioritised listing will be created to identify sites requiring further investigation. The site listing will be ordered by the diminishing SCRIM deficiency. This list will then be categorised and investigations will be undertaken in the following order;
- Category 1 - any site more than 0.15 below the I.L.
 - Category 2 - any site more than 0.10 below the I.L.
 - Category 3 - any other site at or below the I.L.
- 10.3 Site investigations solely prompted by collision statistics, rather than a SCRIM deficiency, will also be included in the priority list. The top ten ranked collision sites where wet skidding has been identified as a contributory factor in accidents will be included at the top of the category 2-site site listing.
- 10.4 If a number of sites are of equal SCRIM deficiency then they will be ordered on the basis of highest I.L. and then by the speed limit of the road, high I.L, high speed limit sections being the highest priority.
- 10.5 The objective of a site investigation is to determine the following;
- Whether a surface treatment is justified to reduce the risk of collisions, especially those in wet conditions or involving loss of control;
 - Whether some other form of action is required;
 - Whether the investigatory level is appropriate;
- 10.6 Site investigations will be undertaken following a standard procedure and utilising the form detailed in appendix B. They will be carried out by an engineer with appropriate experience.

11. Remedial actions

- 11.1 Sites identified as requiring treatment will be prioritised on the basis of the severity of the SCRIM deficiency, collision data and speed limit. Sites not able to be programmed in the forthcoming year will be re-examined in the following year to determine if action is still required.



- 11.2 Remedial actions may include, but are not limited to:
- Planing and resurfacing of the existing carriageway;
 - Application of a surface dressing treatment;
 - Mechanical retexturing of the existing surface;
 - Erection of slippery road surface signs.

- 11.3 Surface treatments are seasonal; many cannot be laid outside of the May to September period. Therefore in some cases it will be necessary to provide warning signs as soon as it has been decided that treatment is necessary, as a warning to road users during the period before treatment can be carried out. A record of the location and date of erection/removal of signs will be maintained.

Surface texture depth will also be considered when determining remedial actions as this is known to have an influence on the skidding resistance afforded to road users especially at moderate and high speeds.

12. Skid Resistance Management on Roads outside the Defined Network

- 12.1 On parts of the network not subject to routine SCRIM testing, sites will be identified for further investigation by the Accident Investigation Team. The method for determination will be sites which exhibit a significant incidence of wet skidding accidents above what is normal for that class and environment.

13. Records

- 13.1 Records of the annual SCRIM results and the outcome of investigations (including remedial actions) will be maintained for a period of 10 years.

14. Early life skid resistance

- 14.1 It can take a period of time for the frictional properties of a newly laid asphalt road surface to be realised. During construction, the aggregate in the road surface is coated in a film of binder and this needs a period of trafficking before the surface “wears in” and the binder film has worn away or weathered to enable direct contact between tyre and aggregate. During this time, skidding resistance can be affected in both wet and dry conditions.
- 14.2 Highways Agency Interim Advice Note IAN 49/03 (written for highly trafficked Trunk Roads) recommends that slippery road signs are erected and kept in place for a period of 6 months. Local experience suggests that the period before full skidding resistance is achieved can exceed this time and is dependent on the traffic volumes using the road.



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- 14.3 In Gloucestershire all new asphaltic surfaces placed on roads with a speed limit greater than 40mph, shall have warning signs in place for a period of not less than 12 months after construction (or until such time as routine SCRIM testing indicates that in-service skid resistance levels have been met).
- 14.4 A record of the location and date of erection/removal of signs will be maintained.

15. Responsibilities

- 15.1 Responsibility for the management of the skid resistance policy and procedure within Gloucestershire Highways is as follows:

Asset Manager – management of Skid Resistance Policy

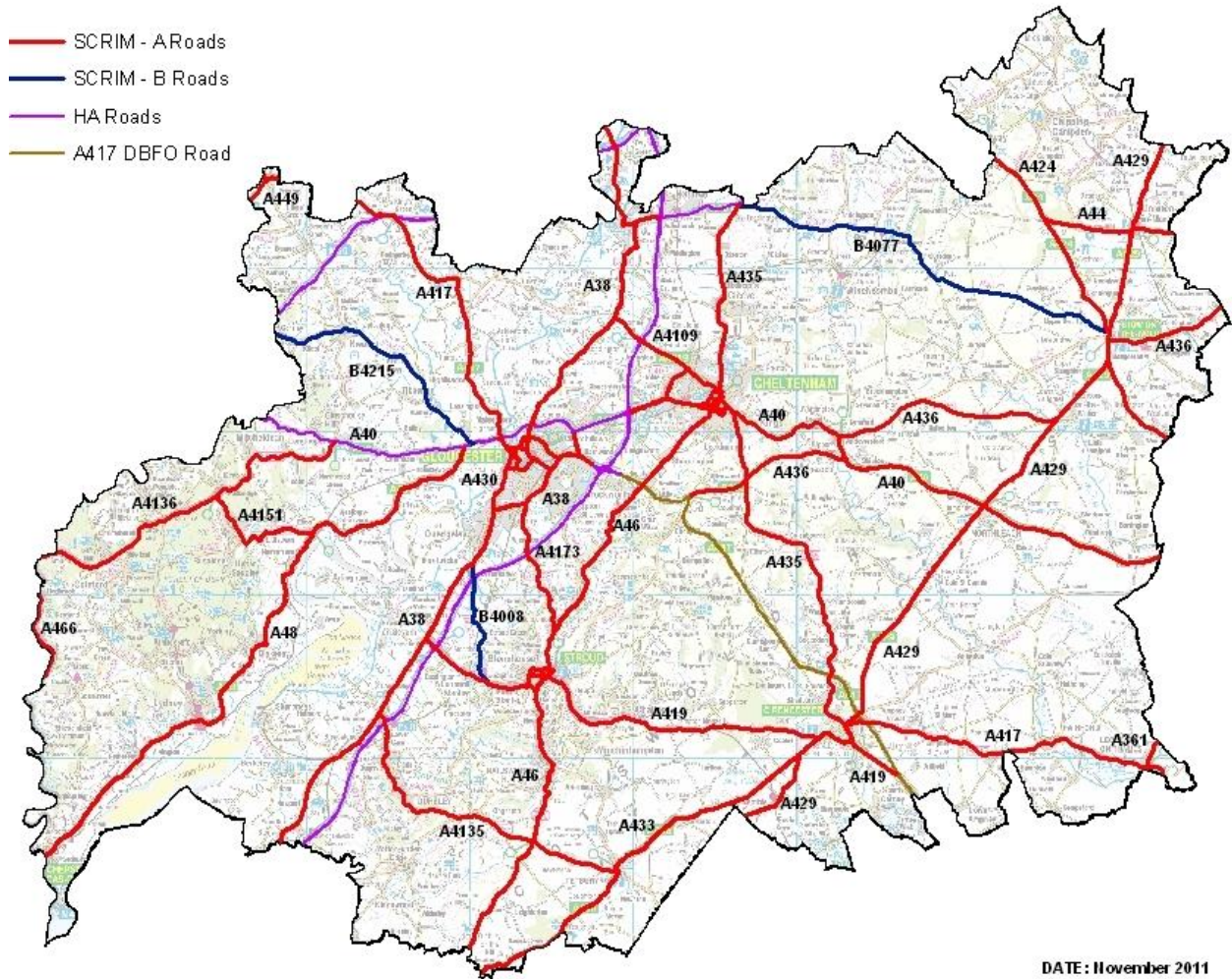
Pavement Assessment Engineer – survey procurement, site categorisation, determination of site investigatory levels, maintenance of SCRIM survey records, management of site investigation process, policy development

Forward Programme Manager – programming of remedial works

Accident Investigation Team Leader – review of accident data, support of site investigation process

Appendix A Plan and listing of network

Annual SCRIM Survey Network





ROAD	FROM	TO
A361	Lechlade on Thames	County Boundary
A38	County Boundary (South)	Junc. 1 M50 (via Gloucester & Tewkesbury)
A40	C&G Roundabout	Churchdown Roundabout
A40	Golden Valley Bypass/M5 (via Cheltenham)	County Boundary
A4013	Benhall Roundabout, Cheltenham	A4019 Junc. Swindon Village
A4015	Montpellier, Cheltenham	Cheltenham town centre
A4019	Coombe Hill	Cheltenham
A4135	A38 Junction, Dursley	Tetbury
A4136	A40 Huntley	County Boundary
A4151	Elton	Steam Mills
A417	Kingsholm	County Boundary (via Staunton)
A417	Barnwood	C&G Roundabout
A417	Cirencester	County Boundary (Lechlade on Thames)
A4171	Stroud	Stroud
A4172	Preston Cross	County Boundary
A4173	Pitchcombe	A38 Junction, Tuffley
A419	Junction with A38	Cirencester
A424	Junction with A44	County Boundary (Upper Rissington)
A429	County Boundary (via Moreton-in Marsh, Stow-on-the-Wold, Cirencester)	County Boundary
A430	A38 Junction, Quedgeley	Alney Island/Westgate
A430	Kingsholm	St. Paul's/Bristol Road Junction
A4301	St. Paul's/Bristol Road Junction	Westgate Junction
A4302	Barton	Coney Hill
A433	Cirencester	County Boundary
A435	Northway (Tewkesbury)	Cirencester
A436	Birdlip	Bourton-on-the-water
A436	Stow-on-the-Wold	County Boundary
A438	County Boundary	M5 Junc. 9
A44	County Boundary (Broadway)	County Boundary (Moreton-in-Marsh)
A449	County Boundary	Preston Cross
A46	M5 Junc. 9	Teddington
A46	Cheltenham	County Boundary (via Stroud)
A466	Redbrook	County Boundary
A48	A40 Junc. Highnam Roundabout	County Boundary (Chepstow)
B4008	Hardwicke	A419 Junction Stonehouse
B4077	Stow-on-the-Wold	Teddington
B4215	Highnam	Newent
B4221	Newent	County Boundary (Gorsley)


The following roads are displayed on the above map but are not currently maintained by Gloucestershire Highways.

ROAD	FROM	TO
A417	Cirencester	Gloucester
A40	Golden Valley Bypass/M5 (via Gloucester)	County Boundary (West)
A46	M5 Junc. 9	Junction with A435/B4077



Appendix B - SCRIM Site Investigation Report

For use in the investigation of sites in accordance with HD 28/04

		Gloucestershire HIGHWAYS <small>Gloucestershire County Council & Atkins</small>			SCRIM Site investigation Report	
		Survey Year				
General Information						
Date investigation commenced:				Investigator:		
Location				Investigation Reference No.		
Nature of Site:						
Site Category:				Investigatory level(s):		
Has site changed since I.L. set ?				Y / N		Speed Limit:
DfT Road Number:			PMS Section Reference(s):			
Site Start:	E		N		Length of Site:	
End:	E		N			
Date site last surfaced:				Has the site been previously investigated ?		
				Y / N		
				If yes, when ?		
Survey Data						
How much below I.L. is the CSC ?						
Is the lowest CSC in locations where vehicles have a specific need to stop or manoeuvre ?				Y / N		
Does SCANNER data indicate low macro texture depth ?				Y / N		
Do other SCANNER defects exist that could affect the site ?						
What is the average RCI value of the site ?						
Traffic Volume		AADT:		HGV:		
Accident Data						
Period		Number of accidents			Analysis Length	
From:	To:	Total:	Wet:	Wet Skid:	km:	
		Site Data		Average for site category		
Accidents / Year						
Accident/Year/100km						
Accidents/ 10 ⁸ veh-km						
% Wet						
% Wet skid						
Accidents linked to surface condition ?		Y / N				
Other comments on accident data (time?) :						



Site Inspection			
Date	Inspected by	Weather Conditions	Traffic Conditions
Visual Assessment			
Type and condition of surfacing:			
Is condition consistent across the C/way ?		Y / N	
Localised defects (polishing, low texture, patching) ?		Y / N	
Could these localised areas cause uneven skidding resistance ?		Y / N	
Presence of debris or contamination ?		Y / N	
Does drainage appear adequate ?		Y / N	
Road Users			
Traffic speeds in relation to road layout:			
Evidence of Accident/ near miss ?		Y / N	
Road Layout			
Does it appear to meet the current design specification ?		Y / N	
Is the layout appropriate to venerable road users ?		Y / N	
If junctions exist, are they appropriate for turning manoeuvres ?		Y / N	
Markings, Signs and Visibility			
Are markings and signs clear and effective in all conditions ?		Y / N	
Clear sight lines / visibility of queues / vegetation etc ?		Y / N	
Other observations			
Please indicate if any:			
Recommendations			
Date:		Is further action required ?	Y / N
If no, why Not ?			
If yes, please indicate what is required ?			
<input type="checkbox"/>	Resurface / Surface dress	<input type="checkbox"/>	Retexture
<input type="checkbox"/>	Replace/Upgrade Signs or Road markings.	<input type="checkbox"/>	Redesign Junction
<input type="checkbox"/>	Clean Drains	<input type="checkbox"/>	Change Investigatory Level
<input type="checkbox"/>	Other (i.e. Warning Signs etc):		



Site Plan
Additional Comments