

Highway Skid Resistance Strategy

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Introduction

As the Local Highway Authority responsible for maintaining nearly 3,900km of roads, Warwickshire County Council has a duty under the Highways Act 1980 to maintain the highway in a condition that is safe and fit for purpose. Although ensuring safe levels of skid resistance is not a specific legal requirement for local authorities, the Council wishes to manage the skid resistance in accordance with relevant standards and best practice. The strategy has been developed in accordance with the requirements of CS 228 taking in to account local conditions.

This Skid Resistance Strategy sets out the Council's approach to managing skid resistance across its highway network, outlining the purpose and benefits, and providing descriptions of principles and processes. The overriding aim of our Skid Resistance Strategy is to ensure acceptably safe skid resistance conditions for all road users. It forms part of the Local Highway Authority's wider remit of highway asset management and maintenance of all its public highways.

The Strategy takes a risk-based approach to managing skid resistance through a regime of surveys on a defined network of roads.

The aim of the strategy is to provide guidance to ensure that the road surface provides adequate skid resistance to drivers during wet conditions and to target maintenance to reduce related accidents.

Operational Guidance

Skid resistance is a measure of the frictional properties between the tyre of a moving vehicle and the road surface, which directly affect the ability of a driver to slow/stop the vehicle. As such, it is a key component of road safety.

The skid resistance of a surface decreases over time due to the effects of traffic and weathering. Routine monitoring of skid resistance is carried out annually across the network using a Sidewaysforce Coefficient Routine Investigation Machine (SCRIM) to provide a deficiency measurement known as the Skid Coefficient (SC). The Skid Coefficient is combined with other data to determine areas for further investigation and potential treatment.

The analysis of skid resistance is the responsibility of officers from the County Highways Policy and Delivery teams.

The SCRIM Network

The SCRIM Network is that part of the highway network on which it is considered advisable to manage the risk of wet skidding accidents.

In line with the general principles of the Well-Managed Highway Infrastructure code of practice, and CS 228, this Strategy applies a risk-based approach to the management of skid resistance to our highways network, including:

- The surveyed portion of the highway network, such as hierarchy, traffic types, speeds, relevant accident statistics, and local knowledge.
- Location factors, such as road layout/geometry, driver visibility.

The Defined SCRIM Network consists of:

- Principal roads (A Roads)

and sections where the speed limit is ≥ 40 mph on the following carriageway hierarchies:

- Strategic Routes
- Main distributor roads

Road sections with the presence of traffic calming features, such as road humps, are not tested as testing is not possible. In addition, any routes subject to a speed limit of less than 30mph will not be tested as the risk of skidding at these low speeds is very low.

Higher risk B, C and unclassified roads will be considered through analysis of 3-year accident records and liaison with the Road Safety team. Accident records will be reviewed annually to identify any changes that may be required to the defined SCRIM Network. Major changes will be updated prior to the next survey cycle.

The SCRIM Network is divided into Site Categories and each site category is allocated a target skid resistance level by setting an Investigatory Level (IL). Site categories are determined with reference to CS 228 and the accident history.

All locations on the defined SCRIM Network where the measured values are equal to or below the Investigatory Level are investigated. In order to prioritise site investigations the magnitude of deficiency will be considered.

Details of the defined SCRIM Network are maintained by County Highways.

Skid resistance surveys will not be routinely undertaken on other parts of the network. However, site assessments may be undertaken when requested by a Locality or Delivery Team Leader as a result of local knowledge. Where possible such sites will be included in the next annual survey programme and will be reviewed to determine whether they should be included in the defined SCRIM Network.

If sites identified by the Team Leader cannot be included in the annual survey programme alternative survey methods (such as GripTester) may be considered. Results from such surveys can be converted to SCRIM equivalent measurements for analysis.

The survey contractor will be required to provide evidence that the survey machine has been subject to, and passed annual calibration testing.

Investigatory Levels

Investigatory Levels (IL's) are a pre-defined limit of minimum acceptable skid resistance. Measurements greater than the limit are considered satisfactory, while those equal to or less than the limit will be assessed along with other criteria to trigger further investigation.

IL's are applied to specific sections of carriageway on the SCRIM Network based on the site category which takes in to consideration the type and nature of the road. IL's for each site category are set according to the wet-skidding incident risk, so that higher-risk sections of roads have higher IL's, i.e. more stringent skid resistance requirements.

A range of applicable IL's has been determined based on whether the risk at the specific site is considered to be Low (L), Standard (S), or High (H). Sites will be defined as Standard (S) risk except in the following circumstances:

High (H) risk sites:

- sites where one or more Killed or Seriously Injured (KSI) wet skidding incident has occurred within the preceding three years, OR three or more non-KSI wet skidding incidents have occurred within the preceding three years
- sites which are on an approach to a hazard (defined as categories Q and K), AND where the speed limit ≥ 50 mph.

Low (L) risk sites:

- unclassified roads with a speed limit of 30mph, AND where analysis of accident data has shown that the site is generally less prone to wet skidding accidents
- sites with no history of wet skidding accidents within the preceding three years.

Site risk classification may be subject to review.

Table 1 sets out the full list of IL's to be applied for each Site Category. These IL's are consistent with the lower levels set out in CS 228. The part of the table coloured red is critical, representing the highest risk.

IL's will be assessed annually to derive the level of risk as per table 1.

Table 1: Site categories and description

Site Category Code & Description		Investigatory Level (L/S/H risk)					
		0.3	0.35	0.4	0.45	0.5	0.55
B	Dual carriageway/one-way non-event	L	S	H			
C	Single carriageway non-event		L	S	H		
G1	Gradient 5-10%, longer than 50m. Not applicable to uphill gradients on dual/one-way sections.			L	S	H	
G2	Gradient >10%, longer than 50m. Not applicable to uphill gradients on dual/one-way sections.				L	S	H
Q	Approaches to and across minor and major junctions. Approaches to roundabouts and traffic signals.				L	S	H
K	Approaches to pedestrian crossings and other high risk situations.					S	H
R	Roundabouts				S	H	
S1	Bend radius <500m & speed limit >= 50mph. Dual carriageway/one way.			L	S	H	
S2a	Bend radius <500m & speed limit >= 50mph. Two way traffic.				L	S	H
S2b	Bend radius <250m & speed limit >= 40mph. Dual or single carriageway.				L	S	H
S2c	Bend radius <100m & speed limit >= 30mph. Dual or single carriageway				L	S	H

Measuring Skid Resistance

Skid resistance will be measured using SCRIM to survey the defined highway network. The survey period has been defined to be undertaken during the period 1st June to 31st July when the lowest SC values are theoretically likely to occur.

This approach provides an annual coverage of 100% of the SCRIM Network and a consistent dataset.

Identification of Sites for Investigation

All locations on the SCRIM Network where the Skid Coefficient is equal to or below the corresponding Investigatory Level shall be considered for investigation. These sites will be prioritised based on a weighted score matrix which includes the magnitude of skid resistance deficiency.

The process for analysis of SCRIM survey data is as follows:

- 1 Import/update network and IL data in to Horizons asset management software.
- 2 Import Skid Coefficient data into Horizons to determine SCRIM Deficiency.
- 3 Import three-year accident data in to Horizons with contributory factors 101, 102 & 103 and road condition of wet taken from accident statistics form (stats 19 form).

- 4 Undertake data analysis by desktop study associating SC, accident data and SCANNER texture depth to identify and prioritise sites at which a more detailed site investigation is warranted.
- 5 Rank sites using a risk-based scoring system as set out below in Table 2 to allow prioritisation of sites to be investigated.
- 6 Sites are merged in Horizons using proximity to form schemes for detailed investigation.

Table 2: Scrim site investigation score matrix

Weighting Factor	Criteria	Score
Skid accident severity	Fatal	12
	Serious	6
	Slight	2
Wet skid accidents per road section	No. of accidents	1 per accident
SCRIM deficiency	>0	0
	≤ 0 and > -0.1	4
	≤ -0.1 and > -0.2	6
	≤ -0.2	10
Texture depth	Greater than 0.6mm	0
	Less than or equal to 0.6mm	3

Identification of sites at which there is a SCRIM deficiency will be undertaken within the same survey season.

Site Investigation

Sites for detailed investigation will be determined by the scored priority list by working from the top scoring site downwards. The top 50 sites will be subject to a detailed site investigation as well as those sites where the SC value is ≤ 0.25 . Only sites where the deficiency extends greater than 10 linear metres will be considered for detailed site investigation, unless the SC value is ≤ 0.25 .

Site investigations must be undertaken by a competent person, using the Site Investigation Form in Appendix 1 which is designed with reference to CS 228, and making reference to the detailed guidance notes. Initially, this will be part of a desktop exercise.

Once on site the blue section of the form should be completed, noting any inconsistencies between machine survey data and on-site assessment, and taking photographs of the site where appropriate to provide:

- An overview of the location, illustrating site characteristics such as gradient, bends, visibility across junctions, etc.
- The road surface, defects and other important features which could contribute to determining the required remedial action.

The investigation will include an assessment of the Site Category and Investigatory Level to determine if a revision is required.

Records of all site investigations will be retained for a minimum of 8 years. These will include sites at which remedial works are required, sites where other action is required, and sites at which no

further action is considered necessary. Sites at which no further action is required will be reviewed the following year to monitor the performance of the road surface and to review the level of risk.

Identification and Prioritisation of Remedial Actions

The following are some possible actions after completion and review of the Site Investigation:

- Surface treatment works
- Resurfacing works
- Other actions, such as cleaning/replacing signs, increasing routine verge maintenance, etc.
- Review site after next survey
- Reduce/Increase risk rating
- Review visibility splays, road alignment or road markings
- No further action required
- Monitor

Any carriageway maintenance work will be carried out in accordance with the County Road Construction Strategy. Generally, the treatment to restore an adequate skidding resistance to the surface of a road is surface dressing. As this treatment is seasonal, it may be necessary in some cases to provide warning signs as soon as it has been decided that treatment is necessary, as a warning to road users during the interim period before treatment is carried out.

Use of 'Slippery Road' Warning Signs

Slippery road signs can be used to warn drivers that the upcoming section of carriageway may have a lower than expected skid resistance. Frequent use of these signs can contribute to sign clutter across the network. More importantly, clutter can reduce the impact of these signs, which are intended to positively alter driver behaviour at specific locations on the network. To avoid over usage the following criteria has been developed to define limitations as to where such signs should be used.

Warning signs will only be considered at the following sites:

Sites with a deficiency ≤ -0.2 and longer than 40m, or following a detailed Site Investigation that concludes the site is recommended for inclusion in the next available maintenance programme and;

- There has been a fatal or serious accident in the preceding 3 years, or
- The skid resistance is substantially below the IL (0.10 SC units or more).

An inventory of 'Slippery Road' signs shall be maintained. This will include details of sign locations, date of erection, date of removal, and details of related works orders.

Programming of Works

Treatment of skidding related sites is seen as one consideration when developing the overall forward maintenance programme. Those sites rated highly for early treatment where the assessed sites are considered to pose a significant risk of collision are to be given priority and included in the next available programme with the remainder entering the longer term planned programme.

APPENDICES

Carriageway Skid Resistance – Detailed Site Investigation Form

1. General Information								
Road Name/Area					Reference No.			
Posted Speed Limit					Urban/Rural			
2. Section Data								
Name	Section Label	Length (m)	Site Cat.	Road Type	Chainage	IL	Min SC	Diff
3. Location & nature of site								
3.1 Plan(s) attached				<input type="checkbox"/> Yes		<input type="checkbox"/> No		
3.2 Has the site been previously investigated? If so when?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		
3.4 Does SCANNER data indicate low texture depth?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		
3.5 Are the accidents a result of the road surface?				<input type="checkbox"/> Yes		<input type="checkbox"/> No		
3.6 Is a detailed site investigation required? If no provide reason.				<input type="checkbox"/> Yes		<input type="checkbox"/> No		
4. Collision History (3 years)								
4.1 Period start date						Period end date		
4.2 Number of collisions during the period						In recent year		
4.3 Number that were wet skid collisions						In recent year		
4.4 Number of wet road fatal or serious injuries						In recent year		
Do skid risk warning signs need to be erected?				<input type="checkbox"/> Yes <input type="checkbox"/> No				
Note: Warning signs will be erected where the road has been recommended for treatment and:								
There has been either a fatal or serious accident (4.4) or the SC is -0.10 or more below the IL (See Section 2 Diff).								
5. Visual Assessment								
Name of assessor								
Date of inspection					Time of inspection			
5.1 General condition of surfacing?				<input type="checkbox"/> Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor				
5.2 Are there localised defects?				<input type="checkbox"/> Yes <input type="checkbox"/> No				
Variation of surfacing, polishing, low texture, patching, rutting, fretting, potholes etc. If yes provide details. State if localised defects occur where road users are expected to stop or manoeuvre.				Description:				
Provide photos is possible								

5.3 Describe any features that could be expected to require road users to be able to stop or manoeuvre to avoid collision. For example, junctions, laybys, crossings, bend or steep gradients.			
5.4 Could the localised defects affect vehicle handling?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
5.5 Is the site free from debris and other contamination?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
5.6 Does drainage appear adequate?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
6. Road Users			
6.1 Does the site have a high proportion of vulnerable road users? For example, elderly, cyclists at speed, children? If yes provide detail.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
6.2 Is there evidence of road users consistently failing to negotiate the site? e.g. verge overrunning, impacted street furniture. If yes provide photo.		<input type="checkbox"/> Yes	<input type="checkbox"/> No
7. Signs, Road Markings & Visibility			
7.1 Are safety critical road markings missing or worn?		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Other observations:			
8. Recommendations			
Is further action required?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Resurface	<input type="checkbox"/>	Replace/upgrade road markings	<input type="checkbox"/>
Surface dressing	<input type="checkbox"/>	Drainage/gully works	<input type="checkbox"/>
High friction surfacing	<input type="checkbox"/>	Clear debris/remove overhanging vegetation etc.	<input type="checkbox"/>
Replace/upgrade signs	<input type="checkbox"/>	Monitor	<input type="checkbox"/>
Detail of further action:			
If no further action proposed please provide a reason for your answer:			

Completed forms to be returned to County Highways Policy Team.