Staffordshire County Council

Skidding Resistance Policy

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Executive Summary

Introduction

Staffordshire County Council is responsible for approximately 6,200km of highway and is committed to managing skid resistance levels of road surfaces across this network to achieve acceptable road user safety in a cost-effective manner.

The maintenance of adequate levels of skidding resistance is a critical aspect of highway maintenance, and one that contributes significantly to network safety.

This Policy sets out the approach to managing skid resistance levels of road surfaces across the Council's highway network and provides detailed guidance for the processes by which the strategy will be applied.

This Skid Resistance Policy forms part of the Staffordshire County Council (SCC) Highway Infrastructure Asset Management Strategy.

Guidance

This document is based on guidance in the UK Design Manual for Roads and Bridges (DMRB), CS228 Skidding Resistance. CS 228 is designed for application to the UK Strategic Road Network rather than a local authority network such as Staffordshire's. As such, some aspects of this policy deviate from CS228 guidance to ensure that desired outcomes are maintained, and that the strategy is practical for the Council's purposes. Deviations from CS228 are noted and justified throughout this document and are made only where there is a clear benefit and safety risk is considered to remain acceptable.

This policy is also written in accordance with the relevant principles defined in the 2016 UKRLG Code of Practice (Well-Managed Highway Infrastructure).

This document sets out Staffordshire County Council's specific requirements and responsibilities, the annual skid resistance programme, applying seasonal correction to skid resistance measurements, setting the Investigatory Levels, the process for identifying sites that require a detailed investigation, methodology for identifying and prioritising proposed treatments and actions, and for identifying sites where slippery road warning signs are required.

Principles

Skid resistance surveys will be undertaken annually on defined parts of the highway network which are referred to as the Skid Network and is comprised of:

- Strategic Routes
- Main Distributor Roads
- Selected Secondary Distributor Roads

Skid resistance is an important property relating to the safety of highway users, particularly in damp or wet conditions. Over the course of a road's life the surface

can lose some of its characteristics associated with grip. Effective maintenance of the highway network includes the requirement to systematically monitor the skid resistance of the road surface and to take a proactive approach so that the skid resistance across the network is maintained to an appropriate standard.

This document outlines the approach to identifying skid deficient sites, the determination of appropriate treatments and prioritising remedial works in the context of budget and programme considerations.

The procedure for managing skid resistance on the Councils highways takes an asset management and a risk-based approach to managing skidding resistance and puts a greater emphasis on engineering assessment. This document also complements the Highway Asset Management Strategy, which looks to manage assets in a strategic way.

The objective of the Skid Resistance Policy is to:

- Enable the public to travel safely.
- Enable the Council to robustly defend against claims.
- Reduce the number of killed or seriously injured due to accidents on the Council's road network.
- Ensure the Council adheres to its duty under the Highways Act 1980.

To achieve this the Council will:

- Formalise processes for monitoring skid resistance across the Council's road network.
- Identify deficient sites using skid resistance survey methods for further investigation.
- Use accident data on sites identified for further investigation to determine whether inadequate skidding resistance could be a factor.
- Recommend appropriate actions to negate risks.
- Prioritise skid deficient sites for improvement works based on where the greatest risks lie
- Ensure improvements to skid deficient sites are incorporated into the annual highway maintenance works programme.

Where remedial treatment is deemed to be of benefit, sites will be prioritised using a risk assessment approach and inserted into the works programme for action within the resources and budget available.

In summary, the procedure is as follows:

- The defined network will be assigned Investigatory Levels (IL) depending on a range of factors such as the speed limit and geometry of the road.

- Skid resistance data for a particular section of road (a site) will be scrutinised and compared against its Investigatory Level.
- Sites where skid resistance values are at or below the Investigatory Level will be identified for further investigation.
- Further investigation will take into account other factors such as whether there is road traffic crash history at the site to establish whether remedial treatment is necessary.

The term "skid resistance" refers to the frictional properties of the road surface in wet conditions. The skid resistance of a wet or damp road surface can be substantially lower than the same surface when dry and is more dependent on the condition of the surfacing material. It should also be noted that there is no boundary at which the skid resistance passes from being "safe" to being "dangerous".

Skid resistance measurements are used as an empirical assessment of a road surfaces level of grip and as an indication of the potential need for further investigation based on defined acceptable limits. However, it should be noted it does not represent the definitive grip available to a road user making a particular manoeuvre at a particular time and at a particular speed.

Part 1: Responsibilities

1.1. Legal Responsibilities

Ensuring safe levels of skid resistance is not a specific legal requirement on local authorities. However, maintaining highways to an acceptable level of safety supports the fulfilment of the duties of Highways Authorities under the Highways Act 1980. In addition, it is general good practice and clearly desirable to maintain acceptable skid resistance.

The development of this skid resistance policy is to ensure a suitably structured procedure and strategy is implemented for the highway under its care and adequate levels of skid resistance are maintained within reasonable expectations as outlined in the Highways Act 1980.

1.2. Roles, Responsibilities and Competencies

This section sets out the various roles and responsibilities for the management of the Skid Resistance Policy.

The annual Skid Resistance Survey Programme will be procured through a specialist accredited SCRIM contractor whilst any accompanying Griptester survey programme will be employed through Staffordshire County Council's Laboratory Services.

The Council's Highway Asset Management team will ensure that the most appropriate remedial action is taken at sites identified as requiring action. Examples of the options available are:

- Monitor
- Erection and removal of warning signs
- Refresh of road markings on the carriageway
- Retexturing of the road surface with the appropriate treatment
- Resurfacing of the carriageway with a material that will ensure that the road achieves the correct skid resistance for that road section

Part 2: Skid Resistance Annual Programme

The skid resistance annual programme has been produced to define a realistic achievable timetable for each part of the Skid Resistance Policy.

The skid resistance annual programme is illustrated below in Table 1:

Table 1 – Skid Resistance Annual Programme

Date Range	Activity	Delivery Date	Comment
Not Specific	Annual Review of Existing Slippery Road Warning Signs	Should be within 12-18 months of last review	Annual
	Review Investigatory Levels	Within 3 years of last review	Triennial
January to April	Create and deliver to the survey contractor the network and sections to be surveyed	30th April Network shall be available for the contractor	The Council undertakes the Single Annual Survey.
1st May to 20th June	SCRIM survey shall be undertaken if an 'Early' survey is required	Survey contractor shall deliver the corrected CSC to the council within 1 month of the final survey date	The council may request the uncorrected data as soon as the survey is complete. However, the CSC data will also be supplied in accordance with the delivery date
21st June to 10th August	SCRIM survey shall be undertaken if a 'Mid' survey is required		
11th August to 30th September	SCRIM survey shall be undertaken if a 'Late' survey is required		

31st October (can be earlier if mid or early season survey)	Data shall be loaded into the Councils Pavement/Asset Management System for processing	Within 1 month of receipt of corrected CSC data all road sections requiring investigation shall be identified	The Councils representative shall process the data through the configured rule set
November to January (can be earlier if mid or early season survey)	Road sections requiring detailed investigation shall have an on-site assessment carried out	Detailed site investigations shall be undertaken within 3 months of having been identified.	ALL sites requiring signing OR treatment shall be identified for the forward works programme
	Erect Slippery Road Signs where applicable	Within 3 months of the need for warning signs being identified.	Where the speed limit is greater than 30mph and with at least one KSI and/or two Slight accidents in the previous three years, constitutes a need for a review of Warning Signs applicability
	Produce Treatment Priority List	Produce bespoke treatment/ action priority list within 1 month of completion of Detailed Site Investigations and incorporate in the production of works programme	Based on budget and priorities
January to March	Assess Remedial Treatment/Action	Incorporate within works programme	Maintain and update record of maintenance works

2.1. The Skid Network – Sections to be Surveyed Annually

Sections of the following road hierarchy shall be surveyed on an annual basis and form the Skid Network.

The Skid Network which will be subject to skid resistance testing is subject to modification if there are changes in crash patterns or amendments to the network.

The Skid Network is in line with "Well Managed Highway Infrastructure – A Code of Practice" and consists of:

- Strategic Route
- Main Distributor
- Selected Secondary Distributor

However, as this code of practice states that the council is required to consider local factors it may also include the link road network. An up-to-date network section list will be provided for the survey contractor for use. Both directions of each carriageway shall be surveyed.

The Skid Network will be surveyed once during the testing season in each year. For continuity, the surveys are planned such that in successive years the network is tested in the early, middle, and late parts of the season as defined in CS228 section 3.7 and illustrated in Table 2 below:

Early 1st May -20th June

Middle 21st June -10th August

Late 11th Aug – 30th September

Table 2 – Annual Survey Regime

Season\Year	2023	2024	2025	2026	2027	2028
Early			✓			✓
Middle		✓			✓	
Late	✓			✓		

Inevitably there will be some sections in the above classifications where a SCRIM survey is inappropriate and will be excluded from the annual survey. Reasons for exclusions could include traffic calming schemes, speed humps and tables, width, height or weight restrictions, 20mph zones or road layouts where it is not possible or safe to maintain the survey speed. A list of sections not surveyed is produced by the surveying contractor on an annual basis.

Part 3: Setting the Investigatory Level

An Investigatory Level (IL) shall be assigned for every part of the Skid Network, by determining the most appropriate Site Category for each location. The objective of setting an IL is to assign a level of skidding resistance appropriate for the risk on the site, at or below which further investigation is required to evaluate the specific risks in more detail.

For the avoidance of doubt each Site Category has specific definitions and only one Investigatory Level. Additional 'Increased Risk' Site Categories are created to accommodate the higher Investigatory Levels. By defining the level of risk within each Site Category definition the assignment of the most appropriate Site Category is more objective than subjective and will lead to less ambiguous interpretation and more accurately defined categories.

Site Categories and their associated Investigatory Levels will be reviewed every three years by competent personnel.

3.1. Allocate Site Category and Investigatory Levels

An Investigatory Level (IL) shall be assigned for every part of the Skid Network, by determining the most appropriate Site Category for each location and its associated IL, as defined in Table 3. Note the table is as per the details in Table 4.2 of CS228, with Staffordshire's recommended Investigatory Levels highlighted in grey.

Table 3 – Site Categories

Site Category and Definition		IL for CSC Data (skid data speed corrected to 50km/h and seasonally corrected)						
		0.30	0.35	0.40	0.45	0.50	0.55	0.60
		Grip Number						
		0.34	0.39	0.45	0.51	0.56	0.61	0.67
B	Non-event carriageway with one-way traffic	LR	ST	ST				
C	Non-event carriageway with two-way traffic		LR	ST	ST			
Q	Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals				ST	ST	ST	
K	Approaches to pedestrian crossings and other high risk situations					ST	ST	
R	Roundabout				ST	ST		
G1	Gradient 5-10%, longer than 50m				ST	ST		
G2	Gradient >10%, longer than 50m				LR	ST	ST	
S1	Bend radius <500m, carriageway with one way traffic				ST	ST		
S2	Bend radius 250-500m, carriageway with two-way traffic				LR	ST	ST	
S3	Bend radius <250m, carriageway with two-way traffic				LR	ST	ST	

If more than one Site Category is appropriate, then the Site Category with the highest recommended IL shall be selected. If the highest recommended IL for the Site Categories are the same, then the category highest up the Table shall be selected (B being the highest on the table and S3 the lowest). ILs for Site Categories Q and K are based on the 50m approach to the feature and, in the case of approach to junctions, through to the extent of the junction. The approach length shall be extended when justified by local site characteristics.

3.2. Network Changes Review

A review of the Investigatory Level of a site shall be carried out when a substantial change to the network is made, that would require a revised Investigatory Level and/or Site Category.

Part 4: Procedure for Identifying Sites Requiring Further Investigation

To prioritise between all SCRIM deficient locations over the surveyed Skid network, the Council uses a weighted ruleset, where the scoring includes:

- The most recent SCRIM reading
- The current three years accident data
- The maximum speed limit at the SCRIM deficient location
- The site category at the SCRIM deficient location

The initial site score will identify sites requiring further investigation (desk-based or detailed) and is achieved by summing up the scores from the criteria in Table 3 for each site.

It is nationally recognised that SCRIM is not an exact measure (it is a coefficient) and will have a seasonal variation. This seasonal variation not only varies throughout the summer months but can and will vary year on year. Setting a threshold has resulted in significant fluctuations in the number of sites identified. Therefore, the council use the following methodology to identify a minimum number of **50** sites.

Table 4 – Criteria for Initial Site Score

Road Priority Scoring											
Criterion	**Scoring**										**Weight**
Amount Below IL	Range from 0 - (-.2)										33%
	Scored on an X^2 relationship with a max score of 4										
KSI Wet Accidents	0		1		2		3		>=4		27%
	0		1		2		3		4		
Speed Limit	<=30		40		50		60		70		20%
	0.80		1.60		2.40		3.20		4.00		
Site Category	B	C	Q	K	R	G1	G2	S1	S2	S3	13%
	0.63	0.75	3.50	4.00	3.13	1.63	2.00	2.00	2.50	3.00	
Slight Wet Accidents	0		1		2		3		>=4		7%
	0		1		2		3		4		

SCRIM - Weighted the highest amongst the scoring criteria, the SCRIM difference is a measurement that relates directly to the section of road in question. This relates to the policy objective of taking a long-term approach to the management of skid resistance on the network.

KSI Wet Accidents (Three years) - The next criterion focuses on the authorities' corporate aim of reducing accidents on the network. Weighting this as such thereby highlights those sections of road that have had KSI's in the locality of the deficient location. Whilst the KSI's might not be directly attributed to the skid resistance at that location the likelihood that it may be a contributory factor should be considered. This information is gained from the contributory factor part of the Police Stats 19 report.

Speed Limit - Speed is the third weighted criterion, as speed increases the potential risks and severity of incident increases for all road users. Actual traffic speeds are not available for the network, so the applicable speed limit is used.

Site Category - Site category of the SCRIM deficient location is fourth differentiating factor as the demand on the user varies, and potential consequence of any accident, dependent upon the geometry and layout of the network at that location.

Slight Wet Accidents (Three years) - The final consideration is slight wet accidents. Whilst the corporate aim is to reduce KSI's, these are less frequent occurrences. The use of slight wet accidents helps identify areas of concern.

Scoring - Each category has been given an obtainable score of 4 and weighted 1-5 in the order above, this produces a maximum obtainable score of 60 per deficient location.

Part 5: Methodology for the Identification and Prioritisation of Proposed Treatments

The Council uses an engineering approach for the identification and prioritisation of proposed treatments and actions, providing an auditable objective process to the identification and prioritisation based on the results from the detailed on-site investigations and other available information. This provides a certain level of intervention criteria, however this level of intervention (i.e. treatment) is ultimately determined by budget, provided a minimum service level can be attained.

Budgeting and programming issues will influence when the treatments are carried out and this process should be managed through the Councils process for prioritising maintenance.

Ranking of skid resistance maintenance schemes takes into account the findings of the site investigations.

The most appropriate form of treatment will be identified for each site which is found to require remedial works and to restore an adequate level of skid resistance. Often this will include a surface treatment. However, if site investigations should identify different defects or an issue with the behaviour of road users which an engineering measure may not be able to resolve, then the relevant department within the council will be notified to identify the best course of action to be taken.

The final programme of works will be based on available budget and council priorities. The final list of schemes shall be reported to council cabinet members.

To aid the process, a desktop study is completed first, and then a detailed site investigation is completed second.

Part 6: Site Investigation Process

6.1. Desktop Site Investigation Process

After the top 50 sites have been identified, a desktop process is used first to filter out locations that may not be required from the detailed on-site investigation process, such as sites that have been treated since the survey was undertaken, or sites that are due to be treated in the next season. This process aids resource use within the asset management team and shall be performed within one month of receiving the top 50 sites.

All other sites will be added to the detailed on-site investigation list, which will be accompanied with a GIS map of the location.

6.2. Detailed Site Investigation Process

A detailed site investigation shall be undertaken within three months of having been identified after the desktop filter process has been completed.

The results of the investigation, including whether further action is required, shall be documented using the form in Appendix 1 and retained electronically, together with the identity of the investigator.

6.3. Investigation Findings

Following the completion of the site investigations, the staff who undertook them shall review the findings with the Senior Engineers. The Senior Engineers will assess the recommendations provided and will sign them off if in agreement.

Part 7: Determining Locations Requiring Warning Signs

Sites which, as a result of a detailed investigation, have been identified as requiring treatment to improve skid resistance shall only have warning signs where it is deemed appropriate. Warning signs will not automatically be used on every scheme; only to advise the road users where an engineer has deemed appropriate following a review of all the available information.

Here sites are identified for consideration of warning signs if the following criteria are invoked:

- Where the speed limit is greater than 30mph and with at least one KSI and/or two Slight accidents in the previous three years.

Where a KSI and/or a slight accident has occurred within a site, the raw accident data will be reviewed to ascertain whether the causation factors include any aspect related to the carriageway surface. If they do not, then there will be no requirement for a warning sign, but the site will be kept under review.

Once the location of sites requiring warning signs has been identified, a schedule for warning signs shall be produced.

7.1. Review Locations of Existing Signs

The skid resistance at the location of all existing slippery road warning signs shall be reviewed to determine whether the sign is still needed. This review should occur annually and once completed, the schedule for warning signs shall be updated to include the signs which required removal.

7.2. Install, Amend or Remove Warning Signs

Warning signs shall be installed as soon as practicable after the need for treatment has been identified.

The slippery road warning sign (Diagram 557) with no supplementary plate must be used in accordance with the Traffic Signs Regulations and General Directions and Chapter 4 of the Traffic Signs Manual.

It is essential that records of the erection and removal of slippery road warning signs shall be kept, including works orders issues and inventories.

This strategy provides a targeted use of signs and is designed to avoid a proliferation of signs that would undermine their effectiveness and would not make best use of resources.

Warning signs shall be removed as soon as they are no longer required. This should be after the surface treatment has been carried out. In all cases, the aim should be to avoid leaving signs in place after their usefulness has expired to avoid drivers becoming complacent.

Part 8: Accident Clusters

Whilst Staffordshire County Council use the policy to reduce accidents across the network by maintaining adequate levels of skid resistance, a separate casualty reduction team, focuses on the task of analysing highway accident clusters and fatality cause.

Accidents involving personal injury that are collected by Staffordshire Police are reported to the County Council. Searches of the database are carried out to identify cluster sites for detailed investigation. Where common factors that can be treated are identified, remedial measures are introduced to try to prevent similar accidents occurring. Searches are also carried out to identify sites where possible deficiencies in the road surface may contribute to the accidents recorded.

Sites are identified where a significantly higher percentage of accidents than would normally be expected have been recorded when the road surface was wet. Sites are also identified where common factors are recorded such as skidding, rear end collisions and loss of control. All severities of accidents are considered during this process.

Sites identified are forwarded to the Senior Engineers for detailed assessment, and appropriate treatments are introduced if deficiencies are confirmed.

Upon receipt of such sites, if accurate current data is not available, the Griptester will be utilised,thereby giving accurate measurements along the section of network, to help in determining the causes of accidents. Since the site information has been referred from within the County Council, the measurement will not be assessed against other sites on the network; however, in conjunction with the Senior Engineers' recommendations regarding treatment and timescales, the site will immediately be assessed for signage, thereby warning motorist in a timely manner.

Part 9: Records

In order to maintain accurate and up to date information it will be necessary to formally record skid resistance data and this will be done by maintaining the following records to demonstrate the ongoing operation of this procedure:

- Investigatory Levels for the surveyed road network, including justification for any deviation from the recommendations and dates of Investigatory Level review and the identity of the reviewer.
- Skid testing results and data analysis including survey date(s) and date(s) the survey data is received.
- Site investigation findings for every site assessed including survey date(s) and the identity of the inspector.
- A record of sites where and when slippery road warning signs have been erected showing subsequent removal dates where appropriate. This will also include dates when sites are identified as requiring signing.
- Priority lists of sites for remedial treatment to restore an adequate level of skid resistance. This will also include dates when the treatment/action priority list are produced and when the works programme is signed off.
- Details of completed works programmes, relating to remedial treatment for substandard skid resistance. This will also include dates when the works are complete.

References

Design Manual for Roads and Bridges

- CS 228 Skidding Resistance

Staffordshire County Council Highways Base Specification

The Traffic Signs Regulations and General Directions 2016

Highways Act 1980

Well-managed Highway Infrastructure a Code of Practice

Glossary of Terms

CSC - Characteristic SCRIM Coefficient - The SC value that has been corrected for seasonal variations following the method appropriate to the survey strategy adopted by the Council.

DMRB Volume 7 Section 3 CS 228 Pavement. Inspection and assessment. Skidding resistance supersedes: HD 28/15 Pavement design and maintenance. Pavement maintenance assessment.

Griptester – A trailer-based friction measuring device.

IL - Investigatory Level – The level of skid resistance at or below which an investigation of the skid resistance is to be undertaken.

SCRIM - Sideways Force Coefficient Routine Investigation Machine.

SC - A friction coefficient calculated from a sideway-force coefficient routine investigation machine reading, by application of a speed correction and index of SFC.

Seasonal Correction – Process of applying in year and between year corrections to the raw data in processing within Pavement Management System.

SFC – Sideways Force Coefficient.

Site – A Site is an assessment length with consistent Site Categorisation and Investigatory Level (typically site lengths range from 50-149m and 10m for roundabouts). Detailed investigations are undertaken for whole sites.

Site Category – A length of highway with similar geometric and layout, with an Investigatory Level assigned.

Skid Resistance – The frictional properties of the road surface.

Speed corrections – Process of correcting readings to 50kph speed limit (applying correction in 3.21 of CS 228