STAFFORDSHIRE COUNTY COUNCIL

Economy, Infrastructure and Skills

SKID RESISTANCE POLICY

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April 2020

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Skid Resistance Policy

To consider and analyse the current skid resistance of the entire A, B and selected C/U class network through the utilisation of SCRIM (Sideways Co-Efficient Routine Investigatory Machine) and Griptester Mk2 information, and when combined with other relevant attributes, identify sections of road that are a current cause for concern in relation to Staffordshire's objective of reducing accidents directly attributed to skidding.

1. Skid Resistance Strategy

1.1 Introduction

The purpose of Staffordshire's Skid Resistance Strategy is to describe how the management of appropriate levels of skid resistance will be undertaken on Staffordshire's maintained highways to fulfil Staffordshire Skid Resistance Policy

The development of Staffordshire's Skid Resistance Strategy will be a major contributory factor in enabling Staffordshire County Council, as the Local Highway Authority (LHA) for the publicly maintainable local highway network within Staffordshire, to apply a consistent, long term approach to the management of skid resistance on the County's highway assets.

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

1.2 Outside Consideration

The requirements contained within this Strategy to provide and maintain an appropriate level of skid resistance upon the local highway network within Staffordshire, reflect the recommendations of the UK Road Liaison Group's Well Managed Highway Infrastructure, Code of Practice - (October 2016).

This Skid Resistance Strategy has, in part, been derived from Highways England CS 228 Pavement, Inspection and assessment, Skidding resistance which superseded: HD 28/15 Pavement design and maintenance, Pavement maintenance assessment, Skidding resistance (HA, 2015). (The Highways Agency is now known as Highways England). Design manual for roads and bridges, DMRB, 7.3.1, which is contained within the Design Manual for Roads and Bridges (DMRB) Volume 7: Section 3 and details the skid resistance requirements for UK Motorways and Trunk Roads. Reference has also been made to Highways England Standard CD 236 – Surface Course Materials for Construction, which is contained within DMRB Volume 7: Section 5. This Standard, in part, details the aggregate requirements at the design, construction and maintenance stages of a surface courses' life, which aim to ensure that appropriate skidding resistance is provided.

1.3 Concerned Parties

A copy of the current Strategy, for use by Staffordshire Highways personnel, will be located on H:\Highways\Operational Info\Policy Documents\Operational Policies.

Copies of this Strategy will also be provided to the following: -

- Insurance Services
- SCC's Insurers
- SCC's Solicitors
- Neighbouring Highway Authorities
- Staffordshire Police (Accident & Investigation Unit)

Access to this Strategy will also be available to members of the public via the Staffordshire Web.

1.4 Terms and Guidance

In this Strategy, the term "skid resistance" refers to the frictional properties of the road surface, measured using a specified device, under standardised conditions. The term always refers to measurements made on wet roads, unless specifically stated otherwise.

This Strategy provides advice and guidance to assist engineering staff in determining an appropriate level of skid resistance for each location. It lays down the procedure to be used for measuring the skid resistance and, for cases where the measured skid resistance is below a predetermined level, known as the Investigatory Level; it provides a methodology to assist the Engineer in assessing the requirement for remedial works. Remedial works will be subject to an economic assessment of the costs and benefits before proceeding, to promote the best use of maintenance budgets.

1.5 Updating the Strategy

Staffordshire's Skid Resistance Strategy will be reviewed and updated as necessary. Should important guidance be issued, this will be reviewed, and if necessary, added to the strategy as an interim addendum until a formal review is undertaken and the interim addendum released / re-issued as outlined above.

2. Legislation

2.1 Legal Requirement

The Institute of Highway Engineers' Well Managed Highway Liability Risk' publication sets out the Law on Highway Liability in section 3.

Staffordshire County Council, as the Local Highway Authority (LHA) for Staffordshire, has a statutory duty under Section 41 of the Highways Act 1980, to maintain those highways. The duty extends to the fabric and structure of the highway. This duty is balanced by providing a statutory defence in Section 58 of the Highways Act 1980. The LHA must be able to prove, in a court of law, that it had taken "such care as in all the circumstances was reasonably required to secure that the part of the highway to which the action relates was not dangerous for traffic" based upon:

- The character of the highway and the traffic which was reasonably to be expected to use it;
- The standard of maintenance appropriate for a highway of that character and used by such traffic;
- The state of repair in which a reasonable person would have expected to find the highway;
- Whether the Highway Authority knew, or could reasonably have been expected to know, that the condition of the part of the highway to which the action relates was likely to cause danger to users of the highway (*e.g. evidence of previous complaint*);
- Where the Highway Authority could not reasonably have been expected to repair that part of the highway before the cause of the action arose, what warning notices of its condition had been displayed.

Where a Section 58 defence is used by a LHA to counter a legal action for negligence, it should be noted that the above are not the only criteria that a Court will consider and that decisions will be based upon case precedent.

The 1980 Highways Act does not stipulate the standard of maintenance which should be applied to highways and, indeed, it is accepted by the Courts that different standards will apply to major roads and minor roads and footpaths that will be related to vehicle and pedestrian usage and vehicle speeds. Thus, a Court may recognise that it would not be practical for a LHA to monitor and maintain adequate levels of skidding resistance on all parts of the highway for which they are responsible, since to attempt to do so, would not be considered to be "reasonably practicable".

2.2 Skid Resistance Development

As a responsible LHA, Staffordshire County Council has developed a Skid Resistance Strategy. This has been produced to ensure that the County Council is able to show that it has implemented suitable highways management procedures, with regard to the maintenance of adequate levels of skid resistance across the network, taking account of a variety of factors. This will allow the

County Council to produce a robust defence, which can be used in a court of law, if a road traffic accident occurs where it is alleged that deficient skidding resistance of a particular section of the highway network may have been contributory to the cause of the accident.

3. Skid Resistance

3.1 Staffordshire's Skid Resistance

Various types of equipment are available for measuring skid resistance. Staffordshire adopts the use the Sideway-force Skid resistance Survey device; known as SCRIM®[1] and Griptester MK2.

Within Staffordshire, the A/B class network is surveyed annually in alternate directions, except dual carriageways, which are surveyed annually in both directions. Up to 10% of the C class network, and ad-hoc C/U class requests, are also collated annually.

More information related to the SCRIM surveying process is available in Annex 1-3.

3.2 Surveying Process

The surveying strategy is planned so that the effects of seasonal variation, both within a single season and/or between successive years, can be taken into account in the determination of the Characteristic SCRIM Coefficient (CSC) for any particular length of road.

Staffordshire calculates the CSC of each section of the highway by using the Single Annual Survey Method (See Annex 3 A3.12 – A 3.22), relying on the lengths of dual carriageways surveyed each year to calculate a correction factor that is applied to the whole network. This method estimates the underlying skid resistance once the effect of any seasonal variation has been taken into account.

Once received the data is processed typically this will include:

- Readings for each 10m sub section collected within the speed range 25 to 85kph shall be corrected to a speed of 50kph using the correction equation in HD28/15:

$$SR(50) = SR(s)*(-0.0152*s2 +4.77 *s +799)/1000$$

Where:

- SR(50) is the value of SR(s) corrected to 50km/h
- SR(s) is the Sideway Force Coefficient, measured at test speeds, multiplied by 100. This term is defined further in British Standard BS7941-1.

- Multiplication by the Index of SFC applicable to the SCRIM at the time it was making the measurement (currently 0.78);

The CSC is then calculated by applying the correction factor derived from Single Annual Survey Method.

On receipt of processed survey data, the Asset Management Section shall check that the whole of the specified network has been surveyed. For sections of highway where accurate measures

[1] SCRIM is a registered trademark of W.D.M. limited

were not possible the most recent survey data will be used, provided it is not more than 2 years old.

4. Site Categories

4.1 Assignment

The objective of setting an Investigatory Level (IL) for a site is to assess the nature of the site and assign an appropriate level of skid resistance. The Site Categories and associated Investigatory Levels that have been assigned to the highway network within Staffordshire are defined in Table 4.1. This table has been derived from HD 28/15; however, it been altered to reflect the lower traffic levels and more diverse nature of the highways for which Staffordshire County Council are responsible.

The Site Category most appropriate to the layout of the site will be selected from the list in Table 4.1. If more than one Site Category applies then the highest IL is assigned, if two equal ILs apply to a location then priority is given to road layout over road geometry.

Investigatory Levels are applied to 100m averaging lengths, with the exception of Site Categories Q and K which will normally be the 50m approach to the feature and Site Category R which are based on 10m averaging lengths. Residual lengths less than 50% of a complete averaging length may be appended to the penultimate length, providing the Site Category is the same.

Table 4.1 – Setting Site Categories along a Network

Site Category & Description			Investigatory Level at 50km/h						
		CSC	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	Dual carriageway non-event								
C	Single carriageway non-event								
D	Single carriageway non-event, speed limit ≤ 30 mph								
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 - 250m – single carriageway								
S3	Bend radius <250m – single carriageway								

Notes:

1. Investigatory Levels are for the mean skidding resistance within the appropriate averaging length.
2. Investigatory Levels for Site Categories B, C and D, are based on 100m averaging lengths or the length of the feature if it is shorter.
3. Investigatory Levels and averaging lengths for Site Categories Q ,K, G1, G2, S1, S2 and S3 are based on the 50m approach to the feature but this shall be extended when justified by local site characteristics.
4. Investigatory Levels for Site Category R are based on 10 m lengths.
5. Residual lengths less than 50% of a complete averaging length may be attached to the penultimate full averaging length, providing the Site Category is the same.
6. As part of site investigation, individual values within each averaging length should be examined and the significance of any values which are substantially lower than the mean value assessed.

4.2 Re-Assessment

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 (see Appendix 1; SRF1).

5. Prioritisation

5.1 A and B Class Roads

To prioritise between all SCRIM deficient locations over the A and B class surveyed network, Staffordshire County Council uses a weighted ruleset (table 5.1). This scoring matrix takes into account:

- The most recent SCRIM reading
- The current 3 years Killed and Seriously Injured (KSI) figures (In Wet / Damp conditions)
- The Maximum Speed limit at the SCRIM deficient location
- The Site Category of the SCRIM deficient location
- The current 3 years Slight Accident figures (In Wet / Damp conditions)

These attributes have been selected as those which will have a major influence on the identified SCRIM deficient locations and thereby enable the Engineer to prioritise sites across the network for investigation.

Prioritisation is only applied to sites at or below the Investigatory Level.

Table 5.1 – A-B Road Priority Scoring Matrix

A/B 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 , D	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.

Wet - KSI's (3 Year)

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.

Speed

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.

Wet - Slight Accidents (3 years)

The final consideration is slight accidents. Whilst the corporate aim is to reduce KSI's these are less frequent occurrences. The use of slight 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.

5.2 C and U Class Roads

Due to the different characteristics of the C and U roads on the Staffordshire network, table 5.1, cannot be applied in the same manner for prioritisation of locations on these classes. To account for the varying levels of usage and therefore, the varying number of users being subjected to the deficient location, Staffordshire have incorporated Traffic Flows as an additional criterion to separate between roads that are surveyed. The scoring matrix for C and U class roads is detailed in table 5.2.

Table 5.2 – C and U Road Priority Scoring Matrix

C/U Road Priority Scoring											
Criterion	**Scoring**										**Weight**
Amount Below IL	Range from 0 - (-.2)										29%
	Scored on an X^2 relationship with a max score of 4										
KSI Wet Accidents	0		1		2		3		>=4		24%
	0		1		2		3		4		
Traffic Flows	<1001		1001-2000		2001-5000		5001-7500		>7501		19%
	0.8		1.6		2.4		3.2		4		
Speed Limit	<=30		40		50		60		70		14%
	0.8		1.6		2.4		3.2		4		
Site Category	B	C , D	Q	K	R	G1	G2	S1	S2	S3	10%
	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		5%
	0		1		2		3		4		

6. Desktop Site Investigation

Upon receipt of the annual A and B road network SCRIM data and targeted C/U road network grip test results, Asset Management Section will process the information against tables 5.1 and 5.2 respectively. This enables the scoring and prioritisation of deficient locations for treatment recommendations and warning signage. Further investigation into these prioritised locations is carried out in two phases, initially a desktop study with subsequent on-site investigation if required.

6.1 Desktop Procedure for A and B Class Roads

Staffordshire will undertake the investigation of up to the 100 highest scoring locations using the methodology in table 5.1. This will be completed as soon as practicable upon receipt of the SCRIM data. The method for the desktop procedure is detailed in figure 6.1

The deficient locations to be investigated will be compared against the current and following year's preventative and structural maintenance programmes. This will determine if the extents of the deficient location, either have been treated since survey, or will be treated within the next financial year. The possible outcomes are detailed below:

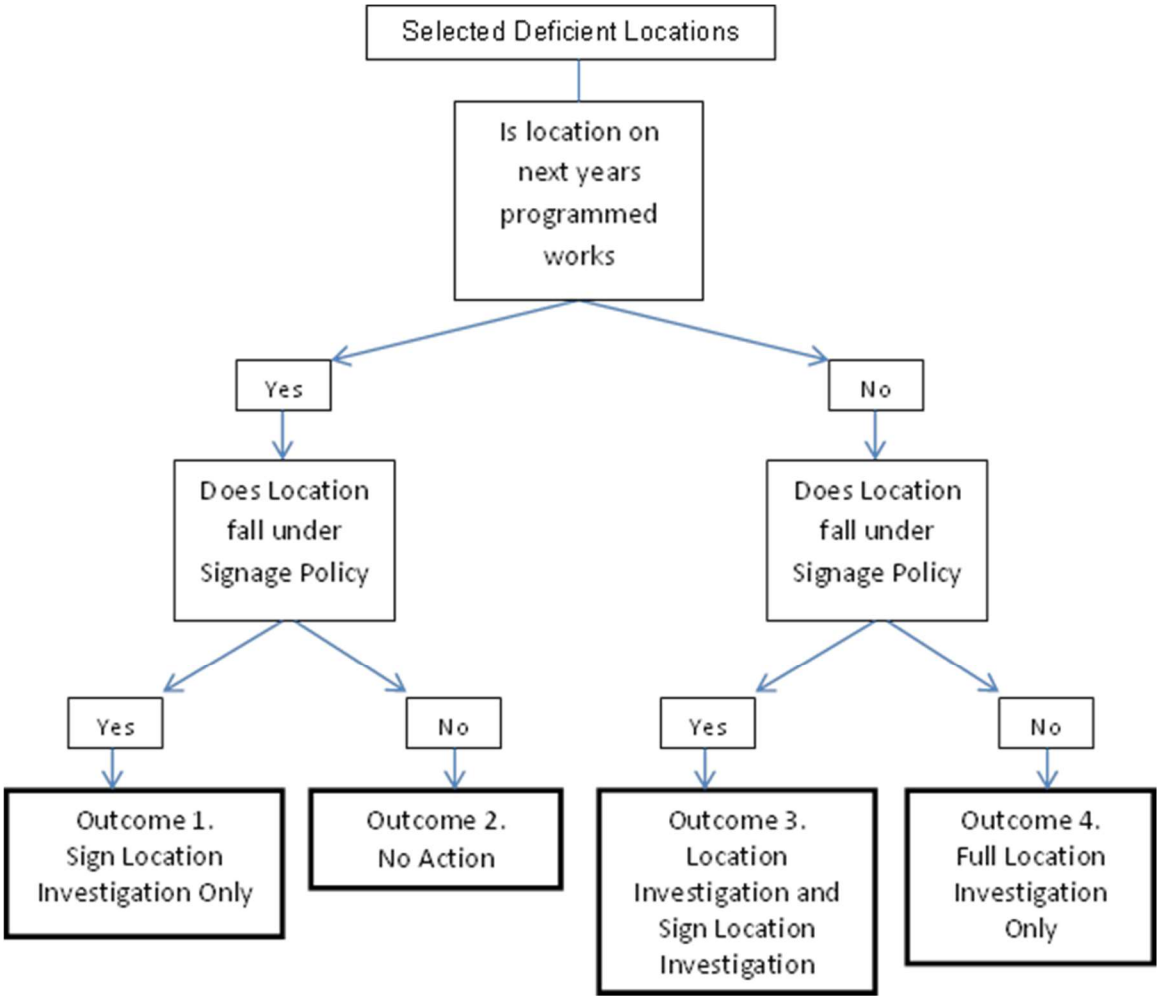
- Those locations where the extent falls within next years programmed works and don't meet the criteria of the signage policy as stated in 8.2 will require no further action and will be signed off by a Senior Engineer. Figure 6.1 Outcome 2

- Those locations where full extent falls within next years programmed works that meet the criteria for signage will only have a signage location investigation (See Appendix 3; SRF3), Figure 6.1 Outcome 1.

- Locations that appear on the next financial years programmed works list whose full extents are not currently covered by the proposed works shall be reviewed by a Senior Engineer to determine whether they can be incorporated. If this is the case then the above bullet point will be applied

- Where the extents are unable to be incorporated, the remaining locations in the top 100 will warrant a site investigation (See Appendix 2; SRF2) in accordance with figure 6.1 Outcome 4. Locations that at any point match the signage policy 8.2, will also have a sign location investigation (See Appendix 3; SRF3) conducted at the same time. Figure 6.1 Outcome 3.

Figure 6.1 – Method of Investigating Top 100 Points



6.2 Desktop Procedure for C/U Class Roads

The analysis of the prioritised C/U class deficient locations will follow the same format as stated in chapter 6. After scoring against table 5.2, up to the top 20 locations will follow the same procedure as listed in paragraph 6.1. Staffordshire County Council has specifically set aside a maximum of 10% of the available budget for the improvement of skid resistance on the C/U class network.

Since testing of the whole C/U class network is not done annually, those locations that did not get prioritised in their surveyed year, will be re-scored in the following years skid resistance analysis of the C/U class network.

Any ad hoc testing completed on the network as a result of injury investigation or other such query will be individually accessed against figure 6.1. The ad hoc survey results will not be compared for prioritisation of investigation against the routinely surveyed roads, as there is special cause for concern at this location.

6.3 Transferring from Desktop to On-Site

Once the locations for site visits have been identified, the extent of investigation is increased by a 55 metre buffer. The full extent of the identified location and 55m buffer at both ends of the site will be investigated under the same assessment.

7. On-Site Investigations

7.1 Investigation Process

Following consideration as detailed in Chapter 6, On-site investigations by Asset Management Section will normally be completed as soon as practicable on both the selected A/B Class and the C/U Class deficient locations, utilising form SRF2 (see Appendix 2)

The results of the investigation, including whether further action is required, shall be documented using SRF2 and retained electronically together with the identity of the Investigator.

7.2 Investigation Findings

Following a site investigation there are a number of potential recommendations. These include:

- No further action
- Treatment to improve skid resistance
- Routine maintenance
- Consider other road safety engineering measures

7.3 Prioritisation of Findings

The Senior Engineer will review and sign off all information gathered, and assess the recommendations provided. Annex 4 and 5 provide more in-depth knowledge for the Senior Engineer when assessing the recommendations. Where structural or preventative maintenance has been recommended then this will be prioritised in accordance with the authority's asset value management process.

8. Warning Signs

8.1 Signs Used

The "Slippery Road" warning sign (Diagram 557 with Supplementary Plate to Diagram. 570) is to be used in accordance with the instructions contained in The Traffic Signs Regulations and General Directions 2016 and amendments thereof.

8.2 Signage Requirement

Following the investigation of the identified locations, a sign location investigation (see Appendix 3; SRF3) may be carried out and warning signs will be erected at those locations that have a speed limit greater than 30mph and with at least 1 KSI and/or 2 Slight accidents in the previous 3 years, regardless of when the location falls on the programme of works.

In all cases where warning signs are to be erected, a record shall be made, (see Appendix 3; SRF3 and Appendix 4; SRF4) and retained electronically. This will enable mapping of the current signs in use and allow for checks to be conducted on their validity.

Since warning signs are erected (if required) after a site investigation, it is particularly important to complete site investigations within a reasonable time period supporting the selection of the top 100 locations. This enables warning signs to be placed where they are needed without undue delay.

8.3 Monitoring and Removal

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 “familiarity breeding contempt”.

9. Referral Process and Accident Clusters

9.1 Casualty reduction

Whilst the County Council use the policy above 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.

9.2 Accident Cluster Sites

Accidents involving personal injury that are collected by Staffordshire Police are reported to the County Council.

Searches of the database are carried out by the Council 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 carried out to identify sites where possible deficiencies in the road surface may be contributing 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 for detailed assessment and appropriate treatments are introduced if deficiencies are confirmed. Where funding is limited, sites are prioritised for treatment by carrying out a cost benefit analysis for each site.

Each fatal accident recorded is assessed in accordance with the County Council's Fatal Accident Procedure (Annex 6)

9.3 Reaction to Accident Cluster Sites

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 against paragraph 8.2, thereby warning motorist in a timely manner.

10. Other Considerations

10.1 Footway and Horse Users

In Staffordshire, while pedestrians and horse user's vulnerability are a concern, risk analyses and likelihood of event chart has shown that accidents relating to these user groups are low per year, when compared to vehicular accidents. The county council has developed a method for gathering data, and proper procedure when treating network, where interaction with these users is likely. These are located in Annex 7

11. Glossary of terms

AAV	Aggregate Abrasion Value. A measure that characterises how rapidly san aggregate abrades under traffic
Characteristic SCRIM coefficient (CSC)	A value to represent the SCRIM coefficient, typically reported for every 10m of survey
Griptester	A trailer based friction measuring device
HD28/15*	Document published by Highways England setting out the management of Skidding Resistance on the UK Strategic Road network **DMRB Volume 7 Section 3 CS 228 Pavement. Inspection and assessment. Skidding resistance supersedes: HD 28/15 Pavement design and maintenance. Pavement maintenance assessment. Skidding resistance (HA, 2015).*
Investigatory Level	A determined value below which a process of prioritisation and investigation is considered.
Locality	Geographic area with similar climatic conditions used to derive seasonal correction
Pavement Management System (PMS)	A computer system that holds pavement condition and associated data.
PSV	Polished Stone Value. A measure that characterises the skid performance of aggregate used for road surfaces. A higher PSV provides a better skid resistance.
Road Traffic Accident	As collected through the police Stats19 reporting. Also can be referred to as collisions or crashes.
SCRIM	Trademark of W.D.M. limited. A self-contained lorry-based friction measuring device
SCRIM difference	The difference between the measured CSC and the Investigatory level
SCRIM processed	SCRIM data held in PMS which includes corrected data at 10m sub section level

SCRIM RAW	SCRIM data held in PMS which includes uncorrected SCRIM coefficient
SCRIM summary	SCRIM data held in PMS reporting the average for each SCRIM summery length (100m of length of site category)
Seasonal correction	Process of applying in year and between year corrections to the raw data in processing within PMS
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 3.29 of HD28/15) **DMRB Volume 7 Section 3 CS 228 Pavement. Inspection and assessment. Skidding resistance supersedes: HD 28/15 Pavement design and maintenance. Pavement maintenance assessment. Skidding resistance (HA, 2015).*
Survey period	The period within the survey year when the survey is carried out in.

12. References

Design Manual for Roads and Bridges

HD 28 (DMRB 7.3.1) Skid Resistance*

**DMRB Volume 7 Section 3 CS 228 Pavement. Inspection and assessment. Skidding resistance supersedes: HD 28/15 Pavement design and maintenance. Pavement maintenance assessment. Skidding resistance (HA, 2015)..*

CD 236 (DRMB 7.5.1) Surfacing Course Materials for Construction

HD 37 (DRMB 7.5.2) Bituminous Surfacing Materials and Techniques

HD 39 (DRMB 7.2.5) Footway Design

Interim Advice Notes

157/11	-	Thin Surface Course Systems – Installation and Maintenance
154/12	-	Revision of SHW Clause 903, Clause 921 and Clause 942
155/12	-	Revision of SHW notes for Guidance Sample Appendix 7/1

Note the DMRB is undergoing a process of updating, and these references are those in place at the time the policy was written (2019).

Manual of Contract Documents for Highway Works

Volume 1 Specification

Volume 2 Notes for Guidance

UK Roads Liaison Group

Well Managed Highway Infrastructure – A Code of Practice. October 2016

Asset Management Competence Framework. March 2019

Accreditation and Quality Assurance of Sideway- force Skid Resistance Survey devices. Version 3. July 2016

Institution of Highway Engineers

Well Managed Highway Liability Risk. March 2017

Statutory Instruments

The Traffic Signs Regulations and General Directions 2016

ADEPT

CSS / British Horse Society – ‘Horses and Highway Surfacing’ -

A Guidance Note for Highway Authorities - (Ref No. - Eng/3-05)

British Standards Institute

BS EN 1097-8: 2000	Tests for the Mechanical and Physical Properties of Aggregates – Determination of the Polished Stone Value
BS EN 1338:2003	Concrete Paving Blocks - Requirements and Test Methods
BS EN 1338:2003	Concrete Paving Flags - Requirements and Test Methods
BS EN 1436:2007	Road Marking Materials - Road Marking Performance for Road Users
BS 7941-1:2006	Methods for Measuring the Skid Resistance of Pavement Surfaces. Sideway-force Coefficient Routine Investigation Machine
BS 7941-2:2000	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
BS EN 13036-4:2003	Road and Airfield Surface Characteristics. Test Methods. Method for Measurement of Slip / Skid Resistance of a Surface.

Other Reference Sources

Staffordshire County Council - 'Highway Safety Inspection Code of Practice'

Staffordshire County Council – 'Base Specification

Transport Research Laboratory Published Project Report PPR497 (Griptester **Trial** – October 2009)

Transport Research Laboratory Published Project Report PPR815 (Better Understanding of the tyre/ Surface Interface – February 2017)

Transport Research Laboratory Published Project Report PPR492 (Further Studies of the Skid Resistance of Asphalt Surfaces - February 2010)

ANNEX 1

BACKGROUND INFORMATION ON THE MEASUREMENT AND INTERPRETATION OF SKID RESISTANCE

General

A1.1 When a vehicle travels over a road, each part of the tyre in contact with the road surface is momentarily at rest. The frictional forces generated at these stationary contact areas between the tyre and the road surface can allow vehicles to be manoeuvred. However, a vehicle will start to skid whenever the available friction between the road surface and the tyre is insufficient to meet the demands of the driver in whatever manoeuvre (including braking) they are attempting to make.

A1.2 The friction available to a driver attempting a particular manoeuvre depends on many different factors and is not constant during the manoeuvre. The influence of road surface characteristics is described below. Other factors include the vehicle's tyres and braking system, the dynamic interaction of the vehicle suspension with the road geometry and environmental factors, such as the temperature and the presence of water or other contaminants. The objective of measurements carried out under the operation of this Strategy is to characterize the influence of the road surface skid resistance and hence define the skid resistance available to road users.

Road Surface Properties

A1.3 The contribution of the road surface to the overall friction is known as skid resistance. In practice, it is found that the skid resistance measured on dry, road surfaces is generally high, but that lower and more variable measurements are obtained when the same road surfaces are wet or damp. For this reason, measurements of skid resistance for the purpose of routine condition monitoring are made on wetted road surfaces.

A1.4 The level of (wet road) skid resistance is dependent on two key properties of the surface, the micro-texture and the texture depth (macro-texture). The fine scale micro-texture, on the surface of aggregate particles and provided by the fines in the mixture, is the main contributor to wet skidding resistance at low speeds and the main property measured in wet skid resistance tests. Greater texture depth generates friction by physically deforming the tyre surface (hysteresis) and also provides rapid drainage routes between the tyre and road surface.

A1.5 The effects of micro-texture and texture depth combine to influence the wet skidding resistance at higher speeds. The TRL report PPR815: 'Better understanding of the surface/tyre interface' applies a breaking model to undertake analysis of the influence of SCRIM and texture depth on braking distance from various speeds with and without ABS, This indicates at 75kph, an increase of around 25% in braking distance at a texture depth of 0.6mm, against 1.0mm, at the same skid resistance.

Effects of Traffic

A1.6 Under the action of traffic, the micro-texture becomes “polished”, leading to a reduction in skid resistance. CD 236 (see Annex 5) requires the components of the surfacing mixture to satisfy certain criteria in relation to their resistance to polishing, so that surfacing materials generally provide adequate skid resistance during their service lifetimes.

A1.7 In combination with the specification of surfacing materials, the skid resistance of roads is monitored to identify areas where the micro-texture has been lost as the surface has been polished by traffic and treatment might, therefore, be needed to improve the skid resistance. This is necessary because the performance in service cannot be predicted precisely from the properties of the surfacing components and traffic levels, and the effects of manoeuvring vehicles at the location might be greater than was anticipated at the time the surfacing was designed.

A1.8 Similarly, the texture depth of some types of road surfacing materials can reduce with time under the combined influences of traffic flow, temperature and the nature of the surface. Texture depth is also monitored and the measurement of texture depth is described in HD 29 (DMRB 7.3.2).

Early Life Skid Resistance of Asphalt Surfacings

A1.9 Different types of asphalt surfacing materials exhibit different skid resistance properties in the initial period after laying, compared with the same surfacing materials that have been exposed to traffic for a period of time. The TRL published Project report PPR492 concluded that whilst this effect can occur it is difficult to predict, and the benefits of new surfaces in terms of accident reduction outweigh this risk. As a consequence, the previous requirement to take measures to mitigate this risk have not been included in HD28/15. The method used within Staffordshire to address any reduction in early life skid resistance of asphalt surfacing materials is described in Annex 5 of this Strategy. This practice will continue until a more detailed review is undertaken.

Seasonal Variation of Skid Resistance

A1.10 After any initial period of wearing in, road surfaces reach an equilibrium state of polishing. For roads where the traffic level is constant, the skid resistance will then fluctuate through seasonal weathering and polishing cycles but will remain at a fairly constant level for many years. If traffic levels subsequently increase or decrease, the position of the equilibrium will shift so that a lower or higher overall level of skid resistance is observed, but with the same seasonal fluctuation superimposed.

A1.11 An example of long-term variation in skid resistance is shown in figure A1. This is from a control site in the SW of England collected using 3 runs each year from 1995 - 2009

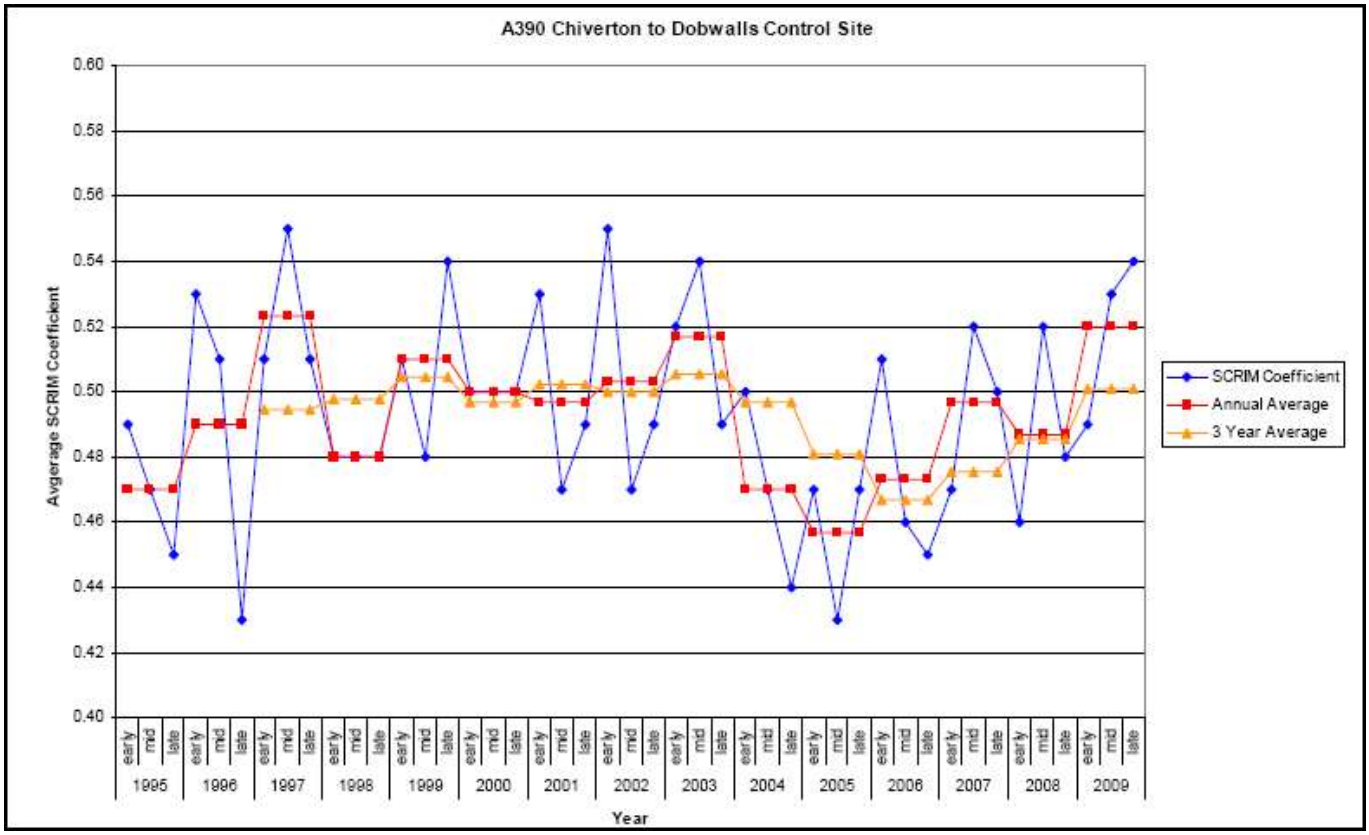


Figure A1: Seasonal variation 1995 to 2009

A1.12 The accepted explanation for the annual variation is that in the winter (October to March) when the roads are wet for much of the time, the detritus on a road surface is coarser, than when the road is predominantly dry. The coarser detritus has a rejuvenating effect on the micro- texture, whereas the finer aggregate tends to contribute to polishing. In practice, the minimum skid resistance varies from year to year and occurs during different periods depending on the prevailing weather conditions.

A1.13 Because the skid resistance varies seasonally and between years, various strategies have been developed to provide a measurement that characterises the state of polish of the micro-texture. Survey strategy and processing procedures are designed to reduce the effect of the variation within a year and/or between successive years, so the sites with low skid resistance can be identified more accurately. Typically, measurements are made during the summer period, when the lowest measured values are observed.

A1.14 The survey and analysis methods to be used for the purposes of this Strategy are described in Annex 2 and Annex 3 of this Strategy.

Standardised Measurements

A1.15 To characterize the condition of the micro-texture, measurements of skid resistance are made under standardised conditions that restrict the influence of other factors on the measurement as far as possible. HD28/15, BS 7941-1:2006, and the UKRLG document, Accreditation and Quality Assurance of Sideway- force Skid Resistance Survey devices

detail the processes applied to control the survey operations to ensure comparisons between different surveys, carried out at different times can be made. . Further details of test procedures are given in Annex 2.

A1.16 The measurements made and interpreted according to this Strategy; provide a guide to the general condition of the road to assist in maintenance planning. Because they indicate the general level of skid resistance under standardized conditions, the values do not relate directly to specific accident situations, where other factors such as the tyre condition, vehicle speed and type of manoeuvre attempted, all influence the level of friction generated at that time.

A1.17 In contrast, skid tests carried out by the Police for the purpose of reconstructing the situation leading to an accident are intended to recreate the specific conditions of the accident. The results of these different types of test cannot be compared precisely.

Relationship to Accident Risk

A1.18 Within normal ranges, low skid resistance does not cause accidents on its own although, depending on the particular circumstances, it may be a significant contributory factor, or influence the consequence of a particular accident. The level of skid resistance, even on a polished surface, will generally be adequate to achieve normal acceleration, deceleration and cornering manoeuvres on sound surfaces that are dry and free from other contamination. However, higher skid resistance can allow manoeuvres that demand higher friction to be completed, e.g. to stop quickly or corner sharply. Appropriate levels of skid resistance can therefore reduce accidents in cases where drivers need to complete a more demanding manoeuvre in order to avoid an accident. A key part of this Strategy is the judgment of locations where this is more likely to occur, so that the provision of higher levels of skid resistance can be targeted at these locations.

A1.19 Accident analyses have shown that there are relationships between measured skid resistance and accident risk. These relationships are not precise, in that differences in skid resistance may account for only a relatively small part of the difference in accident risk between individual sites because of all the other factors involved. Nevertheless, they have allowed general observations to be drawn that make it possible to provide guidance for managing the provision of skid resistance on the network.

A1.20 The influence of skid resistance on accident risk is markedly different for roads with different characteristics. For this reason, site categories have been defined to group roads with similar characteristics.

A1.21 For some site categories, no statistically significant relationship, or only a weak relationship, is observed between skid resistance and accident risk. A good example of this is motorways, where the road design has minimised the potential for conflict between road users. Although the skid resistance is still important, because of the need to provide uniform road characteristics, the level of skid resistance can be lower than other categories.

A1.22 For other site categories the accident rate increases, on average, as the skid resistance falls. For these categories, there are benefits in maintaining a higher level of skid resistance to contribute to reducing the number of accidents at these sites.

A1.23 However, not all sites within a single category are equivalent in terms of their accident risk; there is a range of accident risk present for individual sites within a single site category. This range is not surprising when the range of characteristics present within a single nominal site category is considered, e.g. in road design and traffic flow. It should also be noted that there is no boundary at which the skid resistance passes from being “safe” to being “dangerous”.

A1.24 Judgment of the relative accident risk and appropriate level of skid resistance for different sites within the same category forms a key part of the effective operation of this Strategy.

ANNEX 2

SCRIM SURVEY OPERATIONAL PROCEDURES

A2.1 This Annex lists the standard testing procedures that are required to limit the variability of skid resistance measurements resulting from factors other than the road surface condition.

Testing Season

A2.2 For standardised tests, measurements shall be made during the testing season, defined as the summer period 1 May – 30 September. This survey season is divided into 3 periods; described as 'early,' 'middle' and 'late.' Surveys are undertaken over a three year cycle so one survey is carried out in each of the three periods.

A2.3 In exceptional circumstances the testing season may be extended but only with the prior agreement of Staffordshire County Council.

Testing Speed

A2.4 On all roads within Staffordshire, the target test speed is 50kph.

A2.5 The SCRIM driver shall maintain a vehicle speed as close to the target test speed as possible. This is achievable for most parts of the network**.**

A2.6 If it is not safe or practical to maintain the target speed then, a different speed may be used at the discretion of the SCRIM driver, within the range 25 – 85kph. The safety of the SCRIM and other road users has priority at all times.

A2.7 The Investigatory Levels for the CSC values defined in Chapter 5 have been set in terms of the 50km/h standard testing speed. The method for applying speed corrections is given in Annex 3 of this Strategy.

Testing Lane and Line

A2.8 The survey strategy is to undertake testing in alternate directions on single carriageways each year, and in both directions on dual carriageways. Testing will be undertaken in lane 1 in all cases, as this lane usually carries the heaviest traffic and can, therefore, be expected to show the lowest skid resistance. In areas where this is not the case (for example, approaching points where routes diverge and a greater proportion of heavy vehicles uses the offside lane) then a different lane, or more than one lane may be tested.

A2.9 The test lane shall be as specified by Staffordshire County Council.

A2.10 SCRIM measurements shall be carried out with the test wheel in the nearside wheel path of the running lane unless an alternative line has been agreed with Staffordshire CC.

A2.11 If it is necessary for the SCRIM to deviate from the test line (e.g. to avoid a physical obstruction or surface contamination) the data shall be marked as invalid and eliminated from the standard analysis procedure.

A2.12 On urban roads where roadside parking in unmarked positions is commonplace, there may be two pairs of wheel paths – one followed at times of day when parked cars are mostly absent and another when they are largely present. In such circumstances the line that normally carries the most commercial vehicle traffic must be followed.

A2.13 In situations where the test line is prone to physical obstruction, for example by parked cars, then an alternative test line must be agreed with Staffordshire CC to avoid recording invalid data for the same length of road in successive years. Testing the offside wheel path might be an appropriate alternative in these circumstances, with the aim of achieving a consistent test path, year on year.

Testing on Bends

A2.14 There are no special requirements for testing on bends. At locations where a sharp bend is combined with traffic braking or accelerating, the wheel path on the outside of the bend can become more polished than the inside wheel path. This is taken into account in setting the Investigatory Level (See Chapter 4).

Testing on Roundabouts

A2.15 Roundabouts can present practical problems regarding potential traffic conflicts and testing speed. They range from small, mini-roundabouts to large grade-separated interchanges. Larger roundabouts may have free-flowing traffic or traffic light controls at certain times of day.

A2.16 Mini-roundabouts or small island roundabouts should be treated as part of the main carriageway test line and do not need to be tested separately. (This applies to the testing procedure – the roundabout section may be assigned to a different Site Category to that of the main line.)

A2.17 On most roundabouts or interchanges, a line equivalent to the outermost lane should be tested.

A2.18 On roundabouts with lane markings for specific routes, a representative line should be chosen broadly following the most polished path. Usually this will be that followed by most heavy vehicles, which, because of their size, may not be able to keep to the marked lanes.

A2.19 The test line(s) to be followed at roundabouts shall be as agreed by the survey contractor and Staffordshire CC. They will take into account the need for consistency in representative measurements in successive surveys and possible variations in Site Category through the intersection.

A2.20 On some smaller roundabouts where the distance between the arms is short, it may be appropriate to record data at a shorter interval than the standard 10m length. Changes to the recording interval will be specified by Staffordshire CC.

Ambient Conditions During Testing

A2.21 The ambient conditions can have an effect both on the skid resistance of the road and on the measurements. The survey contractor shall record the weather conditions at the time of the survey as required by BS7941-1:(2006).

A2.22 Testing in extremely strong side winds must be avoided because these can affect the measurements by creating turbulence under the vehicle that causes the water jet to be diverted from the correct line.

A2.23 Testing must be avoided in heavy rainfall or where there is standing water on the road surface. Excess water on the surface can affect the drag forces at the tyre / road interface and influence the measurements.

A2.24 Measurements shall not be undertaken when air temperatures are below 5°C.

A2.25 Staffordshire CC shall maintain a record of general conditions throughout the testing season. Both the survey contractor and Staffordshire CC shall endeavour to record any road conditions that could affect the results.

A2.26 Contamination of the road surface by mud, oil, grit, or other contaminants is to be noted and the affected measurements identified so that results are eliminated from the standard analysis procedure. If the contamination is severe, emergency action may be required to remove the contamination. In this case the problem must be reported by the survey contractor without delay, to Staffordshire CC, together with the relevant results if possible. Staffordshire CC will then notify the local Area Highways Office to enable appropriate action to be carried out.

ANNEX 3

PROCESSING AND COMPUTATION OF CHARACTERISTIC

SCRIM COEFFICIENT

A3.1 This Annex lists the processing requirements of Staffordshire CC. The processing requirements must be applied in the order listed below.

A3.2 On completion of the survey, the speed corrected SCRIM Coefficient (SC) shall be determined for each 10m section for which a valid SCRIM Reading is available. The corrected SC shall then be used to determine the CSC using the Single Annual Survey Method.

Speed Correction

A3.3 The test speed has a significant effect on the measurements of skid resistance.

A3.4 For the purpose of this Strategy, measurements collected within the speed range 25 to 85 km/h will be corrected to a speed of 50km/h, using the following equation (HD28/15):

$$SR(50) = SR(s)*(-0.0152*s2 +4.77 *s +799)/1000$$

Where:

SR(50) is the value of SR(s) corrected to 50km/h

SC (s) is the SC measured at the test speed, s.

Temperature Correction

A3.5 The temperature of the air or road can have a small effect on the tyre rubber and the measurements made. Under normal UK conditions, the influence of temperature is not of practical significance in comparison with other factors affecting the measurements. Temperature correction is not applied for surveys carried out under the conditions set out in this Strategy.

Index of SFC

A3.6 The Index of SFC was originally introduced as a factor to relate the values given by SCRIM to the SFC obtained from the equipment at TRL, during the period 1963-1972, used to derive information on which to base proposals for specification. From this revision of the Strategy, it serves as a general correction factor that will allow Staffordshire CC to maintain the SC at a consistent general level as future developments are made to the equipment or monitoring techniques.

A3.7 The Index of SFC is defined by Staffordshire CC. The value currently in force is 78 per cent (0.78) and is applicable to all SCRIM in current use but it may be amended in future, either for the whole fleet or for individual SCRIM.

A3.8 The SC value shall be multiplied by the Index of SFC currently in force.

Calculation of Characteristic SCRIM Coefficient Values

A3.9 As noted in Annex 1, the skid resistance of road surfaces can fluctuate within a year and between successive years, while maintaining a similar general level over a long period of time. The basis of this Strategy is that skid resistance will be assessed on the basis of the overall (summer) level of skid resistance rather than an instantaneous measurement.

A3.10 By removing the effect of seasonal variation as far as possible (both variation within a single year and between successive years) sites exhibiting a lower skid resistance can be identified more accurately.

A3.11 Paragraphs, A3.12 to A3.23, outline the method that Staffordshire has adopted to provide an estimate of the summer skid resistance, referred to as the CSC, from the corrected SC values.

Single Annual Survey Method

A3.12 This approach is based upon a single annual survey of the network. The method uses measurements from the preceding 3 years to characterise the long-term skid resistance of the network. This value is used with the mean network skid resistance in the current year, to calculate a correction factor, which is applied to the current year's data to make current values consistent with the long-term average.

A3.13 As the effect of seasonal variation will vary in different geographical areas (e.g. due to different amounts of rainfall), larger networks may be split into smaller localities and the correction factor will be determined and applied separately within each locality. For Staffordshire 1 locality is applied to the whole network

A3.14 The whole network shall be surveyed once during the Testing Season in each year. Surveys must be planned such that in successive years each road length is tested in the early, middle and late parts of the season.

A3.15 The early, middle and late parts of the season are defined, respectively, as:

- **Early:** May to mid-June,
- **Middle:** mid-June to mid-August and
- **Late:** mid-August to the end of September.

For example, a route tested in the early part of the season in year 1 could be tested in the late part of the season in year 2 and in the middle part of the season in year 3. In year four, it must be tested in the early part of the season again, etc.

A3.16 Each site on the network shall be allocated to a locality by the Overseeing Organisation. New sections must be assigned a locality prior to processing the survey data,

A3.17 A **locality** is a collection of road sections or routes for which a Local Equilibrium Correction Factor will be determined. A locality must be small enough so that similar weather conditions will normally be experienced within it and large enough so that a stable value

can be calculated to represent the long-term skid resistance. This approach is based on the assumption that the climatic effects leading to seasonal variation influence all the roads in a local area in a similar way.

A3.18 The **Local Equilibrium Correction Factor** (LECF) is the correction factor determined within each locality to bring the current year data to a level consistent with the long-term average.

A3.19 By surveying all road sections within a locality at the same time, this method can remove a component of the within-year seasonal variation as well as the variation between years.

A3.20 All the road sections within each locality shall be surveyed within the same part of the test season.

A3.21 The LECF is calculated in three stages:

(i) The **Local Equilibrium SC** (LESC) is determined to represent the average skid resistance level for the locality over recent years. The LESC is the average SC, calculated for all valid 10m sub-section measurements in the defined locality over the 3 years that precede the current testing season. This must contain surveys from each of the three parts of the test season. Valid measurements are those that were made in the required part of the test season, on the required test line, on road surfaces that were at least 12 months old at the time of testing.

(ii) The **Local Mean SC** (LMSC) is determined for the current survey. The LMSC is the average of all valid 10m sub-sections in the locality in the current year survey.

(iii) The LECF is determined by dividing the LESC by the LMSC, i.e.:

LECF = LESC/LMSC

A3.22 The CSC for each 10m sub-section shall be determined by multiplying the corrected SC by the LECF.

Measurements Outside the Normal Testing Season

A3.23 Occasionally, SCRIM measurements may be made outside the normal testing season. Although data from such measurements can be used for comparative purposes by experienced personnel, such measurements are subject to the full uncertainty of seasonal variation and do not form part of this Strategy.

A3.24 Survey planning should allow for the possibility of delays, for example, due to a machine breakdown or severe wet weather, and allow for recovery within the defined testing season.

A3.25 Exceptionally, surveys may be completed up to the end of the first week of October with the agreement of Staffordshire CC, provided that the general weather conditions in the area remain comparable to those experienced in September and that no frosts or treatments to the road such as gritting have occurred.

Annex 4

DESIGN MANUAL FOR ROADS AND BRIDGES – CD 236 – SURFACE COURSE MATERIALS FOR CONSTRUCTION

General

A4.1 The choice of surfacing materials used on the highways within Staffordshire plays a vital role in providing roads that are safe, that meet the needs of the user and which provide value for money. A key element of this is the importance in ensuring that aggregates with appropriate properties are selected for use within the materials specified for works on the highway network. This requirement is an essential component in ensuring that adequate skid resistance values, for both new build and maintenance operations, is provided at the construction stage, and subsequently maintained at an appropriate level for the whole life of the carriageway, as detailed within Staffordshire's 'Carriageway Life Cycle Plan'.

A4.2 CD 236 provides a summary of surfacing options available for use on both flexible and rigid pavements and advises on current requirements for surfacing. It also details the requirements for aggregates to ensure that satisfactory skid resistance is provided on roads for both new and maintenance construction.

A4.3 Specific elements of CD 236 have been adapted and included within this Strategy for use on the highway network within Staffordshire (see Chapter A4.8), while taking into consideration IAN 154/12 and 155/12

A4.4 PSV is the value applicable to a particular aggregate, not the road surface. The higher the PSV figure the greater resistance the aggregate has to polishing, and the greater the ability the aggregate has to retain its own natural very fine micro-texture, (roughness).

A4.5 Aggregate durability is also important when selecting appropriate aggregate for use on highway surfacing schemes because it is important that the aggregate will not wear away, abrade, too quickly. Aggregate durability is measured by the Aggregate Abrasion Value (AAV) test as described in BS EN 1097-8: 2000. AAV is a measure of the durability or resistance to abrasion of aggregates under the action of traffic. The smaller the AAV number, the less the aggregate abrades.

A4.6 To enable Engineers for both new build and maintenance operations to select the correct aggregate for use within Staffordshire, Staffordshire Highways Laboratory will provide datasheets for PSV values from different suppliers/sources on request.

A4.7 The minimum PSV to be applied to different Site Categories / Site Descriptions for a range of Investigatory Levels, related to commercial vehicle traffic flows at design life, are provided in Table 3.2 of CD236. The maximum AAV, related to commercial vehicle traffic flows at design life, is provided in Table 3.4 of CD236. These tables refer to both new works and carriageway maintenance operations.

A4.8 Table 3.2 and Table 3.4 have been adapted for use on the highway network within Staffordshire, for both new construction and maintenance works. These Tables are only for use in those situations where the required traffic flows are not available. The amended versions have been included within this Strategy as Tables A4.1 and A4.2 respectively. The Site Categories and Site Descriptions have been amended to correspond to the Site Categories and Descriptions developed specifically for Staffordshire, which are contained within Table 4.1 of this Strategy.

A4.9 Where traffic flows are available, Table 3.2 and Table 3.4 of CD236 should always be the primary source to be referenced in order to obtain the appropriate PSV and AAV values.

A4.10 The appropriate values of both PSV and AVV given in Tables 3.2 (or Table A4.1 of this Strategy if applicable), shall be inserted into the appropriate part of Appendix 7/1 of any Specifications (MCHW1) prepared for both new works and maintenance operations undertaken within Staffordshire.

A4.11 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 Tables 3.2 (or Table A4.1 of this Strategy if applicable) may be considered. If however, the measured skid resistance of the site when related to the life achieved and the skidding accident rate are below expectations for an aggregate from a particular source, then a higher PSV than that given in Table 3.2 (or Table A4.1 of this Strategy if applicable) may be specified.

A4.12 The requirements of Tables 3.2 and 3.4 (or Tables A4.1 and A4.2 of this Strategy (if applicable) cover:

- chippings for surface dressing;
- course aggregate in thin surface course systems, porous asphalt, bitumen macadam surface courses and surface courses of rolled asphalt without coated chippings applied to the surface;
- coated chippings applied to the surface of rolled asphalt, to mastic asphalt and to fine graded macadam;
- coarse aggregate in slurry surfacing and micro surfacing systems;
- coarse aggregate in non-surface dressed binder courses of bitumen macadam or stone mastic asphalt and bases of bitumen macadam or rolled asphalt used as temporary surfaces by general traffic for prolonged periods and not subject to speed restrictions or without warning signs.

A4.13 Notwithstanding the contents or use of the Tables within this Chapter, Highway Engineers involved in carriageway surfacing design are strongly advised to familiarize themselves with the complete contents of CD 236, which deals with a greater range of subjects within the field of carriageway surfacing materials.

Site category	Site description	IL	Minimum PSV required			
			Road Hierarchy Traffic Groups (Current Traffic usage – cv/ each direction/ day)			
			04 – 07 (< 250)	03 (250 – 500)	02 (750 – 1250)	01 (> 1250)
B, C, D	Dual and single carriageway non event, where traffic is generally free flowing in a relatively straight line	0.30	50	50	50	55
		0.35	50	50	55	60
Q	Approaches to and across major and minor junctions, approaches to roundabouts or other hazards where frequent or sudden braking occurs but in generally a straight line	0.45	60	65	68+	68+
K	Approaches to crossings and other high risk situations	0.50	65	65	68+	68+
G1 and G2	Gradients > 5%, longer than 50m	0.45	55	60	65	68+
R, S1, S2 and S3	Bends (radius < 500m) on all types of roads, including roundabout circulation areas, approaches to hazards that require combined braking and cornering	0.45	50	60	65	65

Notes:

1. This table is only to be used for new works and maintenance operations within Staffordshire where lack of required traffic flows precludes the use of Table 3.1a and 3.1b contained within IAN 156/16.
2. Sites are grouped according to their general character and traffic behaviour. The Investigatory Levels (IL) for specific Site Categories of site are defined in Table 4.1. The IL to be used here

is that which has been allocated to the specific site on which the material is to be laid, as determined by following the procedures contained in Chapter 4.

3. Dual carriageway slip roads may fit in a number of categories depending on their layout. For example, a free-flowing section close to the main line would be in Category B/C whereas the end of an off-slip approaching a give way line or the point at which a queue develops would be in Category Q/K. Some slip roads with gradients may be in Category G1/G2. Use the most appropriate Site Category from Table 4.1 that was used to determine the Investigatory Level.

4. Where '68+' material is listed in this Table, none of the three most recent results from consecutive tests relating to the aggregate to be supplied shall fall below 68. See CD236 paragraph 3.8.

5. Throughout this table, HFS means specialized high friction surfacing; incorporating Calcined Bauxite aggregate, conforming to Clause 924 of the Specification (MCHW1) will be required. See Chapter 11.

6. For sites in Categories R, G1, G2, S1, S2, S3, any PSV in the range given for each traffic level may be used for any IL and should be chosen based on local experience of material performance. In the absence of other information, the values given for the appropriate IL and traffic level should be used.

Table A4.1 Minimum PSV of Chippings, or Coarse Aggregate in unchipped surfaces, for use on highways within Staffordshire where current Traffic Flows are not available.

Road Hierarchy Traffic Groups	**07 – 04**	**03**	**02**	**01**
Current Traffic Usage – cv/each direction/day	**(<250)**	**(250-750)**	**(750–1250)**	**(>1250)**
Maximum AAV for chippings for hot rolled asphalt and surface dressing, and for aggregate in slurry and micro surfacing systems.	14	12	12	10
Maximum AAV for aggregate in thin surface course systems, exposed aggregate concrete surfacing and coated macadam surface course.	16	16	14	12

Notes:

1. This table is **only** to be used for new works and maintenance operations within Staffordshire where lack of required traffic flows precludes the use of Table 3.2 contained within HD 36/06.

2. For carriageways within Road Hierarchy Traffic Groups 02 to 07, aggregate of higher AAV may be used where experience has shown that satisfactory performance is achieved by an aggregate from a particular source.

3. The maximum AAV requirement for porous asphalt is specified in Clause 938 of the Specification (MCHW 1).

Table A4.2 Maximum AAV of Chippings, or Coarse Aggregate in unchipped surfaces, for use on highways within Staffordshire where current Traffic Flows are not available.

Annex 5

IMPROVING SKID RESISTANCE IN STAFFORDSHIRE

Early Life Skid Resistance

General

A5.1 HD 28/15 does not contain procedures to mitigate the risks associated with the reduced early life skid resistance of some newly laid surfacing materials. The Highways Agency published an Interim Advice Note 49/03 to address this issue, later superseded by IAN 49/13. This has subsequently been withdrawn.

A5.2 Staffordshire have developed their own policy, for use on local authority-maintained highways within Staffordshire, to manage the potential problems associated with the reduced early life skid resistance of some newly laid Surfacing Course materials. This procedure will remain in place, until a more detailed assessment of the benefits is undertaken.

A5.3 The early life skid resistance of Stone Mastic Asphalt (SMA) Surfacing Course is a cause for concern. This is due to the high binder content of the SMA materials used and the presence of significant amounts of this bitumen at the surface of the carriageway after the laying of the material. This surface bitumen may result in SMA skid resistance values measured in dry conditions displaying similar values to those measured on existing trafficked material in wet conditions and hence may result in SMA skid resistance values in wet conditions that are significantly below the values required by this Strategy.

Use of Sealing Grit

A5.4 Staffordshire Highways Combined Specification contains a Contract Specific Additional Clause AR 971. This Additional Clause details Staffordshire's 'Policy For Use of Stone Mastic Asphalt on County Roads', and also provides information on the use of sealing grit to establish Staffordshire's requirement for the provision of early life skid resistance.

A5.5 The application of coated sealing grit conforming to the requirements of BS 4987: Part 1, Clause 7.9, 0-4mm sealing grit, on the generic SMA Surfacing Course specified for use within Staffordshire, has been found to provide a significant improvement in early life skid resistance and therefore its use should be specified on all carriageways where SMA is to be laid.

A5.6 The rate of spread of the sealing grit should be approximately 0.5 to 0.7 kg/sq.m and the material should be applied to the hot mat during the compaction process. Mechanical means should be used to apply the grit to ensure an even rate of spread and to avoid the occurrence of excessive localized accumulations of material.

A5.7 It is recognised that the application of grit will reduce texture depth to some degree, however, a monitoring regime of gritted SMA carried out by Staffordshire Highways Laboratory, on both high speed roads and low speed roads and roundabouts, indicates

that it is unlikely that texture depths will be reduced below those levels required to provide adequate levels of skid resistance.

A5.8 On sites where sealing grit has been applied, warning signs will not normally be required and skid resistance tests need only be carried out where there is a recent skid related accident history, or where a previously higher level of skid resistance existed which has come to be relied upon by road users.

High Friction Surfaces

General

A5.9 Although all roads require an appropriate level of skid resistance, there are some locations that may require a higher level of skid resistance than others to increase the levels of safety for the highway user.

A5.10 High Friction Surface (HFS) systems can be highly effective when used to increase the skid resistance of a site, however they should only be installed in locations where its use is specified within Table 3.1 of CD236, or within Table A4.1 of his Strategy if the required traffic flows for the site are not available.

A5.11 Additionally, and only in appropriate circumstances, the use of HFS may be targeted at specific site's, where there is an identified risk of accidents involving skidding, to produce benefits in the form of a reduction in the number of vehicular accidents and their levels of severity.

A5.12 Typical locations for the installation of HFS systems are busy sites subject to high traffic densities and sites where vulnerable highway users are present, such as on the approaches to pedestrian crossings and signal controlled junctions, and other high risk situations such as sharp bends or steep gradients or where there is a combination of both, are also locations that may benefit from the use of HFS systems.

A5.13 Whilst it is accepted that CD236 requires a minimum HFS treatment length of 50m on the approach to a hazard, it is also acknowledged CD236 has been developed for use on Trunk Roads. Local authority-maintained highways generally carry lower levels of traffic and may therefore, be considered lower risk. Where HFS is to be used on LHA highways within Staffordshire, an assessment of the proposed location may be carried out, and a record should be retained, to determine whether 50m of HFS is required, or whether a shorter length may be considered adequate.

A5.14 Design Engineers should be aware that the 'unrestricted' use of HFS systems may raise the expectations of local highway users, resulting in the transferral of the problem from the treated site to another location within the same general locality.

A5.15 There was historic use of HFS at locations which could not be justified in terms of accident reduction or the requirements of CD236 and when a site is due for surface maintenance, a risk-based approach should be adopted to ascertain whether reinstatement of the HFS

is justified or whether a replacement surfacing material containing an aggregate with a Polished Stone Value (PSV) that meets the requirements of CD236 would be more appropriate.

A5.16 Professional engineering judgment, taking into account local experience and the accident history of each site where a HFS system is proposed, should be used to consider which method is most suitable for that particular site or whether a more cost efficient alternative may be more appropriate. These alternatives include road safety measures such as improvements to road markings, signs or street lighting, or the use of surface dressing materials with a high skid resistant natural aggregate bonded with a binder capable of withstanding the braking forces generated at the site.

A5.17 There may be a limited number of sites where the use of HFS systems is not warranted by reference to Table 3.1 or Table A4.1, but it is recognized that there may be advantages to be gained by the use of a surfacing system that provides the material properties required for the site together with a visual impact similar to that provided by a HFS system. In these cases, the options include;

- The use of a Surface Course material which contains a coloured aggregate or coloured pre-coated chippings. The binder of this material may additionally contain a coloured pigment;
- Application of a surface dressing containing coloured chippings.

A5.18 There are alternative methods of achieving similar high levels of surface friction at specific sites that may be more beneficial when whole life costs are considered:

- Application of a surface dressing with 68+ PSV natural aggregate
- Installation of a Surface Course containing a 68+ PSV natural aggregate.
- Proprietary products utilising artificial aggregate in conventional surface courses

A5.19 Requirements for the use of specialized HFS systems, and Surface Courses and Surface Dressing containing 70+PSV aggregates, must be included within Appendix 7/1 of any Contract documentation produced for new or maintenance Works on Staffordshire's highway network and this information forwarded to the Asset Management Section.

Materials and Workmanship

A5.20 Although HAPAS approval is not required for the use of specialized HFS systems on local authority maintained highways (it is required for use on Trunk Roads and Motorways), Staffordshire specifies that the systems used on its highways adhere to the requirements of MCHW Clause 924; High Friction Surfaces. This requires the system to have a current British Board of Agrément HAPAS Roads and Bridges Certificate and to be installed by a Contractor, approved by the BBA and the Certificate Holder, to install that system.

A5.21 Natural aggregate that has a PSV over 60 is regarded as a high skid resistant aggregate, but aggregates with a PSV over 65 are needed for particularly high stressed sites.

A5.22 HFS is a term that describes the specialized group of road surface treatment systems that are applied as a topping to the road surface and utilize Calcined Bauxite as the aggregate, and a variety of different binders that provides the specified minimum 70+ PSV.

A5.23 Specialized HFS systems are more expensive than conventional surfacings, both to install and maintain, and on more heavily trafficked sites the durability of different surfacing systems can vary greatly, therefore it is important to consider the whole life costs of the proposed works and to ensure that the correct system is used taking into account the volume of traffic predicted for the site for the expected life of the system.

A5.24 The Calcined Bauxite aggregate used in specialized HFS systems exhibits very high PSV and very low Aggregate Abrasion Value's (AAV), although the PSV does alter according to the source.

A5.25 There are several sources of Calcined Bauxite on the market with densities varying from 2.6 to 3.4, dependent upon source. Density is a good indication of the PSV of the Calcined Bauxite, with high density indicating a high PSV.

A5.26 Test certificates should be requested to ensure that the Calcined Bauxite used has an appropriate PSV.

A5.27 Specialized HFS systems usually use a form of resin rather than bitumen to hold the aggregate to the road surface. There are two types:

1. Cold applied processes using a thermosetting, epoxy, polyurethane or methyl methacrylate resin. They are supplied as separate components that when mixed together undergo a chemical reaction that produces some heat and sets after a number of hours.

2. Hot applied process where the Calcined Bauxite and the thermoplastic resin, which is supplied in a granular form, are supplied premixed. The material is heated and screeded out onto the road surface where it sets.

Measurement of Skid Resistance Values

A5.28 Staffordshire does not specify an 'end product' SRV for specialized HFS systems because it is considered unlikely that a currently certified system, installed by an Approved Contractor, will not be fit for purpose.

Annex 6

STAFFORDSHIRE COUNTY COUNCIL – ECOMONY INFRASTRUCTURE AND SKILLS

FATAL ACCIDENTS PROCEDURE

This procedure has been developed using advice from the ADEPT Traffic and Safety Working Group. It seeks to ensure that our response to fatal accidents on County maintained roads is appropriate while making the most efficient use of staff resources to maximise casualty reduction.

(1) Accident Investigation or similar staff should not attend the fatal accident scene at the time of the incident as this would hinder the immediate action being taken by the emergency services. Maintenance staff should attend if requested (as now).

(2) Following confirmation of a fatality by Staffordshire Police, the three or five year casualty data at the site is checked by the Road safety Manager (RSM) for patterns of circumstances.

(3) The RSM or similar suitably experienced staff will visit the fatality site in due course if any of the following apply:

(a) There is any doubt about the precise location or site conditions.
(b) There has been another fatality at that location in the previous year.
(c) There have been one or more previous accidents at the site, in similar circumstances, during the previous three years
(d) A Police Hazard Report has been received.

(4) A joint visit with Staffordshire Police may be organised by either party if thought to be necessary. The RSM and/or other suitably experienced staff to attend.

(5) No remedial action should be taken without a accident investigation and ideally with the benefit of the outcome of the Coroner's Inquest and/or Court proceedings. This is to establish that the highway might have in some way influenced the accident, and that this being the case to ensure that appropriate measures are proposed to deal with it.

(6) If any engineering action seems appropriate, this shall be decided jointly with the RSM. Staffordshire Police shall be informed of the outcome.

July 2019

Annex 7

FOOTWAYS, CYCLEWAYS, PAVED SURFACES AND VULNERABLE USERS

General

A7.1 This Chapter deals with the maintenance of adequate levels of slip resistance and skid resistance on footways, cycleways and other paved surface areas, which may include Byways Open to All Traffic (BOAT).

A7.2 Slip resistance is defined as the ability to resist relative movement between a pedestrian foot and the trafficked surface.

A7.3 Skid resistance is defined as the ability to resist relative movement between a vehicle tyre and the trafficked surface.

A7.4 Footways are designed for pedestrian usage, however there are locations where motorized and non-motorized vehicular movements also occur therefore these surfaces are required to provide both slip resistance and skid resistance.

A7.5 A cycleway that is located upon a carriageway will have the same Investigatory Level as the carriageway, and therefore its skid resistance value will be maintained at the same level as the carriageway.

A7.6 A cycleway that is located either adjacent to, and is structurally an integral part of a footway, or is separate to, or remote from any footway or highway, may be treated in a similar fashion to bituminous footways to provide the same levels of skid resistance.

A7.7 A BOAT does not generally have a paved surface, however there are a small number within the County that do. In these cases, a site specific assessment should be carried out to establish the type of vehicular usage (if any) and a determination made on what (if any) the appropriate surfacing material / aggregate PSV or surface treatment should be.

Inspection and Testing

A7.8 The establishment of an effective regime of inspection, assessment and recording is a crucial component of highway maintenance. Regular inspections are necessary to monitor the condition of all elements of the network in order that any defects can be identified and an informed engineering judgment can be made about the strategy to be adopted to rectify any deficiencies, including inadequate slip / skid resistance values. If the deterioration in slip / skid resistance values presents a safety hazard to users, then maintenance becomes essential.

A7.9 The frequency of inspections is as detailed within Staffordshire's 'Highway Safety Inspection Code of Practice'.

A7.10 'Well Maintained Highways' details three categories of inspection for highways, Safety Inspections, Service Inspections, and Condition Surveys.

A7.11 Safety Inspections are designed to identify all defects likely to create a danger or inconvenience to users of the highway network. Safety Inspections for footways, cycleways and other paved surfaces will identify defects such as potholes, broken flags, rocking flags, missing pavers or flags, trips, ruts or depressions.

A7.12 Service Inspections are more strongly focused on ensuring that the network meets the needs of the user and comprise more detailed specific inspections of particular highway elements. 'Well Maintained Highways' allows Service Inspection frequency for footways and cycleways to be determined locally and accepts that they may be undertaken in conjunction with Safety Inspections or Condition Surveys.

A7.13 Presently within Staffordshire, Safety Inspections and Service Inspections are carried out concurrently by Area Highway Inspectors. Any locations on the network where it appears that there is a reduced level of slip / skid resistance will be identified during these inspections and prioritized for inclusion in the forward works programme for surface treatment.

A7.14 Non compliance by utility companies undertaking reinstatements works has been identified as one area where an unacceptable reduction in slip / skid resistance values may occur. The Network Management Unit of Place has issued to utility companies who operate within Staffordshire with a formal 'Prior Notification' of Staffordshire's 'local custom and practice' requisite for the use of 45 PSV aggregates for Surface Course reinstatements in pedestrian areas and on cycle tracks as outlined within the Highway Authorities & Utilities Committee (HAUC) Code of Practice - Specification for the Reinstatement of Openings in Highways (DfT et al, 2002): Chapter 8:S8.1.1 (2). A robust inspection regime, together with adherence to the requirements of the HAUC Code, will ensure that slip / skid resistance values of reinstated surfaces of footway / cycle way / other paved areas is appropriate to that of the existing surfacing following reinstatements carried out after utility works.

A7.15 Should any footway, cycleway or other paved area within Staffordshire, be brought to the attention of Place due to third party complaints of inadequate slip / skid resistance values, Staffordshire Highways Laboratory will be requested to undertake Pendulum tests at the location to assess whether an appropriate level of slip / skid resistance exists. Any locations on the network where the test results indicate that there is a reduced level of slip / skid resistance that could lead to a greater slip / skid risk for highway users, will be identified and prioritized for inclusion in the forward works programme for surface treatment.

Surfacing Materials

A7.16 Loss of surface texture due to normal foot or tyre traffic cannot be eliminated, but it can be reduced to an acceptable level by using the appropriate materials for the wear properties required. Material that is well suited to its situation, allows texture loss due to wear to be balanced by a texture increase due to weathering.

A7.17 Pedestrian traffic has the potential to polish footway surfaces to levels where safety can be compromised. The surface of a footway should have adequate slip / skid resistance and abrasion resistance and must not become difficult for pedestrians to walk on when wet.

A7.18 The most commonly used types of surfacing for footways are bituminous materials (bitumen macadam or hot rolled asphalt), precast concrete (PCC) pavers and flags or clay pavers. It is not recommended that in situ concrete is used due to the difficulties caused when works by Statutory Undertakers are carried out. Natural stone flags, cobbles and setts are not commonly used within Staffordshire as they tend to be both expensive and difficult to lay, although there are some locations where they have been used.

A7.20 Engineers should ensure that, for new construction and maintenance operations on footways, a minimum PSV of 45 is specified for aggregates used in bituminous Surface Course materials and in maintenance surface treatments, as detailed within Staffordshire Highways Combined Specification **(this will exclude Limestone as a permissible surfacing aggregate)**. This requirement should be included within any applicable Appendices of any Contract documentation produced for Works on Staffordshire's highway network. If this principle is adhered to, inadequate slip / skid resistance and abrasion resistance are unlikely to be a problem on bituminous surfacing materials.

A7.21 It is unlikely that the slip / skid resistance of PCC products used for footways will be inadequate. Under normal conditions of use, PCC pavers / flags provide satisfactory slip / skid resistance during the working life of the product, provided they are subjected to normal maintenance and unless a major proportion of aggregates which polish excessively have been exposed on the upper face.

A7.22 Care should be taken when specifying clay pavers as in areas of heavy pedestrian use, clay pavers can become slippery when wet. The resistance to polishing of clay pavers is expressed as a Polished Paver Value (PPV). As a first approximation PPV is equivalent to PSV for aggregates. A minimum PPV of 45 should therefore be specified for general use.

Surface Treatments

A7.23 A surface treatment has two objectives, firstly, to seal the surface to prevent deterioration and secondly, to provide a non-slip surface. It also has the advantage of restoring a consistent appearance to the surface.

A7.24 **Slurry surfacing:** Slurry surfacing is used to stabilize the surface area, to ensure that it is impermeable and is of a consistent appearance. Slurry surfacing includes a 3mm to 6mm, well graded aggregate that provides a textured surface that restores slip / skid resistance to surfaces that have become smooth.

A7.25 **Surface dressing:** Surface dressing is a thin veneer suitable for restoring slip/skid resistance values, arresting deterioration and restoring waterproofing properties of the surface.

A7.26 **Retexturing:** Re-texturing of modular surfaces that have become slippery due to heavy pedestrian traffic can be undertaken by various methods, these include scabbling, sand or shot blasting, high pressure water jetting or application of a weak acid. If a section of concrete footway becomes polished due to heavy pedestrian traffic it can also be retextured by shot blasting.

A7.27 **Washing of the surface:** In feature areas it may be necessary to wash the walking surface. This is done by adapted small suction sweepers using hot water with added detergent. In addition to the cleaner appearance there is a significant improvement in the slip / skid resistance values.

Specialized Surfacing Systems

A7.28 Specialized high skid resistant surface systems (similar to the HFS systems used on carriageways) may be used to treat pedestrian / cycle way surfaces in locations where specific problems are encountered. In locations where conflict with other highway users may occur e.g. across the mouth of T-junctions, these specialized systems may contain a coloured pigment. In these situations, a finer particle 60 PSV aggregate is used and the surfacing tends to be referred to as anti-slip or anti-skid surfacing.

A7.29 There are also a variety of proprietary products that can be painted onto the surface to increase slip / skid resistance in problem areas such as steep slopes.

HORSES AND HIGHWAY SURFACING

General

A7.30 Nationally, since the mid 1990's, it is reported that there has been an apparent increase in the numbers of horses slipping on the highway surface, this increase has been particularly apparent since the year 2000.

A7.31 Historically there have been occasional reports of horses slipping on highway surfaces; however, these problems would have been rectified by local, routine maintenance. The increase in the number of reports is attributed to the binder rich, negative texture thin surfacing materials, generally reported as SMA, that have an increased binder film thickness on the surface of the laid material.

A7.32 The County Surveyors Society (CSS) has worked with the British Horse Society (BHS) to produce a Guidance Note for Highway Authorities - Horses and Highway Surfacing (Eng/3-05), to deal with this issue. The Guidance Note deals with slipping by horses in the early life of negatively textured Surface Course materials. A copy of this Guidance Note can be located at:

https://www.bhs.org.uk/~/media/bhs/files/pdf-documents/safety-leaflets/horse-and-highway-surfacing-leaflet.ashx?la=en

A7.34 The Guidance Note suggests that, in certain circumstances, alternative treatments to remove the surface binder film on the Surface Course aggregate are carried out to increase the initial grip between the steel shoe of the horse and the highway. The alternative treatments proposed are:

i/ During construction:

- application of grit.

ii/ After construction:

- surface dressing;
- application of grit;
- application of hot grit;
- texturing by the use of wire brush or water jetting.

Procedure

A7.35 Staffordshire County Council presently apply coated grit during the laying process for all SMA Surface Course materials used on the highway network within Staffordshire. SCC therefore complies with the suggestions contained within the Guidance Note.

A7.36 At sites where 'Slippery Road' warning signs are in place; equestrian users will need to be aware of these signs and follow the BHS advice contained within the Guidance Note that 'all horse riders using the highway in any context must exercise their duty of care as a road user'. Considerations should also be given to positioning the warning signs at locations where they are visible to horse riders joining the highway from adjacent routes.

A7.37 In conjunction with the BHS, CSS helped to produce a standard form, 'Horse/Road Surface Interface Incident Report Form', which is contained within the Guidance Note, a copy of which is also appended to this Strategy (see Appendix 5). This Form can be used by BHS members to report horse slipping problems on highways. The Incident Report Form is also located on the BHS website at:

www.BHS.org.uk.

A7.38 Upon receipt of an incident report form, an investigation shall be undertaken.

This should include written documentation on:

- the condition of the surfacing;
- the type of surfacing;
- comments relating to the geometry of the highway;
- any additional information that may be considered relevant to the incident.

A7.39 Details will also be required on:

- the horse;
- the condition of the horse’s shoes;
- in the case of litigation farrier’s records will be required to assess the condition of the horse's shoes at the time of the incident.

A7.40 Any decisions following the investigation should be formally documented and the documentation retained.

Appendix 1

Site Category Review - SRF1

Review Reference Number ……

Road Number ……

Cross section

Start/ End chainage

Existing Site Category ……

Existing Investigatory Level ……

Proposed Site Category ……

Proposed Investigatory Level

Description of Extents ……

Site Category & Description			Investigatory Level at 50km/h						
		CSC	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	Dual carriageway non-event								
C	Single carriageway non-event								
D	Single carriageway non-event, speed limit ≤ 30 mph								
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 - 250m – single carriageway								
S3	Bend radius <250m – single carriageway								

RECOMMENDED BY ……

DATE ……

Appendix 2

On Site Investigation - SRF2

General Site Information

Site Investigation Reference Number	
Road Name	
Highest Speed Limit	
Reason for Site Investigation	
Road Number	
Site Category	
Greatest Level of SCRIM Deficiency	
No# of KSI Accidents	
No# of Slight Accidents	
Policy Signage Requirement	
Date when the site was last surface treated	
Current ATF	

Site Visit

Date of Site Investigation	
Asset Management Investigator	
General weather conditions during visit	

Site Pavement

Current Surface Course Material	
Is the pavement uniformly degraded	
Is there Evidence of Mud/ Ponding /Blocked Gullies / Poor Drainage	
Current Pavement Defects	

On Site Considerations

Additional features at location that increase risk (Layout / Geometry / Vegetation)	
Recent Evidence of Vehicles Accidents	
Priorities clearly defined with visible markings, warning /direction signs	
Traffic signals operating correctly and clearly visible	

Recommendations

Possible reason for low scrim value	
No further action	
Type of Treatment	
Other recommendations	
Are Warning Signs required above Policy Requirements / Why	
Priority and timing of treatment	
Additional Comments	

Approved By	
Date	

Appendix 3

Signage Location Investigation – SRF3

Asset Management Investigator	
Site Investigation Number (YYYY-DIV-XXX)	
Sign ID	
Direction of Travel	
Description of location	
Signage Post Required	
Size of Sign Required	
Distance of Sign from Hazard	
Additional Supplementary Plate Lettering	
Date of Notification of Order	
Erection Order Completion date	
Inspected By	

Appendix 4

Signage Removal - SRF4

Site Investigation Number (YYYY-DIV-XXX)	
Sign ID	
Date of Notification of Removal	
Removal Completion Date	
Inspected By	

Appendix 5

BRITISH HORSE SOCIETY WEBSITE FORM

HORSE / ROAD SURFACE INTERFACE - INCIDENT REPORT FORM

Name: _____

Address: _____

_____

_____

_____

Telephone number: _____

Date of incident: _____

Please give details of the incident (what happened?)

_____

_____

_____

_____

On what location did the incident happen? (Please specify Road number, name and location e.g. outside house number 42)

_____

_____

Village/Town: _____ **County:** _____

Did this stretch of road have a verge? **Y/N:** _____

If yes, please give details:

_____

Did the incident occur on a gradient? **Y/N:** _____

Did the incident occur at a change of surface? **Y/N:** _____

What time of the day did the incident happen?

_____

What were the weather conditions at the time of the incident? (wet, dry etc)

_____

Were any other people / vehicles involved?

_____

_____

Were you riding the normal line or was there a reason to be elsewhere in the road?

_____

_____

Was normal control maintained or had the horse been "spooked" by other factors?

_____

_____

What road use experience does the rider have? _____

_____

Have you had BHS training for road use with a horse? Y/N: _____

Were any injuries received by yourself? Y/N: _____

If yes, please give details:

_____

_____

Were any injuries received by your horse? Y/N: _____

If yes, please give details:

_____

_____

At the time of the incident did your horse have shoes fitted? Y/N: ____

If so, were you using road studs? Y/N: ____

If so, please specify the type (e.g. removable road studs, nails etc)

_____

_____

Have you been in touch with the local Highways Authority or County Council to verify the type of surface?

Y/N: _____

If yes, please give details of who, where and what:

Please give any further details that you feel may be relevant:

Signature: **Date:**