VOLUME 7 PAVEMENT DESIGN AND MAINTENANCE

SECTION 3 PAVEMENT MAINTENANCE ASSESSMENT

PART 1

HD 28/15

SKIDDING RESISTANCE

SUMMARY

The purpose of this document is to describe how the provision of appropriate levels of skid resistance on the UK strategic road network will be managed. This document describes how measurements of skid resistance are to be made and interpreted and is complemented by HD36 (DMRB 7.5.1), which sets out advice on surfacing material characteristics necessary to deliver the required skid resistance properties.

INSTRUCTIONS FOR USE

1. This document supersedes HD 28/04, which is now withdrawn. It also supersedes IAN 98/07 and IAN 49/13.

2. Remove existing Contents page for Volume 7 and insert new Contents page for Volume 7 dated July 2015.

3. Remove HD 28/04, which is superseded by HD 28/15, and archive as appropriate

4. Insert HD 28/15 in Volume 7, Section 3, Part 1.

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REGISTRATION OF AMENDMENTS

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PART 1

HD 28/15

SKIDDING RESISTANCE

Contents

1 INTRODUCTION

General

1.1 The purpose of this document is to describe how the provision of appropriate levels of skid resistance on the UK strategic road network will be managed. This document describes how measurements of skid resistance are to be made and interpreted and is complemented by HD36 (DMRB 7.5.1), which sets out advice on surfacing material characteristics necessary to deliver the required skid resistance properties.

1.2 While this document is not intended for management of skid resistance on local roads, similar principles may be applicable.

1.3 In this document, the term "skid resistance" refers to the frictional properties of the road surface in wet conditions. The skid resistance of a wet or damp road surface can be substantially lower than the same surface when dry, and is more dependent on the condition of the surfacing material.

1.4 To achieve consistency, skid resistance is measured using a specified device, under standardised conditions. These measurements are used to characterise the road surface and assess the need for maintenance, but cannot be related directly to the friction available to a road user making a particular manoeuvre at a particular time.

1.5 Skid resistance surveys are sometimes carried out for special purposes, such as research or local investigations. Due to the different test procedures, these measurements require careful interpretation. The data from such surveys do not form part of this Standard.

1.6 The objectives of this Standard are to:

i. Maintain a consistent approach to the provision of skid resistance across the strategic road network, so that road users find consistent friction characteristics when accelerating, braking and cornering.

ii. Provide a level of skid resistance appropriate to the nature of the road environment at each location. The appropriate level is determined from a combination of: network-wide analyses of crash history, consideration of friction demands by road users and local judgement of site-specific factors (by suitably experienced engineers).

1.7 This Standard provides advice and guidance to assist the engineer in determining an appropriate level of skid resistance for each site. It lays down the procedure to be used for measuring the skid resistance and, for cases where the measured skid resistance is at or below a predetermined level, provides a methodology to assist the engineer in assessing the requirement and priority 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.

1.8 In this Standard, the provision of appropriate levels of skid resistance is treated primarily as an asset management issue rather than one of road safety engineering, although the crash risk is assessed in order to determine an appropriate level of skid resistance for each site. Specifically, this Standard does not address the identification of locations or routes where road safety engineering measures could be beneficial to reduce crashes.

Structure

1.9 Chapter 2 summarises the operation of the skid resistance Standard. Chapters 3 to 7 describe key components of the Standard: the measurement of skid resistance, setting Investigatory Levels, initial investigation, detailed site investigation and prioritisation and use of slippery road warning signs.

1.10 These chapters are supported by a number of Annexes that give more detailed instructions or advice. Annex 1 provides background information relevant to the measurement and interpretation of skid resistance. Annex 2 to Annex 4 provide details of different strategies for reducing the influence of seasonal variation, Annex 5 describes the selection of site categories and Investigatory Levels, Annex 6 provides a template for site investigation and Annex 7 provides a procedure for identifying sites for detailed investigation. Annex 8 provides a glossary of terms.

Implementation

1.11 This Part must be used forthwith on all schemes for the improvement and maintenance of the strategic road network, currently being prepared, provided that, in the opinion of the Overseeing Organisation, this would not result in significant additional expense or delay. Design organisations must confirm its application to particular schemes with the Overseeing Organisation.

1.12 This Part supersedes the guidance, provided previously in IAN98/07, on implementation of skid resistance policy by Highways Agency service providers.

1.13 This Part supersedes the guidance, provided previously in IAN49/13, on the use of slippery road warning signs in connection with new asphalt road surfaces.

Mutual Recognition

1.14 Any reference in this specification to a "British Standard", or to a "British Standard which is an adopted European Standard", must be taken to include a reference also to the following standards:

(a) a standard or code of practice of a national standards body or equivalent body of any EEA state or Turkey;

(b) any international standard recognised for use as a standard or code of practice by any EEA state or Turkey;

(c) a technical specification recognised for use as a standard by a public authority of any EEA state or Turkey; and

(d) a European Technical Approval (ETA) issued in accordance with the procedure set out in directive 89/106/EEC.

1.15 Where there is a requirement in this specification for compliance with any part of a British Standard or a British Standard which is an adopted European Standard, that requirement may be met by compliance with any of the standards given above, provided that the relevant standard imposes an equivalent level of performance and safety provided for by a British Standard or a British Standard which is an adopted European Standard.

"EEA State" means a state which is a contracting party to the EEA Agreement.

"EEA Agreement" means the agreement on a European Economic Area signed at Oporto on the 2nd May 1999 as adjusted or amended.

Equality Impact Assessment

1.16 This Standard seeks to manage the provision of appropriate levels of skid resistance on the strategic road network and in turn should be of benefit to all users. Any adverse or beneficial impacts that result from the introduction and adoption of this Standard are not expected to discriminate against any defined group in society. No equality impact assessment has been carried out in the development of this Standard as it is not considered relevant.

2 OPERATION

2.1 This chapter summarises the procedures for making and interpreting skid resistance measurements on the strategic road network and for the identification and prioritisation of sites for treatment, as indicated in Figure 2.1.

2.2 Routine measurements of skid resistance shall be made using sideway-force coefficient routine investigation machines and processed to derive Characteristic Skid Coefficient (CSC) values in accordance with Chapter 3, supplemented by any additional instructions issued by the Overseeing Organisation.

2.3 The CSC is an estimate of the underlying skid resistance once the effect of seasonal variation has been taken into account. This value is taken to represent the state of polish of the road surface. These terms are explained in Chapter 3 and Annex 1.

2.4 On receipt of processed survey data, the CSC values shall be compared with the predetermined Investigatory Levels (ILs), to identify lengths of road where the skid resistance is at or below the Investigatory Level.

2.5 Investigatory Levels represent a limit, above which the skid resistance is considered to be satisfactory but at or below which the road is judged to require an investigation of the skid resistance requirements. Site Categories are assigned based on broad features of the road type and geometry plus specific features of the individual site. Investigatory Levels are assigned according to the perceived level of risk within each Site Category. Investigatory Levels will be reviewed on a rolling programme, to ensure that changes in the network are identified, local experience is applied and consistency is achieved. The process for setting Investigatory Levels and the normal range of Investigatory Levels for each Site Category are described in Chapter 4.

2.6 Wherever the CSC is at or below the assigned Investigatory Level an investigation shall be carried out to determine whether treatment to improve the skid resistance is required or whether some other action is required.

2.7 The investigation process is described in Chapters 5 and 6. The decision of whether treatment is necessary is unlikely to be clear-cut, but requires professional engineering judgement taking into account local experience, the nature of the site, the condition of the road surfacing and the crash history for the past three years. If successive investigations show that treatment is not warranted at the current level of skid resistance then consideration should be given to lowering the Investigatory Level (within the constraints of Table 4.1).

2.8 The processes of setting Investigatory Levels and undertaking investigations are complementary, since local knowledge and experience gained through conducting detailed investigations can be used to refine the criteria for setting Investigatory Levels for similar types of site.

2.9 The investigation process will result in a number of lengths being recommended for treatment to improve the skid resistance. The priority for treatment will be established through the Overseeing Organisation's process for prioritising maintenance.

2.10 Once a site requiring treatment to improve the skid resistance has been identified, signs warning road users that the road could be slippery shall be erected, as described in Chapter 7.

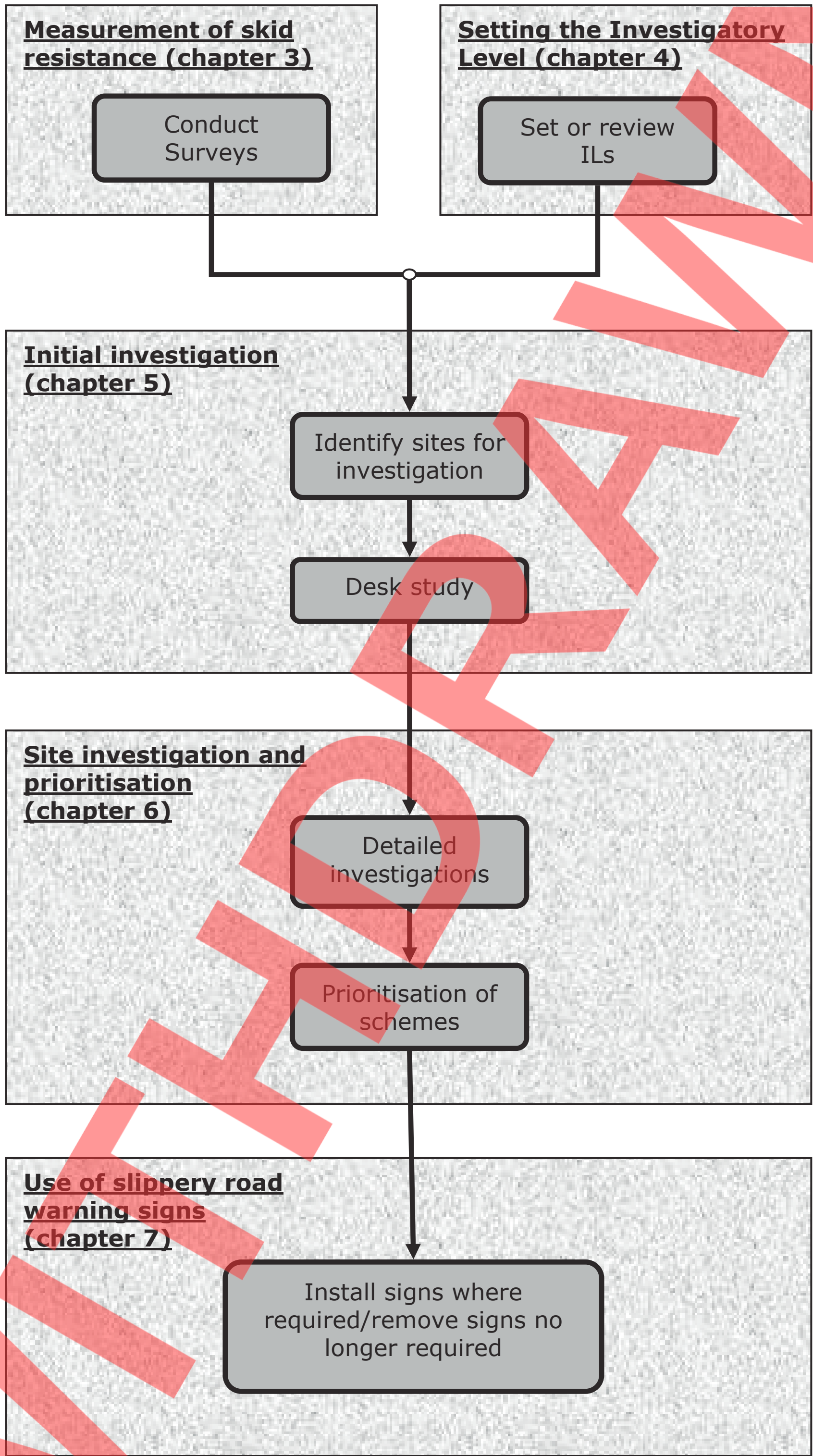

Figure 2.1 Overview of the operation of this Standard

3 MEASUREMENT OF SKID RESISTANCE

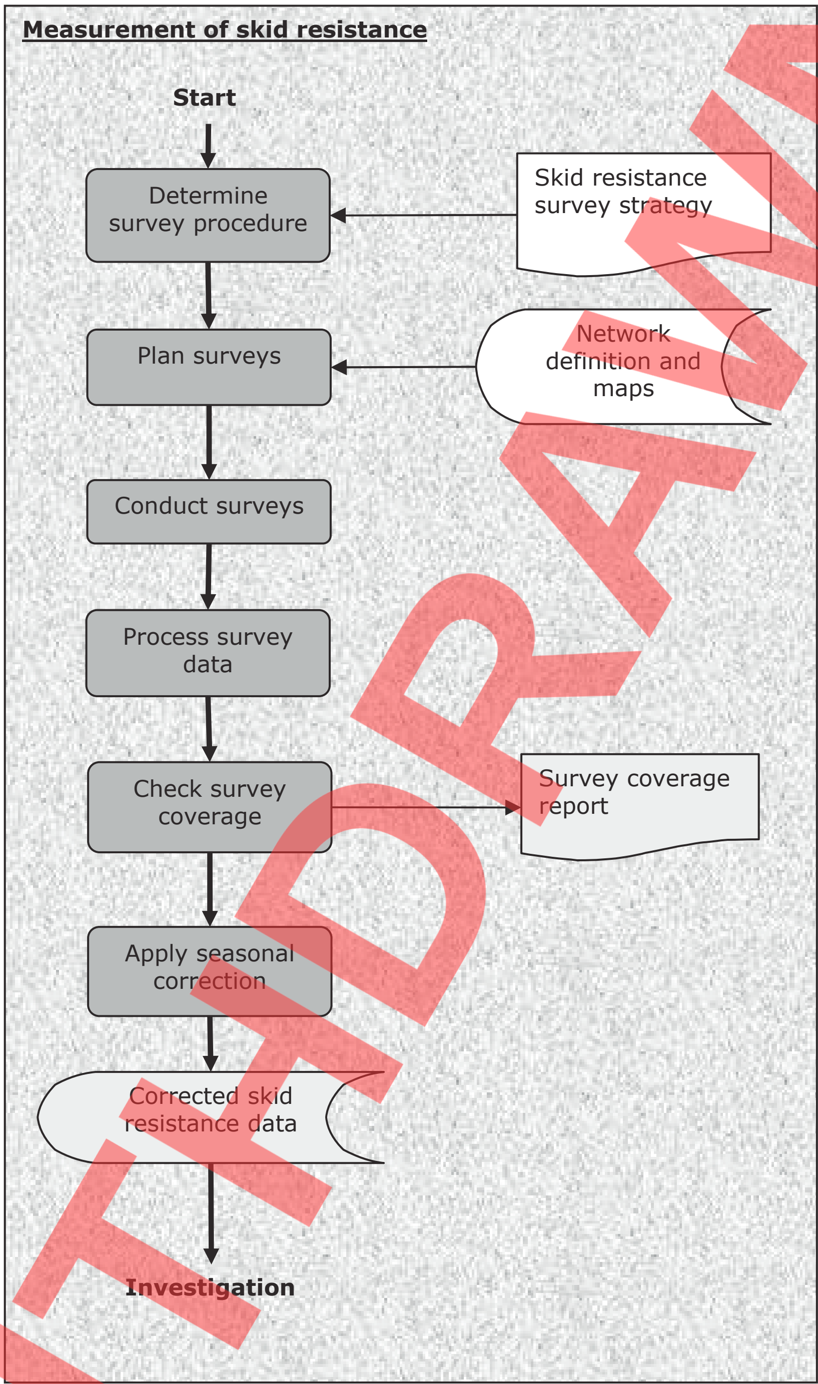

Figure 3.1 Measurement of skid resistance

Overview

3.1 This chapter details the procedure for planning and conducting skid resistance surveys and processing the data.

3.2 The process is outlined in Figure 3.1 and is split into the following 6 steps:

1. Determine the survey procedure
2. Plan surveys
3. Conduct surveys
4. Process survey data
5. Check survey coverage
6. Apply seasonal correction

3.3 The steps are detailed in turn below.

Determine the survey procedure

3.4 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. By smoothing these fluctuations due to seasonal effects, sites exhibiting lower skid resistance can be identified more accurately.

3.5 The basis of this Standard is that the overall (summer) level of skid resistance will be assessed rather than using a single measurement. This overall level of skid resistance is known as the Characteristic Skid Coefficient (CSC).

3.6 Because of the different nature of traffic patterns and road networks in the different UK regions, the way in which surveys are planned and seasonal variation is accounted for may be different for the individual Overseeing Organisations. The alternative monitoring strategies available are explained in Annex 2, Annex 3 and Annex 4.

3.7 Prior to the survey season, the network to be surveyed, the survey period, the test lane, the survey strategy and the method and/or the accuracy of location referencing required shall be specified. These are normally specified by the Overseeing Organisation.

3.8 Various types of equipment are available for measuring skid resistance. Work has been carried out that has produced some correlations between devices. However, these equations are not robust enough to allow the machines to operate interchangeably.

3.9 Measurements for monitoring the in-service skid resistance of the strategic road network, in line with this Standard, shall be made with a sideway-force coefficient routine investigation machine conforming to the general characteristics of British Standard BS7941-1.

3.10 Only machines that have been accredited by the Overseeing Organisation for use on their network and are fitted with dynamic vertical load measurement capability shall be used for surveys. The requirements for achieving and maintaining accreditation will be specified by the Overseeing Organisation.

Plan surveys

3.11 The machine operator shall plan survey routes that optimise the efficiency of the survey and minimise the loss of data as a result of parked cars or slow moving traffic.

3.12 Surveys shall be planned so that they will occur during the required survey period (early, middle or late) to allow for the determination of CSC values. These survey periods will be defined so that the low point in the summer should occur during the middle period, as shown in Figure 3.2. The dates for the survey periods may differ for different geographic regions and shall be specified by the Overseeing Organisation.

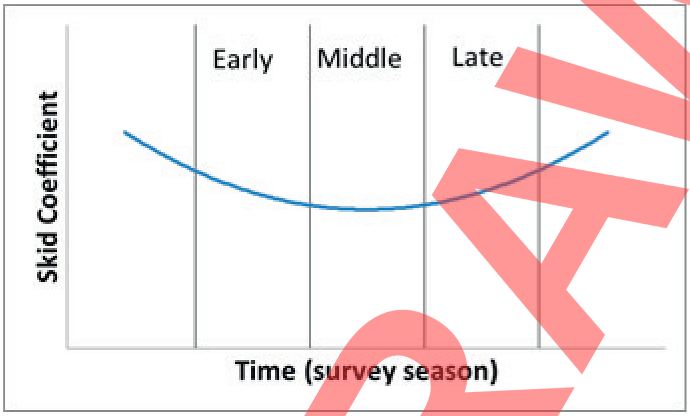

Figure 3.2 Survey periods

3.13 In exceptional circumstances the Overseeing Organisation may extend the testing season beyond these periods. This may only be done if the general weather conditions in the area remain unchanged and if no frosts or treatments to the road, such as gritting, have occurred.

Conduct surveys

3.14 Machine operators providing measurements under this Standard shall develop appropriate procedures to ensure that measurements comply with the principles for calibration, testing and reporting set out in British Standard BS7941-1, are carried out safely and to a suitable standard of quality.

3.15 In each direction of travel, the lane carrying the greatest number of heavy vehicles shall be tested. For most roads, this will be the leftmost permanent lane.

3.16 Additional lanes, including the hard shoulder for sections where the hard shoulder is opened to traffic, may be surveyed only if specified by the Overseeing Organisation.

3.17 Measurements shall be carried out with the test wheel in the nearside (left) wheel path of the lane to be tested. The Overseeing Organisation may specify an alternative test line in exceptional circumstances.

3.18 If it is necessary for the machine 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.

3.19 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.

3.20 After entering a roundabout, a minimum of one complete circuit shall be tested. Where safe to do so, the preferred test line is the outermost lane. However, on multiple lane roundabouts with lane markings for different routes, it may be necessary to test an alternative lane to avoid conflict with other traffic.

3.21 Mini roundabouts and small island roundabouts that are physically too small to test as above shall be tested as part of the main carriageway and do not need to be tested separately.

3.22 Measurements shall not be undertaken where the air temperature is below 5°C.

3.23 Testing shall 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.

3.24 Where the posted speed limit is greater than 50mph, the target survey speed shall be 80km/h. On all other roads, the target survey speed shall be 50km/h where this speed is permissible given the mandatory speed limit in force.

3.25 The machine driver shall maintain a vehicle speed as close to the target test speed as possible. However all speed limits, either temporary or permanent, must be obeyed regardless of the target survey speed. In addition, if it is not safe to maintain the target speed then a different speed may be used at the discretion of the driver. The safety of the machine and other road users shall take priority at all times.

3.26 Contamination of the road surface by mud, oil, grit, or other contaminants shall be noted and the results eliminated from the standard analysis procedure.

3.27 The survey operator shall maintain a record of weather conditions that could influence the survey results, such as heavy rainfall and strong winds.

Process survey data

3.28 On completion of the survey, the survey data will be loaded into the appropriate data management system and aligned to the road network.

3.29 Readings for each 10m sub-section collected within the speed range 25 to 85km/h shall be corrected to a speed of 50km/h using the following equation:

$$SR(50) = SR(s)*(-0.0152*s^2 + 4.77 *s + 799)/1000$$

Where:

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

SR(s) is the Sideway Force Coefficient, measured at test speed s, multiplied by 100. This term is defined further in British Standard BS7941-1.

3.30 Temperature correction shall not be applied for surveys carried out under the conditions set in this standard.

3.31 SC values shall be calculated for each 10m sub-section for which a valid SR(s) value is available using the following equation:

$$SC = (SR(50) /100) * \text{Index of SFC}$$

Where:

The Index of SFC (Sideways Force Coefficient) is currently 0.78 and shall be applied to all survey machines in current use.

Check survey coverage

3.32 The survey machine Operator shall produce a survey coverage report detailing the network that was to be surveyed, lengths with missing or invalid data, and an explanation for the missing or invalid data.

Apply seasonal correction

3.33 Once the data have been loaded and checked the seasonally corrected CSC values shall be determined from the SC values following the method appropriate to the survey strategy, as described in Annex 2, Annex 3 and Annex 4.

4 SETTING THE INVESTIGATORY LEVEL

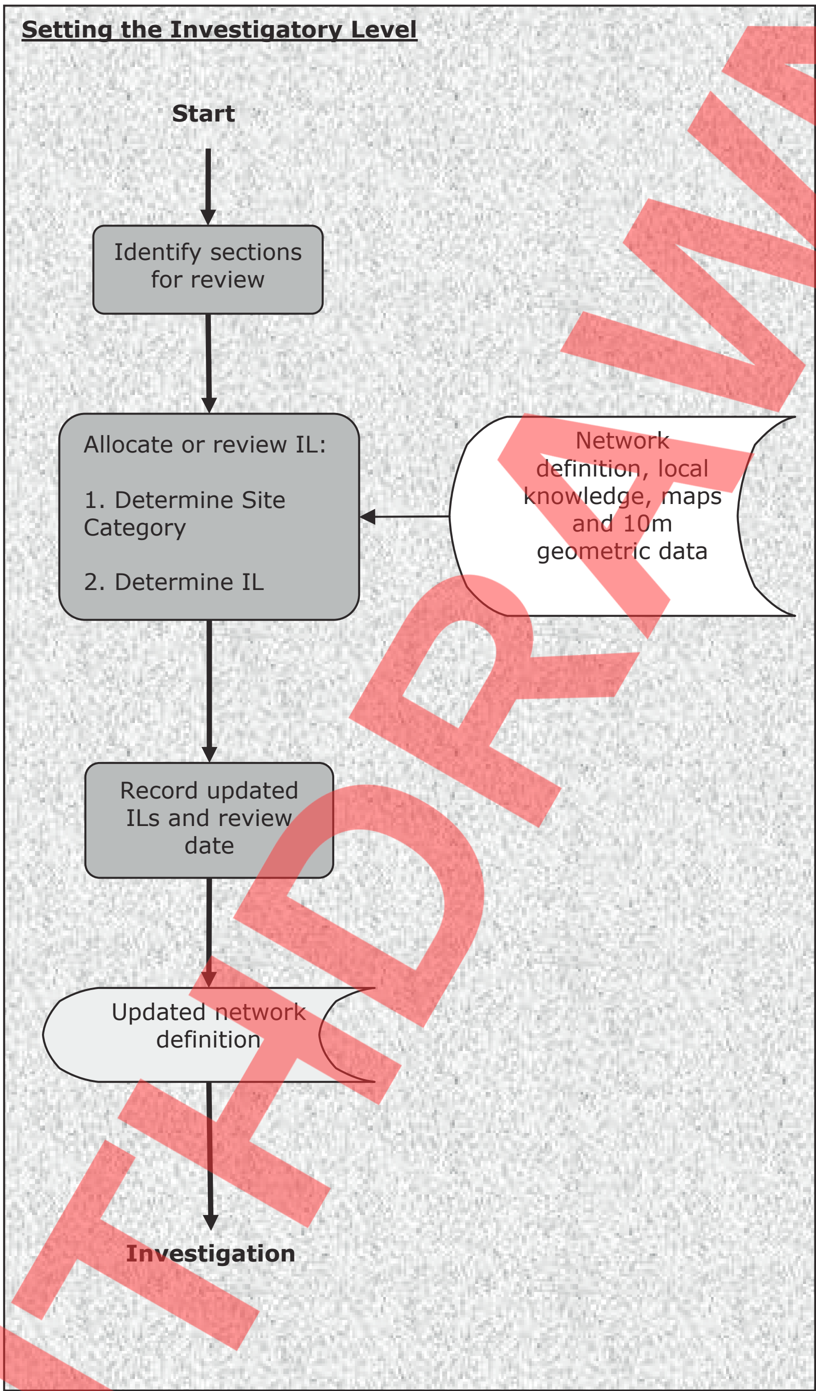

Figure 4.1 Setting the Investigatory Level

Overview

4.1 An Investigatory Level (IL) shall be defined for every part of the network, by determining which Site Category is most appropriate to each location and then selecting an appropriate IL from within the range for that Site Category. The objective of setting an IL is to assign a level of skid resistance appropriate for the risk on the site, at or below which further investigation is required to evaluate the site specific risks in more detail.

4.2 Sites with the same Site Category may have different levels of risk of skidding crashes. There is therefore the flexibility to set different ILs for different sites within the same category. This allows sites where the risk of skidding crashes is potentially higher to have a higher IL and possibly be treated to maintain a higher level of skid resistance.

4.3 The Overseeing Organisation or its Managing Organisation(s) shall assign a Site Category and IL to each part of the network, so that the IL can be compared with the CSC. This information shall be recorded together with the date of assessment.

4.4 The process is outlined in Figure 4.1 and is split into the following 3 steps:

1. Identify sections for review

2. Allocate or review IL

3. Record updated ILs and review date

The steps are detailed in turn below.

Identify sections for review

4.5 A review of the IL shall be carried out when a significant change to the network is made, for example changes to the road layout.

4.6 Notwithstanding the above, a procedure shall be put in place for reviewing the IL at least every three years. This may be done by reviewing one third of the network each year. Lengths with missing IL data, or where the IL lies outside the range specified in Table 4.1, shall be included in each review.

Allocate or review IL

4.7 Site categories and an associated range of ILs are defined in Table 4.1. These categories and ranges were developed for the strategic road network and may not be applicable to local authority roads, which are more diverse in nature.

4.8 The Site Category and IL applied to a length will be applied to all lanes of the carriageway which have traffic running in the same direction. If appropriate this will include the hard shoulder (e.g. if hard shoulder running is implemented). Therefore all lanes of the carriageway (with the same direction of traffic) should be considered when identifying what Site Category and IL will be applied.

4.9 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 is appropriate then the Site Category with the highest recommended IL will be selected. If the highest recommended IL for the site categories are the same then the category highest up the Table shall be selected (A being the highest on the table and S2 the lowest).

Site Category and definition		IL for CSC data (Skid data speed corrected to 50km/h and seasonally corrected)							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
A	Motorway								
B	Non-event carriageway with one-way traffic								
C	Non-event carriageway with two-way traffic								
Q	Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals (see note 5)								
K	Approaches to pedestrian crossings and other high risk situations (see note 5)								
R	Roundabout								
G1	Gradient 5-10% longer than 50m (see note 6)								
G2	Gradient >10% longer than 50m (see note 6)								
S1	Bend radius <500m – carriageway with one-way traffic (see note 7)								
S2	Bend radius <500m – carriageway with two-way traffic (see note 7)								

Notes applicable to all:

1. The IL should be compared with the mean CSC, calculated for the appropriate averaging length.
2. The averaging length is normally 100m or the length of a feature if it is shorter, except for roundabouts, where the averaging length is 10m.
3. Residual lengths less than 50% of a complete averaging length may be attached to the penultimate full averaging length, providing that the Site Category is the same.
4. As part of site investigation, individual values within each averaging length should be examined and the significance of any values that are substantially lower than the mean value assessed.

Notes applicable to specific site categories

5. ILs for site categories Q and K are based on the 50m approach to the feature and, in the case of approach to junctions, through to the extent of the junction. The approach length shall be extended when justified by local site characteristics.
6. Categories G1 and G2 should not be applied to uphill gradients on carriageways with one-way traffic.
7. Categories S1 and S2 should be applied only to bends with a speed limit of 50 mph or above, except if the radius of the bend is <100m, where the S1 and S2 categories shall be applied at all speeds.

Table 4.1 Site categories and Investigatory Levels

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4.10 After selecting a Site Category, the appropriate IL is assigned from the range available for that Site Category, following the process described in Annex 5. The range of ILs for each Site Category has been developed as a result of UK research studies on the strategic road network and reflects the variation in crash risk within a Site Category. Further details are given in Annex 1.

4.11 If any lay-bys are specified as requiring surveys they should, in general, have the Site Category and IL from the adjacent carriageway applied. However if there is an additional risk associated with the lay-by not present in the adjacent carriageway then the Site Category and IL shall be adjusted appropriately.

4.12 Dark shading in Table 4.1 indicates the range of ILs that will generally be used for roads carrying significant levels of traffic. Light shading indicates a lower IL that will be appropriate in low risk situations, such as low traffic levels or where the risks present are mitigated, providing this has been confirmed by the crash history. Exceptionally, a higher or lower IL may be assigned if justified by the observed crash record and local risk assessment.

4.13 Further details on the setting of ILs can be found in Annex 5.

Record updated ILs and review date

4.14 The sections reviewed by the Overseeing Organisation or its Managing Organisation shall be recorded, together with the review date and any changes to the site categories and ILs.

5 INITIAL INVESTIGATION

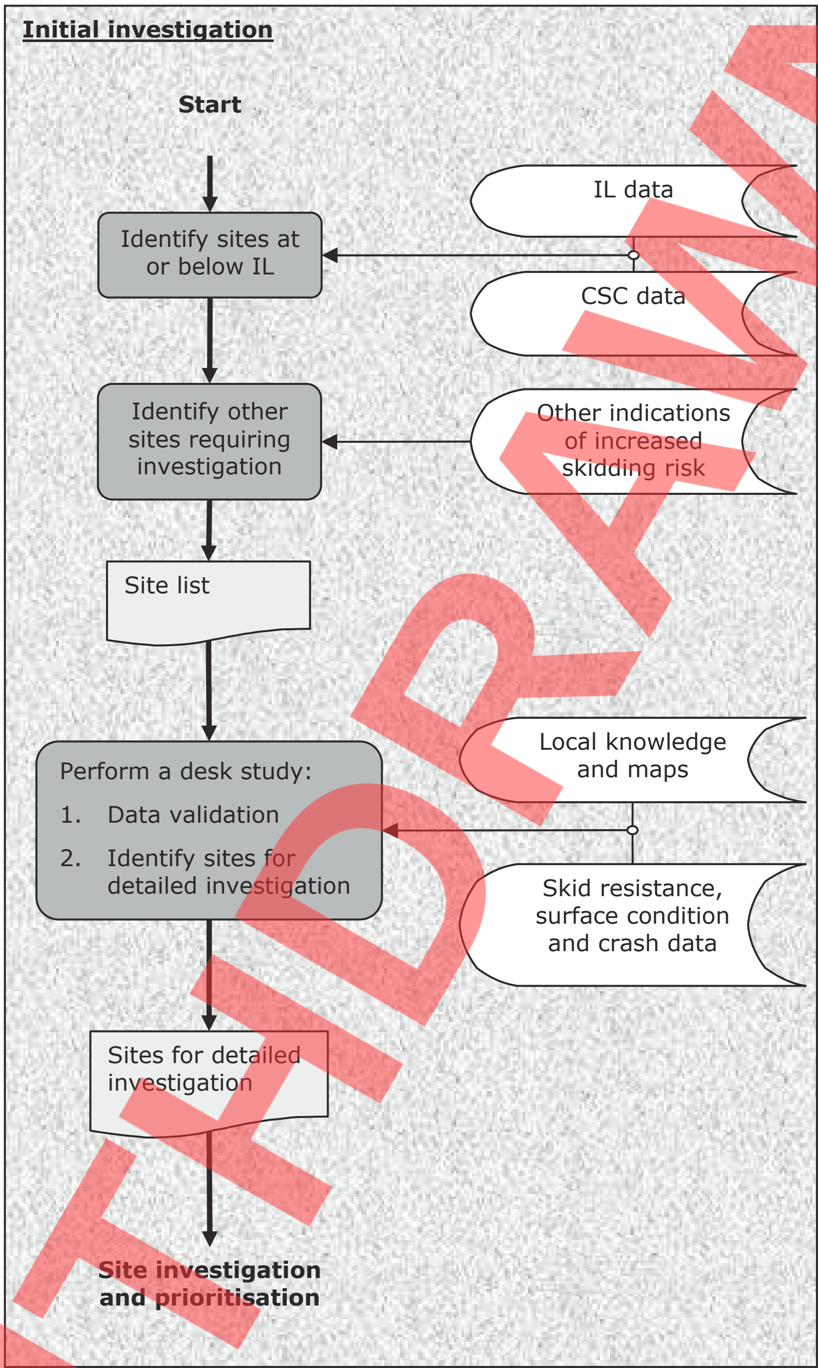

Figure 5.1 Initial investigation

Overview

5.1 All sites where the measured CSC is at or below the IL shall be investigated. The objective is to determine whether a surface treatment is justified to reduce the risk of vehicles skidding, whether some other form of action is required, or whether no action is currently required. If no action is taken, sites will automatically be reviewed again following the next skid resistance measurement if they remain at or below the IL.

5.2 The investigation may be undertaken in two stages: an initial investigation, described in this chapter, to check the data and assess the need for a detailed investigation and, secondly, a detailed investigation to assess the justification and priority for treatment, which is described in Chapter 6.

5.3 The process for the initial investigation is outlined in Figure 5.1 split into the following steps:

1. Identify sites at or below the IL
2. Identify other sites requiring investigation
3. Data validation
4. Identify sites for detailed investigation

The steps are detailed in turn below.

Identify sites at or below the IL

5.4 Unless specified otherwise by the Overseeing Organisation, the mean CSC for 100m averaging lengths should be calculated for comparison with the IL, except that 10m averaging lengths should be analysed for Site Category R.

5.5 The averaging length shall be truncated on any change of Site Category or IL; consequently the averaging length will be shorter where the Site Category is less than 100m long or at the end of a Site Category longer than 100m. Residual lengths less than 50% of a complete averaging length may be appended to the penultimate length, if both the lengths have the same IL.

5.6 If the skid resistance is close to the IL, successive 10m or 100m lengths can fall alternately above and below the IL. These lengths may be combined into a single site for investigation. The longer lengths are also more robust for crash analysis. Subsequent detailed investigations may show that only part of this length would require treatment.

Identify other sites requiring investigation

5.7 An investigation shall also be carried out if, as a result of processes separate from this Standard, sites are identified where increased wet or skidding crash levels have been observed. Examples include Annual Safety Reports, Police complaints, Managing Organisation observations and damage to roadside furniture.

Data validation

5.8 Basic data validation checks shall be conducted for sites that have been identified as at or below the IL. This shall include confirming that the IL has been assigned correctly in accordance with current guidance and that the skid resistance recorded is within the normal range expected.

5.9 If the IL is incorrect then it shall be updated and recorded together with the date of the change. If the skid resistance is above the revised IL then further investigation is unnecessary and the change of IL should be recorded as the outcome of the investigation.

Identify sites for detailed investigation

5.10 Sites at or below IL requiring detailed investigation should be identified based on the Site Category, IL, current skid resistance and observed crash history. Sites identified for reasons other than skid resistance (see 5.7) shall be subject to a detailed investigation.

5.11 The identification of sites requiring detailed investigation can be carried out using the crash model or the alternative approach, both of which are detailed in Annex 7.

5.12 A list of sites requiring detailed investigation shall be produced as soon as practicable on receipt of the CSC data, or as specified by the Overseeing Organisation.

6 DETAILED SITE INVESTIGATION AND PRIORITISATION

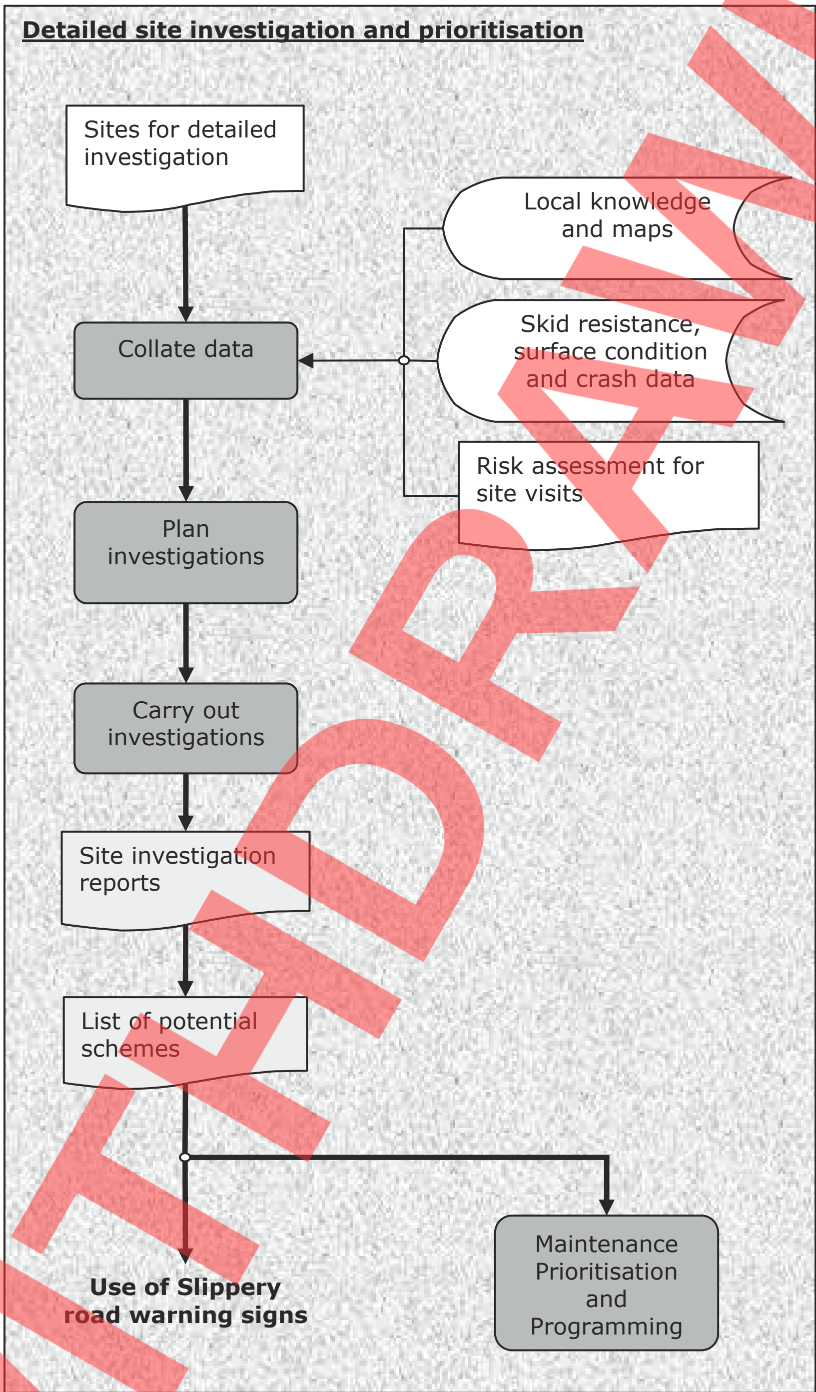

Figure 6.1 Detailed site investigation and prioritisation

Overview

6.1 A detailed investigation is carried out to collate and assess the information available for each site in order to reach a decision about the best course of action. These detailed investigations are carried out on the sites identified from the process described in Chapter 5.

6.2 The process is outlined in Figure 6.1 and is split into the following four steps:

1. Collate data
2. Plan investigations
3. Carry out investigations
4. Prioritise and programme maintenance

The steps are detailed in turn below.

Collate data

6.3 As a minimum, the data collected shall include skid resistance, texture depth and the most recent 3 years of crash data available.

6.4 Skid resistance data at 10m intervals for bends and roundabouts shall be obtained, because short lengths with low skid resistance could be hazardous for vehicles cornering. These shall not be disguised by being averaged over a longer length.

6.5 Skid resistance data at 10m intervals shall also be obtained if the condition of the surfacing material is known to be variable over local areas.

6.6 Obtain the rut depth, longitudinal profile, gradient, crossfall and curvature data if they are relevant, i.e. if the site has poor transverse or longitudinal evenness, or bends or gradients. In some instances these data assist in checking whether the Site Category and/or Investigatory Level are correct or need amending. Information on the date of last surface treatment may also be relevant to the investigation and the interpretation of collision data.

6.7 For each site, the relevant data shall be collated to show the location of lengths with poor surface condition relative to the location of previous crashes and features such as bends, junctions, etc. This data could be collated as strip maps, GIS mapping or spread sheets.

6.8 The location of crashes occurring in wet conditions, irrespective of whether skidding was reported, should be identified specifically.

6.9 Given the limited accuracy of locating accident positions, it may be assumed for the purpose of this investigation that the position of a crash coincides with the location of poor surface condition if it occurred within 200m.

6.10 The overall crash risk shall be calculated for the site for comparison with control data.

6.11 The crash risk may be calculated as the total number of crashes, per 10^8 vehicle km, if traffic data are available, or otherwise as the total number of crashes per year, per 100 km. For this calculation the choice of whether to use carriageway length or route length, and the choice of units (km or miles) shall be consistent with the method used for the calculation of control data.

Plan investigations

6.12 Investigations should be planned primarily to maximise efficiency. Greater priority should be given to completing investigations for sites that are substantially below the IL or where the crash history indicates that there is a risk of wet skidding crashes occurring.

6.13 It is recommended that a physical visit to the site is made. Different investigation methods can be used, with differing advantages:

- On foot (this allows the condition of the road to be observed in detail but has associated safety risks that shall be controlled).

- From a parked or moving vehicle (this allows the pattern of traffic movement and speed to be observed during the visit, but has associated safety risks that shall be controlled).

- From recent local knowledge of the site (this may provide a more general knowledge of the road usage under a wider range of traffic, weather and lighting conditions).

- From video records and maps. Note, maps should not be used in isolation as they do not show obstructions to visibility, drainage issues, field accesses, hidden dips etc.

6.14 The Health and Safety of personnel conducting site investigations, maintenance operatives and other road users is paramount. As such, site investigations shall be undertaken in a manner that minimises risk to these groups. Risk assessments and method statements can be used to identify and address the risks associated with site investigations. Guidance for the production of risk assessments is given in GD04 (DMRB 0.2.3).

Carry out site investigations

6.15 Site investigations shall consider the factors detailed below and shall be carried out by personnel with suitable experience and/or qualifications. An example template of a site investigation form is given in Annex 6.

6.16 The level of detail appropriate for the investigation will depend on the nature of the site and the time since a detailed investigation was last carried out. Many of the points listed are only relevant to more complex sites. If the site has been investigated recently then it will only be necessary to identify the changes that have occurred since the last investigation.

6.17 The full carriageway width should be included in the investigation, e.g. all lanes of a dual carriageway and both directions of a single carriageway. In addition all junction approaches should also be investigated to determine whether the advance signing/alignment etc. is adequate or could be improved.

6.18 When carrying out site investigations it should be borne in mind that skid resistance and texture depth are generally measured in the nearside wheel track in lane one. If, during a site investigation, the rest of the pavement is not visually consistent then it is possible that the skid resistance of the rest of the lane or other lanes could be lower than the line tested. In these cases it may be necessary to carry out additional surveys to investigate this.

6.19 If a site contains a sharp bend to the left in combination with traffic braking or accelerating then the offside wheel path can become more polished and the CSC can be up to 0.05 units lower than in the nearside wheel path. If present this should be taken into account during the detailed investigation.

6.20 Determine if the skid resistance is likely to be representative for the site; in particular very low values should be viewed with caution. Localised reduction in the skid resistance can be caused by contamination or by fatting up of the binder. Alternatively, it is possible that there has been an error in the survey. In this case, the data should be compared to data measured in previous years and also with adjacent lengths with the same surfacing material, to determine if the skid resistance is representative of the condition of the surfacing material. If it is considered that the reduction in skid resistance is temporary and not representative for the site, then this should be recorded with reasons. Further investigation is not needed at that time, but if subsequent surveys continue to appear unrepresentative then the causes should be investigated.

6.21 As a result of the investigation, a clear recommendation shall be recorded of the actions to be taken (including if no immediate action is required).

6.22 If the site investigation identified any characteristic of the site or road user behaviour that suggests other road safety engineering measures could be appropriate, then persons with relevant local experience, such as the person locally responsible for crash investigation and prevention, should be consulted.

6.23 If the site investigation identifies requirements for additional routine highway maintenance, such as sweeping, renewal of markings etc. then appropriate action shall be taken.

6.24 Treatment to improve the skid resistance should be recommended if, taking into account the nature of the site and the observed crash history, it is likely to reduce the risk of crashes in wet conditions. Based on knowledge of skid resistance and crash risk trends, this includes locations where the position of crashes in wet conditions (whether or not skidding was reported) appears to be linked to surface condition, or where the overall crash risk is higher than average when compared with suitable control data.

6.25 Refer to the Overseeing Organisation, if necessary, for the provision of appropriate control data for the purpose of making this assessment.

6.26 If treatment is only required on part of the site then particular care should be taken to identify the lengths where treatment is required.

6.27 For sites where neither of the above conditions apply (see 6.24), treatment should be recommended if the skid resistance, combined with the nature of the individual site, suggest that the observed crash count underestimates the actual level of risk. In this case, preventive treatment is justified to pre-empt a potential increase in crashes.

6.28 Guidance for the assessment of texture depth is given in HD29 (DMRB 7.3.2). Texture depth from TRACS surveys in Categories 1 and 2 can be regarded as satisfactory, whereas texture depth in Categories 3 and 4 should be regarded as low. Alternative methods of assessing texture data may be specified by the Overseeing Organisation.

6.29 If there is no justification for treatment then no further action shall be required. If the site remains below the Investigatory Level after the next measurement of skid resistance then it will automatically become subject to a further investigation.

6.30 If the skid resistance and crash pattern at sites at or below the IL have remained stable for more than 3 years, then the IL can be lowered by 0.05 units CSC providing it remains within the range of ILs specified in Table 4.1.

6.31 The results of the investigation shall be documented and retained together with the identity of the assessor and other parties consulted.

Maintenance prioritisation and programming

6.32 Budgeting and programming issues will influence when the treatments are carried out and this process should be managed through the Overseeing Organisation's process for prioritising maintenance.

6.33 Any ranking of skid resistance maintenance schemes should take into account the findings of the site investigations in addition to the supporting survey and crash data.

7 USE OF SLIPPERY ROAD WARNING SIGNS

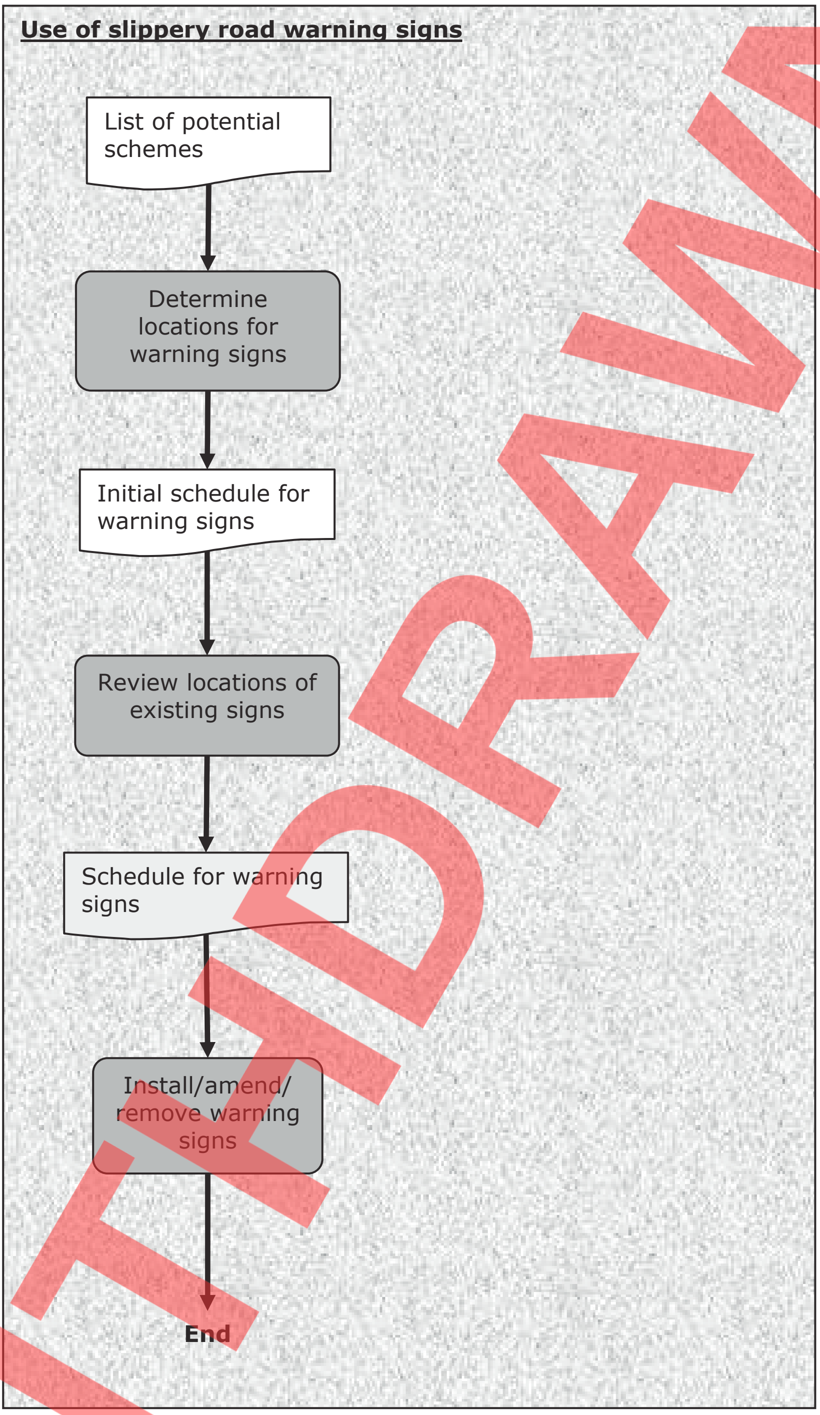

Figure 7.1 Use of slippery road warning signs

Overview

7.1 Slippery road warning signs are erected to warn road users of sites where the skid resistance is low and may result in an increased risk of collision.

7.2 The process for erecting and managing slippery road warning signs as part of this Standard is outlined in Figure 7.1 and is split into the following three steps:

1. Determine locations requiring warning signs
2. Review locations of existing signs
3. Install/amend/remove signs as necessary

The steps are detailed in turn below.

Determine locations requiring warning signs

7.3 Sites which have been identified as requiring treatment to improve the skid resistance shall have warning signs erected.

7.4 In Scotland, sites identified as requiring treatment shall be referred on an individual basis to the Overseeing Organisation for a decision on the provision of warning signs.

7.5 Slippery road warning signs shall not be used in connection with newly-laid asphalt road surfacing materials (see Annex 1, A.1.24 to A.1.26).

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

Review locations of existing signs

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

Install / remove signs as necessary

7.8 Warning signs shall be installed as soon as practicable after the need for treatment has been identified. They shall then be removed as soon as practical after treatment has been applied.

7.9 The slippery roads warning sign (Diagram 557) in conjunction with an appropriate supplementary plate (Diagram 570) must be used in accordance with the Traffic Signs Regulations and General Directions and Chapter 4 of the Traffic Signs Manual.

7.10 Short individual lengths requiring warning signs should be merged if they are separated by less than 1km.

7.11 For the purpose of legal proceedings it is essential that records of the erection and removal of slippery road warning signs shall be kept, including works orders issued and inventories.

7.12 A visual inspection of the site shall be made after the signs are erected to confirm that they have been erected and correctly placed and a record of this observation shall be made and retained.

8 REFERENCES

Normative References

1. Design Manual for Roads and Bridges (DMRB)

GD04 (DMRB 0.2.3) Standard for Safety Risk Assessment on the Strategic Road Network

HD29 (DMRB 7.3.2) Data for Pavement Assessment

HD36 (DMRB 7.5.1) Surfacing Materials for New and Maintenance Construction

2. British Standards

BS-7941-1 Methods for measuring the skid resistance of pavement surfaces. Sideway-force coefficient routine investigation machine, 2006

3. Traffic signs

TSRGD, Traffic Signs Regulations and General Directions, TSO London, 2010

Informative References

4. Transport Research Laboratory Documents

LR738; Hosking, J. R. and Woodford, G. C. Measurement of Skidding Resistance Part ii: Factors Affecting the Slipperiness of a Road Surface, TRRL, 1976

5. Traffic signs

TSM, Traffic Signs Manual, TSO London, 2008

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ANNEX 1 BACKGROUND INFORMATION ON THE MEASUREMENT AND INTERPRETATION OF SKID RESISTANCE

What is skid resistance?

A.1.1. The contribution of the road surface to the overall friction available between the tyre and the road surface is known as skid resistance. The skid resistance of a wet or damp road surface can be substantially lower than the same surface when dry, and is more dependent on the condition of the surfacing. For this reason, measurements of skid resistance for the purpose of routine condition monitoring are made on wetted road surfaces.

How is it generated?

A.1.2. The level of (wet road) skid resistance is dependent on two key properties of the surface, the microtexture and the texture depth. The fine scale microtexture, provided by the surface of aggregate particles or by the fines in the mixture, is the main contributor to skid 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 and also provides rapid drainage routes between the tyre and road surface.

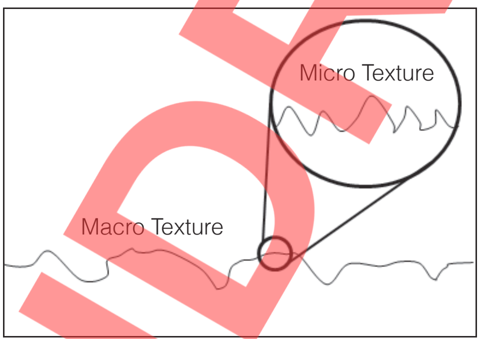

Figure A.1.1 Macro Texture and Micro Texture

A.1.3. The effects of microtexture and texture depth combine to influence the skid resistance at higher speeds.

A.1.4. Under the action of traffic, the microtexture becomes "polished", leading to a reduction in skid resistance. HD36 (DMRB 7.5.1) 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.

Relationship with crash risk

A.1.5. Within normal ranges, low skid resistance does not cause crashes although, depending on the particular circumstances, it may be a significant contributory factor. 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 wet but free from other contamination. However, higher skid resistance is required to allow manoeuvres that demand higher friction to be completed safely, e.g. to stop quickly or corner sharply. Higher skid resistance can therefore reduce crashes in cases where drivers need to complete a more demanding manoeuvre in order to avoid a crash. A key part of this Standard is the judgement 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.

A.1.6. Crash analyses have shown that there are relationships between measured skid resistance and crash risk. These relationships are not precise, in that differences in skid resistance may account for only a relatively small part of the difference in crash risk between individual sites because of all the other factors involved. Nevertheless, they have allowed general conclusions to be drawn that make it possible to provide guidance for managing the provision of skid resistance on the network.

A.1.7. The influence of skid resistance on crash risk is markedly different for roads with different characteristics. For this reason, Site Categories have been defined to group roads with similar characteristics.

A.1.8. For some Site Categories, no statistically significant relationship, or only a weak relationship, is observed between skid resistance and crash risk. A good example of this is motorways, where the road design has effectively reduced 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.

A.1.9. For other Site Categories, progressively more crashes are observed, 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 crashes at these sites.

A.1.10. However, not all sites within a single category are equivalent in terms of their crash risk. Figure A.1.2 illustrates the range in crash 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".

A.1.11. Judgement of the relative crash risk and appropriate level of skid resistance for different sites within the same category therefore forms a key part of the effective operation of this Standard.

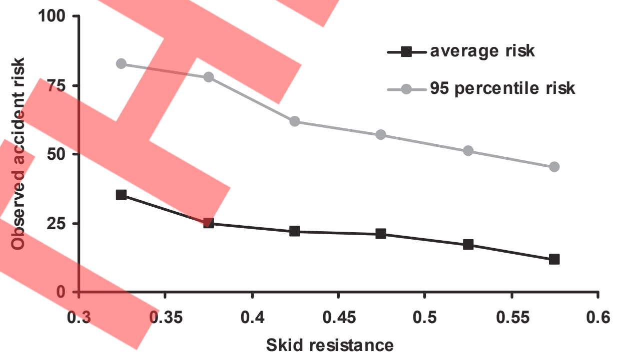

Figure A.1.2 Crash risk and skid resistance – variation within Site Category

Measuring skid resistance

A.1.12. Road surface skid resistance is monitored to identify areas where the microtexture has been lost due to the surface being polished by traffic. In these cases treatment might 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 weather, traffic and other influences may be different to what was anticipated at the time the surfacing was designed.

A.1.13. Similarly, the texture depth of road surfacings can reduce with time under the combined influences of traffic flow, temperature and the nature of the surface. Therefore texture depth is also regularly monitored in accordance with HD29 (DMRB 7.3.2).

A.1.14. Various types of equipment are available for measuring skid resistance. They use different measurement principles although, in different ways, all measure the force developed on a rubber tyre or slider passing over a wetted road surface and derive a value that is related to the state of polish of the road surface. In spite of many attempts to determine a correlation between devices, there is currently no reliable method for converting between measurements of different types.

A.1.15. Skid resistance is influenced by the measurement principle employed, the slip ratio (described below), the vehicle speed, test tyre and water depth; it also varies during the year as a result of seasonal effects. For this standard the effect of these factors are removed by either standardisation (e.g. specified slip ratio and test tyre) or are corrected to a standard condition (e.g. seasonal correction and speed correction). Skid resistance is also influenced by temperature, although this effect is relatively small for the normal temperature range in the UK and is ignored under this Standard.

A.1.16. The slip ratio is the ratio of the speed at which the test tyre slides over the surface (the slip speed), to the speed of the survey vehicle (the survey speed), normally expressed as a percentage. Devices which are suitable for routine measurements of a network have a slip ratio of less than 40%. For example, when a sideways-force coefficient routine investigation machine (slip ratio 34%) carries out a test at 50km/h, the test wheel is sliding at a slip speed less than 20km/h.

A.1.17. Measurement devices using different principles, including in Police braking tests, are used for research and investigation purposes. The results are not directly comparable with those from sideway-force coefficient routine investigation machines and they do not form part of this Standard.

A.1.18. Since friction reduces with increasing speed, this means that the level of skid resistance reported from routine measurements (the road surface contribution to friction) will be higher than that experienced by road users during a skid.

A.1.19. The reduction of friction with speed depends on surface type and texture depth. As such, sites with low skid resistance and low texture depth should be prioritised. The typical reduction of friction experienced by traffic with speed and the influence of texture depth is illustrated in Table A.1.1. The effect of texture depth becomes apparent at speeds as low as 50 km/h, but is increasingly significant at higher speeds.

Table A.1.1 Typical reduction in skid resistance experienced by traffic compared with sideways -force coefficient routine investigation machines measurement

Speed	Texture depth (mm SMTD)		
	Below 0.5	0.5 – 0.8	Above 0.8
50 km/h	40%	30%	25%
120 km/h	70%	60%	50%

Seasonal variation of skid resistance

A.1.20. After the 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 variations, weathering and polishing cycles but will usually remain at about a constant level for many years. If the traffic level subsequently increases or decreases, the position of the equilibrium may shift so that a lower or higher overall level of skid resistance is observed, but with the same seasonal fluctuation superimposed.

A.1.21. An example of long term variation in skid resistance is shown in Figure A.1.3. A suggested 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 is mainly gritty so that the road surface becomes harsh and the skid resistance rises. The lowest skid resistance is generally observed in the summer period, when the roads are wet for a relatively short time, the detritus on them is mainly dusty so that the road surface becomes polished and the skid resistance falls. Also, other contaminants, such as oil and tyre rubber (which act as lubricants and hence reduce the available skid resistance) can build up on the surface, particularly between the wheel paths. In practice, the minimum skid resistance varies from year to year and occurs during different periods depending on the prevailing weather conditions.

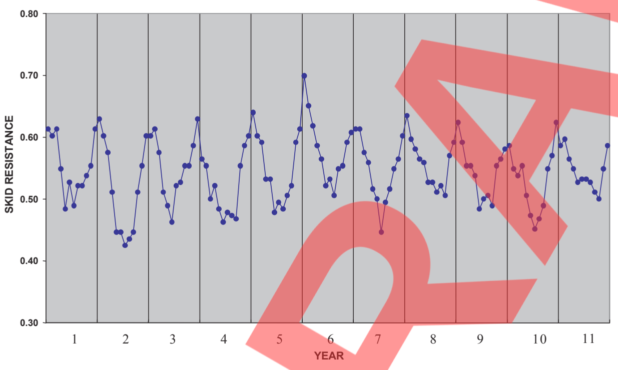

Figure A.1.3 Long term variation in skid resistance (from LR 738)

A.1.22. Because the skid resistance varies continuously, various strategies have been developed to provide a measurement that characterises the state of polish of the microtexture. Survey strategy and processing procedures are designed to reduce the effect of the variation within a year and/or between successive years, so that 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.

A.1.23. Three of the strategies for providing a measurement that characterises the state of polish of the microtexture are detailed in Annex 2, Annex 3 and Annex 4.

Early life skid resistance of asphalt surfacings

A.1.24. Asphalt surfacing materials exhibit different skid resistance properties in the initial period after laying, compared with the same surfacings that have been exposed to traffic for a period of time. This phenomenon is not within the scope of this document, which is concerned with in-service condition rather than the properties in the initial period.

A.1.25. A substantive review of the tyre/road friction characteristics and accident risk associated with newly-laid asphalt materials showed that the risks were smaller, and different, to those initially envisaged, and that the options for mitigation are limited and would not be cost-effective.

A.1.26. Sections of road that exhibit these different skid resistance properties shall be identified so that they can be excluded from certain types of analyses, as described in Chapter 3, Annex 2, Annex 3 and Annex 4 of this Standard. The duration of this initial phase will depend on local conditions but, for the purpose of interpreting skid resistance measurements, it is assumed that the surface has reached an equilibrium state one year after opening to traffic on the strategic road network in the UK.

ANNEX 2 SINGLE ANNUAL SKID SURVEY (SASS) APPROACH TO CALCULATION OF CSC

Overview of SASS approach

A.2.1. 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.

Benefits of SASS approach

A.2.2. The SASS approach only requires one survey for each section in each year. It is therefore economically viable to survey the whole network each year and produce yearly CSC values.

A.2.3. Variation of skid resistance both within and between years can be taken into account by using the SASS approach.

A.2.4. It is possible to determine the correction factors (and therefore supply CSC values) after the end of each survey period rather than at the end of the survey season.

Shortfalls of SASS approach

A.2.5. The processing of the survey data in order to determine the correction factors can be labour intensive.

A.2.6. The SASS approach takes account of yearly variation and therefore the calculations are affected by maintenance carried out in the last three years. As such sections which have had resurfacings carried out in the last three years have to be identified and removed from the calculation procedure for the correction factors.

A.2.7. If a survey is undertaken outside of the designated survey period then additional processing of data is required to calculate a correction factor. The resulting correction factor is less suitable resulting in less accuracy in the CSC value. Surveys undertaken outside of the target survey period for the current year can also reduce the accuracy of correction factors calculated in the next three years.

SASS approach calculation procedure

A.2.8. The effect of seasonal variation will vary in different geographical areas (e.g. due to different amounts of rainfall), therefore larger networks will be split into smaller localities and the correction factor will be determined and applied separately within each locality.

A.2.9. The whole network shall be surveyed once during the Testing Season in each year. Surveys shall be planned such that in successive years each road length is tested in the early, middle and late parts of the season.

A.2.10. 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 will be tested in the early part of the season again, etc.

A.2.11. Each site on the network shall be allocated to a locality by the Overseeing Organisation.

A.2.12. A **locality** is a collection of road sections or routes for which a correction factor will be determined. A locality should 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.

A.2.13. 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.

A.2.14. 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.

A.2.15. All the road sections within each locality shall be surveyed within the same part of the test season.

A.2.16. 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 shall 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. This means that if a length of road has been resurfaced within the last 4 years then that length should be excluded from the LECF calculation.

(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

A.2.17. The CSC for each 10m sub-section shall be determined by multiplying the corrected SC by the LECF.

ANNEX 3 BENCHMARK SITES APPROACH TO CALCULATION OF CSC

Overview of Benchmark sites approach

A.3.1. This approach is based upon a single annual survey of the network combined with data from selected sites known as "benchmark sites" (spread around the network). The benchmark sites have three surveys in the year (one in each survey period), and are used to indicate seasonal variation.

Benefits of Benchmark sites approach

A.3.2. The Benchmark sites approach requires one survey for each section each year along with 3 surveys for each benchmark site. It is therefore economically viable to survey the whole network each year and produce yearly CSC values.

A.3.3. This approach produces two correction factors for each area for each year (in general). The SASS approach on the other hand produces one correction factor for each road and area combination for each year (see Annex 2). Therefore the benchmark site approach is less process intensive than the SASS approach.

A.3.4. The survey of the network can be spread over the survey periods and the choice of survey period has no impact on the CSC value calculated.

Shortfalls of Benchmark sites approach

A.3.5. If a benchmark site experiences different weather conditions in comparison to the nearby sections then the resulting CSC value will be inaccurate. The different weather conditions could arise if there is a large amount of rain occurring between the benchmark site survey and the survey for nearby sections. Different weather conditions could also arise if there is a large distance between the sections and the associated benchmark site.

A.3.6. Because surveys from all of the survey periods are used to calculate the correction factors, determination of CSC using this approach will not be possible until after the end of the testing season when the final Benchmark Site survey has been completed.

Benchmark sites approach calculation procedure

A.3.7. The Overseeing Organisation will agree a number of Benchmark Sites to cover a relevant geographical area.

A.3.8. The Benchmark Sites shall all be tested three times with surveys spread through each testing season to provide Mean Summer SC (MSSC) values. MSSC values are calculated by taking the average of the three survey periods for each 10m length.

A.3.9. An overall average MSSC value for each area shall also be calculated.

A.3.10. The whole of the selected network shall be tested once in each year. It is acceptable to survey different parts of the network in different parts of the testing season.

A.3.11. Whenever a part of the network is surveyed, all the Benchmark Sites shall be tested at the same time.

A.3.12. The LECF is the correction factor determined for the network area to bring the current year data to a level consistent with the long-term average.

A.3.13. With this method it is assumed that the average behaviour of the Benchmark Sites is representative of the area and that the climatic effects leading to seasonal variation between years will have influenced all of the Benchmark Sites in an area in a similar way. By surveying the benchmark sites three times each season, some account can be taken of the within-year variation. Comparing the sites in successive years allows the effects of between-year variation to be reduced.

A.3.14. The LECF is calculated in five stages:

(i) The **Mean Summer Correction Factor** (MSCF) is determined in order to take account of the variation in skid resistance between the time of a particular survey and the average during the testing season. The MSCF is the overall average of the benchmark sites in the same area for the testing season, divided by the average of all of these benchmark sites for the survey period of the relevant survey.

(ii) The MSSC for each 10m sub-section in the survey is estimated by multiplying the SC for each valid 10m sub-section by the MSCF.

(iii) The LESC is determined to represent the average skid resistance level in the area over recent years. The LESC is the overall average MSSC for all of the Benchmark Sites over the three years that precede the current testing season (with lengths that have undergone treatment in the last 4 years excluded).

(iv) The LMSC is determined to represent the average skid resistance level in the area for the current testing season. The LMSC is the average MSSC of all benchmark sites in the area for the current testing season (with lengths that have undergone treatment in the last 4 years excluded).

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

LECF = LESC/LMSC

A.3.15. The CSC for each 10m sub-section shall be determined by multiplying the estimated MSSC for each 10m sub-section by the LECF.

ANNEX 4 CALCULATION OF MEAN SUMMER SKID COEFFICIENT (MSSC)

Overview of MSSC approach

A.4.1. This method uses the MSSC to represent the equilibrium summer level of skid resistance. MSSC is calculated by conducting three surveys in the year (one in each survey period) and averaging the results together.

Benefits of MSSC approach

A.4.2. This approach does not require the calculation of correction factors, and therefore there is very little processing of the data to be carried out.

Shortfalls of MSSC approach

A.4.3. Each section requires three surveys each year in order to determine a MSSC value. This is more expensive than the other approaches and therefore the network is usually split into smaller parts with only parts of network surveyed each year, resulting in gaps in the dataset. This means that changes to the skid resistance occurring in the intervening years between tests might pass undetected, with increased crash risk for a time.

A.4.4. Although this approach takes account of within year variation it does not take account of yearly variation. Particularly hot or wet summers, for example, could give rise to relatively low or high MSSCs compared with the underlying equilibrium value. In a "low-MSSC" year, small changes could give rise to significant lengths of the network requiring investigation and subsequent treatment that may not be necessary. Conversely, in a "high-MSSC" year, sites that should be investigated may be missed and not reviewed until the next survey (in two or three years). This can cause large fluctuations in the lengths of road being identified for treatment, with consequent difficulties for maintenance planning.

A.4.5. Calculation of MSSC is only possible at the end of the testing season once all of the surveys have been completed.

MSSC approach calculation procedure

A.4.6. Using the MSSC method, the network shall be surveyed three times in the same year, in the early, middle and late parts of the testing season.

A.4.7. The MSSC is determined for each 10m sub-section by taking the average of the three SC values from the three surveys. The MSSC averaged over the relevant site should be used as the CSC value for comparison with Investigatory Levels.

A.4.8. In areas where the MSSC method is used, dividing the network into two or three parts and testing the parts over successive years can reduce the proportion of the network to be surveyed in any year. Thus half the network is surveyed in alternate years or one third of the network may be surveyed each year so that the whole network is covered over a three year cycle.

ANNEX 5 APPLICATION OF SITE CATEGORIES AND INVESTIGATORY LEVELS

Overview

A.5.1. This Annex provides detailed guidance on the selection of appropriate site categories and ILs from the range in Table 4.1. These are then followed by some examples.

A.5.2. Additional guidance may also be provided by the Overseeing Organisation. If there are any conflicts between the guidance given here and the guidance provided by the Overseeing Organisation, then guidance provided by the Overseeing Organisation takes precedence.

A.5.3. Lengths with no specific risk of skidding crashes will be assigned the lowest IL with dark shading from the appropriate Site Category. Where identified risks exist, a higher IL should be selected from within the range. The guidance given in this section is not exhaustive and therefore judgement of the risks specific to each location shall be exercised.

A.5.4. Additional information, such as safety reports and congestion reports may be useful when setting site categories and the IL. They can be used to help identify higher risk situations and where queuing is likely.

Category A: Motorway (main carriageway)

A.5.5. Use this Site Category for all sections of main carriageway that meet motorway standards of geometric design, including merging and diverging areas of the carriageway. Motorway slips roads shall not have category **A** applied but instead shall have category **B** (or the appropriate event category) applied.

A.5.6. If the motorway length under consideration does not meet motorway standards of geometric design then the length should be treated as a carriageway with one-way traffic (either event or non-event depending on the situation).

A.5.7. An IL of **0.35** will be appropriate in almost all circumstances.

A.5.8. The IL can be changed to **0.30** in exceptional cases if, following a detailed site investigation, it is clear that the crash risk associated with a skid resistance below 0.35 is low.

Category B: Non-event carriageway with one-way traffic

A.5.9. Use for all non-motorway dual carriageways and other lengths with one-way traffic, including motorway slip roads. Note that other events on lengths with one-way traffic, such as approaches to roundabouts/ junctions, bends or gradients should be considered and categorised accordingly.

A.5.10. At junctions, use category **B** for areas where traffic merges or diverges if:

- The junction layout allows traffic leaving or joining the mainline to match the speed of the mainline traffic, and
- There is adequate taper length for merging to occur.

A.5.11. For category **B** an IL of **0.35** will be appropriate in most circumstances. The IL can be reduced to **0.30** only following a detailed site investigation and it is clear that the crash risk associated with a skid resistance below 0.35 is low.

A.5.12. The IL should be increased to **0.40** for:

- Areas where pedestrians or other vulnerable road users are common but category K is not appropriate
- Hazards where the speed limit is 50mph or above and where category Q is not appropriate, including:
    - Junctions where the geometry does not justify using category Q.
    - Bus stops, laybys etc.
    - Other accesses, e.g. private roads/drives.
- Bends on roads with a radius >100m and a speed limit below 50mph if they present a particular hazard in spite of the lower speed.
- Uphill sections that give rise to a speed differential between vehicles that could result in increased risk.
- The approach to the end of a dual carriageway where a lane drop occurs.

Category C: Non-event carriageway with two-way traffic

A.5.13. Use for all non-event carriageway sections with two-way traffic.

A.5.14. At junctions, use category **C** for areas where traffic merges or diverges if:

- The junction layout allows traffic leaving or joining the mainline to match the speed of the mainline traffic, and
- There is adequate taper length for merging to occur without the mainline being forced into avoiding action.

A.5.15. An IL of **0.40** will be appropriate in most circumstances. The IL can be reduced to **0.35** only following a detailed site investigation.

A.5.16. The IL should be increased to **0.45** for:

- Areas where pedestrians or other vulnerable road users are common but category K is not appropriate
- Hazards where the speed limit is 50mph or above (over the braking area) and where category Q is not appropriate, including:
    - Junctions where the geometry does not justify using category Q.
    - Bus stops, lay-bys etc.
    - Other accesses, e.g. private roads.
- Bends on roads with a radius >100m and a speed limit below 50mph if they present a particular hazard in spite of the lower speed.

- Uphill sections that give rise to a speed differential between vehicles that could result in increased risk, but category G1 or G2 is not appropriate.

Category Q: Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals

A.5.17. Use this Site Category for:

- Major / minor priority junctions
- Other significant accesses
- Approaches to roundabouts and traffic signals (except for high risk circumstances such as pedestrian crossings etc.).

A.5.18. If the junction design and traffic volume allows the traffic to merge with/diverge from the mainline traffic without changing speed, this Site Category is not needed (use category **B** or **C** instead).

Approaches to Junctions:

A.5.19. For the purposes of this standard, roads involved in a junction are split into two types, the major road and the minor road(s). The major road is the road where traffic has permanent priority. The minor road(s) are where traffic is required to give way.

A.5.20. Drivers on the major road have permanent priority and are not expecting to give way, but may have to brake sharply if a vehicle emerges unexpectedly from the minor road or turns right across their path. Factors to consider are:

- Right turning vehicles from a minor road are at risk of a side impact with traffic on the major road, and the outcome of this type of crash is likely to be severe.
- The risks increase where the speed of traffic joining or leaving the main carriageway differs greatly from those continuing straight on. This is heavily influenced by the taper length, provision of dedicated lanes for right-turning traffic, etc.

A.5.21. On the minor road, the risk of having to brake unexpectedly is lower since the need to give way is indicated clearly in advance of the junction.

A.5.22. On the major road apply Site Category **Q** to the 50m approach (in the direction of travel) to the junction and across the extent of the junction. For roads with a speed limit of 50mph or above, consider extending the approach distance, depending on the risk of traffic having to brake unexpectedly.

A.5.23. For major roads with two-way traffic, consider the two directions separately to determine the overall extent of the Site Category. The two directions should be assigned the Site Category and IL independently so that Site Category Q is not applied on the length following a junction.

A.5.24. For major roads use an IL of **0.45** if:

- The speed limit is below 50mph
- The speed limit is 50mph or above but the traffic volume and speed differential between the major and minor traffic streams results in an acceptably low risk.

A.5.25. For major roads use an IL of **0.50** if the speed limit is 50mph or above and:

- The combination of speed differential and traffic volume result in a moderate level of risk
- Sight lines on the minor road are poor, leading to the possibility of driver error
- Right-turning traffic from the major road is not adequately catered for
- High levels of traffic on the mainline may induce drivers joining it to take risks when pulling out.

A.5.26. For major roads use an IL of **0.55** in exceptional circumstances where the risk is high. Consider whether the high risk could be mitigated more appropriately by other means.

A.5.27. On the minor road apply Site Category **Q** to the 50m approach to the stop/give way line. Extend the distance, if necessary, to take into account likely queues.

A.5.28. For minor roads use an IL of **0.45** in most circumstances.

A.5.29. The IL should be increased for minor roads to **0.50** if the sight lines (on the minor road) approaching the junction are poor, leading to the possibility of a driver having to brake suddenly.

A.5.30. Where the volume of traffic using the access warrants it, treat other significant accesses (petrol stations, superstores etc.) as for major/minor priority junctions, above. If the volume of traffic is low, use the appropriate non-event categories instead.

Approaches to roundabouts and traffic signals:

A.5.31. Apply Site Category **Q** to the 50m approach to the stop/give way line. Extend the distance, as necessary, to take into account likely regular queuing.

A.5.32. Do not use this Site Category for signal-controlled pedestrian crossings or for other high risk situations – use category **K** instead.

A.5.33. Use an IL of **0.45** if the speed limit is below 50mph, or if there is a higher speed limit but actual traffic speeds are low, e.g. because the road layout does not lend itself to higher speed.

A.5.34. Use an IL of **0.50** if the speed limit is 50mph or above unless actual traffic speeds are low.

A.5.35. Use an IL of **0.55** in exceptional circumstances where the risk is high. Consider whether the high risk could be mitigated more appropriately by other means.

Category K: Approaches to pedestrian crossings and other high risk situations

A.5.36. Use where the consequences of a crash are likely to be severe, including:

- Signal controlled pedestrian crossings and zebra crossings
- Railway crossings
- Other situations where there is both a likelihood of vulnerable users in the road and a high risk of injury in the event of a crash.

A.5.37. Site Category **K** is to be applied for the 50m approach to the event. Consider extending this distance for roads with speed limits of 50mph or above, depending on the likelihood of traffic having to brake unexpectedly.

A.5.38. An IL of **0.50** will be appropriate in most circumstances.

A.5.39. The IL can be increased to **0.55** where there is reason to believe pedestrians or other vulnerable road users may misjudge the speed of oncoming traffic, e.g.:

- Near schools or other facilities for children
- Near public houses
- Where the speed of approaching traffic is high.

Category R: Roundabout

A.5.40. Use for roundabout circulation areas, including approaches to traffic lights on roundabouts. If there are specific, high-risk situations then use category **K**. Mini roundabouts should be excluded from this Site Category, in this instance category **Q** should be applied to the approach and across the mini roundabout.

A.5.41. An IL of **0.45** will be appropriate in most circumstances.

A.5.42. Consider raising the IL to **0.50** in case of the following circumstances:

- High speed of circulating traffic
- High incidence of cyclists or motorcyclists
- Absence of signalised control on roundabouts at grade separated interchanges.

Category G1: Gradient 5-10% longer than 50m

A.5.43. On carriageways with two-way traffic, use for lengths of at least 50m with an average uphill or downhill gradient of between 5 and 10%.

A.5.44. On carriageways with one-way traffic, use for lengths of at least 50m with an average downhill gradient of between 5 and 10%.

A.5.45. This assessment can be based on 10m gradient data from traffic-speed surveys or from accurate topographical survey data when available.

A.5.46. An IL of **0.45** will be appropriate in most circumstances.

A.5.47. Raise the IL to **0.50** if there are other risk factors also present such as poor visibility etc.

Category G2: Gradient >10% longer than 50m

A.5.48. On carriageways with two-way traffic, use for lengths of at least 50m with an average uphill or downhill gradient greater than 10%.

A.5.49. On carriageways with one-way traffic, use for lengths of at least 50m with an average downhill gradient of 10% of higher.

A.5.50. This assessment can be based on 10m gradient data from traffic-speed surveys or from accurate topographical survey data when available.

A.5.51. An IL of **0.50** will be appropriate in most circumstances.

A.5.52. The IL can be reduced to **0.45** only after a detailed site investigation.

A.5.53. Raise the IL to **0.55** if there are other risk factors also present such as poor visibility etc.

Category S1/S2: Bend radius < 500m

A.5.54. Use for bends on carriageways with one-way traffic (category **S1**) and on carriageways with two-way traffic (category **S2**).

A.5.55. For bends with radii between 100m and 500m the **S1** and **S2** categories should only be applied where the speed limit is 50mph or above. For roads with lower speed limits, use the non-event Site Category **B** or **C**. For bends that have radii less than 100m, **S1** and **S2** will apply at all speeds.

A.5.56. This category should not generally be used for:

- Short lengths, for example less than 100m, with a radius of curvature between 250m and 500m.
- Roundabout exits.

A.5.57. The Site Category should be extended upstream and downstream to where the radius of the road has exceeded 500m or 100m for bend radii where S1 or S2 is used at speeds lower than 50mph.

A.5.58. The lower, dark shaded band for each category will be appropriate in most circumstances (IL of **0.45** for category **S1**, or **0.50** for category **S2**).

A.5.59. Raise the IL if there are other risk factors also present (IL of **0.50** for category **S1**, or **0.55** for category **S2**), or particular potential for loss of control, including if:

- The geometry of the bend is particularly hazardous, taking into account the traffic speed.
- Adverse camber is present.

A.5.60. For category **S2**, the IL can be reduced to **0.45** only after a detailed site investigation.

A.5.61. This assessment can be based on 10m curvature data from traffic-speed surveys, drawings or from accurate topographical survey data when available.

Example: Motorway grade separated Junction

A.5.62. For generic Motorway grade separated junctions there are four different site categories in effect, as described below and shown in Figure A.5.1. In some cases other site categories may also be required due to other events occurring in the vicinity.

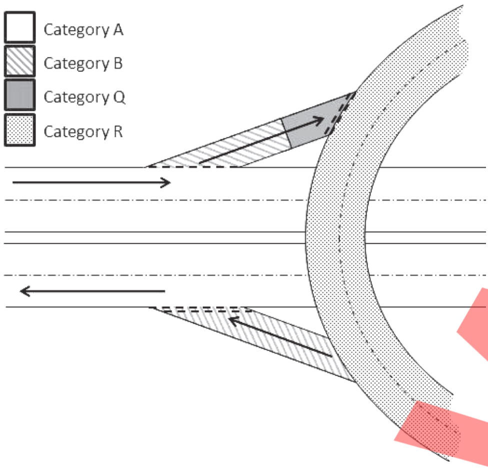

Figure A.5.1 Site categories for a typical motorway grade separated junction layout

A.5.63. The main carriageway will have category **A** applied to its whole length (if appropriate to its geometry/ layout).

A.5.64. The off slip will have category **B** applied for the majority of its length with category **Q** applied to the last 50m (length of **Q** to be extended if queues likely).

A.5.65. The on slip will have category **B** applied to its whole length unless other events for the site take precedence (e.g. high gradient or tight bend).

A.5.66. The roundabout will have category **R** applied to its whole length.

Example: T-junction on a Single carriageway

A.5.67. For a T-junction on a single carriageway there are two different site categories in effect, as described below and shown in Figure A.5.2. In some cases other site categories may also be required due to other events occurring in the vicinity.

A.5.68. In the figure for this example the major road (where traffic has permanent priority) is the horizontal road and the minor road (where traffic is required to give way) is the vertical road.

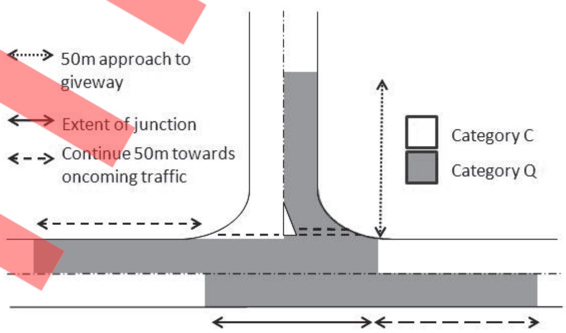

Figure A.5.2 Site categories for junction approaches on a single carriageway

A.5.69. On the minor road a category of Q is applied to the 50m approach to the junction. This length may be extended if queuing is likely. The remaining length (including the lane with traffic moving away from the junction) is given a category of C.

A.5.70. On the major road a category of Q is applied to the extent of the junction and the 50m leading to the junction (in the direction of traffic on the major road) for both lanes. This length may be extended if the risk of traffic having to brake unexpectedly is higher than usual. The remaining length of the major road is given a category of C (if appropriate to the site geometry/layout).

Example: Priority junction

A.5.71. For a priority junction between two single carriageways there are two different site categories in effect, as described below and shown in Figure A.5.3. In some cases other site categories may also be required due to other events occurring in the vicinity.

A.5.72. In the figure for this example the "major road" (where traffic has permanent priority) is the top part of the horizontal road (traffic moving from left to right) and the bottom part of the horizontal road (traffic moving from right to left). The "minor roads" are the vertical road and the turn lane of the horizontal road. This example is assuming that right turns from the vertical road are prohibited.

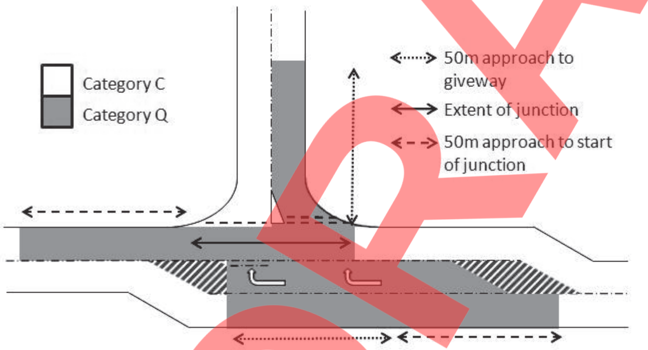

Figure A.5.3 Site categories for a priority junction

A.5.73. The top part of the horizontal road ("major road") will have a category of **Q** applied to the extent of the junction and the 50m leading to the junction (in the direction of traffic on the major road). This length may be extended if the risk of traffic having to brake unexpectedly is higher than usual. The remainder of the top part of the horizontal road will have the appropriate non-event category applied (in this case **C**).

A.5.74. The turn lane ("minor road") will have a category of Q applied to the 50m approach to the giveway. The bottom part of the horizontal road ("major road") will have a category of Q applied to the 50m approach to the start of the junction and for the extent of the junction. As the two lanes described above are running lanes from the same carriageway with traffic in the same direction, they will have the same Site Category and IL applied along their coinciding length (see paragraph 4.8).

A.5.75. The vertical road (one of the "minor roads") will have a category of **Q** applied to the 50m approach to the junction. This length may be extended if queuing is likely. The remaining length (including the lane with traffic moving away from the junction) will have the appropriate non-event category applied (in this case **C**).

Example: Roundabout with a pedestrian crossing

A.5.76. For a roundabout with a pedestrian crossing on an approach or exit, there are four different site categories in effect (if all of the roads are single carriageway), as described below and shown in Figure A.5.4. In some cases other site categories may also be required due to other events occurring in the vicinity.

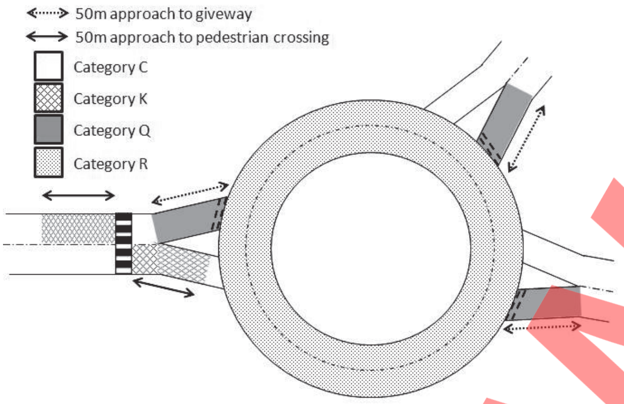

Figure A.5.4 Site categories for a roundabout with a pedestrian crossing

A.5.77. A Site Category of **K** will be applied to the 50m approach to the pedestrian crossing. This length may be extended depending on the likelihood of traffic having to brake unexpectedly.

A.5.78. The roundabout will be assigned a category of **R** for its whole length. Note, if this was a signalised roundabout, the roundabout would still be assigned a category of **R** for its whole length.

A.5.79. The approaches to the roundabout will all have category **Q** applied for the 50m approach. This length may be extended if queuing is likely. Also if the remaining distance between this category and the crossing is small then this category may be extended back to the crossing.

A.5.80. The remaining lengths will have category **C** applied (if appropriate to its geometry/layout), as they are all non-event carriageways with 2-way traffic.

Example: Signal controlled crossroads involving a dual carriageway road and a single carriageway road

A.5.81. For this type of crossroads there are four different site categories in effect, as described below and shown in Figure A.5.5. In some cases other site categories may also be required due to other events occurring in the vicinity.

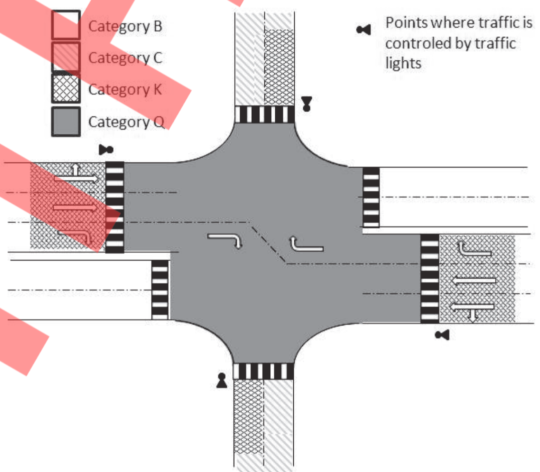

Figure A.5.5 Site categories for a signal controlled crossroads between a dual carriageway road and a single carriageway road

A.5.82. A Site Category of **K** will be applied to the 50m approach to the pedestrian crossings. This length may be extended depending on the likelihood of traffic having to brake unexpectedly.

A.5.83. The extent of the junction (i.e. in this case, the area enclosed by the pedestrian crossings) will have a category of **Q** applied to it. The remaining lengths will have the appropriate non-event site categories applied (**B** for the dual carriageway and **C** for the single carriageway).

ANNEX 6 SITE INVESTIGATION REPORT TEMPLATE

Skid Site Investigation Report		**Survey year:**	
Unit	**Route**	**Site ID**	**Location**
Name of Managing Organisation and Overseeing Organisation's Area/Region designation	Road Code	Reference no.	Section(s)/ Chainage

Site Location and Use
Location and Nature of Site:
State the limits of and nature of the site including speed limit and environment. List hazards e.g. junctions, lay-bys, other accesses, crossings, bends or steep gradients.
Current Site Category and IL:
State current Site Category and Investigatory Level. Are these consistent with current guidance?

Pavement Condition Data
Skid resistance and texture depth:
Attach plot or spread sheet showing the skid resistance, texture depth and other data if relevant. State here if low skid resistance or texture depth occurs where road users need to stop or manoeuvre.
Other aspects of pavement condition:
Note if there any extreme values of rut depth or longitudinal profile variance that could affect vehicle handling or drainage of water from the carriageway. Attach data if relevant.

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Crash Data						
Period		Number of crashes			Analysis length	
From:	To:	Total:	Wet:	Wet skid:	Length (km):	Traffic (AADT):

	Site Data	Control data: Similar sites	Control data: Route data	Control data: National data
Crashes/year				
Crashes/year/100km				
Crashes/10^8 veh-km				
Crashes linked to surface condition?	Y / N	Does the position of wet or wet-skid crashes coincide with the lengths with low skid resistance?		
Other comments on crash data:				

Site Investigation		
Date:	Inspected by:	Method:
	Name	On site/desk study

Visual Assessment	
Type and condition of surfacing:	Consider variations across whole carriageway width.
Any inconsistencies with survey data:	
Presence of debris or other contamination:	Consider likely route taken by different road users.
Local defects (potholes, fatting-up etc.):	Indicate position, extent and severity of defects.
Is drainage adequate?	List any indications that road does not drain adequately.
Road Users	
Volume and type of traffic:	Consider heavy vehicles and vulnerable road users.
Traffic speeds in relation to road layout:	Consider peak, day time and night time.
Type of manoeuvres and consequences of driver error:	Evidence of crash damage or near miss e.g. tyre tracks in the verge.
Road Layout	
Does it appear to meet current design specification?	Note unusual or confusing layouts.
Is layout appropriate for vulnerable road users?	Consider volume and type of vulnerable road users expected.

Are junctions appropriate for turning manoeuvres?		Note if junction sizes are appropriate for all vehicle movements and right turning vehicles are adequately catered for. Note whether traffic signals are operating correctly and are clearly visible.
Markings Signs and Visibility		
Are markings and signs clear and effective in all conditions?		Sometimes old pavement markings have not been removed properly or there are redundant signs that could cause confusion.
Roadside objects protected from vehicle impact?		
Clear sight lines/visibility of queues/ vegetation		Consider sight lines through junction/accesses. Is the end of likely vehicle queues visible? Will vegetation growth affect visibility or obscure signage?
Additional Information and Other Observations		
Please indicate if any:		Are any other sources of information available, such as reports or visual evidence of damage only crashes, or reports from the Police?
Recommendation		
Is treatment required?	Y / N	State why treatment is justified
What type of treatment?	Y / N	State if surface treatment is required or if any other treatment/actions can be applied instead to mitigate the existing risk.
Change IL?	Y / N	State reasons for changing IL.
Other action required?	Y / N	State what other action should be considered and why.
Approval		
Print name:	Signature:	Date:

ANNEX 7 PROCEDURE FOR IDENTIFYING SITES REQUIRING DETAILED INVESTIGATION

A.7.1. Experience has shown that some sites falling below Investigatory Level are relatively low risk in that the skid resistance is close to the Investigatory Level and there is a low recent history of crashes. Following a desk-top study to confirm that they are low risk, these sites can be removed from the process without further investigation. This allows efforts to be focussed on the sites that are more likely to justify treatment. Suggested approaches for achieving this are described below.

A.7.2. However, sites that have been identified for reasons other than skid resistance (see 5.7) should not be removed by this process.

Crash Model

A.7.3. A model which has been developed and can be used to identify sites requiring detailed investigation. It utilises crash trends (both rate and severity) from historic data to predict the expected crash saving from the application of a surface treatment. The model requires the input of crash counts for the latest 3 years, CSC values and Site Category. It then produces a score which can be used to identify if the site requires detailed investigation. The documentation supplied with the model gives guidance on the site scores that should trigger a detailed site investigation. This model is available from the Highways England.

Alternative method

A.7.4. An alternative method to identify sites requiring detailed investigation is achieved by splitting up the site into segments and summing up the scores from the criteria in Table A.7.1 for each segment. This alternative method is a simplified approximation of the Crash Model and a modified version may be implemented by the Overseeing Organisation if they feel it does not accurately represent their network.

A.7.5. If any segment within the site has a score greater than or equal to 6 then the whole site should have a detailed investigation. Segments are continuous lengths with the same Site Category and IL. Segments should also have similar levels of skid resistance.

Table A.7.1 Scores for identification of sites requiring detailed investigation

	Scores and criteria				
Number of crashes	0	1	2	3+	
Score	0	4	8	12	
Likely impact of a crash	Slight	Slight/serious	Serious	Serious/fatal	
Score	1	2	3	4	
Skid resistance Difference (SD)	>0	>-0.05 and ≤0	>-0.10 and ≤-0.05	>-0.15 and ≤-0.10	≤-0.15
Score	0	1	3	6	12
Site has SD≤0 and poor texture at the same point	No	Yes			
Score	0	1			

A.7.6. Number of crashes. This refers to the total number of personal injury crashes. Wet and wet skid crash counts are not considered separately here and should be investigated during the detailed investigation of the site.

A.7.7. Likely impact of a crash. The likely impact of a crash will vary from site to site, for example crashes on roundabouts are likely to be low speed rear or sideways collisions (i.e. slight). Whereas a crash on a carriageway with 2-way traffic would possibly involve a head on collision which is likely to be serious or fatal.

A.7.8. Skid resistance Difference (SD) is equal to the CSC value minus the Investigatory Level. Therefore sites which should be investigated (i.e. with a CSC value at or below the Investigatory Level) will have a Skid resistance Difference of zero or below (i.e. negative). The lowest SD value for the segment should be used.

A.7.9. Site has SD≤0 and poor texture at the same point. The combination of low texture depth and low skid resistance has been shown to be associated with an increased crash risk. Texture depths less than or equal to 0.8mm are considered to be low. Note, low texture depth combined with skid resistance above the Investigatory Level does not pose an increased crash risk for the purposes of this standard.

ANNEX 8 GLOSSARY OF TERMS

A.8.1. Terms used within this report are defined in the Glossary below.

A.8.2. **Characteristic Skid Coefficient (CSC)**. The SC value that has been corrected for seasonal variations following the method appropriate to the survey strategy adopted by the Overseeing Organisation.

A.8.3. **Dynamic Vertical Load Measurement**. Device to measure the vertical load on the test wheel whilst the machine is in motion. This is used to compensate for variations in load.

A.8.4. **Index of SFC (Sideways Force Coefficient)**. A factor applied to relate the values given by sideways-force coefficient routine investigation machines to historic values.

A.8.5. **Investigatory Level**. The level of skid resistance at or below which an investigation of the skid resistance is to be undertaken.

A.8.6. **Managing Organisation**. The contracted organisation commissioned to manage the network by the Overseeing Organisation.

A.8.7. **Overseeing Organisation**. The organisation legally responsible for operation of the road network to the Secretary of State for Transport (the title of this person may vary depending on the Overseeing Organisation).

A.8.8. **Site Category**. One of the levels within a broad classification of the road network according to the risk of skidding.

A.8.9. **SC**. A friction coefficient calculated from a sideways-force coefficient routine investigation machine reading, by application of a speed correction and Index of SFC.

A.8.10. **Skid resistance Difference (SD)**. The value obtained by subtracting the Investigatory Level from the CSC.

A.8.11. **Seasonal variation**. The variation in the skid resistance measured during the course of the year due to weathering and polishing cycles.

A.8.12. **Skid resistance**. The contribution of the road surface to the overall friction available between the tyre and the road surface is known as skid resistance.

A.8.13. **Slip ratio**. The ratio of slip speed to survey speed.

A.8.14. **Slip speed**. The speed at which the contact area of a test tyre is sliding over the road surface, i.e. the effective speed of the test.

A.8.15. **State of polish**. Under the action of traffic, the microtexture becomes "polished", leading to a reduction of skid resistance. The state of polish is the degree to which microtexture has been lost due to the action of traffic.

A.8.16. **Survey contractor**. The organisation contracted to provide skid resistance measurements by either the Overseeing Organisation or the Managing Organisation.

A.8.17. **Survey period**. The period within which the survey is carried out in.

A.8.18. **Survey speed**. The speed of the test vehicle during the survey.

A.8.19. **Test lane**. The lane in which the survey is carried out.

A.8.20. **Test line**. The line within the test lane that the test wheel follows.