INTERIM ADVICE NOTE 98/07

GUIDANCE FOR HA SERVICE PROVIDERS ON IMPLEMENTING THE SKID RESISTANCE POLICY (HD28/04)

Summary
This interim advice note provides guidance to facilitate the effective application of the Skid Resistance Policy (HD28/04) by the Highways Agency and its Service Providers. It provides specific instructions and additional guidance about how to implement the Standard on trunk roads in England as well as introduces several changes to the standard itself. This advice is based on the results of consultation process and feedback provided by Service Providers and external consultants.

Instructions for Use
This IAN takes immediate effect.

CONTENTS

1 INTRODUCTION

The Highways Agency's policy for managing skid resistance on trunk roads is set out in the Standard HD 28/04 ("the Standard"; DMRB 7.3.1). Providing a safe and serviceable network is a key part of the Highways Agency's role, monitored against casualty reduction targets set by Government, and maintaining satisfactory skid resistance on roads is an important component of this.

However, maintenance treatments carried out to improve the skid resistance also have implications for traffic disruption, monetary cost and environmental impact. All these factors need to be considered when determining whether treatment is justified, so that treatments to improve the skid resistance are targeted at locations where net benefits will be gained.

The skid resistance Standard provides advice and guidance to assist engineers in determining appropriate levels of skid resistance and a way of assessing the requirement and priority for remedial works.

This document contains one change to the mandatory (boxed) sections of the Standard, which concerns the notes to Table 4.1 in the Standard. This change is explained in Section 4.1: Procedure for Setting IL.

The remainder of this document contains detailed advice to facilitate the effective application of the Standard by the Highways Agency (HA) and their Service Providers. It provides specific instructions and additional guidance about how the Standard will be implemented on trunk roads in England, with the objectives to:

- Facilitate the effective and consistent application of the Standard across the whole network
- Provide additional detail in some areas in response to feedback from Service Providers
- Clarify the division of responsibility between the HA and its Service Providers
- Facilitate the collection and retention of adequate information to allow the operation of the policy to be demonstrated and its success to be monitored.

This advice in this document is broadly consistent with the existing advice in the Standard. However, where discrepancy exists between this advice and the advice in the Standard, this document should take precedence.

For ease of reference, the structure of this document is broadly aligned with the structure of HD 28:

Section 2 gives background information on the role of surface condition in limiting the risk of skidding accidents.
Section 3 gives an overview of the operation of the Standard.

The later sections give detailed information:
Section 4 on setting Investigatory Levels
Section 5 on carrying out site investigations
Section 6 on prioritising treatments
Section 7 on the use of slippery road warning signs.

This guidance must be applied forthwith in connection with the application of the Standard.

For general enquiries, and to pass on information required by the HA relating to implementation of the Standard, please contact:

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2 BACKGROUND TO SKID RESISTANCE AND HD 28/04

The friction available on a wet or damp road can be substantially lower than the same surface when dry, and is dependent on the condition of the surfacing material, i.e. how polished the road surface has become under traffic. This depends primarily on the aggregate type (its resistance to polishing), the amount of heavy traffic and the type of traffic movement (free flow, braking, turning etc).

Lack of friction can be an important contributory factor in road accidents, although it is not normally a causative factor. It not possible to define a threshold at which the skid resistance goes from being “safe” to “dangerous”, because:

- Even on wet roads with low skid resistance, friction will be adequate to achieve normal acceleration, deceleration and cornering manoeuvres.
- Conversely, the friction needed to avoid a crash in some situations may be higher than can actually be achieved.

However, where high levels of friction are needed, e.g. in an emergency stop, better skid resistance can help to reduce accidents.

The principle of HD 28 is to broadly equalise the risk of skidding accidents across the network by providing a level of (wet road) skid resistance that is appropriate to each location. A key part of the Standard is therefore to identify locations where a greater level of friction is likely to reduce the risk of skidding accidents.

It has been found that skid resistance has a greater effect on accident risk for some site categories than for others. For example, there is a stronger link between skid resistance and accidents for single carriageway roads than for dual carriageway roads, or for motorways. This is why the different site categories have different Investigatory Levels (ILs) for skid resistance.

There is also a wide variation in accident risk for sites in the same site category, implying that local factors such as road layout, visibility and traffic levels can be important. This is why a range of IL was introduced for most site categories in the Standard.

In addition, it should be noted that the skid resistance measured by SCRIM is only one aspect of the road surface condition relevant to road safety. Other aspects, such as the texture depth or the presence of localised areas of deterioration, also need to be considered.

The overall approach to addressing these issues, set out in HD 28, is:

- Skid resistance is measured regularly.
- Investigatory Levels are set, based on the road layout and geometry, and other local factors. Above the IL, the skid resistance is assumed to be satisfactory. (This means it is critical to set the IL at an appropriate level.)
- Where the skid resistance is at or below the IL a site investigation is carried out. This draws on a range of additional information, to assess whether increasing the skid resistance would be likely to reduce accidents.
- If treatment is justified, this is prioritised and programmed and warning signs are erected in the interval before treatment is carried out.

The success of this approach relies on local assessment to allocate appropriate ILs and robust site investigation to assess the need for treatment where the skid resistance is at or below the IL. The following sections of this document give guidance on this process.

3 OPERATION OF THE STANDARD

The operation of the Standard follows an annual cycle that is summarised in Chapter 2 of the Standard. It is implemented by a combination of:

- The HA, who are responsible for updating the Standard, supervising its implementation and monitoring its success. HA also provide skid resistance survey data to its Service Providers via *Confirm* (the database underlying the Highways Agency Pavement Management System)
- HA's Service Providers, including Managing Agents, Managing Agent Contractors and DBFO Companies who implement the Standard.

The procedures to be followed are summarised in Sections 3.1 to 3.3 and illustrated in Figure 1 to Figure 3.

Each Service Provider should implement these procedures within the framework of their own Quality Management Systems so that:

- Procedures are followed
- An appropriate level of control is exercised
- Staff with appropriate experience/training are available
- Risks to health and safety associated with roadside working are addressed, and
- Necessary documentation is retained.

Specific minimum requirements for documentation are listed in Section 3.4 and it should be noted that it may be necessary for these to serve as evidence in legal proceedings.

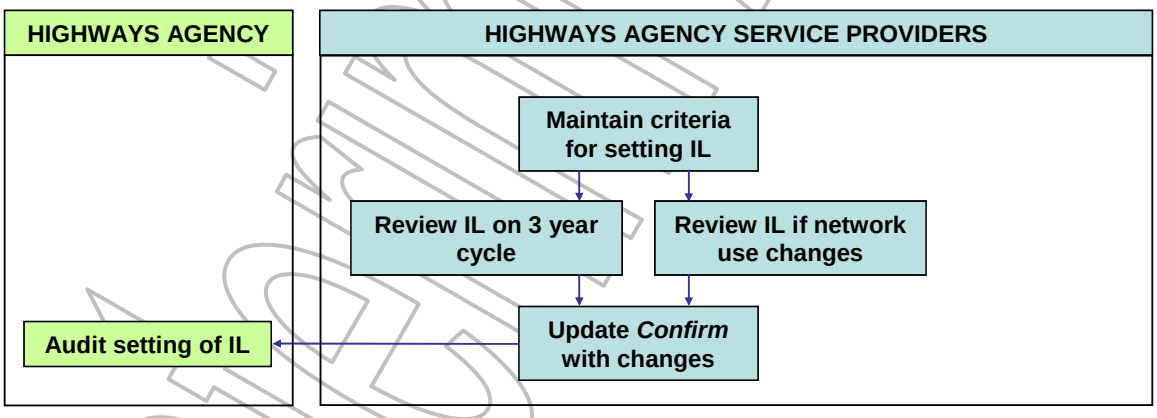

Figure 1 Overview of process for setting and reviewing IL

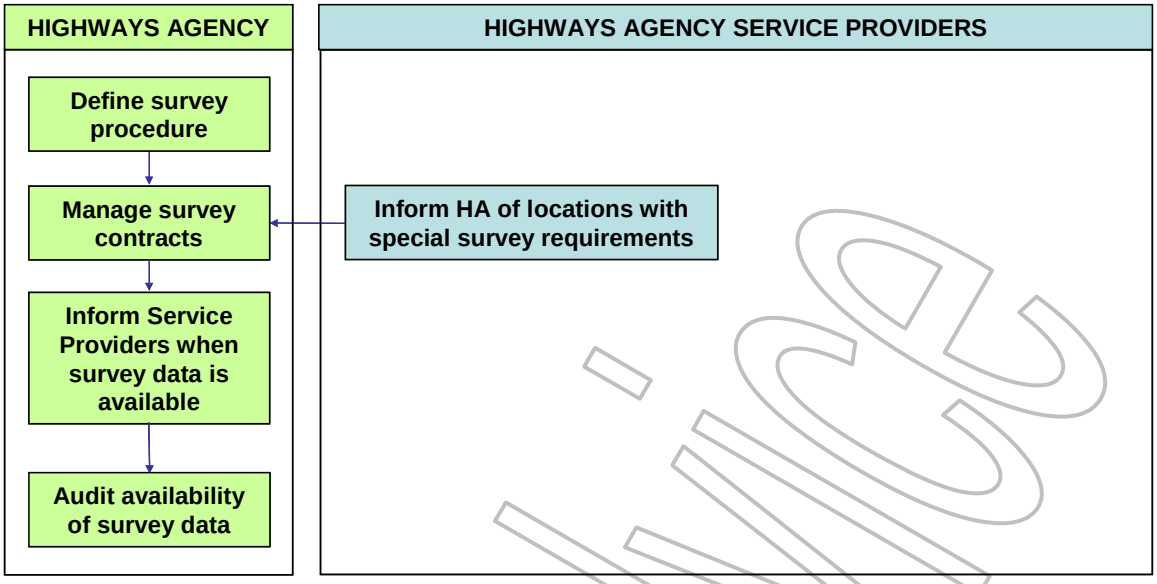

Figure 2 Overview of process for obtaining skid resistance data

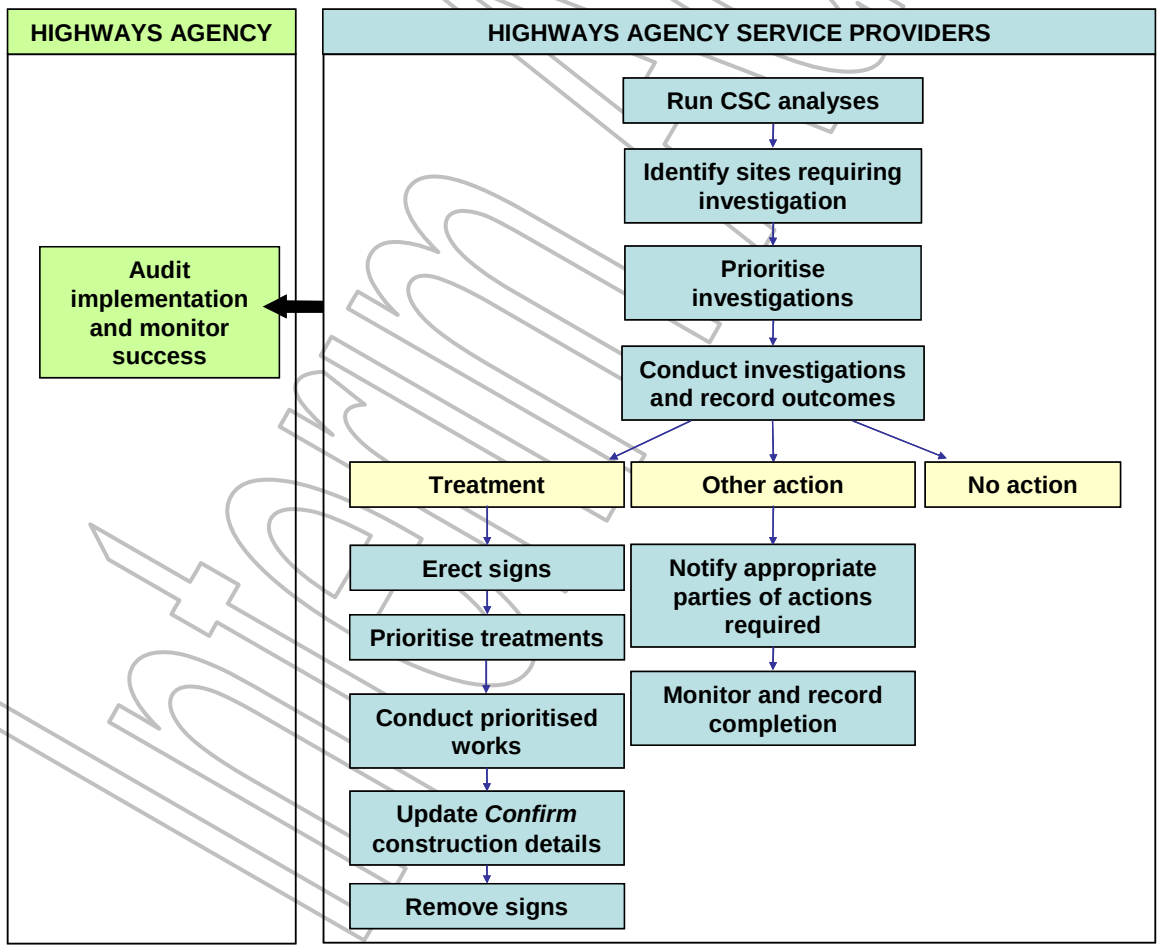

Figure 3 Overview of process for carrying out site investigations and subsequent actions

3.1 Setting and reviewing Investigatory Levels for skid resistance

ILs must be assigned to every part of the network in accordance with current guidance, and then be kept up to date. Guidance on setting ILs is given in Section 4.

ILs could change because of, for example, improvements in junction layout, or changes in use such as a superstore opening. The criteria for assigning IL may also change if the Standard or this guidance is updated, or from experience in assessing risk gained from site investigations.

Changes in IL should be made as soon as the change is identified and all ILs must be reviewed on a three yearly cycle, following a timetable determined by each Service Provider. The dates at which the site categories and ILs are updated in *Confirm* will be used to maintain an audit trail of the process of setting and updating IL.

If a number of similar site investigations reach the same conclusion over treatment either being justified or not justified, this might indicate that the guidance for setting the IL can be improved (see the Standard, paragraph 4.13). In this case, records to this effect should be maintained and the new criteria used subsequently when setting ILs.

Responsibilities of HA Service Providers:

- Reviewing ILs on a 3-year cycle
- Updating the site categories and ILs in *Confirm*, including recording when the site categories and IL are reviewed.
- Maintaining criteria for setting ILs based on local experience, where appropriate.

HA responsibilities:

- Auditing the process of setting and updating the ILs.

3.2 Obtaining skid resistance survey data

HA provides skid resistance survey data centrally through contracts covering the whole network, using the single annual survey method defined in Annex 3 of the Standard. Other arrangements may apply for some DBFO Companies.

Skid resistance is normally measured in Lane 1 because this line generally carries most heavy vehicles and has the lowest skid resistance. Parts of the network where other lanes carry more traffic than Lane 1 need to be identified so that the survey arrangements can be modified, e.g. in case of:

- The presence of drop lanes in advance of a junction
- A high proportion of heavy traffic using Lane 2 to turn right at a junction on a 2-lane dual carriageway
- New lane use arrangements (such as the M42 ATM) where the effect of new traffic patterns on skid resistance is unknown and may need to be monitored.

Responsibilities of HA Service Providers:

- Identifying non-standard survey requirements
- Arranging different or extra surveys for these locations (or notifying HA for the central contracts).

HA responsibilities:

- Managing the central survey contracts and the provision of CSC data via *Confirm*
- Informing Service Providers when their data becomes available
- Auditing the availability of survey data.

Under the Single Annual SCRIM Survey strategy used by HA for data collection, each part of the network is surveyed at different times each year. The dates for the different survey periods and the timetable for making data available through *Confirm* are shown in Table 1**Error! Reference source not found.**.

Survey Period	**Start and end dates**	**Raw data uploaded to *Confirm***	**Seasonal correction factors calculated**	**CSC data available in *Confirm***
Early	1 May - 20 June	20 July	19 August	02 September
Middle	21 June - 10 August	09 September	09 October	23 October
Late	11 August - 30 September	30 October	29 November	12 December

Table 1 Dates at which CSC data become available

Once collected and processed by HA's survey contractors, skid resistance data are accessed from *Confirm* through the CSC analysis template. Although the data can also be accessed through the single survey analysis template, these values are not corrected for seasonal variation and should not be used. Note that if the IL is changed, the analysis should be repeated so that locations below the IL are identified correctly.

3.3 Site investigations and subsequent actions

The CSC analysis indicates locations on the network where the CSC is at or below the IL, and therefore need to be investigated. Site investigations could also be prompted by knowledge of a high proportion of wet or wet skid accidents, or information from the Police or members of the public that suggest a possible skidding problem. Guidance on carrying out site investigations is given in Section 5.

3.3.1 Identifying and prioritising sites for investigation

Sites requiring investigation should be identified as soon as practicable after receipt of the CSC data. As the site investigations will take several months to complete, the most urgent cases should be prioritised and completed so that necessary actions are not delayed by the completion of the remaining, less urgent, investigations.

A prioritised list of investigations should be produced within one month of the receipt of the survey data, and all site investigations should be completed by the end of the following May.

3.3.2 Conducting site investigations

Staff carrying out site investigations must be appropriately experienced in pavement engineering and / or have received appropriate training. Site visits will be required as part of some investigations and it is paramount that risks to the workforce associated with roadside working are addressed through appropriate training and procedures. Further details of the procedures for conducting site investigations are given in Section 5.

3.3.3 Prioritising treatments and use of slippery road warning signs

Maintenance works on sites found to justify surfacing treatment will be prioritised and programmed, and slippery road warning signs must be erected at these sites. Further details of these procedures are given in Sections 6 and 7.

Responsibilities of HA Service Providers:

- Running CSC analyses to identify locations at or below the IL.
- Identifying sites needing investigation.
- Producing a prioritised list of investigations within one month of CSC data becoming available.
- Addressing risks to the health and safety of staff carrying out site inspections.
- Completing the investigations by the following May and recording the outcome.
- Taking appropriate actions as identified in the site investigation.

HA responsibilities:

- Auditing the process of site investigation and completion of subsequent actions.
- Identifying and disseminating best practice.
- Monitoring the effectiveness of the Standard in targeting maintenance.
- Identifying improvement opportunities and taking appropriate actions.

3.4 Documentation to be retained

The information listed in Table 2 is recommended as a minimum to maintain an audit trail and, if necessary, to be available as evidence in legal proceedings.

Best practice procedure is to compile an annual report summarising the implementation of the Standard. Records maintained by Service Providers should be approved following the appropriate internal Quality Management System.

Information required	By whom*	When
Local criteria for setting IL, where applicable	SP	As updated
Record of IL being reviewed	SP via *Confirm*	To timetable determined by SP
Record of availability of survey data	HA via *Confirm*	When CSC data available
Prioritised list of site investigations	SP	Within 1 month of CSC data being available
Record of each site investigation	SP	By May in the year following the survey
Outcomes from site investigations including prioritised list of treatments	SP	On completion of site investigations
Record of warning signs erected and removed	SP	As applicable
Record of resurfacing carried out	SP via *Confirm*	On completion of construction works

*SP = Service Provider; HA = Highways Agency

Table 2 Documentation to be retained

4 SETTING THE INVESTIGATORY LEVEL

4.1 Procedure for setting IL

An IL must be defined for every part of the network. This involves choosing an appropriate site category, and then selecting an appropriate IL. The Standard defines normal ranges of IL for 10 site categories, which are reproduced in Table 3.

Table 3 Site categories and Investigatory Levels reproduced from the Standard

Site category and definition		Investigatory level at 50km/h							
		0.30	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**
A	Motorway class								
B	Dual carriageway non-event								
C	Single carriageway non-event								
Q	Approaches to and across minor and major junctions, approaches to roundabouts								
K	Approaches to pedestrian crossings and other high risk situations								
R	Roundabout								
G1	Gradient 5-10% longer than 50m								
G2	Gradient >=10% longer than 50m								
S1	Bend radius <500m – dual carriageway								
S2	Bend radius <500m – single carriageway								

Notes:

1. Investigatory Levels are for the mean skidding resistance within the appropriate averaging length.
2. Investigatory Levels for site categories A, B and C are based on 100m lengths or the length of the feature if shorter.
3. Investigatory Levels and averaging lengths for site categories Q and K are based on 50m approach to the feature but shall be extended when justified by local site characteristics.
4. Investigatory Levels for site category R are based on 10m lengths.
5. Categories G1 and G2 must not to be applied to uphill gradient on dual carriageways.
6. Categories S1 and S2 must not to be applied to bends with a speed limit below 50 mph.
7. Residual lengths less than 50% of a complete averaging length may be attached to the penultimate full averaging length, providing the site category is the same.
8. As part of the 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.

A bulk update of the site investigation data in *Confirm* was carried out in June 2004 on the introduction of the revised Standard. However, some changes were not captured, including the need to apply higher IL for some sites in each category.

Therefore, there was a need to review ILs and capture the resulting changes as soon as practicable. In particular, new limits on radius of curvature for categories S1 and S2 were not captured by the bulk update.

The *Confirm* facility to download site categories and ILs in .XML format should be used to facilitate reviewing and editing this data, so that an audit trail is maintained. When the edited file is uploaded to *Confirm*, the review date will be associated with all sections reviewed, irrespective of whether or not changes were made to the site category or IL.

4.2 Choosing the appropriate site category

Identify which site category from Table 3 is most appropriate to the road layout at each point on the network.

Only one site category can be assigned at each point; if there is more than one category that is applicable then choose the one that allows a higher IL or, if both ILs are the same, then the one further up the table.

The length of a single site category can vary from a few metres to several kilometres.

4.2.1 Non-event Site Categories

A non-event site category (A, B or C) should be assigned to any length of road where there are no junctions, roundabouts, crossings, bends or gradients present.

Category A: Motorway

Use this site category for all sections of carriageway that meet motorway standards of geometric design, including merging and diverging areas of the carriageway (see Figure 4).

For motorway slip roads, use category **B**, but note that other events on slips roads, such as approaches to roundabouts/junctions, bends, or sections with 2-way traffic should be considered and categorised accordingly.

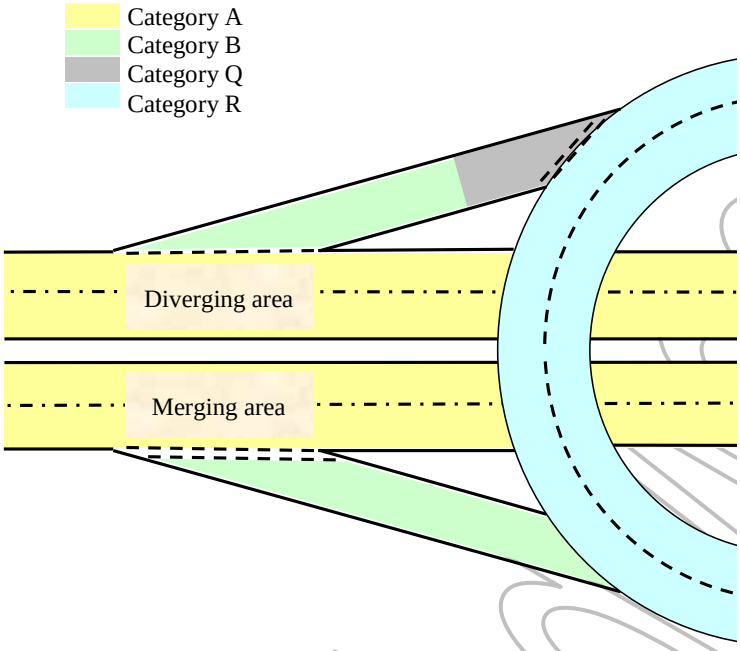

Figure 4 Site categories for a typical motorway grade separated junction layout

Category B: Dual c/way non-event

Use for all non-motorway, dual carriageways and other lengths with one-way traffic, including motorway slip roads (see Figure 4).

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.

If the junction layout does not meet these criteria then use category **Q**.

Category C: Single c/way non-event

Use for all carriageway sections with two-way traffic.

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.

If the junction layout does not meet these criteria then use category **Q**.

4.2.2 Event Site Categories

For all event site categories, consider carefully how far the category needs to extend upstream and downstream.

Category Q: Approaches to junctions and roundabouts

Use this site category for:
- Major / minor priority junctions
- Other significant accesses
- Approaches to roundabouts and traffic signals (except for high risk circumstances).

Major / minor priority junctions
NB: 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).

On the major road (where traffic has permanent priority):
Apply site category **Q** across the extent of the junction and continue for a further 50m in the direction of oncoming traffic, as shown in Figure 5.

For roads with a speed limit of 50mph or above, consider extending this distance to 100m, depending on the risk of traffic having to brake unexpectedly.

On roads with two-way traffic, consider both directions separately to determine the overall extent of the site category (see Figure 5).

On the minor road (where traffic is required to give way):
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.

Other significant accesses
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
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.

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

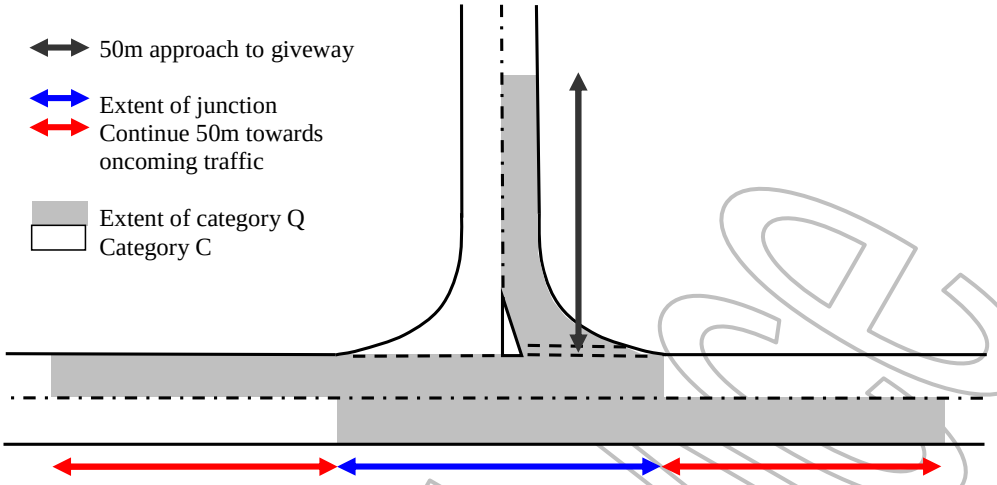

Figure 5 Site categories for junction approaches on a single carriageway

Category K: Approach to pedestrian crossings and high risk situations

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

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

Site category **K** is to be applied for the 50m approach to the event. Consider extending this distance to 100m for roads with speed limits of 50mph or above, depending on the likelihood of traffic having to brake unexpectedly.

Category R: Roundabout

Use for roundabout circulation areas, including approaches to traffic lights on roundabouts. If there are specific, high-risk situations then use category **K**.

Category G1/G2: Gradient

Category G1

On single carriageways, use for lengths of at least 50m with an average uphill or downhill gradient of between 5 and 10%.

On dual carriageways, use for lengths of at least 50m with an average downhill gradient of between 5 and 10%.

Category G2

On single carriageways, use for lengths of at least 50m with an average uphill or downhill gradient of10% or higher.

On dual carriageways, use for lengths of at least 50m with an average downhill gradient of 10% of higher.

This assessment will normally be based on TRACS (Traffic-speed Condition Survey) 10m gradient data.

Note 3 to Table 4.1 in the Standard (reproduced as Table 3 in this document) indicated that the length of the site may include the 50m approach to a **G1/G2** category, but the Note 3 is now amended through this Advice and the 50m approach is not now applicable to these categories.

Category S1/S2: Bend radius < 500m

Use for bends on dual carriageway roads (category **S1**) and single carriageway roads (category **S2**) where the speed limit is 50mph or above.

For roads with lower speed limits, use the non-event site category **B** or **C**.

Use S1 or S2 for:

- Sharp bends where the radius of curvature is below 250m at any point.
- Long, continuous bends where the radius of curvature is between 250m and 500m for at least 100m, e.g. some slip roads linking motorway mainline sections.

This category should not generally be used for:

- Short lengths with a radius of curvature between 250m and 500m.
- Roundabout exits

The site category should be extended upstream and downstream to where the road is essentially straight.

Assessment will normally be based on TRACS 10m radius of curvature data but drawings can be used if available.

4.3 Selecting an Investigatory Level

For each site, allocate an Investigatory Level from within the range shown in Table 3. In doing this, take account of local knowledge of:

- Hazards present or conflicts between road users that could lead to a vehicle losing control or to sudden braking or avoidance manoeuvres.

- The likelihood of an accident situation occurring, considering:
  - Traffic flow and speed
  - Road layout
  - Presence of warning signs or other measures that reduce the risk

- The severity of the outcome in the event of an accident, giving particular attention to the following situations, which are the main mechanisms of death and serious injury:
  - Head-on or side impacts at speed.
  - Accidents involving vulnerable road users.

In general:

- In most cases, select the IL corresponding to the lower end of the dark shaded range.
- Select a higher IL where there are identifiable hazards present, except if that hazard is acceptably mitigated.
- Also, select a higher IL if there is more than one type of event present, unless acceptably mitigated.

The following sections give specific guidance for each site category.

4.3.1 Non-event Site Categories

On non-event sites, the traffic will generally be free-flowing, with few hazards and little conflict between road users.

Category A: Motorway

		Investigatory level at 50km/h							
A	**MOTORWAY CLASS**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**

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

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

Category B: Dual c/way non-event

		Investigatory level at 50km/h							
B	**DUAL CARRIAGEWAYS NON-EVENT**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**

An IL of **0.35** will be appropriate in most circumstances.

As for motorways, the IL can be reduced to **0.30** following a detailed site investigation.

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 on roads where the speed limit is 50mph or above 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. houses.
- Bends on roads with 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, but category G1 or G2 is not appropriate.

Assess the lengths for which the higher IL applies in the same way as for the length of category Q, R or S.

Category C: Single c/way non-event

		Investigatory level at 50km/h							
C	**SINGLE CARRIAGEWAY NON-EVENT**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**

An IL of **0.40** will be appropriate in most circumstances.

As for motorways, the IL can be reduced to **0.35** only following a detailed site investigation.

The IL should be increased to **0.45** for any of the reasons listed above for category B, plus:

- In known, popular overtaking areas.

4.3.2 Event Site Categories

Event sites have a higher IL to reflect their higher overall accident potential and the greater effect of low skid resistance on accident risk.

Category Q: Approaches to junctions and roundabouts

		Investigatory level at 50km/h							
Q	**APPROACH TO AND ACROSS MINOR AND MAJOR JUNCTIONS, APPROACHES TO ROUNDABOUTS**	**0.30**	**0.35**	**0.40**	**0.45**	**0.50**	**0.55**	**0.60**	**0.65**

Major / minor priority junctions
Guidance on setting ILs is given below.

For major / minor priority junctions, the risks are greater on the major road.

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 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..

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.

On the major road (where traffic has permanent priority):

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 (e.g. see Figure 6 and Figure 7).

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 (e.g. see Figure 8)
- Sight lines on the minor road are poor, leading to the possibility of driver error
- Right-turning traffic is not adequately catered for
- High levels of traffic on the mainline may induce drivers joining it to take risks when pulling out.

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.

On the minor road (where traffic is required to give way):

Use an IL of **0.45** in most circumstances.

The IL should be increased to **0.50** if the sight lines on the minor road approaching the junction are poor, leading to the possibility of a driver changing their mind at a late stage

Other significant accesses
Treat other significant accesses as for major / minor priority junctions.

Approaches to roundabouts and traffic signals
The risks increase with the speed of vehicles approaching the junction.

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.

Use an IL of **0.50** if the speed limit is 50mph or above.

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.

Figure 6 Example of poor junction design, but the volume of traffic is low. An IL of 0.45 should be assigned to the mainline carriageway near the approach to the junction.

Figure 7 Example of refuge lane for right turning traffic on a derestricted single carriageway. An IL of 0.45 should be assigned to the mainline carriageway on the major road.

Figure 8 Example of poor junction design for a busy access on to a 70mph road. An IL of 0.50 should be assigned to the mainline carriageway near the approach to the junction.

Category K: Approach to pedestrian crossings and other high-risk situations

K	APPROACH TO PEDESTRIAN CROSSINGS AND OTHER HIGH RISK SITUATIONS	Investigatory level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65

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

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

R	ROUNDABOUT	Investigatory level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65

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

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/G2: Gradient

G	GRADIENTS	Investigatory level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
G1:	5 – 10% LONGER THAN 50M								
G2:	>=10% LONGER THAN 50M								

The lower, dark shaded band for each category will be appropriate in most circumstances (IL of **0.45** for category **G1,** or **0.50** for category **G2**).

Raise the IL to if there are other risk factors also present (IL of **0.50** for category **G1,** or **0.55** for category **G2**).

For category **G2**, the IL can be reduced to **0.45** only after a detailed site investigation.

Category S1/S2: Bend radius < 500m

S	BENDS RADIUS <500M	Investigatory level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
S1:	DUAL CARRIAGEWAY								
S2:	SINGLE CARRIAGEWAY								

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**).

Raise the IL to 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 (e.g. see Figure 9)
- Traffic needs to slow down to safely negotiate the bend
- Adverse camber is present.

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

Figure 9 Example of a single carriageway bend combined with a downhill gradient and the possibility of the VRS failing to contain a vehicle that looses control. This should be assigned an IL of 0.55.

5 SITE INVESTIGATION

5.1 Purpose

Site investigation is required if the skid resistance is at or below the IL.

The objective is to determine if maintenance to improve the surface condition, normally the skid resistance, is justified to reduce the risk of accidents (specifically accidents in wet conditions involving skidding).

It may also highlight that some other form of action is required or, alternatively, that no action is required at the current time.

The Standard states (paragraphs 5.3 and 5.4) that some form of treatment will be justified if:

- *"Based on an accident analysis, the number of accidents observed is higher than the average for the type of site being considered;*
- *Based on an accident analysis, the site has a higher than average proportion of accidents in wet conditions or involving skidding for the type of site being considered;*
- *The nature of the individual site and the demands of road users mean that a higher accident risk (compared with other sites in the same category) might be expected with the skid resistance at its current value […].*

If none of the above are true then there is currently no justification for treatment to increase the skid resistance."

The site investigation process consists of:

- Defining sites for investigation
- Prioritising investigations
- Conducting investigations
- Recording results of the investigations

These procedures are described further in this section. Sections 6 and 7 describe subsequent actions for sites where treatment is justified.

5.2 Defining sites for investigation

5.2.1 CSC data

The CSC data from *Confirm* indicate where the skid resistance is at or below the IL.

CSC data should normally be averaged at 100m intervals, which reduces variability in the values. As the CSC analysis begins a new "100m" length whenever the IL changes, shorter analysis lengths will automatically be generated for features less than 100m in length, e.g. approaches to junctions.

5.2.2 Site length

If the skid resistance is close to the IL, successive 10m or 100m lengths can fall alternately above and below the IL.

It is practical to combine a number of such lengths into a single site for investigation, if the characteristics are similar throughout the length (i.e. similar traffic speed, geometry etc.). The longer lengths are also more robust for accident analysis.

An example of defining the length of site for a motorway slip road (site category S1) is shown in Figure 10.

Alternatively, the whole of the *Confirm* section can be investigated so that a consistent length can be investigated in successive years, irrespective of changes in the measured skid resistance.

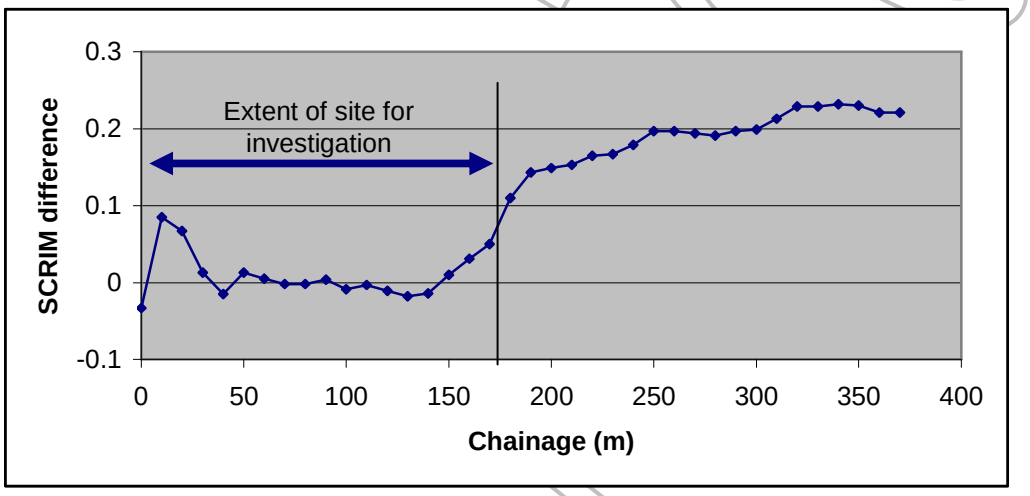

Figure 10 Example of defining site boundaries

5.2.3 Cross sectional position

The full carriageway width should be included in the investigation, i.e. all lanes of a dual carriageway and both directions of a single carriageway.

5.3 Prioritising investigations

Site investigations should be prioritised initially using the site category and the how far the skid resistance is below the IL at the worst point within the site:

High priority: Sites 0.05 or more below the IL
Medium priority: Event sites and single carriageway non-event sites
Low priority: Other non-event sites

This order may be refined by grouping investigations of sites that are close together to increase efficiency.

The resulting prioritised list should be produced within one month of receipt of survey data.

If it later becomes apparent that some sites have a particularly high number of accidents then the order should be re-examined and possibly adjusted to give these sites a higher priority.

5.4 Conducting investigations

The site investigation procedure is given in Annex 4 of HD 28 and involves collating various sources of information to reach a decision about the appropriate course of action.

This involves:

- Reviewing the IL (see 5.4.1)
- Collating various sources of pavement condition data (see 5.4.2)
- Obtaining accident data (see 5.4.3)
- Assessing the positions of accidents relative to the areas with low skid resistance (see 5.4.4)
- Assessing the overall level of accident risk (see 5.4.5)
- Assessing the site characteristics (see 5.4.6)
- Determining whether surface treatment or other action is required (see 5.4.7)

This process, including the basis on which decisions are reached, must be documented and the record retained. An example form that could be used for this is included in Appendix A.

5.4.1 Review IL

Confirm that the IL has been assigned correctly in accordance with current guidance. If the IL is incorrect then it should be changed in *Confirm* (see 3.1).

If the skid resistance is above the revised IL then further investigation is unnecessary. Record the change of IL as the outcome of the investigation.

5.4.2 Collate pavement condition data

For each site, collate skid resistance and texture depth data as strip maps or spreadsheets that show the location of lengths with poor surface condition relative to accidents and features such as bends, accesses etc.

Run new CSC analyses to obtain data at 10m intervals for bends and roundabouts, because short lengths with low skid resistance could be hazardous for vehicles cornering. These must not be disguised by being averaged over a longer length.

Also, examine the 10m data if the condition of the surfacing material is variable over local areas.

Collate the rut depth, longitudinal profile data and gradient crossfall and curvature data if relevant, i.e. if the site has poor transverse or longitudinal evenness, bends or gradients.

5.4.3 Obtain accident data

Obtain the last 3 years valid accident data for the site being investigated.

Two sources of STATS19 injury accident data are available:

- Data logged by the Police and collected by the local highway authority, which is more up-to-date, but has been subject to varying local validation processes.

- Data available from *Confirm* that has been snapped to network sections and facilitates consistent analysis via standard accident reports. Accident data is generally loaded each summer for the previous calendar year.

Either of these sources of data can be used for site investigations. If there is a particular reason to think that the accident pattern may have changed recently then the more recent Police data should be sought as it is more up-to-date.

Note that accidents are snapped to the closest section with the correct direction of travel in *Confirm.* For grade-separated junctions this will not accurately distinguish between accidents on the mainline carriageway, the slip roads and the junction.

If there were no accidents on the site within the last 3 years, this should also be recorded.

5.4.4 Assess accident positions

Plot the accident positions on maps or diagrams so the locations can be compared with the lengths where the skid resistance is low, including areas where the texture depth is low or the surface condition is otherwise poor (e.g. fatted up surface). Identify wet and wet-skid accidents separately.

If wet, or wet-skid accidents have occurred on, or close to, lengths with poor skid resistance assume (for the purpose of the investigation) that these accidents are linked to the poor surface condition.

Given the limited accuracy of the accident positions, assume an accident to be linked to the surface condition if it occurred within 200m of the length with low skid resistance.

5.4.5 Assess overall level of accident risk

Compare the overall levels of accident risk with typical values for the network, using appropriate control data.

Accident risk should be expressed as accidents per 10^8 vehicle-km, if traffic data is available, or otherwise as accidents per 100km.

National control data should be obtained from the current version of the document *"Accidents on HA roads"*, available from the HA. The figures most relevant to the type of site should be extracted.

Control data for routes and for similar sites can be obtained by interrogating *Confirm*, as described in the document *"Skidding Accident Statistics"*, available in the *Confirm* Documentation under the Accident Data Documentation Index (currently near the bottom of the index under "Other documents"). Note that the reports need to be qualified on accident date to obtain statistics for the last 3 years.

5.4.6 Assess site characteristics

Assess the site characteristics following the guidance in Annex 4 of HD 28 (paragraphs A4.18 to A4.22). This considers:

- Visual assessment of the surface condition

- Needs of road users
- Adequacy of road layout
- Adequacy of markings, signs and sight lines
- Other information available

Bear in mind that, in general, the risk of accidents increases as the skid resistance falls, but this increase is greater for sites where the road user is likely to need to stop quickly or manoeuvre unexpectedly, particularly at high speed.

This assessment can be carried out by:

- Using local knowledge of the site
- Reviewing the TRACS forward facing video
- Carrying out a walked (where feasible) or driven inspection of the site

A walked or driven inspection can give valuable information, but it creates a risk to the health and safety of the staff involved and to other road users. If the site is very straightforward, e.g. motorway or some dual carriageway non-event sites, a physical site visit may not provide additional information. Therefore, target site visits at sites where the information is most useful and ensure they are carried out in a way that minimises the risks to health and safety.

Service providers must choose the most appropriate method to collect the information required for the investigation.

5.4.7 Outcome of the site investigation

Determine, based on the information gathered, whether any form of treatment is justified, or if some other action is needed. This decision process is summarised in Figure 11**Error! Reference source not found.**.

A Need for treatment

Some form of treatment is needed if:

- The overall accident risk is above average AND the position of wet or wet-skid accidents appears to be linked to the poor surface condition.
- OR the percentage of wet or wet skid accidents is above average AND the position of these accidents appears to be linked to the poor surface condition
- OR the identified risks are high, OR the deterioration is severe

B Type of treatment

Where treatment is needed, surface treatment to improve the skid resistance will be the best course of action in most cases. However, before recommending this, consider whether some other form of treatment/action is practical to reduce the risk at source, thereby negating the need for surface treatment.

For example, if it appears that the high accident rate could be a result of poor road layout, high traffic speed, or some other characteristic of the site or road user behaviour, then road safety measures may be a more appropriate way of mitigating the risk. In this case, notify the appropriate specialist dealing with safety schemes and determine whether improvement actions, if appropriate, can be carried out within a reasonable timescale.

Otherwise, surface treatment should be recommended. Sections 6 and 7 give details of the next actions required in this case.

C Change IL

If treatment is not currently required then reduce the IL if:

- The current IL is consistent with current guidance AND
- Successive site investigations have demonstrated that the overall level of accident risk is acceptable AND
- The site has exhibited stable skid resistance for at least 3 years.

The decision to reduce the IL should be recorded so that consistent trends can be identified, which might lead to the criteria for assigning ILs to be updated.

Proposals to lower the IL outside the range of IL specified in HD 28 should be referred to HA for approval before action.

D Other action

If the site investigation identifies some other form of action to reduce accident risk, such as reapplication of road markings, cutting back vegetation or removing surface contamination then appropriate arrangements must be made and progress must be monitored until completion.

5.5 Recording the investigation

Record the results of the investigation, showing the information on which the decisions were based and the justification for all actions proposed.

This record must be retained to provide an audit trail. An example of a form that could be used for this is given in Appendix A, but the layout, style and format can be modified to suit each Service Provider.

Where surface treatment is recommended, the site investigation report must note the length of the site that justifies treatment to improve the surface condition and what specific defects (low skid resistance, low texture, etc) give rise to the accident risk.

Other defects that may be present can be recorded separately if desired, but should not influence this recommendation.

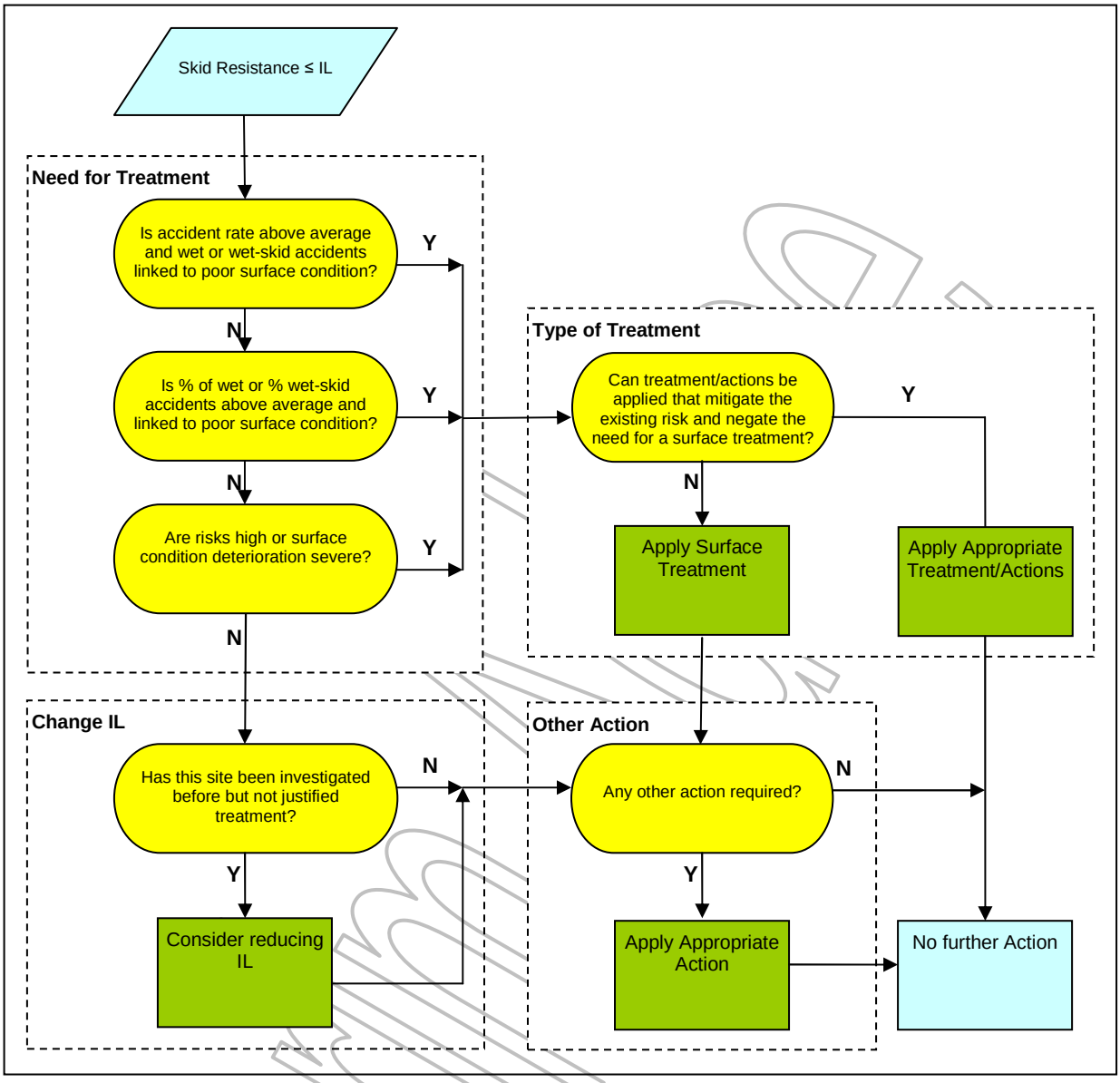

Figure 11 Flow chart summarising decision process

Following completion of all site investigations, a summary list of site investigation outcomes should be compiled, consisting of:

- Site ID
- Location: section(s) and chainage
- Date investigated
- Outcome of investigation – which, if any, of the above actions are recommended.

6 PRIORITISATION OF TREATMENT

The Standard indicates that priority for treatment should be given to completing treatments where the skid resistance is substantially below the IL (e.g. at least 0.05 units CSC below the IL), or low skid resistance is combined with low texture depth, or the accident history shows there to be a clearly increased risk of wet or skidding accidents.

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

On completion of the works the construction record in *Confirm* must be updated to register the works, to facilitate overall monitoring of the effectiveness of the Standard.

7 USE OF SLIPPERY ROAD WARNING SIGNS

7.1 Placement of Signs

For HA roads, warning signs are to be used for all sites where surface treatment is required to improve the skid resistance, i.e. the site investigation has demonstrated that treatment is justified.

Erect the warning signs as soon as is practicable after the site investigation.

It is important to avoid a proliferation of signs but it is also essential that the sign and its supplementary plate (stating the distance over which the hazard applies) are meaningful and helpful in influencing driver behaviour. Therefore:

- Merge short, individual lengths needing warning signs into longer lengths if they are separated by less than 1km.
- Use an appropriate distance plate, stating the overall merged length, prior to the first length justifying treatment.
- Use repeater signs within 1km of all joining side roads, if the end of the merged length is further than 1km from the side road. The distance plate for repeater signs should indicate the remaining merged length
- Consider both directions of travel in this way for roads with 2-way traffic.

Figure 12 shows two examples of applying this approach.

7.2 Removal of Signs

Warning signs must be removed as soon as surface treatment has been carried out. Certain surface treatments will require the signs to be left in place for a period after the treatment has been applied as detailed in Interim Advice Note IAN 49/03.

7.3 Records

For the purpose of legal proceedings it is essential that records of the erection and removal of slippery road warning signs are kept, e.g. works orders issued and inventories.

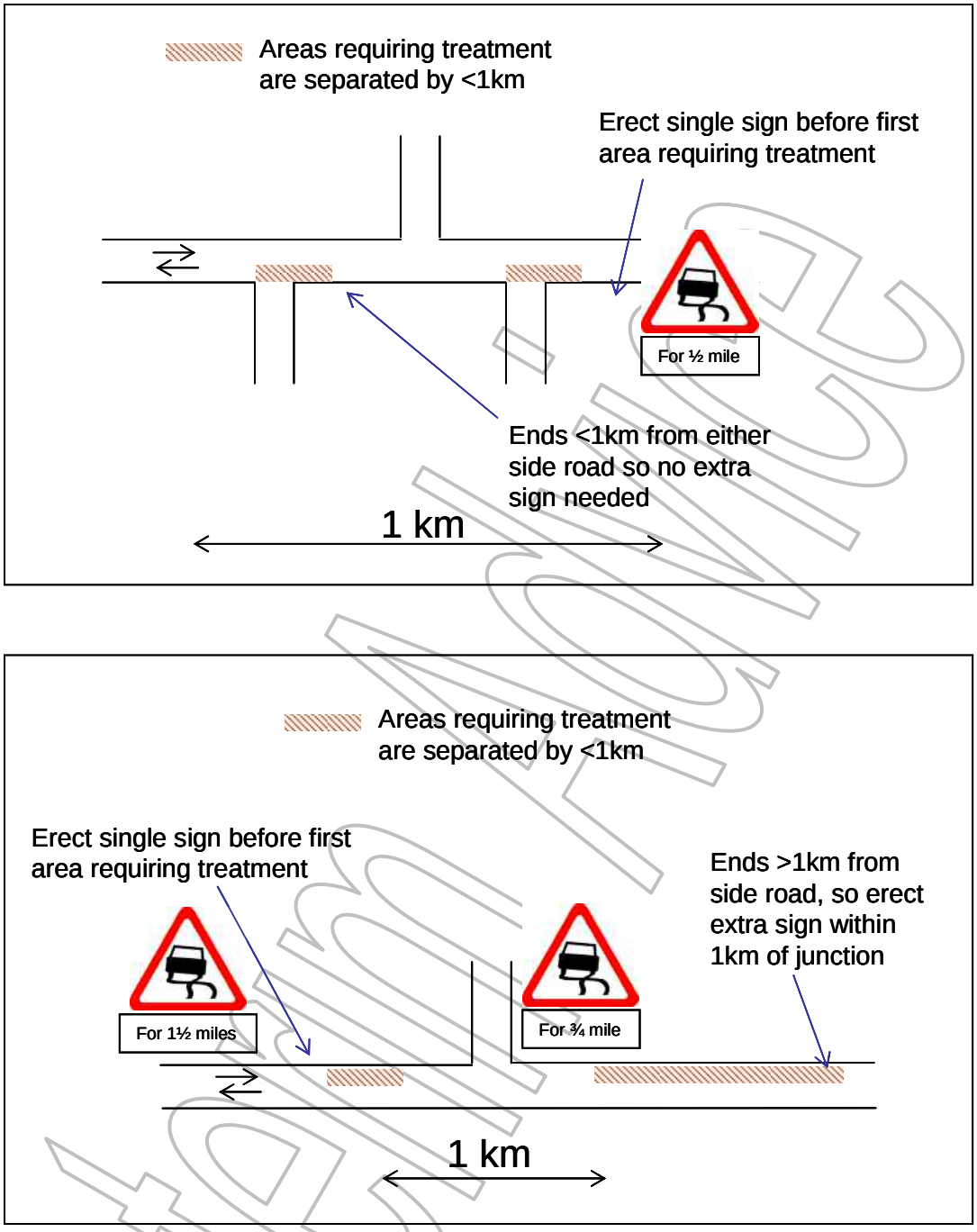

Figure 12 Examples of slippery road warning signs needed on a single carriageway with side roads (NB. 1 mile ~ 1.6 km)

REFERENCES

HD 28 (DMRB 7.3.1) Skid resistance
HD 36 (DMRB 7.5.1) Surfacing materials for new and maintenance construction
IAN 49/03 Use of warning signs for new asphalt road surfacings

Appendix A. Site Investigation Report Template

Headings include a reference to the relevant paragraphs in HD 28 (Annex 4).

SCRIM Site Investigation Report			**Survey year:**	
Unit	**HA Area**	**Route**	**Site ID**	**Location**
Name of Service Provider		Road Code	Reference no.	Section(s)/ Chainage

Site Location and Use (A4.14)
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 (A4.15)
Skid Resistance and Texture Depth:
Attach plot or spreadsheet 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.

Accident Data (A4.16)

Period		**Number of accidents**			**Analysis length**	
From:	To:	Total:	Wet:	Wet skid:	Length (km):	Traffic (AADT):

	Site data	**Control data**		
		Similar sites	**Route data**	**National data**
Accidents /year				
Accidents /year/100km				
Accidents /10^8 veh-km				
% Wet				
% Wet skid				
Accidents linked to surface condition?	Y/N	Does the position of wet or wet-skid accidents coincide with the lengths with low skid resistance?		
Other comments on accident data:				

Site Inspection (A4.17)		
Date:	Inspected by:	Method:
	Name	On site / desk study

Visual Assessment (A4.18)	
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 (A4.19)	
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 accident damage or near miss e.g. tyre tracks in the verge

Road Layout (A4.20)	
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 (A4.21)	
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 junctions / accesses. Is the end of likely vehicle queues visible? Will vegetation growth affect visibility?

Additional Information (A4.22) and Other Observations	
Please indicate if any:	

Recommendation (A4.8-13)		
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: