**Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CD236 Surface Course Materials for Construction**


MANCHESTER CITY COUNCIL

# SKID RESISTANCE STRATEGY

## Annex to DMRB Document CS228 for Skid Resistance

Highways Service, Neighbourhoods Directorate
April 2022

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CS228 for Skid Resistance

# Contents

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## Document Information

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| ***Description*** | *This Strategy sets out Manchester City Council's specific requirements that complement, supplement and replace the requirements and advice contained in the main DMRB Document (CS228 for Skid Resistance)* |

## Document History

| Version No. | Status | Author | Date | Changes from Previous Version |
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| ***01*** | **Template** | **XAIS/RSTA** | **20/11/2019** | **First Internal Release for Council Template** |
| ***02*** | **Draft** | **TK** | **24/01/2020** | **MCC amendments** |
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| ***04*** | **Draft** | **TK** | **22/09/2020** | **Update based on XAIS/RSTA published version + Appendix 1 added** |
| ***05*** | **Draft** | **TK** | **18/04/2022** | **MCC Amendments** |

**Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CS228 for Skid Resistance**

# 1. Executive Summary

This document supplements the GM Skidding Resistance Framework document. It details Manchester's step-by-step approach to identifying skid deficient sites and sets out a process for deciding on their subsequent treatment, and how this will be prioritized taking into account budget and programme considerations.
These procedures set out a long-term strategy for managing the skid resistance of Manchester City Council's Road network to a consistent and safe level.
The procedure complements the Council's Highway Asset Management Strategy, which looks to manage assets in a strategic way and takes an Asset Management approach to managing skidding resistance, which puts a greater emphasis on engineering assessment.
The methodology detailed in CS228 forms a basis for Manchester City Council's (MCC) Skid Resistance Strategy.
It is recognised that the Councils highway network has significant differences and expectations from the road user to the UK's motorway and trunk road network.

In accordance with the advice in GG 101 The Introduction to the Design Manual for Roads & Bridges section 2.2 Note 3: "Other highway authorities or local authorities can develop their own application annexes to complement, supplement or replace the requirements and advice contained in the main DMRB document."

This local application annex details all the differences from the CS228 Document regarding Manchester's Strategy for maintaining adequate Skid Resistance on the highway network. It sets out our specific requirements on responsibilities, the annual skid resistance programme, applying seasonal correction to skid resistance measurements, setting the Investigatory Levels, the process for identifying sites that require a detailed investigation, methodology for identifying and prioritising proposed treatments and actions, and for identifying sites where slippery road warning signs are required.

A separate annex to DMRB CD 236 is included at the end of this document (Appendix A), which details Manchester City Council's approach to the choice of surfacing materials utilised in highway maintenance or highway improvement schemes within the authority.

## 1.1 Principles

Councils are responsible for maintaining the local road network, containing strategic, main distributor and secondary distributor roads which are subject to a skidding resistance survey.

Skid resistance is an important property relating to the safety of highway users, particularly in damp or wet conditions. Over the course of a road's life the surface can lose some of its characteristics associated with grip. Effective maintenance of the highway network includes the requirement to systematically monitor the skid resistance of the road surface and to take a

proactive approach so that the skid resistance across the network is maintained to an appropriate standard.

## 1.2 Roles, Responsibilities and Competencies

The Councils Highway Asset Management Team will have relevant competencies as set out by the Council, and all training, experience and other forms of staff development should be recorded and documented. As a minimum staff will have passed the RSTA Skid Resistance training course, which prepares them for:

- Management, development, implementation and regular review of the Skid Resistance Strategy.
- The procurement and subsequent management of skid resistance surveys with contractors.
- Assignment of site categories and investigatory levels on the road network subject to skid resistance surveys.
- Processing, analysis and review of skid resistance data received from survey contractor.
- Review of the site categories and investigatory levels for the road network subject to skid resistance surveys. Reviews will be undertaken following significant identified network changes, as well as a full review every 3 years.
- Maintaining the appropriate records of site visits and associated documents.
- Informing other Council departments of any issues affecting the site which may be contributory to skid resistance issues.
- Providing a prioritised list of sites that would benefit from improvement works and making informed decisions about how these are integrated into the annual highways forward works programme.

The Councils Highway Asset Management Team will ensure that the most appropriate remedial action is taken at sites identified as requiring action. Some examples of the options available are:

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

# 2. Glossary of Terms

AADF – Average Annual Daily Flow. The number of vehicles estimated to pass a given point on the road in a 24-hour period on an average day in the year.

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

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

LECF - Local Equilibrium Correction Factor - the correction factor used to calculate the CSC

LESC – Local Equilibrium SC

LMSC – Local Mean SC

PSV- Polished Stone Value

SASS – Single Annual Skid Survey – A method used for calculating the CSC

SCRIM - Sideways Force Coefficient Routine Investigation Machine

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

SD – SCRIM Deficiency or Skid-Resistance Difference. The value obtained by subtracting the Investigatory Level from the CSC.

SFC – Sideways Force Coefficient

Site – A Site is an assessment length with consistent Site Categorisation and Investigatory Level whose length is defined in table 6.1 (typically site lengths range from 50-149m and 10m for roundabouts). Detailed investigations are undertaken for whole sites

SR(s) - The sideways force coefficient, measured at test speed s, multiplied by 100.

Urban Attribute – denotes network sections subject to 40mph or less speed restrictions (Not specifically related to whether the environment is built up)

UKRLG - United Kingdom Roads Liaison Group

# 3. Skid Resistance Annual Programme

The skid resistance annual programme has been produced to define a realistic achievable timetable for each part of the skid resistance strategy.
The skid resistance annual programme is illustrated below in Table 3.1:

| Date Range | Activity | Delivery Date | Comment |
|---|---|---|---|
| **Not Specific** | Annual Review of Existing Slippery Road Warning Signs | Should be within 9-15 months of last review | **I.e. annually +/- 3 months** |
| | Review Investigatory Levels | Should be within 3 years of last review | **May choose to review one third of the network each year** |
| **Jan to April** | Create and deliver to the survey contractor the network and sections to be surveyed | 30th April Network shall be available for the contractor | **The Council undertakes the Single Annual Survey** |
| **May to Mid-June** | Skid resistance survey shall be undertaken if an 'Early' survey is required | Survey contractor shall deliver the corrected CSC to the council within 1 month of the final survey date | **The council may request the uncorrected data as soon as the survey is complete. However, the CSC data will also be supplied in accordance with the delivery date** |
| **Mid-June to Mid-August** | Skid resistance survey shall be undertaken if an 'Mid' survey is required | | |
| **Mid-August to End of September** | Skid resistance survey shall be undertaken if an 'Late' survey is required | | |
| **October (can be earlier if mid or early season survey)** | Data shall be loaded into the Councils Pavement/Asset Management System for processing | Within 1 month of receipt of corrected CSC data all road sections requiring investigation shall be identified | **The Councils representative shall process the data through the configured rule set** |
| **November to June (can be earlier if mid or early) season survey)** | Road sections requiring detailed investigation shall have an on-site assessment carried out | Detailed site investigations shall be undertaken within 6 months of having been identified | **ALL sites requiring signing OR treatment shall be identified for the forward works programme** |
| | Erect Slippery Road Signs where applicable | As soon as Practicable after the treatment AND need for warning signs has been identified | **Average deficiency <=-0.2 and/or > 75% polishing AND where there has been at least 1 wet skidding collision in the previous 3-year period constitutes a need for a review of Warning Signs applicability** |
| | Produce Treatment Priority List | Incorporate within production of works programme | **Based on budget and priorities** |
| | **Undertake Remedial Treatment/ Action** | **Incorporate within works programme** | **Maintain and update record of maintenance works** |

**Table 3.1 – Sample Skid Resistance Annual Programme**

## 3.1 The Skid Network – Sections to be surveyed annually

Sections of the following road hierarchy shall be surveyed on an annual basis and form the Skid Network, as outlined in "Well Managed Highway Infrastructure – A Code of Practice".

Between 2016 and 2021, 65% of all wet collisions on Manchester's Road network occurred on the classified 'M', 'A' and 'B' roads. These roads also encompass the Key Route Network (KRN), defined across Greater Manchester, which is an integral contributory to the regional economy with around 64% of vehicles relying on it for parts of their journey.
From a risk-based perspective, MCC's Skid network therefore comprises the classified 'M', 'A' and 'B' roads together with other sections of road which generally carry 'A' road volumes of traffic. A map of these roads (highlighted in red) is shown in Appendix 1.
The Skid Network which will be subject to skid resistance testing is subject to modification if there are changes in crash patterns or amendments to the network.

Inevitably there will be some sections in the above classifications where a Skid resistance survey is inappropriate and will be excluded from the annual survey. Reasons for exclusions could include traffic calming schemes, speed humps and tables, width, height or weight restrictions, 20mph zones or road layouts where it is not possible or safe to maintain the survey speed.
Roads within the boundary of the City Centre wards have been excluded from the skid network, as traffic volumes and slow speeds mean there is a very low risk of wet skidding collisions. Any sites of concern will be added to the testing schedule as required.

Other specific roads determined to have a high skid risk may also be included each year, such as potential diversion routes, routes identified by outside agencies e.g. Police Authority or sites where increased wet skidding collision levels have been identified.
An up to date network section list will be provided for the survey contractor for use. Both directions of each carriageway shall be surveyed.
A list of sections not surveyed is produced by the surveyor contractor on an annual basis.

# 4. Single Annual Skid Survey (SASS) Approach to Calculation of CSC

## 4.1 Overview of SASS Approach

The method shall use measurements from the preceding three years to characterise the long-term skid resistance of the network.

The long-term value of skid resistance shall be used, with the mean network skid resistance in the current year, to calculate a correction factor that is applied to the current year's data to make current values consistent with the long-term average.

Sections which have had resurfacing carried out in the last four years shall be identified and removed from the calculation procedure for the correction factors.
*Note: The SASS approach takes account of yearly variation and therefore the calculations are affected by maintenance carried out in the last four years.*

The Skid network will be surveyed once during the testing season in each year. For continuity, the surveys are planned such that in successive years the network is tested in the early, middle, and late parts of the season as defined in CS228 section 3.7 and illustrated in Table 4.2 below:

Early 1st May -20th June
Middle 21st June -10th August
Late 11th Aug – 30th September

| Season\Year | 2019 | 2020 | 2021 | 2022 | 2023 | Etc. |
|---|---|---|---|---|---|---|
| **Early** | | ✔ | | | ✔ | |
| **Middle** | | | ✔ | | | ✔ |
| **Late** | ✔ | | | ✔ | | |

**Table 4.2 – Annual Survey Regime**

The local equilibrium correction factor (LECF) is the correction factor that shall be used within each locality to bring the current year data to a level consistent with the long-term average.
*Note: The LECF is calculated in three stages.*

The local equilibrium SC (LESC) shall be determined to represent the average skid resistance level for the locality over recent years.
*Note: The LESC is the average SC, calculated for all valid 10-m sub-section measurements in the defined locality over the three years that precede the current testing season.*
The LESC shall contain surveys from each of the three parts of the test season with valid measurements being those that were made in the required part of the test season, on the required test line, and on road surfaces that were at least 12 months old at the time of testing. As a consequence, if a length of road has been resurfaced within the last four years, then that length should be excluded from the LECF calculation.

# 5. Setting the Investigatory Level

Whilst the majority of this document compliments and supplements CS228, this Chapter along with Appendix 2 replaces CS228 Chapter 4 and Appendix A.

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CS228 for Skid Resistance

The site categories and associated Investigatory Levels defined in CS228 have been developed for Trunk Roads and Motorways, therefore in formulating this procedure, it is recognised that these standards may not be applicable to the more diverse nature of local authority roads.
The differences between this chapter and CS228 are subtle, but important.

A table of approved Investigatory Levels is contained in Table 5.1.
The objective of setting an IL is to assign a level of skidding resistance appropriate for the risk on the site, at or below which further investigation is required to evaluate the specific risks in more detail.

An Investigatory Level (IL) shall be assigned for every part of the Skid network, by determining the most appropriate Site Category for each location.

For the avoidance of doubt each site category has specific definitions and only one Investigatory Level. Additional 'Increased Risk' site categories are created to accommodate the higher investigatory levels.

By defining the level of risk within each site category definition the assignment of the most appropriate site category is more objective than subjective and will lead to less ambiguous interpretation and more accurately defined categories.

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

Staff responsible for setting and approving the Investigatory Levels will have the relevant competencies as set out by the Council. As a minimum they will have passed the RSTA Skid Resistance training course.
The process that shall be followed for reviewing and assigning site categories and their associated investigatory levels is outlined in figure 5.1.
The process is split into the following 3 steps:

- Allocate Site Category and associated IL
- Identify sections for review
- Record updated ILs and review date

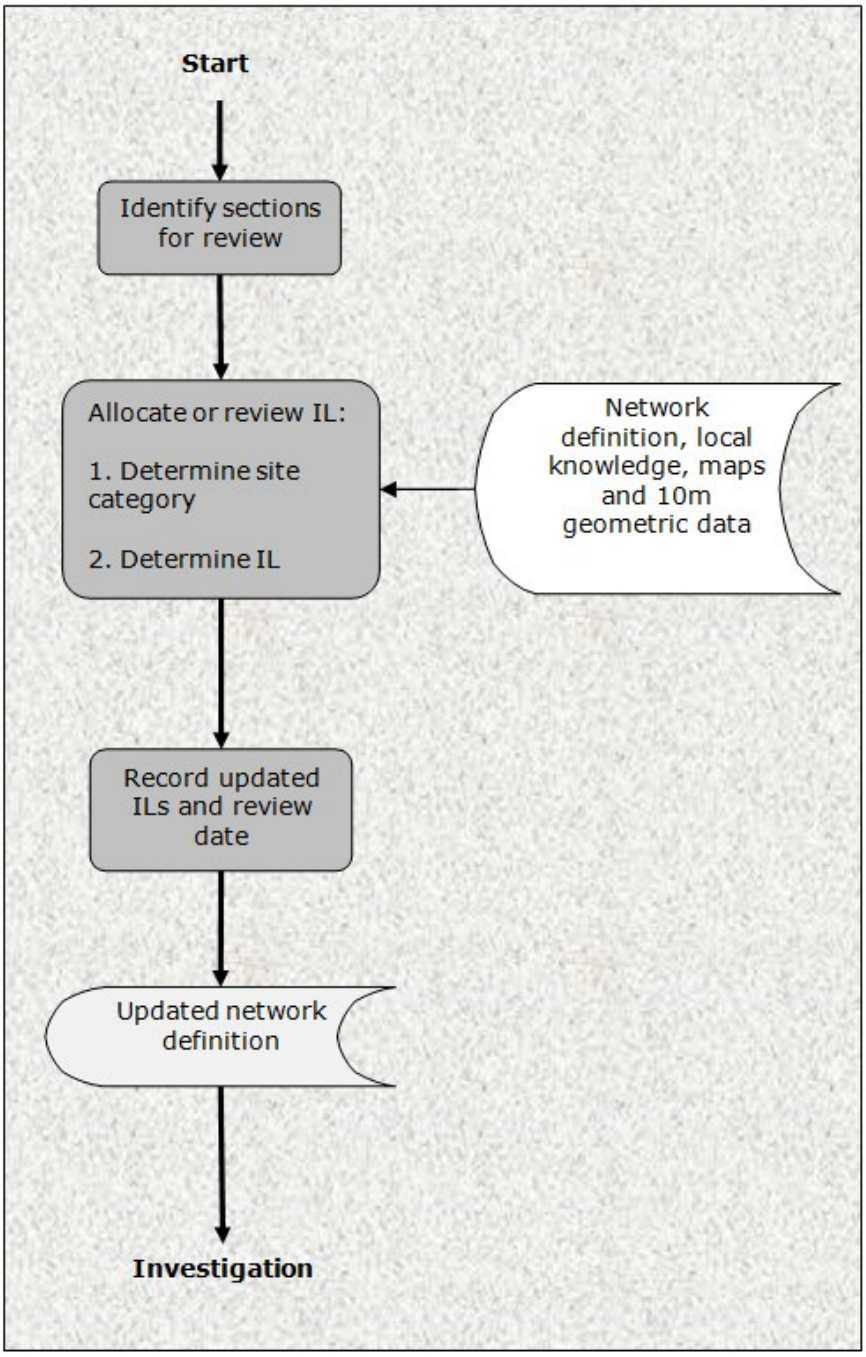



Figure 5.1 - Setting the Investigatory Level

## 5.1 Allocate Site Category and Investigatory Level

An Investigatory Level (IL) shall be assigned for every part of the skid network, by determining the most appropriate site category for each location and its associated IL defined in Table 5.1

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CS228 for Skid Resistance

| Site Category | Definition | Investigatory Level at 50km/h | | | | |
|---|---|---|---|---|---|---|
| | | 0.35 | 0.40 | 0.45 | 0.50 | 0.55 |
| A | Motorway | ✔ | | | | |
| B | Non-event Dual Carriageway | ✔ | | | | |
| Bi | Increased Risk, Non-event Dual Carriageway | | ✔ | | | |
| C | Non-event Single Carriageway | | ✔ | | | |
| Ci | Increased Risk, Non-event Single Carriageway | | | ✔ | | |
| Q | Approaches to and across minor and major junctions and approaches to roundabouts | | | ✔ | | |
| Qi | Increased Risk, Approaches to junctions and roundabouts | | | | ✔ | |
| K | Approaches to pedestrian crossings, traffic lights and other high-risk situations | | | | ✔ | |
| Ki | Increased Risk, Approaches to high-risk situations | | | | | ✔ |
| R | Roundabout | | | ✔ | | |
| Ri | Increased Risk, Roundabout | | | | ✔ | |
| G1 | Gradient 5-10% longer than 50m | | | ✔ | | |
| G1i | Increased Risk, Gradient 5-10% longer than 50m | | | | ✔ | |
| G2 | Gradient >10% longer than 50m | | | | ✔ | |
| G2i | Increased Risk, Gradient >10% longer than 50m | | | | | ✔ |
| S1 | Bend radius <500m – carriageway with one-way traffic | | | ✔ | | |
| S1i | Increased Risk, Bend radius <500m – carriageway with one-way traffic | | | | ✔ | |
| S2 | Bend radius <500m – carriageway with two-way traffic | | | | ✔ | |
| S2i | **Increased Risk, Bend radius <500m – carriageway with two-way traffic** | | | | | ✔ |

**Table 5.1 – Site Categories**

If more than one Site Category is appropriate, then the Site Category with the highest recommended IL shall be selected.

If the highest recommended IL for the site categories is the same, then the category highest up the Table shall be selected (A being the highest on the table and S2i the lowest).

ILs for site categories Q and K are based on the 50m approach to the feature and, in the case of approach to junctions, through to the extent of the junction
The approach length shall be extended when justified by local site characteristics.

Categories G1 and G2 should not be applied to uphill gradients on carriageways with one-way traffic.

Category S1 should be applied to all bends on carriageways with one-way traffic where the radius of curvature <100m

Category S2 should be applied to all bends on carriageways with two-way traffic where the radius of curvature <100m

Category S1 should be applied to all bends on carriageways with one-way traffic where the radius of curvature >=100m but <500m where the speed limit is >= 50mph

Category S2 should be applied to all bends on carriageways with two-way traffic where the radius of curvature >=100m but <500m where the speed limit is >= 50mph

The site category and IL applied to a length should be applied to all lanes of the carriageway that have traffic running in the same direction

When defining site categories, no site shall be defined as being less than 50% of its averaging length. Where this occurs, the site should be included in either the preceding or following site, whichever has an investigatory level nearest to and at or above the investigatory level of the site being defined.

Appendix 2 provides detailed guidance on the selection of appropriate site categories and its associated IL defined in Table 5.1, along with some examples.

## 5.2 Identify Sections for Review

A review of the IL shall be carried out at least every three years, or when a significant change to the network is made, for example changes to the road layout.

## 5.3 Record Updated Investigatory Levels and Review Date

The sections reviewed shall be recorded, together with the review date and any changes to the site categories and Investigation Levels.

# 6. Prioritisation

To prioritise between all SCRIM deficient locations over the A and B class surveyed network, Manchester City Council uses a weighted ruleset (table 6.1). This scoring matrix takes into account:

- The most recent SCRIM reading
- The last 3 years collision data
- Texture (where available)

These attributes have been selected as those which will have a major influence on the identified SCRIM deficient locations and thereby enable the Engineer to prioritise sites across the network for investigation. Prioritisation is only applied to sites at or below the Investigatory Level.

| Scores and Criteria | | | | | | |
|---|---|---|---|---|---|---|
| Number of crashes[1] | 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 | > -0.2 and <= -0.15 | <= -0.2 |
| Score | 0 | 1 | 3 | 6 | 12 | 18 |
| | | | | | | |
| Site has poor texture | No | | Yes | | | |
| Score | 0 | | 1 | | | |
| | | | | | | |
| Number of Fatal Crashes | 0 | | 1+ | | | |
| Score | 0 | | 1 | | | |
| | | | | | | |
| Number of Wet-skid crashes | 0 | | 1+ | | | |
| Score | 0 | | 1 | | | |

**Table 6.1 – Criteria for Initial Risk Score**

[1] Number of crashes within the last 3 years of available data; this refers to the total number of personal injury crashes, filtered beforehand to remove 'human error' etc.

Fatal and wet skid crash counts are also considered separately here resulting in a possible extra 2 points to the final score.

The objective is to provide a risk assessment of these sites with regards to the risk of a skidding incident. This risk assessment will enable prioritisation of sites for detailed onsite investigations by summing up the scores from the criteria in Table 6.1 for each site. This method is a simplified approximation of the Highways England's Crash Model and refined further to include additional points for Fatal and Wet Skid crashes.

The latest available crash data is supplied nationally and is updated on an annual basis. (2018 crash data became available in autumn 2019). The data set can be downloaded from the following web address: https://data.gov.uk/dataset/road-accidents-safety-data

Given the limited accuracy of locating crash positions, it may be assumed for the purpose of this investigation that the position of a crash coincides with a Site if it occurred within 75m for urban roads (40 mph or less). However, crashes in excess of 75m can be 'tagged' to the site and crashes within the 75m boundary can be 'untagged' if their location is deemed to not be relevant to the specific site. For example, there are some crashes that are within 75m of a site that occur on roads parallel to the site but cannot be accessed from the site.

*Note: CS228 states a 200m buffer, but after reviewing the accuracy of the location of crashes, particularly in urban areas, it was deemed more appropriate to set a buffer of 75m for urban roads (40mph or less); the rationale for 75m is the stopping distance for 40 mph in the wet is 72m (75m accommodates a further 3m for location accuracy). Far too many crashes automatically tagged were clearly not relevant to the site as there were on parallel roads, etc.*

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. Every applicable network section will have an attribute detailing its likely impact of crash. The attribute will be reviewed with Investigatory Levels at least every 3 years (in the first instance a default of 'Serious' is applied to 2-way traffic on speed limits greater than 40mph and 'Slight/serious' applied to all other carriageway sections)

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 will be used.

Site has SD ≤0 and poor texture at the same point (where texture data is available). 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 0.6mm 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.

The likely impact of crash is generated using the following table 6.2:

| Site Category | Environment |
|---|---|
| | Urban (<=40mph) |
| *A* | Slight/Serious |
| *B* | Slight/Serious |
| *C* | Serious |
| *Q* | Serious |
| *K* | Serious |
| *R* | Slight/Serious |
| *G1* | Slight |
| *G2* | Slight |
| *S1* | Slight/Serious |
| *S2* | Slight/Serious |

**Table 6.2 - Likely Crash Impact**

# 7. Desktop Site Investigation

Upon receipt of the annual SCRIM data, the information is processed against the criteria in section 6. This enables the scoring and prioritisation of deficient locations for treatment recommendations and warning signage. Further investigation into these prioritised locations is carried out in two phases, initially a desktop study with subsequent on-site investigation if required.

## 7.1 Desktop procedure

All sites where the measured CSC is at or below the corresponding IL shall undergo the initial site risk assessment process as described in section 6. Identification of sites at which there is a SCRIM deficiency will be undertaken as soon as is reasonably practical, and within no more than six weeks from receipt of all relevant processed data. Other sites may be put forward for initial risk assessment where increased skidding crash levels have been observed.

Following this initial risk assessment, sites will be ranked in order of descending risk. Detailed site investigations will be carried out at all sites with a risk score of 20 or greater. This threshold is higher than that set out in HD 28/15 for mandatory detailed site investigations to account for the more limited resources of a local authority (as compared to National Highways) while still balancing safety risks and was determined by assessing various scenarios using potential combinations of the criteria in Table 6.1.

All other sites flagged for potential investigation (i.e., with risk scores between 12 and 20) should undergo detailed site investigations on a risk-prioritised basis, as far as resources will allow, in descending order of risk-ranking, i.e. higher risk sites have a higher priority for investigation.
In the event that this process produces more sites than expected and our limited resources mean we are unable to visit all sites, then the sites will be prioritised based on descending order of risk-ranking, i.e., higher risk sites have a higher priority for site investigation. In this scenario, we will investigate as many as we can, but with consideration to how much remedial works we are physically able to deliver during a fiscal year, given the level of funding available. Any remaining sites that are not inspected will be considered should additional funding be made available, or once the next round of SCRIM survey results have been returned.

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

- Those locations where the extent falls within next years programmed works and don't meet the criteria of the signage policy as stated in section 10 will require no further action and will be signed off by a Senior Engineer.
- Those locations where full extent falls within next years programmed works that meet the criteria for signage will only have a signage location investigation.
- Locations that appear on the next financial years programmed works list whose full extents are not currently covered by the proposed works shall be reviewed by a Senior Engineer to determine whether they can be incorporated. If this is the case, then the above bullet point will be applied.
- Where the extents are unable to be incorporated, the remaining identified locations will warrant a detailed site investigation in accordance with section 8. Locations that at any point match the signage policy in section 10, will also have a sign location investigation conducted at the same time.

All sites where the skid resistance is 'substantially' deficient (0.2 <= Investigatory Level) will be reviewed for erection of slippery road warning signs in accordance with section 11.

# 8. Detailed Site Investigations

All sites selected for detailed site investigations following the process in section 7 will be passed on to the person(s) responsible for coordinating these investigations. A schedule of investigations will be planned out in such a way as to undertake the work in as timely and efficient a manner possible – investigations should be carried out according to the initial risk assessment:

- High risk (>=20): high-priority site investigation, to be carried out as soon as possible following initial risk assessment.

- Medium risk (12-20): investigate on a risk-prioritised basis, as resources allow, as soon as is reasonably practical following initial risk assessment.
- Low risk (<12): no further investigation required unless there are specific concerns about a site.

Site investigations must be undertaken by a competent person (see section 1.2), using the Site Investigation Form in Appendix 3 (designed with reference to CS 228 Appendix B) or similar data collection form, and referring to the detailed guidance notes.
Prior to going on site, the investigator should gather all relevant information as far as is practical, and pre-fill the Site Investigation form where possible. The following list provides a guide for information to be gathered prior to going on site:

- Location/referencing: road number and/or name, section reference, site ID, chainages, coordinates, etc.
- Site attributes: layout, design, particular features, speed limit, gradient, etc. If possible, a map and/or a design drawing of the site should be obtained. Current Site Category and IL should be recorded.
- Condition data: skid resistance data (CSC and differential vs. IL) and texture depth data (where available). Additional pavement condition data may also be useful, in particular longitudinal profile variance and rutting measurements from machine surveys, and defects noted from visual inspections.
- Crash data: limit the investigation to the past 3 years of available data. Number of crashes, with subtotals for wet and/or wet-skid crashes, and detailed crash causes if available. Benchmark crash data for the site against crash data for the route the site forms a part of, and relevant national data, where available.
- Traffic data: where available, traffic flow volume data will be useful (even more so if there is any indication as to the types of vehicles using the site).

Site investigations may be carried out on foot or from a vehicle – the decision shall be made based on factors such as assessed site skid risk, resources and/or time available, health and safety risks to inspectors, and prior knowledge of the site. In general, it is preferable for the investigator to walk the site in order to get the most detailed results, especially if skid risk is high.
In rare circumstances, detailed site investigations may be carried out without physically going on site, however this must be robustly justified – for example, due to health and safety risks. In these cases, the investigator should use (recent) photos/videos of the site wherever possible.
As a result of the investigation, remedial actions to address skid resistance risk at the site may be recommended by the investigator(s). These will be clearly noted on the Site Investigation form and addressed according to the approach set out in the following section (9).
Post-investigation, an investigation report for each site shall be produced including:

- Site investigation form (see Appendix 3), completed by the investigator and signed off by the appropriate person.

- Digital copies of relevant photos taken at the scene.
- Any other documentation/information deemed relevant.

Records of all site investigations and ensuing reports (including additional data/documentation) will be retained for five years.

# 9. Outcomes of Site Investigations

Site investigations may result in the need for various actions. These may include actions to reduce skid resistance risk (e.g., pavement works, improving signage, etc.) – these are covered in section 10.
The inspector may also recommend changes to the site IL and/or risk rating (as per Appendix 2) based on risk factors observed at the site. In these cases, a review will be undertaken, considering the site investigation report and inspector recommendations, to determine whether the site IL and/or risk rating should be changed, and to what value(s).
Site investigations may also result in an outcome of "no action required". These sites should be picked up by the process in the following year since they will have SD ≤0 – in this way their skid risk will be continually monitored.
All such reviews will be documented, and records maintained. Where the site risk rating is changed following any review, this post-investigation risk rating will be applied for the purposes of determining the priority of remedial actions, as described in section 6. Note that a change to the IL may affect site risk rating whether/not the risk rating is changed directly.
All site investigation outcomes will be reviewed and approved by a suitably qualified and experienced person – this person will sign off the investigation form.

# 10. Remedial actions to reduce skid risk

The Council has produced a risk-based methodology for the identification and prioritisation of proposed treatments and actions, providing an auditable objective process to the identification and prioritisation based on the results from the detailed on-site investigations and other available information. This provides a certain level of intervention criteria, however this level of intervention (i.e. treatment) is ultimately determined by budget, provided a minimum service level can be attained.
The minimum service level set within this documentation is to review a site for erection of slippery road warning signs where the skid resistance is 'substantially' deficient (0.2 <= Investigatory Level).

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

The most appropriate form of treatment will be identified for each site which is found to require remedial works and to restore an adequate level of skid resistance. Often this will include a surface treatment. However, if site investigations should identify different defects or an issue with the

behaviour of road users which an engineering measure may be able to resolve, then the relevant department within the council will be notified to identify the best course of action to be taken.

The final programme of works will be based on available budget and council priorities.

The on-site questions (detailed in Table 10.2) and the process detailed below are specifically designed to reduce the level of subjectivity with regards to treatment selection.

### *Treatment identification*

The treatments identified by the following process are treatments suggested based on the information collated.

The treatments identified by the above process are treatments suggested based on the information collated; the treatments identified by the Engineer shall be allocated into treatment 'Bin(s)' detailed in Appendix 4.

The objective is to reduce the risk of vehicle skidding and to determine the appropriate treatment or whether some other form of action is required or whether no action is required.

### *Prioritisation of Suggested Treatments*

The treatment can then be prioritised within each individual 'Group' or 'Bin' based upon the final scoring detailed in the site investigation report (Appendix 4), the greater the score the higher the priority. The highest scoring site will be the highest priority within the 'Group' or 'Bin'.

# 11.Determining Locations Requiring Warning Signs

Sites which, as a result of a detailed investigation, have been identified as requiring treatment to improve skid resistance shall only have warning signs where it is deemed appropriate. The slippery road warning sign (Diagram 557) with no supplementary plate must be used in accordance with the Traffic Signs Regulations and General Directions and Chapter 4 of the Traffic Signs Manual.
Short individual lengths requiring warning signs should be merged if they are separated by less than 1km.
For the purpose of legal proceedings, it is essential that records of the erection and removal of slippery road warning signs shall be kept. 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.
Warning signs will not automatically be used on every site; only to advise the road users where an engineer has deemed appropriate following a review of all the available information.
Extra consideration to high-risk sites is automated within the treatment prioritisation methodology detailed in chapter 10.

Sites are identified for consideration for warning signs if the following criteria are invoked:

- Where the skid resistance is substantially low. Those sites with a deficiency <=-0.2 and longer than 50m.
- Where Detailed Site Investigations have identified the site has > 75% of the wheel tracks polished.

**AND**

- Where there has been at least 1 wet skidding collision in the previous 3-year period

Slippery road warning signs shall not be used in connection with newly laid asphalt road surfacing materials; see "Early life skid resistance of asphalt surfacing" (HD28/15 Annex 1. A.1.24 to A.1.26).

The skid resistance at the location of all existing slippery road warning signs shall be reviewed annually to determine whether the sign is still needed.
Slippery road warning signs should be removed after treatments have been completed, or when SCRIM readings show no deficiency in the following 2 surveys.
After each annual review the schedule for warning signs shall be updated to include the signs which require removal.

# 12.Records

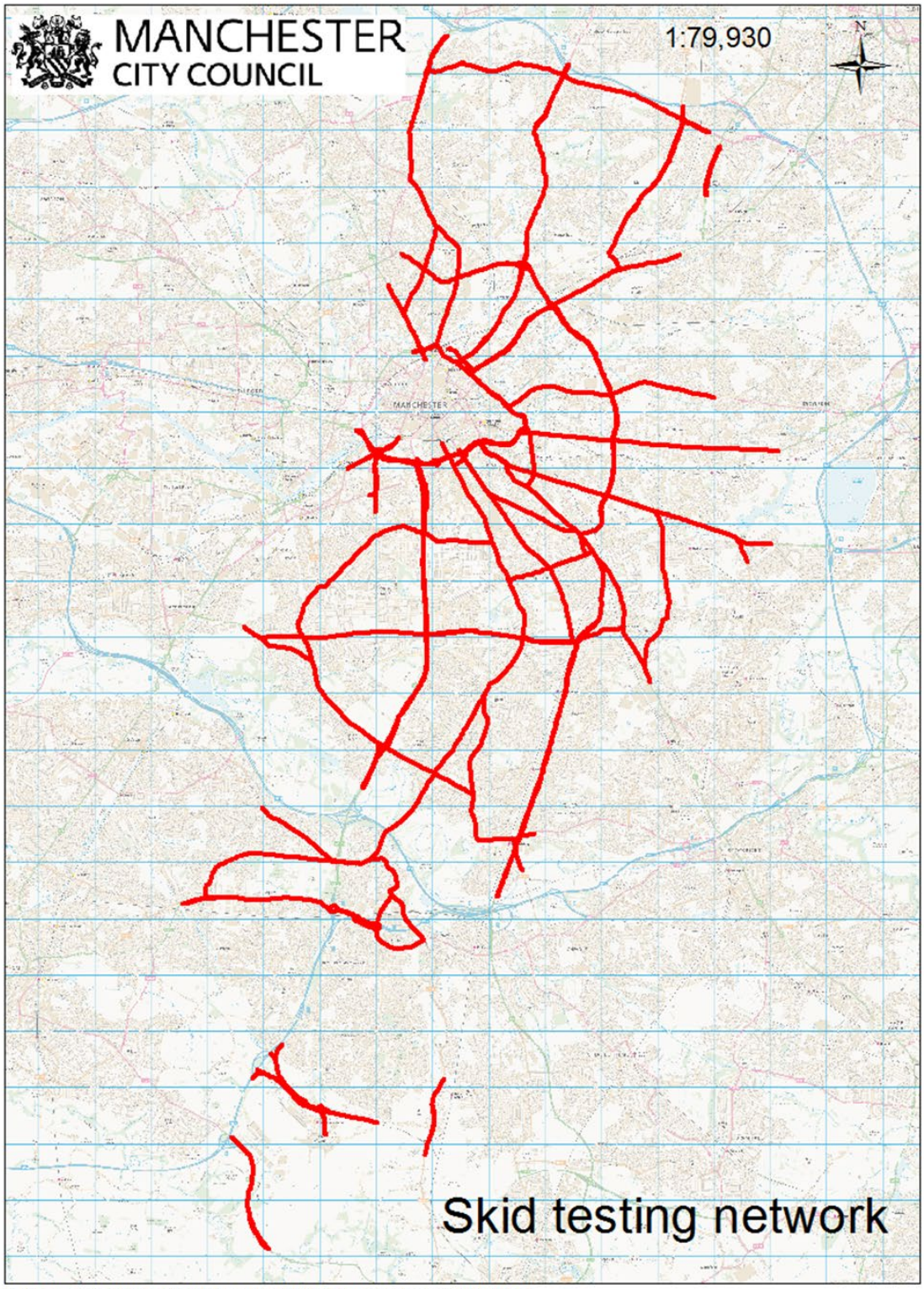
In order to maintain accurate and up to date information it will be necessary to formally record skid resistance data, and this will be done by maintaining the following records to demonstrate the ongoing operation of this procedure:

- Investigatory Levels for the surveyed road network, including justification for any deviation from the recommendations in Chapter 5 and dates of Investigatory Level review and the identity of the reviewer.
- Skid testing results and data analysis including survey date(s) and date(s) the survey data is received.
- Site investigation findings for every site assessed including survey date(s) and the identity of the inspector.
- A record of sites where and when slippery road warning signs have been erected showing subsequent removal dates where appropriate. This will also include dates when sites are identified as requiring signing.
- Priority lists of sites for remedial treatment to restore an adequate level of skid resistance. This will also include dates when the treatment/action priority list are produced and when the works programme is signed off.
- Details of completed works programmes, relating to remedial treatment for substandard skid resistance. This will also include dates when the works are complete.

# 13.References


- Design Manual for Roads and Bridges
  HD28 (DMRB 7.3.1) Skid Resistance
  HD36 (DMRB 7.5.1) Surfacing Materials for New and Maintenance Construction
  HD36 (DMRB 7.5.2) Bituminous Surfacing Materials and techniques.
- The Traffic Signs Regulations and General Directions 2002
- Highways Act 1980
- Well-maintained Highways. Code of Practice for Highway Maintenance Management
- County Surveyors Society – Code of Practice for Highways Management – Section 9.7 Skidding Resistance Measurement Requirements (Revision F)
- County Surveyors Society – CSS Guidance Note – The Use of High Friction Surfaces (January 2010)
- TRL Report TRL622 - Accidents and the Skidding Standards for Strategic Roads in England
- Statistical Report on Collision Buffer Review.pdf – XAIS (July 2020)

## Appendix 1 – MCC's Skid Network



# Appendix 2 - Application of Site Categories and Investigatory Levels

### *Overview*

This appendix provides detailed guidance on the selection of appropriate site categories and its associated Investigatory Level defined in Table 6.1. These are then followed by some examples.

The guidance given in this section is not exhaustive and therefore judgement of the risks specific to each location should be exercised.

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

### *Category A, B & C: Non-event carriageway*

Use for all non-event carriageway sections, Motorway (A), Dual Carriageway (B) and Single Carriageway traffic (C);

For category **A** an IL is defined as **0.35**

For category **B** an IL is defined as **0.35**

For Category **C** an IL is defined as **0.40**

At junctions, use category **B** or **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.

Increased Risk, Non-event carriageway:

Category **Bi** is defined as **0.40** and Category **Ci** is defined as **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 not categorised as Q or Qi
    - Bus stops, lay-bys, 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 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

- The approach to the end of dual carriageways where a lane drop occurs and/or where any lanes merge

- Other increased risk situations as defined in table 6.2

| Increased Risk Situation | Descriptor |
|---|---|
| Footways requiring pedestrians to cross the carriageway | Where a footway stops on one side of the road and continues on the other side shall be recorded as 'High Risk' where the signed speed of the road section is >=50mph. Signed Public footpaths/bridleways shall also be recorded under this item |

**Table 6.2 – Definitions of Increased Risk Situations**

***Category Q: Approaches to and across minor and major junctions and approaches to roundabouts***

This Site Category is used for:

- Major / minor priority junctions
  - Major junctions are defined as all interconnecting classified roads
  - Minor roads are defined in urban areas, those subject to 40mph or less speed restrictions as junctions that will only include unclassified roads that are bus routes.
- Other significant accesses
  These include accesses with right turning lanes, 'Ghost' islands, access to supermarkets, business parks and retail centres
- Approaches to roundabouts

If the junction design and traffic volume allow 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).

If the volume of traffic is low, then use the appropriate non-event categories instead.

For category **Q** an IL is defined as **0.45** if the speed limit is below 50mph and low-risk sites where the speed limit is above 50mph (i.e., where situations detailed in the following increased risk definition do not occur)

Increased Risk, Approaches to junctions:

For category **Qi** an IL is defined as **0.50** if the speed limit is at or above 50mph and:

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

***Approaches to Junctions:***

For the purposes of this document, roads involved in a junction are split into two types:

- Roads where traffic has permanent priority
- Roads where traffic is required to give way

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

- Right turning vehicles from an intersecting road are at risk of a side impact with traffic on the permanent priority 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 permanent priority 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.

For permanent priority 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.

On the road where traffic is required to give way, the risk of having to brake unexpectedly is lower since the need to give way is indicated clearly in advance of the junction. Apply Site Category **Q** to

the 50m approach to the stop/give way line. Extend the distance, if necessary, to consider likely queues.

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

***Approaches to roundabouts:***

Apply Site Category **Q** and **Qi** to the 50m approach to the stop/give way line. Extend the distance, as necessary to consider likely regular queuing.

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

***Category K: Approaches to traffic signals, pedestrian crossings and other high-risk situations***

Use this category at the following locations:

- Traffic Lights.
- Signal controlled pedestrian crossings and zebra crossings.
- Railway crossings.
- Other High Risk 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. For the avoidance of doubt High Risk situations are described in table 6.3. This table will be reviewed periodically taking in 'lessons learnt' particularly from the initial collection.

| High Risk Situation | Descriptor |
|---|---|
| Schools / Nurseries | Areas around schools often include School Patrol/parking signage, crossing points and appropriate 'School' lining.<br>For the avoidance of doubt, within the confines of a school boundary and/or school warning signs, all pedestrian dropped crossings (tactile or non-tactile) shall be recorded under this item. |

**Table 6.3 – Definitions of 'Other' High Risk Situations**

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.

For category **K** an IL is defined as **0.50**

Increased Risk, high risk situations:

For category **Ki** an IL is defined as **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*

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.

For category **R** an IL is defined as **0.45**

Increased Risk, roundabouts:

For category **Ri** an IL is defined as **0.50** for 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*

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%.

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

This assessment can be based on 10m gradient data from Scanner surveys or from accurate topographical survey data when available.

For category **G1** an IL is defined as **0.45**

Increased Risk, gradients:

For category **G1i** an IL is defined as **0.50** where other risk factors are present such as poor visibility, etc.

### *Category G2: Gradient >10% longer than 50m*

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

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

This assessment can be based on 10m gradient data from Scanner surveys or from accurate topographical survey data when available.

For category **G2** an IL is defined as **0.50**

Increased Risk, gradients:

For category **G2i** an IL is defined as **0.55** where other risk factors are present such as poor visibility, etc.

### *Category S1/S2: Bend radius < 500m*

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

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. For bends that have radii less than 100m, **S1** and **S2** will apply at all speeds.

This category should not generally be used for:

- Short lengths, for example less than 50m, with a radius of curvature between 250m and 500m.
- Roundabout exits.

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 is used at speeds lower than 50mph.

For Category **S1** the IL is defined as **0.45**
For Category **S2** the IL is defined as **0.5**

Increased Risk, bends:

For category **S1i** the IL is defined as **0.50** and for category **S2i** the IL is defined as **0.55** where other risk factors are present or particular potential for loss of control, including if:

- The geometry is particularly hazardous, taking into account traffic speed
- Adverse camber is present

This assessment can be based on 10m curvature data from Scanner surveys, drawings or from accurate topographical survey data when available.

### *Example: Dual carriageway grade separated Junction*

For a dual carriageway grade separated junction there are two different site categories in effect, as described below and shown in Figure 6.2. In some cases, other site categories may also be required due to other events occurring in the vicinity

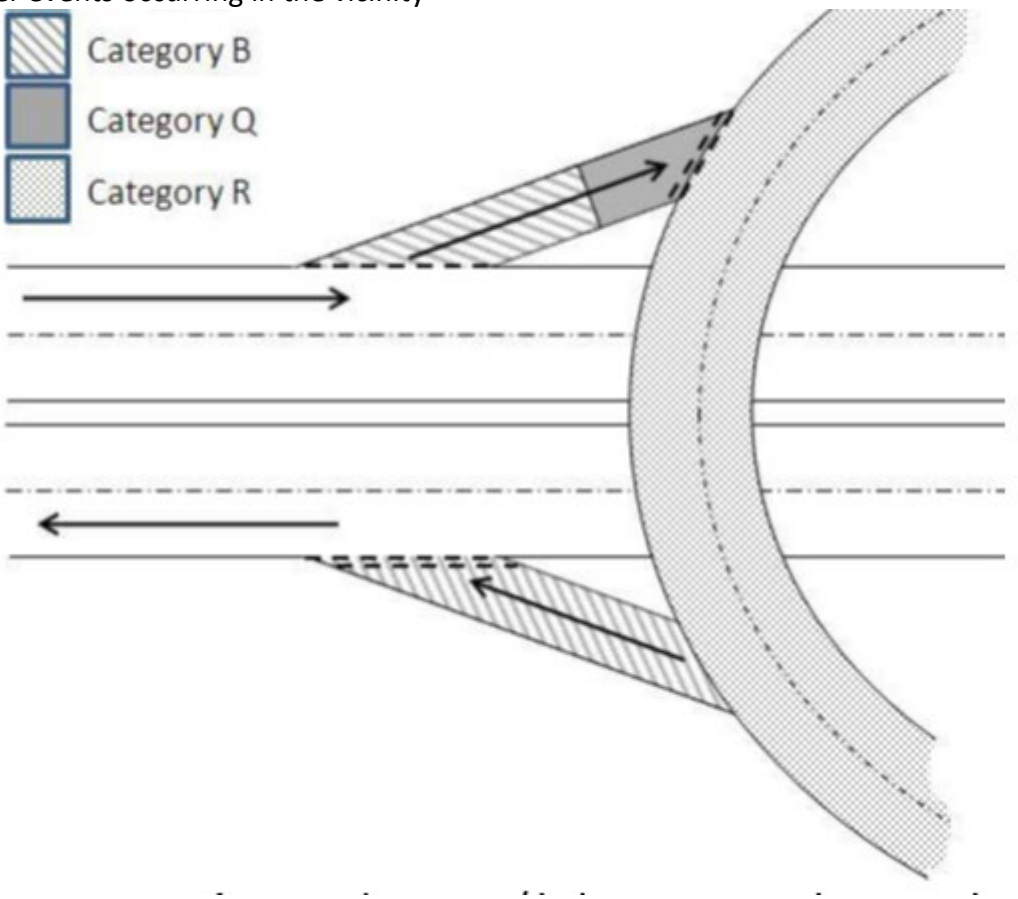



**Figure 6.2 - Site Categories for a typical motorway/dual carriageway grade separated junction**

The main carriageway should have category **B** applied to its whole length (if appropriate to its geometry/layout). The off slip should 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). The on slip should have category **B** applied to its whole length unless other events for the site take precedence (e.g. high gradient or tight bend). The roundabout should have category **R** applied to its whole length.

### *Example: T-junction on a Single carriageway*

For a T-junction on a single carriageway there are two different site categories in effect, as described below and shown in Figure 6.3. In some cases, other site categories may also be required due to other events occurring in the vicinity.

In the figure for this example the road where traffic has permanent priority is the horizontal road and the road where traffic is required to give way is the vertical road.

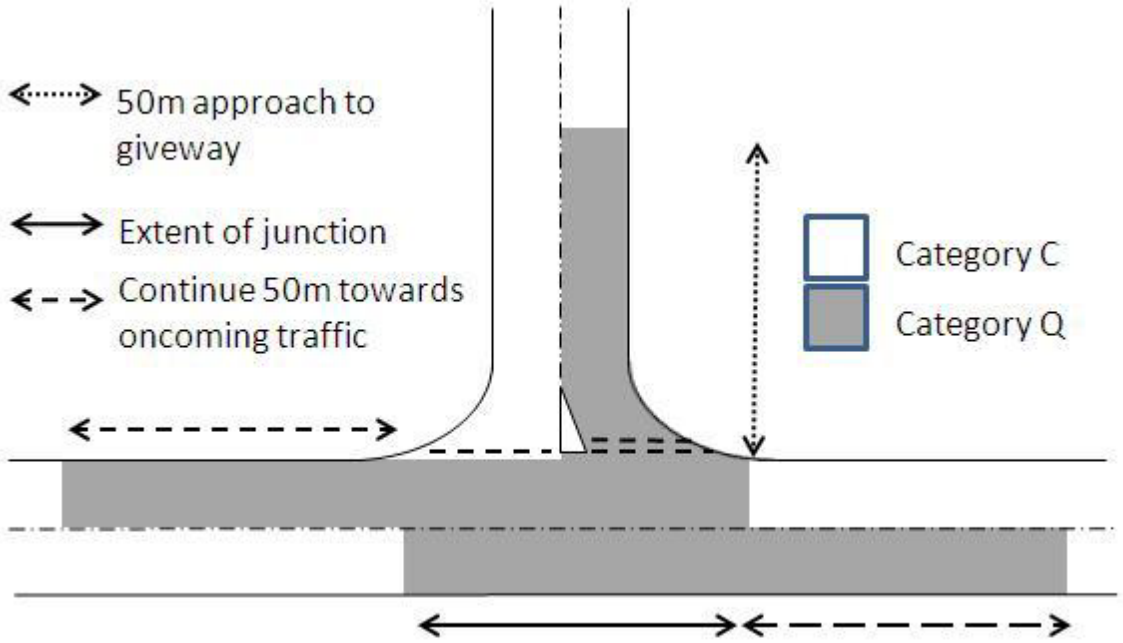



**Figure 6.3 - Site categories for junction approaches on a single carriageway**

On the vertical road required to give way a category of Q should be 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) should be given a category of C.

On the horizontal permanent priority road, a category of Q should be applied to the extent of the junction and the 50m leading to the junction (in the direction of traffic on the horizontal 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 horizontal road should be given a category of C (if appropriate to the site geometry/layout).

### *Example: Priority junction*

For a priority junction between two single carriageways there are two different site categories in effect, as described below and shown in Figure 6.4. In some cases, other site categories may also be required due to other events occurring in the vicinity.

In the figure for this example the 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 roads required to give way 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.

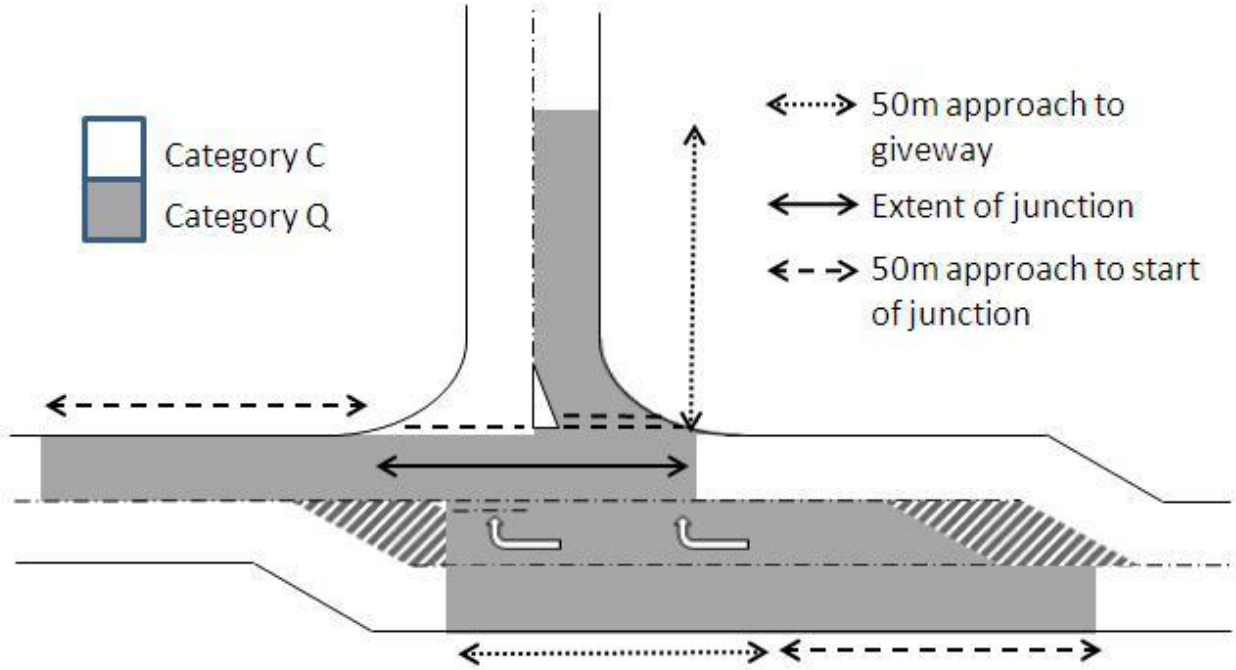



**Figure 6.4 – Site categories for a priority junction**

The top part of the horizontal road (permanent priority road) should 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 horizontal 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 should have the appropriate non-event category applied (in this case **C**).

The turn lane should have a category of Q applied to the 50m approach to the give way. The bottom part of the horizontal road (permanent priority road) should 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 should have the same Site Category and IL applied along their coinciding length.
The vertical road (required to give way) should 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) should have the appropriate non-event category applied (in this case **C**).

### *Example: Roundabout with a pedestrian crossing*

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 6.5. In some cases, other site categories may also be required due to other events occurring in the vicinity.

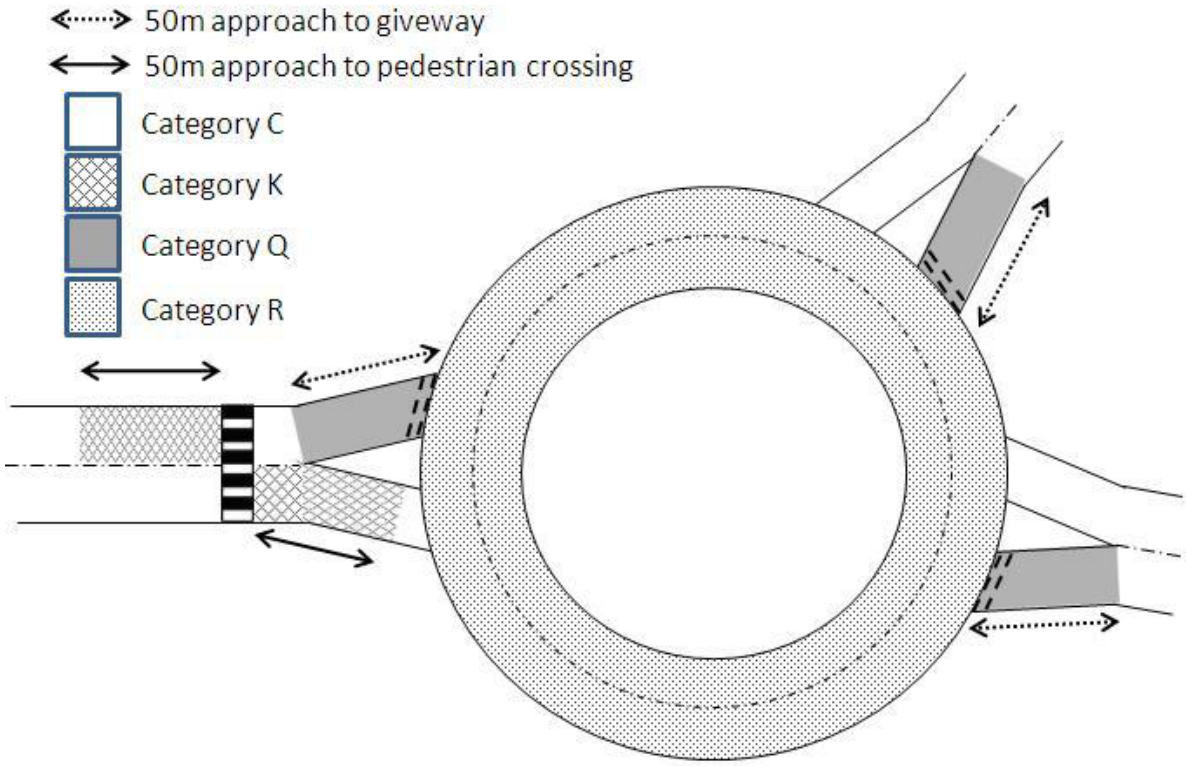



**Figure 6.5 - Site categories for a roundabout with a pedestrian crossing**

A Site Category of **K** should 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.

The roundabout should 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.

The approaches to the roundabout should 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.

The remaining lengths should 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*

For this type of crossroads there are four different site categories in effect, as described below and shown in Figure 6.6. In some cases, other site categories may also be required due to other events occurring in the vicinity.

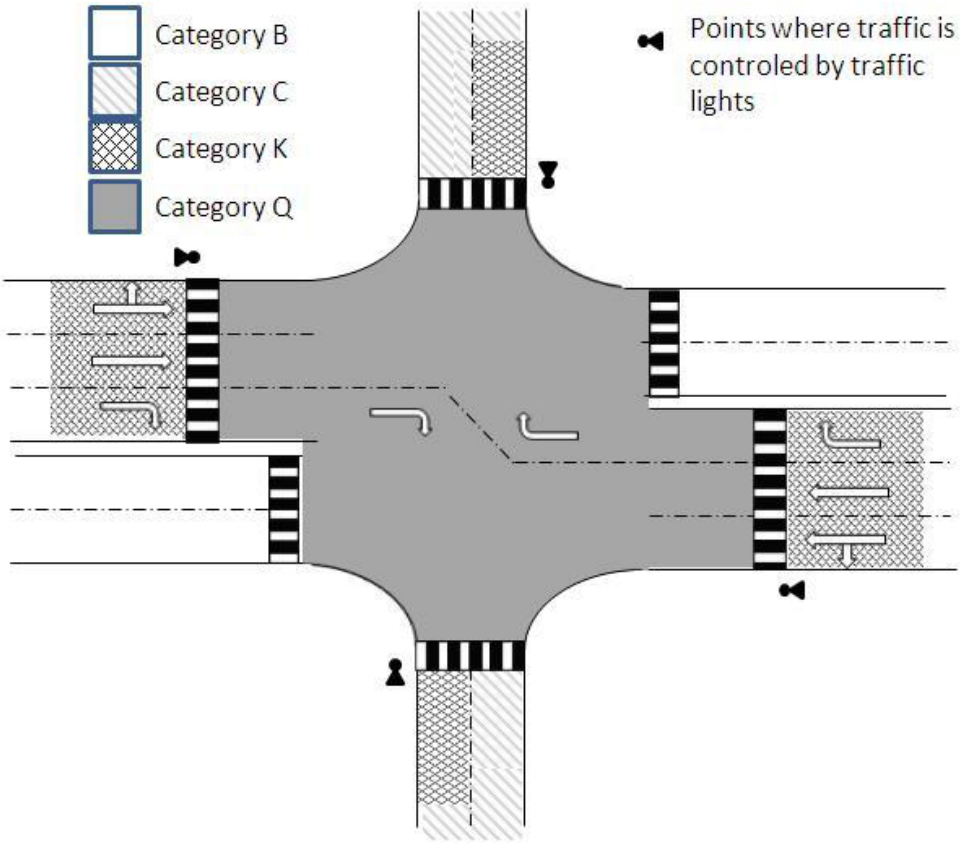



**Figure 6.6 - Site categories for a signal-controlled crossroads between a dual carriageway road and a single carriageway road**

A Site Category of **K** should 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.

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

# Appendix 3 – Site Investigation Form

Based on the template from CS228, Annex 6.

This form is designed to be completed electronically. Relevant photos should be taken during the site investigation to accompany the information to be provided in this form – refer to photos where relevant.

| Manchester City Council – Skid Site Investigation Report | | | |
|---|---|---|---|
| Site ID number / Location | | | |
| Date of visit | | Assessor | |
| Speed limit | | Traffic conditions | |
| Streetlights | | Signage | |
| Current Site Cat | | Investigatory Level | |

| Questions | Guide response | Actual response | Guide score | Actual score | Comments |
|---|---|---|---|---|---|
| *Average SCRIM deficiency** | 1/-0.01/-0.10/-0.20 | | 1/5/10/20 | | |
| Does the site exhibit >15% loss of HFS within the wheel paths/braking zone? | No/Yes | | 0/1 | | |
| Does the site exhibit Fatting/Polishing/Minor Fretting within the wheel paths/ braking zone? | No (<15%)/Yes (15-75%)/Yes (>75%) | | 0/1/2 | | |
| Is there Deformation/Pushing of Material? | No/Yes | | Info Only | | |
| Does the site Exhibit Major Fretting within the Surface Course (entire area)? | No/Yes (<20%)/Yes (>=20%) | | 0/0.5/1 | | |
| Is there evidence of standing water NOT drainage related? (i.e., Rutting/Settlement) | No/Yes | | 0/1 | | |
| Is there evidence of the drainage system not working? (i.e., Blocked drains) | No/Yes | | Info Only | | |
| Is >50% of the Centre Line Longitudinal Road Markings clearly visible? (Due to wear, not leaves, etc.) | Yes/No | | Info Only | | |

| | | | | | |
|---|---|---|---|---|---|
| Are Road Markings i.e., stop lines, clearly visible? (Due to wear, not leaves, etc.) | Yes/No | | Info Only | | |
| Are Road Signs clear, visible, and easily understood? | Yes/No (Sign Requires Maintenance) /No (Sign Obstructed) | | Info Only | | |
| Is the site affected by trees/ vegetation? | No/Yes | | Info Only | | |
| Majority Surface Type | HFS/HRA/SD/ Micro/SMA/ Other/Bitmac | | Info Only | | |
| Is there Contamination (e.g., Detritus) on the road surface? | No/Detritus/Oil /Soil/Sand/ Other | | Info Only | | |
| *Wet Collisions** | *0/1+* | | 0/5 | | |
| *Fatal Accidents** | *0/1+* | | 0/1 | | |
| Is there evidence of past patching repairs/ pothole fillings? | No/Yes | | 0/1 | | |
| Is there evidence of crash damage or heavy braking (i.e., Skid marks)? | No/Yes | | Info Only | | |
| Does the site have shared use? (i.e., Bus or cycle lane) | No/Yes | | Info Only | | |
| Is there presence of existing slippery road signs? | No/Yes | | Info Only | | |
| Is there presence of Traffic Signal Induction Loops? | No/Yes | | Info Only | | |
| Is Queuing/ Standing traffic likely at any time? (Including Peak hours) | No/Yes | | 0/1 | | |
| Is there sufficient space? (i.e., lane width >2.7m No Damaged Kerbs present) | Yes/No | | Info Only | | |
| Is there presence of Lay-bys or other access (i.e., property/field access)? | No/Yes | | 0/1 | | |
| Is there poor advance visibility? (Cannot see event from 100m in either direction/ Complicated Turning/ Sudden stopping) | No/Yes | | 0/1 | | |
| | | | **SCORE:** | | |

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CS228 for Skid Resistance

Additional Information and Other Observations:

*Average Deficiency & accident information are automatically collated for each site and are not specific on-site detailed Inspection question and responses

| **Recommendations:** | | |
|---|---|---|
| Is treatment required to improve skid resistance? | Y/N | |
| Should the site risk rating be changed? | Y/N | |
| Should the site category and/or IL be changed? | Y/N | |
| Any other action(s) required? | Y/N | |
| **Reviewed and approved by:** | | |

| **Name** | **Signature** | **Date** |
|---|---|---|
| | | |

## Appendix 4 – Treatment Bins

| Group | Treatment 'Bin' | Treatment | Comments |
|---|---|---|---|
| 1 | Review for Slippery Roads Signs | Review for Slippery Roads Signs | If the skid value is at or below the assigned level an investigation shall be carried out to determine whether treatment to improve skid resistance is required or whether some other action is required. 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 where deemed necessary, as described in section 11. Remove signs when no longer required. |
| | Review Wet Collisions | Review Wet Crash data | The existing prioritisation scoring methodology ensures that crashes occurring in wet conditions are allocated a high priority. However, the location and relevance of the wet crash should be further reviewed before determining the appropriate treatment |
| | | Technical Survey | Consider other options to support the skid investigatory location if deemed necessary i.e. Skid Pendulum or Sand Patch Testing |
| | Resurface | Plane and resurface | Requires professional engineering judgement taking into account local experience, the nature of the site, the condition of the site and crash history for the past 3 years. Considering any of these treatment options suggests that skid treatments listed below are not an option based on defects present including any evidence of structural failure. |
| | | Overlay | |
| | | Partial Recon <200mm | |
| | | Full Recon >200mm | |
| | 'Patch and..' | Structural Patch Repair | Based on defects present it is likely that a resurface treatment is not yet required, but a surface treatment alone will not be sufficient |
| | Patch | Patch Repair | Consider basic maintenance patching to minor/localised areas of failure. |
| | Skid Treatment | High Friction Surfacing (HFS) | Hot or cold applied. Hot applied and screeded out or cold applied by machine or manually. |
| | | Surface Dressing | Consider all options available - 10mm, 10/6 racked 14/6 racked Sandwich Dressing etc. |
| | | Micro Asphalt | Thin surfacing treatment <20mm |
| | | Diamond Grooving | Retexturing - Ideal for concrete surfaces but also used on flexible pavements. |
| | | Shot Blasting | Retexturing - Restores skid resistance and re-exposes the Micro texture of the carriageway surface aggregate. |
| | | Bush Hammering | Retexturing - can be used on all surfaces |
| | | High Velocity Water Blasting | Retexturing - Water cutting. Restores macro texture. Short term solution only |

| | | | |
|---|---|---|---|
| | Re-design | Improve Sight Line | This option could be costly and possibly not feasible due to environmental factors /cost etc. |
| | | Improve Existing Lining Layout | Inadequate lining. Refer any comments to the traffic department re: feasibility study? |
| | | Improve Existing Signing/ fencing | Investigation required re: existing signing at the skid location. Need for additional signing or safety fencing or pedestrian guardrail. Advanced signing or review speed limit is traffic calming required etc |
| | | Improve Street Lighting | Is the existing street lighting inadequate or additional street lighting is required? Refer any concerns to the street lighting department |
| 2 | Routine Maintenance | Drainage Maintenance | Blocked gullies, standing water, detritus in channel or localised flooding etc. Drainage cleansing or design investigation required |
| | | Sweeping/ Cleansing Maintenance | Contamination of the road surface has been identified and should be cleansed appropriately |
| | | (Longitudinal) Road Marking Maintenance | Renew/ Repair Longitudinal lines or road markings etc |
| | | Sign Maintenance | Renew/ Repair or Clean sign |
| | | Obstruction to Sign | Remove Obstruction and/or Illegal signing etc deemed a hazard etc |
| | | Tree/ Vegetation Maintenance | Refer to Environmental/PROW Department (Enforcement Action) |
| 3 | Review Investigatory Level | Review Investigatory Level | If a site has been subject to a review 3 times and there is no evidence to support maintenance, then the Investigatory Level should be reviewed |
| | Monitor | Monitor | No evidence to support skid value. Monitor via future SCRIM/Road collision data or local knowledge. |

**Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CD236 Surface Course Materials for Construction**

# Appendix A - Surface course materials for construction

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

Aggregate can be graded depending on size and Polished Stone Value (PSV); the higher the PSV figure the greater resistance the aggregate has to polishing, and the greater the ability the aggregate has to retain its own natural very fine micro-texture (roughness). PSV testing is carried out in accordance with BS EN 1097-8:2000.
Due to the nature and risk within the road network, different PSV aggregates should be used in different locations. CD 236 details the requirements for aggregates to ensure that satisfactory skid resistance is provided on motorways & trunk roads for both new and maintenance construction. Table 3.2 of CD 236 details the minimum PSV to be applied to different Site Categories / Site Descriptions for a range of Investigatory Levels, related to commercial vehicle traffic flows at design life.
Where traffic flows are available, Table 3.2 of CD236 should always be the primary source to be referenced in order to obtain the appropriate PSV values.

Table A1 below is based on guidance from CD 236 and shows the minimum PSV requirements to be selected in Manchester depending on SC's, risk factors and estimated daily traffic flows.

The requirements of Table 3.2, or Table A1 of this Strategy (if applicable) cover:

- chippings for surface dressing.
- coarse aggregate in all surface treatments without coated chippings applied to the surface.
- coated chippings applied to the surface of rolled asphalt, to mastic asphalt and to fine graded macadam.

High Friction Surfacing (HFS) will only be applied where it is deemed an essential requirement following a risk assessment of the site. As a general rule, due to the lower traffic speeds on Manchester's highway network, aggregate with a high PSV will be applied rather than an HFS. A 65 or 68 PSV aggregate can provide a more than adequate skidding resistance for a site, especially where urban traffic speeds are low, whilst lasting throughout the lifespan of the road surface. This minimises construction timescales and long-term maintenance costs, as well as reducing the use of scarce natural resources and is therefore a more suitable and sustainable alternative treatment.

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CD236 Surface Course Materials for Construction

| Site Cat | Definition | Inv Level | Road traffic hierarchy groups / estimated traffic usage – cv/lane/day | | | |
|---|---|---|---|---|---|---|
| | | | >= 4 | 3 | 2 | 2 |
| | | | <200 | 200-500 | 500-1000 | >1000 |
| A, B | Motorway, Non-event Dual Carriageway | 0.35 | **50** | **50** | **50** | **55** |
| Bi, C | Increased Risk, Non-event Dual Carriageway, Non-event Single Carriageway | 0.40 | **55** | **55** | **55** | **60** |
| Ci, Q | Increased Risk, Non-event Single Carriageway, Approaches to and across minor and major junctions and approaches to roundabouts | 0.45 | **60** | **65** | **65** | **68** |
| Qi, K | Increased Risk, Approaches to junctions and roundabouts, Approaches to pedestrian crossings, traffic lights and other high-risk situations | 0.50 | **60** | **65** | **68** | **68/ HFS** |
| Ki | Increased Risk, Approaches to high-risk situations | 0.55 | **65** | **68/ HFS** | **68/ HFS** | **68/ HFS** |
| R, G1 | Roundabout, Gradient 5-10% longer than 50m | 0.45 | **55** | **60** | **65** | **65** |
| G1i, Ri, G2 | Increased Risk, Roundabout or Gradient >5% longer than 50m | 0.50 | **60** | **65** | **68** | **68** |
| G2i | Increased Risk, Gradient >10% longer than 50m | 0.55 | **65** | **68/ HFS** | **68/ HFS** | **68/ HFS** |
| S1 | Bend radius <500m – carriageway with one-way traffic | 0.45 | **60** | **65** | **68/ HFS** | **68/ HFS** |
| S1i, S2 | Increased Risk, Bend radius <500m – carriageway with one-way traffic, Bend radius <500m – carriageway with two-way traffic | 0.50 | **60** | **65** | **68/ HFS** | **68/ HFS** |
| S2i | Increased Risk, Bend radius <500m – carriageway with two-way traffic | 0.55 | **65** | **68/ HFS** | **68/ HFS** | **68/ HFS** |

**Table A1 – Minimum PSV required for chippings/aggregate in bituminous surfacing**

The appropriate PSV values shall be inserted into the appropriate part of Appendix 7/1 of any Specifications (MCHW1) prepared for both new works and maintenance operations undertaken within Manchester.

On an existing site, if the life that has been achieved by the aggregates, the skid resistance and the collision rate have all been satisfactory, then the continued use of the same aggregate source, albeit with a lower PSV than that detailed in the appropriate table may be considered.

# Manchester City Council - Skid Resistance Strategy - Annex to DMRB Document CD236 Surface Course Materials for Construction

Also, when an existing a site has a worn HFS, but the Skidding Resistance survey confirms that an adequate level of skidding resistance is still being provided by the underlying road surface, we will continue to annually monitor the site, but choose not to replace the HFS unless our historic collision data shows the number of road traffic collisions have increased over the preceding 3-year period.

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

Notes on Table A1

1. Sites are grouped according to their general character and traffic behaviour. The Investigatory Levels (IL) for specific Site Categories of site are defined in Table 5.1.
2. Skidding requirements may vary along a road that is to be treated, however the use of different aggregates of varying PSV on different lengths of the site is generally considered impractical, particularly regarding applying a surface dressing treatment. In this situation, the engineer should decide the most appropriate PSV for the site as a whole but may consider resurfacing particular sections of the road where a higher PSV is required. For example: on sharp bends, or on the approaches to pedestrian crossings.
3. Where '68' material is listed in this Table, none of the three most recent results from consecutive tests relating to the aggregate to be supplied shall fall below 68.
4. Throughout this table, HFS means specialized high friction surfacing; incorporating Calcined Bauxite aggregate, conforming to Clause 924 of the Specification (MCHW1) will be required.
5. An HFS treatment shall not be used solely because a coloured road surface is required.
6. It is not normal practice to provide a Binder course or Base course layer with a PSV higher than 55, therefore, no temporary planed surface shall be left open to traffic at high traffic speeds. In this situation, traffic speed should be restricted to a maximum 40mph through-out the duration of the works, by using appropriate traffic management.

Competent Engineering judgement shall be used on all surfacing, resurfacing and surface dressing sites to determine the appropriate PSV for each location, such as outside schools and other high-risk areas, as part of the engineer's risk-based approach; an alternative PSV value may be specified, with justification.
Any deviation from this document shall require approval from the Director of Highways.