

CARRIAGEWAY SKIDDING RESISTANCE PLAN

DOCUMENT HISTORY

Issue	Status	Author	Date	Notes
001	Draft	WS	03.02.2022	Draft for Angus Council Committee Approval

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Date: 26.01.2022	Date: 26.01.2022	Date: 03.02.2022

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EXECUTIVE SUMMARY

Maintaining the skidding resistance of the running surfaces of roads is a high priority within the overall maintenance strategy of the Authority as the ability of a road to provide adequate friction to the vehicle wheels is taken for granted and cannot normally be determined visually. Although road pavements are designed to provide adequate skidding resistance through their serviceable life there are numerous reasons and contributing factors which can lead to low surface skidding resistance conditions such as heavy traffic flow, accelerating and braking actions, the layout of the road (tight bends and steep gradients), or more subtle issues such as leaf litter on the road at certain times of the year.

The purpose of this plan is to define how the skidding resistance of roads shall be monitored in Angus and defines what actions shall be taken to ensure that the level of carriageway surface skid resistance is maintained at the safest level within available budgets. It also details responsibilities and a timetable for delivery of the plan.

This document has been written based upon the guidance given in the Code of Practice for Well-Managed Highway Infrastructure (Oct 2016).

SURVEY APPROACH

The overall approach is based on the requirements given in the Design Manual for Roads and Bridges, CS 228 (Aug 2019). However, as these standards have been written for Trunk roads they have been amended where required by the contents of this document to reflect the needs of Angus Council roads. Unless specifically mentioned, the definitions and procedures given in CS 228 shall apply. The Director for Infrastructure has the overall responsibility for the application of this plan.

OVERVIEW OF TESTING PROCESS

A skid resistance survey cycle shall comprise the following stages:

- Routine measurements of skid resistance shall be made in accordance with this plan
- These measurements shall be compared to predetermined investigatory levels to highlight lengths of road at or below investigatory level
- Sites falling at or below investigatory level and meeting the criteria of this plan shall be subject to a site investigation
- Sites identified as requiring remedial work shall be prioritised and scheduled for work subject to budget & programming limitations
- Slippery road signs shall be erected on sites identified as requiring treatment where appropriate.

TEST EQUIPMENT

All routine skidding resistance survey tests shall be conducted using an accredited Sideways Force Co-Efficient Routine Investigation Machine (SCRIM®). In exceptional circumstances and for specific

FREQUENCY OF SURVEY

The Identified Network will be surveyed once annually with a cycle of Early-season, Mid-season, and Late-season over a rolling 3-year period.

SEASONAL CORRECTION

Because surface skidding resistance varies throughout the year (TRRL LR510) SCRIM® surveys shall only be carried out between 1st May and 30th September when the skidding resistance is typically lowest. Within this period the value still varies, so an approved methodology is required to correct the survey data to a Characteristic SCRIM® Coefficient (CSC). This correction improves the consistency of the survey data and ensures more comparable results are obtained year on year.

Angus Council employ the SINGLE ANNUAL SKID SURVEY (SASS) APPROACH TO CALCULATION OF CSC. This approach is based upon a single annual survey of the network. The method uses measurements from the preceding 3 years to characterise the long-term skid resistance of the network. This value is used, with the mean network skid resistance in the current year, to calculate a correction factor which is applied to the current year’s data to make current values consistent with the long-term average.

AUTHORISED STAFF

The officers listed below are responsible for the various areas of this plan. Only authorised members of staff within the Roads and Transportation Service are able to make decisions in these areas and are responsible for retaining all relevant documentation as listed in Section 10.

Area of Responsibility	Authorised staff
Survey Procurement	Team Leader - Operations
Authorisation to survey additional roads	Manager – Traffic
Authorisation to omit scheduled roads from a survey	Team Leader - Operations
Setting/approving investigatory levels	Service Leader – Roads and Transportation
Review of investigatory levels	Service Leader – Roads and Transportation
Quality Assurance procedures	Service Leader – Roads and Transportation
Validation of SCRIM® data	Team Leader - Operations; Data validation to be undertaken by survey contractor, in accordance with the UKPMS specification, prior to issue to the Council
Distribution of SCRIM® exception reports	Team Leader - Operations
Completion of site investigation	Team Leader - Roads Operations and Team Leader - Traffic
Erection/removal of warning signs	Roads Area Supervisor with Management by Team Leader – Roads Operations
Prioritization of remedial works	Team Leader - Roads Operations and Team Leader - Traffic
Surfacing early life skid resistance plan	Service Leader – Roads and Transportation

Area of Responsibility	Authorised staff
Implementation timetable	Manager – Roads Assets
Retention of documentation	Team Leader - Operations

SETTING AND REVIEW OF INVESTIGATORY LEVELS

To determine whether the level of skid resistance provided by the road is adequate, it needs to be assessed against a benchmark. As different circumstances will require higher or lower skid resistance properties, such as at bends or when braking for traffic lights, a number of site categories with associated investigatory levels shall be assigned based on the values given in Appendix B.

The investigatory levels in Appendix B follow the introduction of the new CS 228 standard. Once site investigations have been established and risk ratings given to each site, the investigatory levels may be revised as appropriate to within the tolerances given in this document, see table appendix B.

Any such alterations shall be approved collectively and authorised by all group members (see Authorised Staff table above) and documented in Appendix G.

A review of the Investigatory levels shall be carried out following a significant change of layout or traffic volume on any of the routes in the Identified Network. This need will be assessed and arranged by the Service Manager–Roads and Transportation, as and when traffic/project managers notify changes made to the network.

In any event, all investigatory levels shall be reviewed at least once every 3 years to check for any new roads or changes to existing road layouts which may include new roundabouts, junctions, or traffic signals.

QUALITY ASSURANCE PROCEDURES FOR DATA COLLECTION

Due to the automated nature of the data collection, it is important that adequate quality processes are put in place to verify (in as far as is practicable) both the physical and locational accuracy of the data. The following quality procedures are required on an annual basis, these will be specified within the relevant procurement documentation:

- Annual successful completion of the UK SCRIM[®] correlation trial administered by TRL on behalf of National Highways
- Audit of Contractors Internal Quality processes
- Site visits by Angus Council upon completion of the survey
- Validation of supplied data for coverage of the identified network
- Inspection of supplied data from separate survey runs and comparison to previously collected data to identify significant variations.

SITE INVESTIGATION

FULL SITE INVESTIGATION

On receipt of the complete and processed SCRIM[®] survey data, an investigation of all sites identified by Appendix F shall be completed by the Council's Traffic Section or a suitably qualified contractor. This investigation shall be as described by CS 228, incorporating the changes listed below.

DATA VALIDATION

Basic data validation checks shall be conducted for sites that have been identified as at or below the IL. This shall include confirming that the IL has been assigned correctly in accordance with current guidance and that the skid resistance recorded is within the normal range expected. If the IL is incorrect, it will be updated and recorded with the date of the change. If the skid resistance is above the revised IL, then further investigation is not required, and the change of IL should be recorded as the outcome of the investigation.

SITE IDENTIFICATION

A list of sites requiring a detailed investigation will be produced to inform future road surface maintenance investment need, and the Carriageway Maintenance Forward Programme, on processing of the CSC data.

The identification of sites requiring detailed investigation (the initial site score) can be carried out as detailed in Appendix F, which is based upon the alternative method detailed in Annex 7 of the previous standard HD28/15 (this method is an alternative to the crash model detailed in CS 228 which was developed specifically for the Highways England Road network and is not appropriate to be used on a Local Highway Authorities Road network).

PRIORITISING INVESTIGATIONS

Sites shall be prioritised to the following criteria:

- 1st Priority: Sites more than 10 points
- 2nd Priority: Sites between 5 – 10 points
- 3rd Priority: Sites between 0 – 5 points

ACCIDENT DATA ANALYSIS

As there are no nationally developed accident risk statistics for non-trunk roads, accident analysis shall be based on comparing site statistics to County Average accident data. These averages shall be identified by road class and whether urban or rural.

Where there is insufficient data to calculate the Annual Average Daily Traffic (AADT) figures for these different categories, the accident rate per vehicle Km element of the analysis is not to be included.

CHANGING INVESTIGATORY LEVELS

If the skid resistance and crash pattern of a site at or below the IL have remained stable for more than three years, then the IL may be lowered by 0.05 units CSC providing it remains within the range of ILs specified in Appendix B.

REPORTING SITE INVESTIGATION RESULTS

An example of a possible layout is given in Appendix C Site Investigation Report template. In addition to individual reports for each site, a summary listing of all sites identified as requiring further action shall be compiled and distributed to those required.

USE OF WARNING SIGNS

The use of warning signs shall be considered for sites identified as requiring remedial works to improve skidding resistance following a Site Investigation but should be used judiciously. Signs should only be erected if the remedial treatment cannot be carried out within 4 weeks. There will be close liaison and collaboration between the Manager – Roads Assets and the Manager – Traffic & Transport.

The Transport Scotland Interim Amendment - Skidding Resistance TSIM Skidding Resistance [Ref 2.N] shall be used to determine where warning signs are necessary on the Scottish trunk road network.

PRIORITISATION OF REMEDIAL WORKS

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

IMPLEMENTATION TIMETABLE

Action	To be completed annually by	Responsible member(s) of staff
Establishment/review of site categories & investigatory levels for annual survey	1 st March	Service Manager
Commissioning of survey	1 st May	Team Leader - Operations
Supply of network and any changes	1 st May	Team Leader - Operations
Supply of processed SCRIM® data	31 st October	Accredited Survey Supplier
Completion of full site investigation report	28 th February	Team Leader – Operations
Placement of warning signs	30 th November	Supervisors

Action	To be completed annually by	Responsible member(s) of staff
Review and Schedule of CW assessment priority rating scheme	1 st April onwards	Team Leader - Operations

DOCUMENTS TO BE RETAINED

In order to demonstrate the successful implementation of this plan, the following documentation is to be retained to evidence actions taken and decisions made.

1. This plan document with all preceding and subsequent versions
2. Records of when site categories and investigatory levels are set and reviewed
3. Records of the network surveyed in each year
4. Results from the early season investigations
5. Supplied processed SCRIM[®] data
6. Listings of all sites falling below investigatory level
7. The results of all site investigations
8. A record of when and where warning signs are erected & removed
9. Carriageway Assessment Priority Ratings
10. Carriageway Maintenance Forward Programmes.

REFERENCES

Well-Managed Highway Infrastructure (October 2016)

CS 228 Skidding Resistance; Design Manual for Roads and Bridges, Volume 7, Section 3 (Aug 2019)

CSS/BHS ENG 03/05 Horses and Highway Surfaces; CSS, Jan 2006

Interim Advice Note IAN 49/13: Use of Warning Signs for New Asphalt Road Surfaces

GLOSSARY & ACRONYMS

IL	Investigatory Level
SCRIM [®]	Sideways force Co-efficient Routine Investigation Machine
PSRT	Portable Skid Resistance Tester
CSC	Characteristic SCRIM [®] Coefficient
SASS	Single Annual SCRIM [®] Survey

APPENDIX A


SCRIM® NETWORK

Road Name	Network Length (M)	Network Length (to nearest KM)
A92	61,659.57	62
A923	8,965.89	9
A926	25,008.17	25
A928	16,701.17	17
A930	12,995.9	13
A932	16,962.63	17
A933	24,466.46	24
A934	10,468.21	10
A935	19,834.75	20
A937	8,347.05	8
A94	15,042.82	15
Grand Total	220,452.62	220

Please note, above figures represent SCRIM network length not annual survey lane length (where sections are to be surveyed in both directions where possible).

APPENDIX B

SITE CATEGORIES & INVESTIGATORY LEVELS

Site Category and Definition		Level of skid resistance							
									
		Investigatory Level at 50km/h							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
A	Motorway	AC	HR						
B	Dual Carriageway	AC	HR						
C	Single Carriageway		AC	HR					
Q	Approaches to and across minor and major junctions, approaches to roundabouts and traffic signals			LR	AC	HR			
K	Approaches to pedestrian crossings and other high-risk situations				LR	AC	HR		
R	Roundabout			LR	AC	HR			
G1	Gradient 5% to <10% - longer than 50m			LR	AC	HR			
G2	Gradient > 10% - longer than 50m			LR	AC	HR			
S1	Bend Radius <500m - dual carriageway. Speed limit > 40mph			LR	AC	HR			
S2	Bend Radius <500m - single carriageway. Speed limit > 40mph			LR	AC	HR			

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Sites are the same as or slightly lower as AC currently use the lowest available for each site category.

Key - All notes in CS 228 shall apply to this table	
Low Risk - for consideration subject to site investigation monitoring	LR
Angus Council Default IL and site category to reflect new COP CS 228	AC

High Risk - for consideration for speed limits >50mph or poor visibility subject to site investigation

HR

Notes :

1. All notes specified by CS 228 shall apply to this table
2. Minor and Major Junctions shall be defined as including the following :
 - a) Junctions between adopted roads
 - b) Filling Service Station accesses (=>50mph)
 - c) Access to Supermarkets and other large commercial/industrial sites (=>50mph)
 - d) Oxbow laybys (=>50mph)
 - e) other junctions identified as posing significant risk
3. For category K the upper IL should be used near schools or other facilities for children and public houses. The lower IL limit should be used where 20mph speed limits apply.
4. For category R the upper IL should be used for high speed roundabouts and high incidence of cyclists and motorcyclists
5. For S1 and S2 bends, risk categories shall apply as denoted in the above table
6. When defining site categories, in instances where two categories apply to the same length of road, the category with either the highest investigatory level or the category which is furthest down the table shall apply (i.e where Q and K both apply, K takes priority)
7. Where successive sites lie within 55m of each other they shall be merged to a single site.

APPENDIX C
SITE INVESTIGATION REPORT

Skid Site Investigation Report			
Job Number :		Surveyed By :	
Area :		Survey Year :	
Report Date :		Survey Date :	
Site Number :	Section :	Visit Required :	
Section Length (km) :	Start Chainage :	End Chainage :	
Total Length Assessed :	XSP Code:		
Location and Nature of Site :			
Map of Scheme		Site Photo	
<p style="text-align: center;">SCRIM Plot</p>		<p style="text-align: center;">Texture</p>	
Start Chainage	End Chainage	Site Category	Investigatory Level
Average CSC			
Skid Resistance and Texture Poor			

Skid Site Investigation Report

Crash Data				
Year	Total Crashes	Wet Crashes	Length (km)	Traffic AADF (Vehicles)
2020				
2019				
2018				

HE Crash Model Rating	
Comments	HE CRASH Model site rating of less than the threshold of 150, no further action required

Insert Site Imagery Here

Signed as Checked :	<input type="checkbox"/> Engineer 1
	<input type="checkbox"/> Engineer 2
	<input type="checkbox"/> Engineer 3
Q-Form :	Report No :

Skid Site Investigation Report			
Visual Assessment			
Type and condition of surfacing	Surface : _____ Aggregate Size : _____ Aggregate Condition : _____		
Any Inconsistencies with data :	_____		
Presence of debris or other contamination :	_____		
Local defects (potholes, fretting, etc.) :	_____		
Is drainage adequate? :	_____		
Road Layout			
Does it appear to meet current design specification?	_____		
Is layout appropriate for vulnerable road users?	_____		
Are junctions appropriate for turning manoeuvres?	_____		
Markings, Signs and Visibility			
Are markings and signs clear and effective in all conditions?	_____		
Are roadside objects protected from vehicle impact?	_____		
Clear sight lines / visibility of queues / vegetation	_____		
Additional Comments and Other Observations			

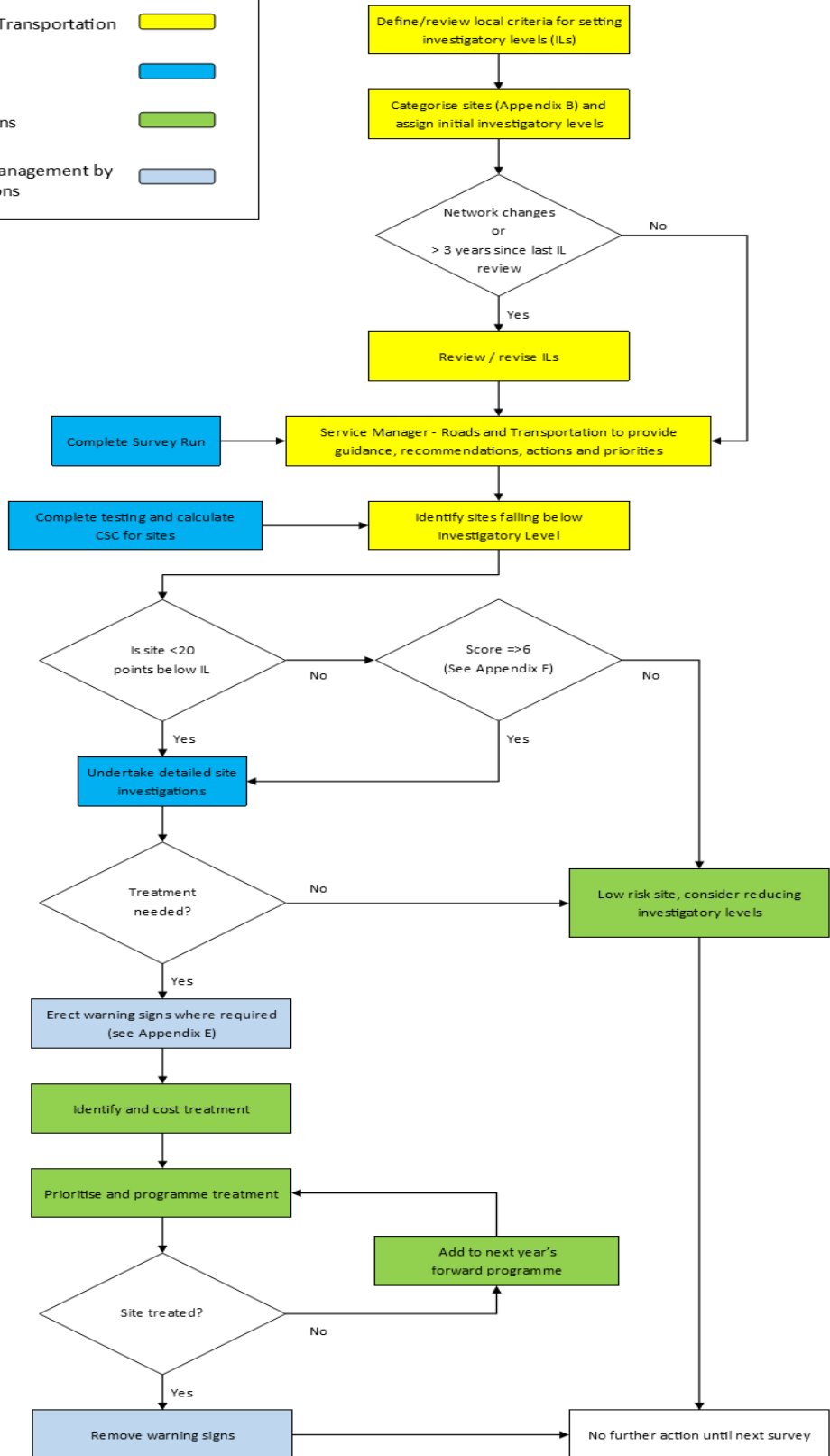
Recommendation			
Is treatment required?	_____	What type of treatment?	_____
Change IL?	_____	Other action required?	_____
Investigated By :			
Signed as Checked :	_____	<input type="checkbox"/> Engineer 1	_____
_____	_____	<input type="checkbox"/> Engineer 2	_____
_____	_____	<input type="checkbox"/> Engineer 3	_____
_____	_____	_____	_____
Q-Form :	_____	Report No :	_____

APPENDIX D

PROCEDURE FOR IDENTIFICATION AND CLASSIFICATION OF SITES

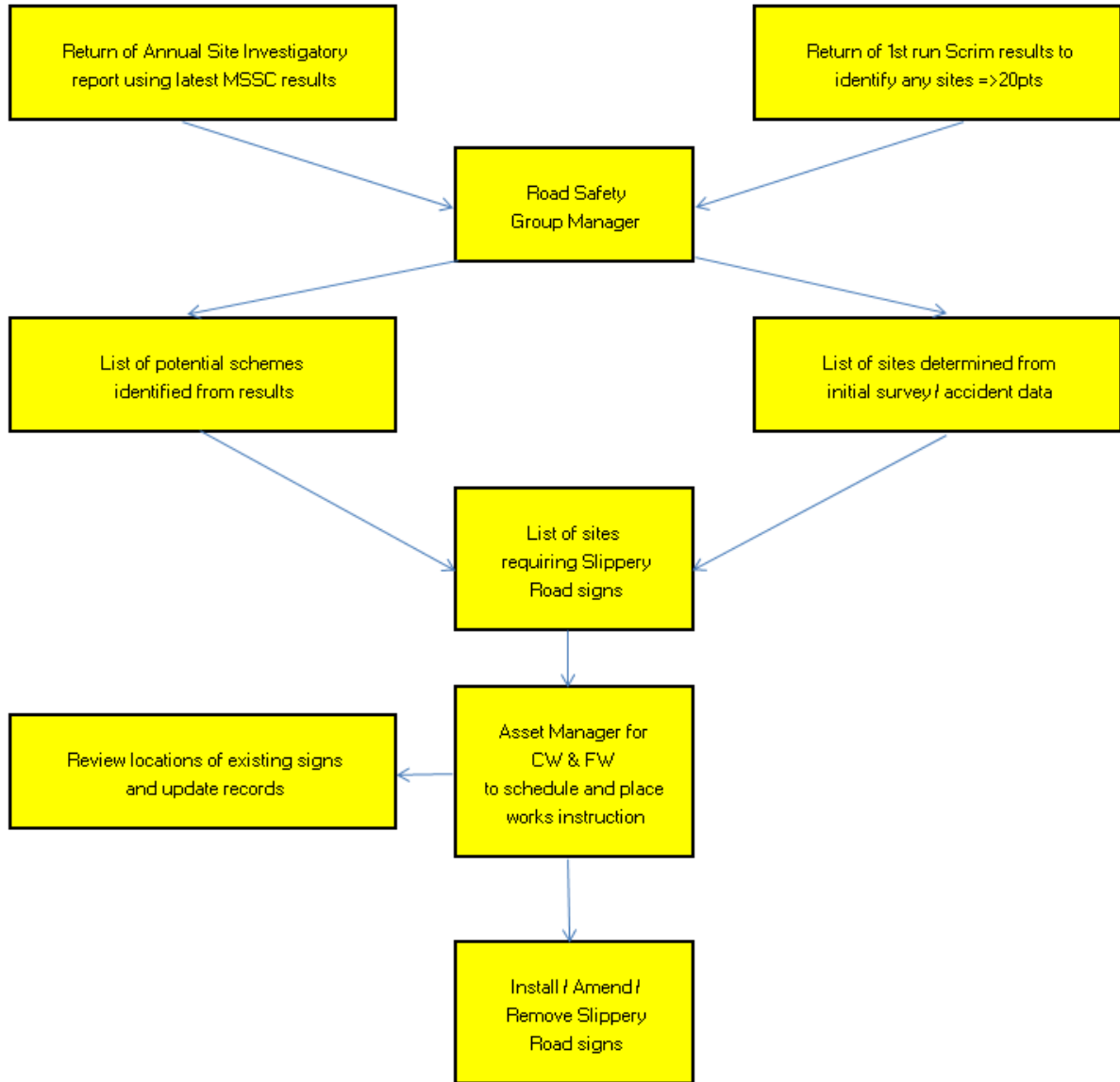
Responsibilities for Delivery:

Service Manager – Roads and Transportation	
Survey Contractor	
Team Leader - Roads Operations	
Roads Area Supervisor with Management by Team Leader – Roads Operations	



APPENDIX E

PROCEDURE FOR SLIPPERY ROAD SIGNS



APPENDIX F

METHODOLOGY FOR THE IDENTIFICATION OF SITES REQUIRING DETAILED INVESTIGATION

The identification of sites requiring detailed investigation (the Initial Site Score) can be carried out as follows based on the alternative method detailed in Annex 7 of HD28/15. The alternative method is an alternative to the crash model, which has been developed specifically for the Highways England Road network. It is not appropriate to use this crash model on a network outside of the Highways England network.

The Initial Site Score will identify sites requiring detailed investigation and is achieved by summing up the scores from the criteria in the following table for each site.

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

Scores and criteria (Detailed investigation required on sites scoring 6 or more)					
Number of crashes in last 3 years	0	1	2	3+	
Score	0	4	8	12	
Likely impact of crash	Slight	Slight/serious	Serious	Serious/fat al	
Score	1	2	3	4	
Skid resistance Difference (SD)	>0	>-0.05 and ≤0	>-0.10 and ≤ -0.05	>-0.15 and ≤ -0.10	≤ -0.15
Score	0	1	3	6	12
Site has SD≤0 and poor texture at the same point	No	Yes			
Score	0	1			

Number of crashes within the last 3 years; this refers to the total number of personal injury crashes. Wet and wet skid crash counts are not considered separately and should be investigated during the detail investigation of the site.

Given the limited accuracy of locating accident positions, it may be assumed for the purpose of this investigation that the position of a crash coincides with a Site if it occurred within 50m. However, crashes in excess of 50m can be ‘tagged’ to the site and crashes within the 50m 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 50m of a site that occur on roads parallel to the site but cannot be accessed from the site.

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 $SD \leq 0$ and poor texture at the same point. The combination of low texture depth and low skid resistance has been shown to be associated with an increased crash risk. Texture depths less than or equal to 0.8mm are considered to be low. Note, low texture depth combined with skid resistance above the Investigatory Level does not pose an increased crash risk for the purposes of this standard. 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). While a crash on a carriageway with 2-way traffic could possibly involve a head on collision, which could 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 the likely impact of crash is generated from the following table:

SCRIM Category	ROAD TYPE	
	= <40mph	= >50mph
B	Slight / Serious	Serious / Fatal
C	Slight / Serious	Serious / Fatal
Q	Slight / Serious	Serious / Fatal
K	Serious	Serious / Fatal
R	Slight	Slight / Serious
G1	Slight	Serious
G2	Slight	Serious
S1	Slight	Serious
S2	Slight	Serious

APPENDIX G

REGISTER OF AMENDED SITES WITH REDUCED OR ENHANCED IL'S

Road No	Road name	Reasons for change and evidence to support change	New IL value	Dated / Officers initials