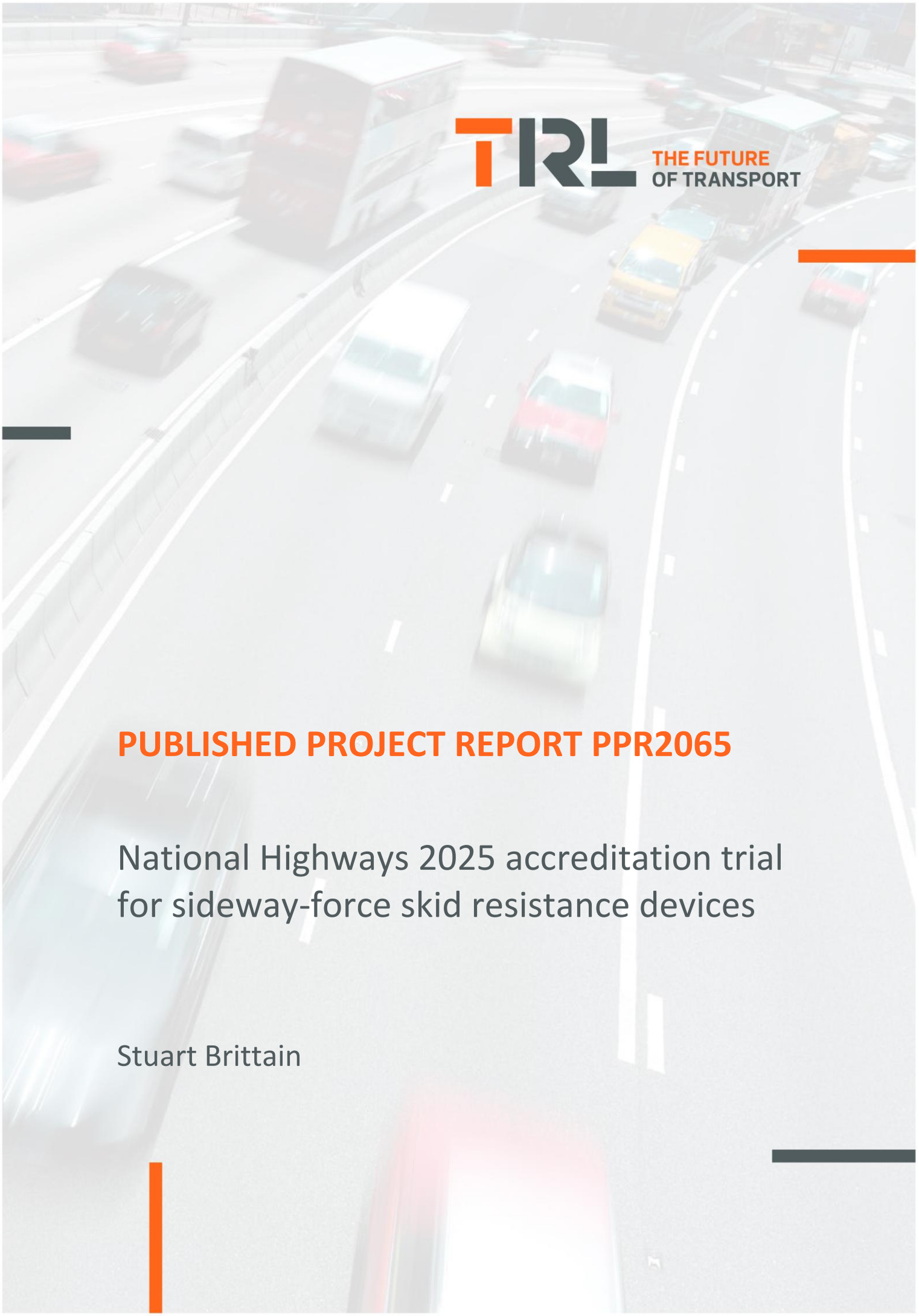

THE FUTURE OF TRANSPORT

PUBLISHED PROJECT REPORT PPR2065

National Highways 2025 accreditation trial for sideway-force skid resistance devices

Stuart Brittain

Report details

Report prepared for:	National Highways		
Project/customer reference:	SPaTS2 T-0167 PAAQA4		
Copyright:	© Transport Research Laboratory		
Report date:	17/06/2025		
Report status/version:	Issue 1		
Quality approval:			
Stephanie Davison (Project Manager)	**S Davison**	Martin Greene (Technical Reviewer)	**M Greene**

Disclaimer

This report has been produced by TRL Limited (TRL) under a contract with National Highways. Any views expressed in this report are not necessarily those of National Highways.

The information contained herein is the property of TRL Limited and does not necessarily reflect the views or policies of the customer for whom this report was prepared. Whilst every effort has been made to ensure that the matter presented in this report is relevant, accurate and up-to-date, TRL Limited cannot accept any liability for any error or omission, or reliance on part or all of the content in another context.

Contents

1 Introduction 4

2 Pre-trial preparation 6

2.1 Test wheel assembly weighing and vertical calibrations 6

2.2 Test tyres 6

2.3 Site Preparation 6

3 Test sections 7

3.1 Twin straights 7

3.2 Straight Line Wet Grip area 7

3.3 Network route to Sheepy Magna (near MIRA) 8

3.4 Crowthorne network route 11

4 Machine inspections 13

4.1 Left test wheel weight checks 13

4.2 Water flow rate checks 14

4.3 Vertical and horizontal load calibration 14

4.4 Distance calibration 14

4.5 Speed 14

5 Skid resistance measurements 15

5.1 Machine repeatability 15

5.2 Variation between machines 15

5.2.1 First set of Straight Line Wet Grip tests (15th April) 16

5.2.2 MIRA Network route tests (16th April) 16

5.2.3 Second set of Straight Line Wet Grip tests (17th April) 17

5.3 Summary of skid resistance testing 18

6 Location referencing 19

6.1 Distance measurement 19

6.2 3 dimensional spatial coordinates data 21

7 File formats 24

8 Conclusions and recommendations 25

Appendix A Machine identification and performance 27

Appendix B	Between run standard deviation	28
Appendix C	Assessment of 3-dimensional spatial coordinates data	30
Appendix D	Assessment criteria	33

Executive Summary

The national accreditation for sideway-force skid resistance devices is organised annually by TRL, on behalf of National Highways. The purpose of this accreditation is to verify the performance of all sideway-force skid resistance devices operating on the UK trunk roads so that consistency is maintained throughout the fleet. The measurements by these machines are used to monitor the skid resistance of the motorway and trunk road network in support of National Highways skidding resistance standard (DMRB CS 228). By examining the results from the machines operating on specified test sections it is possible to assess the performance of individual machines and the consistency of the whole UK fleet.

The 2025 accreditation trial was held during the week beginning 14th April 2025. Eighteen machines attended.

The following principal conclusions were drawn in relation to the mandatory tests and assessments:

- All eighteen machines were found to be satisfactory with regards to the machine being in good general mechanical order and test wheel weight.
- All eighteen machines met the criteria for the skid resistance measurements.
- All eighteen machines were identified as suitable for vehicle speed.
- Seventeen of the eighteen machines met the automatic markers criteria with regards to the measurement of distance during the trial. One machine met the manual markers criteria.
- All eighteen machines provided satisfactory water flow rate and direction.

The following principal conclusions were drawn in relation to the various additional tests and assessments:

- OSGR data was provided from fifteen machines for assessment. Ten machines achieved a high performance, four a low and one not suitable.
- Altitude data was provided from fifteen machines for assessment. Ten machines achieved a medium performance, four a low and one not suitable.

Overall, the trial demonstrated that the UK fleet continues to perform at a level suitable for use in supporting the implementation of the skid resistance standard.

1 Introduction

The 2025 sideway-force skid resistance accreditation trial was held, on behalf of National Highways, during the week commencing 14th April 2025. The trial is funded by National Highways supported by participant fees for each machine attending, paid for by the survey contractors/operators of the machines.

The trial was held on the HORIBA-MIRA proving ground (referred to as MIRA in the rest of this report) and on two Network routes. Eighteen machines based in the UK and Ireland attended.

The purpose of the trial is to verify the performance of all sideway-force skid resistance devices operating on the UK trunk road network so that consistency is maintained throughout the fleet. This is important because the results of measurements by these machines are used to monitor the motorway and all-purpose trunk road network in support of the National Highways skidding resistance standard (DMRB CS 228).

By examining the results from the machines operating on specified test sections, it is possible to assess the performance of individual machines and the consistency of the whole UK fleet.

TRL has been responsible for planning and running the accreditation trials since 1995. The 2025 trial comprised seven general stages:

1. **Preparations**: During the days immediately preceding the trial, the test track, documentation and support facilities were checked and made ready. Operators were required to undertake weighing of their own test wheel assembly and vertical calibrations before the trial.
2. **Ordnance Survey Grid Reference (Crowthorne network route)**: Machines with OSGR systems fitted undertook surveys of the Crowthorne network route, either before or after the testing at MIRA, for the assessment of their OSGR systems.
3. **Waterflow, speed and distance (MIRA)**: Machines were inspected to check the performance of the water flow control. Operators were given an opportunity to undertake a distance calibration of their machine. Laps were undertaken on the Twin Straights, with timing gates set up over one section on the site. Data from this testing was used to assess the distance and speed measurements of the machines.
4. **Skid Resistance measurements (MIRA)**: Laps were undertaken of the Straight Line Wet Grip (SLWG) facility at MIRA to provide initial indication of performance with regards to skid resistance measurements.
5. **Machine alterations**: Operators were provided with feedback on the performance of their machines after the first set of testing on the SLWG. This information was used by the operators to make alterations to the machines, if required, before the remaining testing in the trial.
6. **Testing of network route near MIRA**: Laps were undertaken of the network route near MIRA. This data was used to support the skid resistance assessment on the SLWG and the OSGR assessment on the Crowthorne network route.

7. **Repeat test track skid resistance measurements (MIRA)**: The SLWG testing was repeated to assess fleet variability and the performance of devices following any required alterations arising from Stage 5.

The results from the testing described above are discussed in this report and are provided in the accreditation certificates issued to the trial participants. These certificates are also accessible on the UKRLG website in the road condition information area at:

https://ukrlg.ciht.org.uk/ukrlg-home/guidance/road-condition-information/data-collection/skid-resistance/

For convenience, throughout this report machines are referred to using the running number assigned at the trial. For ease of comparison, machines usually retain the same running numbers from one year to the next. To avoid confusion with earlier vehicles, when a machine is replaced or re-built on a new chassis, the new vehicle is assigned a new running number in sequence when it first appears at the trials. Appendix A lists all the machines, their running numbers (ID) and their operating organisations as they were in April 2025.

Sometimes machines are unable to attend the main trial, or problems are identified that cannot be resolved during the main trial. If machines do not attend or fail to pass the main trial then an additional trial will be required to achieve accredited status which must be fully funded by the machines' owners.

2 Pre-trial preparation

2.1 Test wheel assembly weighing and vertical calibrations

Survey contractors were asked to weigh their test wheel assemblies and conduct a vertical calibration before the trial. This data was provided to TRL before arriving on site at MIRA. The test wheel assembly weights are discussed in section 4.1.

2.2 Test tyres

Small variations in skid resistance measurements can sometimes be caused by differences between test tyres fitted to different machines. The tyres used for this trial were all purchased as new in 2024 for the 2024 trial and have been re-used for the 2025 trial. Before the 2025 trial TRL carried out surveys on the A329m with each of these tyres to check the batch consistency. The data from the tyres to be used was found to be suitable for the trial.

2.3 Site Preparation

Prior to the trial, a drive through of the network routes was undertaken to identify if there could be any issues with using the routes (e.g. roadworks) or any aspects that may need to be considered when assessing the data collected (e.g. road deterioration or recent maintenance). During this inspection it was found that no roadworks were in place or signs announcing imminent works present, and no other issues were identified.

The parts of the MIRA proving ground used in the trial were prepared leading up to the trial. The reference points at the start of each test length were identified using cones and the track was visually inspected.

There is always an element of variability in the skid resistance measurements that is a result of drivers following slightly different driving lines in each survey run. This manifests itself both in variation between runs with the same driver and in different general lines followed by different drivers. To reduce the variability on the Straight Line Wet Grip test site, cones are placed either side of the lane to create a corridor for the machines to travel within. However, the cones have to enable testing with the largest vehicle and also provide some leeway so that cones are not hit on a regular basis. Therefore, although this approach may reduce the driving line variability, some may still remain.

3 Test sections

The trial uses two areas of the MIRA proving ground (the Twin Straights and the Straight Line Wet Grip Area), along with a network route in the surrounding area. In addition, a second network route has been established near to TRL's head office in Crowthorne, Berkshire for the assessment of OSGR/Altitude measurement systems.

3.1 Twin straights

This area is used for distance calibration and the location referencing tests (including speed measurement). The overview of the Twin Straights and the position of the marker points A-G are given in Figure 3.1.

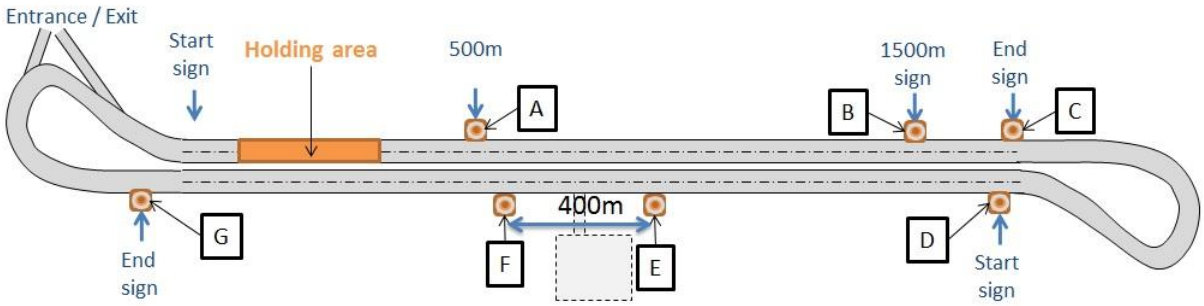

Figure 3.1: Overview of Twin Straights and position of marker points

3.2 Straight Line Wet Grip area

The Straight Line Wet Grip (SLWG) area on the MIRA proving ground is utilised to provide lengths with a range of skid resistance levels including some particularly low values not present on the network route. The position of the sections is given in Figure 3.2 and details of the sections are given in Table 3.1.

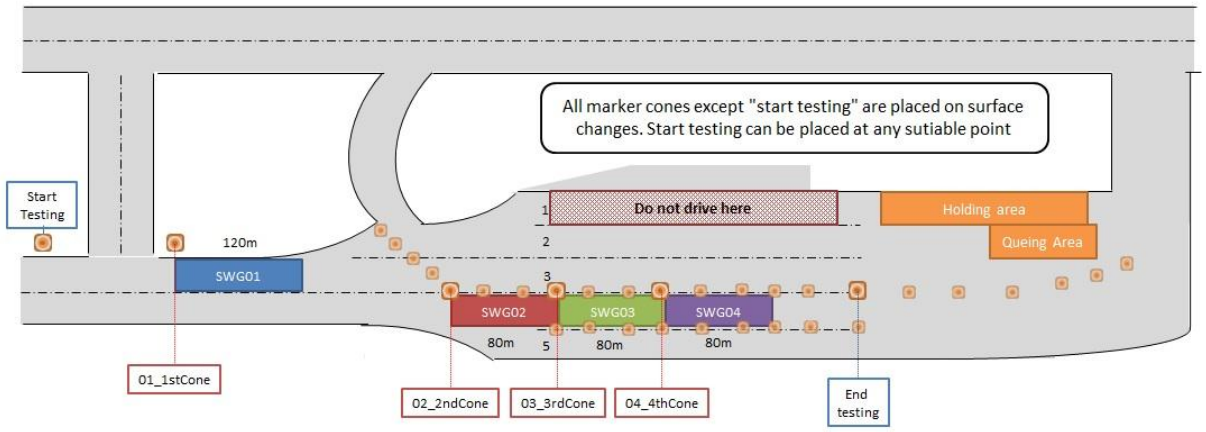

Figure 3.2: Skid resistance test sections on the Straight Line Wet Grip area

Table 3.1: Skid resistance test sections on the Straight Line Wet Grip area

Section	Length (m)	Surface description
SWG01	100	Transverse grooved Portland cement concrete
SWG02	60*	Worn bitumen macadam
SWG03	60*	Bridport gravel (with quartzite) exposed aggregate concrete
SWG04	60*	Smooth asphalt concrete

* The trial lengths on the wet grip area did not include the full length of each surfacing in order to exclude the transitions between the different surfaces.

3.3 Network route to Sheepy Magna (near MIRA)

A network route is included in the accreditation trial to provide supporting data for the assessment of skid resistance and location referencing. The first marker of the route is at the roundabout exit directly outside of the MIRA site, the route then loops round to Sheepy Magna and returns to MIRA as shown in Figure 3.3 (Contains Ordinance Survey data © Crown copyright and database right 2025). Details of the route are given in Table 3.2.

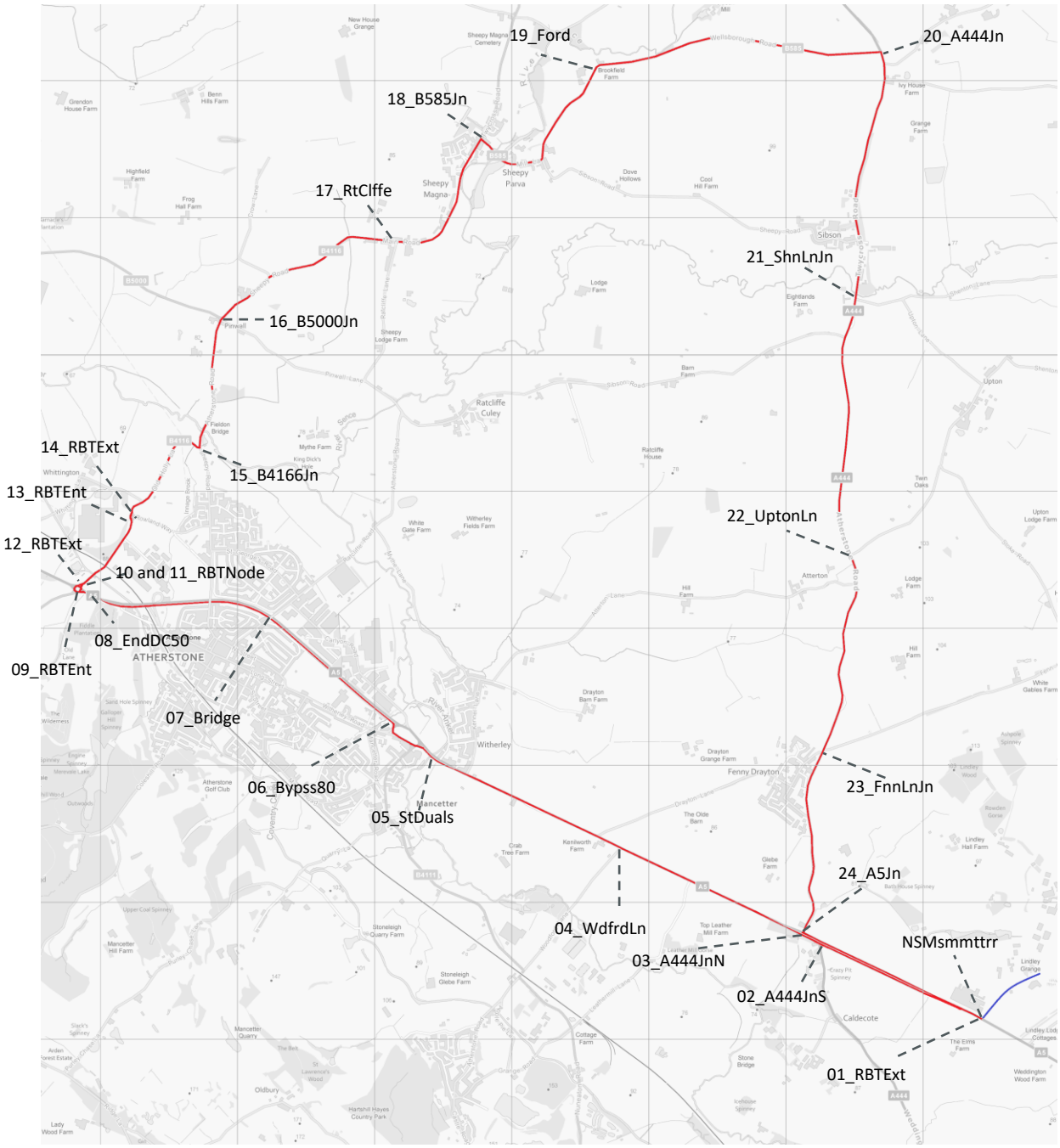

Figure 3.3: Network route to Sheepy Magna

Table 3.2: Details of network route, including marker positions

Survey distance (km)	Section length (m)	Markers	Marker position	Driving Instructions
n/a	n/a	NSMsmmttrr	Entry to MIRA roundabout	Turn right at the MIRA exit roundabout (A5 WB)
0	1260	01_RBTExt	Node at exit of MIRA roundabout	Continue on A5, testing in Lane 1
1.26	192	02_A444JnS	Node at entry to gyratory at junction with A444 south	Continue on A5
1.45	1454	03_A444JnN	Node at exit of gyratory at Junction with A444 North	Continue on A5
2.91	1379	04_WdfrdLn	Node at centre of Junction with Woodford Lane (has sign for Dobbie's Garden world)	Continue on A5
4.28	543	05_StDuals	Start of duals	Dual carriageway commences. Take right lane and continue to second exit on to A5 Atherstone by-pass towards Tamworth.
4.83	1199	06_Bypss80	Mancetter circulatory system exit	Return to testing on Lane 1 for exit of circulatory system on to A5.
6.03	1249	07_Bridge	Centre of 1st road bridge going over A5	Continue on A5
7.28	178	08_EndDC50	Node at end of dual carriageway	Continue testing for approx. 200m on approach to roundabout
7.45	128	09_RBTEnt	Entry to roundabout junction with B4116	Test roundabout as per CS 228
7.58	147	10_RBTNode	Roundabout "Node"	Continue survey of roundabout
7.73	111	11_RbtNode	Roundabout "Node"	7.73
7.84	640	12_RBTExt	Roundabout exit	Take exit, B4116 towards Twycross.
8.48	30	13_RBTEnt	Roundabout (access to Aldi distribution depot)	Take second exit (straight on)
8.51	836	14_RbtExt	Roundabout exit	Continue testing on B4116
9.35	970	15_B4166Jn	At T-junction	Turn left and continue testing on B4116 towards Twycross
10.32	1486	16_B5000Jn	Junction with B5000 (on left) at the Red Lion	Continue testing on B4116
11.80	1100	17_RtClffe	Centre of junction with Ratcliffe Ln (on right)	Continue on B4116 and enter Sheepy Magana
12.90	1333	18_B585Jn	At exit of T-Junction	Turn right on to B585 (Mill Lane) towards Market Bosworth.
14.24	2108	19_Ford	Centre of junction with signpost for ford.	Continue on B585
16.34	1847	20_A444Jn	At junction with A444	Turn right onto A444 towards Nuneaton.
18.19	1910	21_ShnLnJn	At Junction with Shenton Lane (signposted Upper Shenton)	Continue on A444
20.10	1476	22_UptonLn	At junction with Upton Lane (on left, is signposted for Upton)	Continue on A444
21.58	1385	23_FnnLnJn	At junction with Fenn Lanes (on left, is signposted for Bosworth Battlefield)	Continue on A444
22.96	n/a	24_A5Jn	Centre of A444/A5 Junction	Turn left on to A5 towards Hinkley. Continue along the A5. On dual carriageway in Lane 1 This marks the end of the route.

Fourteen 100m lengths of varying skid resistance levels are selected from various locations along the network route for the analysis. These lengths have been selected for homogeneity of skid resistance within the length and low indications of variation due to test line. As parts of the route may be maintained between accreditation trials, the lengths used in the analysis are reviewed in each accreditation trial and modified as necessary. Therefore, the locations of these lengths (and the typical skid resistance values) may vary between trials.

3.4 Crowthorne network route

To support the robust assessment of the OSGR and Altitude systems, a network route site has been established close to TRL's head office in Crowthorne (Berkshire). This site includes significantly more tree coverage than the MIRA network route (discussed in section 3.3) and also features retro-reflective marker posts for the automatic detection of section start and end points. Only machines which are having their OSGR and Altitude systems assessed test this route.

The Crowthorne route is located on the B3430 between the A3095 and A322 (in both directions). An overview of the eastbound and westbound routes is shown in Figure 3.4 and Figure 3.5 respectively. Details of the marker positions are given in Table 3.3 and Table 3.4 (Contains Ordinance Survey data © Crown copyright and database right 2025).



Figure 3.4: Eastbound direction of Crowthorne network route



Figure 3.5: Westbound direction of Crowthorne network route

Table 3.3: Section Identifiers for Eastbound direction of Crowthorne network route

Section Start Identifier and Description	Section Length (m)	Start Easting	Start Northing	Section Identifier
Start to A - Run in before the Golden Retriever junction (B3430/A3095).	>200m	N/A	N/A	Run-in
A to B – B3430 Nine Mile Ride (Start is by double-triangle warning sign)	596m	485723.3	166084.9	AB
B to C – After first right-hand bend, near to final black and white reflective road edge marker as corner straightens	336m	486307.5	166170.4	BC
C to D – Prior to first left hand bend, marker is just before change to high friction surfacing	709m	486631.6	166057.7	CD
D to E – Prior to left-hand bend warning triangle sign (with yellow background)	388m	487335.0	166133.8	DE
E to Run out – After arrow for right turn lane (opposite road sign on right-hand side)	>200m	487711.7	166248.5	Run-out

Table 3.4: Section Identifiers for Westbound direction of Crowthorne network route

Section Start Identifier and Description	Section Length (m)	Start Easting	Start Northing	Section Identifier
Start to F - Run in B3430 Nine Mile Ride from A322 junction.	>200m	N/A	N/A	Run-in
F to G – At arrow for right turn lane (road sign on Left-hand side)	400m	487714.8	166241.4	FG
G to H – After reverse of sign on left hand side	702m	487335.9	166131.2	GH
H to I – After second right hand bend, marker is just after change to high friction surfacing	337m	486631.1	166054.9	HI
I to J – Prior to left hand bend, marker is before the change to high friction surfacing	589m	486309.3	166166.8	IJ
J to Run out – B3430 Nine Mile Ride (Marker is opposite previous double-triangle warning sign)	>200m	485735.8	166084.5	Run-out

4 Machine inspections

4.1 Left test wheel weight checks

As discussed in section 2.1 the survey contractors were asked to weigh the test wheel assemblies on their machines and provide the data before the trial. The results of these measurements are given in Table 4.1.

Table 4.1: Test wheel weights

ID	Un-bounced 1	Un-bounced 2	Un-bounced 3	Un-bounced Mean	Bounced 1	Bounced 2	Bounced 3	Bounced Mean
3	197.0	197.0	197.0	197.0	199.5	199.0	200.0	199.5
13	199.0	199.5	199.5	199.3	203.0	203.0	202.0	202.7
16	192.1	192.1	190.5	191.6	201.3	200.5	200.4	200.7
17	201.0	201.0	201.0	201.0	202.5	202.5	202.5	202.5
19	200.0	200.0	200.0	200.0	201.5	201.0	202.0	201.5
21	198.5	198.5	198.5	198.5	199.0	199.0	199.0	199.0
22	193.6	192.8	194.0	193.5	204.6	203.8	205.7	204.7
23	198.0	199.0	199.0	198.7	202.0	202.0	202.0	202.0
24	198.0	198.5	198.5	198.3	200.0	200.0	200.0	200.0
25	197.5	197.5	197.5	197.5	200.5	201.0	200.0	200.5
26	200.0	200.0	200.0	200.0	202.5	202.5	202.5	202.5
28	198.4	199.0	201.0	199.5	204.6	200.6	200.0	201.7
29	204.4	208.0	206.9	206.4	202.2	202.1	201.8	202.0
31	200.0	200.0	200.0	200.0	202.0	202.5	202.0	202.2
33	206.0	206.5	206.5	206.3	206.0	206.0	206.0	206.0
35	206.0	206.0	206.0	206.0	207.0	207.0	207.0	207.0
37	201.0	201.5	201.0	201.2	202.0	202.0	202.5	202.2
39	198.0	198.0	198.0	198.0	201.0	202.0	201.0	201.3

It can be seen in Table 4.1 that all of the “bounced” mean weights of the machines fell within the tolerances given in Appendix D.

In 2009, British Standards published a CEN Technical Specification for these devices (BSI, 2009). This is a Draft for Development (DD) document that can be used voluntarily over a period so that experience can be gained before being accepted and introduced (if appropriate) as a full EN (European Norme). This is one of a series of documents for skid resistance measurement devices intended to encourage consistent standards in the use of similar machines in different European countries. The requirements in this document may be incorporated into future revisions of the British Standard.

This DD was developed from BS 7941-1 (BSI, 2006) so it is already largely consistent with current UK practice. However, some aspects were revised to take account of wider experience of the use of similar devices in Europe and one of these is the reduction of the tolerance for static wheel weight to ±1 kg.

At this trial, all of the machines were within the current ±8 kg tolerance. However, had the CEN TS requirement been applied to the fleet this year, thirteen machines would have been outside the ±1 kg tolerance. However, it is noted that all devices that attend this trial incorporate measurement of dynamic vertical load in the processing of the survey data.

Therefore, the need to tighten the criteria may not be required. These aspects have been raised with the relevant CEN committee.

4.2 Water flow rate checks

After minor adjustments to some machines, it was deemed that all machines had satisfactory water flow rates and direction of flow.

4.3 Vertical and horizontal load calibration

Operators were asked to arrive on site with the machines having had a recent vertical calibration. The crews were also asked to conduct a horizontal calibration at the start of each day of testing that involved collection of skid resistance measurements.

4.4 Distance calibration

All crews undertook a distance calibration check of their machine on a defined length at the test site.

4.5 Speed

The assessment of speed (both the attainment of the target speed and the accurate recording of speed in the survey data) was carried out using data collected during the tests on the Twin Straights. Testing on this site was undertaken such that at least three passes at 50km/h and 80km/h were achieved for each machine.

Timing gates are set-up to measure the time taken for the machines to travel between markers E and F on the Twin Straights. This data, along with the distance between the two markers is used to determine an independent measure of the average speed of machines over this length.

However, during the 2025 trial technical issues were experienced with the operation of the timing gates due to the high levels of wind on the day. This meant that data collection reverted to manually recording the times using stopwatches. Examination of the times obtained found that the error introduced by the manual process meant that it was not suitable to assess the devices to the level needed for the assessment.

Therefore, the data collected throughout the trial (both on this site and other sites) were examined for anomalies with regards to the speed measurement. This analysis uncovered no anomalies. As such all machines were awarded a “pass*” with the following additional text on the certificate:

> *“Due to high winds and resulting technical issues, the full speed assessment could not be completed during the trial. Investigation of the survey data found no issues with regards to speed measurement for this device.”*

It is recommended that for future trials the Auditor investigates different options to avoid the effect of wind (e.g. gates triggered by driving over strips rather than light beams to break or stronger fixing in place of the sensors), and development of suitable fallback options.

5 Skid resistance measurements

Skid resistance measurements are taken on two sites (Straight Line Wet Grip, and the network route near MIRA).

The assessment of skid resistance measurements falls into two parts; machine repeatability and variation between machines (see Appendix D).

5.1 Machine repeatability

The between run standard deviation (BRSD) data for the skid resistance measurements are given in Appendix B. On examination of the between run standard deviation and plots of the individual runs the following observations were made:

- The data from the first set of tests on the Straight Line Wet Grip area shows higher BRSD for some machines on SWG04. It has been found from previous trials that SWG04 experiences larger track conditioning effects and as such the BRSD is typically higher. In addition, there was some increased variability for machines 22 and 29.
- For the MIRA network route there were some scattered instances where increased BRSD was seen. NSM 06 showed some higher variation for some machines. In addition, machines 21, 24 and 35 showed increased variability for the route.
- The second set of tests on the Straight Line Wet Grip shows higher BRSD for some machines on SWG04. In addition, there was some increased variability for machines 21 and 22.

Overall, all the machines were within the BRSD criteria in most cases. Therefore, all machines were deemed to be performing acceptably with regards to between run variation. Although SWG04 was found to be more variable (as seen in previous years) it was not identified that it was necessary to exclude this section from the analysis.

5.2 Variation between machines

The average Skid Reading (SR) values produced by the machines for each of the test sites are shown in the tables below (Table 5.1to Table 5.3). At the base of each table is the average calculated for the trial indicated as “Trial mean”, and the Between Equipment Standard Deviation for the trial indicated as “Trial BESD”.

One machine (machines 39) was a new machine. The reference dataset excludes machines that were not accredited during the previous year, as such this machine cannot be considered as part of the reference dataset. Therefore, in addition to the mean and BESD for the trial (all machines), the tables below also show the mean and BESD for the reference machines.

Machine SR values are highlighted in green if they lie within 2 times the BESD criterion (see Appendix D) of the reference mean, in orange if they lie between 2 and 3 times the BESD criterion, and in red if they are greater than 3 times the BESD criterion. The “Ref BESD” and “Trial BESD” values are highlighted in green if they are below the BESD criterion, in orange if they are below 1.5 times the BESD criterion and in red if they exceed this value.

5.2.1 First set of Straight Line Wet Grip tests (15th April)

During this testing Machine 24 suffered engine issues and was unable to maintain speed. As such this machine only carried out two of the five laps. All other machines carried out the full set of 5 laps. The results from this testing are shown in Table 5.1.

Table 5.1: Average SR from the 1st set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	63.6	88.1	25.5	53.3	58.5
13	64.7	91.3	24.8	54.5	59.7
16	65.0	91.5	24.9	55.2	60.0
17	61.5	89.0	25.6	50.8	57.4
19	59.4	87.8	22.3	48.6	55.2
21	63.8	89.9	26.6	53.5	59.2
22	63.7	92.0	27.5	58.8	61.0
23	59.1	86.0	23.1	49.1	55.0
24	59.6	88.3	20.9	49.7	55.3
25	61.7	88.3	27.0	52.1	57.9
26	62.1	91.0	24.5	50.9	57.9
28	58.0	85.2	24.7	48.9	54.8
29	61.2	89.7	24.3	50.0	57.0
31	60.3	88.2	23.2	48.0	55.7
33	62.4	89.4	24.7	51.2	57.7
35	63.9	93.6	25.3	53.6	59.8
37	59.3	85.8	22.4	47.2	54.5
39	56.0	80.9	22.5	49.3	52.7
Ref mean	61.7	89.1	24.6	51.5	57.4
Ref BESD	2.18	2.30	1.74	3.03	2.08
Trial mean	61.4	88.7	24.4	51.4	57.2
Trial BESD	2.51	2.95	1.76	2.98	2.30

It can be seen from Table 5.1 that the BESD criteria is met for the average of the site for the trial dataset. In addition, no machine was more than 3 times the BESD criterion away from the trial mean (in fact all machines were within two times the BESD criterion of the trial mean). Therefore, at this stage no machine has been identified as an outlier.

5.2.2 MIRA Network route tests (16th April)

As noted in section 3.3, fourteen 100m lengths of varying skid resistance levels have been selected on the network route for the analysis. These lengths are selected for homogeneity of skid resistance within the length and low indications of variation due to test line. As such the lengths used (and the typical skid resistance values) may vary between trials. As noted in section 2.3, part of the site preparation tasks is to drive through the site to identify if there are any issues with using the routes (e.g. roadworks) or any aspects that may need to be considered when assessing the data collected. A drive through of the MIRA network route

was undertaken prior to the trial and it was found that no roadworks were in place nor were any signs up announcing imminent works and no other issues were identified. The results from the testing on the Network route are shown in Table 5.2.

Table 5.2: Average SR from the MIRA network route surveys

ID	NSM 01	NSM 02	NSM 03	NSM 04	NSM 05	NSM 06	NSM 07	NSM 08	NSM 09	NSM 10	NSM 11	NSM 12	NSM 13	NSM 14	Avg
3	59.3	53.8	62.9	73.2	54.7	63.5	66.8	59.8	63.7	54.8	60.9	58.0	51.2	65.7	60.6
13	65.6	57.9	65.7	78.3	57.4	68.5	72.2	65.6	71.5	60.3	66.5	63.5	59.4	69.8	65.9
16	58.9	53.5	60.9	69.9	51.0	62.1	64.1	55.2	59.3	52.7	59.7	54.5	48.5	59.5	57.8
17	64.1	55.4	65.7	75.8	56.3	67.6	71.4	63.2	66.8	59.9	65.6	61.9	55.3	68.1	64.1
19	59.7	47.6	63.9	72.8	53.2	67.3	67.5	63.9	63.9	57.6	63.2	59.1	53.5	64.6	61.3
21	64.0	54.1	66.5	74.5	55.4	70.1	70.5	63.0	65.3	57.9	65.3	60.0	54.1	66.8	63.4
22	68.3	60.0	69.1	77.4	56.5	69.0	72.6	61.1	64.9	59.7	64.0	59.4	51.5	65.8	64.2
23	61.4	52.1	62.7	71.4	56.1	65.7	69.2	61.0	64.0	56.3	62.6	58.1	52.6	64.7	61.3
24	62.2	56.9	66.6	79.2	57.8	62.6	69.8	66.2	66.5	58.4	66.0	64.6	55.1	68.0	64.3
25	61.3	54.5	64.1	73.4	54.5	65.6	68.9	61.0	65.5	59.3	64.5	60.7	52.1	67.1	62.3
26	64.6	58.7	71.1	78.1	58.6	69.6	73.4	64.6	68.1	58.6	67.4	63.6	54.7	69.8	65.8
28	61.6	50.9	67.0	75.9	55.5	66.9	68.7	61.3	65.7	59.3	64.3	60.7	54.6	66.6	62.8
29	66.4	61.3	69.6	83.1	64.5	69.3	73.4	64.7	68.0	60.2	70.0	66.7	58.1	69.4	67.5
31	59.2	54.1	64.0	73.6	54.3	65.5	67.5	61.9	63.4	56.2	63.0	59.4	53.3	63.2	61.3
33	63.7	55.6	67.4	74.8	56.8	70.5	72.0	67.5	67.1	59.9	66.7	63.3	60.5	67.3	65.2
35	64.8	58.7	67.1	79.9	57.7	74.2	77.5	68.2	71.3	66.4	69.6	70.6	59.4	70.1	68.3
37	60.0	52.7	62.3	71.1	53.8	65.4	67.4	62.0	63.1	55.0	60.0	57.1	51.8	62.5	60.3
39	58.3	51.1	63.5	72.2	53.0	66.2	66.1	58.0	61.1	53.4	59.6	55.9	50.0	59.9	59.2
Ref mean	62.6	55.2	65.7	75.4	56.1	67.3	70.2	63.0	65.8	58.4	64.7	61.3	54.5	66.4	63.3
Ref BESD	2.81	3.50	2.77	3.52	2.89	3.13	3.21	3.14	2.99	3.01	2.98	3.88	3.29	2.90	2.75
Trial mean	62.4	54.9	65.6	75.3	56.0	67.2	69.9	62.7	65.5	58.1	64.4	61.0	54.2	66.1	63.1
Trial BESD	2.91	3.52	2.74	3.50	2.90	3.04	3.26	3.26	3.10	3.14	3.13	3.97	3.37	3.21	2.84

It can be seen from Table 5.2 that the trial BESD is just above the criterion for the average of the site (2.8 for the network route). In addition, no machine was identified as being more than three times the BESD criterion away from the trial mean for the average of the site (in fact all machines were within two times the BESD criterion of the trial mean).

Although the trial BESD was above the criterion for the average of the site, no machine has been identified as an outlier.

5.2.3 Second set of Straight Line Wet Grip tests (17th April)

The results from the 2nd set of tests on the Straight Line Wet Grip are shown in Table 5.3.

Table 5.3: Average SR from the 2nd set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	63.5	88.1	23.8	47.4	56.8
13	68.2	93.8	26.6	54.3	61.8
16	63.1	89.0	21.8	47.6	56.5
17	61.0	88.8	22.9	44.9	55.3
19	59.1	86.3	21.1	45.9	54.0
21	66.4	93.0	24.6	48.7	59.3
22	61.9	90.5	25.2	51.5	57.9
23	60.5	87.4	23.8	46.8	55.5
24	59.2	85.6	21.0	47.0	54.0
25	61.7	86.2	23.1	48.1	55.8
26	63.0	91.8	23.0	47.7	57.3
28	58.0	85.4	21.3	45.1	53.2
29	60.7	89.9	20.0	45.1	54.9
31	60.9	87.4	23.2	46.1	55.3
33	60.8	88.8	21.5	45.7	55.2
35	65.5	93.8	24.4	51.1	59.7
37	60.5	85.1	21.0	45.5	54.1
38	56.9	82.3	19.7	42.2	51.3
Ref mean	62.0	88.9	22.8	47.6	56.3
Ref BESD	2.69	2.88	1.77	2.58	2.31
Trial mean	61.7	88.5	22.7	47.3	56.0
Trial BESD	2.87	3.19	1.87	2.80	2.53

On examination of Table 5.3 it can be seen that the Trial BESD meets the criterion. In addition, no machine was identified as being more than three times the BESD criterion away from the trial mean for the average of the site.

Therefore, based on this data and the data collected on the network route all machines that attended the trial are deemed acceptable with regards to the reproducibility of skid resistance measurements.

5.3 Summary of skid resistance testing

All machines produced suitable results with regards to repeatability of skid resistance measurement (BRSD criterion, see Appendix D).

All machines produced suitable results with regards to reproducibility of skid measurement (BESD criterion, see Appendix D).

6 Location referencing

6.1 Distance measurement

The assessment of distance measurement recorded by the machines was undertaken using data from the Twin Straights. Testing was undertaken such that at least three passes at 50km/h and 80km/h were achieved for each machine. The data was assessed by comparing the lengths of five sections, A to B, B to C, D to E, E to F and F to G as shown in Figure 3.1 (i.e. excluding the banked bends).

There are three mechanisms for recording location referencing points (from which distances can be determined) in the survey data:

1. Push button entry – survey contractor pushes a button to enter the location of the point manually.
2. Automatic marker detection – using a system to automatically detect the markers, typically retroreflective marker detection.
3. OSGR fitting – identifying locations of the markers using the collected OSGR data and known coordinate positions of the markers.

In order to assess the distance measurement system in isolation, the OSGR fitting method is not typically used in the assessment (as this would introduce an additional variation into the assessment). Therefore, machines are assessed on the push button or automatic marker entry depending on whether the machine has automatic marker detection fitted. To account for potential operator error-in the push button entry method these two approaches have slightly different assessment criteria (see Appendix D).

In order to maintain the high levels of accuracy required by National Highways for their surveys, the machines that have OSGR systems fitted are assessed using the Automatic markers criteria (regardless of whether automatic marker detection is fitted or not).

The distance measurement results from the testing on the Twin Straights are shown in Table 6.1 along with the criteria applied and the performance achieved. Values which do not meet the required percentage for the two assessed intervals (2m for automatic markers and 5m for manual markers) are highlighted in bold red text.

Table 6.1: Distance measurement assessment

ID	Percentage within 1m	Percentage within 2m	Percentage within 5m	Percentage within 10m	Assessment criteria used	Met criterion
3	27%	51%	91%	100%	Automatic	Fail
13	67%	100%	100%	100%	Automatic	Pass
16	69%	98%	98%	98%	Automatic	Pass
17	53%	63%	100%	100%	Automatic	Fail
19	97%	100%	100%	100%	Automatic	Pass
21	89%	100%	100%	100%	Automatic	Pass
22	96%	98%	98%	98%	Automatic	Pass
23	87%	96%	96%	100%	Automatic	Pass
24	18%	68%	100%	100%	Automatic	Fail
25	96%	100%	100%	100%	Automatic	Pass
26	94%	98%	100%	100%	Automatic	Pass
28	100%	100%	100%	100%	Automatic	Pass
29	69%	89%	91%	91%	Automatic	Pass
31	59%	98%	100%	100%	Automatic	Pass
33	34%	64%	98%	100%	Automatic	Fail
35	52%	80%	100%	100%	Automatic	Pass
37	98%	98%	100%	100%	Automatic	Pass
39	100%	100%	100%	100%	Automatic	Pass

From Table 6.1 it can be seen that all but four machines meet the assessment criteria applied.

An assessment of the data from Machine 3 found that although this machine had automatic marker identification fitted, the markers at points B and D were not automatically detected (and were entered manually). It was found that the lower performance displayed by this machine was caused by these manual markers. As such this machine has been identified as suitable with regards to the measurement of distance.

Machine 33 reports OSGR data but does not have automatic marker detection fitted and all markers were manually entered. Examination of the data provided for this machine identified a good performance in the 50km/h tests and a slightly worse performance in the 80km/h tests. This is consistent with errors introduce from manual marker entry. The data provided also met the criteria for manual marker entry. Therefore, this machine has also been identified as suitable with regards to the measurement of distance. However, it was decided that the following additional text would be added to the certificate:

> *"This device did not meet the automatic markers criteria for distance (a requirement for systems providing OSGR data) however it did meet the manual markers criteria."*

Machines 17 and 24 have automatic mark identification fitted and most of the markers were detected on each run. Examination of the lengths reported for these devices saw a consistent and proportional difference from the reference which is indicative of an incorrect distance calibration applied. The operator of these two machines was notified of this issue. They investigated the distance calibration applied and provided updated datasets for these

two machines. The updated results are shown in Table 6.2 and show that the two machines met the assessment criteria.

Table 6.2: Updated distance measurement data for M17 and M24

ID	Percentage within 1m	Percentage within 2m	Percentage within 5m	Percentage within 10m	Assessment criteria used	Met criterion
17	93%	100%	100%	100%	Automatic	Pass
24	96%	100%	100%	100%	Automatic	Pass

Therefore, all machines that attended the trial have been deemed acceptable with regards to distance measurement.

6.2 3 dimensional spatial coordinates data

The assessment of 3 dimensional spatial coordinates is mandatory for any device that is to be used on the central National Highways survey contract and optional for the other devices; fifteen machines took part in these tests.

The assessment is carried out on the Crowthorne network route and the network route near MIRA. The reference data from the Crowthorne network route were obtained from a high-resolution survey conducted by an independent mapping company, and the MIRA network route reference data was supplied by National Highways' HARRIS survey vehicle.

The Crowthorne network route also uses retro reflective marker posts to allow for the automatic detection of markers (where fitted). This site is within a forested area which results in interruption in satellite coverage providing a challenging scenario for the systems. This may highlight machines which are not suitable to survey in these conditions.

Due to the availability of clear marker posts and robust reference data, the Crowthorne network route was assessed against the closed test section criteria. Although the driving line is constrained, this is still a live site and therefore the 2m criteria level requirements were excluded. In the next update to the Accreditation specification the text relating to these criteria will be amended to clarify that live traffic routes which are suitable to be assessed using the closed test section can be assessed against these criteria and the 2m level requirements will be reviewed. The assessment criteria for "closed" and "live" sections as stated in the Accreditation specification are given in Appendix D.

The detailed results from the OSGR and altitude assessments and the criteria applied are given in Appendix C. All machines were assessed using the OSGR fitted criteria along with the corresponding marker entry criteria. Data from any machines which did not provide OSGR fitted data, were fitted by TRL using National Highways' MSP software.

The final performance level awarded to each machine is the same as the lowest level achieved by the device from all of the 3-dimensional spatial coordinate tests completed during the trial.

The summary of the performance achieved on each site and the final awarded performance level are summarised in Table 6.3 and Table 6.4.

Table 6.3: Summary of OSGR assessments

ID	Performance on MIRA Network route (OSGR fitted)	Performance on Crowthorne Network route (Marker entry)	Performance on Crowthorne Network route (OSGR fitted)	Awarded Performance
3	High	Not Suitable	Not Suitable	Not Suitable
13	High	High	High	High
16	High	High	High	High
17	High	Low	Medium	Low
19	High	High	High	High
21	High	Low	High	High (see below)
23	High	High	High	High
24	High	High	High	High
25	High	High	High	High
26	High	Low	Medium	Low
31	High	High	High	High
33	High	High	High	High
35	High	Low	Medium	Low
37	High	High	High	High
39	High	Low	High	Low

Analysis of the data from Machine 21 on the Crowthorne network route identified that the last marker in each direction was manual entry. The incorrect positioning of this marker resulted in the poorer performance for the marker entry dataset for this machine. If the last section is removed for this device the performance raises to 95% within 4m. Due to this, this machine has been awarded the high performance rating.

On examination of the performances for the fleet overall (Table 6.3) it can be seen that there is a mixture of performances. All machines achieved a high performance on the MIRA network route, this is due to the less challenging environment (generally an unobstructed 'view' of the sky and hence satellites) and the lower level criteria specified for this site. Due to the heavy tree coverage, the Crowthorne route generally involves lower quality satellite signals (or complete loss of signal during parts) which can result in the lowest level of specified performance (Not Suitable) from some devices. For the combined assessment, ten machines achieve a high performance rating, four a low and one not suitable.

Table 6.4: Summary of Altitude assessments

ID	Performance on MIRA Network route (OSGR fitted)	Performance on Crowthorne Network route (Marker entry)	Awarded Performance
3	Medium	Not Suitable	Not Suitable
13	High	Medium	Medium
16	Low	Medium	Low
17	High	Medium	Medium
19	High	Medium	Medium
21	Medium	Low	Low
23	Medium	Medium	Medium
24	Medium	Medium	Medium
25	High	Medium	Medium
26	Medium	Medium	Medium
31	High	Medium	Medium
33	High	Medium	Medium
35	Medium	Medium	Medium
37	High	Low	Low
39	Medium	Low	Low

For the measurement of altitude (Table 6.4) ten machines achieved a medium performance rating, four a low and one not suitable. It should be noted that although an altitude assessment is specified this data is not typically used by end users of the data and as such generally has a lower priority assigned to it by operators.

7 File formats

All of the machines that took part in the skid resistance testing supplied suitable ".S10" and ".loc" files. Any device undertaking the OSGR assessment is also required to provide RCD files for the OSGR test sites. In addition, any device that is to be used on the central National Highways contract shall provide BCD data (this is optional for other devices).

All fifteen machines provided RCD files. The following machines provided BCD files:

- Machine 13
- Machine 17
- Machine 19
- Machine 23
- Machine 24
- Machine 25
- Machine 26
- Machine 31
- Machine 37
- Machine 39

Examination of the supplied RCD and BCD found that the data formatting was suitable.

8 Conclusions and recommendations

The 2025 sideway-force skid resistance accreditation trial was held during the week commencing 14th April 2025. The trial was held on and around the MIRA proving ground and on a Network route near TRL in Crowthorne. Eighteen machines attended.

The following conclusions were drawn in relation to the various mandatory tests and assessments:

(i) General condition

No machines were identified as having any issues with their general condition during the trial.

(ii) Skid resistance measurement

All eighteen machines met the criteria for the measurement of skid resistance at the trial.

(iii) Vehicle Speed attainment and recording

All eighteen machines were identified as suitable for vehicle speed attainment and recording. Due to issues with undertaking this test, all machines had an additional comment added to the certificate for this test.

(iv) Distance measurement

Seventeen machines met the automatic markers criteria. One machine met the manual markers criteria.

(v) Left test wheel weight

All eighteen machines met the current ±8 kg tolerance for the left test wheel weight.

(vi) Water flow

All eighteen machines were found to provide satisfactory water flow and direction.

The following conclusions were drawn in relation to the various additional tests and assessments (note: OSGR is mandatory for machines operating on the central National Highways survey contract and optional for others):

(vii) Measurement of OSGRs

OSGR data was provided from fifteen machines for assessment. Ten machines achieved a high performance, four a low and one not suitable.

(viii) Measurement of Altitude

Altitude data was provided from fifteen machines for assessment. Ten machines achieved a medium performance, four a low and one not suitable.

(ix) File formats

All eighteen machines supplied.s10 and .loc files. Fifteen machines provided RCD files. BCD files were provided for ten machines. All of the provided files were found to be suitably formatted.

A summary of the machines that attended the 2025 accreditation trial and the criteria that they met can be found in Appendix A.

It is acknowledged that the current accreditation and QA specification requires updating to more accurately reflect the current OSGR assessment process (use of controlled network route vs test track). Therefore, this should be considered when the document is next reviewed.

References

BSI. (2006). *BS 7941-1. Methods for measuring the skid resistance of pavement surfaces - Sideway-force coefficient routine investigation machine.* London: BSi.

BSI. (2009). *DD CEN/TS15901-6:2009. Road and airfield surface characteristics. Procedure for determining the skid resistance of a pavement surface by measurement of the sideway force coefficient (SFCS).* BSi.

DMRB CS 228. (n.d.). *Design Manual for Roads and Bridges Volume 7 Section 1, CS 228 Skidding resistance*. London: The Stationery Office.

TRL. (2020). *Accreditation and Quality Assurance of Sideways Force Skid Resistance Survey Devices v4.1 [online]. [Accessed 4th March 2021].* Available from World Wide Web: https://ukrlg.ciht.org.uk/ukrlg-home/guidance/road-condition-information/data-collection/skid-resistance/.

Acknowledgements

The author wishes to thank the operators of the sideway-force coefficient routine investigation machines for their co-operation in the accreditation process. The author is also grateful to Martin Greene who provided expert technical advice on skid resistance measurements. The author also wishes to thank Darius Singfield for running the trial and to Chris Collis, Jake Ellis, Jenessa Norman, Pawel Zwierzchowski and Roy Jaques in supporting the running of the trial.

Appendix A Machine identification and performance

Table A.1: Machine identification and performance summary

ID	Current Owner	Registration number	Skid resistance	Speed	Distance travelled[1]	Weight	OSGR	Altitude	S10 and loc file	RCD file	BCD file
3	DFI Roads	IKZ 2203	Pass	Pass	Pass	Pass	Not Suitable	Not Suitable	Satisfactory	Satisfactory	-
13	WDM Ltd	S700 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
16	XAIS-PTS	S66 HSL	Pass	Pass	Pass	Pass	High	Low	Satisfactory	Satisfactory	-
17	WDM Ltd	S800 WDM	Pass	Pass	Pass	Pass	Low	Medium	Satisfactory	Satisfactory	Satisfactory
19	WDM Ltd	S900 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
21	Surrey CC	KX07YXH	Pass	Pass	Pass	Pass	High	Low	Satisfactory	Satisfactory	-
22	XAIS-PTS	KX07YVH	Pass	Pass	Pass	Pass	-	-	Satisfactory	-	-
23	WDM Ltd	S11 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
24	WDM Ltd	S12 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
25	WDM Ltd	S13 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
26	WDM Ltd	S14 WDM	Pass	Pass	Pass	Pass	Low	Medium	Satisfactory	Satisfactory	Satisfactory
28	National Highways[2]	WX60 AXN	Pass	Pass	Pass	Pass	-	-	Satisfactory	-	-
29	XAIS-PTS	YD02 XSN	Pass	Pass	Pass	Pass	-	-	Satisfactory	-	-
31	WDM Ltd	S16 WDM	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
33	PMS	17 2G 1777	Pass	Pass	Pass*[3]	Pass	High	Medium	Satisfactory	Satisfactory	-
35	PMS	22 1G 1770	Pass	Pass	Pass	Pass	Low	Medium	Satisfactory	Satisfactory	-
37	WDM Ltd	S18 WDM	Pass	Pass	Pass	Pass	High	Low	Satisfactory	Satisfactory	Satisfactory
39	WDM Ltd	S19 WDM	Pass	Pass	Pass	Pass	Low	Low	Satisfactory	Satisfactory	Satisfactory

[1] Machines are assessed on different criteria depending on the equipment fitted. See section 6.1 or the test certificate for details on criteria used.

[2] Operated by TRL on behalf of National Highways

[3] Did not meet the automatic markers criteria (requirement if OSGR fitted). No automatic marker detection was fitted and the machine met the manual markers criteria.

Appendix B Between run standard deviation

Values that are within the BRSD criteria (see Appendix D) are shaded in green. Values up to 1 standard deviation greater than the criteria are shaded in orange, and greater than this in red. Note: averages are calculated by taking the square root of the average variance.

Table B.1: Between run SD for the 1st set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	1.31	0.94	0.64	3.37	1.82
13	2.46	2.33	1.03	4.72	2.89
16	2.67	1.22	0.95	1.93	1.97
17	1.42	1.24	0.70	2.44	1.56
19	0.83	1.64	0.68	2.94	1.67
21	2.24	1.68	2.06	2.74	2.22
22	5.38	4.09	2.67	3.66	4.28
23	1.85	1.12	2.23	3.42	2.25
24	2.17	1.93	0.05	0.19	1.58
25	1.10	1.47	2.94	2.75	2.09
26	1.00	0.62	0.60	1.77	1.09
28	0.92	0.82	1.14	1.54	1.11
29	1.75	2.17	4.71	4.14	3.25
31	1.26	1.01	0.93	1.64	1.24
33	1.60	1.20	1.44	2.55	1.75
35	1.46	0.67	0.73	3.55	1.92
37	1.05	1.68	0.26	1.59	1.25
39	2.05	2.28	2.13	3.35	2.45
Avg	2.08	1.75	1.83	2.89	2.17

Table B.2: Between run SD for the Network route

ID	NSM 01	NSM 02	NSM 03	NSM 04	NSM 05	NSM 06	NSM 07	NSM 08	NSM 09	NSM 10	NSM 11	NSM 12	NSM 13	NSM 14	Avg
3	2.80	2.32	4.87	1.65	1.43	1.77	1.65	1.19	1.61	2.21	1.85	3.37	2.23	4.54	2.38
13	2.72	1.09	1.09	2.06	1.68	0.80	1.12	1.09	1.91	2.92	4.14	2.47	4.51	3.28	1.79
16	3.59	3.54	0.91	2.74	3.49	1.28	2.05	4.04	1.50	1.48	3.08	2.48	3.93	1.84	2.69
17	1.87	0.29	2.24	0.82	0.71	0.99	1.20	0.66	2.09	1.67	1.51	1.81	1.75	1.72	1.40
19	1.25	0.95	0.62	0.48	1.01	1.08	0.47	2.79	1.94	3.11	0.48	2.46	3.19	0.74	1.63
21	2.38	2.87	3.89	3.65	2.82	4.01	3.92	3.69	3.49	3.37	2.72	3.84	3.86	3.71	3.45
22	1.88	3.41	1.21	1.57	1.46	1.50	1.32	0.74	1.08	1.37	1.01	1.04	0.69	1.84	1.70
23	1.58	3.16	2.21	2.61	3.96	2.13	0.80	2.96	2.38	2.28	0.85	1.74	2.63	3.10	2.55
24	0.88	0.53	1.27	2.66	1.70	10.64	4.96	1.83	2.18	1.10	0.50	3.09	0.98	1.12	4.00
25	1.55	4.78	0.55	0.66	1.29	2.22	2.12	1.19	0.87	2.47	0.68	0.57	2.80	2.74	2.13
26	0.37	1.82	0.76	1.50	1.56	1.04	1.22	1.46	1.09	2.53	0.84	1.29	1.54	0.66	1.45
28	1.00	0.31	2.55	1.88	0.76	1.59	0.33	1.82	0.54	0.70	0.75	1.38	1.45	0.48	1.36
29	1.13	2.50	1.19	1.39	2.06	5.99	5.09	1.60	1.78	1.83	1.17	2.24	2.38	4.07	2.93
31	3.24	2.52	1.33	2.33	2.00	1.71	1.57	1.78	1.53	0.21	0.31	1.13	2.77	1.75	1.97
33	2.95	2.52	2.37	1.31	0.67	0.73	0.47	0.87	0.65	1.92	2.06	2.57	3.14	1.54	1.69
35	4.17	2.78	3.04	2.01	1.44	2.75	2.90	0.94	3.38	4.85	2.60	2.98	1.49	2.21	3.04
37	3.04	1.47	0.88	1.50	0.57	0.35	0.76	0.64	1.02	3.30	2.83	1.19	0.82	1.27	1.67
39	1.76	1.08	1.06	1.36	0.51	1.55	1.33	0.23	1.18	1.32	0.72	1.93	1.07	1.13	1.22
Avg	2.35	2.43	2.13	1.95	1.87	3.35	2.33	1.95	1.86	2.40	1.90	2.26	2.55	2.41	2.30

Table B.3: Between run SD for the 2nd set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	1.47	0.98	0.47	3.24	1.81
13	2.06	2.44	2.59	3.77	2.70
16	1.03	1.62	0.87	5.83	2.90
17	0.48	2.09	0.67	1.38	1.23
19	0.98	0.74	0.19	1.36	0.93
21	2.61	2.64	3.20	5.26	3.47
22	3.52	2.41	3.77	4.83	3.70
23	1.12	1.39	0.78	3.77	2.01
24	2.16	1.14	1.53	2.97	2.08
25	2.81	1.04	1.42	2.45	2.18
26	0.39	0.99	0.57	1.91	1.06
28	1.45	1.97	1.41	2.63	1.87
29	1.71	1.41	1.11	1.46	1.48
31	0.52	1.40	0.94	2.99	1.62
33	1.54	0.94	1.58	3.73	2.13
35	2.82	2.25	0.79	2.05	2.22
37	0.80	1.22	0.34	3.24	1.68
39	1.13	0.90	0.85	2.15	1.33
Avg	1.82	1.64	1.60	3.31	2.16

Appendix C Assessment of 3-dimensional spatial coordinates data

C.1 OSGR data

Table C.1: OSGR performance (percentage of 10m data points within): MIRA Network route –OSGR fitted data

ID	3m	6m	12m	17m	20m	25m	30m	Performance
3	97%	100%	100%	100%	100%	100%	100%	High
13	99%	100%	100%	100%	100%	100%	100%	High
16	100%	100%	100%	100%	100%	100%	100%	High
17	99%	100%	100%	100%	100%	100%	100%	High
19	99%	100%	100%	100%	100%	100%	100%	High
21	88%	100%	100%	100%	100%	100%	100%	High
23	91%	95%	99%	100%	100%	100%	100%	High
24	100%	100%	100%	100%	100%	100%	100%	High
25	99%	100%	100%	100%	100%	100%	100%	High
26	99%	100%	100%	100%	100%	100%	100%	High
31	98%	100%	100%	100%	100%	100%	100%	High
33	98%	100%	100%	100%	100%	100%	100%	High
35	95%	100%	100%	100%	100%	100%	100%	High
37	99%	100%	100%	100%	100%	100%	100%	High
39	98%	100%	100%	100%	100%	100%	100%	High

Table C.2: OSGR performance (percentage of 10m data points within): Crowthorne network route –OSGR fitted data

ID	2m	4m	5m	7m	8m	20m	25m	Performance
3	50%	84%	86%	91%	92%	97%	99%	Not Suitable
13	95%	100%	100%	100%	100%	100%	100%	High
16	91%	100%	100%	100%	100%	100%	100%	High
17	47%	91%	93%	99%	100%	100%	100%	Medium
19	83%	100%	100%	100%	100%	100%	100%	High
21	87%	99%	100%	100%	100%	100%	100%	High
23	84%	99%	100%	100%	100%	100%	100%	High
24	88%	100%	100%	100%	100%	100%	100%	High
25	94%	100%	100%	100%	100%	100%	100%	High
26	72%	91%	95%	100%	100%	100%	100%	Medium
31	92%	100%	100%	100%	100%	100%	100%	High
33	86%	100%	100%	100%	100%	100%	100%	High
35	70%	91%	94%	95%	96%	100%	100%	Medium
37	92%	100%	100%	100%	100%	100%	100%	High
39	70%	97%	100%	100%	100%	100%	100%	High

Table C.3: OSGR performance (percentage of 10m data points within): Crowthorne network route–Push button or automatic marker data

ID	2m	4m	5m	7m	8m	20m	25m	Marker entry type	Performance
3	19%	81%	85%	90%	91%	97%	98%	Automatic	Not Suitable
13	80%	99%	100%	100%	100%	100%	100%	Automatic	High
16	78%	100%	100%	100%	100%	100%	100%	Automatic	High
17	24%	83%	92%	99%	100%	100%	100%	Automatic	Low
19	61%	100%	100%	100%	100%	100%	100%	Automatic	High
21	58%	88%	95%	100%	100%	100%	100%	Automatic	Low
23	71%	99%	100%	100%	100%	100%	100%	Automatic	High
24	71%	100%	100%	100%	100%	100%	100%	Automatic	High
25	75%	99%	100%	100%	100%	100%	100%	Automatic	High
26	32%	83%	92%	100%	100%	100%	100%	Automatic	Low
31	36%	99%	100%	100%	100%	100%	100%	Automatic	High
33	76%	97%	98%	98%	98%	100%	100%	Push	High
35	16%	60%	85%	95%	96%	100%	100%	Push	Low
37	54%	99%	100%	100%	100%	100%	100%	Automatic	High
39	34%	59%	87%	100%	100%	100%	100%	Automatic	Low

C.2 Altitude data

Table C.4: Altitude performance (percentage of 10m data points within): MIRA Network route – OSGR fitted data

ID	2m	4m	5m	6m	20m	Performance
3	88%	100%	100%	100%	100%	Medium
13	97%	100%	100%	100%	100%	High
16	0%	71%	97%	100%	100%	Low
17	91%	100%	100%	100%	100%	High
19	97%	100%	100%	100%	100%	High
21	56%	100%	100%	100%	100%	Medium
23	87%	100%	100%	100%	100%	Medium
24	88%	100%	100%	100%	100%	Medium
25	90%	100%	100%	100%	100%	High
26	83%	100%	100%	100%	100%	Medium
31	95%	100%	100%	100%	100%	High
33	91%	100%	100%	100%	100%	High
35	72%	100%	100%	100%	100%	Medium
37	93%	100%	100%	100%	100%	High
39	66%	99%	100%	100%	100%	Medium

Table C.5: Altitude performance (percentage of 10m data points within): Crowthorne Network route – Push button or automatic marker data

ID	2m	4m	5m	6m	20m	Performance
3	18%	46%	63%	71%	92%	Not Suitable
13	89%	100%	100%	100%	100%	Medium
16	39%	92%	100%	100%	100%	Medium
17	82%	98%	100%	100%	100%	Medium
19	76%	100%	100%	100%	100%	Medium
21	0%	6%	40%	74%	100%	Low
23	71%	100%	100%	100%	100%	Medium
24	62%	98%	100%	100%	100%	Medium
25	71%	95%	100%	100%	100%	Medium
26	72%	89%	91%	93%	100%	Medium
31	79%	98%	100%	100%	100%	Medium
33	70%	90%	98%	98%	100%	Medium
35	51%	87%	94%	97%	100%	Medium
37	12%	59%	88%	98%	100%	Low
39	0%	19%	53%	70%	100%	Low

Appendix D Assessment criteria

The accreditation trial criteria are specified in "Accreditation and Quality Assurance of Sideways Force Skid Resistance Survey Devices" (TRL, 2020). This document is a live document (i.e. is subject to change) and the June 2020 version of the document was used for the 2023 Accreditation trial. The relevant section of the document is reproduced verbatim below (including the section numbering from that document) in section D.1. Note in the text below:

- "Equipment" is a defined term and refers to the overall machine being assessed, incorporating the measuring systems and the survey vehicle.
- "System" refers to an individual measurement system installed on the Equipment, e.g. the sideway-force measurement system, GPS, distance measurement system, etc.
- "Employer" refers to the organisation that commissions the Survey Contractor to complete a survey and will generally be the final user of the data provided.
- "Owner" refers to the organisation or individual to which Equipment belongs and to whom Accreditation Certificates are awarded.

D.1 Trial criteria from the Accreditation and QA document

E.3 Equipment inspection

E3.1 Equipment shall be inspected to ensure that they are in a suitable condition to conduct the tests. Contractors should be provided with an inspection check sheet to complete and provide to the Auditor in advance of the Trial.

E3.2 Inspections shall include:

- Water flow System (including verification of flow rate, nozzle alignment and general condition).
- Verification of the test wheel weight.
- Verifying that the Equipment is in good general mechanical order.

E3.3 During the trial the Auditor should confirm that the Contractors have undertaken the following calibrations:

- Vertical load System
- Horizontal load System

E.4 Running Trials

E4.1 Overview

E4.1.1 As detailed in Appendix B, trials shall be carried out on a test site separated into test stations, and laid out such that laps of the set of test sections can be undertaken by the Fleet for the purposes of repeating the measurements.

E4.2 Skid resistance testing – Mandatory Requirement

E4.2.1 The assessment for skid resistance measurements is described below, and a worked example is provided in Appendix C.

E4.2.2 Some Equipment may have skid resistance measurement Systems fitted to both the nearside and offside of the Equipment. If fitted then these systems should be assessed independently and given independent Accreditation results. This requires that suitable reference data is collected for both wheel paths or that the Equipment test on offset driving lines so that the test wheel traffics the same part of the test surface. The Auditor may specify that only one side of the Equipment will be assessed.

E4.2.3 The Equipment shall undertake laps so that the following criteria are met:

- At least 3 laps are undertaken that comply with the requirements for Reference Data (see Appendix B, App B.3).
- Survey data is collected at the target test speed.

E4.2.4 The Contractor shall supply the skid resistance measurements for their Equipment from each test lap in the file formats specified by the Auditor.

E4.2.5 The Auditor shall calculate:

- The mean values for the Equipment for each 100m length test section or the length of the test section if shorter (averaging together the repeat measurements).
- The standard deviation of these mean values for the Fleet and for all of the Equipment at the trial, referred to as the Fleet between-Equipment standard deviation (BESD) and the Trial BESD. These values shall be used to assess the consistency of the Equipment at the Trial.
- The standard deviation of the skid resistance values between runs for the Equipment for 100m lengths (or the length of the test section if shorter). This data is referred to as the between-run standard deviation (BRSD). These values shall be used to assess the repeatability of each individual Equipment.

E4.2.6 The BRSD assessment criterion is given in Table 1. Where the BRSD criterion is exceeded, the data shall be examined for any obvious error, for example as a result of significant variation in test line, and if necessary individual runs on that section may be excluded from subsequent analysis. If Equipment consistently records data with unacceptable between-run standard deviation, the data from that Equipment shall be regarded as unacceptable.

E4.2.7 The Trial BESD shall be acceptable if it is below the criterion given in Table 1. If the Trial BESD exceeds this criterion then the data shall be further examined to identify outlying Equipment. This should include examining the fleet BESD and data from individual Equipment. Outlying Equipment shall be rejected and the data reassessed until the performance is acceptable.

E4.2.8 In addition, any Equipment that deviates by more than 3 times the BESD criterion from the Fleet mean shall be rejected. Any Equipment that is between two and three times the BESD criterion from the all-Equipment mean shall be subject to further investigation.

E4.2.9 The data from any Equipment rejected due to the BRSD, BESD or otherwise identified as an outlier shall not be used in the calculation of the Reference Data (App B.3.1).

Table 1 – Acceptance Criteria for Skid resistance measurements

Parameter	Acceptability Limit
Between run standard deviation (BRSD)	Investigate if >3 SR on 100m lengths
Between Equipment standard deviation (BESD) on closed site (e.g. test track)	≤2.7 SR
Between Equipment standard deviation (BESD) on live site (e.g. network route)	≤2.8 SR

E4.2.10 The Auditor should also review the vertical load Parameter in the data collected at the trial with the aim to identify anomalies and to develop tests for this Parameter to be included in future specifications. If the Auditor identifies anomalies in this data, this may lead to additional testing of Equipment, Accreditation for Equipment being withheld and/or issuing of Improvement Notices (see Section H).

E4.2.11 In addition to the above assessments the Auditor should review the profiles of the Survey Data over the site for each Equipment and investigate any anomalies. Based on the results of the investigation the Auditor may withhold Accreditation for Equipment and/or issue an Improvement Notice as detailed in Section H.

E4.3 Vehicle Speed – Mandatory Requirement

E4.3.1 The assessment of vehicle speed is split into two parts:

- The speed recorded by the Equipment compared with the independently measured speed
- The speed recorded by the independent measure compared with the required target survey speed.

E4.3.2 The test shall be carried out on at least 3 test laps at each target survey speed.

E4.3.3 The acceptance criteria for vehicle speed measurement are given in Table 2.

Table 2 – Acceptance Criteria for Vehicle Speed Measurement

Parameter	Acceptability Limit
Vehicle Speed recorded by the Equipment compared to independent measure	≥80% within ± 1km/h of the independently measured speed
Vehicle speed recorded by the independent measure compared to the target speed	≥80% within ± 3km/h of required target speed

E4.4 Location Referencing – Distance Criteria

E4.4.1 The Accreditation of distance measurement shall be carried out using at least 6 measurements of distance made using the Equipment.

E4.4.2 There are three mechanisms for recording location referencing points in the survey data:

- Push button entry relies on the survey operator pushing a button to enter the location of the point manually.
- Automatic marker uses a system which automatically detects the markers.
- OSGR fitted utilises the coordinate data to identify the elapsed chainage of the location reference points within the survey data.

E4.4.3 The push button entry approach will include some operator error and therefore it is expected that Equipment using this approach will be less accurate than the other methods. The criteria applied to the test measurements for the push button and automatic markers are given in Table 3.

Table 3 – Criteria for measurement of distance travelled for repeatability and reproducibility

Parameter	Push button entry	Automatic markers (where available)
Distance measured	≥80% within 5m	≥80% within 2m

E4.4.4 If the Survey Contractor will be supplying data to a Customer with OSGR fitted location reference points then the original survey data for these Equipment (i.e. not OSGR fitted) shall be assessed on the automatic markers criteria (regardless of the marker entry method used during the survey).

E4.5 Test wheel weight

E4.5.1 The Accreditation of test wheel weight shall be carried out using at least 3 measurements. There can be a tendency for the shaft bearings to stick slightly when the wheel is first lowered (without the shaking action that would be experienced on the moving vehicle at the start of a survey run). For this reason, the assessment shall be carried out after the bearings have been released (achieved by applying foot pressure to the wheel arm bearing and "bouncing" the back-plate against the suspension damper and spring).

E4.5.2 For this assessment the test wheel shall be raised/lowered and the "un-bounced" measurement taken. The System shall then be bounced and the "bounced" measurement taken. This process shall be repeated until at least 3 sets of measurements have been taken. The Auditor should review the differences between the bounced and un-bounced values and the ranges for the three sets of measurements. The "bounced" measurements made shall be averaged together and the criteria applied are given in Table 4.

Table 4 – Criteria for test wheel weight

Parameter	Acceptability Limit
"Bounced" test wheel weight	200±8kg

E4.6 Water flow

E4.6.1 The water delivery system shall be inspected and checked to confirm that the Equipment is delivering water at an acceptable rate and to the correct position on the road surface. The water flow delivery system is required to achieve a target

water film thickness of 0.5mm at 50km/h. Due to differences in design (e.g. position of the nozzle) the target flow rate to achieve this will differ between Equipment. The target flow rate for each Equipment shall be determined (through consultation between the Auditor and the Developer). Each Equipment shall be tested to confirm that the flow rate supplied is within the criteria given in Table 5. In the cases where the Equipment incorporates a speed controlled water flow system, the flow rate will be assessed using both 50km/h and 80km/h test pulses.

Table 5 – Criteria for water flow rate

Parameter	Acceptability Limit
Water flow rate	Within 10% of the target flow rate

E.5 Additional Tests

E5.1 Overview

E5.1.1 This sub-section describes the additional criteria which may be assessed to provide additional information on the capabilities of the Equipment. These criteria are assessed as High, Medium and Low levels of performance. These criteria typically include the assessment of Systems not fitted to all Equipment and/or tests which are not as mature as the mandatory assessments. In future revisions to this document some or all of these criteria may become mandatory criteria.

E5.1.2 Some Employers may require a specific level of performance in some or all of these additional tests to carry out Accredited Surveys on their Network.

E5.2 Location Referencing – OSGR data

E5.2.1 As noted in E4.4.2 there are three mechanisms for recording the location of location referencing points. The differences in these approaches result in different criteria for OSGR assessment. However, it is noted that automatic marker detection is normally not possible on a network route test and as such no automatic marker criteria are given for the network route.

E5.2.2 OSGR Systems shall be assessed using both the OSGR fitted criteria and the marker entry criteria (Push or Automatic) matching the method used during the survey. The criteria applied shall be noted on the Accreditation certificate. If the Survey Contractor does not supply OSGR fitted data, then the data will be fitted by the Auditor and noted as such on the Accreditation Certificate.

E5.2.3 OSGR data collected from the closed test sections shall be assessed using the criteria given in Table 6.

Table 6 – Closed test section: Criteria for OSGR data of individual 10m data points

Performance level	Push button entry	Automatic markers (where available)	OSGR fitted
High	90% within 5m 95% within 7m 100% within 20m	90% within 2m 95% within 4m 100% within 20m	90% within 2m 95% within 4m 100% within 20m
Medium	80% within 5m 90% within 7m 100% within 20m	80% within 2m 90% within 4m 100% within 20m	80% within 2m 90% within 4m 100% within 20m
Low	80% within 8m 100% within 20m	80% within 5m 100% within 20m	80% within 5m 100% within 20m
Not suitable	Otherwise	Otherwise	Otherwise

E5.2.4 OSGR data collected from a live traffic route shall be assessed using the criteria given in Table 7

Table 7 – Live traffic route: Criteria for OSGR data of individual 10m data points

Performance level	Push button entry	OSGR fitted
High	90% within 12m 100% within 25m	90% within 6m 100% within 20m
Medium	90% within 17m 100% within 25m	90% within 12m 100% within 25m
Low	100% within 25m	100% within 25m
Not suitable	Otherwise	Otherwise

E5.2.5 The OSGR performance recorded on the Accreditation Certificate shall correspond to the lowest performance of all of the test sites used and the criteria applied, unless it is identified that some data should be disregarded. If any data is disregarded then this should be recorded on the Accreditation Certificate along with the reasons.

E5.3 Location Referencing – Altitude data

E5.3.1 Altitude data collected shall be assessed using the criteria given in Table 8.

Table 8 –Criteria for Altitude data of individual 10m data points

Performance level	Criteria
High	90% within 2m 95% within 5m 100% within 20m
Medium	80% within 4m 90% within 6m 100% within 20m
Low	100% within 20m
Not suitable	Otherwise

E.6 Checking of file formats

E6.1.1 Some Employers require the production of data in specific data formats, for example Highways England requires data to be produced as Raw Condition Data (RCD) and Base Condition Data (BCD). Where required, Owners shall be asked to deliver accreditation data files in the required format.

National Highways 2025 accreditation trial for sideway-force skid resistance devices

A key element in the successful maintenance of a road network is the availability of accurate, reliable and consistent survey data. To this aim, National Highways commission annual accreditation trial for Sideways Force Skid Resistance devices supported by ongoing QA for the devices. In order to undertake accredited surveys, the survey devices are required to meet the mandatory criteria of the trial.

This report covers the 2025 trial run by TRL and held in the week beginning the 14th April 2025.

Other titles from this subject area

PPR2047	National Highways 2024 accreditation trial for sideway-force skid resistance devices. S Brittain. 2026
PPR2046	National Highways 2023 accreditation trial for sideway-force skid resistance devices . S Brittain. 2026
PPR2045	National Highways 2022 accreditation trial for sideway-force skid resistance devices. S Brittain. 2026
PPR1021	Highways England 2021 national accreditation trial for sideway-force skid resistance devices. S Brittain. 2022

TRL
Unit 19 The Business Centre, Molly Millars Lane,
Wokingham, Berkshire, RG41 2QY,
United Kingdom
T: +44 (0) 1344 773131
E: enquiries@trl.co.uk
W: www.trl.co.uk

ISSN 2514-9652

DOI 10.58446/fcmi9373

PPR2065