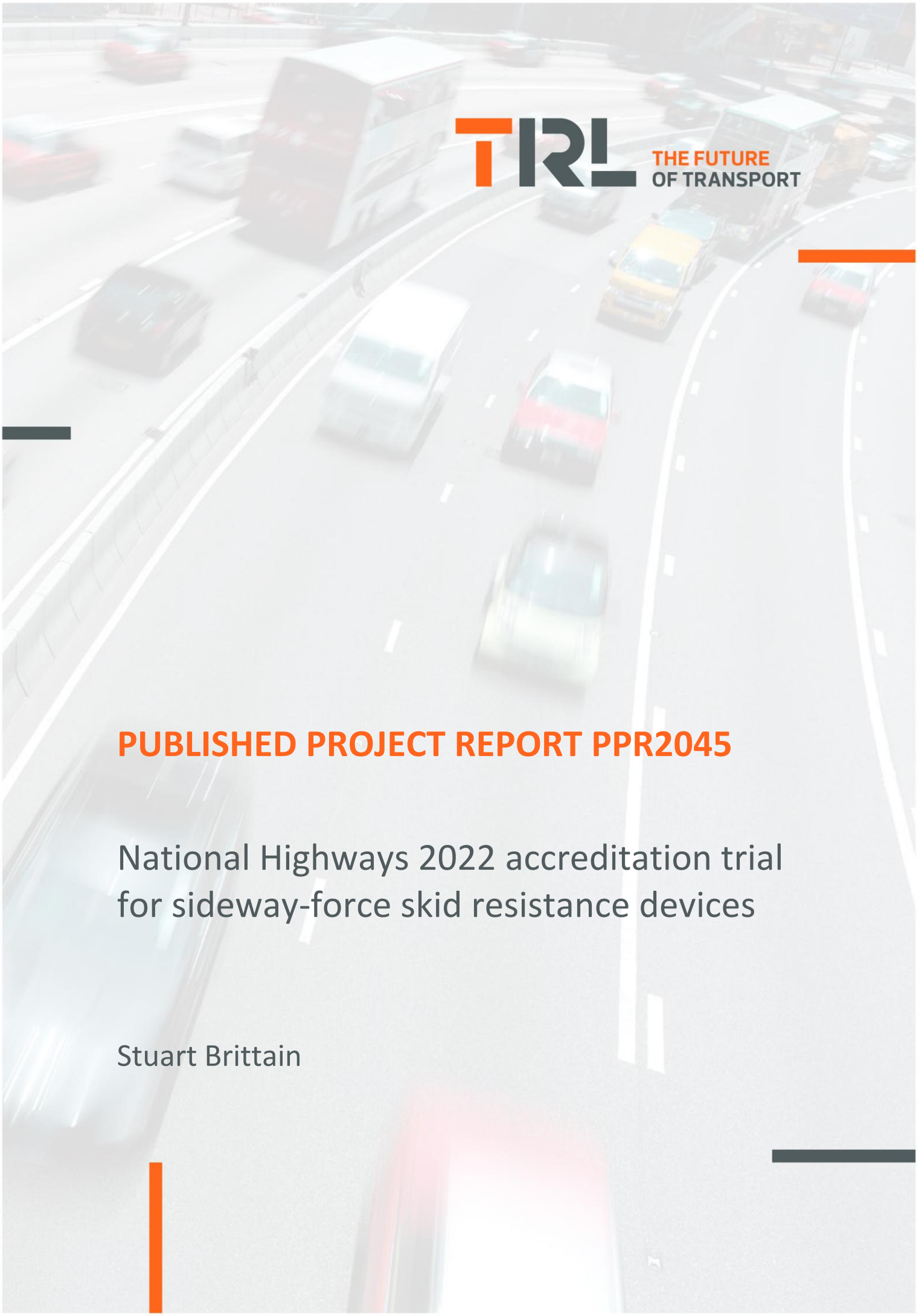

THE FUTURE OF TRANSPORT

PUBLISHED PROJECT REPORT PPR2045

National Highways 2022 accreditation trial for sideway-force skid resistance devices

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Report details

Report prepared for:	National Highways		
Project/customer reference:	SPaTS2 T-0167 PAAQA4		
Copyright:	© Transport Research Laboratory		
Report date:	14/06/2022		
Report status/version:	Issue 1		
Quality approval:			
Stephanie Davison (Project Manager)	**Stephanie Davison**	Martin Greene (Technical Reviewer)	**Martin Greene**

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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 2022 accreditation trial was held during the week beginning 11th April 2022. Due to the ongoing health situation of COVID-19 and the presence of the bank holiday on the Friday, the trial structure was different to previous years. However, the trial process included all of the required assessments. Seventeen machines attended, including one machine that operates in the USA.

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

- All seventeen machines were found to be satisfactory with regards to the machine being in good general mechanical order and test wheel weight.
- All seventeen machines met the criteria for the skid resistance measurements.
- All seventeen machines met the criteria for vehicle speed.
- Fourteen of the seventeen machines met the criteria with regards to the measurement of distance using the primary test site for this measurement. The remaining three were deemed acceptable following more in-depth investigations using additional test sites.
- All seventeen machines provided satisfactory water flow rate and direction.

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

- Fourteen machines fitted with 3-dimensional spatial coordinate systems were assessed for the measurement of OSGRs. Ten machines achieved a high performance, three a low performance and one was identified as not suitable.
- Fourteen machines fitted with 3-dimensional spatial coordinate systems were assessed for the measurement of altitude. Two machines achieved a high performance, seven a medium performance and five a low performance.

Overall, the trials 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 2022 sideway-force skid resistance accreditation trials were held on behalf of National Highways, during the week commencing 11th April 2022. The trials were held on the HORIBA-MIRA proving ground (referred to as MIRA in the rest of this report) and on two Network routes. Sixteen machines based in the UK and one machine based in the USA 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 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 accreditations since 1995. For the 2022 trial a modified trial process was implemented. This was due to the ongoing situation with COVID-19 and because the Friday of the week of the trial was a bank holiday. This resulted in a need to finish early on the Thursday to allow participants to return home before the bank holiday. However, the content and robustness of the trial was not compromised to achieve this altered timetable.

The 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. **OSGR (Crowthorne network route)**: Machines with OSGR systems fitted undertook surveys of the Crowthorne network route, in either the week 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 (three at 50km/h and three at 80km/h for each machine) were undertaken on the Twin Straights, with timing gates setup over one section on the site. Data from this testing were used to assess the distance and speed measurements of the machines.
4. **Skid Resistance measurements (MIRA)** Laps (target of five at 50km/h for each machine) 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 the 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 (three for each machine) 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**: The SLWG testing (five laps at 50km/h for each machine) 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 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 2022.

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

2 Pre-trial preparation

2.1 Test wheel weighing and vertical calibrations

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

2.2 Test tyres

Small variations in skid resistance measurements can be caused by differences between test tyres fitted to different machines. Although it has been found generally to not be a large source of variation, the tyres purchased for this work were scrubbed in prior to the trial and the data produced was checked for 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 are undertaken to identify if there could be any issues with using the routes (e.g. road works) 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 identified that a contraflow was in place on a section of the network route near MIRA, however it would still be possible to undertake testing on the route (following the contraflow diversions). The effected length was excluded from the OSGR assessment as the reference data would not be appropriate.

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

There is always an element of variability in the measurements that is a result of drivers following slightly different test 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. For this reason, the test line to follow is explicitly identified on appropriate parts of the test track. This was achieved by placing cones 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 Crowthorne for the assessment of OSGR/Altitude measurement systems.

3.1 Twin straights

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

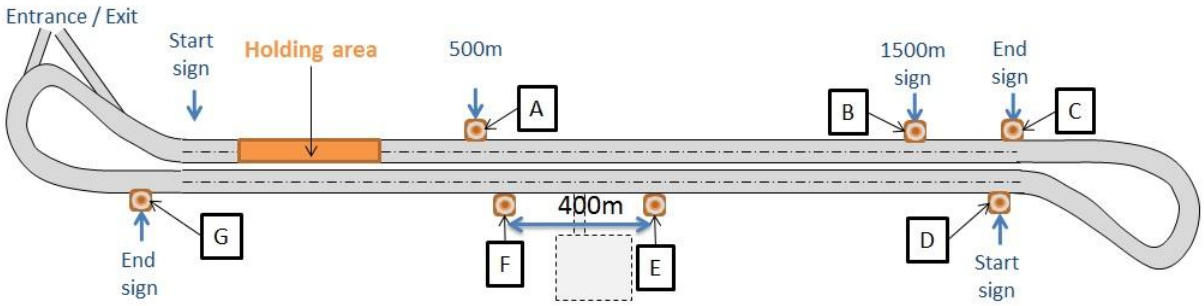

Figure 3.1: Overview of Twin Straights and position of marker points

The skid resistance data is assessed on the length between markers E and G, and utilises the National Highways calibration site. Six sections on this length have been selected for analysis. The position of these sections is shown in Figure 3.2. Details of the surfaces are given in Table 3.1.

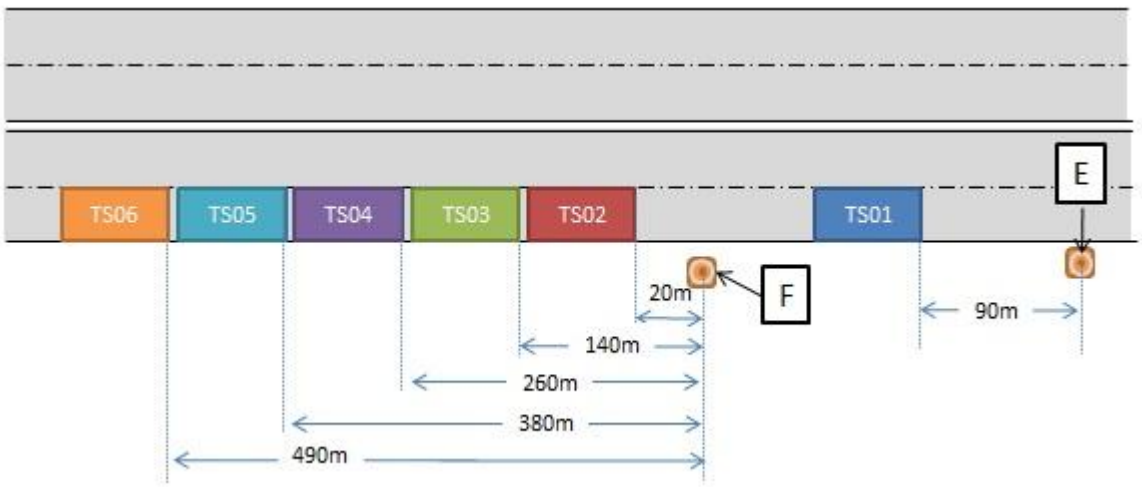

Figure 3.2: Skid resistance test sections on Twin Straights

Table 3.1: Skid resistance test sections on Twin Straights

Section	Length (m)	Surface description
TS01	130	Normal track surface, thin surfacing applied in October 2013.
TS02	100*	A proprietary thin surfacing material using 6 mm coarse aggregate and polymer-modified bitumen. The small-size particles are closely packed and the texture is formed by large numbers of relatively narrow and shallow gaps between them. This type of surfacing generates very low levels of traffic noise but it has a relatively lower texture depth (compared with other thin surfacings with coarser aggregates). Laid in October 2010.
TS03	100*	A proprietary thin surfacing material using 10 mm coarse aggregate and a fibre-reinforced bitumen. This is typical of low-noise asphalt materials laid on many roads. Laid in October 2010.
TS04	100*	A proprietary thin surfacing material using 14 mm coarse aggregate. It has a rather more open grading, and hence greater texture depth, than the surfacings with the smaller aggregate. Laid in October 2010.
TS05	50*	A hot-rolled asphalt mat into which 20 mm chippings that have been lightly pre-coated with bitumen are rolled while the asphalt is still hot. This is the "traditional" material used commonly on UK main roads until the introduction of thin surfacings from about 1990. Laid in October 2010.
TS06	100	Normal track surface, thin surfacing applied in October 2013.

* The trial lengths are shorter than each surfacing so as to exclude the transitions between the different surfaces.

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 3.3 and details of the sections are given in Table 3.2. Due to maintenance work being undertaken to parts of the SLWG area during the trial, the holding and queuing areas were repositioned for this trial to the locations as shown.

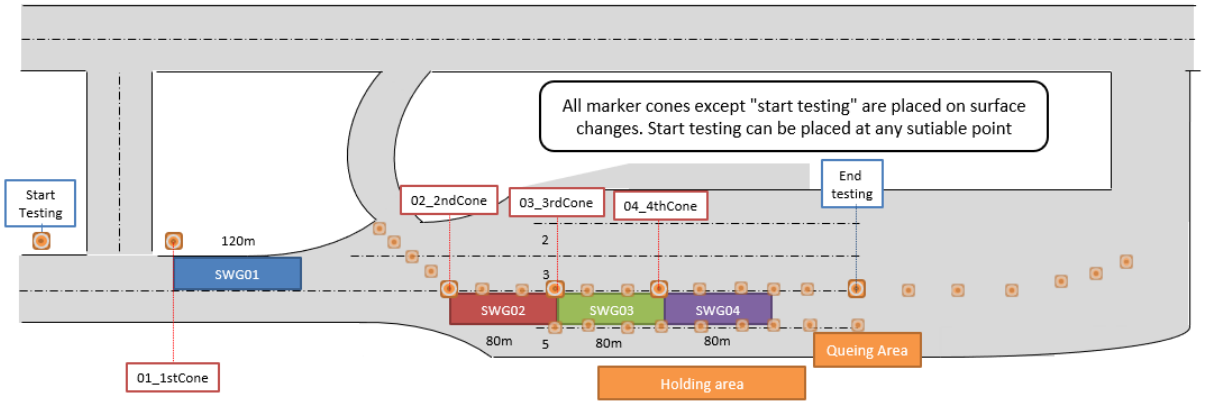

Figure 3.3: Skid resistance test sections on the Straight Line Wet Grip area

Table 3.2: 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 entrance of MIRA, the route then loops round to Sheepy Magna and returns to MIRA as shown in Figure 3.4 (Contains Ordinance Survey data © Crown copyright and database right 2022). Details of the route are given in Table 3.3.

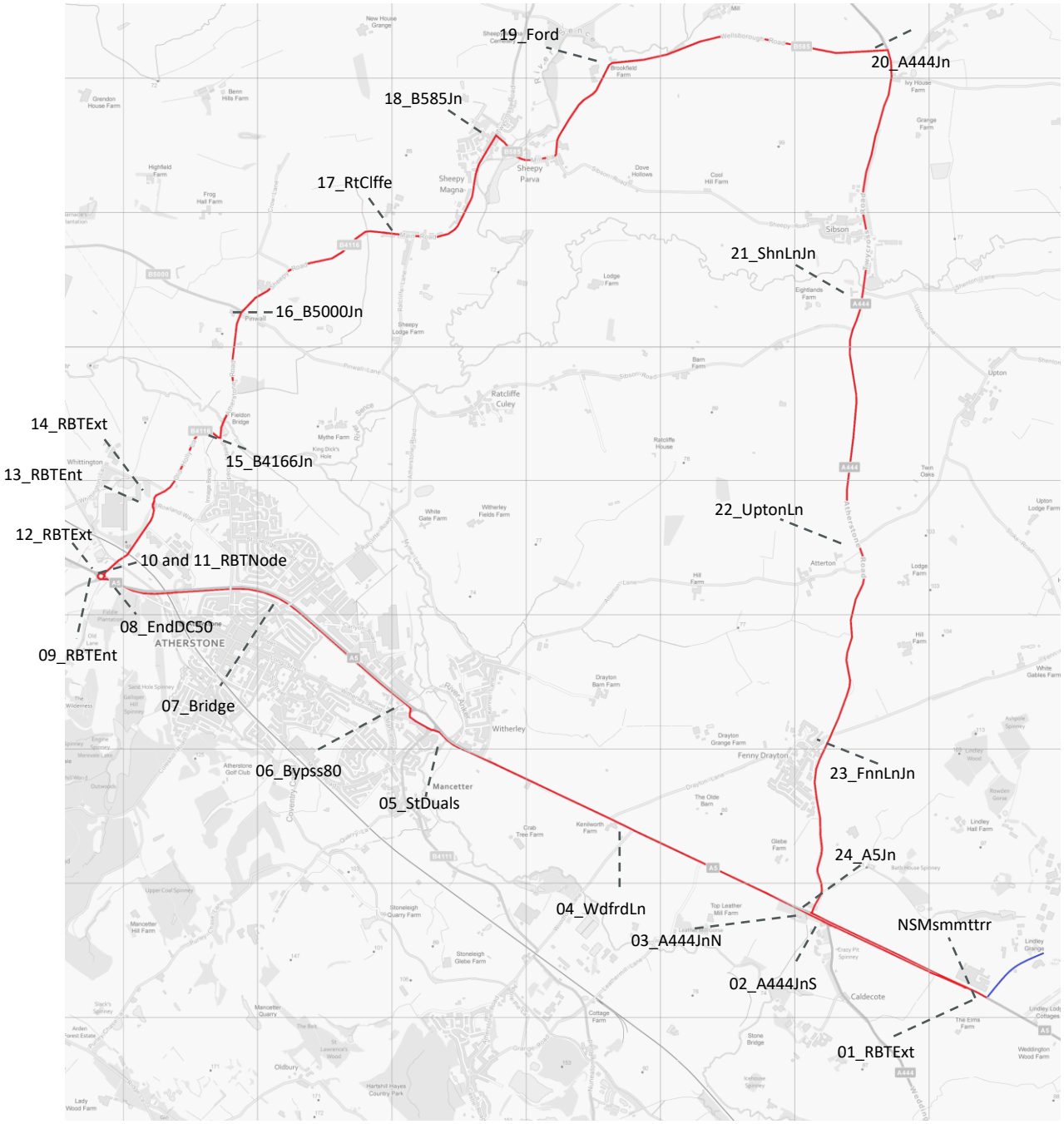

Figure 3.4: Network route to Sheepy Magna

Table 3.3: 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.

As noted in section 2.3 the drive through of the route prior to the trial identified that a contraflow was in place which changed the test line on one part of the route. This did not affect the collection of data or the position of marker points. The assessment of OSGR systems excluded the length with the contraflow in place.

Fourteen 100m lengths of varying skid resistance levels are selected from 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 below in Figure 3.5 and Figure 3.6 respectively. Details of the marker positions are given in Table 3.4 and Table 3.5 (Contains Ordinance Survey data © Crown copyright and database right 2022).



Figure 3.5: Eastbound direction of Crowthorne network route

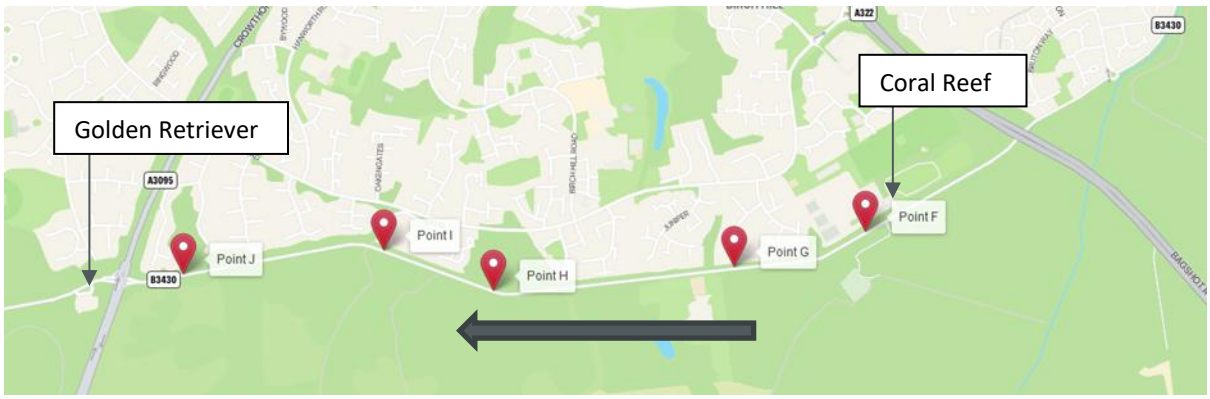

Figure 3.6: Westbound direction of Crowthorne network route

Table 3.4: 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 3.5: 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. Initial examination of this data found a large difference between the “un-bounced” and “bounced” weights for Machines 31 and 36. The survey contactor for these machines was notified and it was recommended that they investigate this before the trial. They investigated the machines and found that the air suspension had been set incorrectly on Machine 31 during the service by the vehicle dealership and no issues was found with Machine 36. Machine 31 was re-weighed following resetting of the air suspension and the final measurements for each machine are given in Table 4.1.

Table 4.1: Test wheel weights (kg)

ID	Un-bounced 1	Un-bounced 2	Un-bounced 3	Un-bounced Mean	Bounced 1	Bounced 2	Bounced 3	Bounced Mean
3	198.0	198.0	198.0	198.0	198.0	198.0	198.0	198.0
13	201.0	201.0	200.5	200.8	202.0	202.0	202.0	202.0
16	202.3	201.8	202.0	202.0	203.8	201.4	201.6	202.3
17	199.5	200.0	200.0	199.8	201.5	201.5	201.5	201.5
19	200.0	199.5	200.0	199.8	201.0	201.0	201.0	201.0
21	198.5	198.5	198.5	198.5	200.0	200.5	200.5	200.3
22	200.7	200.7	200.8	200.7	202.7	202.5	202.5	202.6
23	200.0	200.0	199.0	199.7	201.5	201.5	201.5	201.5
24	199.0	199.0	199.0	199.0	201.0	201.0	201.0	201.0
25	199.0	199.5	199.5	199.3	202.5	202.5	203.0	202.7
26	198.0	198.0	198.0	198.0	202.0	202.0	202.0	202.0
28	197.0	196.5	196.5	196.7	199.0	200.0	199.0	199.3
29	205.2	206.8	205.8	205.9	206.0	206.9	206.8	206.6
31	199.0	199.0	199.0	199.0	202.0	202.0	202.0	202.0
33	204.5	204.5	204.5	204.5	205.5	205.5	205.5	205.5
35	205.5	205.0	204.5	205.0	206.0	206.0	205.0	205.7
36	195.0	195.0	195.0	195.0	202.5	202.5	202.0	202.3

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.1.

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. In future trials it may be appropriate to review this aspect more closely, both in terms of how the weight is measured and the tolerances that are practicably achievable (or necessary where dynamic vertical load is measured), so that the British Standards Committee that deals with these matters can be advised of the practical experience and take this into account in their deliberations and their discussions when the British Standard or the CEN document are due for review.

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. Other than some issues with automatically detecting the markers, no issues were reported during this process. It was not recorded if any of the machines adjusted their calibrations as a result of this check.

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 three at 80km/h were achieved for each machine.

The time taken for the machines to travel between markers E and F on the Twin Straights, along with the distance between these two markers, was used to determine an independent measure of the average speed of the machines over this length. The elapsed time was recorded using a set of timing gates which recorded the time, in seconds, to 2 decimal places. In addition to using the timing gates, backup measurements of survey speed were made using a hand-held speed gun.

The differences between the speed reported in the survey data and the independent measurement are shown in Table 4.2. The differences between the independent measure and the target speed are shown in Table 4.3. Instances where the value exceeds the criteria levels in Appendix D.1 are highlighted in bold red text. Instances where a measurement was not made (or did not include suitable marker detection) are shown as “-”.

The timing gates failed to operate suitably on some of the 80km/h tests and due to the time restraints of the trial, testing was continued whilst the operation of the gates was investigated, as such the back up speed gun measurements were used for these runs. Due to the capability of the speed gun device these measurements have a lower degree of accuracy. Measurements where the speed gun data was used are shown in italics and in a lighter shade.

Table 4.2: Difference between speed recorded in data and independent measure

ID	50km/h Run 1	50km/h Run 2	50km/h Run 3	50km/h Run 4	50km/h Run 5	80km/h Run 1	80km/h Run 2	80km/h Run 3	80km/h Run 4	80km/h Run 5	% within criterion
3	-	-	0.50	0.48	0.46	-0.08	-0.08	-0.12	-0.12	-	100%
13	0.35	0.35	0.35	0.35	0.33	*0.75*	*-0.46*	*0.35*	*-0.05*	*-*	100%
16	-0.21	-0.47	-0.24	-0.31	-0.31	***-1.06***	***-3.04***	***-1.47***	*-0.66*	*-0.66*	70%
17	-	-0.17	-0.19	-	-0.14	*-0.47*	*-0.47*	*0.95*	*0.74*	*-0.06*	100%
19	0.36	0.36	0.34	0.34	0.34	*-0.85*	*0.34*	*-*	*0.00*	*0.03*	100%
21	-0.71	-0.69	-0.79	-0.83	-0.83	*0.14*	*-0.66*	*-*	***-1.47***	*-0.66*	89%
22	0.02	0.02	0.02	-0.03	0.00	*0.72*	*0.19*	*0.15*	*0.26*	*-0.09*	100%
23	0.07	0.07	0.08	0.01	0.00	*-*	*-*	*0.30*	*0.23*	*-*	100%
24	-0.22	-0.29	-0.34	-0.30	-0.22	*-0.22*	*0.46*	*-0.15*	***-1.67***	*-0.63*	90%
25	0.17	-	0.03	-0.07	0.03	-0.17	-0.07	-0.03	-	-0.25	100%
26	0.02	-0.08	-0.07	-0.05	0.07	-0.15	-0.12	-0.05	-0.17	-0.06	100%
28	-0.26	-0.26	-0.28	-0.28	-0.28	0.18	0.18	0.18	-	0.14	100%
29	-0.50	-0.54	-0.38	-0.45	-0.42	-0.65	-	-0.66	-0.52	-0.49	100%
31	-0.07	-0.09	-0.10	-0.14	-	-0.16	-0.21	-0.21	-0.25	-0.25	100%
33	0.33	0.33	0.31	0.31	0.31	0.49	0.49	0.49	0.44	0.44	100%
35	0.31	0.34	-	-	-	-0.10	-0.45	-0.45	-	-0.54	100%
36	0.01	-0.17	-0.17	-0.18	-0.16	-0.02	-0.11	-0.11	-0.27	-0.10	100%

Table 4.3: Difference between independent measure and target speed

ID	50km/h Run 1	50km/h Run 2	50km/h Run 3	50km/h Run 4	50km/h Run 5	80km/h Run 1	80km/h Run 2	80km/h Run 3	80km/h Run 4	80km/h Run 5	% within criterion
3	-0.52	-0.52	-0.50	-0.48	-0.46	-0.92	-0.92	-0.88	-0.88	-0.88	100%
13	-1.35	-1.35	-1.35	-1.35	-1.35	*-2.75*	*-1.54*	*-2.35*	*-1.95*	*-1.95*	100%
16	0.21	0.47	0.24	0.31	0.31	*0.06*	*-1.54*	*0.47*	*-0.34*	*-0.34*	100%
17	1.19	1.17	1.19	1.19	0.14	*0.47*	*0.47*	*-1.14*	*-0.74*	*0.06*	100%
19	-0.36	-0.36	-0.34	-0.34	-0.34	*0.06*	*-0.61*	*-*	*-0.34*	*-0.34*	100%
21	-0.24	-0.19	-0.19	-0.17	-0.17	*-1.14*	*-0.34*	*-*	*0.47*	*-0.34*	100%
22	-1.02	-1.02	-0.02	0.03	0.00	*-0.74*	*-0.34*	*-0.34*	*-0.34*	*0.06*	100%
23	0.60	-0.29	0.02	-0.28	0.31	*-2.35*	*-0.74*	*-2.35*	*-1.54*	*-1.54*	100%
24	0.19	-0.05	0.24	-0.31	0.56	*0.47*	*-1.14*	*-1.14*	*0.87*	*0.87*	100%
25	-0.17	-	-0.03	0.02	-1.42	-1.05	0.00	-0.75	-	-0.31	100%
26	-2.05	-0.92	-0.79	-0.53	-0.90	-0.75	-0.22	-0.22	0.22	-0.35	100%
28	-0.74	-0.74	-0.72	-0.72	-0.72	-1.18	-1.18	-1.18	-1.14	-1.14	100%
29	-1.50	-2.00	-0.89	-0.03	-0.85	0.31	0.99	0.85	0.81	1.49	100%
31	0.07	0.09	0.10	0.14	-	-0.84	-0.79	-0.79	-0.75	-0.75	100%
33	0.67	0.67	0.69	0.69	0.69	-0.49	-0.49	-0.49	-0.44	-0.44	100%
35	-0.31	-0.34	-0.55	-0.28	-	-0.49	0.45	0.45	-	0.54	100%
36	-1.14	-2.22	-1.22	-1.19	-0.16	-1.44	0.40	-0.75	-0.49	-1.35	100%

From these Table 4.2 it can be seen that sixteen of the seventeen machines achieved at least 80% of their data within the criterion for the difference between the data recorded in the survey and the independent measure. The remaining machine (Machine 16) only failed this criterion on the laps using the speed gun measurements. The speed gun reported the speed in MPH to zero decimal places. Therefore, following the conversion to km/h this

introduces an error of ±0.8km/h. In addition, the speed gun measurements for the second run at 80km/h for this machine were highly variable (4 measurements were taken with the speed gun for each machine on each lap). Due to these factors, alongside the good performance of the machine on the other laps it was decided that this machine should also be identified as suitable for this criterion.

On inspection of Table 4.3 it can be seen that all seventeen machines had 100% within the criterion (80% within the criterion is the requirement) for the difference in the independent measure of survey speed and the target speed.

Therefore, all machines are deemed acceptable with regards to measurement of survey speed.

5 Skid resistance measurements

Skid resistance measurements were taken on three sites (Twin straights, Straight Line Wet Grip, and the network route). The assessment of skid resistance measurements falls into two parts; machine repeatability and variation between machines (see Appendix D.1).

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 conclusions were made:

- The BRSDs were generally low during the 50km/h tests on the Twin straights. There were some increased values for sections T01, T02 and T03 in the 80km/h tests. However, the fleet BRSD remained within expectations for all sections.
- The data from the first set of tests on the Straight Line Wet Grip area shows higher BRSD for some machines on SWG04 and one machine on SWG02. It has been found from previous trials that the BRSD is typically higher for SWG04.
- For the MIRA network route there were a few scattered instances where increased BRSD was seen. In addition, an increase in BRSD values was seen on section 06.
- On the MIRA network route one machine (Machine 31) also produced slightly higher BRSD values overall. However, this machine was not seen as an outlier on any of the other sites.
- The second set of tests on the Straight Line Wet Grip shows generally low BRSD values with two individual higher values (Machine 3 on SWG02 and Machine 28 on SWG04).

Therefore, due to no consistent outliers, all machines were deemed to be performing acceptably with regards to between run variation and no sections need to be considered for exclusion 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 5.1 to Table 5.5). 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”.

Three machines (machines 33, 35 and 36) taking part in the trial were not accredited during the previous year. One machine has attended previous trials but not last year’s trial (Machine 33), one machine was a rebuild of existing equipment on a new vehicle (Machine 35) and the remaining machine (Machine 36) was a new device. The reference dataset excludes machines that were not accredited during the previous year, as such these machines 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.1) 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 Tests on the Twin Straights (12th April)

The testing on the twin straights is undertaken at 50km/h and 80km/h and is primarily used to assess the measurement of speed and distance travelled (discussed in 4.5 and 6.1 respectively). However, the skid resistance data is also reviewed to support the conclusions from the Straight Line Wet Grip and MIRA network route tests. The results from the 50km/h tests are given in Table 5.1 and the 80km/h tests in Table 5.2.

Table 5.1: Average SR from the 50km/h tests on the Twin Straights

ID	TS01	TS02	TS03	TS04	TS05	TS06	Avg
3	70.2	93.7	81.8	80.1	79.1	67.1	78.2
13	76.0	95.0	82.6	79.6	79.2	68.6	80.0
16	79.1	97.9	85.4	82.4	82.2	70.1	82.7
17	73.3	93.0	81.7	79.3	77.5	66.9	78.4
19	75.5	93.2	83.0	80.5	78.2	68.4	79.7
21	81.6	104.9	92.0	89.3	87.8	76.0	88.3
22	78.9	94.3	83.1	81.6	79.2	68.6	81.0
23	75.1	96.6	84.0	81.6	80.7	69.0	80.9
24	73.5	90.4	77.6	76.7	75.1	66.5	76.6
25	73.1	97.1	84.7	81.0	80.5	69.4	80.6
26	74.4	96.9	84.6	81.4	80.7	69.3	80.9
28	67.7	90.3	79.5	76.9	76.5	65.4	75.6
29	73.0	98.2	84.2	80.7	80.5	66.6	80.2
31	73.1	94.7	83.0	81.3	79.8	68.5	79.8
33	80.0	104.6	92.9	90.1	88.0	75.0	88.1
35	73.7	101.1	87.5	84.3	83.8	70.9	83.1
36	72.7	96.3	84.6	81.0	80.4	69.0	80.3
Ref mean	74.6	95.4	83.4	80.9	79.8	68.6	80.2
Ref BESD	3.58	3.71	3.24	2.94	2.97	2.51	2.98
Trial mean	74.8	96.3	84.2	81.6	80.5	69.1	80.9
Trial BESD	3.54	4.19	3.82	3.53	3.44	2.78	3.34

Table 5.2: Average SR from the 80km/h tests on the Twin Straights

ID	TS01	TS02	TS03	TS04	TS05	TS06	Avg
3	65.4	89.3	78.4	76.2	76.4	63.5	74.3
13	68.1	92.1	78.3	77.0	76.3	63.6	75.5
16	72.9	95.0	81.4	78.3	78.4	65.6	78.3
17	61.7	86.9	76.1	73.7	75.4	61.4	71.8
19	63.7	87.4	78.4	76.3	75.5	63.0	73.5
21	69.5	97.5	85.6	84.1	83.8	70.3	81.1
22	70.6	87.9	74.5	74.4	73.5	61.5	73.6
23	64.7	89.7	77.2	75.3	75.8	63.9	73.9
24	62.7	87.2	75.7	73.7	73.8	62.0	72.0
25	69.6	93.9	81.1	78.8	79.0	66.6	77.7
26	67.3	92.3	81.4	78.4	78.2	65.3	76.6
28	64.8	88.7	77.1	74.9	76.6	62.8	73.5
29	67.2	91.7	78.2	74.3	74.4	61.0	74.1
31	69.5	92.8	80.5	78.3	77.7	64.6	76.8
33	75.7	100.2	88.0	86.4	85.4	71.4	84.0
35	73.0	95.2	81.9	79.9	80.2	66.7	79.1
36	66.6	91.2	80.6	77.7	77.9	65.2	75.9
Ref mean	67.0	90.9	78.8	76.7	76.8	63.9	75.2
Fleet BESD	3.24	3.26	2.90	2.79	2.63	2.47	2.62
Trial mean	67.8	91.7	79.7	77.5	77.5	64.6	76.0
Trial BESD	3.85	3.81	3.49	3.49	3.23	2.92	3.28

It can be seen from Table 5.1 and Table 5.2 that the trial BESD is not met at either speed. In addition, this data suggests that machines 21 and 33 are potential outliers. This site is subject to driving line variability and it is not possible to control the test line as well as on the Straight Line Wet Grip testing. Therefore, as previously noted this site is not used in the formal accreditation but instead provides supporting data for the remaining analysis.

5.2.2 First set of Straight Line Wet Grip tests (12th April)

Due to time constraints on the first day of testing, the full set of 5 laps for each machine was not undertaken in the 1st set of tests on the Straight Line Wet Grip. However, it was possible to obtain at least three laps from each machine, and the results are shown in Table 5.3.

Table 5.3: Average SR from the 1st set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	65.3	89.8	26.4	47.3	58.4
13	62.8	88.8	23.9	45.0	56.2
16	68.1	96.5	31.8	55.3	63.6
17	62.8	88.5	25.6	48.0	57.2
19	64.1	90.2	26.6	47.0	58.0
21	68.7	96.3	26.8	51.3	61.9
22	64.6	89.5	27.0	48.8	58.5
23	64.0	89.1	25.8	45.9	57.3
24	62.1	88.6	24.5	46.0	56.3
25	64.0	92.0	27.0	50.1	59.1
26	64.7	92.3	28.9	52.6	60.4
28	62.3	87.6	26.7	48.1	57.0
29	62.6	91.2	21.3	42.7	55.6
31	64.0	90.9	25.7	48.5	58.2
33	65.4	90.3	26.8	49.7	59.1
35	65.2	92.9	26.8	48.6	59.4
36	64.1	90.5	31.4	55.7	61.0
Ref mean	64.3	90.8	26.3	48.3	58.4
Ref BESD	1.99	2.71	2.38	3.23	2.25
Trial mean	64.4	90.9	26.6	48.9	58.7
Trial BESD	1.83	2.50	2.48	3.42	2.13

It can be seen from Table 5.3 that the BESD criteria is met for the average of the site for the trial dataset. In addition, no particular outliers are identified (particularly if you consider the average for the site). Therefore, based on this information no machine investigation / alterations were recommended before the remaining testing in the trial.

5.2.3 MIRA Network route tests (13th 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.

The results from the testing on the route are shown in Table 5.4.

Table 5.4: Average SR from the MIRA network route surveys

ID	01	02	03	04	05	06	07	08	09	10	11	12	13	14	Avg
3	63.5	60.2	68.1	62.7	61.7	85.9	89.0	90.8	66.3	57.2	74.4	54.4	51.5	61.1	67.6
13	64.9	60.8	70.7	64.1	62.5	89.7	91.9	98.0	68.9	59.9	79.0	57.2	47.7	63.9	69.9
16	67.1	61.6	70.4	65.4	63.6	87.8	89.6	96.2	70.3	62.4	80.1	57.7	49.9	65.0	70.5
17	62.2	61.7	68.4	63.9	63.1	81.5	85.2	86.0	68.8	58.0	72.9	53.0	47.2	59.0	66.5
19	62.5	58.5	69.1	63.5	62.8	86.1	85.0	93.3	64.4	56.9	74.2	53.6	48.6	61.2	67.1
21	67.5	60.8	74.3	69.8	68.6	85.0	87.8	98.6	70.0	63.8	81.4	59.4	52.7	66.5	71.9
22	62.3	59.6	66.5	62.3	60.1	85.1	89.3	88.6	64.8	59.2	76.6	55.7	50.0	60.9	67.2
23	61.1	57.7	67.3	61.8	61.4	83.5	86.6	90.8	65.2	56.6	73.9	54.5	47.6	61.0	66.4
24	59.4	56.7	67.1	60.5	60.7	85.4	85.5	90.4	64.8	57.3	74.6	54.3	48.0	59.4	66.0
25	63.3	60.6	71.9	63.7	64.4	87.4	90.7	96.8	69.9	63.5	79.8	59.1	54.0	64.8	70.7
26	60.3	58.9	68.0	62.8	62.7	83.5	85.2	90.8	64.1	59.6	75.5	54.9	50.5	60.6	67.0
28	63.9	57.5	70.5	62.4	61.0	87.8	88.7	94.7	67.9	60.0	76.7	58.1	52.1	63.5	68.9
29	64.4	61.4	68.6	68.0	64.4	85.5	89.1	91.5	63.7	57.8	75.3	51.5	44.5	57.8	67.4
31	63.3	60.3	69.7	66.2	63.8	85.5	84.8	93.1	68.0	60.6	77.2	56.8	54.9	63.9	69.1
33	66.7	61.5	72.5	66.4	64.9	85.5	85.0	91.0	69.0	60.5	78.1	57.2	51.1	68.5	69.8
35	66.0	60.4	72.9	65.0	65.8	84.1	86.9	94.4	69.6	60.2	79.6	54.5	49.2	64.8	69.5
36	61.9	57.9	67.8	64.7	63.7	87.5	88.7	96.2	66.4	58.6	74.2	52.1	47.8	61.4	67.8
Ref mean	63.3	59.7	69.3	64.1	62.9	85.7	87.7	92.8	66.9	59.5	76.5	55.7	49.9	62.0	68.3
Ref BESD	2.30	1.62	2.10	2.52	2.11	2.09	2.33	3.68	2.43	2.37	2.63	2.38	2.91	2.57	1.86
Trial mean	63.6	59.8	69.6	64.3	63.2	85.7	87.6	93.0	67.2	59.5	76.7	55.5	49.8	62.6	68.4
Trial BESD	2.35	1.60	2.25	2.35	2.07	1.98	2.23	3.47	2.34	2.17	2.58	2.36	2.70	2.87	1.75

It can be seen from Table 5.4 that the trial BESD is within the criterion for the average of the site. In addition, no particular outliers are identified (particularly if you consider the average for the site).

5.2.4 Second set of Straight Line Wet Grip tests (22nd April)

The results from the 2nd set of tests on the Straight Line Wet Grip are shown in Table 5.5.

Table 5.5: Average SR from the 2nd set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	63.2	87.1	22.9	43.9	55.5
13	64.2	91.2	23.7	44.7	57.1
16	64.2	92.9	23.9	45.4	57.7
17	60.6	86.0	21.9	43.0	54.0
19	63.1	89.0	21.9	42.1	55.3
21	67.2	95.3	23.2	46.5	59.4
22	62.1	87.7	23.1	44.4	55.5
23	61.8	88.4	22.2	42.0	54.8
24	60.6	86.6	20.3	43.4	53.9
25	64.7	92.9	23.9	47.5	58.3
26	60.8	86.2	22.1	46.0	54.8
28	63.2	90.7	23.8	45.5	56.9
39	61.7	91.2	18.3	40.5	54.2
31	61.6	88.8	23.4	44.6	55.6
33	63.2	90.6	22.9	44.9	56.5
35	64.6	93.9	22.5	45.3	57.7
36	62.6	88.1	25.6	47.4	56.9
Ref mean	62.8	89.6	22.5	44.3	55.9
Ref BESD	1.87	2.86	1.59	1.93	1.70
Trial mean	62.9	89.8	22.7	44.5	56.1
Trial BESD	1.74	2.83	1.62	1.90	1.61

On examination of the data from the 2nd set of Straight Line Wet Grip testing (Table 5.5) it can be seen that the average Trial BESD is within the criteria. In addition, no particular outliers are identified.

Therefore, based on this data and the data collected on the network route all machines are deemed acceptable with regards to 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 Twin Straights. Testing was undertaken such that at least three passes at 50km/h and three at 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 3.2 (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 criteria (see Appendix D).

In order to maintain the 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 level (for the criteria used) 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	43%	83%	100%	100%	Automatic	Pass
13	67%	93%	100%	100%	Automatic	Pass
16	9%	57%	91%	91%	Automatic	Fail
17	57%	89%	100%	100%	Automatic	Pass
19	56%	84%	98%	98%	Automatic	Pass
21	74%	96%	96%	96%	Automatic	Pass
22	56%	90%	100%	100%	Automatic	Pass
23	23%	43%	94%	100%	Automatic	Fail
24	4%	48%	90%	100%	Automatic	Fail
25	73%	96%	100%	100%	Automatic	Pass
26	51%	82%	98%	98%	Automatic	Pass
28	64%	100%	100%	100%	Automatic	Pass
29	58%	98%	98%	98%	Automatic	Pass
31	34%	82%	100%	100%	Automatic	Pass
33	46%	82%	100%	100%	Automatic	Pass
35	35%	73%	100%	100%	Push	Pass
36	76%	98%	100%	100%	Automatic	Pass

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

Further examination of the data from these three machines found that the ratio of the measured value to the reference value was consistent for each of the lengths on the site. This suggested that distance measurement systems on these devices were incorrectly calibrated. The average ratio of measured length to reference length (i.e. measured divided by reference) for these machines is given in Table 6.2. Note: the length B to C is noticeably shorter than the other lengths and as such the ratio calculated for this length will be more variable than the others.

Table 6.2: Ratios of measured lengths to reference length

ID	A to B	B to C	D to E	E to F	F to G	Average (excluding B to C)
16	0.997	*0.986*	0.997	0.997	0.997	0.997
23	1.003	*1.005*	1.003	1.003	1.003	1.003
24	0.995	*0.985*	0.996	0.995	0.995	0.995

The lengths measured by these machines on the Crowthorne network route were also assessed and were found to be suitable. Therefore, these three machines were awarded a "Pass *" with the following note on the certificate:

> The device did not meet the requirements for distance measured on the official test site (twin horizontal straights at MIRA). However, the measurements from the device were consistent between runs and it also exhibited a better performance on the

other test sites. Therefore, it is deemed that there is not a systematic issue with the system but that it was not correctly calibrated at the trials.

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; fourteen of the seventeen 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 were 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. In the next update to the Accreditation specification the text around 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. For this initial use of the site the 2m criteria level requirements were excluded. 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 (OSGR fitted)	Performance on Crowthorne Network route (Marker entry)	Awarded Performance
13	High	High	High	High
16	High	Not Suitable	High	Not Suitable
17	High	Low	High	Low
19	High	High	High	High
22	High	High	High	High
23	High	High	High	High
24	High	High	High	High
25	High	High	High	High
26	High	High	High	High
28	High	High	High	High
29	High	High	Low	Low
31	High	High	High	High
33	High	Low	High	Low
36	High	High	High	High

Table 6.4: Summary of Altitude assessments

ID	Performance on MIRA Network route (OSGR fitted)	Performance on Crowthorne Network route (Marker entry)	Awarded Performance
13	High	High	High
16	Low	Low	Low
17	Medium	High	Medium
19	High	Medium	Medium
22	Low	Low	Low
23	High	Medium	Medium
24	Medium	Medium	Medium
25	High	Medium	Medium
26	High	Medium	Medium
28	High	Medium	Medium
29	High	Low	Low
31	High	High	High
33	Medium	Low	Low
36	High	Low	Low

It can be seen that the OSGR performance (Table 6.3) that the fleet is generally achieving the high performance level. All machines achieved a high performance on the MIRA network route, this is due to the less challenging environment (no tree coverage) and the lower criteria for this site.

For the measurement of altitude, the performance was more mixed with 2 achieving a high performance, seven medium and five low.

7 File formats

All of the machines that took part in the skid resistance testing supplied suitable ".S10" and ".loc" files. There is a mandatory requirement that any device that is to be used on the central National Highways contract shall provide RCD and BCD data.

The following machines provided RCD files:

- Machine 13
- Machine 16
- Machine 17
- Machine 19
- Machine 22
- Machine 23
- Machine 24
- Machine 25
- Machine 26
- Machine 28
- Machine 29
- Machine 31
- Machine 33
- Machine 36

The following machines provided BCD files:

- Machine 13
- Machine 16
- Machine 17
- Machine 19
- Machine 22
- Machine 23
- Machine 24
- Machine 25
- Machine 26
- Machine 28
- Machine 29
- Machine 31
- Machine 36

Examination of the supplied RCD and BCD found that the data formatting was, in general, suitable. Machine 33 did not have the chainage of the marker points in the RCD file in the correct format. This information was fed back to the owner of the machine and recorded on the Accreditation certificate.

8 Conclusions

The 2022 sideway-force skid resistance accreditation trials were held during the week commencing 11th April 2022. The trials were held on and around the MIRA proving ground and on a Network route near TRL in Crowthorne. The format of the trials was adapted due to the ongoing COIVID-19 restrictions and the presence of the bank holiday on the Friday of the trial week. Seventeen 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 seventeen machines met the criteria for the measurement of skid resistance at the trial.

(iii) Vehicle Speed attainment and recording

All seventeen machines met the criteria for vehicle speed attainment and recording.

(iv) Distance measurement

Fourteen of the seventeen machines met the criteria with regards to the measurement of distance. After further review of the data the remaining three machines were also found to be acceptable.

(v) Left test wheel weight

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

(vi) Water flow

All seventeen 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

Fourteen machines fitted with 3-dimensional spatial coordinate systems were assessed for the measurement of OSGRs. Ten machines achieved a high performance, three a low and one was identified as not suitable.

(viii) Measurement of Altitude

Fourteen machines fitted with 3-dimensional spatial coordinate systems were assessed for the measurement of altitude. Two machines achieved a high performance, seven a medium performance and five a low performance.

(ix) File formats

All seventeen machines supplied suitable .s10 and .loc files. Thirteen machines provided suitable RCD files. One machine provided RCD files with a minor formatting issue (format for chainage of markers). Thirteen machines provided suitable BCD files.

A summary of the machines that attended the 2022 accreditation trial and the criteria that they met can be found in Appendix A.

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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 and Roy Jaques for his assistance in processing the data. The author also wishes to thank Darius Singfield for running the trial and to Dave Blackman, Jenessa Norman, Razvan Pana, Nelson Smith, Jake Tagg, Chris Torkington and Patrick Werro 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	-	-	Satisfactory	-	-
13	WDM Ltd	S700 WDM	Pass	Pass	Pass	Pass	High	High	Satisfactory	Satisfactory	Satisfactory
16	PTS Ltd	S66 HSL	Pass	Pass	Pass*	Pass	Not Suitable	Low	Satisfactory	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	-	-	Satisfactory	-	-
22	PTS Ltd	KX07YVH	Pass	Pass	Pass	Pass	High	Low	Satisfactory	Satisfactory	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	High	Medium	Satisfactory	Satisfactory	Satisfactory
28	Operated by TRL on behalf of National Highways	WX60 AXN	Pass	Pass	Pass	Pass	High	Medium	Satisfactory	Satisfactory	Satisfactory
29	PTS Ltd	YD02 XSN	Pass	Pass	Pass	Pass	Low	Low	Satisfactory	Satisfactory	Satisfactory
31	WDM Ltd	S16 WDM	Pass	Pass	Pass	Pass	High	High	Satisfactory	Satisfactory	Satisfactory
33	PMS	17 2G 1777	Pass	Pass	Pass	Pass	Low	Low	Satisfactory	Not suitable	-
35	PMS	22 1G 1770	Pass	Pass	Pass	Pass	-	-	Satisfactory	-	-
36	WDM Ltd	72-805P	Pass	Pass	Pass	Pass	High	Low	Satisfactory	Satisfactory	Satisfactory

[1] Machines are assessed on different criteria for distance travelled depending on the equipment fitted. Please see the corresponding part of this report or the test certificate for the machine to see which criteria were applied for the assessment. See section 6.1 for further details on the “Pass *” entries.

Appendix B Between run standard deviation

Values that are within the BRSD criteria (see appendix D.1) 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 50km/h tests on the Twin Straights

ID	TS01	TS02	TS03	TS04	TS05	TS06	Avg
3	2.27	1.23	0.73	2.31	1.51	1.24	1.70
13	1.96	1.90	1.63	0.91	0.89	0.44	1.47
16	2.84	2.39	2.44	1.74	1.07	0.86	2.13
17	1.91	0.20	1.00	1.63	0.85	1.28	1.34
19	1.19	1.41	0.71	1.30	1.04	0.93	1.13
21	0.70	1.10	0.69	1.16	0.89	0.43	0.86
22	2.46	0.88	1.03	0.76	0.56	0.92	1.38
23	1.87	0.60	0.85	1.12	0.97	0.52	1.14
24	2.30	1.18	1.17	1.20	0.91	0.68	1.43
25	1.24	1.30	0.72	0.83	0.67	0.66	0.97
26	1.21	0.65	0.93	1.08	0.77	0.98	0.98
28	0.98	1.52	0.51	0.76	0.91	0.57	0.94
29	1.86	1.48	0.69	0.77	0.91	0.95	1.24
31	3.30	0.33	1.16	1.40	1.56	0.95	1.83
33	0.85	1.48	1.14	1.37	0.49	0.53	1.07
35	6.57	1.44	1.43	1.46	0.60	0.89	3.27
36	0.25	1.70	0.81	0.84	0.26	0.38	0.88
Avg	2.42	1.34	1.13	1.28	0.93	0.82	1.51

Table B.2: Between run SD for the 80km/h tests on the Twin Straights

ID	TS01	TS02	TS03	TS04	TS05	TS06	Avg
3	0.65	1.95	0.37	0.89	0.66	0.48	0.99
13	3.41	5.31	4.64	1.95	2.62	2.93	3.72
16	3.41	3.99	2.61	0.99	1.22	0.77	2.62
17	0.75	1.46	0.63	0.76	1.21	0.60	0.92
19	1.23	1.11	1.35	0.53	0.19	0.32	0.96
21	1.01	0.75	0.44	0.64	0.24	0.41	0.68
22	3.89	1.05	0.66	1.50	1.14	0.61	2.04
23	1.81	2.88	0.37	0.03	0.11	0.14	1.47
24	0.66	1.51	0.78	0.65	0.34	0.22	0.82
25	0.88	1.20	1.55	1.02	1.52	0.74	1.15
26	1.60	1.62	2.06	0.98	0.54	0.93	1.44
28	1.60	2.68	1.54	1.49	2.42	1.60	1.89
29	3.19	3.36	1.68	1.64	1.82	1.25	2.39
31	1.42	2.44	1.31	0.42	0.65	0.39	1.36
33	1.02	1.32	1.39	1.30	1.27	1.23	1.25
35	3.70	3.52	1.98	1.25	1.17	1.02	2.52
36	0.96	1.50	1.24	0.80	0.86	0.59	1.05
Avg	2.16	2.52	1.77	1.10	1.28	1.06	1.79

Table B.3: Between run SD for the 1st set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	1.08	0.86	2.45	1.84	1.61
13	0.32	2.00	0.37	0.43	0.98
16	1.33	1.45	2.79	3.93	2.46
17	0.77	1.27	0.47	1.50	1.05
19	0.51	0.47	1.89	1.49	1.18
21	0.87	4.18	0.86	1.43	2.15
22	0.53	1.29	1.70	1.67	1.30
23	1.11	0.88	1.61	1.20	1.21
24	0.89	1.37	0.58	3.59	1.88
25	0.64	0.54	0.90	2.12	1.16
26	0.51	2.40	2.02	4.25	2.46
28	2.84	1.77	1.71	4.03	2.77
29	0.77	1.20	1.15	1.27	1.07
31	0.65	1.86	1.55	1.78	1.45
33	1.44	0.95	1.62	2.80	1.78
35	1.02	1.00	1.06	2.07	1.32
36	1.16	0.74	1.94	1.33	1.33
Avg	1.12	1.66	1.60	2.43	1.69

Table B.4: Between run SD for the Network route

ID	01	02	03	04	05	06	07	08	09	10	11	12	13	14	Avg
3	1.35	2.11	1.53	1.12	1.13	1.20	0.36	0.85	1.04	1.08	1.69	1.53	3.64	1.00	1.25
13	1.42	1.23	0.73	0.79	1.03	3.39	2.05	1.19	0.44	1.31	0.60	0.91	1.59	1.61	1.57
16	0.90	1.94	0.67	0.62	0.68	4.19	2.01	3.08	2.99	2.11	2.26	1.46	1.22	1.78	2.24
17	0.64	2.57	0.75	2.07	2.25	2.12	0.84	1.71	0.45	0.11	0.74	4.52	8.11	3.53	1.59
19	2.05	0.59	0.46	0.13	0.43	4.70	0.36	2.11	0.46	0.84	1.05	1.04	2.43	1.17	1.80
21	1.00	1.46	1.02	1.20	1.05	3.85	4.83	2.23	2.30	0.97	1.69	1.01	1.99	1.61	2.37
22	0.76	1.57	0.64	1.57	1.07	1.18	2.34	2.23	2.60	3.30	2.37	2.51	2.87	2.50	1.91
23	1.92	2.38	1.98	1.99	2.47	4.19	1.57	0.79	2.61	2.62	2.82	2.55	1.38	1.03	2.40
24	0.70	1.19	1.78	1.27	2.93	2.30	2.09	1.39	2.23	1.93	1.74	1.83	2.02	1.49	1.89
25	1.81	0.32	0.89	0.65	1.24	3.41	2.89	1.40	1.67	1.22	2.21	1.83	0.92	0.73	1.80
26	1.47	2.57	0.78	2.63	2.98	1.47	3.10	1.40	2.09	1.06	2.25	3.29	1.42	1.24	2.11
28	1.77	1.23	1.29	1.12	1.29	1.92	2.45	4.55	2.63	2.54	2.65	2.95	2.16	1.50	2.30
39	0.60	2.77	0.21	5.47	3.79	0.84	1.89	0.60	3.63	3.54	2.50	2.73	3.03	1.06	2.88
31	1.72	3.66	2.19	3.94	2.13	2.97	4.71	1.36	3.68	2.55	2.59	2.19	0.56	1.32	3.07
33	0.96	2.41	0.23	1.30	1.08	4.14	0.23	2.53	1.06	1.72	2.47	3.62	2.37	7.37	1.93
35	1.61	1.24	0.21	1.10	2.44	3.71	2.66	1.44	2.28	2.11	1.62	0.54	1.67	1.51	2.10
36	0.86	2.24	0.81	2.22	1.62	3.37	1.92	0.80	2.26	1.00	0.80	1.20	2.69	1.42	1.89
Avg	1.35	2.03	1.12	2.14	1.96	3.12	2.49	1.99	2.26	1.99	2.01	2.35	2.87	2.41	2.11

Table B.5: Between run SD for the 2nd set of tests on the Straight Line Wet Grip

ID	SWG01	SWG02	SWG03	SWG04	Avg
3	1.77	3.04	1.17	2.12	2.09
13	0.94	1.06	0.47	0.62	0.83
16	1.00	1.34	0.44	1.65	1.17
17	0.62	0.88	0.31	1.30	0.83
19	0.47	1.24	0.38	0.74	0.75
21	0.85	1.49	0.41	2.59	1.48
22	1.04	0.84	0.89	2.51	1.43
23	1.01	1.58	0.28	0.60	1.00
24	0.62	1.65	0.66	2.43	1.44
25	0.33	1.19	0.97	2.75	1.47
26	0.62	0.43	0.39	2.82	1.38
28	1.21	2.17	0.48	3.59	2.08
29	0.95	0.62	0.52	2.01	1.15
31	0.42	1.30	0.61	2.00	1.16
33	0.30	0.68	0.21	1.57	0.82
35	0.26	1.52	0.57	1.10	0.92
36	0.82	1.11	1.40	2.16	1.39
Avg	0.86	1.44	0.68	2.09	1.32

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 level
13	100%	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
22	98%	100%	100%	100%	100%	100%	100%	High
23	96%	98%	100%	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
28	98%	99%	100%	100%	100%	100%	100%	High
29	98%	100%	100%	100%	100%	100%	100%	High
31	99%	100%	100%	100%	100%	100%	100%	High
33	98%	100%	100%	100%	100%	100%	100%	High
36	99%	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 level
13	95%	100%	100%	100%	100%	100%	100%	High
16	43%	67%	79%	98%	100%	100%	100%	Not Suitable
17	70%	78%	80%	88%	90%	100%	100%	Low
19	94%	100%	100%	100%	100%	100%	100%	High
22	68%	100%	100%	100%	100%	100%	100%	High
23	86%	100%	100%	100%	100%	100%	100%	High
24	96%	100%	100%	100%	100%	100%	100%	High
25	99%	100%	100%	100%	100%	100%	100%	High
26	81%	100%	100%	100%	100%	100%	100%	High
28	88%	100%	100%	100%	100%	100%	100%	High
29	63%	100%	100%	100%	100%	100%	100%	High
31	79%	99%	100%	100%	100%	100%	100%	High
33	57%	86%	91%	97%	99%	100%	100%	Low
36	78%	100%	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 level
13	93%	100%	100%	100%	100%	100%	100%	Automatic	High
16	30%	74%	93%	100%	100%	100%	100%	Push	High
17	59%	100%	100%	100%	100%	100%	100%	Automatic	High
19	43%	99%	100%	100%	100%	100%	100%	Automatic	High
22	34%	96%	100%	100%	100%	100%	100%	Push	High
23	84%	100%	100%	100%	100%	100%	100%	Automatic	High
24	72%	98%	100%	100%	100%	100%	100%	Automatic	High
25	71%	100%	100%	100%	100%	100%	100%	Automatic	High
26	81%	100%	100%	100%	100%	100%	100%	Automatic	High
28	52%	99%	100%	100%	100%	100%	100%	Automatic	High
29	0%	11%	35%	92%	100%	100%	100%	Push	Low
31	30%	96%	100%	100%	100%	100%	100%	Automatic	High
33	32%	83%	91%	97%	99%	100%	100%	Push	High
36	67%	97%	100%	100%	100%	100%	100%	Automatic	High

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 level
13	100%	100%	100%	100%	100%	High
16	0%	25%	81%	98%	100%	Low
17	74%	100%	100%	100%	100%	Medium
19	98%	100%	100%	100%	100%	High
22	3%	34%	67%	93%	100%	Low
23	97%	100%	100%	100%	100%	High
24	82%	100%	100%	100%	100%	Medium
25	96%	100%	100%	100%	100%	High
26	95%	100%	100%	100%	100%	High
28	99%	100%	100%	100%	100%	High
29	92%	100%	100%	100%	100%	High
31	94%	100%	100%	100%	100%	High
33	87%	100%	100%	100%	100%	Medium
36	90%	100%	100%	100%	100%	High

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 level
13	97%	100%	100%	100%	100%	High
16	2%	37%	60%	78%	100%	Low
17	96%	100%	100%	100%	100%	High
19	77%	100%	100%	100%	100%	Medium
22	37%	57%	58%	61%	100%	Low
23	84%	100%	100%	100%	100%	Medium
24	83%	100%	100%	100%	100%	Medium
25	76%	100%	100%	100%	100%	Medium
26	37%	93%	100%	100%	100%	Medium
28	85%	100%	100%	100%	100%	Medium
29	0%	0%	39%	81%	100%	Low
31	100%	100%	100%	100%	100%	High
33	39%	80%	83%	85%	99%	Low
36	36%	78%	88%	99%	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 2022 Accreditation trial. The relevant section of the document is reproduced verbatim below (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 2022 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 trials 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 2022 trial run by TRL and held in the week beginning the 11th April.

Other titles from this subject area

PPR1021	Highways England 2021 national accreditation trial for sideway-force skid resistance devices. S Brittain. 2022
PPR975	Highways England 2020 national accreditation verification for sideway-force skid resistance devices. S Brittain. 2022
PPR1020	Highways England 2019 national accreditation trial for sideway-force skid resistance devices. S Brittain. 2022
PPR935	Highways England 2018 national accreditation trial for sideway-force skid resistance devices. S Brittain. 2020

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ISSN 2514-9652

ISBN 10.58446/jjxm6396

PPR2045