

Transport Scotland Executive Agency of the Scottish Government Roads (Standards and Asset Management)

Summary

This Interim Amendment contains the Operations Manual for use of the Griptester on the trunk road network in Scotland.

1. Background

Transport Scotland introduced the TS2010 Surface Course Specification in 2010. In order to facilitate implementation of this specification Transport Scotland purchased four Griptester devices and issued them to the NW, NE SW and SE Operating Companies. Initially the process for use of these Griptesters was detailed in the TS2010 Specification. The requirements have now been revised and taken out of the revised TS2010 Specification (4th edition). A standalone operating procedure has been written and is contained in this TSIA.

2. Action

All Griptester measurements carried out on the Scottish Trunk road network should be carried out according to the operating procedure contained in this TSIA.

3. Implementation

This TSIA shall be implemented immediately except where the procurement of works, at any stage from conception through design to completion of construction, has reached a stage at which, in the opinion of the TS Project Manager, use of this document would result in significant additional expense or delay progress.

4. Further action

Any questions or feedback regarding the use or content of this TSIA should be directed to Transport Scotland: info@transport.gov.scot.

Appendix A

Operating Procedure for the use of Griptester on the Scottish trunk road network.

The use of GripTester on the Scottish trunk road network



Operating Procedure

November 2018

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1 Introduction

As a consequence of providing GripTester braked-wheel fixed-slip machines to Operating Companies for skid-resistance measurements on the Scottish trunk road network, Transport Scotland has prepared this document as guidance on the use of the GripTester for collecting friction measurements.

This document was primarily prepared to provide guidance on collecting skid-resistance data for TS2010 surface course specification (TSIA No 35), but the guidance may be useful in surveying other surface course materials.

2 Equipment

The GripTester braked-wheel fixed-slip device is generically described in BS 7941-2:2000. The British Standard also provides guidance on using the GripTester to measure skid resistance along a continuous surface on a range of paved surfaces.

3 Certification

3.1 Annual Certification

An annual certification process shall be undertaken for each GripTester to be used on the Scottish trunk road network. The procedure shall be carried out in accordance with ASTM E1844 test procedures where network machines are verified against the manufacture's reference machine. The testing procedure must confirm that network machines are within a GripNumber (GN) of ± 0.02 of the reference machine.

3.2 Weekly Certification

A reference site shall be chosen and subjected to a GripTester survey once a week following the methodology set out within this operations document. This certification check shall be carried out to facilitate seasonal corrections through the winter months (November-March). During the summer testing season (April-October) weekly certification checks shall be carried out to ensure that machines continue to read within ± 0.05 GN of previous values achieved at the chosen reference site. If this accuracy is not achieved, the machine shall not be used for testing.

The reference site shall be at least 500m in length and shall be surfaced with a stone mastic asphalt (SMA) that has been in service for at least two years, exhibits a consistent appearance and is in good condition, i.e. defect free.

4 Pre-survey checks and calibration

Calibration checks shall be carried out at the start of each survey day. If the machine cannot be calibrated in accordance with the guidelines set out below it shall not be used for testing. The process to be followed when carrying out calibration and checks of the GripTester machine is set out within Figure 1 and the clauses below provide a general overview of the step-by-step procedures that should be carried out prior to undertaking a GripTester survey both daily and weekly. Full details for the calibration process can be found in the manufacturer's maintenance manual (Findlay Irvine, 2008). It is also important that regular maintenance is carried out in accordance with the manufacturer's guidelines.

4.1 FACTS check

A FACTS check shall be carried out each day prior to testing. In the first instance, switch the signal processing unit (SPU) on and ensure the battery is sufficiently charged. The SPU shall be switched on at least five minutes prior to testing to allow a stable state to be reached and the battery level should read at least 10 volts. Invert the GripTester and check the following:

- | | |
|-------------------|--|
| Free | Check mechanism rotates freely. |
| Aligned | Check alignment of sprocket gears and chain. |
| Chain | Check the gap between bottom of chain and roller is between 17mm and 22mm. The chain should be lightly lubricated. |
| Tyre | The wear indicator on the smooth test wheel shall be greater than 1mm. The tread depth of the drive wheels shall be at least 2mm. Check all tyres have a pressure of 20psi (± 1) and are free from any deposits. |
| Suspension | Bounce the suspension and listen for any noises. |

The results for these checks shall be recorded. An example of a recording sheet is given in Appendix A.

4.2 Calibration

This section has been written under the assumption that the chosen unit of measurement is kilograms (kg).

4.2.1 Quick calibration

It is essential that a quick calibration test is completed each day a GripTester survey is carried out. This should be done as per the following:

- Load Zero** Using the calibration mode on the SPU select Load Zero. A comparison between the target figure and actual figure will be shown. Lift the measuring wheel approximately 10mm off the ground, the display will show the target Load Zero figure on the left and the actual Load Zero on the right. The actual figure should be recorded. The actual Load Zero should read 0000 ± 0010 , if this is not achieved a full calibration shall be carried out as described in section 4.2.2.

An example of a typical recording sheet is given in Appendix A.

4.2.2 *Weekly calibration*

In addition to 4.2.1 a weekly calibration test shall be completed each week that the GripTester is in use. This shall be done using the appropriate calibration jig on a level surface and includes the following:

Calibration jig

Zero Switch on the Weigh-tronics loading device. Once the calibration jig is held vertically check that the loading device reads zero. If not, press the "Zero" button.

GripTester

Load Zero Using the calibration mode on the SPU select Load Zero. The figure displayed on the left is the target Load Zero and the figure on the right is the actual Load Zero. Press "Enter" and wait, this will make the actual Load Zero equate to the target Load Zero.

Load Gain Using the calibration mode on the SPU select Load Gain. Mount the calibration jig vertically on the GripTester; a wire is used to connect the GripTester to the calibration jig. Ensure that the actual reading is at zero, adjust wire if not. Apply a load force of exactly 20kg (if this value is exceeded, wind back to zero and restart) and record value. Press "Enter" which will make the actual figure equate to the target figure.

Drag Zero Using the calibration mode on the SPU select Drag Zero. Mount the calibration jig horizontally to the GripTester ensuring the test wheel is clear of all debris and centrally positioned on the grit paper; a spring is used to connect the GripTester and calibration jig. Apply a load of approximately 15kg and then release ensuring the loading device is completely free. The actual figure should be recorded and then the "Enter" button should be selected to make the actual figure equal to the target.

Drag Gain Using the calibration mode on the SPU select Drag Gain. Gently apply a load until the actual load is displayed as +0001 (if this value is exceeded, wind back to zero and restart) then zero the loading scale. Gently apply a load of exactly 15kg (if this value is exceeded, wind back to zero and restart). The actual figure should be recorded and then the "Enter" button should be selected to make the actual figure equal to the target.

All of the results shall be recorded and an example of a recording sheet is given in Appendix A. If this calibration is unable to be completed then the manufacturer should be consulted.

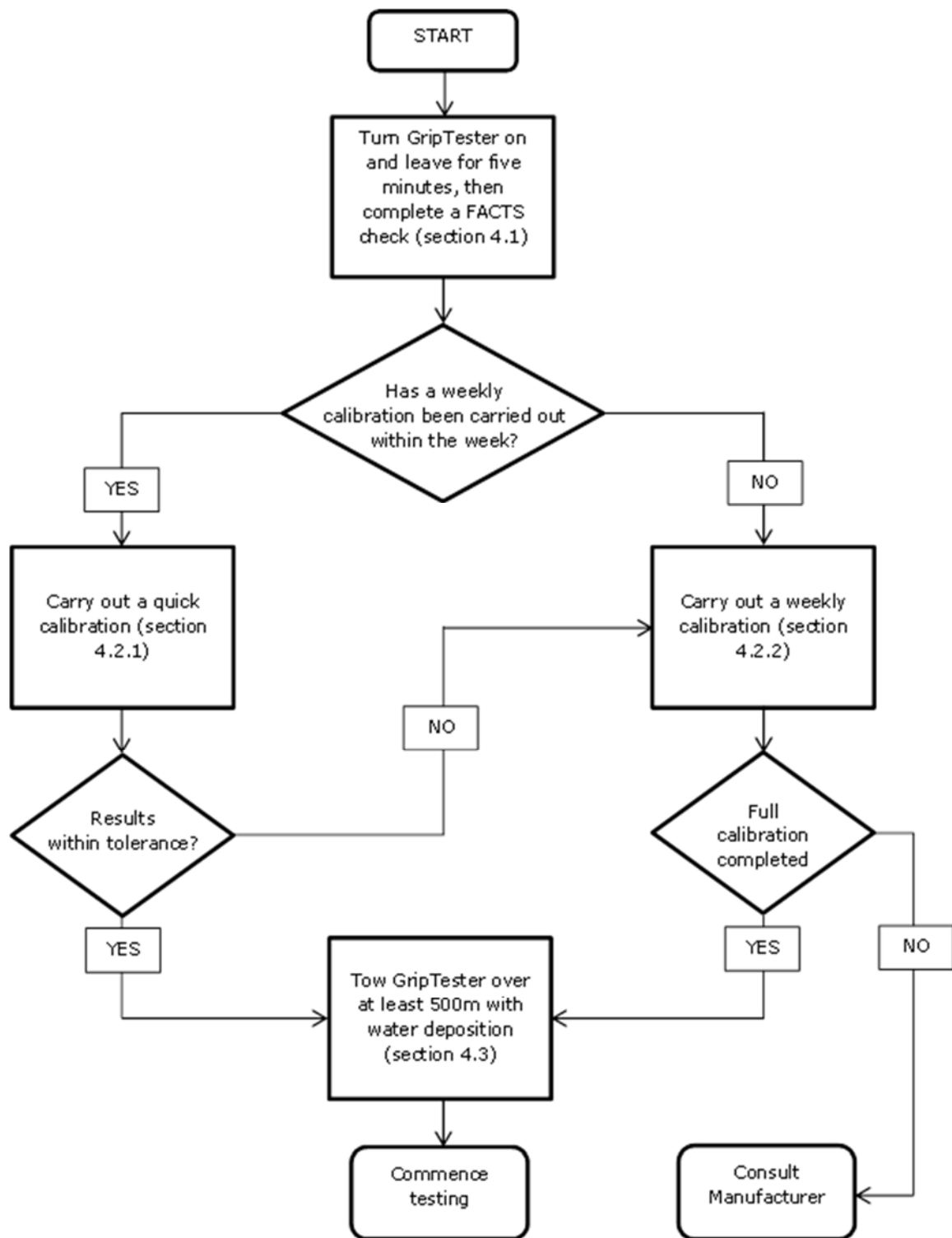


Figure 1: Calibration process prior to surveys

GripTester Operating Procedure

4.3 GripTester warm up

Prior to conducting a survey, ensure that the GripTester is towed over at least 500m, with water deposition, on a material representative of that which is to be tested.

4.4 Automatic Watering System (AWS)

Ensure there is sufficient water for testing and that the AWS is dispensing water prior to the survey. N.B. unrepresentative GripNumbers will be recorded if no water is deposited whilst testing. Further details can be found the GripTester Automatic Watering System Operations Manual (Findlay Irvine, 2005).

4.5 Longitudinal test position

Ensure the distance between the GripTester and operator is input correctly, this may be different dependant on the size of the tow vehicle.

4.6 Location

The start and end points of the test area must be clearly identified prior to the survey. It is essential for safety reasons that suitable turning points are identified prior to the survey commencing.

4.7 Data collection

A GripLength of 1m shall be selected, unless otherwise specified by the client.

5 Survey procedure

5.1 Weather conditions

In order to conduct the survey at the required target test speed the weather conditions shall be assessed to ensure good visibility. In addition, the air temperature must be greater than 4°C. If necessary the survey may require to be rescheduled to an alternative time when these requirements can be met.

Weather conditions must be noted as part of the survey report (example in Appendix B) as it is possible that different conditions may affect test results.

5.2 Road surface condition

The road surface temperature must be greater than 5°C and less than 50°C. The survey must be rescheduled for an alternative time if these requirements cannot be met. The road surface shall not be tested when there is standing water, frost, grease, debris or other contamination likely to affect results, unless these features are the purpose of the survey.

5.3 Survey team

The GripTester requires two operatives: one to drive the tow vehicle and one to control the GripTester. Both operatives must be trained and competent in the use of the GripTester.

5.4 Driving line

Testing shall be carried out so that the GripTester test wheel runs in the near side wheel path, unless specified differently. The driver of the tow vehicle shall aim to keep a consistent position on the survey route. In the case of subsequent runs the driver must endeavour to follow the same testing line as the previous runs, with start and end points remaining the same. Any deviations to the test route must be noted.

5.5 Test speed

The normal testing speed shall be 50km/h \pm 10% tolerance. However, if this is deemed to be too slow for the prevailing traffic conditions then an alternative target speed of 80km/h \pm 10% tolerance can be used.

The driver must endeavour to keep to a consistent speed, providing it is safe to do so. Data collected outwith the 10% speed tolerance shall not be used. The speed shall be checked after each survey to ensure that 75% of the survey is within the 10% speed tolerance. It should be noted that the speed at which the survey is carried out will influence the results, it is generally recognised that the higher the speed of the survey the lower the results.

It may be difficult to maintain a target speed owing to the prevailing traffic conditions, e.g. during peak travel times. Consideration shall be given to conducting the survey at the most appropriate time for operational and safety reasons. In some circumstances, such as roundabouts, target speeds may not be achievable under normal operation and temporary traffic management could be considered to facilitate the test. In situations where the target test speed cannot be achieved, this shall be noted as part of the survey report.

5.6 Water flow

The water flow shall be deposited to achieve a target water film depth of 0.25mm. The desired water flow will vary dependant on the target speed as follows:

50km/h	10.4 litres/min \pm 20% tolerance
80km/h	16.7 litres/min \pm 20% tolerance

Data collected outwith the 20% water flow tolerance shall not be used. The water deposited shall be between the temperatures of 5°C and 25°C.

At the end of the survey the water flow shall be checked and if not within tolerance for 75% of the section the run must be repeated.

5.7 Location referencing

Location referencing shall be recorded using a GPS system. The GPS data shall have an accuracy of better than 5m and shall be collected with a minimum update rate of 0.1 seconds.

Where applicable, the manual input of points of interest can be made to aid the location referencing process, e.g. start and end points, joints, nodes etc. An example (Appendix B) shows a summary report highlighting start and end link/section and chainages.

5.8 Run results

The aim of the survey is to record an average GripNumber (GN) for a tested section that is within 0.02GN of a consecutive run. Typically this is achieved between two and four runs. Each survey site is to be tested a minimum of two times with the GripTester. If the overall average GripNumber of the tested section is within 0.02GN of the previous run then the latter run shall be submitted as the test result. For example, if the third run is within 0.02GN of the second run then the third run is to be reported as the test result. If the fourth run is not within 0.02GN of the third run then the survey site should be visited at an alternative time and/or the GripTester calibration should be checked. Table 1 gives the four potential scenarios that may be encountered and which run should be submitted as the test result. Results must be recorded as 1m averages, unless instructed otherwise. After the survey, water and speed measurements should be checked to ensure they are within tolerance.

Table 1: Examples of GripNumber selection process

Run	Scenario			
	1	2	3	4
1	0.63	0.63	0.63	0.63
2	0.64	0.66	0.66	0.66
3	-	0.67	0.69	0.69
4	-	-	0.7	0.73

Scenario 1: First two runs are with 0.02GN; report Run 2 as test result.

Scenario 2: First and second runs not within 0.02GN, second and third runs within 0.02GN; report Run 3 as test result.

Scenario 3: First and second, second and third runs not within 0.02GN, third and fourth runs within 0.02GN; report Run 4 as test result.

Scenario 4: First and second, second and third, third and fourth runs not within 0.02GN; no result, check GripTester and reschedule test.

6 Reporting

6.1 Reporting format

Once the GripTester survey has been completed, a report containing results shall be submitted to the client within a month of surveying. A summary report is to be submitted with all CSV files with the test area highlighted, an example of the summary report is shown in Appendix B.

6.2 Guidance on processing results

Results shall be submitted to the client as raw or unprocessed data. However, if in-house analysis is required this section gives brief advice on the processing of GripTester data, including speed and seasonal correction.

6.2.1 *Tolerance checks*

Tolerance checks shall be applied to both speed and water flow. An example of calculating this tolerance is given in Appendix C1.

6.2.2 *Speed correction*

The standard test speed for GripTesting is 50km/h, if the non-standard speed of 80km/h is deemed necessary then a correction to the results shall be applied. This correction can vary over different material types. The current correction for Thin Surface Courses is an addition of 0.03GN to results carried out at 80km/h, this value is subject to change based on the most recent findings of Transport Scotland's GripTester precision trial. An example of applying this correction is given in Appendix C2.

6.2.3 *Seasonal correction*

Where applied, seasonal variation throughout the year shall be taken into account when analysing GripTester survey results. The correction value will be mostly dependent on the time of year the survey is carried out and the geographical area. A method for calculating the correction value for seasonal correction is given in Appendix C3.

6.2.4 *General analysis*

It is recommended that an average GripNumber for each Site Class is reported after the data has been processed in accordance with the tolerances described in sections 6.2.1 & 6.2.2. These average results can then be corrected for seasonal variation in accordance with section 6.2.3 and this should be reported as the average result for each Site Class or category.

6.2.5 *TS2010*

When testing TS2010 (SMA), results can be compared against the values given in Table 2.4 of TSIA No 35, from which the values are reproduced herein as Table 2 for convenience. This table contains the acceptable GripTester results for the respective Site Classes. The table also includes definitions of Site Category, in accordance with HD 28/15 (DMRB, 2015).

Table 2: Accepted GripNumber results for respective site classes

Site Class	HD 28 Site Category ^{a)}	Accepted GripNumber after six months trafficking
1	A, B & C	0.39
2	R, G1 & S1	0.51
3	Q, K, G2 & S2	0.56

^{a)} Table 4.1 of HD28 (DMRB 7.3.1)

For the compliance of TS2010 a 10m rolling-average is applied to results and compared to values in Table 2. An example of calculating this is given Appendix C4.

7 Glossary

Skid resistance

A property of the trafficked surface which limits relative movement between a vehicle tyre contact patch and the road.

Braked-wheel friction tester

Apparatus that can be moved over the test surface at a known, steady speed and that includes a test wheel, and a system for braking the test wheel and instrumentation for measuring the resulting friction between the test tyre and test surface.

Fixed slip

A braking system that forces the test wheel to roll at a fixed reduction of its natural speed.

GripTester

A braked-wheel fixed-slip device friction tester capable of being manually pushed or towed at up to 130km/h.

Load

A dynamic instantaneous vertical force acting on the test wheel.

Drag

A dynamic instantaneous horizontal force acting on the test wheel.

Instantaneous friction reading

Drag divided by load.

GripNumber

The mean of a number of instantaneous friction readings over a defined length. The value range of the GripNumber is 0.00 to 1.20.

GripLength

Defined length over which the GripNumber is produced.

Water deposition system

System for depositing a given amount of water in front of the test tyre so it then passes between the tyre and the surface being measured.

Theoretical water film thickness

Thickness of the water film that would exist between a test tyre with a smooth tread and the surface being measured if this surface had zero texture depth.

Routine skid resistance testing

Measurement of the skid resistance of a surface in standardized test conditions, which normally include a defined rate of water deposition.

8 References

- ASTM E1844-08. (2015).** *Standard Specification for A Size 10x4-5 Smooth-Tread Friction Test Tire.* West Conshohocken: ASTM International.
- British Standards. (2000).** *BS 7941-2:2000. Surface friction pavements – Part 2: Test method for measurement of surface skid resistance using the GripTester braked wheel fixed slip device.* London: BSi.
- Findlay Irvine (2005).** *GripTester, Automatic Watering System Operations Manual, Issue 2.* Midlothian: Findlay Irvine Limited.
- Findlay Irvine (2008).** *GripTester, MK2 D-type, Maintenance Manual, Issue 4.* Midlothian: Findlay Irvine Limited.
- Highways England, Transport Scotland, Welsh Assembly and The Department for Regional Development Northern Ireland. (2008).** *Design Manual for Roads and Bridges, Volume 7: Pavement Design and Maintenance, Section 3: Pavement maintenance assessment, Part 1: HD28 Skidding resistance.* London: The Stationary Office.
- TSIA No 35/18 (2018).** *Transport Scotland Interim Amendment No 35/18: TS2010 Surface Course Specification and Guidance.* Glasgow: Transport Scotland.

Appendix A: GripTester Calibration Report

GripTester		Tyre Serial No.		Week commencing				
Weekly Checks		Target	Actual	Reset (✓/*)	Comments			
Load Zero								
Load Gain								
Drag Zero								
Drag Gain								
Daily Checks		Mon	Tue	Wed	Thu	Fri	Sat	Sun
Free	✓/*							
Aligned	✓/*							
Chain	✓/*							
Tyres	✓/*							
Suspension	✓/*							
Load Zero	Target							
	Actual							
Signed (initials)								
Comments								

Signed.....

Name.....

Appendix B: GripTester Survey Summary Report

Location Detail			
Scheme Name		Scheme ID	
Road		Area	
Start link/section		Start chainage	
End link/section		End chainage	
Surfacing and Survey Details			
Material Type		Nominal Aggregate Size	
Material Specification		Coarse Aggregate	
Date Laid		PSV of Coarse Aggregate	
GripTester		Target survey date	
Weather		Actual survey date	
Site class/ category	e.g. Class 1	e.g. S2M	Etc.
Run 1			
Run 2			
Run 3 (if applicable)			
Run 4 (if applicable)			
Length of section (m)			

Signed.....

Name.....

Appendix C: Guidance on analysis

This Appendix is intended to give brief guidance on the processing of GripTester results. It covers tolerance checks, speed correction, seasonal correction and 10m averaging. These calculations are undertaken using a fabricated example, the general details of which are shown in table C1 and C2. Calculations used in all examples are described below each table and are generally intended for use in Microsoft excel.

Table C1: Details of GripTester survey

GripTester	GT A
Date of test	3 rd April 2017
Speed	80km/h
Site Class	1

Table C2: Example of GripTester results

Chainage (m)	GripNumber	Speed	Water Flow
1	0.63	80	14.1
2	0.64	80	14.2
3	0.67	79	13.6
4	0.62	79	13.3
5	0.65	78	13.2
6	0.68	78	13.5
7	0.61	76	14.3
8	0.61	76	14.7
9	0.61	74	15.1
10	0.64	71	15.1
11	0.64	75	15.5
12	0.63	77	15.8
13	0.65	78	16.3
14	0.66	78	16.3
15	0.66	80	16.3
16	0.66	80	16.7
17	0.68	80	16.6
18	0.69	81	16.4
19	0.65	80	16.7
20	0.64	80	16.7

Appendix C1: Tolerance checks

Table C1 declares the target speed of the survey as 80km/h, this requires a tolerance check of 10% (results must be within 72-88km/h to be considered valid). This speed also requires a water flow target of 16.7 litres/min with a tolerance of 20% (results must be within 13.4-20 litres/min to be considered valid). Table C3 gives an example of the tolerance check being applied to the fabricated results displayed in Table C2. Equations 1 & 2 are given below the table. It is noted that from the tolerance checks results at chainage 4, 5 & 10 should not be used in any further calculation.

Table C3: Example of GripTester tolerance checks for speed and water flow

Chainage (m)	GripNumber	Speed	Water Flow		Speed Check ^a	Water Flow Check ^b
1	0.63	80	14.1		0.63	0.63
2	0.64	80	14.2		0.64	0.64
3	0.67	79	13.6		0.67	0.67
4	0.62	79	13.3		0.62	FALSE
5	0.65	78	13.2		0.65	FALSE
6	0.68	78	13.5		0.68	0.68
7	0.61	76	14.3		0.61	0.61
8	0.61	76	14.7		0.61	0.61
9	0.61	74	15.1		0.61	0.61
10	0.64	71	15.1		FALSE	0.64
11	0.64	75	15.5		0.64	0.64
12	0.63	77	15.8		0.63	0.63
13	0.65	78	16.3		0.65	0.65
14	0.66	78	16.3		0.66	0.66
15	0.66	80	16.3		0.66	0.66
16	0.66	80	16.7		0.66	0.66
17	0.68	80	16.6		0.68	0.68
18	0.69	81	16.4		0.69	0.69
19	0.65	80	16.7		0.65	0.65
20	0.64	80	16.7		0.64	0.64

^a Equation for calculating speed check:

$$\text{Speed Check} = \text{IF}(\text{AND}(\text{speed} > 71, \text{speed} < 89), \text{GripNumber})$$

Where *speed* is the speed value for that chainage and *GripNumber* is the GripNumber value for that chainage.

^b Equation for calculating water flow check:

$$\text{Water Flow Check} = \text{IF}(\text{AND}(\text{water flow} > 13.3, \text{water flow} < 20.1), \text{GripNumber})$$

Where *water flow* is the water flow value for that chainage and *GripNumber* is the GripNumber value for that chainage.

Appendix C2: Speed correction

As results from this example survey were taken at the non-standard speed of 80km/h a speed correction shall be applied, this correction value may vary between material types but the value at time of writing is deemed to be an addition 0.03GN. This is shown in Table C3 along with the average results.

Table C4: Example of calculating speed correction of results taken at 80km/h

Chainage (m)	GripNumber	Tolerance check		Speed corrected to 50km/h ^c
1	0.63	0.63		0.66
2	0.64	0.64		0.67
3	0.67	0.67		0.70
4	0.62	FALSE		FALSE
5	0.65	FALSE		FALSE
6	0.68	0.68		0.71
7	0.61	0.61		0.64
8	0.61	0.61		0.64
9	0.61	0.61		0.64
10	0.64	FALSE		FALSE
11	0.64	0.64		0.67
12	0.63	0.63		0.66
13	0.65	0.65		0.68
14	0.66	0.66		0.69
15	0.66	0.66		0.69
16	0.66	0.66		0.69
17	0.68	0.68		0.71
18	0.69	0.69		0.72
19	0.65	0.65		0.68
20	0.64	0.64		0.67
Average				0.68

^c Equation for calculating speed correction:

$$\text{Speed correction} = \text{GripNumber} + 0.03$$

Where *GripNumber* is the GripNumber value for that chainage.

Appendix C3: Seasonal correction

The correction of seasonal variation can be estimated through weekly results taken from the reference site, as described in section 3.1. These results should be plotted on a scatter graph, day of year (x-axis) against GripNumber (y-axis). This should be done within a single year and be repeated for each subsequent year separately. An example of this graph is given in Figure C1.

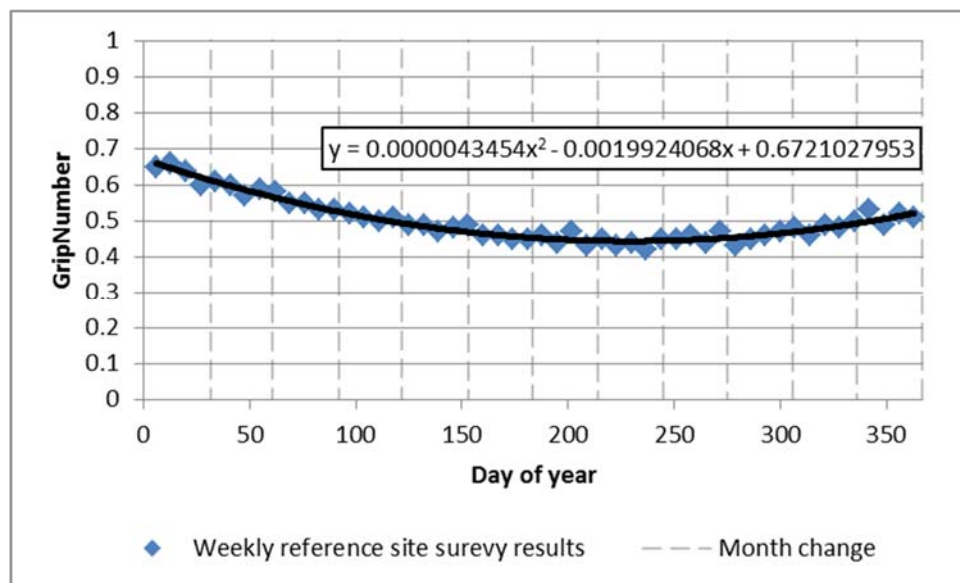


Figure C1: example results from reference site

Within Figure C1 a line of best fit (polynomial – 2nd order) has been established, the equation is included with values to 10 decimal places. These values can be used in the following equation to allow for seasonal correction of GripTester survey results:

^d Equation for calculating Mean Summer GripNumber (MSGN):

$$MSGN = \frac{\sum_{n_j}^{n_i} a(n^2) + bn + c}{n_j - n_i + 1}$$

Where:

n_i is the day of year where the summer period starts.

n_j is the day of year where the summer period ends.

n is the day of year valued between n_i & n_j .

a is the coefficient to x^2 from the equation of the line of best fit from the reference site.

b is the coefficient to x from the equation of the line of best fit from the reference site.

c is a constant based on the new y-intercept for the survey as calculated in Equation ^e.

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^e Equation for calculating new y-intercept (*c*) for survey:

$$c = y - a(x^2) - bx$$

Where:

a & *b* are as per Equation ⁴.

y is the GripNumber result from the survey.

x is the day of year the survey was carried out.

Example

An example of the use of Equation ^d and Equation ^e are described below using the fabricated data used in Tables C1 to C5. From Table C1 it is declared that the example survey was carried out on 3rd April 2017, this is day 92 in the year, Table C5 shows that the average GripNumber, after data processing, is 0.68GN. Using the coefficients of x^2 and x from the line of best fit in Figure C1 and Equation 5 the new y intercept (*c*) can be calculated as follows:

Using Equation ^e

$$c = 0.68 - (0.0000043454 * (92^2)) - (-0.0019924068 * 92)$$

$$c = 0.82652196$$

This value (*c*) can now be used in Equation 4. For the purposes of this example it is assumed that the summer season is between the 1st May (day 121 of the year) and 30th September (day 273 of the year):

Using Equation ^d

$$MSGN = \frac{\sum_{121}^{273} 0.0000043454(n^2) + (-0.0019924068n) + 0.82652196}{273 - 121 + 1}$$

$$MSGN = \frac{93.5036360178}{152}$$

$$MSGN = 0.6111345976$$

Therefore within this example the final result after seasonal correction (Mean Summer GripNumber) is 0.61GN.

Appendix C4: Calculation of 10m rolling average

This section gives guidance on calculating 10m rolling average with GripTester survey results. In the case where surveys cover multiple site classes the 10m rolling average should not cross over between site classes.

Table C5: Example of calculating 10m rolling average

Chainage (m)	GripNumber	Tolerance check		10m Rolling Average ^f	Chainage Averaged over
1	0.63	0.66			
2	0.64	0.67			
3	0.67	0.70			
4	0.62	FALSE			
5	0.65	FALSE		0.666	1-10
6	0.68	0.71		0.667	2-11
7	0.61	0.64		0.666	3-12
8	0.61	0.64		0.663	4-13
9	0.61	0.64		0.666	5-14
10	0.64	FALSE		0.669	6-15
11	0.64	0.67		0.667	7-16
12	0.63	0.66		0.674	8-17
13	0.65	0.68		0.683	9-18
14	0.66	0.69		0.688	10-19
15	0.66	0.69		0.686	11-20
16	0.66	0.69			
17	0.68	0.71			
18	0.69	0.72			
19	0.65	0.68			
20	0.64	0.67			

^f Equation for calculating 10m rolling average:

$$10m \text{ Rolling Average } = \text{AVERAGE}(\text{chainage1}:\text{chainage10})$$

If any chainage is out of tolerance, noted as FALSE, it is not used within this calculation. This equation is for the first average value the second average value would be between chainage 2 & 11 as shown in Table C2.