

SCANNER surveys for local roads

Specification Volume 3
Accreditation and Consistency Testing

For surveys in 2006/07

Halcrow Group Limited

Halcrow

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Acknowledgement

This specification is substantially based on the original "TRACS Type Surveys for the Principal Road Network- Specification and Advice Note" produced for the UK Roads Board by Chris Britton Consultancy and TRL Limited. It incorporates many detailed changes based on experience of using the TTS specification in 2003/04 and 2004/05 and a wide range of comments from interested parties and includes the results of the initial research. In addition the style has been changed to be consistent with new styles of contract (i.e. "the contractor carries out surveys", rather than, "the contractor shall survey").

Considerable assistance and support has been given by: TRL Limited, the UKPMS Development Support Consultant (Chris Britton Consultancy), Survey Contractors, UKPMS developers, and members of the SCANNER Implementation Advisory Group.

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Foreword

This document is one of a series of six describing the complete process of carrying out SCANNER Surveys (Surface Condition Assessment of the National Network of Roads). It replaces the version first published in July 2005.

The six Volumes are:

1. Advice to Local Authorities
2. Specification for Services
3. Accreditation and Consistency Testing
4. Quality Assurance and Audit
5. Further Technical Guidance
6. Survey Parameters and Data File Formats

This Volume, Accreditation and Consistency Testing, describes the requirements for testing survey vehicles to become accredited by site and network tests and is to be read in conjunction with the other documents. It describes the requirements for consistency testing and for the reporting and delivery of survey data from SCANNER accredited Surveys.

Volume 1 contains advice to Local Authorities about the Services to be provided under the SCANNER Specification. It contains background information about the development of SCANNER surveys from TTS and TRACS. It includes advice on contact procurement and mobilisation. It includes a glossary of technical terms and a model contact document as annexes.

Volume 2, Specification for Services contains details of survey procedures, data processing, route fitting and calculations of derived parameters.

Volume 4, Quality Assurance and Audit contains details of the Quality Assurance procedures to ensure Services are consistent and reliable. The document includes audit processes, monitoring, calibration, and requirements for repeat surveys.

Volume 5, Further technical guidance explains the background to SCANNER Surveys and gives further guidance on the interpretation of processed SCANNER data.

Volume 6, Survey Parameters and Data File Formats, provides definitions for the calculation of the derived parameters, definitions of the File Formats and a description of the Machine Survey Pre-processor (MSP). This information was previously provided in Volume 2, Annex A and Annex B

1 Introduction

- 1.1.1* The purpose of accreditation testing to the SCANNER survey specification (Surface Condition Assessment of the National Network of Roads) is to ensure that the system of data collection and data processing complies with the SCANNER specification. This should give a client (the Employer) confidence that a machine and its driver and operator, offered to carry out SCANNER accredited surveys, are capable of producing accurate, consistent and reliable results under standardised test conditions.
- 1.1.2* The purpose of consistency testing to the SCANNER survey specification is to measure the performance of all survey equipment on a realistic sample of the road network; to measure the repeatability of each machine and the reproducibility between different survey machines. So that accredited SCANNER survey results may be reported with confidence intervals ("error bands") and used for reporting road condition for both national statistical purposes (NRMCS, SRMCS) and local performance monitoring purposes (BVPI, SPI, LTP and CPA).
- 1.1.3* The Employer specifies in any contract for the provision of SCANNER surveys that the surveys may only be carried out by a machine (the Equipment) which has a currently valid Accreditation Certificate.
- 1.1.4* The Employer specifies in any contract for the provision of SCANNER surveys that the Contractor has and operates a Quality Assurance regime for carrying out surveys that includes driver/operator training and instruction.
- 1.1.5* Before commencing SCANNER accredited surveys the Contractor provides the Employer and any appointed Auditor with a copy of a currently valid Accreditation Certificate.
- 1.1.6* The Accreditation Tests may be carried out on any machine and at any time. Following the successful completion of the tests, the tester issues an Accreditation Certificate for the survey machine to carry out SCANNER accredited surveys for a period of up to 15 months.

- 1.1.7* At intervals of no more than one year following the successful completion of the Accreditation Tests the Contractor submits the survey equipment for Accreditation re-testing as described in Section 7. Following the successful completion of an annual re-test, the tester issues a SCANNER Accreditation Certificate for a further period of up to one year. This is calculated from the date of expiry of the previous Accreditation Certificate.
- 1.1.8* The Consistency Tests will be carried out on all survey equipment at, as near as possible, the same time of year. This will normally be as part of the annual Accreditation re-testing. When new survey equipment is accredited at a different time of the year, the Tester will award a provisional consistency score, based on the predefined sample road network, and re-tested at the next annual re-Accreditation Tests.
- 1.1.9* The Accreditation Tester may assess the competence of drivers and operatives as part of the Accreditation Testing and the annual re-testing.
- 1.1.10* The Auditor may revoke an Accreditation Certificate at any time and require the Contractor to undertake retesting if the Equipment fails to meet the accuracy requirements during SCANNER surveys, including Contractor's repeat surveys and Auditor's repeat surveys.
- 1.1.11* If a Contractor makes any significant change to the Equipment after the issue of an Accreditation Certificate the Auditor may require the Equipment to be submitted for an additional Accreditation re-test.
- 1.1.12* If the Equipment is required to undergo an additional Accreditation re-test, the Auditor may also require the Equipment to be submitted for an additional Consistency re-test.

2 Accreditation testing

- 2.1.1 The Accreditation Tests assess the capability of the survey equipment in the measurement and reporting of the parameters specified in the following sections. The accuracy of the equipment in the measurement of each parameter is assessed separately so that the equipment may be judged as acceptable or not (as applicable) in the measurement of each parameter individually.
- 2.1.2 The machine developer or Contractor attends the Accreditation Tests, and carries out any surveys or data processing required by the Accreditation Tester, at its own cost.
- 2.1.3 The survey equipment is driven and operated by drivers and operators named in the Contractor's quality system. The Accreditation Tester supervises and controls the tests.
- 2.1.4 The Accreditation Testing is carried out as site tests, network tests and survey data acceptance tests:
- In the site tests the parameters measured by the survey equipment are compared with those measured by the Reference Methods on test sections located on sites selected by the Accreditation Tester.
 - The network tests assess the operational capabilities of the survey equipment when carrying out surveys under normal operating conditions on one or more routes selected by the Accreditation Tester and located on the public road network.
 - In the survey data Accreditation tests the data output from the Survey Equipment is checked to ensure that it complies with all the requirements for loading into a UKPMS accredited system.
- 2.1.5 If the survey equipment fails to achieve the required levels of accuracy in the measurement of individual parameters, the machine developer or Contractor may seek to resolve this issue by enhancing the performance of the survey equipment. The Accreditation Test for that measurement may

then be repeated, at the Contractor's expense, at a time convenient to both the Accreditation Tester and the machine developer or Contractor.

- 2.1.6 Failure to achieve the requirements in the measurement of any single parameter does not necessarily exclude the survey equipment from carrying out surveys on the local road network in England, provided the measurement that the survey equipment is not able to provide is not required by the Employer for the assessment of the Employer's network. (For example, if a survey machine cannot meet all the requirements for surveying concrete road surfaces and the Employer does not require surveys of concrete road surfaces, the machine may be acceptable and accredited for use on other road surfaces).
- 2.1.7 On successful completion of the Accreditation Tests, including the survey data Accreditation testing, the Accreditation Tester issues an Accreditation Certificate as shown in Figure 3.1 which summarises the results of the Accreditation Tests in the measurement of each defined survey parameter.
- 2.1.8 The initial accreditation certificate is valid up to 15 months from the date of issue. Before the accreditation certificate expires, the machine developer or Contractor submits the survey equipment for Accreditation re-testing, as described in Section 6.

3 Consistency testing

- 3.1.1* The Consistency Tests measure the repeatability of the survey equipment in the measurement and reporting of the parameters specified in the following sections, and the reproducibility between different survey equipment. The overall consistency of the Equipment is reported in terms of the bias and random error present in the reported SCANNER Road Condition Indicator.
- 3.1.2* The machine developer or Contractor attends the Consistency Tests, and carries out any surveys or data processing required by the Tester, at its own cost.
- 3.1.3* The survey equipment is driven and operated by drivers and operators named in the Contractor's quality system. The Tester supervises and controls the tests.
- 3.1.4* The Consistency Testing is carried out on a predefined road network which includes representative samples of the road networks for which the survey equipment is required.

SCANNER Accreditation Certificate

The Equipment:
Operated by:
Has undergone testing at:.....
Test Format:
Supervised by (company)

Parameter	Comments	Pass/Fail/Partial
Location Referencing:.....		
Grid Co-ordinates:		
Road Geometry:		
Gradient:		
Crossfall:		
Curvature:		
Longitudinal Profile:		
Deceleration limits(m/s ²): 3m:10m:.....30m:		
Rutting:		
Texture Profile:.....		
Cracking:		
Sensitivity Factor (if available):.....		

The Equipment is Accredited to carry out surveys to the SCANNER specification between:	
Date of Issue:	Date of Expiry:
Assessor's Name:	Assessor's Signature:

Figure 3.1: Example SCANNER Accreditation Certificate

4 Site tests

4.1

General matters

4.1.1

For several of the Site Tests it is necessary for the survey equipment to record the location of the start of each test section to an accuracy better than $\pm 1\text{m}$ so that the data provided by the machine developer or Contractor can be accurately aligned with the Reference Data.

- To enable this level of accuracy to be achieved the Accreditation Tester places markers at the test section start and end points adjacent to the nearside of the traffic lane being surveyed.
- These markers take the form of posts approximately 0.75m tall. The face of the posts (aligned longitudinally with the traffic lane) are covered with a retro-reflective material of dimensions approximately 0.65m by 0.1m.
- The survey equipment must record the location of these posts placed at the test Section start and end points to an accuracy of better than $\pm 1\text{m}$ over the range of speeds under which the survey equipment would normally be operated.

4.1.2

The Accreditation Tester provides the Contractor with a plan describing the test sites and the survey procedures to be applied (e.g. survey speeds) on those sites at least 5 working days before the commencement of the tests.

4.1.3

For the Site Tests the Contractor:

- Surveys the test sites as instructed by the Accreditation Tester in the plan provided before the tests.
- Where reflective posts are placed at the Section start and end points, records the location of the posts marking the Section start and end points to an accuracy of better than $\pm 1\text{m}$ using suitable equipment installed on the survey equipment
- Processes the Survey Data from the test site to generate SCANNER RCD and SCANNER HMDIF files. [Where reflective posts are placed at the Section start and end points and are recorded by the

survey equipment, it should not normally be necessary to align the Survey Data with the planned survey route before generating the SCANNER RCD and SCANNER HMDIF files.] However, where it is found necessary to carry out alignment of the Survey Data with the planned survey route the Contractor ensures that the elapsed distances of the section change points recorded in the location records of BOTH the SCANNER RCD and SCANNER HMDIF files are the aligned (post-fitted) distances.

- Delivers the SCANNER RCD and SCANNER HMDIF files to the Accreditation Tester within 8 working days of the test sites being surveyed.

4.1.4

The Accreditation Tester uses a number of Reference Methods to assess the accuracy of the Equipment in the Site Tests, these are summarised in Table 3.1 .

Parameter	Parameter	Values to be Compared with Reference	Reference Method - Site Tests
Location Referencing	Distance Travelled	Measured lengths of Sections	Calibrated Measuring wheel and Steel Tape
	National Grid Co-ordinates of Section start points	National Grid Co-ordinates of Section start points	Static GPS combined with an Optical Survey
	National Grid Co-ordinates of positions of moving vehicle	National Grid Co-ordinates of positions of moving vehicle	Static GPS combined with an Optical Survey
Geometry	Gradient	Gradient	Rod and level
	Crossfall	Crossfall	Rod and level
	Radius of Curvature	Radius of Curvature	Calibrated Measuring wheel / Steel Tape
Longitudinal Profile	Longitudinal Profile	Measured Longitudinal Profile	ARRB Walking Profiler and/or Artificial Profile (characterised using micrometer and/or rod and level)
	Variance	3m, 10m, 30m Moving Average Longitudinal Profile Variance	ARRB Walking Profiler
Rutting	Rut Depth	Rut depth	Straight-edge and wedge And/or HARRIS ¹ , with manual assessment of the measured transverse profiles
Texture Profile	Texture Profile	Measured Texture Profile	Characterised Artificial Profile
	Sensor Measured Texture Depth (SMTD)	Sensor Measured Texture Depth (SMTD)	HARRIS ¹
Cracking	Crack Intensity	Crack Intensity	Primary Reference Data: Manual Assessment of Digital Images
	Crack Intensity	Crack Intensity	Secondary Reference Data: Mean Crack Intensity Recorded by each item of Equipment ²
	Crack map	Individual Grid tiles containing Cracks	Manual Assessment of Digital Images

1. Highways Agency Road Research Information System (HARRIS1/HARRIS2)

2. Where more than one piece of Equipment from *different* Contractors participate in the Tests

Table 3.1: Reference Methods to be used in the Accreditation Tests of the survey equipment on the test sites selected by the Accreditation tester

4.2

Site tests of location referencing

4.2.1

The Accreditation Tester selects a test site and divides it into a number of Sections, marking the start and end of each section with a reflective post.

- The site may contain both straight and curved Sections.
- The site may contain Sections having levels of GPS signal availability (in terms of the length of the Section over which the GPS signal is available) ranging from less than 10% availability of GPS signal to greater than 90% availability.

4.2.2

The Contractor defines a survey route appropriate for the survey of the test site, surveys the test site at a range of speeds (as required by the Accreditation Tester) and delivers the SCANNER RCD and the SCANNER HMDIF from the test site to the Accreditation Tester.

4.2.3

The Accreditation Tester compares the lengths of the Sections recorded in the SCANNER RCD and SCANNER HMDIF provided by the Contractor with the lengths of the Sections measured by the Reference Method.

4.2.4

The Accreditation Tester compares the National Grid Co-ordinates and the Altitudes recorded in the SCANNER RCD and SCANNER HMDIF provided by the Contractor with National Grid Co-ordinates and the Altitude recorded for these Sections using the Reference Method.

4.2.5

The test is passed if all the following criteria are met:

- 95% of the measured Section lengths fall within $\pm 1\text{m}$ (or $\pm 0.1\%$, whichever is larger) of the Section lengths measured using the Reference Method.
- 95% of the measured National Grid Co-ordinates are within $\pm 2\text{m}$ of the National Grid Co-ordinates measured using the Reference Method for those Sections having better than 70% availability of the signal used by the equipment for the calculation of National Grid Co-ordinates
- 95% of the measured National Grid Co-ordinates are within $\pm 10\text{m}$ of the National Grid Co-ordinates measured using the Reference Method for those Sections having less than 70% availability of the signal used by the equipment for the calculation of National Grid Co-ordinates.

- All of the measured National Grid Co-ordinates are within 50m of the National Grid Co-ordinates measured using the Reference Method.
- 95% of the measured Altitudes are within $\pm 3\text{m}$ of the Altitudes measured using the Reference Method for those Sections having better than 70% availability of the signal used by the equipment for the calculation of National Grid Co-ordinates.
- 95% of the measured Altitudes are within $\pm 5\text{m}$ of the Altitudes measured using the Reference Method for those Sections having less than 70% availability of the signal used by the equipment for the calculation of National Grid Co-ordinates
- All of the measured Altitudes are within 50m of the Altitudes measured using the Reference Method.

4.3

Site tests of road geometry

4.3.1

The Accreditation Tester selects a test site and divides it into a number of Sections, marking the start and end of each section with a reflective post..

4.3.2

The Accreditation Tester surveys the test site for Gradient, Cross-fall and Radius of Curvature using the Reference Method(s) given in Table 3.1.

- The geometry of the site may be varied, with cross-fall, gradient and curvature lying in the full range specified in Volume 2.

4.3.3

The Contractor defines a survey route appropriate for the survey of the test site, surveys the test site at a range of speeds (as required by the Accreditation Tester) and delivers the SCANNER RCD and the SCANNER HMDIF from the test site to the Accreditation Tester.

4.3.4

The Contractor provides measurements of gradient, cross fall and radius of curvature. The longitudinal separation of measurements may not exceed 0.5m. The measurements are averaged over 5m and expressed as values at 5m intervals.

Measured Parameter	Range
Gradient	At least $\pm 20\%$
Cross-fall	At least $\pm 20\%$
Radius of curvature	At least $\pm 2000\text{m}$

Table 3.2 Road Geometry Parameters: Range requirements.

4.3.5 The Accreditation Tester subtracts the gradient, cross-fall and radius of curvature recorded in the SCANNER RCD and SCANNER HMDIF provided by the Contractor from the gradient, cross-fall and radius of curvature measured with the Reference Method.

4.3.6 The test is passed if all the following criteria are met:

- 95% of the differences between the measured Gradient and the Reference Gradient fall within ± 1.5 , or $\pm 10\%$ of the Reference Gradient, whichever is greater.
- The difference between the measured gradient and the Reference Gradient shall never exceed ± 6 .
- 95% of the differences between the measured Cross-fall and the Reference Cross-fall fall within ± 1.5 , or $\pm 10\%$ of the Reference Cross-fall, whichever is greater.
- The difference between the measured cross-fall and the Reference Cross-fall shall never exceed ± 6 .
- 65% of the differences between the measured Radius of Curvature and the Reference Radius of Curvature fall within $\pm 20\text{m}$, or $\pm 10\%$ of the Reference Radius of Curvature, whichever is greater.
- 95% of the differences between the measured Radius of Curvature and the Reference Radius of Curvature fall within $\pm 50\text{m}$, or $\pm 25\%$ of the Reference Radius of Curvature, whichever is greater.

4.4 ***Site tests of longitudinal profile***

4.4.1 The Accreditation Tester selects a test site and divides it into a number of Sections, marking the start and end of each section with a reflective post.

- The site may contain both straight and curved Sections, but shall not contain any extremes of geometry.

4.4.2 The Accreditation Tester measures the longitudinal profile of the site using the Reference Method given in Table 3.1

4.4.3 The Contractor defines a survey route appropriate for the survey of the test site.

4.4.4 The Accreditation Tester provides the Contractor with a breakdown of the range of speeds for which longitudinal profile measurements of the site will be required.

- A number of test surveys are carried out at constant survey speed and a number of test surveys are carried out under conditions of deceleration.
- To achieve even decelerations the Accreditation Tester marks out the test site to indicate the locations at which survey vehicle braking should start and end.

4.4.5 The Contractor uses the survey equipment to collect measurements of Longitudinal Profile on the test site under the range of conditions defined by the Accreditation Tester and delivers the SCANNER RCD and the SCANNER HMDIF from the test site to the Accreditation Tester.

4.4.6 If the Contractor intends to use its own facilities to calculate SCANNER HMDIF from the Survey Data when carrying out SCANNER accredited surveys, the Accreditation Tester checks to ensure that the calculation of 3m, 10m and 30m variance in the Contractor's facility is satisfactory.

4.4.7 The test of the calculation of variance is carried out as follows:

- The Contractor delivers the SCANNER RCD from the test site and the SCANNER HMDIF from the test site calculated from the Survey Data using the facility provided by the Contractor.
- The longitudinal profile recorded in the SCANNER RCD provided by the Contractor is processed by the Accreditation tester to obtain the SCANNER HMDIF. This is compared with the SCANNER HMDIF provided by the Contractor.

4.4.8 The measurement of Longitudinal Profile measured by the survey equipment over the test site and provided in the SCANNER RCD is assessed as follows:

- A moving average filter is applied to both the Reference Profile and the measured profile to obtain three filtered profiles for which wavelengths in excess of 3m, 10m and 30m have been attenuated.

- If required, the Accreditation Tester normalises the measured profile, for example to remove any constant, or linear, offset between the Reference and measured profiles. The Accreditation Tester calculates the differences between the filtered Reference Profile and the filtered measured profile by subtracting the filtered Reference Profile from the filtered measured profile.
- If required, the Accreditation Tester normalises the measured profiles and calculates the cross-correlation coefficient between the filtered Reference Profile and the filtered measured profile.
- The Accreditation Tester calculates the 3m Moving Average Longitudinal Profile Variances from the Longitudinal Profiles measured by the survey equipment using the method described in Volume 6. The Accreditation Tester subtracts these values from the 3m Moving Average Longitudinal Profile Variances calculated from measurements of Longitudinal Profile previously made on the selected lengths using the Reference Method(s), to obtain the differences between the measured profile and the Reference Profile.
- The Accreditation Tester calculates fractional errors by dividing the differences by the 3m, 10m and 30m Moving Average Longitudinal Profile Variances calculated from the Reference Profile.
- The Accreditation Tester assesses accuracy separately for surveys carried out at constant speed and surveys carried out under conditions of deceleration

4.4.9

The tests for longitudinal profile are passed, for the surveys carried out at constant speed, if:

- The SCANNER HMDIF obtained by the Accreditation Tester from the SCANNER RCD is the same as the SCANNER HMDIF calculated by the Contractor from the Survey Data.
- 95% of the differences between the measured Longitudinal Profile and the Reference Profile fall within the ranges given in column A of Table 3.2.
- 95% of the cross-correlation coefficients equal or exceed the values given in column B of Table 3.2.
- 65% of the errors between the moving average profile variances calculated from the measured profile and the moving average profile variances calculated from Reference Profile fall within the ranges given in column C of Table 3.2.

- 95% of the errors between the moving average profile variances calculated from the measured profile and the moving average profile variances calculated from Reference Profile fall within the ranges given in column D of Table 3.2.

	A	B	C	D
Moving Average Length (m)	Profile Differences (95%)	Profile Cross Correlation Coefficient	Variance Error (65%)	Variance Error (95%)
3	±2.00	0.75	±0.30	±0.60
10	±4.00	0.85	±0.35	±0.70
30	±6.00	0.85	±0.45	±0.90

Note: For 3 m, 10 m and 30 m Longitudinal Profile Variance the tolerances are in terms of the either differences or the fractional errors between the Longitudinal Profile Variances calculated from the measured profile and the Longitudinal Profile Variances calculated from the Reference Profile, as defined in Volume 2 Table2.2 .

Table 3.2: Accuracy requirements for the Site Tests of longitudinal profile

4.4.10 The Accreditation Tester compares the performance of the Equipment at each level of deceleration with the accuracy requirements given in Table 3.2 for the surveys carried out under conditions of deceleration.

4.4.11 The Accreditation Tester records the level of deceleration at which, in its opinion, the Equipment fails to provide measurements to an acceptable level of accuracy when compared with the accuracy requirements given in Table 3.2. This defines the limit of deceleration under which the Equipment provides acceptable data.

4.5 ***Site tests of transverse profile and wheel path rutting***

4.5.1 The Accreditation Tester selects a test site and divides it into a number of Sections, marking the start and end of each section with a reflective post.

4.5.2 The Accreditation Tester provides the Contractor with a map showing the location of the sites and the description of each Section start and end point on each site.

- The sites may cover a broad range of rut depths and other transverse features.
- 4.5.3 The Accreditation Tester measures the rutting present on the test sites using the Reference Method given in Table 3.1.
- 4.5.4 The Contractor defines a survey route appropriate for the survey of each of the test sites, carries out one or more surveys of the test sites as required by the Accreditation Tester and delivers the SCANNER RCD and the SCANNER HMDIF to the Accreditation Tester.
- 4.5.5 The Accreditation Tester averages the rut depths recorded in the SCANNER RCD over 10m lengths and subtracts them from the rut depths measured with the Reference Method over 10m lengths.
- 4.5.6 The test is passed if all the following criteria are met:
- 65% of the differences between the measured maximum Rut Depths in each Wheelpath, and the Reference maximum Rut Depth in each Wheelpath fall within $\pm 1.5\text{mm}$.
 - 95% of the differences between the measured maximum Rut Depths in each Wheelpath, and the Reference maximum Rut Depth in each Wheelpath fall within $\pm 3.0\text{mm}$.
 - All of the differences between the measured maximum Rut Depths in each Wheelpath, and the Reference maximum Rut Depth in each Wheelpath are less than $\pm 10.0\text{mm}$, or 50% of the magnitude of the Reference Rut Depth, whichever is the greater.
- 4.5.7 The tests of transverse profile also assess the accuracy of the Contractor's calculation of the transverse profile parameters defined in Volume 6. The Accreditation Tester compares the values of these parameters calculated by the Contractor for the test site with values calculated by the Accreditation Tester.
- 4.5.8 The Contractor provides SCANNER RCD files containing the transverse profile measurements collected over the test sites, and SCANNER HMDIF files containing the parameters defined in Volume 6 for the test sites.

- 4.5.9 The Accreditation Tester calculates the transverse profile parameters defined in Volume 6, using the transverse profile data provided by the Contractor in the SCANNER RCD, and compares them with the values provided by the Contractor in the SCANNER HMDIF files for the test sites.
- 4.5.10 The Contractor's calculation of the transverse profile parameters defined in Volume 6 is acceptable if the values in the Contractor's HMDIF are the same as those calculated by the Accreditation Tester.
- 4.6 ***Site tests of texture profile***
- 4.6.1 The Accreditation Tester selects a test site consisting of a single Section for the assessment of the measurement of “raw” texture profile, marking the start and end of the Section with a reflective post.
- The Section contains features of a known Texture Profile, characterised using conventional measurement methods.
 - These measured shapes are referred to as the Reference Profile for the assessment of Texture Profile measurement.
- 4.6.2 The Accreditation Tester selects a further test site and divides it into a number of Sections for the assessment of the measurement of Sensor Measured Texture Depth (SMTD), marking the start and end of each section with a reflective post.
- The site may contain both straight and curved Sections, but shall not contain any extremes of geometry.
- 4.6.3 The Accreditation Tester measures the texture profile of the site using the Reference Method given in Table 3.1 for the measurement of SMTD.
- 4.6.4 The Contractor defines a survey route appropriate for the survey of the test site, carries out one or more surveys of the test site as required by the Accreditation Tester and delivers the SCANNER RCD and the SCANNER HMDIF to the Accreditation Tester.
- 4.6.5 If the Contractor intends to use its own facilities to calculate SCANNER HMDIF from the Survey Data when surveying the Employer's Network the Accreditation Tester checks to ensure that the calculation of SMTD in the

Contractor's facility is satisfactory. The Accreditation Tester carries out the test of the calculation of SMTD as follows:

- The Contractor delivers the SCANNER RCD from the test site and the SCANNER HMDIF from the test site calculated from the Survey Data using a facility provided by the Contractor.
- The Accreditation Tester processes the texture profile recorded in the SCANNER RCD provided by the Contractor to obtain the SCANNER HMDIF. The Accreditation Tester compares this with the SCANNER HMDIF provided by the Contractor.

4.6.6 The Accreditation Tester assesses the measurement of texture Profile by the Equipment, over the test site, and provided in the SCANNER RCD as follows:

- The texture profile recorded in the SCANNER RCD provided from the test site for the assessment of the measurement of "raw" texture profile is subtracted from the Reference Profile to obtain the differences between the texture profile and the reference profile.
- The SMTD is calculated from the texture profiles recorded in the SCANNER RCD provided from the test site for the assessment of the measurement of SMTD using the method described in Volume 6. These values will then be subtracted from the SMTDs calculated from measurements of texture Profile previously made on the selected lengths using the Reference Method(s) to obtain the differences between the measured SMTD and the Reference SMTD.

4.6.7 The tests for texture profile measurement will be passed if:

- The SCANNER HMDIF obtained by the acceptance tester from the SCANNER RCD is the same as the SCANNER HMDIF calculated by the Contractor from the Survey Data for the test site for the assessment of the measurement of SMTD.
- 95% of the differences between the measured Texture Profile and the Reference Profile (from the test site for the assessment of the measurement of "raw" texture profile) fall within $\pm 0.5\text{mm}$.
- 95% of the differences between the SMTD calculated from the measured Texture Profile and the SMTD calculated from the

Reference Profile (from the test site for the assessment of the measurement of SMTD) fall within the range $\pm 0.25\text{mm}$.

- All of the differences between the SMTD calculated from the measured Texture Profile and the SMTD calculated from the Reference Profile (from the test site for the assessment of the measurement of SMTD) fall within the range $\pm 0.75\text{mm}$.

4.7

Site tests of cracking intensity measurement

4.7.1

The Accreditation Tester selects a number of test sites and divides them into a one or more Sections, marking the start and end of each Section with a reflective post.

- The sites may cover a broad range of crack intensities; pavement constructions (including fully flexible, rigid and composite); surface types; surface texture; crack widths and crack orientations; as may be found on the English local road network.

4.7.2

There are two sources of reference data for the Accreditation Tests of the measurement of cracking, shown in Table 3.1, termed the Primary and Secondary Reference Data.

4.7.3

The Primary Reference Data forms the basis for initial assessment of the performance of the Equipment as described in paragraphs 4.7.3 to 4.7.15.

4.7.4

The Accreditation Tester derives the Primary Reference Data by visual inspection of digital images. The Highways Agency Road Research Information System (HARRIS) survey vehicle provides the images from which the Primary Reference Data are derived, as follows:

- The HARRIS survey vehicle provides greyscale images (256 levels) of the test sites over a survey width of approximately 2.9m at an image resolution of 2mm longitudinally and 2mm transversely.
- The HARRIS images are displayed in a strip map format on a computer screen for visual inspection. The images are marked with a 200 mm square grid. (Note the outermost grid square will therefore be only partially occupied.).
- The grid-marked images are inspected by eye to identify cracking. Any grid tile containing a crack is counted. The total number of

grid tiles with a crack is counted over each 50m length of survey data.

- The Accreditation Tester calculates the Cracking Intensity as the percentage of 200 mm square grid tiles with a crack over each 50 m sub-section length, which is the Primary Reference Data.

4.7.5 The Accreditation Tester interprets the Primary Reference Data to obtain the Relative Cracking Intensity for each sub-section.

- The Accreditation Tester calculates the average Cracking Intensity recorded over all of the sub-sections surveyed in the Primary Reference Dataset.
- The Accreditation Tester divides the Cracking Intensity for each sub-section by the average Cracking Intensity to obtain the Relative Cracking Intensity for each of the 50m sub-sections. (Note, the overall average value is 1.)
- The Accreditation Tester classifies the individual subsections into high, moderate and low levels of cracking.
- Sub-sections with a Relative Cracking Intensity greater than 1.75 are defined as sub-sections containing high levels of cracking.
- Sub-sections with a Relative Cracking Intensity less than 1.25 but greater than 0.5 are defined as sub-sections containing moderate levels of cracking.
- Sub-sections with a Relative Cracking Intensity less than 0.2 will be defined as sub-sections containing low levels of cracking.

[Note the deliberate separation between high levels of cracking >1.75; moderate levels between 0.5 and 1.25 and low levels <0.2.]

4.7.6 The Accreditation Tester provides the Contractor with a map showing the location of the test sites and the description of each Section start and end point on each test site.

4.7.7 The Contractor defines survey routes appropriate for the surveys of these test sites and carries out at least two surveys over each site, or more if requested by the Accreditation Tester.

4.7.8 The methods of identifying and measuring cracking intensity differ for different systems and the Contractor may need to calibrate the Survey

Equipment to be able to measure cracking intensity on the English local road network. Therefore the Accreditation Tester provides the Contractor with a sample of the Reference Data for a length not exceeding 5km of the Reference Sites. The Contractor may use this data to calibrate the crack identification system fitted to the Survey Equipment.

4.7.9 After any necessary calibration of the crack identification system, the Contractor carries out the surveys of the test sites, and delivers the SCANNER RCD and the SCANNER HMDIF from the test sites to the Accreditation Tester.

4.7.10 If the Contractor intends to use its own facilities to calculate SCANNER HMDIF from the Survey Data when carrying out SCANNER accredited surveys, the Accreditation Tester checks to ensure that the calculation of crack intensities in the Contractor's facility is acceptable. The test of the calculation of crack intensity is carried out as follows:

- The Contractor calculates the SCANNER RCD and the SCANNER HMDIF from the Survey Data of the test sites.
- The Accreditation Tester processes the cracking recorded in the SCANNER RCD provided by the Contractor, using the MSP, to obtain the SCANNER HMDIF.
- The Accreditation Tester compares this with the SCANNER HMDIF provided by the Contractor.

4.7.11 The Accreditation Tester processes the crack data provided by the Contractor in the SCANNER RCD to obtain the Cracking Intensity over each 50m long sub-section. The Accreditation Tester calculates the average Cracking Intensity recorded over all of the sub-sections surveyed from the SCANNER RCD provided by the Contractor. The Accreditation Tester divides the Cracking Intensity for each sub-section surveyed by the calculated average Cracking Intensity. The Accreditation Tester classifies the sub-sections in the same way as the Primary Reference Data described in Paragraph 4.7.5 to obtain the Relative Cracking Intensities for the survey data provided by the Contractor.

4.7.12 The Accreditation Tester compares the Primary Reference Data with the results of the surveys carried out by the Contractor. Each survey run is

treated separately, so that if there are two survey runs two sets of Relative Cracking Intensities will be compared with the Primary Reference Data.

4.7.13

The Accreditation Tester assesses the accuracy of the measurement of cracking using the Primary Reference Data:

- The Accreditation Tester identifies the 50m sub-sections containing a high level of cracking (as defined in paragraph 4.7.5) from the Primary Reference Data. The Accreditation Tester compares the results of the survey carried out by the Contractor using the Survey Equipment over the same sub-sections with the Primary Reference Data.
- The Accreditation Tester identifies the 50m sub-sections containing a moderate level of cracking (as defined in paragraph 4.7.5) from the Primary Reference Data. The Accreditation Tester compares the results of the survey carried out by the Contractor using the Survey Equipment over the same sub-sections with the Primary Reference Data.
- The Accreditation Tester identifies the 50m sub-sections containing a low level of cracking (as defined in paragraph 4.7.5) from the Primary Reference Data. The Accreditation Tester compares the results of the survey carried out by the Contractor using the Survey Equipment over the same sub-sections with the Primary Reference Data.

4.7.14

The tests for measuring Cracking Intensity will be passed only if all of the following requirements are met **for each survey run** (see also paragraph 4.7.15):

- The Accreditation Tester obtains the same SCANNER HMDIF from the SCANNER RCD provided by the Contractor as the SCANNER HMDIF calculated by the Contractor from the Survey Data.
- The Survey Equipment shows a high level of cracking over at least 75% of the 50m sub-sections that the Primary Reference Data shows to have high level of cracking.
- The Survey Equipment shows a low level of cracking over at least 75% of the 50m sub-sections that the Primary Reference Data shows to have a low level of cracking.

[Note: the Accreditation Tester also checks whether the Survey Equipment shows a moderate level of cracking over at least 50% of the 50m sub-sections that the Primary Reference Data shows to have a moderate level of cracking. This is not an absolute requirement for Accreditation, but a more stringent test of machine performance]

4.7.15 As a test of repeatability, the Accreditation Tester applies the requirements in paragraph 4.7.14 separately to the Cracking Intensity recorded in each of the survey runs carried by the Contractor.

4.7.16 If the Survey Equipment is able to meet all of the requirements of paragraph 4.7.14, the Accreditation Tester accredits the Survey Equipment to carry out SCANNER accredited surveys with any variable settings fixed at the settings used for the Accreditation tests. The Contractor provides details of any variable settings to the Accreditation Tester so that the Accreditation Tester may endorse the Accreditation Certificate with the accredited settings.

4.7.17 If the Survey Equipment is unable to meet all of the requirements of paragraph 4.7.14, the Accreditation Tester assists the Contractor to investigate the performance of the Survey Equipment in the measurement of Cracking Intensity to ascertain the reasons for the failure to meet the required standards. This investigation may include, for example:

- Allowing the Contractor to re-process the Survey Data in view of the performance achieved during the first tests of the survey data
- Reviewing performance in terms of surface type.
- Reviewing performance in terms of surface texture.
- Reviewing performance in terms of surface features (such as road furniture, joints etc).

4.7.18 The Contractor and the Accreditation Tester may repeat the assessment of the Survey Equipment, taking into account the results of the further investigations, to determine whether the Survey Equipment is suitable for carrying out surveys on parts of the local road network, with limitations or restrictions.

4.7.19

If the Survey Equipment is acceptable , but with restrictions on the areas of the local road network for which it is acceptable, then:

- The Accreditation Tester endorses any Accreditation Certificate to identify the limitations of the Survey Equipment and the restrictions on its use to provide SCANNER accredited surveys.
- The Contractor removes all cracks identified on such areas from the Survey Data before delivering either the SCANNER RCD or the SCANNER HMDIF to any Employer.
- The lengths for which the Contractor is unable to provide acceptable measurements of Cracking Intensity do not contribute to the coverage requirements for the measurement of Cracking Intensity.
- If required, the Contractor agrees a procedure with any Employer for providing alternative measurements on these areas. [Note, Options for this might include, for example, the commissioning of alternative surveys by the Employer to provide this data, or the provision of this data by the Contractor using alternative survey methods. These options may have cost implications which the Employer and Contractor should clarify before letting any contract].

4.7.20

The Accreditation Tester uses Secondary Reference Data to assess the sensitivity and accuracy of the Survey Equipment in relation to other Survey Equipment (operated by others) that provides measurements of cracking. These comparison tests can, therefore, only be carried out when data from the test sites is provided by more than one set of Survey Equipment

4.7.21

The Accreditation Tester assembles data provided from surveys of the test sites by each piece of Survey Equipment to form the Secondary Reference Data:

- The Accreditation Tester obtains the Cracking Intensities from the SCANNER RCD or SCANNER HMDIF provided by each set of Survey Equipment participating in the Site Tests of cracking, expressed over 50m sub-section lengths.
- The Accreditation Tester examines all the data from each set of Survey Equipment and removes any measurements of Cracking Intensity that are not representative of the overall levels reported by that set of survey equipment (outlying data values).

- The Accreditation Tester calculates a single average Cracking Intensity for each 50 m sub-section from the Cracking Intensities provided by each set of survey equipment.
- These average Cracking Intensities are the Secondary Reference Data.

4.7.22 The Accreditation Tester compares the Cracking Intensities obtained from the SCANNER RCD provided by each Contractor with the Secondary Reference Data.

- The Accreditation Tester identifies any significant local differences between the Cracking Intensities obtained from the SCANNER RCD provided by each Contractor and the Secondary Reference Data.
- The Accreditation Tester may require the Contractor to investigate and explain the reasons for these differences. If the difference arises from an apparent deficiency in the Contractor's Survey Equipment the Accreditation Tester may require the Contractor to make improvements or may impose restrictions applied as described in paragraph 4.7.19.
- The Accreditation Tester evaluates the differences between the general sensitivity of the survey equipment and the Secondary Reference Data.

4.7.23 The comparison with the Secondary Reference Data may enable the Accreditation Tester to estimate a sensitivity factor for the Survey Equipment so that the Cracking Intensities reported by the Survey Equipment can be correlated with the Cracking Intensities reported by Survey Equipment provided by other Contractors. Where this is possible the Accreditation Tester endorses the Accreditation Certificate with the results of the comparison

4.7.24 The comparison with the Secondary Reference Data may show significant differences between the Cracking Intensities reported by the Survey Equipment, or show deficiencies in the capability of the Survey Equipment. In these cases, the Accreditation Tester will require the Contractor to explain the reasons for these differences, and will give the Contractor an opportunity to make improvements to the Survey Equipment. Differences or deficiencies that remain at the conclusion of the Accreditation Tests may

result in the Accreditation Tester specifying restrictions on the use of the Survey Equipment as described in paragraph 4.7.19 or the refusal to issue an Accreditation Certificate.

5 Network tests

5.1 *General requirements*

5.1.1 Providing that the Accreditation Tester accepts the performance of the Survey Equipment in the Site Tests, the performance of the Contractor and the Survey Equipment is further examined in the Network Tests.

5.1.2 The Network Tests assess the overall operational capability of the Contractor and the Survey Equipment in carrying out surveys under conditions typical of those to be encountered on the local road network. They test:

- Route planning.
- Survey procedures.
- Efficiency of operation of the Survey Equipment.
- Alignment of the surveyed route with the planned route and accuracy of locating Section start points.
- Accuracy of the SCANNER RCD and SCANNER HMDIF.
- Coverage obtained by the Survey Equipment.

5.1.3 The Accreditation Tester selects one or more test sites consisting of several Sections. The sites include road types that are typical of the local road network in terms of construction, condition and traffic levels. The test sites may include:

- Flexible and rigid constructions;
- Urban and rural roads,;
- Single and dual carriageway roads;
- Traffic light controlled junctions;
- Slip roads;
- Roundabouts and
- A wide range of typical road geometries.

5.1.4 The Accreditation Tester obtains Reference Data on the test sites using the Highways Agency Road Research Information System (HARRIS). The Accreditation Tester processes Survey Data provided by the HARRIS survey vehicle to provide the following Reference Data for the Network

Tests for each Section within the test site (reported relative to elapsed chainage within Section, as appropriate):

- The OSGR co-ordinates of the Section start points.
- The OSGR co-ordinates reported at 10m intervals.
- The road geometry, 3m, 10m and 30m moving average longitudinal profile variance, rut depth and SMTD reported as averages over 50m sub section lengths
- The cracking intensity reported over 50m sub section lengths.

5.1.5 The Accreditation Tester also produces a forward facing video record of the test route surveyed by HARRIS for reference purposes.

5.1.6 The Accreditation Tester provides the Contractor with a map showing the location of the test sites, the description of each Section start and end point and the Section Labels. The Accreditation Tester provides the Contractor with OSGR co-ordinates of some, but not all, of the Section start points.

5.1.7 The Contractor:

- Defines survey routes appropriate for the surveys of these sites and delivers the planned route to the Accreditation Tester as required for Network surveys in accordance with the requirements of the SCANNER survey specification for survey routes.
- Carries out at least one survey of each route, or more if required by the Accreditation Tester. Wherever possible, the Contractor takes measurements in the left most traffic lane except where otherwise instructed by the Accreditation Tester.
- Uses an appropriate method to record the location of the Section start points applying the rules defined in the SCANNER survey specification for survey routes (Volume 2) for recording the location of the remaining Section start points (unless otherwise instructed by the Accreditation Tester).
- Processes the survey data to obtain the SCANNER RCD and SCANNER HMDIF, noting the requirements of the SCANNER survey specification (Volume 2) concerning the delivery of the route information in the SCANNER HMDIF and SCANNER RCD.

- Following the completion of the survey, carries out any necessary route alignment using the MSP, or a facility provided by the Contractor, as defined in the SCANNER survey specification for survey routes (Volume 2). This includes obtaining the elapsed chainage of those Section start points for which OSGR co-ordinates were provided by the Accreditation Tester.
- Delivers the SCANNER RCD and SCANNER HMDIF to the Accreditation tester for analysis and comparison with the Reference Data.
- Delivers the coverage records as defined in the SCANNER survey specification (Volume 2).

5.1.8 The Accreditation Tester evaluates the Network Level performance by comparing frequency distribution of the data from the whole of the test routes and by comparing detailed data from a sample of individual Sections with the Reference Data.

5.1.9 The tolerances allowed for the comparison of the measurements provided by the Contractor and the Reference Data are given in Table 3.3.

5.1.10 The Network Test will be passed if all the following criteria are met: -

- The survey equipment is able to operate safely whilst causing minimum disruption to other road users, in the opinion of the Accreditation Tester
- Satisfactory procedures have been implemented by the Contractor for route planning and carrying out the survey, in the opinion of the Accreditation tester
- The data provided by the Contractor meet the tolerances given in Table Table 3.3.
- The data provided by the Contractor comply with the requirements for coverage for each measured parameter given in the specification for SCANNER accredited surveys (Volume 2, Section 6.3).

Parameter Measured	Tolerance (90% Limits)	Tolerance (Maximum Error)
Section Lengths	$\pm 5\text{m}$ or $\pm 0.1\%$ ⁶	$\pm 50\text{m}$ or $\pm 10\%$ ⁷
National Grid Co-ordinates of Section Start Point ¹	$\pm 5\text{m}$	$\pm 50\text{m}$
National Grid Co-ordinates ² where GPS > 70%	$\pm 7\text{m}$	$\pm 50\text{m}$
National Grid Co-ordinates ³ where GPS < 70%	$\pm 15\text{m}$	$\pm 50\text{m}$
Road Geometry – Gradient	± 1.5 or $\pm 10\%$ ⁶	± 6
Road Geometry – Crossfall	± 1.5 or $\pm 10\%$ ⁶	± 6
Road Geometry - Radius of Curvature	$\pm 50\text{m}$ or 25% ⁶	2xReference Radius of Curvature or $\pm 100\text{m}$ ⁶
3m Moving Average Longitudinal Profile Variance ⁴	± 0.6	N/A
10m Moving Average Longitudinal Profile Variance ⁴	± 0.7	N/A
30m Moving Average Longitudinal Profile Variance ⁴	± 0.9	N/A
Rut Depth	$\pm 3.0\text{mm}$	50% of True Rut Depth or 10mm ⁷
SMTD	$\pm 0.25\text{mm}$	$\pm 0.75\text{mm}$
Cracking Intensity ⁵	75%	N/A

Table 3.3: Tolerances for network level evaluation

Notes for Table 3.3.:

- (1) The Accreditation Tester calculates National Grid Co-ordinates of Section Start Point from the SCANNER RCD and compares them with the Reference co-ordinates. 90% of the positions obtained from the SCANNER RCD must fall within the required tolerance of the reference position. For those Section start points for which National Grid Co-ordinates were provided by the Accreditation Tester the reference position is the National Grid Co-ordinates provided by the Accreditation Tester. For the remaining Section start points the reference position is the National Grid Co-ordinates of the Section start point recorded in the Reference Survey.
- (2) National Grid Co-ordinates where signal availability > 70% over each 100m length.
- (3) National Grid Co-ordinates where signal availability < 70% over each 100m length.
- (4) The tolerance for 3m, 10m and 30m Moving Average Longitudinal Profile are in terms of the differences or fractional errors between the Moving Average Longitudinal Profile Variances calculated from the measured profile and the Moving Average Longitudinal Profile Variances calculated from the Reference Profile, as described in Volume 2.
- (5) The tolerance for the detection of Cracking Intensity is the minimum percentage of sub-sections that the survey data show to contain high or low levels of Cracking Intensity that are also shown to contain high or low levels of Cracking Intensity in the Reference Data. Cracking Intensity is assessed over selected test Sections using a similar method to that described for the Site Tests
- (6) Whichever is greater.
- (7) Whichever is smaller

6 Survey data accreditation testing

6.1 *General requirements*

- 6.1.1 Provided that the Survey Equipment successfully completes both the Site Tests and the Network Tests, the data output from the Survey Equipment is checked to ensure that it complies with all the requirements for loading into a UKPMS accredited system.
- 6.1.2 The Contractor provides a sample SCANNER HMDIF file (an HMDIF file) to the Accreditation tester.
- 6.1.3 The Accreditation tester tests the SCANNER HMDIF file to ensure that it complies with the requirements of the UKPMS specification in all respects.
- 6.1.4 The Accreditation tester checks a sample of SCANNER HMDIF files to ensure that the format is consistent with the current version of the HMDIF specification, and the current version of the UKPMS Rules and Parameters.
- 6.1.5 The Accreditation tester may ask any or all of the Organisations that supply UKPMS accredited Pavement Management Systems to check a sample of SCANNER HMDIF files to ensure that the files can be loaded into their Pavement Management Systems. The Accreditation tester notifies the Contractor if the SCANNER HMDIF files cannot be loaded or if any differences are found between the format of the SCANNER HMDIF file and the current version of the HMDIF.
- 6.1.6 The Accreditation tester advises the Contractor of the results of the tests and notifies the Contractor of any differences between the format of the SCANNER HMDIF file and the current version of the HMDIF specification.

7 Consistency tests

7.1 *General requirements*

7.1.1 Providing that the Accreditation Tester accepts the performance of the Survey Equipment in the Site Tests and in the Network Tests, the performance of the Contractor and the Survey Equipment is measured in the Consistency Tests.

7.1.2 The Consistency Tests measure the repeatability of each Survey Equipment and the reproducibility between different Survey Equipment under conditions typical of those encountered on the local road network. They provide an estimate of:

- Systematic errors (also referred to as survey equipment **bias** or **accuracy**).
- Random errors (also referred to as **precision**).

7.1.3 The Accreditation Tester selects a road network consisting of many Sections. The network will include road types that are typical of the overall local road network in terms of construction, condition and traffic levels, and in proportions that broadly reflect the proportions to be found on typical local authority road networks. Including a representative range of those factors that are known to, or are likely to, affect the bias – e.g. presence of roads humps, etc.

7.1.4 Where possible, the Accreditation Tester will select test routes for the Consistency Tests that coincide with the routes used for the Network Tests component of the Accreditation tests.

7.1.5 The Accreditation Tester obtains Reference Data on the test sites using the Highways Agency Road Research Information System (HARRIS). The Accreditation Tester processes Survey Data provided by the HARRIS survey vehicle to provide the following Reference Data for the defined Consistency Test road network:

- Gradient
- Cross-fall

- Radius of Curvature

And the following which contribute to the SCANNER Road Condition Indicator:

- 3 m moving average longitudinal profile variance
- 10 m moving average longitudinal profile variance
- Rut depth
- SMTD
- Carriageway Cracking intensity
- Wheel track cracking intensity

And hence,

- SCANNER Road Condition Indicator

7.1.6

The Contractor:

- Defines survey routes appropriate for the surveys of these sites and delivers the planned route to the Accreditation Tester as required for Network surveys in accordance with the requirements of the SCANNER survey specification for survey routes.
- Carries out at least two surveys of each route, or more if required by the Accreditation Tester. Wherever possible, the Contractor takes measurements in the left most traffic lane except where otherwise instructed by the Accreditation Tester.
- Uses an appropriate method to record the location of the Section start points applying the rules defined in the SCANNER survey specification for survey routes (Volume 2) for recording the location of the remaining Section start points (unless otherwise instructed by the Accreditation Tester).
- Processes the survey data to obtain the SCANNER RCD and SCANNER HMDIF, noting the requirements of the SCANNER survey specification (Volume 2) concerning the delivery of the route information in the SCANNER HMDIF and SCANNER RCD.
- Following the completion of the survey, carries out any necessary route alignment using the MSP, or a facility provided by the Contractor, as defined in the SCANNER survey specification for survey routes (Volume 2). This includes obtaining the elapsed chainage of those Section start points for which OSGR co-ordinates were provided by the Accreditation Tester.

- Delivers the SCANNER RCD and SCANNER HMDIF to the Accreditation tester for analysis and comparison with the Reference Data.
- Delivers the coverage records as defined in the SCANNER survey specification (Volume 2).

7.2

Obtaining the measure of consistency

7.2.1

The Accreditation Tester analyses the data collected for the sample networks at a sub-section level to obtain the SCANNER Road Condition Indicator over 10m lengths.

7.2.2

The Accreditation Tester compares the values of the SCANNER Road Condition Indicator with the reference measurements to obtain an estimate of the bias in the SCANNER Road Condition Indicator.

7.2.3

The Accreditation Tester compares the values of the SCANNER Road Condition Indicator obtained from several surveys of the site with the same accredited SCANNER equipment to obtain an estimate of the repeatability of the SCANNER Road Condition Indicator.

7.2.4

The Accreditation Tester compares the values of the SCANNER Road Condition Indicator obtained from surveys of the site with other accredited SCANNER equipment to obtain an estimate of the reproducibility of the SCANNER Road Condition Indicator.

7.3

Reporting consistency measurements

7.3.1

The Accreditation Tester determines the bias and standard deviation of measurement error for each survey machine individually. The Tester reports the individual results to the relevant Contractor, and to the relevant national government responsible for statistical monitoring and performance indicators.

7.3.2

The Accreditation Tester determines the overall single industry-wide measurement of bias and random error determined from the consistency tests. The Accreditation Tester reports the overall performance of all SCANNER accredited survey machines, expressed as a range, as the basis for calculating the confidence limits for an individual authority's BVPI results.

8 Accreditation Re-testing

8.1 *General requirements*

- 8.1.1 At intervals of one year following the successful completion of the Accreditation Tests the Contractor submits the survey equipment for retesting to demonstrate that it still meets the SCANNER specification requirements under rigorously controlled test conditions.
- 8.1.2 Following the successful completion of an annual Accreditation retest, the tester issues a SCANNER Accreditation Certificate for a further period of up to one year. This is calculated from the date of expiry of the previous Accreditation Certificate.
- 8.1.3 In the event of a failure to achieve the survey requirements set out in the quality assurance and audit regime, Survey Equipment may be required to undergo additional Accreditation re-testing. The requirements for Quality Assurance and Audit for SCANNER accredited surveys are set out in Volume 4 of SCANNER surveys for Local Roads.
- 8.1.4 The Accreditation Tester supervises and controls the tests.
- 8.1.5 The Contractor attends the accreditation retests, and carries out any surveys or data processing required by the Accreditation Tester, at its own cost.
- 8.1.6 During the re-testing the Survey Equipment is driven and operated by drivers and operators named in the Contractor's quality system.
- 8.1.7 The Accreditation re-testing assesses the accuracy of the survey equipment in the measurement of each survey parameter and is carried out on a site or sites selected by the Accreditation Tester.
- 8.1.8 The accreditation retesting follows the same general procedure as the Accreditation Tests described in Section 2. However, it is unlikely that tests of acceleration and deceleration described in Section 4.4.4 will be carried out during re-testing of the measurement of longitudinal profile unless the Accreditation Tester specifically requires these tests.

- 8.1.9 The tests will normally take same form as the Accreditation Tests, but reduced in extent and duration, including site tests, as described in Section 4, a short network test, as described in Section 5, on a route located conveniently near the site tests, and survey data acceptance tests as described in Section 6.
- 8.1.10 During the retesting the Contractor uses the same survey equipment and settings that are employed by for routine SCANNER accredited surveys.
- 8.1.11 The Contractor delivers the survey data obtained in the re-testing to the accreditation tester as SCANNER RCD and SCANNER HMDIF for all test sites used in the re-testing within 8 working days following the date when the surveys for the re-tests were carried out.
- 8.1.12 The Accreditation Tester assesses the SCANNER RCD and SCANNER HMDIF from the Contractor's re-testing surveys against the reference methods described in Section 4 for site tests, Section 5 for network tests and Section 6 for the survey data acceptance tests.
- 8.1.13 If the survey equipment fails to meet the requirements for accuracy in the re-test then any current Accreditation Certificate becomes invalid, any data collected by the Equipment since the last successful weekly check on a Reference Test Site (see requirements for Quality Assurance and Audit) are invalid and any results reported from that data are not acceptable as SCANNER accredited surveys.
- 8.1.14 If a Contractor makes any significant change to the Equipment after the issue of an Accreditation Certificate the Auditor may require the Equipment to be submitted for an additional Accreditation re-test.

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