

SCANNER Surveys for Local Roads

Specification Volume 2 Specification for
Services

For surveys in 2006/07

Halcrow Group Limited

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Halcrow Group Limited
Red Hill House 227 London Road Worcester WR5 2JG
Tel +44 (0)1905 361361 Fax +44 (0)1905 361362
www.halcrow.com

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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. 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, UKPMS Development Support Consultant (Chris Britton Consultancy), Survey Contractors, UKPMS developers, and members of the SCANNER Implementation Advisory Group.

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Foreword

General

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. Technical Guidance
6. Survey Parameters and Data File Formats

This Volume contains the Specification for the Services to be provided under the SCANNER survey project and is to be read in conjunction with the other documents. It contains details of survey processes, data processing, and route fitting, and is to be read in conjunction with the other documents.

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 3, Acceptance and Consistency Testing and Accreditation describes the requirements for testing survey vehicles to become accredited by site and network tests. It also describes the requirements for consistency testing and for the reporting and delivery of survey data to carry out SCANNER accredited Surveys.

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 This document specifies the requirements for SCANNER accredited road condition surveys, including the requirements for the Equipment, survey procedure, measurements, data processing and route fitting.
- 1.1.2 The terms are defined in a Glossary annexed to SCANNER Surveys for Local Roads, Volume 1, Advice to Local Authorities.
- 1.1.3 SCANNER Surveys for Local Roads, 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).

2 Survey Equipment

- 2.1 *General requirements*
- 2.1.1 The Contractor collects survey data over specified lengths of the Employer's road network using the Equipment which is accredited to the SCANNER specification. (Further information about acceptance testing and accreditation is given in SCANNER surveys for local roads, Volume 3, Accreditation and Consistency Testing.)

3 Surveys

- 3.1 *General requirements*
- 3.1.1 The Employer specifies the road network over which SCANNER accredited surveys are required. The Contractor carries out the surveys on those roads in accordance with this Specification, and any other requirements of the Employer,

and supplies the SCANNER accredited Survey Data to the Employer. The Contractor carries out Surveys in the directions and the lanes specified by the Employer.

3.1.2 Where the Survey Equipment is unable to, or is likely to be unable to, provide valid survey data over any part of the Employer's road network for any reason, the Contractor agrees with the Employer the procedures to exclude invalid data and to provide alternative survey results from those parts of the Employer's road network.

3.1.3 The Employer owns the results of the survey, the survey data and the results of any data processing carried out by the Contractor.

3.1.4 The Employer requires the Contractor to make the survey data available to the relevant national authority for statistical monitoring purposes.

3.2 ***Quality Assurance and independent Audit***

3.2.1 The requirements for Quality Assurance and independent Audit are set out in SCANNER surveys on local roads, Volume 4. The QA procedures are based on an interlocking series of daily, weekly and monthly checks of the operation and performance of the Equipment by the Contractor with an independent Audit that the procedures are being followed, and independent resurveying of a limited number of sample sites.

3.2.2 The Contractor provides and operates an effective and documented Quality Assurance regime covering all aspects of the SCANNER accredited surveys, including, but not limited to:

- vehicle operation and maintenance
- driver and operative training and instruction
- survey operation and record keeping
- data recording, processing, and analysis
- delivery of survey results

3.2.3 The Contractor delivers any Quality Assurance tests and data required by the Specification within the overall price agreed with the Employer for the surveys of the Employer's road network.

3.2.4 The Contractor delivers any reports required by the Specification to the Employer and to the Auditor promptly in accordance with the timescales defined in the contract or, if the contract defines no timescales, defined by this Specification.

3.2.5 The Contractor reports any repairs or alterations carried out on the Equipment promptly to the Auditor.

4 Survey Procedure

4.1 *Survey Routing*

4.1.1 The Employer provides the Contractor with a list of the Sections that are to be surveyed. The Employer provides the following information for each Section, including:

- The Road Number (if available)
- The Section Label (unique identifier)
- A label describing the Section Start Point
- A label describing the Section End Point
- The Section Length
- A description of the Section and/or a map showing the location of the Section.
- Any additional information the Contractor may require to be able to prepare routes for the Surveys of the Employer's road network.
- Information defining connectivity between sections (eg unique numerical codes for start and end of sections).

[Note: Networks must have all sections within a road digitised in the same direction because the network file does not contain a direction indicator.]

4.1.2 The Employer may provide (at the Employer's discretion) National Grid co-ordinates describing the locations of the Section Start and End Points. If National Grid co-ordinates describing the locations of the Section Start and End Points are provided then the Employer agrees with the Contractor which (if any) of these Section Start Co-ordinates may be used in the alignment of the Survey Data with the Survey Route.

4.1.3 Some, all or none of the Section Start and End points on the employer's network may be physically marked using "studs" as defined in the Trunk Road Maintenance

Manual (TRMM) Volume 1 (Part 2). The Employer may provide (at the Employer's discretion) a list of any Sections having such physical marks before the Contractor commences the surveys.

- 4.1.4 If SCANNER or TTS surveys have previously been carried out on the Employer's Network the Employer may provide (at the Employer's discretion) the "fitted" survey routes provided by the Contractor that carried out a previous survey. If previous fitted survey routes are provided, the Employer will also provide details of any changes that have been made to the network since the previous surveys were carried out. However, the Contractor is responsible for ensuring that any previously fitted survey routes remain suitable and appropriate for the surveys carried out by the Contractor.
- 4.1.5 The Contractor divides the Employer's network into a set of Survey Routes for the purposes of carrying out the Surveys. Due to the large quantity of raw data to be collected, no individual Survey Route may be more than 100km long.
- 4.1.6 A Survey Route comprises an ordered list of one or more "Survey Lanes". Each Survey Lane is identified by a Section label; a lane Direction Indicator; a traffic lane; start Chainage and end Chainage. Each survey lane also has a start location marker label, and the Survey Route has an end location marker label.
- 4.1.7 In most cases a survey lane is likely to extend along the entire length of a Section, but this is not a specific requirement.
- 4.1.8 A Survey Route may include "dummy" survey lanes, of possibly unspecified lengths, to represent parts of the route to be taken by the Survey Equipment over which data is not collected or is not required. For example, the distance across a roundabout may be a dummy survey lane as the Survey Route may have to cross over one or more roundabouts even though surveys are not required on roundabouts.
- 4.1.9 The Contractor prepares map-based and/or textual descriptions of the planned Survey Routes before commencing the Surveys. The description includes an estimate of the total length of the Employer's road network that is to be surveyed. Each planned Survey Route is identified by a unique Survey Route label. The Contractor provides all this information to the Employer and may be required to provide it to the Auditor.

4.2 ***Survey Progress***

4.2.1 The Contractor carries out the SCANNER accredited surveys of each Survey Route using the Equipment.

4.2.2 The surveys are carried out in the direction of normal traffic flow.

4.2.3 The surveys are carried out in the left-most traffic lane, unless otherwise agreed with the Employer. Where there are a significant number of parked cars the survey follows the left most path taken by normal traffic flow.

4.2.4 The Contractor provides details of the location of the equipment at any time, as required by the employer

4.3 ***Location Referencing***

4.3.1 All Survey Data is reported in relation to distance travelled within Section. This is achieved through the identification of Section Start points.

- The Contractor reports the position of all of the Section Start points that are physically marked at the location of the Section start to the level of accuracy specified for the “automatic” detection of Section start points. (section 5.3.3).
- The Contractor reports the position of all of the Section start points that are not physically marked at the location of the Section start, to the level of accuracy specified for the “manual” detection of Section start points. (section 5.3.4). The locations of these Section start points may be marked physically on or adjacent to, the road using a different method or may be associated with specific features located on the Employer’s Network. Guidance on the location of Section Change points is given in Section 4.4. The Contractor agrees which features (for example speed restriction signs and junctions) are associated with the starts of Sections with the Employer before starting the Survey.
- The Contractor reports the position of all of the Section Start for which reference co-ordinates have been provided by the Employer, and which are to be used for the purposes of Location Referencing, to the level of accuracy specified in section 5.3.5.

4.4 ***Guidance on the Location of Section Change Points***

4.4.1 Where Section change points are recorded manually and these are based on recording the location of specific features (for example speed restriction signs and

junctions), the Contractor agrees with the Employer how they are defined before commencing the surveys.

4.4.2 This specification provides a standard approach to the location of Section change points. The Contractor follows this guidance unless the Employer specifies alternative requirements before the Contractor commences the surveys.

4.4.3 Where the feature is a road sign (identified by the Employer) the Section change point is defined as the position marked by a line extending transversely across the traffic lane from the position of the road sign.

4.4.4 At the approach to roundabouts the Section change point is defined as the position marked by the give way markings crossing the end of the approach road – see Figure 2.1.

4.4.5 When leaving roundabouts the Section change point is defined as the position that would be marked by a line denoting the start of the exit road – see Figure 2.1

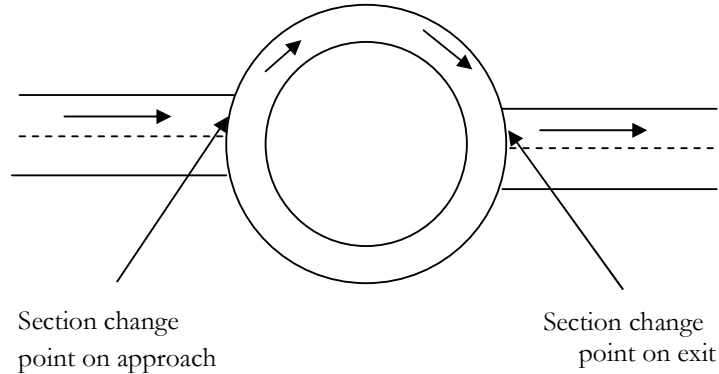


Figure 2.1: Section change points at roundabouts

4.4.6 At junctions or crossroads where turning right or left the Section change point is defined as the end of the approach road – see Figure 2.2.

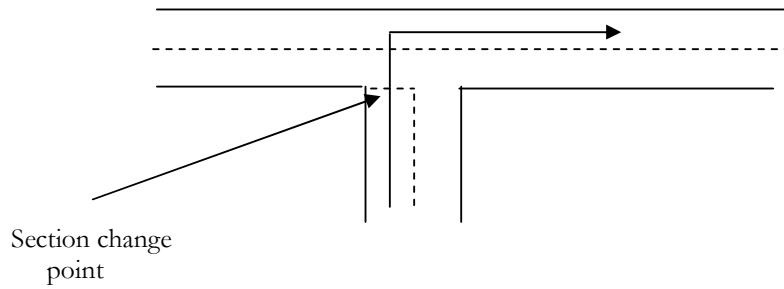


Figure 2.2: Section change point when turning right or left at junctions or crossroads

4.4.7

When turning off the main carriageway the Section change point is defined as the start of the exit road – see **Figure 2.3**.

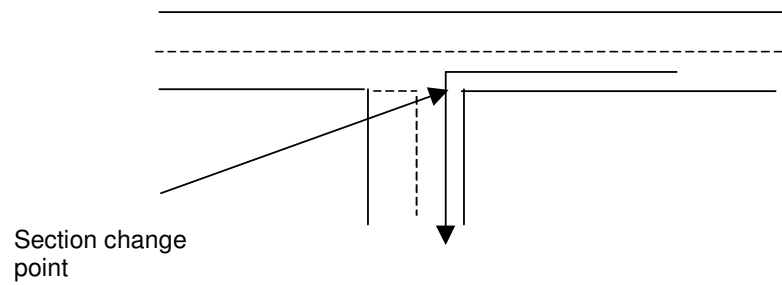


Figure 2.3: Section change point when turning right or left at junctions or crossroads, off the main carriageway

4.4.8 At crossroads, where going straight across, The Section change point is defined as the centre of the junction- see Figure 2.4.

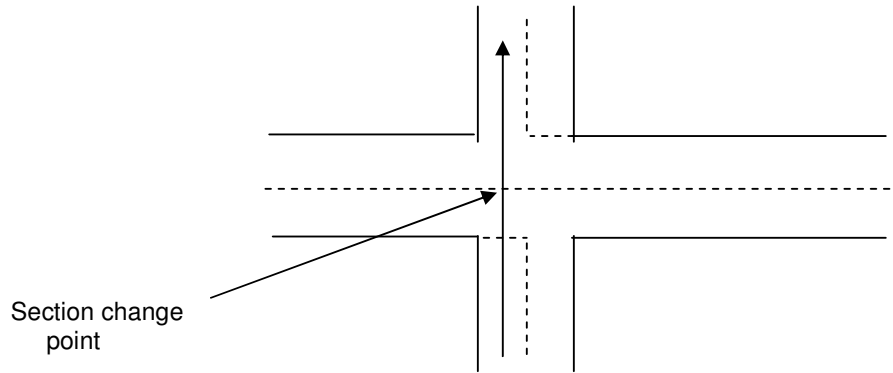


Figure 2.4: Section change point when going straight across crossroads.

4.4.9 At slip roads the Section change points are defined as the start of the slip road and end of the slip road (often coinciding with the start or end of the intermittent lane marking in the nearside), see Figure 2.5.

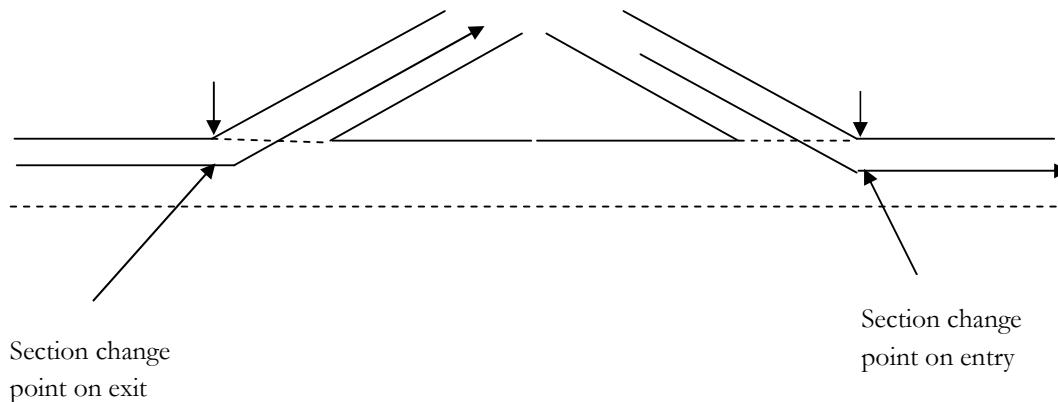


Figure 2.5: Section change points at slip roads

4.5 **Recording Survey Conditions**

4.5.1 Occasionally it may be necessary for the Equipment to deviate from the planned Survey Route for a short length as a result of obstructions in the path of the

Equipment (for example as a result of parked cars or temporary road works). The Contractor records the occurrence of such deviations in the Survey Data with a “Deviation Flag”.

- 4.5.2 The Contractor reports such deviations from the Survey Route in the SCANNER RCD, if provided. The Contractor reports any such deviations from the Survey Route in the SCANNER HMDIF, in an appropriate format.
- 4.5.3 Survey Data collected during deviations from the Survey Route may be considered invalid in terms of the specified Coverage requirements. Deviations caused by parked vehicles would not normally invalidate data. (See section 4.2.3)
- 4.5.4 The Contractor provides and uses a suitable facility on the Equipment to identify and record lengths containing features placed in or on the road surface for the purposes of traffic control (e.g. speed humps and traffic “chicanes”). The Employer may (at the Employer's discretion, and before the Contractor commences the Surveys) require the Contractor to use this facility during the Surveys to monitor for the presence of these features.
- 4.5.5 Where these features are present the Contractor records their presence in the Survey Data and labels any of the parameters of the Survey Data that would be affected by these features (for example longitudinal profile) as invalid.
- 4.5.6 The Contractor is paid for these survey lengths but the invalid data arising from such features does NOT contribute to the coverage requirements (i.e. these lengths are disregarded before calculating the coverage achieved by the Contractor).

5 Survey Specification

5.1 *General Requirements*

5.1.1 This Section describes the requirements for the survey measurements reported by the Contractor using the Equipment. The requirements apply to the measurements when reported as Survey Data, as SCANNER RCD or SCANNER HMDIF.

5.1.2 The accuracy of the measurements made by the Survey Equipment is assessed by the Accreditation Tester as described in SCANNER surveys for local roads, Volume 3, Accreditation and Consistency Testing.

5.1.3 The Contractor delivers a summary report of coverage and invalid data for each Survey Route see also section 6.3.3. The Contractor provides and uses a facility to obtain this summary report of coverage and invalid data for each Survey Route from the Survey Data.

5.2 *Data Formats*

5.2.1 Survey Data is data measured in a SCANNER accredited survey before processing to produce SCANNER Raw Condition Data (RCD). The Employer does not normally require access to the Survey Data, but retains ownership of them.

5.2.2 The Contractor has the capability of delivering the Survey Data in two formats, as SCANNER RCD and as the SCANNER Base Condition Data (BCD). The SCANNER RCD and the SCANNER BCD are defined in this Specification.

5.2.3 Raw Condition Data (RCD) is detailed survey data in a format that enables the Accreditation Tester and the Auditor to carry out detailed checks on the operation of the Survey Equipment. The Employer does not normally require access to the SCANNER RCD, but retains ownership of them.

5.2.4 Base Condition Data (BCD) is processed survey data in a UKPMS Highway Maintenance Data Interchange Format (HMDIF) file that enables the results of a SCANNER survey to be loaded to a UKPMS compliant system. The Employer normally requires the results of a SCANNER accredited survey to be delivered as SCANNER HMDIF (i.e. as a UKPMS compliant HMDIF file).

5.2.5 Having carried out the survey, the Contractor delivers the results of the survey (the survey data) as SCANNER HMDIF in an acceptable UKPMS HMDIF file.

5.2.6 The Employer or the Auditor may specifically request the Contractor to supply SCANNER RCD for Quality Assurance, Audit or other purposes from a particular survey before the Contractor commences that survey. In which case, the Contractor also delivers the results of the survey (the Survey Data) in a SCANNER RCD format file.

5.2.7 The Employer or Auditor may specify the content of the SCANNER RCD file in terms of which data is included in the file or which is not included. (For example the Employer or Auditor could request the longitudinal profile, rutting and crack data, but not require the texture profile and geometry data).

[Note 1: Although the Employer may require the delivery of the Texture Profile within the SCANNER RCD, the primary use of this data is for Accreditation testing and Audit. The data could also be used for the development of additional texture parameters (research). The delivery of this data will place significant data handling requirements on the Contractor and may make it more difficult for the Contractor to provide any other measurements (“added value” measurements) in addition to those required for SCANNER accredited surveys. Therefore the Employer or Auditor should only request raw texture data to meet a specific predefined purpose.]

[Note 2: The SCANNER HMDIF contains values derived from the SCANNER RCD. The Machine Survey Pre-processor (MSP) provides a facility to convert SCANNER RCD into SCANNER HMDIF, but the Contractor may use an alternative method to obtain the SCANNER HMDIF directly from the Survey Data. Any alternative method used by the Contractor must comply with the MSP methodology. The MSP is described in more detail in Volume 6, section 3 of this Specification.]

5.2.8 Methods of calculating those SCANNER HMDIF parameters that are derived from the Survey Data (longitudinal profile variance, Sensor Measured Texture Depth (SMTD), cracking intensity, transverse profile unevenness and edge deterioration) are described in Volume 6, section 2 of this Specification.

- 5.3 ***Location Referencing***
- 5.3.1 The Contractor references all data collected during the Survey uniquely in relation to distance travelled within Section and Lane. The accuracy of the Location Referencing must be unaffected by operating speed or by road geometry.
- 5.3.2 The Contractor agrees the method for locating each Section start point with the Employer before commencing the survey. The requirements for the accuracy of the location of each Section start point depend on the method of identifying each Section start point.
- 5.3.3 Where the Section start points are identified automatically, the Contractor locates the Section start points accurate to within $\pm 1.0\text{m}$.
- 5.3.4 Where the Section start points are identified manually, the Contractor locates the Section start points accurate to within $\pm 5.0\text{m}$.
- 5.3.5 Where the Section start points are reported using National Grid Co-ordinates provided by the Employer (and the Employer and the Contractor have agreed that these are to be used for location referencing), the Contractor locates the Section start points accurate to within $\pm 5.0\text{m}$.
- 5.3.6 The requirements for accuracy of location of the Section Start points apply to the location of all Section Start Points after the Contractor has carried out any necessary route fitting, (section 6.2).
- 5.3.7 For elapsed distances within a Section of up to 1,000 m from the recorded start of a Section, the Contractor references the longitudinal position of all data measured within the Section accurate to within $\pm 1.0\text{m}$ from the recorded start of the Section.
- 5.3.8 For elapsed distances within a Section greater than 1,000 m from the recorded start of a Section, the Contractor references the longitudinal position of all data measured within the Section accurate to within $\pm 0.1\%$ from the recorded start of the Section.
- 5.4 ***3-Dimensional Spatial Co-ordinates***
- 5.4.1 The Contractor measures the 3-Dimensional Spatial Co-ordinates of the position of the Equipment during the Survey at points separated by no more than 5.0 m of distance travelled.

5.4.2

The Contractor reports the 3-Dimensional Spatial Co-ordinates as OSGB36 National Grid Co-ordinates and Altitude, where the Altitude measurement describes the Altitude of the surface of the road being surveyed.

[Note 1: It is anticipated that the Contractor will derive OSGB36 National Grid Co-ordinates from measurements of position obtained using an automated method, possibly based on satellite technology such as the Global Positioning System (GPS) operated by the United States Department of Defense. Such systems typically provide location data in the form of Longitude and Latitude related to a generalised description of the Earth such as the WGS84 Ellipsoid.]

[Note 2: The Ordnance Survey historically provided a means of transforming the measurements from satellite-based systems to OSGB36 National Grid Co-ordinates through the OSTN97 (for position) and OSGM97 (for altitude) transformations. More recently, these have been enhanced and replaced by the Definitive Transformations OSTN02 and OSGM02. The OSTN97, OSGM97, OSTN02 and OSGM02 transformations are the only acceptable methods for the provision of OSGB36 National Grid Co-ordinates from GPS measurements.]

[Note 3: Satellite based location measurements are susceptible to signal loss and increased positional error under certain conditions, for example those encountered in built up or forested areas. The Equipment is required to have the capability to compensate for these errors arising from signal loss such that National Grid Co-ordinates and Altitudes are provided under all survey conditions to the required level of accuracy. Often this requires the use of an inertial referencing system to compensate for signal loss. Nevertheless, to allow for imperfections in the system that is applied to compensate for signal loss, the accuracy requirements are defined in terms of the availability of the signal from which the co-ordinates and altitude are derived. As the accuracy of the compensated position measurement is likely to decrease in areas of signal loss, the accuracy requirements are lower in such areas].

[Note 4: The Equipment is required to provide an indication of signal availability so that areas of possibly reduced accuracy can be monitored. The accuracy of the Equipment in the measurement of National Grid Co-ordinates is assessed in the Accreditation Testing, where the capability of the system to provide accurate measurements in areas of low signal availability is investigated. (SCANNER surveys for local roads, Volume 3.) If the Accreditation Testing shows that the capabilities of the system are limited under certain conditions then restrictions may be applied such that Survey Data is labelled as invalid under those circumstances].

- 5.4.3 For position measurements acquired within 100m lengths where there is signal availability for greater than 70% of the 100m length, the Contractor reports the OSGB36 National Grid Co-ordinates with accuracy such that 95% of the measured positions lie within 2.0 m of the True position.
- 5.4.4 For position measurements acquired within 100m lengths where there is signal availability for less than 70% of the 100m length, the Contractor reports the OSGB36 National Grid Co-ordinates with accuracy such that 95% of the measured positions lie within 10.0 m of the True position.
- 5.4.5 For all position measurements, the Contractor reports the OSGB36 National Grid Co-ordinates with accuracy such that the error between the measured position and the True position never exceeds 50 m.
- 5.4.6 For altitude measurements acquired within 100m lengths where there is signal availability for greater than 70% of the 100m length, the Contractor reports the altitude measurements with accuracy such that 95% of the measured altitudes lie within ± 5.0 m of the True altitude.
- 5.4.7 For altitude measurements acquired within 100m lengths where there is signal availability for less than 70% of the 100m length, the Contractor reports the altitude measurements with accuracy such that 95% of the measured altitudes lie within ± 10.0 m of the True altitude.
- 5.4.8 For all altitude measurements, the Contractor reports the altitude measurement with accuracy such that the error between the measured altitude and the True altitude never exceeds 50.0 m.
- 5.4.9 The Contractor reports the availability of the signal from which the 3-Dimensional Spatial Co-ordinates have been derived with each reported National Grid Co-ordinate.
- 5.4.10 Where the Equipment is unable to meet the accuracy requirements the Contractor labels the 3-Dimensional Spatial Co-ordinate data as invalid.
- 5.4.11 The Contractor monitors the coverage of National Grid Co-ordinates achieved in the surveys, including altitude. Invalid measurements of National Grid Co-ordinates will result in reduced survey coverage where coverage is defined as the

total length within any predetermined length over which valid measurements of longitudinal profile variance are provided.

5.4.12 The Contractor carries out repeat surveys over any length greater than 1.0 km over which less than 95% by length of valid National Grid Co-ordinate measurements can be delivered until either a sufficient length of valid National Grid Co-ordinates can be delivered from that length, or the Employer agrees to accept the survey results without the National Grid Co-ordinate coverage. The Contractor reports any survey lengths greater than 1.0 km over which valid National Grid Co-ordinate measurements cannot be delivered to the Auditor.

5.4.13 The Contractor provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of National Grid Co-ordinates, including altitude. This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's road Network,
- The total length within each Section for which the Contractor is unable to provide valid National Grid Co-ordinates.
- The locations within each Section of the Employer's road Network over which the Contractor is unable to provide valid National Grid Co-ordinates, including altitude.

5.5 **Road Geometry**

5.5.1 The Contractor measures Gradient, Crossfall and Radius of Curvature using the Equipment at points separated by no more than 0.5 m of distance travelled.

5.5.2 The Contractor averages the measurements over 5.0 m and reports the average measurements at 5.0 m intervals.

5.5.3 The Equipment is required to measure Gradient over the range of at least $\pm 20\%$.

5.5.4 The Contractor reports the measured Gradient with accuracy such that:

- 95% of the differences between the measured Gradient and the True Gradient fall within ± 1.5 , or $\pm 10\%$ of the True Gradient, whichever is greater.

- The difference between the measured gradient and the True Gradient never exceeds ± 6 .

5.5.5 The Equipment is required to measure Crossfall over the range of at least $\pm 20\%$.

5.5.6 The Contractor reports the measured Crossfall with accuracy such that:

- 95% of the differences between the measured Crossfall and the True Crossfall within ± 1.5 , or $\pm 10\%$ of the True Cross fall, whichever is greater.
- The difference between the measured crossfall and the True Crossfall never exceeds ± 6 .

5.5.7 The Equipment is required to measure Radii of Curvature over the range of at least $\pm 2000\text{m}$.

5.5.8 The Contractor reports Radii of Curvature greater than $+2000\text{m}$ as $+2000\text{m}$ and reports Radii of Curvature less than -2000m as -2000m .

5.5.9 The Contractor reports the measured Radius of Curvature with accuracy such that:

- 65% of the differences between the measured Radius of Curvature and the True Radius of Curvature fall within $\pm 20\text{m}$, or $\pm 10\%$ of the True Radius of Curvature, whichever is greater.
- 95% of the differences between the measured Radius of Curvature and the True Radius of Curvature fall within $\pm 50\text{m}$, or $\pm 25\%$ of the True Radius of Curvature, whichever is greater.
- The difference between the measured the measured Radius of Curvature and the True Radius of Curvature shall never exceed $\pm 2 \times$ True Radius of Curvature, or $\pm 100\text{m}$, whichever is greater

[Note: For True Radii of Curvature greater than 1500m the requirement is applied in terms of the absolute Radius of Curvature.]

5.6 *Average Speed*

5.6.1 The Contractor measures the average operating speed during the Survey at intervals separated by no more than 0.1 m of distance travelled.

5.6.2 The Contractor reports the Average Speed in cms^{-1} with an accuracy of $\pm 5.0 \text{ cms}^{-1}$ or $\pm 5\%$, whichever is larger.

5.7

Longitudinal Profile

5.7.1

The Contractor measures the Longitudinal Profile during the Survey in the Nearside Wheel path at points separated by no more than 0.01 m of longitudinal distance travelled.

5.7.2

The accuracy of the measured Longitudinal Profile must be unaffected by the profile of the pavement over the full range of profiles that can reasonably be expected to be encountered on the Employer's road network.

5.7.3

The Contractor averages the measured profile points over 0.10 m and expresses the value in units of 1/10mm.

5.7.4

The Contractor filters the measured Longitudinal Profile to attenuate wavelengths in excess of 100m using a filter that attenuates the amplitude of wavelengths greater than 150m by at least 50% without distorting the phase of any profile features with wavelengths shorter than 100m.

5.7.5

The Contractor obtains measurements of Longitudinal Profile such that the frequency response is essentially flat in the bandwidth 0.5m to 100m. (i.e. the ratio of measured Longitudinal Profile amplitude to True Longitudinal Profile amplitude should be 1.0 ± 0.1 for profile components with wavelengths between 0.5 m and 100 m).

5.7.6

The Contractor calculates the Longitudinal Profile Variance as described in Volume 6 section 2.1.

The Contractor measures the Longitudinal Profile with accuracy such that at least 95% of the differences in corresponding amplitude between the measured Longitudinal Profile and the True Longitudinal Profile fall within the ranges given in Table 2.1 calculated for profile amplitudes with moving average lengths of 3m, 10m and 30m.

The Contractor measures the Longitudinal Profile with accuracy such that the phase difference between the measured and True Longitudinal Profile equals or exceeds the cross correlation coefficients given in

Table 2.1 , calculated for profile amplitudes with moving average lengths of 3m, 10m and 30m.

5.7.7

The errors are calculated as either the differences or the fractional errors between the Longitudinal Profile Variances calculated from the measured Longitudinal Profile and the Longitudinal Profile Variances calculated from the True Longitudinal Profile. This depends on the value of the Longitudinal Profile Variance calculated from the True Longitudinal Profile, as defined in Table 2.2.

| Moving Average Length (m) | Differences | Phase Difference Required Cross Correlation Coefficient | Errors | |
|---------------------------|-----------------------|--|-----------------------|-----------------------|
| | 95% within this range | | 65% within this range | 95% within this range |
| 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 |

Table 2.1: Accuracy Requirements for differences, cross correlation coefficients and fractional errors between measured and True Longitudinal Profile amplitudes

[Note: The accuracy of the Survey Equipment in measuring longitudinal profile is assessed in the Accreditation Tests, described in SCANNER surveys for Local Roads, Volume 3, Accreditation and Consistency Testing, which will determine the minimum speed, and the limits of acceleration and deceleration within which the Equipment is able to provide accurate measurements of longitudinal profile.]

| Waveband (m) | Longitudinal Profile Variance (mm ²) | Error |
|--------------|--|------------------|
| 3 | 0 to 0.5 | Difference |
| 3 | > 0.5 | Fractional Error |
| 10 | 0 to 1.0 | Difference |
| 10 | > 1.0 | Fractional Error |
| 30 | 0 to 1.0 | Difference |
| 30 | > 1.0 | Fractional Error |

Table 2.2: Application of error type according to the True value of the Longitudinal Profile Variance

5.7.8 If the Equipment is susceptible to errors under slow speed, stop/start and/or conditions of acceleration and deceleration, the Contractor specifies operating procedures to minimise the adverse effects of these conditions on the measurement of longitudinal profile. The Contractors agrees these procedures with the Auditor before commencing surveys on any Employer's road network.

5.7.9 The Contractor monitors the effects of speed, acceleration and deceleration on the accuracy of the derived parameter variance, through the record of average speed measured by the Survey Equipment and reported in the SCANNER RCD. The Contractor uses this information to label any variance measurements derived from measurements of longitudinal profile measurements that are invalid as a result of any of survey speed, acceleration or deceleration.

[NOTE: Invalid longitudinal profile measurements affect the calculation of variance over a longer length than that over which the longitudinal profile measurement was invalid. Calculation of variance and the effect of invalid profile measurements on the variance values are described in Volume 6 section 2.1].

5.7.10 If the Contractor uses the MSP to generate the SCANNER HMDIF, the MSP interrogates the velocity data provided in the SCANNER RCD when calculating

the 3m, 10m and 30m variance values to determine the validity of the variance measurements. The MSP uses the minimum survey speed, acceleration and deceleration limits for the Equipment obtained in the Accreditation Tests, and provided as input values to the MSP in the MSP parameters file. The validity of each 10m value of 3m, 10m and 30m longitudinal profile variance is reported in the appropriate part of the SCANNER HMDIF file output from the MSP.

5.7.11 If the Contractor uses the Contractor's own software to generate the SCANNER HMDIF results, it is required to interrogate the velocity data when calculating the 3m, 10m and 30m variance values to determine the validity of the variance measurements using the minimum survey speed, acceleration and deceleration limits for the survey defined during the Acceptance Tests. The Contractor reports the validity of each 10m value of 3m, 10m and 30m longitudinal profile variance in the appropriate part of the SCANNER HMDIF file.

5.7.12 The Contractor also checks the Survey Data for any other conditions that may result in invalid measurements of longitudinal profile, in addition to the effects of speed, acceleration and deceleration. These conditions may include, but are not limited to Drop-Outs (missing data points), and failures in any of the measurement devices. In these circumstances, the Contractor labels the data as invalid using the facility provided in the SCANNER RCD and SCANNER HMDIF files.

5.7.13 The Contractor monitors the coverage achieved in the surveys of longitudinal profile. Invalid measurements of longitudinal profile will result in reduced survey coverage, where coverage is defined as the total length within any predetermined length over which valid measurements of longitudinal profile variance are provided.

5.7.14 The Contractor reports any survey lengths greater than 1.0 km over which less than 80% by length of valid longitudinal profile variance measurements can be delivered from that length to the Employer and to the Auditor. If required by the Employer, the Contractor carries out repeat surveys of these lengths until a sufficient length of valid longitudinal profile variance measurements can be delivered, or the Employer agrees to accept the survey results without the longitudinal profile coverage.

[Note 1: In built up areas it is possible that long lengths of invalid data may arise as a result of reduced survey speeds and stop-start conditions. Such locations may therefore require re-surveying under free-flowing conditions. If sufficiently free

flowing conditions cannot be achieved it may be necessary to repeat the surveys using a different method that will provide valid measurements. Repeat procedures are agreed between contractor and Employer prior to surveying. (e.g. Equipment that can obtain valid data)]

[Note 2: Particularly in built up areas there are likely to be lengths of roads containing features placed in or on the road surface for the purposes of traffic control (e.g. speed humps and traffic “chicanes”). Such locations may cause significant lengths of invalid data. Where these features are present the Contractor records their presence in the Survey Data and labels any of the parameters of the Survey Data that would be affected by these features (for example longitudinal profile) as invalid. The Contractor is paid for these survey lengths but the invalid data arising from such features does NOT contribute to the coverage requirements (i.e. these lengths are disregarded before calculating the coverage achieved by the Contractor).]

5.7.15 The Contractor provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of longitudinal profile (and hence longitudinal profile variance). This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's road Network,
- The total length within each Section for which the Contractor is unable to provide valid longitudinal profile and/or variance data (as applicable).
- The locations within each Section of the Network over which the Contractor is unable to provide valid longitudinal profile and/or variance data (as applicable).

5.7.16 Further guidance on the measurement and use of longitudinal profile is given in SCANNER surveys for local roads, Volume 5, Further Technical Guidance.

5.8 ***Transverse Profile***

5.8.1 The Contractor uses the Equipment to measure the Transverse Profile over the full lane width for lanes up to 3.2m wide. For lanes greater than 3.2m wide the Contractor measures a minimum width of 3.2m, centred on the middle of the lane, up to a maximum width of 4.0m.

5.8.2 The Contractor measures the transverse profile using the Equipment at points separated by no more than 0.1 m of distance travelled and expresses the values measured in units of 1/10mm*.

[Note: *Units of 1/10 mm are required because the RCD does not accept decimal points. Therefore, for example, a transverse profile height measured as 95.2mm would be reported as 952 in units of 1/10 mm.]

5.8.3 The Transverse Profile is reported as a minimum of 18 Transverse Profile points spaced across the width of the measured Transverse Profile. Where the Equipment is able to record more than 99 Transverse Profile points the Contractor may be required (as agreed with the Accreditation Tester) to re-sample the Transverse Profile before delivery to limit the number of Transverse Profile points reported.

5.8.4 If re-sampling is required, the Contractor agrees the method with the Accreditation Tester. The Accreditation Tester may require the Contractor to smooth the transverse profile to attenuate short wavelength features before reporting the transverse profile data. The procedures for re-sampling and smoothing are agreed between the Accreditation Tester and the Contractor during the Accreditation Tests.

5.8.5 The Transverse Profile is reported such that NO correction or normalisation is applied to measurements obtained from consecutive transverse profiles (e.g. applying an offset correction for each transverse profile), so that the values of consecutive transverse profile measurements can be used for the calculation of edge deterioration (see volume 6 section 2.6).

5.8.6 The Contractor monitors the measurement of transverse profile and reports in the Survey Data , where possible, individual measurements of transverse profile subject to error as values outside the permitted range.

[Note: In particular the measurement should be unaffected by the presence of pavement features having high levels of luminosity (such as road markings), or measurements over such features should be marked using an appropriate technique to be agreed with the Accreditation Tester.]

5.8.7 The accuracy of the measured Transverse Profile must be unaffected by the profile of the pavement over the full range of profiles that can reasonably be expected to be encountered on the Employer's road network.

5.8.8 The Contractor reports the measured Transverse Profile with accuracy such that at least 95% of the differences between the measured Transverse Profile points and the True Transverse Profile points fall within $\pm 1.5\text{mm}$.

5.8.9 The Contractor monitors the coverage achieved in the surveys of transverse profile. Invalid measurements of transverse profile will result in reduced survey coverage, where coverage is defined as the total length within any predetermined length over which valid measurements of transverse profile are provided.

5.8.10 The Contractor reports any survey lengths greater than 1.0 km over which less than 90% by length of valid transverse profile measurements can be delivered to the Employer and to the Auditor. If required by the Employer, the Contractor carries out repeat surveys of these lengths until a sufficient length of valid transverse profile measurements can be delivered, or the Employer agrees to accept the survey results without the transverse profile coverage.

[Note: Particularly in built up areas there are likely to be lengths of roads containing features placed in or on the road surface for the purposes of traffic control (e.g. speed humps and traffic “chicanes”). Such locations may cause significant lengths of invalid data. Where these features are present the Contractor records their presence in the Survey Data and labels any of the parameters of the Survey Data that would be affected by these features (for example transverse profile) as invalid. The Contractor is paid for these survey lengths but the invalid data arising from such features does NOT contribute to the coverage requirements (i.e. these lengths are disregarded before calculating the coverage achieved by the Contractor).]

5.8.11 The Contractor provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of transverse profile. This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's road Network,

- The total length within each Section for which the Contractor is unable to provide valid transverse profile data.
- The locations within each Section of the Network over which the Contractor is unable to provide valid transverse profile data.

5.8.12 The Contractor calculates the Transverse Unevenness and Edge Deterioration measures from the transverse profile, as described in Volume 6, sections 2.5 and 2.6..

5.8.13 Further guidance on the interpretation and use of transverse profile and rut depth measurements is given in SCANNER surveys on local roads, Volume 5, Further Technical Guidance.

5.9 ***Wheel path Rutting***

5.9.1 The Contractor provides measurements of maximum rut depths in the Nearside and Offside Wheelpaths. The longitudinal separation of successive measurements of rut depth shall not exceed 100mm.

5.9.2 The Contractor averages the measurements of maximum rut depth over lengths of 1m and expresses them in units of 1/10mm*.

[Note: *Units of 1/10 mm are required because the RCD does not accept decimal points. Therefore, for example, a rut depth measured as 9.3 mm would be reported as 93 in units of 1/10 mm]

5.9.3 The Contractor reports the measured values of maximum rut depth with accuracy such that

- 65% of the differences between the measured rut depth in each wheel path and the true rut depth fall within $\pm 1.5\text{mm}$.
- 95% of the differences between the measured rut depth in each wheel path and the true rut depth fall within $\pm 3.0\text{mm}$.
- The differences between the measured rut depth and the true rut depth in each wheel path never exceed 10mm, or 50% of the magnitude of the true rut depth, whichever is the greater.

5.9.4 The Contractor labels any rut depth data that fail to meet the specified requirements as invalid. The Contractor may use the facility provided in the

SCANNER RCD and SCANNER HMDIF output file formats to label the rut depth data as invalid.

5.9.5 The Contractor monitors the coverage achieved in the surveys of rut depth. Invalid measurements of rut depth will result in reduced survey coverage, where coverage is defined as the total length within any predetermined length over which valid measurements of rut depth are provided.

5.9.6 The Contractor reports any survey lengths greater than 1.0 km over which less than 90% by length of valid rut depth measurements can be delivered to the Employer and to the Auditor. If required by the Employer, the Contractor carries out repeat surveys of these lengths until a sufficient length of valid rut depth measurements can be delivered, or the Employer agrees to accept the survey results without the rut depth coverage.

[Note: Particularly in built up areas there are likely to be lengths of roads containing features placed in or on the road surface for the purposes of traffic control (e.g. speed humps and traffic “chicanes”). Such locations may cause significant lengths of invalid data. Where these features are present the Contractor records their presence in the Survey Data and labels any of the parameters of the Survey Data that would be affected by these features (for example rut depth) as invalid. The Contractor is paid for these survey lengths but the invalid data arising from such features does NOT contribute to the coverage requirements (i.e. these lengths are disregarded before calculating the coverage achieved by the Contractor).]

5.9.7 The Contractor provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of transverse profile and rut depth (and hence cleaned rut depth and edge deterioration). This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's road Network,
- The total length within each Section for which the Contractor is unable to provide valid rut depth and/or transverse profile data (as applicable).
- The locations within each Section of the Network over which the Contractor is unable to provide valid rut depth and/or transverse profile data (as applicable).

5.9.8 Further guidance on the interpretation and use of transverse profile and rut depth measurements is given in SCANNER surveys on local roads, Volume 5, Further Technical Guidance.

5.10 ***Texture Profile***

5.10.1 The Contractor measures the Texture Profile during the Survey in the Nearside Wheel path at points separated by no more than 0.5mm.

5.10.2 In Scotland the measurement of texture is carried out in the Nearside Wheel path, the Offside Wheel path and midway between the two wheel paths. The value reported is the lower of the two separate wheel path values.

5.10.3 The accuracy of the measured texture profile must be unaffected by the texture or profile of the pavement over the full range of profiles and textures that can reasonably be expected to be encountered on the Employer's road network.

5.10.4 The Contractor averages the measured texture profile points over 1.0 mm and expresses the value in units of 1/10mm at 1.0 mm intervals.

5.10.5 The Contractor obtains measurements of Texture Profile such that the frequency response is essentially flat in the bandwidth 5.0 mm to 500 mm (i.e. the ratio of measured Texture Profile amplitude to True Texture Profile amplitude should be 1.0 ± 0.1 for profile components with wavelengths between 5.0 mm and 500 mm).

5.10.6 The Contractor measures the Texture Profile measurements with accuracy such that:

- At least 95% of the differences between the measured Texture Profile and the True Texture Profile fall within ± 0.5 mm of the True Texture Profile.
- At least 95% of the differences between the Sensor Measured Texture Depth (SMTD) calculated from the measured Texture Profile and the SMTD calculated from the True Texture Profile fall within the range ± 0.25 mm.
- All of the differences between the Sensor Measured Texture Depth (SMTD) calculated from the measured Texture Profile and the SMTD calculated from the True Texture Profile fall within the range ± 0.75 mm.

5.10.7 The Contractor labels any texture depth data that fail to meet the specified requirements as invalid. The Contractor may use the facility provided in the

SCANNER RCD and SCANNER HMDIF output file formats to label the texture depth data as invalid.

5.10.8 The Contractor labels any texture data that fail to meet the specified requirements as invalid. The Contractor checks the Survey Data for any conditions that may result in invalid measurements of texture profile. These conditions may include, but would not be limited to drop-outs (missing data points), and failures in any of the measurement devices. In these circumstances the Contractor labels the data as invalid using the facility provided in the SCANNER RCD and SCANNER HMDIF files.

5.10.9 The Contractor monitors the coverage achieved in the surveys of texture profile. Invalid measurements of texture profile (and hence SMTD) will result in reduced survey coverage, where coverage is defined as the total length within any predetermined length over which valid measurements of texture profile (and/or SMTD) are provided.

5.10.10 The Contractor reports any survey lengths greater than 1.0 km over which less than 95% by length of valid SMTD measurements can be delivered to the Employer and to the Auditor. If required by the Employer, the Contractor carries out repeat surveys of these lengths shall be carried out until a sufficient length of valid SMTD measurements can be delivered, or the Employer agrees to accept the survey results without the texture profile coverage.

5.10.11 The Contractor provides the Employer and the Auditor, (if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of texture profile and SMTD. This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's road Network,
- The total length within each Section for which the Contractor is unable to provide valid texture profile and/or SMTD data (as applicable),
- The locations within each Section of the Network over which the Contractor is unable to provide valid texture profile and/or SMTD data (as applicable).

5.10.12 Further guidance on the measurement of Texture Profile is given in SCANNER Surveys for Local Roads, Volume 5, Further Technical Guidance.

5.11

Cracking

5.11.1

The Contractor uses the Equipment to identify Cracks over a total width of at least 80% of the width of the traffic lane for traffic lanes up to 3.65m wide on the range of surfaces to be encountered on the Employer's road Network. For lanes greater than 3.65m wide the Equipment identifies cracking within a minimum overall width of 2.9m, centred on the centre of the traffic lane. The Contractor uses the same settings as those used to obtain accreditation, without alteration.

5.11.2

The cracking data is provided within the SCANNER RCD as a record of the location of each individual crack. The cracking data is expressed as the Intensity of Cracking within the SCANNER HMDIF, as well as a record of the location of each individual crack.

5.11.3

The identification of cracking must be unaffected by:

- The surface type or surface texture over the full range of surface types that can reasonably be expected to be encountered on the Employer's road network.
- The presence of longitudinal and transverse joints on either concrete or bituminous pavements.
- The presence of longitudinal and transverse grooves on concrete pavements.

5.11.4

The requirements for calculating intensity of cracking are given in Volume 6 sections 2.3 and 2.4.

5.11.5

The requirements for accuracy of the Cracking measurements are given in SCANNER surveys for local roads, Volume 3, Accreditation and Consistency Testing.

5.11.6

If the Survey Equipment is acceptable, but with restrictions on the areas of the local road network for which it is acceptable (e.g. over concrete or block paving) 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 entering any contract].

5.11.7 The Contractor records all cracking data reported to a level of accuracy that meets the requirements specified in SCANNER surveys for local roads, Volume 3 Accreditation and Consistency Testing. The Contractor removes any cracking data that would fail to meet those requirements from the survey data before delivery.

5.11.8 The Contractor monitors the coverage achieved in the surveys of cracking. Invalid measurements of cracking, will result in reduced survey coverage, where coverage is defined as the total length within any predetermined length over which valid measurements of cracking are provided.

5.11.9 The Contractor provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved (see also section 6.3) in the measurement of cracking. This report is provided as a comma delimited text file including:

- The total length surveyed within each Section of the Employer's Network,
- The total length within each Section for which the Contractor was unable to provide valid cracking data.
- The locations within each Section of the Network over which the Contractor is unable to provide valid cracking data.

5.11.10 Further guidance on the measurement and use of cracking is given in SCANNER surveys for local roads Volume 5, Further Technical Guidance.

6 Data Processing and Route Fitting

6.1 *Data Processing*

6.1.1 Where the Employer or the Auditor requires SCANNER Raw Condition Data (SCANNER RCD), the Contractor processes the Survey Data to provide the SCANNER RCD. The delivery of SCANNER RCD is a requirement for the accreditation tests.

6.1.2 The Contractor processes the Survey Data or the SCANNER RCD (as appropriate) to provide the SCANNER HMDIF file.

[Note: The HA has developed a software application called the Machine Survey Pre-processor (MSP) for the pre-processing of TRACS, Deflectograph and SCRIM data before it is loaded into the HA's pavement management system (HAPMS). Version 7 of the MSP enables SCANNER data to be pre-processed before loading it into local authorities' UKPMS-accredited pavement management systems. Version 7 of MSP will be made available by TRL Limited to Contractors who wish to use it to generate SCANNER HMDIF files. The Auditor may also use the MSP in the accreditation, QA and audit to check the outputs of the SCANNER accredited Equipment and Surveys. Further information on the MSP and data file formats is given in Volume 6, sections 3 and 4..

6.1.3 The Contractor may provide and use the Contractor's own programs to process the survey data. The Contractor's own programs must provide the same level of capability and functionality and obtain all derived parameters (including the parameters for the measurement of edge deterioration and transverse unevenness) as the MSP.

6.1.4 The Contractor either processes the Survey Data or the SCANNER RCD to produce the SCANNER HMDIF using the Contractor's own programmes, or uses the MSP to produce the SCANNER HMDIF from the SCANNER RCD.

6.2 *Route Fitting*

6.2.1 The Contractor fits the Survey Data to the route. This may be carried out using the MSP, as described in Volume 6.

- 6.2.2 Where the Contractor provides and uses a program to align the Survey Data with the Survey Route the program must provide similar capability and functionality as the MSP (see volume 6 section 3).
- 6.2.3 The minimum requirements of the Contractor's own system include:
- The ability to use the National Grid co-ordinates provided by the Employer to obtain the Section Start and End points.
 - The application of checks for differences between the Survey Section Length and Route Section Length
 - Fitting the Survey Data to the Survey Route (by "stretching" or "shrinking")
- as described in the following paragraphs.
- 6.2.4 If the Employer has provided National Grid co-ordinates describing the locations of the Section Start and End Points and has agreed the use of these National Grid co-ordinates in the alignment of the Survey Data with the Survey Route the fitting software shall use the National Grid Co-ordinates recorded in the SCANNER RCD to obtain the elapsed chainage of the Section Start Points in the Survey Data from the National Grid co-ordinates describing the locations of the Section Start and End Points provided in the Route File (if provided).
- 6.2.5 If the horizontal error between the location of the Section Start point calculated from the Survey Data and the National Grid co-ordinates for that Section Start Point provided by the Employer is less than 10m, then the elapsed chainage of the Section Start Points in the Survey Data obtained from the National Grid co-ordinates provided by the Employer describing the locations of the Section Start and End Points replaces the elapsed chainage of the Section Start Points recorded in the Survey.
- 6.2.6 If the horizontal error between the location of the Section Start point calculated from the Survey Data and the National Grid co-ordinates for that Section Start Point provided by the Employer is more than 10m, the Contractor rechecks the values. If, after rechecking, the horizontal error is still more than 10m the Contractor reports the disparity to the Employer. The Employer instructs the Contractor on what action to take within 5 working days of the Contractor's report on the disparity.

- 6.2.7 Following the application of the National Grid Co-ordinates the Contractor aligns the Survey Section Lengths with the Section Lengths recorded in the Survey Route File.
- 6.2.8 The Contractor compares the differences in measured and expected lengths, between Section Start Points (Section Lengths), with limits defined within their route fitting software, and which have been agreed with the Auditor. These limits enable checks on:
- The minimum and maximum acceptable Survey length
 - The maximum allowed difference between Route and Survey Section lengths
 - The maximum number of missing Section Start markers
- 6.2.9 It is likely that the Survey Route will contain Sections having overall lengths which do not exactly match the lengths recorded in the Survey Data. In order to fit the Survey Data to the route may require that the Survey Data for an individual section be either stretched or shrunk.
- 6.2.10 The Contractor undertakes this process by expressing the ratio between the Survey Section length and the Section length recorded in the Route (as a factor greater or less than 1.0). Intermediate 10m subsection lengths within the Survey Data (for that Section) are then extended or compressed by that factor, so that the Survey Data for that Section has the same length as the Route Section length. The intermediate subsection lengths are rounded to the nearest metre
- 6.2.11 The contractor applies limits to this fitting process. Where a Survey Section Length differs from the Section Length recorded in the Route File by more than 50m or 10% of the Section Length (whichever is the lesser) the Contractor uses an appropriate method to ensure that the Section Start and End Points have been recorded to the required levels of accuracy and therefore the Survey is not at fault.
- 6.2.12 If the Contractor determines that the Survey Section Start and End points have been correctly recorded, the Section length has also been correctly recorded, and it is therefore the length provided by the Employer for the Section and used for the Route, that is incorrect, then the Contractor reports the disparity to the Employer. The Employer instructs the Contractor on what action to take within 5 working days of the Contractor's report on the disparity.

6.2.13 The Contractor provides the Employer with the fitted route file, which describes the location and elapsed chainage of the Section Start Points following the fitting of the Survey Data to the Employer's network.

[Note: SCANNER Surveys must use the "Full" Cross Sectional Position (XSP) referencing method. For sections where SCANNER surveys are to be carried the XSP referencing method should be set as "Full" in the carriageway referencing method. More information about XSP Referencing can be found on the UKPMS website.]

6.2.14 The Contractor retains survey data (HMDIF) in a retrievable format for at least two years after initial acceptance by Employer.

6.3 ***Invalid Data and Network Coverage***

6.3.1 The Contractor defines the set of Survey Routes before commencing the surveys of the Employer's network (Section 4.1). Before commencing the Surveys the Contractor provides the Employer with an estimate of the total length of the Employer's network that is to be surveyed, which is the basis for the coverage requirements.

6.3.2 The Contractor provides a return from 100% of the length of each of the Survey Routes consisting of either

- Valid Survey Data provided as SCANNER HMDIF file, or SCANNER RCD (if required by the Employer) or both formats (if required by the Employer).
- Survey Data flagged as invalid and provided as SCANNER HMDIF file, or SCANNER RCD (if required by the Employer) or both formats (if required by the Employer)..
- A report of Sections (or parts of Sections) not surveyed, and the reasons for the failure to survey these Sections.

6.3.3 The Contractor also provides the Employer (and the Auditor, if the Auditor requests it) with a summary report of the coverage achieved in the measurement of all parameters and the quantity of invalid data for each Survey Route. This report is provided as a comma delimited text file and describes the percentage of the Survey Route for which invalid measurements were made for each data parameter, as specified in sections 5.1.3; 5.4.13; 5.7.15; 0; 5.10.11; and 5.11.9.

- 6.3.4 The Contractor monitors the coverage achieved in the surveys for each parameter on the network. Invalid measurements of each parameter will result in reduced survey coverage, where coverage is defined as the percentage of the total survey length required (i.e. the total length surveyed plus the total length not surveyed) for which valid data has been provided as either SCANNER HMDIF or SCANNER RCD (or both, if required by the Employer or Auditor).
- 6.3.5 The minimum requirements for the coverage of the Employer's network are summarised in Table 2.3. Although Table 2.3 describes the coverage required over the network, there are further requirements for the coverage at the Section and sub-section level. These requirements are defined in the preceding Section: 5.4.12; 5.7.14; 5.9.6 and 5.10.10.

| Measured Parameter | Percent of surveyed Network for which valid Survey Data shall be provided | Percent of surveyed Network for which invalid Survey Data or missing Survey Data is permitted ¹ | Total coverage ² (%) |
|-------------------------------------|---|--|---------------------------------|
| Average Speed | 98 | 2 | 100 |
| National Grid Co-ordinates | 98 | 2 | 100 |
| Altitude | 98 | 2 | 100 |
| Longitudinal Profile Rural Areas | | | |
| 3m Variance | 98 | 2 | 100 |
| 10m Variance | 98 | 2 | 100 |
| 30m Variance | 90 | 10 | 100 |
| Longitudinal Profile Urban Areas | | | |
| 3m Variance | 98 | 2 | 100 |
| 10m Variance | 95 | 5 | 100 |
| 30m Variance | 80 | 20 | 100 |
| Transverse Profile | 98 | 2 | 100 |
| Texture Profile | 98 | 2 | 100 |
| Road Geometry | 98 | 2 | 100 |
| Cracking | 98 | 2 | 100 |

¹ Invalid Survey Data is Survey Data which does not meet the accuracy requirements. For the purposes of the coverage requirements invalid Survey Data includes lengths not surveyed.

² Total coverage excludes those lengths which have been disregarded because of traffic calming features.

Table 2.3: Coverage Requirements by Parameter

7 Health and Safety Requirements

- 7.1.1 In addition to statutory duties the Contractor complies with the following requirements:
- 7.1.2 The Contractor carries out the Surveys in accordance with any additional requirements specified by the Employer relating to safety and minimum disruption to other road users.
- 7.1.3 The Contractor complies with the requirements of its own safety policy statements and safety codes of practices, and of any safety policy statements and safety codes of practice the Employer notifies to the Contractor.
- 7.1.4 The Contractor:
- If required, provides the Employer with a copy of the Contractor's current safety policy statement, safety codes of practice, and method statements
 - Informs the Employer as soon as the Contractor becomes aware of any prosecution or pending or likely prosecution of the Contractor for any offence pertaining to the health and safety of its employees or of other persons, or of any conviction on such prosecution, and provides the Employer with such further information and documents as the Employer may require
 - Notifies the Employer as soon as possible of any accident or dangerous occurrence as defined under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulation 1985. This is in addition to the statutory requirement to notify the Health and Safety Executive.
- 7.1.5 The Contractor takes such steps as are necessary to ensure that its employees, and those of any Sub-Contractor's, engaged on the Surveys, are competent to carry out their respective tasks with due regard to the Contractor's obligations and in the interest of the health and safety of other persons engaged in the Surveys or present on the site of the Surveys, and of the general public.
- 7.1.6 The Employer is empowered to suspend the provision of the Surveys in the event of non-compliance by the Contractor with these health and safety requirements.

The Contractor does not resume provision of the Surveys until the Employer is satisfied that the non-compliance has been rectified.

7.1.7 The Contractor ensures that its employees are provided with an adequate and suitable supply of protective clothing and other protective equipment as conditions may require. The equipment and clothing supplied complies with the appropriate British or European EEC equivalent Standard. All personnel, either working on or visiting the site, are required to wear high visibility clothing to Class 3 BS EN 471:1994 Paragraph 4.2.4. High visibility sleeveless waistcoats are NOT acceptable. The Contractor instructs its employees in the use of protective equipment and clothing which is maintained in a fit condition and ensures that protective clothing is worn effectively.

7.1.8 The Contractor ensures that all of the vehicles used in this contract clearly display the Contractor's name and/or logo and telephone number(s). All survey vehicles must comply with Traffic Signs Manual, Chapter 8 and particularly with respect to the use of conspicuous beacons etc.

Halcrow Group Limited
Red Hill House 227 London Road Worcester WR5 2JG
Tel +44 (0)1905 361361 Fax +44 (0)1905 361362
www.halcrow.com