



HiSPEQ7: SPECIFICATION FOR TRAFFIC SPEED PAVEMENT DEFLECTION MEASUREMENT

NOTE: When completing this survey specification template please refer to section HiSPEQ7 in Part 2 of the guidance notes (which can be found on the HiSPEQ website, www.hispeq.com). Once the template is complete, delete this red text.

1 Measurement Data

1.1 Measurement requirements

- 1.1.1 Measurements should be conducted along the line of the nearside wheel path. The wheel path is defined to be xx m from the centreline of the lane.
- 1.1.2 Measurements should be conducted using at least 7 Doppler lasers.
- 1.1.3 Each Doppler sensor should deliver at least 600 samples per second during production testing with the testing vehicle at driving speeds as specified in 1.2.4 of this document.
- 1.1.4 Raw data should be reported for every x m.
- 1.1.5 Processed data should be reported for every x m.
- 1.1.6 Data should be delivered electronically in a Client specified format (at least comma separated or similar). It is recommended that TSD deflection data are delivered in a data format compatible with common FWD backcalculation programs.
- 1.1.7 Measurements should be conducted with an axle load of at least 8 tonnes on the load axle.
- 1.1.8 The longitudinal profile should be measured in the same line as the Doppler sensors. The measurement should either be performed according to HiSPEQ4: SPECIFICATION FOR LONGITUDINAL EVENNESS MEASUREMENT or:
 - Be measured at a minimum spacing of 25mm and reported at 100mm spacing;
 - Be measured in mm and reported to 1 decimal place;
 - Contain wavelengths between 0 and 100m;
 - The wavelength response of the equipment should be flat in the range 0.5 to 50m.
- 1.1.9 The device should also be instrumented with sensors to continuously monitor
 - Driving speed;
 - Static and dynamic load on ballast and load axle;
 - Tyre pressure and temperature;
 - Air and road surface temperature.

In connection with each measurement, the following static information should also be registered:

 - Position of Doppler sensors
 - Tyre and wheel configuration
 - Tyre condition.
- 1.1.10 All measurements should be referenced to the network, in accordance with HiSPEQ2: SPECIFICATION FOR LOCATION MEASUREMENT.

1.2 Survey requirements

- 1.2.1 Surveys should only be carried out when the road surface is dry.
- 1.2.2 Surveys should not be carried out in abnormal weather conditions, which can influence testing results. This may include wet or soaked unbound materials and subgrade as well as cases of very strong side winds.
- 1.2.3 During testing the pavement temperature at a depth corresponding to $\frac{1}{3}$ to $\frac{1}{2}$ of the total asphalt thickness should be between 5 °C and 35°C.
- 1.2.4 Surveys should be carried out at a constant speed in the range 40-80 km/h.

2 Parameters

- 2.1.1 The following parameters should be delivered as a result of the testing:

At all Doppler sensor locations:

- Deflection velocity
- Deflection slope
- Absolute deflection
- (Maximum) deflection at center of loading

- 2.1.2 The following parameters are recommended outputs from the testing:

- Structural Curvature Index, SCI₃₀₀ at distance 300 mm from the center of loading
- Base Distress Index, BDI
- Horizontal tensile strain at the bottom of an asphalt layer
- Relative bearing capacity
- Remaining pavement life
- Uniform sections

- 2.1.3 Determination of the parameters mentioned in 2.1.1 should be done using one of the following analysis methods (or similar):

- Greenwood Engineering refined model
- The 'Area Under The Curve (AUTC)' method

- 2.1.4 Other parameters to be delivered should be:

- Driving speed of measuring vehicle
- Dynamic and static load on ballast and load axle
- Tyre pressure and temperature
- Air and road surface temperature
- Longitudinal profile in same measurement line as Doppler sensors

3 Accreditation

The Accreditation will check the performance of the equipment on one or more test track sites, and on one or more network sites, and will take up to 2 days. These sites will include a range of pavement construction and a range of deflection values from those likely to be present for stiff pavements through to those for weak pavements.

Before Accreditation tests occur, calibration of the beam angle should be performed on a very stiff length of road.

Measurements for the Accreditation tests will only be from surveys on dry roads that have a temperature between 5 and 35°C at a depth of 40 mm.

Repeat surveys of the test track at 40, 50, 60, 70 and 80km/h will be required, with two runs performed for each speed.

Accreditation test surveys of road network routes will be carried out at a constant speed in the range 40-80 km/h, with two repeat surveys performed on each route.

During Accreditation, the accuracy and repeatability of the system will be assessed.

The accredited staff of the survey contractor will operate the equipment during the Accreditation tests.

If multiple survey crews will be used to operate the equipment, then each survey crew will be expected to perform the repeat surveys of the network routes.

The survey contractor will be expected to provide evidence that all crew members have been trained to a suitable level e.g. provide certificates for training by the equipment manufacturer.

3.1 Accreditation of TSD deflection data

- Description of the data to be used for the assessment (e.g. survey of test track);
- What conditions the data should be collected in (e.g. dry, clean road, wet road, temperature range);
- Repeat surveys at a range of constant speeds e.g. 40, 50, 60, 70 and 80km/h on the test track;
- Description of any tests used to assess the competency of the survey crew;
- What the data will be assessed for: Accuracy, system repeatability.

3.1.1 Accreditation tests and requirements for accuracy of TSD deflection data

Ideally the accuracy of the measurements should be tested against the true values. However, in practice it is not always possible to obtain true values and thus a reference method or device is used. It is assumed that the reference method/device provides values that are very close or equal to the true values.

- What method(s) or device(s) will be used to provide reference data?
- How the measured data will be compared to/assessed against the reference;
- Requirements for the accuracy;
- Determination of the range of speeds for which survey data is valid.

3.1.2 Accreditation tests and requirements for system repeatability for TSD deflection data

- Comparison of data collected at valid survey speeds (determined in section 3.1.1);
- How the repeat data will be compared with the original data;
- Requirements for the system repeatability.

3.1.3 Accreditation tests and requirements for fleet consistency of TSD deflection data

- How the fleet consistency will be assessed;
- Requirements for the fleet consistency.

3.2 (Accreditation of TSD longitudinal profile)

If measurement of longitudinal profile is required, you may wish to check the quality of the data during the Accreditation testing. It may be appropriate to use the accreditation tests and requirements for the longitudinal profile given in HiSPEQ4. Alternatively, other tests could be used. In this case:

- Provide a description of the data to be used for the assessment (e.g. survey of test track);
- State what conditions the data should be collected in (e.g. dry, clean road, wet road);
- State whether repeat surveys at a range of constant speeds are required e.g. 10 km/h, 20km/h, 40km/h on the test track;
- State what the data will be assessed for: Accuracy, system repeatability.

3.2.1 (Accreditation tests and requirements for accuracy of longitudinal profile)

- What method(s) or device(s) will be used to provide reference data?
- How often the reference data will be updated;
- How the measured data will be compared to/assessed against the reference;
- Requirements for the accuracy;
- Determination of the range of speeds for which survey data is valid.

3.2.2 ((Accreditation tests and requirements for system repeatability for longitudinal profile))

- Comparison of data collected at valid survey speeds (determined in section 3.2.1);
- How the repeat data will be compared with the original data;
- Requirements for the system repeatability.

3.3 Accreditation of TSD parameters

- Description of the data to be used for the assessment (e.g. survey of test track and network routes)
- What conditions the data should be collected in (e.g. dry, clean road, wet road)
- Repeat surveys (on the network routes and at a range of constant speeds e.g. 10 km/h, 20km/h, 40km/h on the test track);
- Description of any tests used to assess the competency of the survey crew;
- What the data will be assessed for: Accuracy, system repeatability, fleet consistency.

3.3.1 Accreditation tests and requirements for accuracy of TSD parameters

- What method(s) or device(s) will be used to provide reference data;
- How often the reference data will be updated;
- How the data will be compared to/assessed against the reference, including the assessment length (e.g. the parameter reporting length);
- Requirements for the accuracy of each parameter delivered/calculated;
- Confirmation/determination of the range of speeds for which survey data is valid.

3.3.2 (Accreditation tests and requirements for system repeatability for TSD parameters)

- Comparison of repeat survey data collected at valid survey speeds.
- How the repeat data will be compared with the original data, including the assessment length (e.g. the parameter reporting length);
- Requirements for the system repeatability.

3.3.3 (Accreditation tests and requirements for fleet consistency for TSD parameters)

- Description of the surveys to be performed by the fleet;
- How the data from multiple devices will be compared, including the assessment length (e.g. the parameter reporting length);
- Requirements for the fleet consistency.

4 Quality Assurance

4.1 QA for TSD deflection data

4.1.1 System repeatability for TSD deflection data

- Regular surveys of the same network sites by the contractor;
- How the measured parameters(s) will be assessed;
- Requirements for data repeatability.

4.1.2 (Fleet consistency for TSD deflection data)

- Surveys of the same road network site(s) by each device and crew in the fleet;
- How the measured parameter(s) from different devices will be compared, including the assessment length (e.g. the parameter reporting length);
- Requirements for consistency.

4.2 QA for TSD longitudinal profile data

4.2.1 System repeatability for ride quality paramters

- Regular surveys of the same network sites by the contractor;
- How the measured parameters(s) will be assessed;
- Requirements for data repeatability.

4.2.2 (Fleet consistency for ride quality paramters)

- Surveys of the same road network site(s) by each device and crew in the fleet;
- How the measured parameter(s) from different devices will be compared, including the assessment length (e.g. the parameter reporting length);
- Requirements for consistency.



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