Test method T160

Deflection measurement (Portable Beam)

OCTOBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
		Reformatted and Revision Summary added	D.Dash	May 1999
		Date on Test Method revised to agree with date on revision	D.Dash	Feb 2001
Ed 2/ Rev 0	ALL	Generally Revised. Title Changed. Tyre specification and pressures updated. Diagram included. Revised method. Notes located under each clause. Appendix for asphalt temperature measurement.	David Hazell	Sept 2008
Ed 3/ Rev 0	All	Reformatted RMS template	J Friedrich	October 2012

Note that Roads and Maritime Services is hereafter referred to as 'RMS'.

The most recent revision to Test method T160 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T160

Deflection measurement (Portable Beam)

1. Scope

This test method sets out the procedure for measuring the rebound deflection of a flexible pavement or road formation using a portable deflection beam under both a standard wheel load and tyre pressure.

2. General

(a) The surface under the beam shall be sound and free of excessive loose material, large protruding objects or significant surface depressions.

(b) Where an electronic data acquisition system is used to directly capture and record test data, it must have a precision at least equivalent to the apparatus replaced.

(c) Asphalt pavements are to have temperature measurements taken.

3. Apparatus

(a) A beam apparatus to measure deflection with distance between tip and support legs consistent with the details in Figure 1. The beam must be insulated from affects of temperature variation. The beam is to be fitted with a displacement measuring devices capable of capturing and measuring deflection values over the expected range of travel:

(i) Dial gauge readable to 0.01 mm and meeting the accuracy and repeatability requirements of AS 2103.

OR

(ii) A Linear Variable Differential Transducer (LVDT) of infinite resolution and a Data Acquisition System. The complete unit shall have an accuracy of measuring ± 0.005 mm at the tip of the beam.

NOTE: An ergonomic handle may be used.

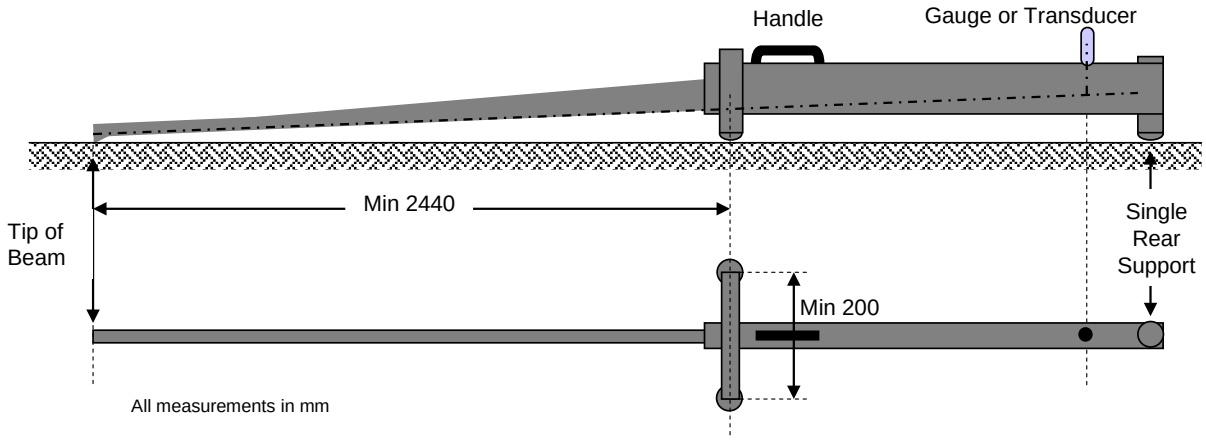

Figure 1 - Deflection Beam Components and Dimensions

(b) A test vehicle equipped with the following:

(i) Single rear axle with dual rear wheels

(ii) Dual rear 11R22.5 radial ply trailer tyres with highway tread pattern (non-lugged).

(iii) Rear tyre pressures of 750 ± 30 kPa measured at the commencement of testing.

(iv) Dual tyre spacing to allow the tip of the beam to be inserted without contacting the tyre walls

NOTE: All four tyres on the rear axle must have a similar degree of wear.
Report if other tyres are used, such as the previous 10 x 20 12 cross-ply tyre and the tyre pressure.

(c) The test vehicle is to have a rear axle load of 8.2 ± 0.15 t equally distributed over each of the dual tyred wheels. The load must remain stable during stop/start operation of the vehicle.

NOTE: Water tanks are unsuitable as a load. Provide a weigh bridge certificate where a load is susceptible to change (e.g. load wetting/drying, moving).

(d) Tyre pressure gauge graduated in 20 kPa divisions or smaller.

(e) System to measure the progressive distance of the test vehicle from the test point

(f) For testing asphalt pavements:

(i) A thermometer with a range 0-100°C readable and accurate to 1°C (e.g. infra-red, digital or conventional thermometer)

(ii) A pourer with oil (e.g. paraffin, glycerine)

(iii) A punch and hammer or drill suitable for making a 30 mm deep hole and diameter of about 13 mm.

4. Preparation

(a) Once every month check that the operation of equipment meets the specified tolerances by comparing the readings with a standard:

(i) Place calibrated spacers under the tip of the beam and record the readings at four different positions over the operating range of the dial gauge or transducer.

NOTE: Feeler gauges may be used.

(ii) Record the distances every 1 m over a total of 9 m using the automatic measurement system and a tape measure

5. Procedure

(a) Measurement of deflection must not be affected by external influences (e.g. wind, passing vehicles, etc).

(b) Set up the equipment.

(c) Select the start point for testing and where required, mark the point:

(i) For a sealed pavement, locate the start point approximately in the centre of the nominated wheelpath.

NOTE: Position at least 0.5 m from the nearest edge of seal.

(ii) For an unsealed surface, establish the specified sampling pattern and locate the start point.

(d) Position the centre of the dual wheels of the vehicle over the start point to within ± 300 mm.

(e) Insert the tip of the beam between the dual wheels:

(i) Where the beam has a manual dial gauge, position the tip at the vertical diameter of the rear wheel ±50 mm. The test point is where the tip contacts the surface.

NOTE: A marker on the vehicle and corresponding mark on the beam can be used to accurately position the tip of the beam.

(ii) Where the beam has electronic data capture, extend the tip through the dual wheels a distance 300 ± 50 mm from the vertical diameter of the rear wheel. The test point is where the tip contacts the surface.

NOTE: Ensure that the beam is free to operate. The tip of the beam must not rest on particles that may rotate during the test. Ensure that the beam is not touched by the tyres.

(f) Set up the method to measure the distance that the vehicle has travelled away from the start point.

(g) Initialise the beam and displacement measuring device ready to measure deflections according to the operating instructions.

NOTE: Ensure that the displacement measuring device is set within an appropriate range.

(h) Smoothly drive the vehicle forward at creep speed.

(i) If required, record the consecutive readings on the displacement measuring device as the rear wheel hub of the test vehicle passes 200 mm, 600 mm, 900 mm and 2700 mm from the start point.

(ii) Take the final reading when the vehicle has moved at least 9 m away from the start point.

NOTE: If the displacement continues to change after the final reading note this event in the report.

(i) For asphalt pavements, at the start and then at least once every hour determine the temperature according to the Appendix – Asphalt Temperature Measurement. Record the temperature, surface or depth in mm against the last test location.

(j) Repeat Steps (d) to (i) to test deflection of another location.

6. Calculations

(a) Determine the maximum deflection (D_0) by multiplying the final reading (R_F) less any initial reading (R_0) by the beam ratio (BR).

(b) If required, calculate the deflections (D_x) at distance 'x' from the selected point as follows:

$$D_x = BR \times (R_F - R_x)$$

Where:

D_x = Deflection at distance 'x' (mm)

BR = Beam Ratio for the beam

R_F = Final Reading (mm)

R_x = Reading at distance 'x' (mm)

x = 200, 600, 900 or 2700 mm.

7. Reporting

Include the following data and results in the report:

(a) Test location (i.e. chainage, direction, lane, offset/wheelpath, etc).

(b) Time at start and end of continuous run or Lot

(c) Surface type and layer

(d) Type of beam and beam ratio (BR)

(e) Maximum Deflection (D_0) to 0.01 mm. Note any points with unstable readings.

(f) Where required, report the other deflection results (D_{200}, D_{600}, D_{900} and D_{2700}) to 0.01 mm.

(g) Where required to report pavement temperature, tabulation of the following:

(i) Time of test

(ii) Nearest test point

(iii) Depth of temperature hole (in mm)

(iv) Pavement temperature in °C

(h) Reference to this test method

Appendix A: Asphalt Temperature Measurement

(a) For asphalt pavements select a location to measure pavement temperature that is typical of the test points (i.e. shading, asphalt thickness, asphalt mix).

(b) Make a hole with diameter slightly larger than that of the thermometer or probe, to a depth approximately 30 mm below the surface.

NOTE: Approximately 75 mm if the depth of asphalt is unknown.

(c) Insert the thermometer into the hole.

(d) Pour light oil in the hole and allow the temperature reading to stabilise before recording the temperature.

NOTE: Do not allow oil to contaminate the surface.

(e) Record the depth of the hole to the nearest 10 mm.