Transport Roads & Maritime Services

NSW GOVERNMENT

Test method T370

Project ride quality (walking profiler)

OCTOBER 2012

Revision Summary

Ed/Rev Number	Clause Number	Description of Revision	Authorisation	Date
Ed 1/Rev 0	All	New Issue		Jul 1997
Ed 1/Rev 1	All	General revision and reformatting.	G Hall	Sep 2009
		Headers Corrected	D. Hazell	June 2010
Ed 2/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 T370 (other than minor editorial changes) are indicated by a vertical line in the margin as shown here.

Test method T370

Project ride quality (walking profiler)

1. Scope

This Test Method sets out the procedure for measuring longitudinal profile of a surface using the ARRB Walking Profiler. The longitudinal profile is used to determine the ride quality of projects.

NOTE: The Test Method is based on Austroads Test Method AG:PT/T450. The clause numbering in this Test Method generally parallels the numbering in the Austroads Test Method and not the usual RMS numbering system.

2. General

2.1 Requirements

(a) This Test Method uses the Single Track IRI track averaging (quarter-car) method

NOTE: The profile averaging method (also know as the half-car method) is not used.

(b) The Walking Profiler must be capable of measuring the longitudinal road surface profile along a path at least once every 250 mm with a precision in elevation of at least 0.5 mm operating over a range of wave length of at least 1.0 m to 30 m

(c) Operate the equipment in accordance with this Test Method in conjunction with the Manufacturer's User Manual. Where there is a conflict this Test Method prevails

(d) The test is applicable to surfaces where the geometry is within the manufacturer's specification for use (e.g. steepness of grade)

(e) The roughness is tested as Test Lanes and Sections that may encompass more than one Lot as defined in RMS Q

(f) The direction of testing must be the planned direction for traffic. Where a Section includes both traffic directions select one direction and remain consistent for the Test Lane

(g) Roughness test data from different types of equipment must not be combined to form a test result (e.g. An IRI from the Walking Profiler must not be combined with an IRI from laser profilometer)

(h) Referenced documents include:

(i) Austroads Test Method AG:PT/T450 - Determination of the International roughness index (IRI) using ARRB Walking Profiler dated May 2007 (abbreviated as AG:PT/T450)

NOTE: http://www.austroads.com.au/pdf/TestMethod/T450_IRI_Walking_profiler.pdf

(ii) Manufacturer's User Manual for the Walking Profiler

2.2 Definitions

Term	Definition
Term	
International Roughness Index (IRI)	(a) The IRI is a mathematical model of the dynamic response of a real vehicle travelling along a single wheelpath (or wheel track) of longitudinal road profile, referred to as the quarter-car (or World Bank) model. The IRI is expressed in terms of accumulated displacement of the simulated suspension in metres per measured kilometre (m/km). IRI can be reported in different ways. This Test Method uses the Single Track IRI based on a quarter-car model run at 80 km/h over a single wheelpath of longitudinal profile (ASTM E 1926-98 2003).
Longitudinal profile	(b) The shape of a surface measured as vertical distances from a datum horizontal plane in the direction of testing.
Grade	(c) Is the rate of longitudinal rise or fall of the surface with respect to

		the horizontal distance, expressed as a ratio or a percentage.
Absolute Offset	(d)	Is the machine-specific average output value between forward and reverse offset.
Absolute Slope	(e)	Is the machine specific average value between forward and reverse slope.
Validated Speed Range (VSR)	(f)	The operational speed range specified in the Manufacturer's User Manual. Profile data collected outside the VSR is non-complying. *NOTE: The VSR is indicated by audible tones emitted by a Walking Profiler.*
Test Lane	(g)	The lane to be tested that is at least 2.0 m wide and consists of Sections and two parallel Paths (refer to **Error! Reference source not found.**).
Section	(h)	A Test Lane is divided into Sections that are 100 ± 5 m in length when measured along the centreline of the Section (refer to **Error! Reference source not found.**) unless where otherwise specified.
Path	(i)	Path L and Path R are to be parallel within each Test Lane and have a transverse spacing of 1.5 ± 0.2 m apart (refer to **Error! Reference source not found.**).
Ride Quality (IRI_{QS})	(j)	Determined by averaging the quarter-car IRI values obtained in each Path of a Section (refer to Calculation 5(a)).

3. Apparatus

(a) A manually operated Walking Profiler fitted with a computer and measuring beam which enables the collection and presentation of longitudinal profile. The Walking Profiler must be calibrated in accordance with the procedure specified in the Manufacturer's User Manual (refer to AG:PT/T450 Appendix A).

(b) Calibrated Smart Level or other similar device that can measure grade or slope to an accuracy of ±1% of grade

(c) Crayon, chalk or similar for marking the test surface

(d) Measuring device accurate to 0.1% to set out Sections

(e) Equipment for cleaning the surface to be tested

NOTE: Broom or blower for loose particles. A heavy flat metal screed for removing concrete dags.

(f) Thermometer, suitable for the measurement of temperatures within the range 0 to 100°C, readable to at least 1°C and having an accuracy of ± 1°C

NOTE: A digital thermometer with a sensor remote from the display is recommended. This will enable the probe to be secured under the cowling while the display is mounted near the lap-top computer.

(g) Soft brush, cloth and solvent for cleaning the Walking Profiler foot pads

NOTE: Solvent required to remove build up of bitumen.

(h) Calibration apparatus as described in AG:PT/T450 Appendix A2

4. Procedure

4.1 Pre-test set-up

(a) Ensure the Walking Profiler battery and the lap-top computer are fully charged and all leads are correctly connected and secured on the Walking Profiler and computer

NOTE: A spare fully charged battery may be required for a day's testing.

(b) Clean the foot pads of the measuring beam by lightly brushing

(c) Ensure that the tyres on the Walking Profiler wheels and other components are free from the build up of deposits of road-making materials (e.g. bitumen, cements etc.) by cleaning with a mild solvent or brushing

(d) Ensure that the power to the machine is switched on at least 20 minutes prior to testing

(e) After switching on the Walking Profiler but before any testing, carry out the Field Offset Trim in accordance with AG:PT/T450 Appendix B3 on a length at least 20 m long. When successfully completed record the temperature within the Walking Profiler cowling as the field operating temperature (T_{FOT})

NOTE: Steps B3(b) to (d) in the procedure may be carried out during the specified warm up period for the Walking Profiler.

(f) Repeat Step 4.1(e) whenever the Walking Profiler unit is restarted

4.2 Preparation for testing

(a) Before commencing the test establish the sampling pattern for the test according to **Error! Reference source not found.**.

(i) Identify and mark the start and end point of the Section to be tested

NOTE: The start is required to locate a specific area that is nonconforming.

(ii) Set out the line to ensure the Walking Profiler remains on the Path

NOTE: The Path may be marked using a line or with points along the line at least every 5 m. An offset arm can be used to align the Walking Profiler in the Path relative to a centreline.

(iii) Exclude lengths where the geometry would exceed the manufacturer's specification

(iv) Remove loose material or contamination from the Path to be tested

NOTE: Dags from texturing concrete should be removed.

(b) Do not test during periods of rain or where the road surface is wet

NOTE: Once a Section of wet road has dried out it may be tested.

(c) Do not operate the Walking Profiler in ambient temperatures outside the temperature range of 0 to 45°C or on road surface temperatures exceeding 75°C

(d) Ensure the test speed is within the VSR

(e) Identify the Paths for the Walking Profiler as equally offset from the middle of the Test Lane being tested.

4.3 Roughness testing

(a) Record the time and the following temperatures at the start of testing each Section:

(i) Ambient temperature

(ii) Road surface temperature

(iii) Air temperature within the cowling

(b) Ensure that the temperatures comply with the operating conditions in Step 4.1(e). When the air temperature within the cowling has changed by more than 10°C from T_{FOT}, carry out a new Field Offset Trim according to Step 4.1(e)

(c) Ensure that the laser system is kept clean and no debris adheres to the Walking Profiler foot pads or tyres (refer to Steps 4.1(b) and 4.1(c))

(d) Test each Path in the Section in the same direction of travel:

(i) Record the start and end point for the Section

(ii) Record the quarter-car roughness IRI_{QL} and IRI_{QR} to 2 decimal places. Ensure that each test result is recorded against the correct Path and Section

(e) Commence recording data at the nominated Start Point of the test ± 0.2 m

(f) From the Start Point and thereafter for the test, the Walking Profiler must be operated at a relatively constant speed within the VSR and in a smooth manner

(g) Do not deviate from the Path or avoid defects in the Path unless they are likely to damage the Walking Profiler. Record such events and report the reason for not testing the Section(s) affected

(h) Record the location and description when any of the following occur during testing:

(i) An incident that does not conform to the Test Method (e.g. defect in Step 4.3(g))

(ii) An unusual feature or event that might affect the results

(i) Terminate testing where conditions prevent continuing in the Path and/or are no longer in accordance with this Test Method. Record the termination point

(j) Reject a test result where any data was not collected in accordance with this Test Method

4.4 Data Download

(a) Data is to be recorded on a secure digital media. Ensure that back-up copies of all data is made daily

(b) Where required, the raw profile readings are to be supplied as a computer file where data can be read in MS-Excel or as otherwise specified

5. Calculations

(a) Calculate the quarter-car Ride Quality (IRI_{QS}) for each Section to 2 decimal places as follows:

$$\text{IRI}_{QS} = \frac{IRI_{QL} + IRI_{QR}}{2}$$

Where:

IRI_{QS} = Quarter-car Ride Quality for the Section (m/km)

IRI_{QL} = Quarter-car roughness for Left Path within the Section (m/km)

IRI_{QR} = Quarter-car roughness for Right Path within the Section (m/km)

6. Reporting

Include the following data and results for each Test Point in the report (computer file):

(a) Project Reference/Contract Number

(b) Location of the test (e.g. spatial reference, local reference), start and end of the test, transverse position and direction of testing. Where GPS was used, the equipment details, mode and datum

(c) Name of operator and equipment identification (Model, Serial No)

(d) Date and time of testing

(e) Surface type

(f) For each Test Lane tabulate the following test results by Section:

(i) Start and end chainage, length of Sections in m

(ii) The quarter-car roughness in the Left Path (IRI_{QL}) and the Right Path (IRI_{QR}) to 2 decimal places

(iii) The quarter-car Ride Quality (IRI_{QS}) to 2 decimal places

(iv) Any unusual features and events that might affect the results

(g) The following temperatures for each Section to the nearest 1°C

(i) Ambient temperature

(ii) Road surface temperature

(iii) Air temperature within the cowling

(h) Where required, the original raw data files in the specified format

(i) Reference to this test method

Appendix A : Sampling Pattern

The sampling pattern consists of two parallel Paths within each Section of a Test Lane with the following minimum requirements:

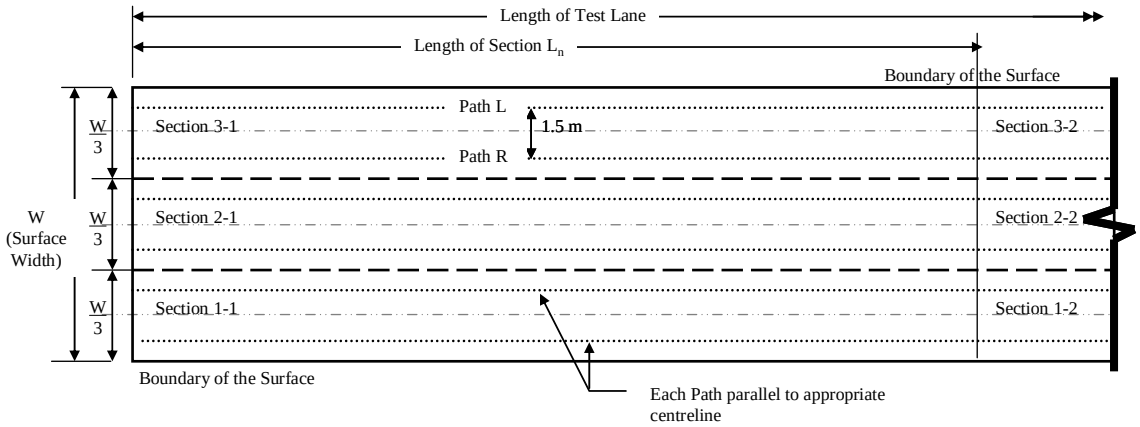
(a) All Sections within each Test Lane must be the specified length. A Section may include a length from an adjacent Section that is necessary to achieve the specified length

(b) The Test Lane configuration must be one of the following:

(i) Where there are no traffic lanes designated, the width of each Test Lane is to be W/3 which is to be from 2.0 m to 3.6 m (refer to Figure 1)

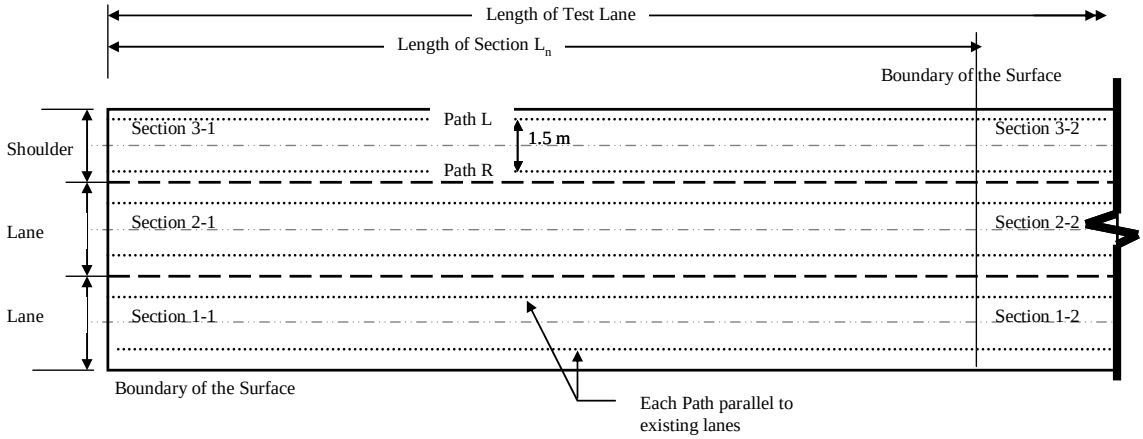
NOTE: Generally on new work or where the old lane configuration is no longer relevant. 'W' is the width of the work being tested.

Figure 1 - Sample Pattern for testing a surface



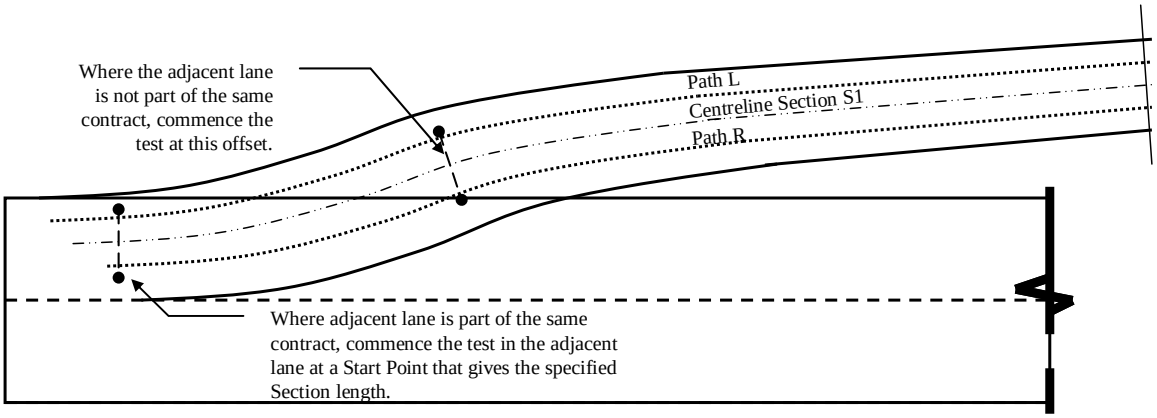
(ii) Where there are traffic lanes designated, the Test Lane coincides with the existing lane or shoulder (refer to Figure 2). A sealed shoulder narrower than 2.0 m is to be included with the adjacent lane

Figure 2 - Sample Pattern for testing an existing surface with traffic lanes designated



(iii) Where there is a slip lane, the Test Lane is to include the slip lane as defined in Figure 3.

Figure 3 - Sample Pattern for testing a slip lane.



(iv) Where a Roundabout is to be tested, concentric Paths within the roundabout are tested where the geometry is suitable for the Walking Profiler. Otherwise, each Path is to follow the side of a polygon that approximates the roundabout to give the specified length of Section (refer to Figure 4)

(v) A roundabout may be incorporated as part of a continuous Test Lane and Section. Identify the start and end of a roundabout as a feature in the comments

Figure 4 - Sample Pattern for testing a roundabout.