

# AUSTROADS TEST METHOD AG:AM/T006

## PAVEMENT DEFLECTION MEASUREMENT WITH A FALLING WEIGHT DEFLECTOMETER (FWD)

### COMMENTARY

#### 1 SCOPE

It is important to note that the test method has been prepared for the testing of pavements at the network level. Care should be taken when applying the test method at the project level.

Additional guidance and background information can be found in the *Austroads Guide to Asset Management – Part 5D: Strength* (Austroads 2008).

#### 2 REFERENCED DOCUMENTS

No comment.

#### 3 DEFINITIONS

No comment.

#### 4 EQUIPMENT

##### 4.1 Minimum Equipment Specification

###### 4.1.1 Table 6.1

Historically, most FWD equipment specifications have been based on equipment manufactured by Dynatest. Every attempt has been made to ensure that this table is not dependent upon a single FWD device manufacturer. It is possible, however, that FWD equipment provided by other manufacturers may not meet some of these requirements. In such cases the actual performance of the machine should be used as an indicator of its appropriateness rather than a specific requirement listed here.

##### 4.2 Automatic Data Quality Checks

Possible data quality checks may include, but are not limited to, the following:

- (a) decreasing deflections – a check to ensure the deflections decrease with distance from the impact location
- (b) out of range – a check on the magnitude of the deflection
- (c) load variation – a check that the load is within the specified tolerance

- (d) deflection variation – a check to ensure the geophone deflections are within a specified tolerance
- (e) sensor checks – automatic system checks of the load cell and deflection sensors.

### **4.3 Manual Data Quality Checks**

No comment.

## **5 CALIBRATION AND VALIDATION**

### **5.1 Calibration Scheme**

The independent assessment of pavement deflections required for equipment validation is problematic in nature. Close control of the calibration of the primary sensors on an FWD is easier to achieve, and provides increased confidence in the test results.

### **5.2 Reference Calibration**

In a reference calibration the primary sensors of the FWD (load cell, deflection sensors and temperature sensors) are calibrated against appropriate reference sensors.

### **5.3 Relative Calibration**

Relative calibrations are conducted on the deflection sensors only. The procedure involves comparing the readings of all deflection sensors against each other; a reference sensor is not used.

### **5.4 Deflection Sensor Monitoring and Replacement**

No comment.

### **5.5 System Validation**

No comment.

## **6 PROCEDURE**

### **6.1 FWD Set-up**

#### **6.1.1 Test Load**

The target applied stress of 566 kPa (corresponding with a load of 40 kN) matches the load level recommended in Austroads (2004). If an alternative load is required then this should be specified in additional contract documentation.

Some FWD devices have an automatic feature that adjusts the applied load level between successive drops to ensure a close match to the target level. Other devices, however, do not have this feature. The 10% limit in this section was selected so as to ensure that the devices without the automatic load targeting function are permitted. In any case, raw deflection readings taken at the applied load level would be normalised (see 7) to match the target load level. Normalising deflections with a 10% range is standard practice.

### 6.1.2 Deflection Sensor Spacings

FWD devices allow for a range of deflection sensor spacings to be used during testing. Unless otherwise specified, typical spacings for a seven sensor device are shown in Table 6.1.

Table 6.1: Deflection sensor spacings

Number of deflection sensors	Sensor spacings (mm) (measured from the centre of the applied load)
7	0, 200, 300, 450, 600, 900, 1500

## 6.2 Deflection Survey

- (a) No comment.
- (b) No comment.
- (c) No comment.
- (d) Differences between deflection sensors are to be expected as the nature of the pavement, especially unbound granular pavements, slowly changes with successive load drops. Additionally, there may be larger differences in sensor readings between drops on a cracked pavement or a pavement in poor condition. When differences of this magnitude occur they should be noted, as the information may provide insight into the performance of the pavement. It is important to note that this test provides an indication of the performance of the pavement and not the performance of the FWD device.
- (e) No comment.

## 6.3 Factors Affecting the Test

All the factors listed could unduly affect the accuracy of the test measurement.

Whilst pavements in a poor or cracked condition can yield inconsistent results (e.g. non-decreasing deflections away from the test load) the accuracy of the result is not affected. It is important to remember that the FWD test is used to determine the characteristics of the tested pavement; anomalous results may well be a reflection of the pavement composition or condition rather than any FWD malfunction.

# 7 CALCULATIONS

No comment.

## 8 REPORTING

### 8.1 Data

No comment.

### 8.2 Data Precision

Precision is not the same as accuracy. Whilst the test method requires that deflection sensor readings be reported to a precision of 1  $\mu\text{m}$ , it is important to realise that individual readings are extremely unlikely to be accurate to this level of precision. By way of comparison, human hair width generally ranges from 20  $\mu\text{m}$  (flaxen hair) to 180  $\mu\text{m}$  (black hair).

### 8.3 Filtering of Deflection Sensor Readings

No comment.

## REFERENCES

Austroads 2004, *Pavement rehabilitation: a guide to the design of rehabilitation treatments for road pavements*, AP-G78/04, Austroads, Sydney.

Austroads 2008, *Guide to asset management – Part 5D: strength*. Publication AG:AM05D/08, Austroads, Sydney.

## AMENDMENT RECORD

Amendment No.	Sections amended	Action <sup>(1)</sup>	Date
1 (Initial release)	All (Michael Moffatt, ARRB)	New	26 March 2007
2 (Revised release)	All (Richard Wix, ARRB, project AT1484)	Substitution	31 March 2011
<sup>1</sup> Key: Format            change in format Substitution      old section removed and replaced with new section New                insertion of new section Removed          old section removed			

This commentary is relevant to the 31 March 2011 release of Austroads Test Method AG:AM/T006.