

AUSTROADS SPECIFICATION AG:AM/S002

SPECIFICATION FOR PAVEMENT DEFLECTION MEASUREMENT WITH A FALLING WEIGHT DEFLECTOMETER (FWD)

1 SCOPE

1.1 Scope of specification

This specification provides minimum equipment, calibration, validation and survey method requirements for the conduct of network level pavement deflection testing using a Falling Weight Deflectometer (FWD).

This specification does not address all occupational health and safety issues associated with its use. It is the responsibility of the Supplier to operate in accordance with appropriate legislation.

1.2 Scope of works

- (a) The list of the roads to be surveyed is attached to this specification as Annex 1.
- (b) The location referencing system to be used to report final data is documented in Annex 2.
- (c) The format for reporting of final data is documented in Annex 3.

2 ROLES

Table 1 outlines the roles of different parties considered in this specification.

Table 1: Roles of different parties considered in this specification

| Role | Description |
|---------------------|---|
| Client | the organisation for whom the FWD data is being collected |
| Contract Supervisor | the representative of the Client organisation |
| Supplier | the operators of the fwd system and the suppliers of the resultant data |

3 REFERENCED DOCUMENTS

Austroads Test Method AG:AM/T005. Distance measurement validation of road condition monitoring vehicles. March 2007.

Austroads Test Method AG:AM/T006. Pavement deflection measurement with a Falling Weight Deflectometer. March 2007.

COST Transport Program 1999, COST 336: Use of Falling Weight Deflectometer in Pavement Evaluation, FWD Calibration Protocols, Draft Report, <http://62.242.229.98/fog/fwd/cost336.htm>, viewed 24 June 2006.

Protocol U2: FWD Short Term Repeatability Verification

4 EQUIPMENT

4.1 Minimum equipment specification

The FWD equipment to be used must meet the minimum requirements in Austroads Test Method AG:AM/T006.

4.2 Calibration

4.2.1 Calibration scheme

This specification requires a two part calibration of FWD equipment, as follows:

- (a) an annual fully traceable *reference calibration* (in accordance with Austroads Test Method AG:AM/T006) that must be active at the time of data collection
- (b) a *relative calibration* (in accordance with Austroads Test Method AG:AM/T006) performed regularly between reference calibration exercises.

Calibrations are required to be conducted in accordance with the calibration scheme in Table 2.

Table 2: Calibration scheme

| Calibration type | Minimum conduct period |
|-----------------------|------------------------|
| Reference calibration | once per year |
| Relative calibration | every three months |

Copies of current calibration certificates must be provided to the Contract Supervisor before any validation or survey activity can commence. At any stage during the collection of data, the last reference and relative calibrations must not be older than the times shown in Table 2.

4.3 Equipment validation

4.3.1 Validation of distance measurement

Test Method AG:AM/T005 must be followed, and its check limits passed, in order to validate the distance measuring equipment used by the FWD.

4.3.2 Repeatability of deflection measurement

For surveys expected to take five days or more to complete, it is required that checks of the repeatability of the FWD equipment be undertaken, in accordance with COST 336 U2, before and after the survey work. Results from routinely conducting the COST 336 U2 procedure can be used provided the interval between the initial check and the initiation of survey work, and the interval between completion of survey work and the next check do not exceed 30 days.

5 SURVEY

5.1 Survey roads

Refer to Annex 1 for a detailed list of the roads to be surveyed.

5.2 Location referencing

Data must be reported in accordance with the location referencing system documented in Annex 2.

5.3 Survey procedure

Survey works must be conducted in accordance with AG:AM/T006.

5.4 Commencement of survey

5.4.1 *Test parameters*

The Contract Supervisor must inform the Supplier of the following test parameters (refer AS:AM/T006) before survey works can commence:

- (a) details of the location referencing to be used to report data
- (b) the locations at which testing is to be conducted
- (c) target load level for tests (if different from the value in AS:AM/T006)
- (d) deflection sensor spacings (if different from the values in AS:AM/T006)
- (e) data formats.

5.4.2 *Validation*

Survey works must not commence until it has been demonstrated to the satisfaction of the Contract Supervisor that the calibration and validation requirements have been met.

5.4.3 *Initial process quality assessment*

For work in excess of 3,000 lane-km of total survey length (or in excess of 6,000 test locations, whichever occurs first), an initial process quality assessment must be undertaken, prior to the commencement of the full survey. This will provide assurance that the entire survey exercise (from data collection to handover of final data) meets the Client's requirements. It also allows the Client to conduct data quality checks against existing records. A minimum of 100 lane-km of the total survey network (or 50 test locations, whichever occurs first) must be surveyed and the data processed and submitted to the Client in the required data formats.

5.5 Ongoing repeatability

A check of the repeatability of the FWD equipment is undertaken, in accordance with COST 336 U2, as part of the validation process (see 4.3). Subsequent to the validation process, COST 336 U2 must be repeated, and its acceptance limits re-passed, on an ongoing basis, at an interval of no greater than 30 days (unless otherwise agreed by the Client).

6 REPORTING

Data must be recorded in accordance with the minimum reporting requirements listed in Austrroads Test Method AG:AM/T006, and be presented to the Client in accordance with the data reporting format documented in Annex 3.

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ANNEX 1 – LIST OF ROADS TO BE SURVEYED

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ANNEX 1 – LIST OF ROADS TO BE SURVEYED

GUIDANCE

The Client must replace this page with either a detailed list of the roads to be surveyed, or a cross reference to such a list in another location within the contract documentation.

The minimum information that must be provided is as follows:

- names of road lengths to be tested
- lengths of roads
- test carriageways, lanes
- designated start and end points of each road
- identification fields used to uniquely identify the road lengths within the location reference system used by the Client (refer Annex 2)
- longitudinal spacing between tests
- transverse location of tests (e.g. outer wheelpath, inner wheelpath, between wheelpaths).

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ANNEX 2 – LOCATION REFERENCING SYSTEM

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ANNEX 2 – LOCATION REFERENCING SYSTEM

GUIDANCE

The Client must replace this page with detailed documentation of the location referencing system to be used in the reporting of data, or a cross reference to such documentation within the contract documentation.

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ANNEX 3 – DATA FORMAT

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ANNEX 3 – DATA FORMAT

GUIDANCE

The Client must replace this page with detailed documentation of the data format(s) to be used in reporting the collected survey data, or a cross reference to such documentation within the contract documentation.

As a minimum the data format documentation must include the following:

- data file type to be used (e.g. ASCII text file, Microsoft Access database (including version), etc.)
- file header information
 - for each data field:
 - name of field
 - description
 - data type
 - length of field/precision of field.

EXAMPLE FORMAT DOCUMENTATION

Data file definition

Data file type: Microsoft Access 2003 database

Data fields: The following data to be reported at every test location

| Database field description | Field name | Field format | |
|---|------------|--------------|--------------------|
| Primary key (unique) calculated as: (Road number * 10,000,000) + (Link * 1,000) + (CH_FR) + 'Survey number' + 'Direction' + 'Data flag' | PKEY | Text | 20 characters |
| Road number | ROAN | Number | Integer |
| Link number | LINK | Number | Integer |
| Distance from start of link to location of test (km) | CH_LO | Number | Float (3 decimals) |
| Carriageway code: A: Undivided road B & C: Divided road R – Z: Ramps | CC | Text | 1 character |
| Carriageway version (denotes how many times the Link on that carriageway has been altered): 1: original version 2: amended once 3: amended twice etc. | CWYV | Number | Integer |
| Lane code: direction surveyed: P: Prescribed C: Counter | DIRN | Text | 1 characters |
| Lane code: through lane number (starting at median lane), e.g.: 1: median lane 2: middle lane 3: kerb lane | LCODE | Text | 3 characters |
| Transverse location of test: O: outer wheelpath B: between wheelpaths I: inner wheelpath | TLOC | Text | 1 character |
| Contract code defined by Client | CCODE | Text | 5 characters |
| Supplier code defined by Client | SCODE | Text | 5 characters |
| Survey vehicle registration number | REGO | Text | 10 characters |
| Operator's identification (initials) | OPERATOR | Text | 4 characters |
| Survey date | DATE | Date | dd/mm/yyyy |
| Survey time | TIME | Time | hh:mm:ss |
| Survey number for link (sequential from A to Z) | SNUM | Text | 1 character |
| Data flag: A: Valid data L: Discrepancy in length Z: Invalid data (refer below) | DFLAG | Text | 1 character |
| Event code (refer to following list) | ECODE | Text | 1 character |
| Comments | COMM | Text | 68 characters |
| Load stress (kPa) | LOAD | Number | Integer |
| Deflection at 0 mm from centre of load (microns) | D0 | Number | Integer |
| Deflection at 200 mm from centre of load (microns) | D200 | Number | Integer |
| Deflection at 300 mm from centre of load (microns) | D300 | Number | Integer |
| Deflection at 450 mm from centre of load (microns) | D450 | Number | Integer |
| Deflection at 600 mm from centre of load (microns) | D600 | Number | Integer |
| Deflection at 750 mm from centre of load (microns) | D750 | Number | Integer |

Continues...

Data file definition (continued)

| Database field description | Field name | Field format | |
|--|------------|--------------|---------|
| | | Number | Integer |
| Deflection at 900 mm from centre of load (microns) | D900 | Number | Integer |
| Deflection at 1200 mm from centre of load (microns) | D1200 | Number | Integer |
| Deflection at 1500 mm from centre of load (microns) | D1500 | Number | Integer |
| Air temperature (°C) | TEMPA | Number | Integer |
| Surface temperature (°C) | TEMPS | Number | Integer |
| Target load stress (kPa) | TARGET | Number | Integer |
| Normalised deflection at 0 mm from centre of load (microns) | N0 | Number | Integer |
| Normalised deflection at 200 mm from centre of load (microns) | N200 | Number | Integer |
| Normalised deflection at 300 mm from centre of load (microns) | N300 | Number | Integer |
| Normalised deflection at 450 mm from centre of load (microns) | N450 | Number | Integer |
| Normalised deflection at 600 mm from centre of load (microns) | N600 | Number | Integer |
| Normalised deflection at 750 mm from centre of load (microns) | N750 | Number | Integer |
| Normalised deflection at 900 mm from centre of load (microns) | N900 | Number | Integer |
| Normalised deflection at 1200 mm from centre of load (microns) | N1200 | Number | Integer |
| Normalised deflection at 1500 mm from centre of load (microns) | N1500 | Number | Integer |

Data flag

Survey data is marked as invalid, and must be flagged in the database, for occurrences of the following events:

- data is collected when the equipment is not complying with the quality plan
- data is collected in localised area of contamination of the road surface, e.g. mud, debris, etc.

Event code

| Event code | Description | Extent |
|---------------------|---|-------------------------------------|
| Valid data | | |
| E | Extraordinary event | Also describe in the comments field |
| O | Change from the nominated lane or transverse location | Each data item affected |
| N | 10% or 5 micron (whichever is greater) difference in deflection readings between second and third test drop | Each data item affected |
| C | Reading other than third test drop used | Each data item affected |
| Invalid data | | |
| D | Sensor drop off exceeds specified limits | Each data item affected |
| U | Test conducted on bridge, culvert, filled trench, or other discontinuity | Discrete event |
| W | Road works (inc. sidetracks, roads under construction or repair, road opening, temporary cover, etc.) | Each data item affected |

AMENDMENT RECORD

| Amendment No. | Sections amended | Action ¹ | Date |
|--|---|---------------------|---------------|
| 1 (Initial release) | All (Michael Moffatt, ARRB) | New | 26 March 2007 |
| 2 | <i>5.4.1 Test parameters</i> Changed text to refer to AG:AM/T006 (Michael Moffatt, ARRB) | Substitution | 2 April 2008 |
| ¹ Key: Format change in format Substitution old section removed and replaced with new section New insertion of new section Removed old section removed | | | |