

TRANSPORT FOR NSW (TfNSW)

QA SPECIFICATION M925

MEASUREMENT OF DEFLECTION BY FALLING WEIGHT DEFLECTOMETER (FWD)

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MEASUREMENT OF DEFLECTION BY FALLING WEIGHT DEFLECTOMETER (FWD)

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IC-QA-M925

VERSION FOR: DATE:

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FOREWORD

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REVISIONS TO PREVIOUS VERSION

This document has been revised from Specification TfNSW R425 Edition 1 Revision 4.

All revisions to the previous version (other than minor editorial and project specific changes) are indicated by a vertical line in the margin as shown here, except when it is a new edition and the text has been extensively rewritten.

PROJECT SPECIFIC CHANGES

Any project specific changes are indicated in the following manner:

- Text which is additional to the base document and which is included in the Specification is shown in bold italics e.g. ***Additional Text***.
- Text which has been deleted from the base document and which is not included in the Specification is shown struck out e.g. ~~Deleted Text~~.

TfNSW QA SPECIFICATION M925

MEASUREMENT OF DEFLECTION BY FALLING WEIGHT DEFLECTOMETER (FWD)

1 GENERAL

1.1 INTENT

The collection of deflection data is for monitoring the pavement strength of a road network using the Falling Weight Deflectometer (FWD) device.

1.2 SCOPE

The Works to be executed under this Specification consists of collecting data using a FWD in accordance with Test Method TfNSW T177 and Austroads Test Method AG:AM/T006 to:

- (a) Measure and analyse the pavement deflection data on the sealed, flexible pavement sections along the roads to determine the maximum deflection and deflection bowl readings at the nominated Test Locations;
- (b) Provide data at the nominated Benchmark Sites at the beginning and end of the Survey and at four week intervals during the survey;
- (c) Provide processed data complying with Annexure M925/L.

1.3 STRUCTURE OF THE SPECIFICATION

This Specification includes a series of annexures that detail additional requirements.

1.3.1 Project Specific Requirements

Project specific details of work are shown in Annexure M925/A.

1.3.2 Information Supplied by the PRINCIPAL

The Principal will supply you with the information summarised in Annexure M925/B.

1.3.3 Measurement and Payment and Resolution of Nonconformities

The method of measurement and payment must comply with Annexure M925/B.

Acceptance of materials and work must be in accordance with Annexure M925/B.

1.3.4 Schedules of HOLD POINTS, WITNESS POINTS and Identified Records

The schedules in Annexure M925/C list the **HOLD POINTS** and **WITNESS POINTS** that must be observed. Refer to Specification TfNSW Q for definitions of **HOLD POINTS** and **WITNESS POINTS**.

M925 Measurement of Deflection by Falling Weight Deflectometer (FWD)

The records listed in Annexure M925/C are **Identified Records** for the purposes of TfNSW Q Annexure Q/E.

1.3.5 Planning Documents

The PROJECT QUALITY PLAN must include each of the documents and requirements listed in Annexure M925/D and must be implemented.

In addition, ensure that the relevant requirements in TfNSW Q are incorporated.

1.3.6 Technical Requirements

The spacing of Test Points that must be applied in accordance with the requirements in Austroads Test Method AG:AM/T006 is described in Annexure M925/F.

1.3.7 Database Format

Database format is specified in Annexure M925/L.

1.3.8 Referenced Documents

Unless specified otherwise, the applicable issue of a referenced document, other than a TfNSW Specification, is the issue current at the date one week before the closing date for tenders, or where no issue is current at that date, the most recent issue.

Standards, specifications and test methods are referred to in abbreviated form (e.g. AS 2350). For convenience, the full titles are given in Annexure M925/M.

1.4 DEFINITIONS AND ACRONYMS

The following definitions and acronyms apply to this Specification:

Benchmark site	A site that is generally representative of the pavements and different road groups to be surveyed and suitable for FWD testing.
Close-out	Survey at the same Benchmark Sites as used in the Validation Test (refer to Clause 3.3) as per TfNSW FWD Short-term Validation Procedure for a Fixed Location.
Counter Direction	The opposite direction of travel to the “Prescribed” direction (refer to RAMS – Lane Numbering).
Falling Weight Deflectometer (FWD)	A vehicle-mounted or towed device that records pavement surface deflection bowls at discrete test points on the pavement surface. Surface deflections are measured at distances from the centre of an impulse test load. The load is applied to the pavement surface through a standard loading plate by a falling weight with a variable drop height while the FWD is at rest.
Flexible Pavement	All pavement structures other than those described as “rigid pavements”. Pavements constructed in layers of one or more from granular, asphalt, stabilised and lean concrete materials.
GDA datum	Geocentric Datum of Australia datum.

Inner Wheelpath (IWP)	The wheelpath that is to the right of travelled lane.
Interval	The distance that data must be aggregated and reported in the database.
Lateral position	The transverse position of the test across the lane in relation to the road centreline or median.
Outer Wheelpath (OWP)	The wheelpath that is to the left of travelled lane.
Prescribed Direction	The direction of travel that TfNSW defines, by convention, as the standard direction for each of its roads (refer to RAMS – Lane Numbering).
Reference Calibration	Calibration performed at least once a year. Refer to Test Method TfNSW T177 or Austroads Test Method AG:AM/T006.
Relative Calibration	Refer to Test Method TfNSW T177 or Austroads Test Method AG:AM/T006.
Rigid Pavement	Pavements consisting of relatively high strength concrete base (usually 30 MPa or more) and a range of subbase materials.
Road Occupancy Licence	Allows the proponent to use a specified road space at approved times, provided certain conditions are met. The licence applies to the occupation of the “road space” only and does not imply permission or approval for the actual (physical) works being undertaken.
ROADLOC	The name given to the Linear Referencing System used by the TfNSW (refer to RAMS – Linear Referencing).
Test Location	The general location that is immediately adjacent to the Test Point.
Test Point	The centre of the FWD load plate used for the test.
Traffic signal green light runs	Green light corridors on survey routes provided by the TfNSW Transport Management Centre (TMC).
Wheelpath	That portion of the pavement that is subject to the passage of and loading from vehicle wheels during trafficking. There are two wheelpaths per trafficked lane.
XSP	Lane numbering convention (refer to RAMS – Lane Numbering).

2 EQUIPMENT

2.1 GENERAL

Measure and record data using a FWD with a minimum requirement described in Austroads Test Method AG:AM/T006. Ensure that equipment is maintained in calibration and good working order.

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Supply the Reference Calibration Certificate for each FWD proposed for the Works. The Reference Calibration Certificate for each FWD must be no more than 12 months old at the commencement of the survey and must remain current during the survey.

Traffic control devices mounted on the vehicle (e.g. Signposting, lights, etc) and any other items required for the Works must also be provided to comply with Specification TfNSW G22.

2.2 LOCATION REFERENCING DEVICES

2.2.1 TfNSW Linear Referencing System (ROADLOC)

Reference all data to the TfNSW Linear Referencing System (ROADLOC). The features and terms used are described in the document “RAMS – Linear Referencing”.

The measured distance must be accurate to within ± 5 m in 1,000 m as measured from the identified ROADLOC Node.

The distance calculated for each ROADLOC LINK must be within the range:

- TfNSW LINK LENGTH \pm [the greater of 10 m or (0.5% x ROADLOC LINK LENGTH)].

The specific requirements for ROADLOC are described in Annexure M925/E1.

2.2.2 Global Positioning (GPS)

When specified in Annexure M925/A, GPS must be collected to supplement the Linear Referencing System.

The GPS coordinates recorded must reference the Geocentric Datum of Australia 1994 datum (GDA94).

The GPS equipment must have the capability specified in Table M925.1.

Table M925.1 – Minimum Equipment Specification for GPS

Parameter	Requirements
Instrument Type	Differential GPS.
Resolution	Data to be provided in decimal degrees either to double precision or with a minimum of 12 significant digits.
Minimum Sampling Rate	10 Hz
Operating Temperature Range	0°C - 40°C
Repeatability	95% of readings within: - 2.5 m Horizontal - 5 m Vertical

The location of each Test Point must be identified by the horizontal and vertical coordinates.

If GPS is used as the primary method of Road Location Referencing, then the PROJECT QUALITY PLAN must include the procedure to validate the accuracy of GPS and the procedure to deal with areas where coverage is substandard. The PROJECT QUALITY PLAN must provide for analysis of GPS location to verify the location and direction entered by the operator.

2.2.3 FWD Temperature

The equipment must be able to record the pavement surface temperature and the ambient temperature at each test location at the time of the pavement deflection measurement.

2.3 DEFLECTION SENSORS

Nine deflection sensors are to be used with the spacing as detailed in Austroads Test Method AG:AM/T006.

Deflection will be measured (at a minimum) at the following distances (millimetres) from the centre of the impact (loading plate):

0, 200, 300, 450, 600, 750, 900, 1200 and 1500 mm

2.4 OPERATOR INTERFACE

Enable road condition, as required in Austroads Test Method AG:AM/T006, to be electronically recorded and location referenced at each Test Point. Similarly, enable the recording of issues encountered during the survey that may affect the data being collected.

2.5 REPORTING EQUIPMENT MALFUNCTION

Include in the PROJECT QUALITY PLAN a requirement to report any equipment failure and include the following information:

- (a) Specific item of equipment that has malfunctioned;
- (b) Date and time that malfunction was identified;
- (c) Reason for failure;
- (d) The road location being tested when the failure occurred;
- (e) Corrective action taken;
- (f) Actions taken to determine the adequacy of the recorded data before the failure;
- (g) Evidence that the replaced or repaired item of equipment provides output that is consistent with that prior to the breakdown;
- (h) Date and time that equipment resumed survey.

Submit the Equipment Malfunction Report to the Principal within 24 hours of the equipment failure occurring.

3 COLLECTION

3.1 GENERAL

In addition to Clause 1.2, the Works include initial calibration and validation, survey of the roads using the FWD, real time processing of data, validation during the survey and storage during the survey and Close-out validation.

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Ensure that all the requirements in Austroads Test Method AG:AM/T006 and Test Method TfNSW T177 and the Specification are incorporated into the PROJECT QUALITY PLAN and that the PROJECT QUALITY PLAN is implemented.

The Inspection and Test Plan (refer to TfNSW Q) must nominate the proposed calibration and testing frequency to verify conformity of the FWD device and must not be less than the frequency specified. Where a minimum frequency is not specified, nominate an appropriate frequency. Include the following requirements:

- (a) A Validation Test prior to the start of survey according to Clause 3.3;
- (b) Relative Calibration in accordance with Austroads Test Method AG:AM/T006 and Test Method TfNSW T177.
- (c) Repeatability Tests in accordance with Clause 3.5.4;
- (d) Final Close-out survey in accordance with Clause 3.6.

Carrying out survey for the Principal does not automatically give you special privileges and all traffic laws must be obeyed. When specified in Annexure M925/A, comply with the following requirements:

- (i) Apply to the Principal for a Road Occupancy Licence (Non-Development) (refer to the Road Occupancy Manual for details);
- (ii) Comply with the conditions applicable to the Road Occupancy Licence issued;
- (iii) Liaise with the Duty Controller at TMC Operations Room during the survey.

Applications for Road Occupancy Licence must be received by the Duty Controller at the TMC a minimum of 14 working days prior to the proposed date of survey. The Principal is not responsible for delays that result should the proposed dates not be acceptable.

3.2 RELATIVE CALIBRATION

Unless specified otherwise in Annexure M925/A, carry out Relative Calibration on each FWD in accordance with Austroads Test Method AG:AM/T006 and Test Method TfNSW T177.

3.3 VALIDATION TEST

Unless specified otherwise in Annexure M925/A, prior to commencement, conduct a Validation Test in accordance with TfNSW “FWD Short-term Validation Procedure for a Fixed Location”.

In addition, the Principal may require a Validation Test where:

- (a) Nonconformity occurs in a Validation Test;
- (b) The PROJECT QUALITY PLAN or operator is changed;
- (c) Work does not comply with this Specification;
- (d) There is equipment malfunction (refer to Clause 2.5).

WITNESS POINT

Process to be Witnessed: Validation Test.

Submission Details: At least 3 days notice of intention to carry out a Validation Test.

Where a Validation Test does not meet the acceptance criteria, the data collected by the FWD and the operator is nonconforming. Do not continue using a nonconforming FWD until the nonconformity is rectified.

The data collected also forms the basis for assessing the Close-out survey in Clause 3.6.

3.4 CONTRACT PROGRAM

Select the order to survey the roads to efficiently comply with this Specification.

The Contract Program must detail the roads to be surveyed by date, the equipment and personnel involved, and when data will be available to the Principal.

Ensure that the Contract Program makes allowance for:

- (a) Satisfying all WHS and traffic requirements;
- (b) Time taken to process applications (e.g. Road Occupancy Licence);
- (c) Conditions for the Road Occupancy Licence (refer to Clause 3.1);
- (d) Avoiding lanes while the configuration is in a Tidal flow configuration or temporary reduced speed (e.g. operating School Zone);
- (e) Kerbside lanes subject to parking that are sometimes inaccessible due to parked vehicles.

HOLD POINT

Process Held: Commencement of survey.

Submission Details: At least 7 days before the proposed date of commencement, submit to the Principal the following:

- (a) Reference Calibration Certificate for FWD.
- (b) Relative Calibration Test Results.
- (c) Raw data and processed data collected from Validation Test.
- (d) Contract Program.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

At the period specified in Annexure M925/B, submit a written progress report to the Principal that includes:

- (i) Progress against the Contract Program (e.g. a list of roads completed and current area of testing);
- (ii) Personnel involved in the survey;

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- (iii) Record of equipment malfunction reports;
- (iv) Calibration reports and repeatability reports;
- (v) Notification of any nonconformity with the approved PROJECT QUALITY PLAN (refer to TfNSW Q);
- (vi) Progress with data processing;
- (vii) Other issues.

3.5 SURVEY

3.5.1 General

Carry out deflection testing using a FWD in accordance with Austroads Test Method AG:AM/T006 and Test Method TfNSW T177.

During the survey, ensure that the correct ROADLOC start reference features (RoadLoc Nodes) are selected and reset the start distance to zero directly adjacent to the identified Node.

Test the survey lane(s) nominated by the Principal and in the lateral position specified in Annexure M925 /B. Do not deviate from the nominated lane.

The Interval between Test Points is specified in Annexure M925/B. The interval is a nominal distance that may need to be adjusted due to a Test Point being relocated or positions not being tested (refer to Clause 3.5.3).

Reference all data records using the location reference system nominated in Clause 2.2 and ensure that the location of each Test Point is marked on the pavement.

Relocate a Test Point once by up to 2 m to provide a conforming Test Point or conforming test result. Record the relocated test results with comments, but do not record the results of the original Test Point. Subsequent locations of Test Points must be measured from the original Test Point and not the relocated position.

Maintain a daily diary of Events that occur during the survey. Events recorded must include, but not be limited to, the following:

- (a) Traffic management incident or any accident, including near misses;
- (b) Public complaints received and actions taken;
- (c) Daily operations (e.g. average daily achievement, operational problems);
- (d) Delays due to inclement weather;
- (e) Equipment breakdowns;
- (f) Quality assurance issues and nonconformities raised;
- (g) Issues relating to data processing.

3.5.2 Direction and Lane Identification

The direction of survey (i.e. Prescribed or Counter Direction) and the actual lane surveyed must be referenced in the database by the lane numbering convention described in the document “RAMS – Lane Numbering”, as the Lane Code.

Where the survey is interrupted or stopped within a Link, recommence testing at the next Test Point.

Should roadworks or some other obstruction make it necessary to deviate from the test lane, ensure that the lane number under test is updated in the database. Minimise this deviation out of the nominated Test Lane.

3.5.3 Selection of Test Points

Testing is limited to sealed flexible pavements that are not under construction or repair. Locate Test Points in accordance with Austroads Test Method AG:AM/T006 or Test Method TfNSW T177 and Annexure M925/F.

Ensure that the following locations are not tested:

- (a) Rigid pavements or rigid pavements with overlay that include:
 - (i) Concrete pavements;
 - (ii) Concrete pavements at the approaches to bridges.
- (b) Bridges or culvert decks.
- (c) Unsealed surfaces, road surfaces milled by road mill profilers or temporary surfacing.

3.5.4 Repeatability Test

Repeatability Tests are required where the survey is for more than 6 weeks duration, or when specified in Annexure M925/A, and must be in accordance with TfNSW “FWD Short-term Validation Procedure for a Fixed Location”.

Conduct Repeatability Tests at least once every 4 weeks.

Where a Repeatability Test does not meet the acceptance criteria, the data collected by the FWD and each operator is nonconforming. Do not continue survey until the nonconformity is rectified.

3.5.5 Sensor or Equipment Replacement

Whenever a sensor on the FWD is repaired or replaced, ensure that the requirements in Austroads Test Method AG:AM/T006 and Test Method TfNSW T177 are met.

Once the survey has commenced, the FWD must not be replaced unless approved by the Principal. The replacement FWD must be of the same model and make as the original, unless approved otherwise by the Principal.

HOLD POINT

Process Held: Survey with a replacement FWD.

Submission Details: At least 7 days before the proposed date of using a replacement FWD, submit to the Principal the following:

- (a) Model, make and identification of FWD.
- (b) Reference Calibration Certificate for the FWD.
- (c) Relative Calibration Test.
- (d) Validation Test.

Release of Hold Point: The Principal will consider the submitted documents prior to authorising the release of the Hold Point.

3.6 CLOSE-OUT

When specified in Annexure M925/A, a Close-out survey must be carried out within 7 days after completion of the data collection survey. Carry out the Close-out survey at the same Benchmark Sites as used in the Validation Test (refer to Clause 3.3).

WITNESS POINT

Process to be Witnessed: Close-out survey.

Submission Details: At least 3 days notice of intention to Close-out.

HOLD POINT

Process Held: Completion of survey.

Submission Details: Within 5 days of completing Close-out, submit to the Principal all survey data.

Release of Hold Point: The Principal will consider the Close-out survey for the FWD and each operator prior to authorising the release of the Hold Point.

Where a Close-out survey does not meet the system validation criteria specified in Test Method TfNSW T177, the data collected by the FWD and operator is nonconforming.

4 REPORTING

4.1 GENERAL

Data reporting includes processing of data following the survey, quality verification, flagging, calculations, storage of the data into the specified database format and supplying the data.

Progressively supply data collected no later than 14 days after collection in the field in the Database format.

Ensure that the following are performed:

- (a) Data is reported at the nominated distance Interval as referenced from the start reference feature (Node) of each ROADLOC Link and progressing in the Prescribed Direction;
- (b) Data collected in the Counter Direction has been processed and stored in the Prescribed Direction;
- (c) The conformity of the data collected and processed during the survey is assessed against the PROJECT QUALITY PLAN.

At completion of survey, submit two (2) complete and final sets of the formatted data on DVD or CD.

Retain all data arising from the survey and the means of reprocessing the data for a period of 5 years from the completion date of the survey.

4.1.1 Supply Conforming Data

Data (raw and processed) must be supplied on an ongoing basis throughout the Agreement.

Supply data on roads surveyed at a minimum every two weeks. This allows TfNSW to check the data supplied for conformity with this Specification and advise of nonconformities.

Supply raw and processed data. The processed data must be Normalised and the following criteria must be met:

- (a) Impact peak load measured during the third loading cycle to a resolution of 100 N and within $\pm 4\%$ of the target pressure.
- (b) The pavement deflection from each of the nine sensors measured during the third loading cycle to a resolution of 1 μm and within the following ranges of the second loading cycle:
 - (i) $\pm 5\%$ when the deflection is greater than 100 μm ;
 - (ii) $\pm 6\ \mu\text{m}$ when the deflection is between 30 μm and 100 μm ;
 - (iii) $\pm 4\ \mu\text{m}$ when the deflection is less than 30 μm .
- (c) The deflection recorded on each sensor must have a minimum value of 1 μm .
- (d) The deflection recorded on each sensor must be less than adjacent sensor closer to the point of loading (a check to ensure the deflections decrease with distance from the impact location).
- (e) Pavement surface and air temperature ($^{\circ}\text{C}$) to an accuracy of 1°C .
- (f) Pavement condition comments, including any cracking and patching.
- (g) The distance from the start of the Link to an accuracy of 0.001 km.
- (h) The differential GPS coordinates at each test location as specified in Table M925.1.

4.2 PROCESSING DATA

Process the data to provide the deflection data as specified in Annexure M925/L.

All data must be reported in the Prescribed Direction. Where the lane is surveyed in the Counter Direction, ensure that the data is adjusted so that it is correctly referenced and reported in the Prescribed Direction.

5 OTHER CONFORMANCE REQUIREMENTS

5.1 GENERAL

A Lot that is referred to in TfNSW Q corresponds to the data that has been collected in a data file and not exceeding 4 hours using the same FWD and operator. The conformity of Lots will be collectively tested using the Repeatability Tests and Close-out.

A data item is nonconforming when the data item is derived from equipment that has malfunctioned or is outside the specified tolerances.

5.2 NONCONFORMITY REPORTING

Submit a Nonconformity Report in accordance with TfNSW Q for all data that is nonconforming. The minimum requirements for the report are summarised as follows:

- (a) Details of Nonconformity.
- (b) Date.
- (c) Road Number.
- (d) Carriageway.
- (e) Location Reference:
 - (i) Link;
 - (ii) Coordinates (where GPS is required).
- (f) Direction and Lane affected.
- (g) Reason for Nonconformity.
- (h) Proposed rectification.
- (i) Corrective action.

ANNEXURE M925/A – PROJECT SPECIFIC REQUIREMENTS**A1 EXTENT OF WORK**

Minimum extent of test points to be collected is 98% of total nominated lane kms (Clause 1.3.1).

Table M925/A.1 – Example of Schedule of Works

Road Name	Road No	Local Road Name	Link No	Highway C	Version No	Sectional P	Begin Offset	End Offset	Item Length	Start Description	Start Location	End Description	End Location	Length
FIVE DOCK-DRUMMOYNE	395	GREAT NORTH RD, FIVE DOCK	30 A	2		PT1	0.18	0.581	0.401	START FLEX PAVEMENT	FIVE DOCK	LYONS RD	RUSSELL LEA	0.581
FIVE DOCK-DRUMMOYNE	395	BAYSWATER ST, DRUMMOYNE	110 B	1		PT1	0	0.474	0.474	LYONS RD	DRUMMOYNE	WESTBOURNE ST	DRUMMOYNE	0.474
FIVE DOCK-DRUMMOYNE	395	BAYSWATER ST, DRUMMOYNE	110 B	1		PT2	0	0.474	0.474	LYONS RD	DRUMMOYNE	WESTBOURNE ST	DRUMMOYNE	0.474
FIVE DOCK-DRUMMOYNE	395	BAYSWATER ST, DRUMMOYNE	110 B	1		PT3	0	0.42	0.42	LYONS RD	DRUMMOYNE	WESTBOURNE ST	DRUMMOYNE	0.474
FIVE DOCK-DRUMMOYNE	395	WESTBOURNE ST, DRUMMOYNE	120 A	1		PT1	0	0.149	0.149	THE ESPLANADE	DRUMMOYNE	MARLBOROUGH ST	DRUMMOYNE	0.149
FIVE DOCK-DRUMMOYNE	395	WESTBOURNE ST, DRUMMOYNE	130 A	1		PT1	0	0.147	0.147	HINKLER CT	DRUMMOYNE	VICTORIA RD	HUNTERS HILL	0.147

Table M925/A.2 – Other Requirements

Clause	Description	Required
2.2.2	Global positioning (GPS)	Yes / No
3.1	Road Occupancy License required	Yes / No
3.1	Traffic signal green light runs	Yes / No
3.2	Relative Calibration	Yes / No
3.3	Validation test	Yes / No
3.5.4	Repeatability test	Yes / No
3.6	Close-out survey	Yes / No

ANNEXURE M925/B – MEASUREMENT AND PAYMENT AND RESOLUTION OF NONCONFORMITIES

B1 MEASUREMENT

Table M925/B.1 – Requirements

Clause	Item	Requirement
1.3.1	Location of Work	As specified by the Principal.
1.3.1	Schedule of Works detailing roads to be surveyed	<ul style="list-style-type: none"> • The Linear References for the Start and End of each Road Link Lane to be surveyed. • The total carriageway length for each Link. • The list of Lanes to be surveyed by Road, Link, Carriageway, Direction and Length.
1.3.2	Information supplied by the Principal	<ul style="list-style-type: none"> • An MS Access database with a table containing the list of Lanes to be surveyed by Road, Link and Length including START and END descriptions. • A soft copy of the MS Access database to be populated
2.2.2	Supplementary Location Referencing System(s)	Differential GPS
2.2.3	Measure Temperature	Surface and Ambient Temperature at each Test Point
3.5	Interval for testing	Nominal 100 m
3.5.1	Lateral position of test	Outer wheelpath
4.1	Frequency for progress report	Every 2 weeks

B2 DISPOSITION OF NONCONFORMITIES

The Principal may accept rectification of data by reprocessing the data where you can demonstrate that the PROJECT QUALITY PLAN has not been followed in regard to processing the data.

Nonconformities in the data items may be accepted by the Principal subject to a reduction in the quantity for “Collection and Reporting of FWD Data”. In this case, the minimum extent of network surveyed that may be accepted by the Principal is specified in Annexure M925/A1.

Where the data is rejected because the requirements of this Specification were not met, all costs associated with rectification, including replacement or correction of the data and any extra costs incurred by you in respect of delays caused by such replacements, must be borne by you.

Sections not tested and nonconforming data will be excluded from the quantity calculated as a basis for payment.

B3 SCHEDULE OF PAY ITEMS

Payment will be made for all costs associated with completing the work detailed in this Specification in accordance with the following Pay Items.

Where no specific pay items are provided for a particular item of work, the costs associated with that item of work are deemed to be included in the rates and prices generally for the Work Under the Contract.

Unless otherwise specified, a lump sum price for any of these items will not be accepted.

The rate for each pay item may be subject to a “Rise and Fall” where provided in the Contract.

Costs satisfying the requirements for Quality Assurance must be borne by you (e.g. Accreditation, validation processes). The costs of rectifying nonconformities must be borne by you and includes traffic management.

Table M925/B.2 – Pay Items

Pay Item No.	Description	Unit
M925P1	<p>Survey Establishment</p> <p>Includes the activities associated with the preparation and the administration of the survey. The payment is made once per survey.</p> <p>The activities include, but are not limited to:</p> <p>(a) Prepare and supply PROJECT QUALITY PLAN.</p> <p>(b) Prepare and supply required reports, licences and certificates.</p> <p>(c) Transport and maintain equipment.</p> <p>(d) Personnel establishment and reporting.</p> <p>(e) All Calibration, Validation, Repeatability, Close-out.</p>	Lump Sum
M925P2	<p>Collection and reporting of FWD data.</p> <p>Includes all costs associated with collection, processing, storage and reporting of deflection in the Outer Wheel Path (OWP).</p> <p>The unit is Each Test Point. The quantity is the sum of the Test Points that have conforming data as determined by the Principal.</p> <p>Excludes Traffic Control.</p> <p>Excludes Test Locations that are not to be tested.</p> <p>Excludes Calibration, Validation, Repeatability, Close-out or retesting after a nonconformity.</p> <p>Excludes nonconforming or rejected data.</p>	Each Test Point
M925PT3.1	<p>Traffic Control Plan I (Surcharge)</p> <p>The costs to provide Level I in Traffic Control and are in addition to M925P1.</p>	Hr

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Pay Item No.	Description	Unit
M925PT3.2	Traffic Control Plan II (Surcharge) The costs to provide Level II in Traffic Control and are in addition to M925P1.	Hr
M925PT3.3	Traffic Control Plan III (Surcharge) The costs to provide Level III in Traffic Control and are in addition to M925P1.	Hr
M925PT3.4	Traffic Control Plan IV (Surcharge) The costs to provide Level IV in Traffic Control and are in addition to M925P1.	Hr
M925PT3.5	Traffic Control Plan V (Surcharge) The costs to provide Level V in Traffic Control and are in addition to M925P1.	Hr

ANNEXURE M925/C – SCHEDULES OF HOLD POINTS, WITNESS POINTS AND IDENTIFIED RECORDS

Refer to Clause 1.3.4.

C1 SCHEDULE OF HOLD POINTS AND WITNESS POINTS

Clause	Type	Description
TfNSW Q	Hold	As specified.
Contract Documents	Hold	Certificate of Currency for each required Insurance.
3.3	Witness	Validation Test.
3.4	Hold	Submission of the following: (a) Reference Calibration Certificate for the FWD; (b) Relative Calibration Test; (c) Validation Test; (d) Contract Program.
3.5.5	Hold	Submission of the following: (a) Model, make and identification of FWD; (b) Reference Calibration Certificate for FWD; (c) Relative Calibration Test; (d) Validation Test.
3.6	Witness	Close-out.
3.6	Hold	Submission of all survey data.

C2 SCHEDULE OF IDENTIFIED RECORDS

The records listed below are Identified Records for the purposes of TfNSW Q Annexure Q/E.

Clause	Description of Identified Record
2.1	Calibration reports required in Austroads Test Method AG:AM/T006 and Test Method TfNSW T177 that include: (a) Reference Calibration; (b) GPS Calibration; (c) Distance measuring device Calibration.
2.5	Equipment Malfunction Reports.
3.2	Test data from Relative Calibration.
3.3	Test data from Validation Site.
3.5.1	Daily Diary.

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Clause	Description of Identified Record
3.5.4	Test data from Repeatability Tests.
3.6	Test data at Close-out.
4.1	Data collected from FWD prior to any processing.
5.2	Nonconformity reports.

ANNEXURE M925/D – PLANNING DOCUMENTS

Refer to Clause 1.3.5.

The following documents are a summary of documents that must be included in the PROJECT QUALITY PLAN. The requirements of this Specification and others included in the Contract must be reviewed to determine additional documentation requirements.

Clause	Description
2.2.2	Procedure to validate accuracy of GPS and deal with areas of substandard coverage and provision for analysis of GPS location.
2.5	Equipment Malfunction Report.
3.1	Requirements in Austroads Test Method AG:AM/T006 and Test Method TfNSW T177.
3.4	Contract Program.

ANNEXURE M925/E – TECHNICAL REQUIREMENTS**E1 TfNSW LINEAR REFERENCING SYSTEM**

Where the specified location referencing is ROADLOC, you must reference all data to the TfNSW's Linear Referencing System called ROADLOC.

Ensure that the correct ROADLOC Nodes are selected. Reset the distance measured to zero directly adjacent to the identified Node.

The nominated lane surveyed must be identified in the database by the lane numbering convention described in the document "RAMS – Lane Numbering", as the Lane Code.

Where the survey is interrupted or stopped within a Link and GPS to the required accuracy is not available, recommence the survey at the Node preceding where the Incident was first encountered. Otherwise, recommence so that the complete data can be established.

E2 NONCONFORMING LENGTH

Where the Link length surveyed does not comply with the distance tolerance specified in Clause 2.2.1, the Link is nonconforming and is reported as nonconformity:

- (a) Flag the record in accordance with Clause 5.2.
- (b) Include in the Comments field that the length measured exceeded the tolerance and the discrepancy.
- (c) Make NO adjustment to the data.
- (d) Ensure that the Nonconformity Report has been provided in accordance with Clause 5.2.

E3 CARRIAGEWAY AND LANE CODES**Table M925/E.1 – Carriageway and Lane Codes**

Carriageway Reference	Lane Reference
"A" Carriageways surveyed in the Prescribed and Counter Direction.	<ul style="list-style-type: none"> • Lane Code PT1, PT2, PT3, PT4, PT5, PT6. • Lane Code CT1, CT2, CT3, CT4, CT5, CT6.
"B" Carriageways surveyed in the Prescribed Direction.	<ul style="list-style-type: none"> • Lane Code PT1, PT2, PT3, PT4, PT5, PT6.
"C" Carriageways surveyed in the Counter Direction.	<ul style="list-style-type: none"> • Lane Code CT1, CT2, CT3, CT4, CT5, CT6.
"D" "E" "F" "G" "K" "L" Carriageways.	Test all lengths that appear in the schedule.
"R" "S" "T" "U" "V" "W" "X" "Y" Carriageways.	Test all lengths that appear in the schedule, including ramps.
Exceptions (not generally surveyed).	<ul style="list-style-type: none"> • Parking bays where traffic calming devices create a parking zone. • Short bus bays or bus lanes < 50 m. • Traffic devices. • Separate Bus Transitways.

ANNEXURE M925/F – TEST PATTERNS

F1 GENERAL REQUIREMENTS

The general requirements for testing a flexible pavement are as follows:

- (a) Position the first Test Point in the LINK a distance of 50 m from the Node when testing in the direction of traffic.
- (b) Position the each consecutive Test Points at 100 m from the previous one until the End Node is reached.
- (c) Ensure that no Test Point is positioned within 15 m of the Node or an area that is not a flexible pavement.
- (d) Position an additional Test Point near a Node when the residual distance $L_R \geq 75$ m.

Exceptions to the general requirements are:

- (i) Avoiding sections that are not flexible pavement (refer to Annexure M925/E2).
- (ii) Testing of multiple lanes in the same direction (refer to Annexure M925/E3).

Links comprising all flexible pavements

- Estimate the number of Test Points (n) in the LINK of length L km

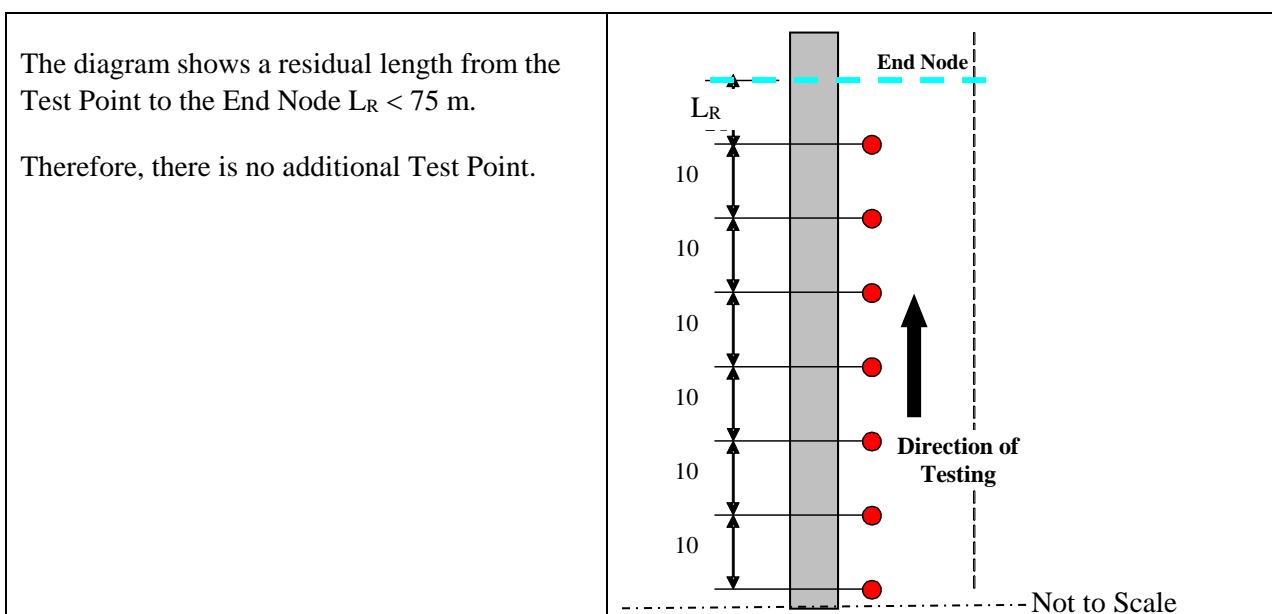
$$n = \text{INTEGER} (L / 0.1) \dots \text{i.e. rounded down}$$

- Estimate the Residual Length (L_R) for the LINK Length (L)

$$L_R = L * 1000 + 50 - 100 * n \dots \text{in metres}$$

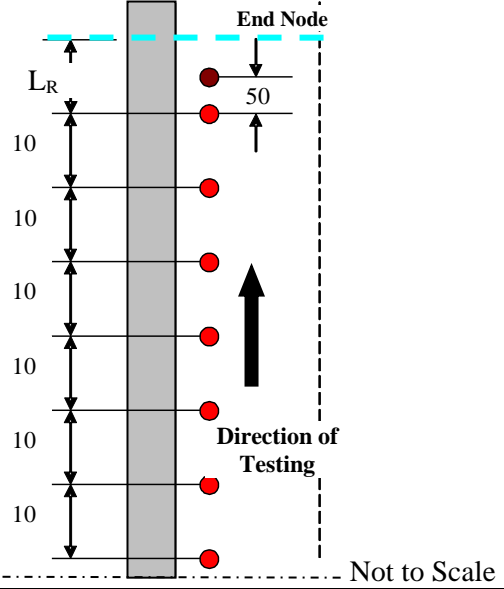
- (1) If $L_R < 75$ m, there are “n” Test Points to be tested in the LINK.
- (2) If $L_R \geq 75$ m, there are “n” Test Points plus an additional Test Point to be tested in the LINK.

Figure M925/F.1 – Locating Last Test Point before Last Node in a ROADLOC Link.



The diagram shows a residual length from the Test Point to the End Node $L_R \geq 75$ m.

Therefore, an additional Test Point is required which is located 50 m from the previous Test Point.



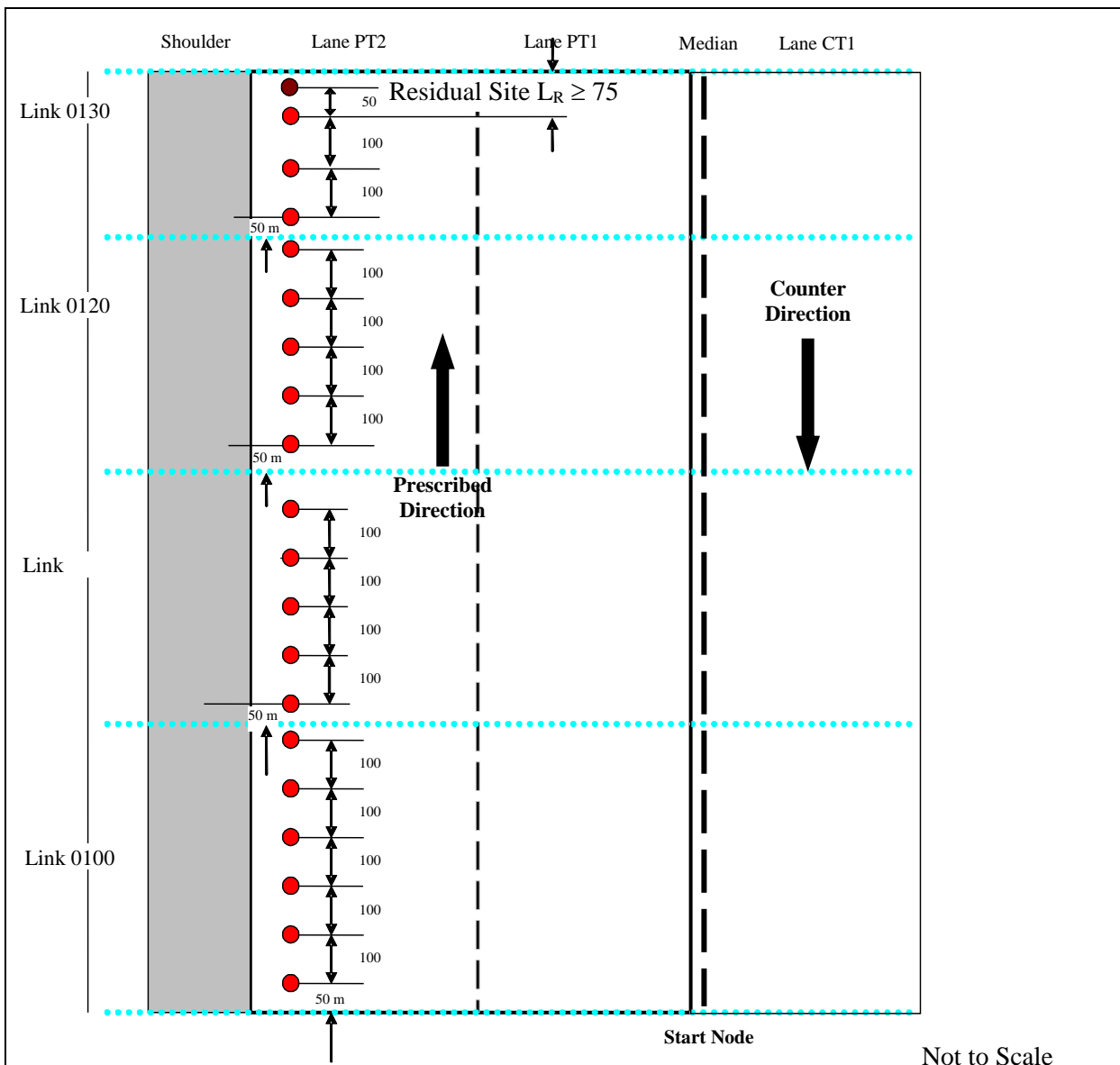
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For “A” and “B” Carriageways that are all flexible pavement

The direction of survey is in the Prescribed Direction from the Start Node towards the End Node.

- (a) Locate the first Test Point 50 m from the Start Node into the Link in the Prescribed Direction.
- (b) Position subsequent Test Points at consecutive 100 m spacing until “n” Test Points are tested.
- (c) Where there is a need for an additional Test Point, locate the additional Test Point in the LINK a distance of 50 m from the n^{th} Test Point.
- (d) Move to the new LINK and repeat the procedure.

Figure M925/F.2 For “A” and “B” Carriageways – Flexible Pavements

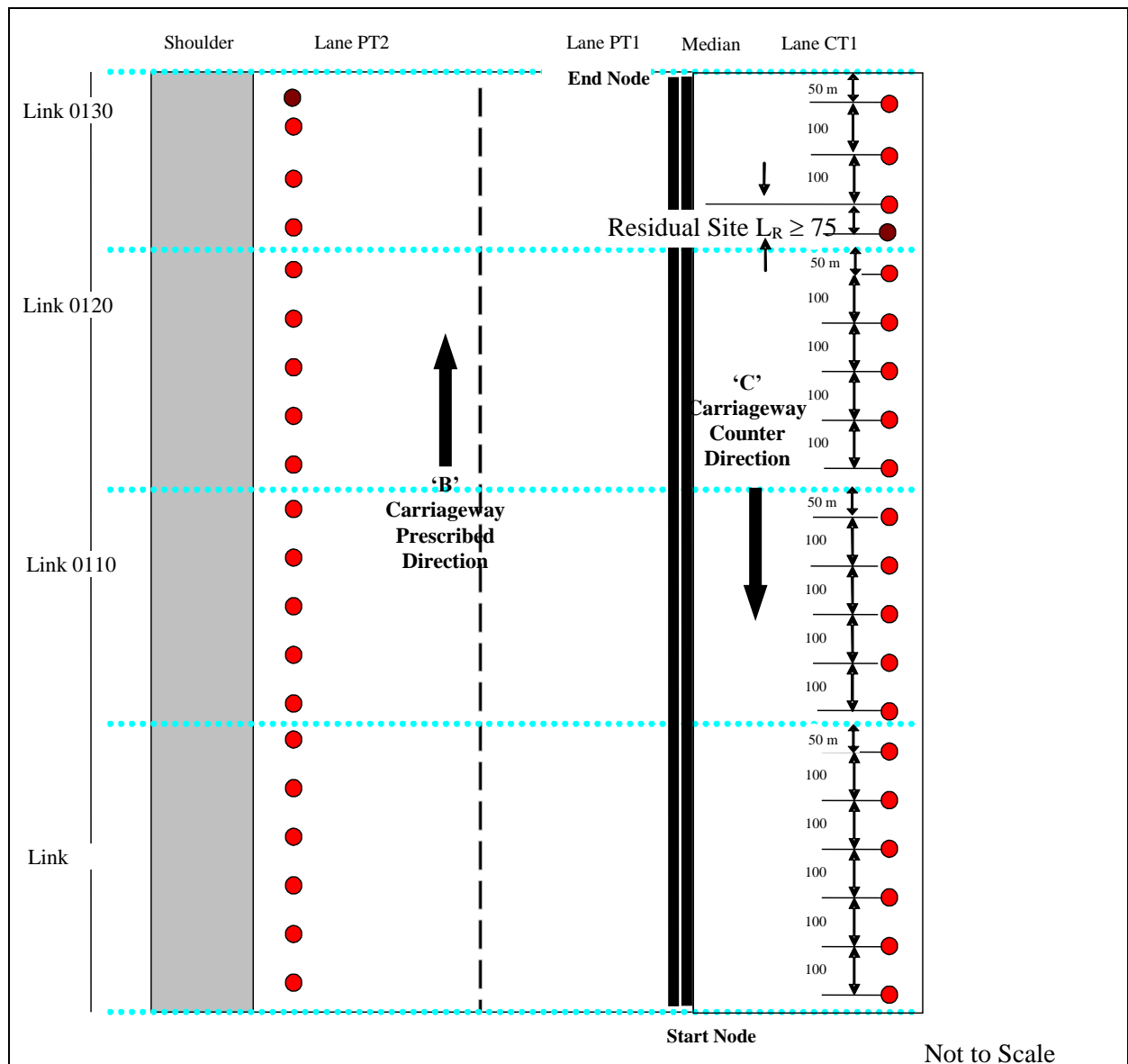


For “C” Carriageways with Links that are all flexible pavements

The direction of survey is in the Counter Direction and measure the distance from the End Node to the Start Node.

- (a) Locate the first Test Point 50 m from the End Node into the Link in the Counter Direction.
- (b) Position subsequent Test Points at consecutive 100 m spacing until “n” Test Points are tested.
- (c) Where there is a need for an additional Test Point, locate the additional Test Point in the LINK a distance of 50 m from the nth Test Point.
- (d) Move to the next LINK and repeat the procedure.

Figure M925/F.3 For “C” Carriageway – Flexible Pavements



F2 SECTIONS TO AVOID

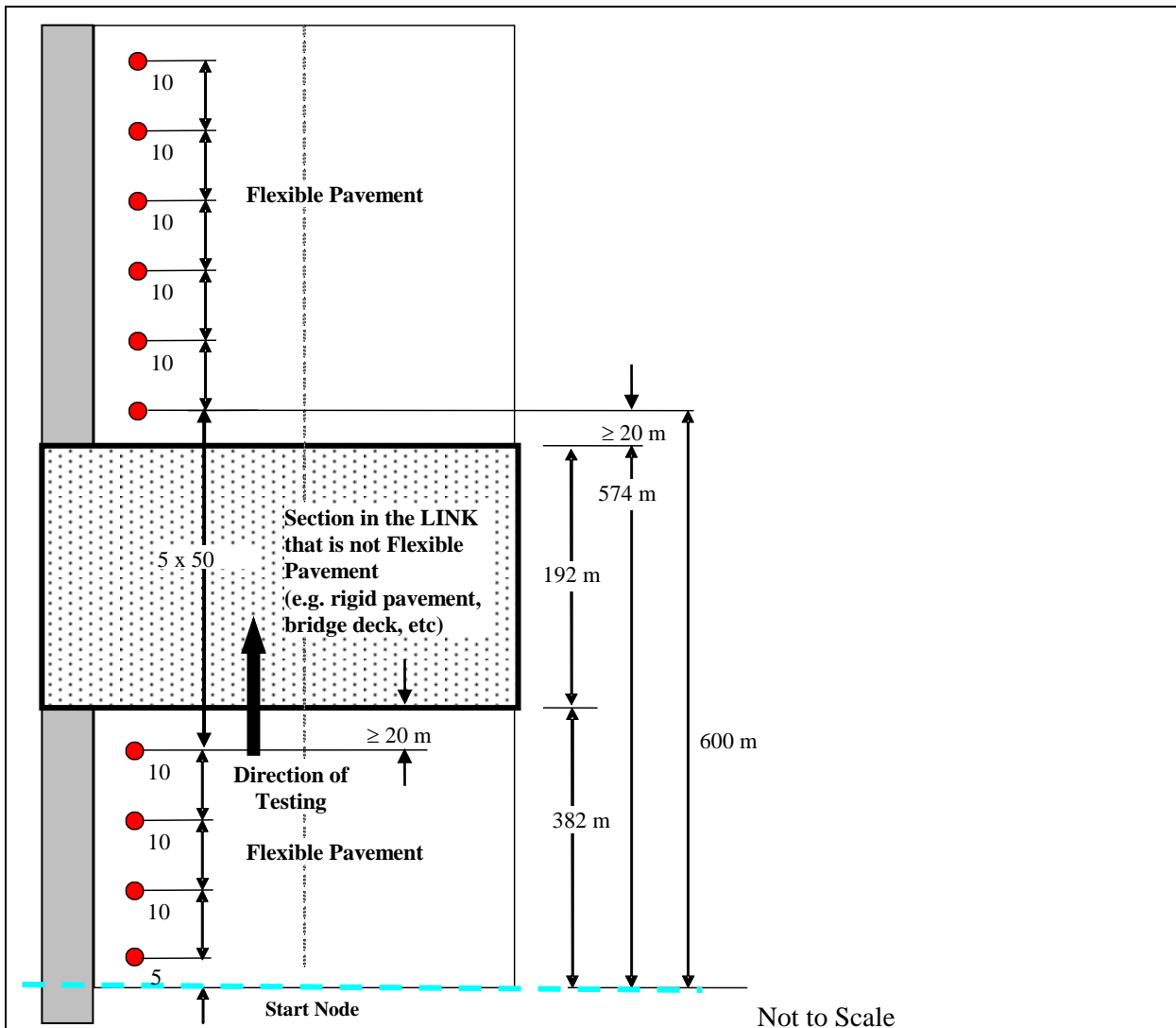
Exceptions to the general requirements are described and involve the positions of Test Points following areas that are not tested.

For Carriageways with Links with sections that are not flexible pavements

Commence as described previously. Do not select a Test Point within 20 m either side of the section to be excluded.

- (a) The Test Point following the excluded section is located at the first multiple of 50 m from the last Test Point that is ≥ 20 m from the excluded section.
- (b) If a section of flexible pavement, located within a Link, is < 50 m, then no Test Point is required.

Figure M925/F.4 – Sections to Avoid



F3 TESTING OF MULTIPLE LANES

Figure M925/F.5 – Case 1: Where the Section Length is ≥ 300 m

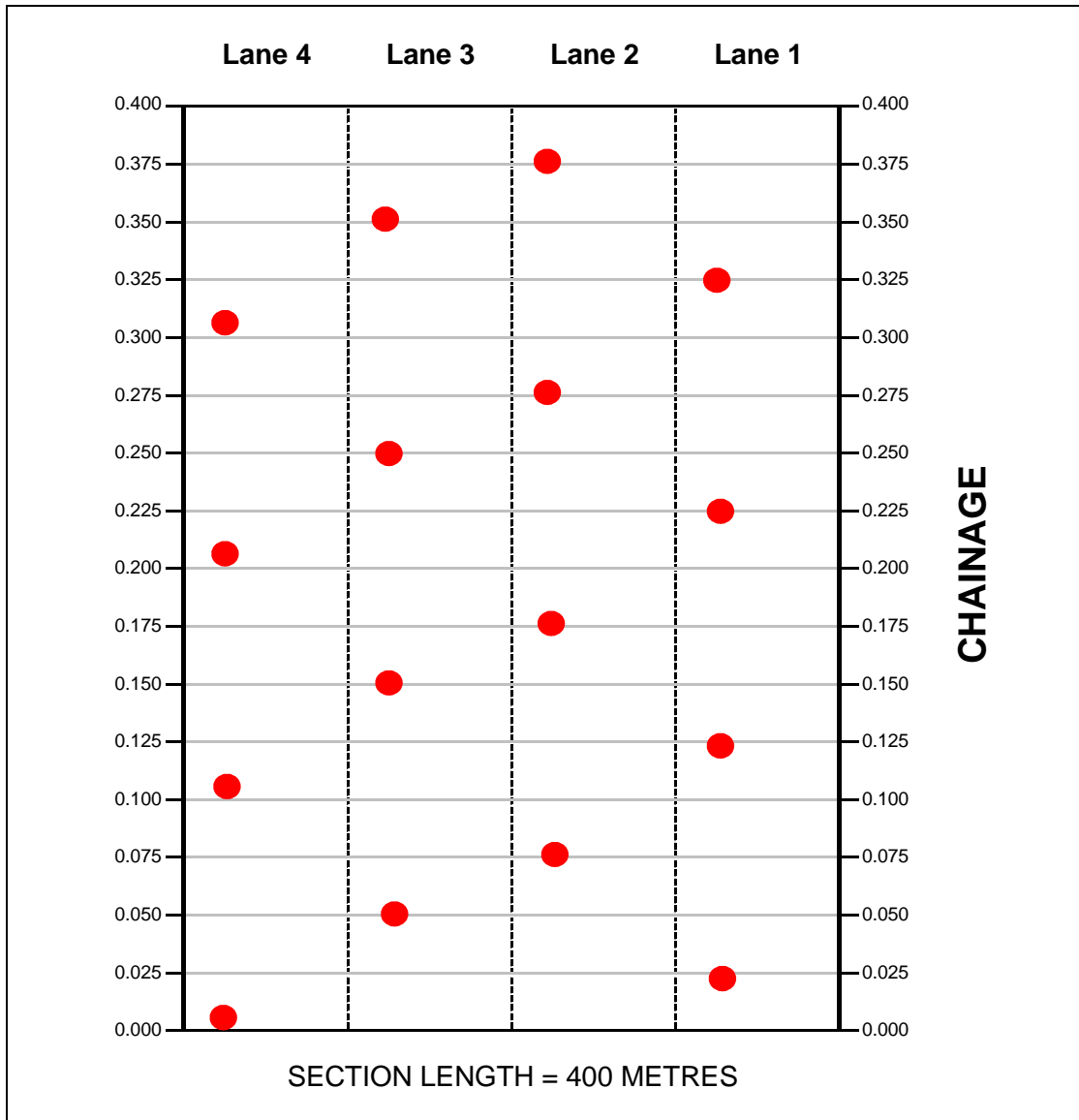
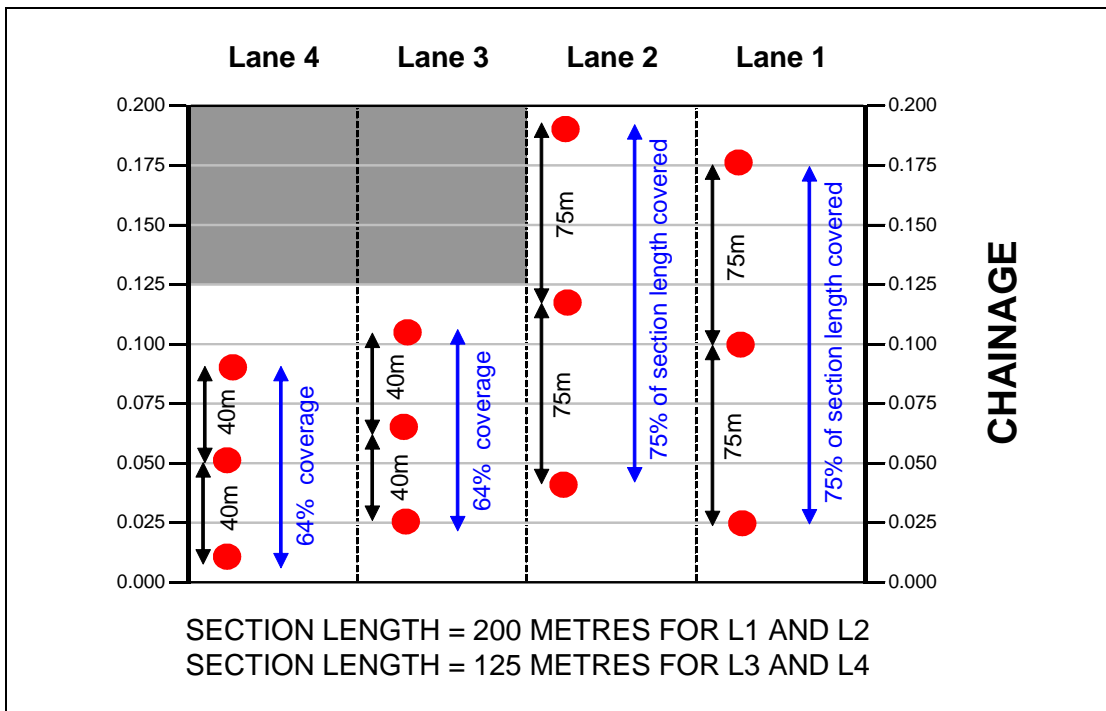


Figure M925/F.6 – Case 2: Where the Section Length is < 300 m



ANNEXURES M925/G TO M925/K – (NOT USED)

ANNEXURE M925/L – DATABASE FORMAT**Table M925/L.1 – Database Field Formats**

FIELD	DESCRIPTION	TYPE	REMARKS
1	Section Identifier	Text	Section description used to collect data
2	Road Name	Text	Name of road
3	Survey Number	Integer	
4	Latest	Yes/No	Flag
5	Region	Text	TfNSW Region
6	Road	Integer	Road Number
7	Link	Integer	Link Number
8	Carriageway	Text	Carriageway Code
9	Direction	Text	Either P (Prescribed) or C (Counter)
10	Lane	Text	RAMS XSP Lane reference
11	Wheelpath	Text	Wheelpath (OWP, IWP, Centre, Other)
12	Distance	Double	Distance from start of Link (km)
13	Latitude	Double	WGS84 in decimal degrees (to 5 decimal places)
14	Longitude	Double	WGS84 in decimal degrees (to 5 decimal places)
15	Elevation	Double	WGS84 in m (to 1 decimal place)
16	Date of Test	Date	Date of testing
17	Time of Test	Time	Time of testing
18	Surface Temperature	Double	Surface temperature from infra-red thermometer (°C)
19	Air Temperature	Double	Air temperature at time of testing (°C)
20	Plate Diameter	Integer	Plate diameter (mm)
21	Plate Pressure	Integer	Plate pressure (kPa)
22	D0	Integer	Displacement under the load (µm)
23	D200	Integer	Displacement at 200 mm from the load (µm)
24	D300	Integer	Displacement at 300 mm from the load (µm)
25	D450	Integer	Displacement at 450 mm from the load (µm)
26	D600	Integer	Displacement at 600 mm from the load (µm)
27	D750	Integer	Displacement at 750 mm from the load (µm)
28	D900	Integer	Displacement at 900 mm from the load (µm)
29	D1200	Integer	Displacement at 1,200 mm from the load (µm)
30	D1500	Integer	Displacement at 1,500 mm from the load (µm)
31	Machine ID	Text	Machine ID of the equipment that completed the survey (e.g. 8083-043)
32	Smoothing	Yes/No	Is smoothing turned on in the processing software?
33	Cracking	Yes/No	Is cracking present at the test location?
34	Patching	Yes/No	Is patching present at the test location?
35	Comments	Text	Any additional relevant information, including data validity
36	Added On	Date	Date the row was added to the database
37	Added By	Text	User ID of the person who added the row
38	Changed On	Date	Date the row was last altered
39	Changed By	Text	User ID of the person who last altered the row

ANNEXURE M925/M – REFERENCED DOCUMENTS

Refer to Clause 1.3.8.

TfNSW Specifications

TfNSW G22 Work Health and Safety (Construction Work)

TfNSW Q Quality Management System

TfNSW Test Methods

TfNSW T177 Pavement Deflection Measurement (Falling Weight Deflectometer)

TfNSW FWD Short-term Validation Procedure for a Fixed Location

TfNSW Guidelines

RAMS – Linear Referencing

RAMS – Lane Numbering

Road Occupancy Manual

Austrroads Test Methods

AG:AM/T006 Pavement Deflection Measurement with a Falling Weight Deflectometer (FWD)