



**Engineering Guidelines for
Subdivisions and Development**

**Part 7
Testing
2014**

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PART 7 - TESTING

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1. INTRODUCTION

This document outlines the Authority's recommended practice for testing roads, water reticulation and sewer reticulation.

This section of the Engineering Guidelines for Subdivisions and Developments outlines the Authority's recommended practice for testing roads, water reticulation and sewer reticulation. It is in no way a comprehensive "Testing Manual" and it is intended to be read in conjunction with relevant Standards that includes:

- Australian Standards;
- RMS NSW Standards;
- Vic Roads Standards;
- WSAA Standards for Water and Sewer; and
- State Government Authority Standards.

The other sections of the Subdivision and Development Guidelines comprise the following:

- Part 1 General Requirements
- Part 2 Roads
- Part 3 Stormwater Drainage
- Part 4 Water Reticulation
- Part 5 Sewerage Reticulation
- Part 6 Landscaping, and Measures for Erosion, Sedimentation and Pollution Control
- Part 7 Testing.**

The developer is required to pay for all tests. Forty-eight hours notice is required.

2. ROADS

Test each layer of pavement material and obtain approval for each layer from the Authority or an Accredited Certifier prior to placing of subsequent pavement layers.

2.1 SUBGRADE

Test the Subgrade profile by template and make good irregularities by the addition or removal of material, followed by further rolling as in Table 1

Table 2.1 Subgrade Testing

Subgrade compaction requirement as obtained in the standard compaction test	95% of maximum dry density
Test every 500 mm lift at	Maximum spacing of 100m
Minimum number of samples per road	2 samples
Compulsory Subgrade inspection	In accordance the quality control checklist

All fill material shall comply with the requirements of AS 3798, Guidelines on Earthworks for Commercial and Residential Developments by the submission of test certificates prior to the commencement of work. Samples must represent a particular batch; lot or consignment and test certificates shall be no older than three months.

Every 500 mm lift of Subgrade shall be proof rolled. The Subgrade shall be checked by proof rolling with a roller having an intensity loading of seven tonnes per metre width of roller. Any permanent deformation of the Subgrade under the roller shall be deemed a failure.

Upon completion of final boxing of Subgrade, the geotechnical testing Authority shall inspect the exposed Subgrade to ensure that the samples taken accurately represent the Subgrade condition and shall certify in writing, to the Authority that this is so prior to the placement of the first pavement layer.

2.2 SUB-BASE AND BASE

The sub-base and base shall be density tested at intervals along the road as directed by the Authority.

The minimum requirements are:

Table 2.2 Sub-base and Base Testing

The sub-base and base shall be density tested at	100 metre
Minimum samples per road to be tested	Two
Sub-base course compaction	95% of the maximum dry density as per the modified compaction test.
Base course	100% of the maximum dry density as per the modified compaction test.
Compulsory sub-base and base inspection	In accordance the quality control checklist

2.3 DENSITY TESTING

All tests are to be undertaken and certified by an authorised representative of a laboratory registered by the National Association of Testing Authorities. The developer is to pay for all density testing with density test results supplied to the Authority or an Accredited Certifier for approval.

2.4 PAVEMENT DETAILS

Sub-base and base course material must be initially tested for suitability unless advised otherwise by the Authority or an Accredited Certifier.

The minimum thickness for base course is 100 mm.

No pavement material shall be placed without the prior approval of the Authority.

All sub-base and base course gravel must comply with the following requirements:

Table 2.3 Pavement Details

Sub-base and base course gravel	To VicRoads Standard Specification for Roadworks and Bridgeworks Section 304
Sub-base Gravel Standard	To VicRoads class 3 Standard
Sub-base Gravel Max PI	10
Sub-base Gravel Min CBR	60
Base Gravel Standard	To VicRoads class 2 Standard
Base Gravel Max PI	6
Base Gravel Min CBR	120

2.5 ASPHALTIC CONCRETE

The supply and laying of asphaltic concrete must comply with RMS test method T612.

2.5.1 Stability of mixes

The stability of the job mix shall be between 16KN and 36KN, as determined by the modified ‘Hubbard – Field Method’ i.e. RMS Test Methods T601 and T603.

Mixes with stability of less than 8KN below the limit or more than 12KN above the upper limit shall be removed from the site. For mixes having stability outside the specified ranges, but within the above-mentioned limit for rejection, consideration will be given to acceptance of the mix subject to deduction in accordance with RMS test method T612.

2.6 VOIDS IN COMPACTED MIXES

The design of job mixes shall be such that between 65% and 85% of the air voids in the total mineral aggregate will be filled by the binder when determined in accordance with RMS Test Methods T601, T605 and T606.

2.7 SPRAYED BITUMINOUS SURFACING

Spray seals shall be in one or two applications as specified on the drawings and shall conform with the RMS specification for the supply and spraying of bituminous material (MR Form 898).

Aggregates shall conform to RMS NSW specification for cover of aggregates RMS DCM materials specification DCM 3151 with proof of compliance submitted prior to the commencement of work. Samples tested must represent a particular batch; lot or consignment and test certificates shall be no older than three months.

2.8 APPLICATION RATES

The designed application rates of binder and aggregates and average least dimension of aggregates is to be submitted for approval 48 hours prior to the commencement of works.

2.9 WORK RECORDS

Details of bitumen and aggregate applied are to be recorded immediately after each "run" and submitted for approval prior to acceptance into maintenance period.

2.10 DEFECTIVE WORK OR MATERIALS

Remove defective materials including replacement of binder that has been overheated, deteriorated or contaminated prior to application to the road. Where the Authority considers that work is not in accordance with the specification whether caused by bad workmanship, defective materials or by materials made defective during construction these materials shall be removed at the cost of the developer and contractor.

Alternatively, the Authority may consider accepting defective work subject to conditions.

2.11 FINAL ROAD PROFILE

2.11.1 Pavement Crossfalls

The final road profile shall satisfy the following requirements (if not otherwise stated in the drawings):

Mean Crossfall	3% \pm 0.25%
Maximum Crossfall	3.5% (5% in extenuating circumstances)
Minimum Crossfall	>2.5%
Standard Deviation of Crossfalls	0.35%

The above requirements do not apply where the road is super elevated.

2.11.2 Vertical Alignment

The vertical alignment shall not deviate more than \pm 0.25% from the value shown on the drawings.

2.12 CONCRETE

Comply with AS 1012 Methods of Testing Concrete.

2.13 SUBDIVISION EARTHWORKS

All earthworks associated with commercial and residential developments must comply with the requirements of AS 3798 "Guideline on Earthworks for Commercial and Residential Developments".

Plans and specification for all earthworks are to be included with the Engineering Drawings and Construction Specification, for the Authority or Accredited Certifier's consideration.

Any material deemed to be unsuitable as described in the Australian Standard shall be disposed of from the site.

Any documentation for earthworks, including Works-As-Executed details and testing shall comply with Sections 3 and 7 of AS 3798. A copy of the documentation and test results shall be supplied to The Authority. The Subdivision Certificate will not be issued prior to the receipt and approval of all earthworks documentation.

3. WASTEWATER RETICULATION

3.1 GENERAL (REFER WSA 22.1)

This section relates to sewerage reticulation acceptance testing. The testing of sewerage reticulation shall generally be in accordance with the latest version of the Water Services Association of Australia (WSAA). However this part of the Authority's "Engineering Guidelines" takes precedence over the WSAA Standards. The "Sewerage Code of Australia (WSA02) Part 3 Construction; Second Edition Version 2.3" has been cross-referenced.

All sewers and maintenance holes shall be subject to testing after construction (NATA accreditation is not mandatory). The tests shall be carried out before issue of the Subdivision Certificate.

Should sewers or maintenance holes fail any test, defects shall be detected and repaired and the test repeated. The process of testing, detection and repair of defects and retesting shall continue until a satisfactory test is obtained.

All lines are to be clear and free from soil, slurry, liquids and other foreign substances at the notification of completion.

3.2 COMPACTION TESTING (REFER WSA 22.1)

All trenches are to be Flood Compacted or as determined by the Authority.

3.3 TEST OF GRAVITATION SEWERS

The testing of gravitation sewers shall be in accordance with the relevant requirements and method of testing specified in Sections 3.4 or 3.5.

Before the test is performed, all pipelaying on the section shall be completed and backfill compacted to the level of the centre of the pipe barrel, and the Developer shall have requested the Authority to check the pipeline for line and grade.

The test may be carried out after risers and/or sidelines are constructed however the Authority will be reliant on the final test conducted immediately prior to acceptance into maintenance.

Any fault detected is to be rectified and a satisfactory test obtained before the remainder of backfill is placed.

3.4 AIR PRESSURE AND VACUUM TESTING OF GRAVITY SEWERS (REFER WSA 22.4)

3.4.1 Equipment

All necessary equipment is to be supplied by the Developer and kept in a condition acceptable to the Water Agency or Accredited Certifier.

Pressure gauges are to be tested daily by static water column. At least one spare gauge per test rig is to be kept on the job at all times.

Compressed air is to be supplied by a compressor capable of supplying at least 1m³/minute at 35 kPa. The air is to be fed through a pressure-reducing valve capable of reducing pressure from that supply to 28 kPa ± 4 kPa. The air is then to pass through an airtight line fitted with a 150 mm Bourdon type pressure gauge reading from 0 to 50 kPa, a pressure relief valve that may be set to blow off at 28 kPa ± 4 kPa and a gate valve to the pipeline to be tested.

3.5 HYDROSTATIC TESTING

Where the Authority permits hydrostatic testing; the hydrostatic test shall be carried in accordance with the specific requirements of the Authority.

3.6 TESTING OF CONCRETE MAINTENANCE HOLES (REFER WSA 22.4.4)

The Authority may request the leakage testing of MH's at its discretion.

Where a test is required the test shall be carried out with the maintenance hole cover surround fitted with rendering of the channels and benches completed.

As an alternative to vacuum testing referred to in WSA 22.4.4 subject to the approval of the Water Agency water testing will be undertaken by plugging all pipe openings in the walls and by filling the maintenance hole with water to the lowest point on the top of the maintenance hole cover surround. The plugs shall be positioned in the pipes as near as practicable to the internal face of the maintenance hole.

After allowing 30 minutes for absorption, if not otherwise determined by the Water Agency, the maintenance hole shall be refilled and the loss of water during the following thirty minutes measured. The test on the maintenance hole will be considered satisfactory provided the water lost is less than 3 mm depth in the top section of the maintenance hole for each 1 metre depth of the maintenance hole. The depth of maintenance hole is to be taken from the bottom of the maintenance hole cover recess in the cover surround to the invert of the outlet from the maintenance hole. The plug of the outlet shall be fitted with a suitable release for emptying the maintenance hole on satisfactory completion of the test.

3.7 VISUAL INSPECTION AND MEASUREMENT FOR INFILTRATION (REFER WSA 22.5)

Whenever the pipeline is subjected to a significant head of groundwater (i.e. 1500 mm or more above the obvert of the sewer main) provided that groundwater is at least 150 mm above any sideline it shall be visually inspected for infiltration.

The Developer shall propose full details of the method by which the infiltration is to be measured and rectified.

The Developer at his own expense shall determine the head of groundwater by a method acceptable to the Water Agency or Accredited Certifier.

3.8 TESTING OF SEWER RISING MAIN

Rising mains including low pressure sewer rising mains shall be pressure tested in accordance with this subclause in order to detect excessive leakage and defects in the pipeline including joints, thrust and anchor blocks, if any.

Pipelines shall be tested in sections approved by the Water Agency or Accredited Certifier as soon as practicable after each section has been laid, jointed and backfilled, provided that: -

- If so specified or if the Developer so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Water Agency or Accredited Certifier; and
- The pressure testing shall not be commenced earlier than seven days after the last concrete thrust or anchor block in the section has been cast.

For the purpose of this subclause, a section shall be defined as a length of pipeline, which can be effectively isolated for testing, eg. by means of main stop valves.

Unless otherwise approved by the Water Agency or Accredited Certifier, pressure testing shall not be carried out during wet weather.

During pressure testing, all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection. During the pressure testing of a pipeline each stop valve shall sustain at least once, the full test pressure on one side of the valve in closed position with no pressure on the other side for at least 15 minutes.

Before testing a pipeline section, it shall be cleaned to the satisfaction of the Water Agency or Accredited Certifier and filled slowly with water, taking care that all air is expelled. Purging of air from rising mains shall be promoted by opening air valves. In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24-hours prior to the commencement of the pressure testing.

The hydrostatic test pressure which shall be applied to each section of the pipeline shall be such that at each point of the section, the test head shall be equal to or greater than the design head specified or shown on the Drawings, but shall not exceed same by more than 20%.

The specified test pressure shall be maintained as long as required by the Water Agency or Accredited Certifier, while they examine the whole of the section, and in any case not less than eight hours. For the purpose of determining the actual leakage losses, the quantity of water added in order to maintain the pressure during the period of testing shall be carefully measured and recorded.

The pressure testing of a section shall be considered to be satisfactory if:

- a. There is no failure of any thrust block, anchor block, pipe, fitting, valve, joint or any other pipeline component:
- b. There is no visible leakage; and
- c. The measured leakage rate does not exceed the permissible leakage rate as determined by the following formula:

$$Q_1 = \frac{(0.000532 + C) D.L (H^{3/2})}{1_p}$$

Where:

- Q₁ = permissible leakage rate (litres per hour)
C = a co-efficient as specified hereunder for the particular pipe material and type of joint
D = nominal diameter of pipe (mm)
L = length of section tested (km)
H = average test head (m)
1_p = average pipe length (m)

If the measured leakage rate does not exceed that rate calculated by the simplified formula for the type of pipe tabulated hereunder, the determination of the permissible leakage rate on the

basis of the formula specified in (c) above will not be necessary. The following simplified formulae are based on the co-efficient “C” and average pipe lengths contained in that tabulation.

Table 3.1 Simplified approach to leakage rates

Pipe Type	Simplified Formulae	Co-Efficient “C”	Nominal Pipe Length (M)
C.I. & D.I.	$Q_1 = 0.0105 DL (H)^{1/2}$	0.0548	5.5
uPVC	$Q_1 = 0.01 DL (H)^{1/2}$	0.0568	6.0

Any failure, defect, visible leakage and/or excessive leakage rate, which is detected during the pressure testing of the pipeline or during the Maintenance Period shall be made good by the Developer at his expense.

3.9 INSPECTION PRIOR TO BACKFILLING

All sewerage lines shall be inspected and approved by the Water Agency or Accredited Certifier after laying and jointing and prior to the placing of any backfilling.

This may be relaxed for deep sewers with written approval of the Authority of a work method that allows for constant backfilling of the trench for safety purposes.

4. WATER RETICULATION

4.1 GENERAL (REFER WSA 9.1)

This section relates to water reticulation acceptance testing. The testing of water reticulation shall generally be in accordance with the latest version of the Water Services Association of Australia (WSAA). However this part of the Authority’s “Engineering Guidelines” takes precedence over the WSAA Standards. The “Water Supply Code of Australia (WSA03) Part 3 Construction; Second Edition Version 2.3” has been cross-referenced.

All water reticulation shall be subject to testing after construction (NATA accreditation is not mandatory). The tests shall be carried out before release of the Subdivision Certificate.

Should the water reticulation fail any test, defects shall be detected and repaired and the test repeated. The process of testing, detection and repair of defects and retesting shall continue until a satisfactory test is obtained.

4.2 ACCEPTANCE TESTING (REFER WSA 19)

4.2.1 Pressure Testing (Refer WSA 19)

All pipelines including services shall be pressure tested to detect and repair leakage and defects in the pipeline including joints, thrust and anchor blocks, if any. The method of setting up and carrying out the test shall be in accordance with the requirements of WSA pressure testing section 19.4.

Pipelines shall be tested in sections approved by the Water Agency or Accredited Certifier as soon as practicable after each section has been laid, jointed and backfilled provided that:

- If so specified or if the Developer so desires, some or all of the pipe joints shall be left uncovered until the whole of the section has been successfully pressure tested to the satisfaction of the Water Agency or Accredited Certifier; and
- The pressure testing shall not be commenced earlier than seven days after last concrete thrust or anchor block in the section has been cast.

For the purpose of this clause, a section shall be defined as a length of pipeline, which can be effectively isolated for testing, eg by means of main stop valves.

Unless otherwise approved by the Water Agency or Accredited Certifier, pressure testing shall not be carried out during wet weather.

During pressure testing all field joints, which have not been backfilled, shall be clean, dry and accessible for inspection.

During pressure testing of a pipeline each stop valve shall sustain at least once the full test pressure on one side of the valve with no pressure on the other side for at least 15 minutes.

Before testing a pipeline section, it shall be cleaned to the satisfaction of the Water Agency or Accredited Certifier and filled slowly with water, taking care that all air is expelled. Purging of air from reticulation shall be prompted by opening hydrants.

In order to achieve conditions as stable as possible for testing by allowing for absorption, movement of the pipeline and escape of entrapped air, the section shall be kept full of water for a period of not less than 24-hours prior to the commencement of the pressure testing.

The minimum hydrostatic test pressure, which shall be applied to each section of the pipeline, shall be 400KPa.

Should the various works not be sufficiently completed to enable the supply to be thus provided when the pipeline is ready for testing, the time for testing shall be postponed until such is the case. Alternatively, the Developer may adopt other measures for supplying the water, but shall have no right to claim for any expenses that may be incurred thereby.

All expenses in connection with testing shall be borne by the Developer. The Developer shall have no claim for compensation or damages in respect of any postponement of the testing.

4.2.2 Disinfection

All new or replacement water mains equal or greater than 100 mm diameter must be disinfected prior to being brought into service. Bacteriological testing and disinfection procedures shall be in accordance with WSA 19.5 and 20.

Disinfecting can only be carried out by appropriately authorised personnel to the Authority's Disinfection Procedures.