



Engineering Guidelines

PART 4

CONSTRUCTION & INSPECTION GUIDE

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1 GENERAL

Requirements for arranging works inspections:

- 48 hours' notice provided to Council for any inspection.
- Inspections to be completed in normal work hours 8:30am to 5pm Monday – Friday. No inspections are to occur on weekends or public holidays.
- Council inspecting officer can cancel the inspection in extreme weather conditions.

2 BREAKDOWN OF CONSTRUCTION LOTS OF WORK

Lots are to be reasonably sized amounts of work that can easily trace any work that requires rectification in the future.

General layout of a Construction Lot:

- Title page (Inc. Lot details, chainages etc.)
- Lot map (highlighting respective Lots' location and extent)
- Inspection Test Plan (ITP) – For respective task/s undertaken in Lot
- Testing results (compaction, pressure testing etc.)
- Conformance levels.
- Survey report (if applicable)
- Material conformance certificates and testing reports (if applicable)
- Approved Design Change Requests (DCRs) or Non-Conformance Reports (NCRs) (If applicable)

* ITPs are to be submitted to Council for approval prior to use. Council will provide feedback following review.

* ITPs will be reviewed by Council on site every 4 weeks during construction.

* Councils' DCR and NCR form to be used where required.

3 SITE ESTABLISHMENT – HOLD POINT

- Site induction and sign-on paperwork.
- Site fencing is secure.
- Copy of CEMP onsite
- Site information board – Inclusive of developer name, phone number, site specific PPE, site radio channel, PCA details and SWC number.
- Environmental Control Measures as per approved plans and CEMP deployed. These are deemed minimum and can only be deviated from after discussions and concurrence by staff.
- Site hut and toilets.
- Signed/approved SWC stamped plans printed and located on site.
- Site Evacuation Point.
- Emergency Response Plan.
- Spill kit – located on site.
- First aid kit – located on site / first aid officers nominated and photo on noticeboard.
- Basic pegged set out of the works for orientation and control reference for all involved onsite. This is to include: Marker peg (50 mm x 20 mm approx. painted white, 1.0 m min. high, marked with survey tape). Offset at a nominated distance from construction centreline marked at top face of peg. Marker peg to also contain chainage details at that point underneath offset. Pegs to be erected at a minimum of 50 m apart.

4 ROAD CONSTRUCTION

4.1 Subgrade, Subbase and Base Layers – Hold Point

- Proof roll – zero deflection.
- Compaction testing (density tested at minimum 100m intervals, minimum. of 2 samples per road. Random Selection (TfNSW sample method) to be used for determining testing locations).
- Conformance level sheets.

4.2 For Subgrade That Needs to be Replaced or Filled to Required Level – Hold Point

- Proof roll required after initial strip.
- Proof roll and compaction test for every 500mm lift (max spacing of compaction tests 100m).
- Conformance level sheets.

Fill material to be select fill or that of sub-base or otherwise approved by Council.

* Note: Council suggests that the developer is to engage a geotechnical firm to be present when Council undertakes the proof roll hold point inspection. This is not a requirement, however, it is suggested to keep the project moving, should rectification be required. Any advice provided by the geotechnical firm is to be included within the geotechnical testing report and must be provided to Council in writing within 48 hours of inspection.

Testing certificates and level conformance reports are to be sent to Council and approved prior to the release of the hold point. A related level conformance must be shown on a control spreadsheet. This spreadsheet is to compare the design levels against the constructed levels. Each subsequent layer is to be added to this spreadsheet for future comparison (layer thickness to be shown).

Proof rolling and visual inspection of to be completed with a full 10,000L tandem axle Water Cart or equivalent as approved by Hilltops Council.

4.3 General Compaction Requirements

- Base 102% Std MMD
- Sub-base 100% Std MMD
- Subgrade 98% Std MMD (100% Std MMD for fill)

* Above is applicable unless Council has approved alternate pavement design.

4.4 Tolerances for Conformance Levels

- Base +10, -0 mm
- Sub-base +0, -20 mm
- Sub-grade +0, -30 mm
- Crossfall +0.5% -0.5%
- Vertical Alignment +0.25%, -0.25%

4.5 Kerb and Gutter

- Pre-pour inspection to be completed by Council. This involves inspection of string line alignment replicating approved Kerb top level. Any anomalies will be raised.
- Level sheet submitted confirming correct level setout prior to pour (conformance same as Sub-base being (+0 mm, -20 mm)).
- Subsurface drainage is to be placed in approved location.
- Concrete test results to be submitted to Council (1 x 7 day and 2 x 28-day cylinders).
- Contraction joint requirements:
- Expansion joints every 15m.
- Contraction dummy joints every 3m.
- Galvanized steel stormwater outlets (one per lot). Same profile as Kerb laid to be provided at lowest lot location with pipe work extended back to lot boundary.
- Stamping of location for any underground services (E.g. W – Water Service).
- Post pour inspection to involve lip level conformance, and checks on above provisions including cracking.

* Slump testing and compaction testing required for any structural concrete.

4.6 Bitumen Sealing of Roadwork

- Submit seal design for approval by Council prior to scheduling. Design to be completed using TfNSW form 395K.
- Pre seal inspection involves prepared base surface with sealing supervisor.
- Post seal inspection includes the review of daily seal spray sheets (use TfNSW 500C daily record sheet), site coverage of seal over base course/Kerb lip, sweeping of any loose aggregate.

4.7 Line Marking & Road Signage

- Post line marking inspection as per approved plans.
- Post signage inspection as per approved plans.
- Both can be inspected within the same inspection.

4.8 Materials

- Material conformance sheets/ test reports for each layer.
- Certificates of compliance provided.
- Supply delivery dockets for all materials at the end of the project.

5 WATER, SEWER AND STORMWATER

5.1 Pipe Laying

Inspection of trench with laid pipes on bedding required prior to backfilling:

- Joints to be inspected.
- Fall requirements to be achieved as per approved plans.
- CCTV to be undertaken on sewer and stormwater lines prior to practical completion of the subdivision.
- Refer to Appendix A for pipe laying requirements.

5.2 General Compaction Requirements (Watermain, Sewer & Stormwater)

General:

- 95% Std MDD – Trenching up to subgrade level.
- Testing required: 1 test per 100m (maximum length). Test to be taken at mid-point between pits (if applicable).

Sewer compaction:

- Embedment compaction testing to 21.3.3 of WSA 02-2014-3.1
- Embedment compaction testing to 21.3.3 of WSA 02-2014-3.1
- Trench fill compaction testing to 21.3.4 of WSA 02-2014-3.1
- Other fill compaction testing to 21.3.5 of WSA 02-2014-3.1

5.3 Watermains

5.3.1 Water Mains (General)

- GPS locating of water mains including any appurtenances including hydrants, stop valves, service connections, Tees, Crosses & Elbows.
- Constant Pressure Test (Water Loss Method) - Pressure Test in accordance with Appendix M of AS/NZS 2566.2:2002
- Pressure test all property services in conjunction with testing of water mains
- Following hydrostatic pressure test, disinfection to be carried out in accordance with Section 20 of WSA 03-2011-3.1
- Water Quality Testing in accordance with 19.7 of WSA 03-2011-3.1.
- WAE – to confirm tolerances as within specifications in accordance with Section 21 of WSA 03-2011-3.1
- Pipe to be chlorinated prior to commissioning.

5.3.2 Hydrostatic Pressure Testing (Watermain)

- Watermain to be kept full for a minimum of 24 hours prior to testing.
- Testing pressure of 400kPa above operating pressure – Not exceeding 1600kPa.

- Test pressure to be held for a minimum of 15 minutes. Timestamped images of pressure gauge to be kept for quality assurance and provided in the respective lot. One photo for test start and another at test end.
- Testing pressure of operating pressure +20% - 0% to be maintained for an 8-hour duration minimum. Timestamped images of pressure gauge to be kept for quality assurance and provided in the respective lot. Photos to be taken every 30 minutes.

5.3.3 Water Service Connections

- Inspection for post-installation of water service connections. Detail and location to be as per approved detail and plans.

6 Sewer

6.1.1 Sewer Mains (General)

- Except where connection to live sewer is required, start construction from the furthest downstream point.
- Vacuum testing of sewer mains in accordance with 21.4.2.1 of WSA 02-2014-3.1 by NATA accredited operator.
- GPS Locating of sewer mains including property connections and elevation of invert level in meters Australian Height Datum (m AHD). Submission to Council for review and approval.
- CCTV inspection to assess workmanship and condition of asset in accordance with WSA 05-2020 4.1 Condition Inspection Reporting. Inspectors shall hold a Statement of Attainment in Unit NWPNET016.
- Infiltration testing in accordance with 21.5 of WSA 02-2014-3.1.

6.1.2 Sewer Manhole and Dead Ends

- Seal joints between precast sections
- Seal joints between manholes and sewer mains.
- Vacuum testing (separate from vacuum testing of sewer mains) in accordance with 21.4.5 WSA 02-2014-3.1.
- Appropriate venting for manholes downstream of a low-pressure sewer.
- Class D covers for trafficable areas and Class B covers for non-trafficable.

6.1.3 Sewer Risers

- Inspection for post-installation of sewer risers. Detail and location to be as per approved detail and plans.

6.1.4 Markings of Junctions and Sidelines

The position of each riser, junction or end of a sideline should be clearly marked by the Contractor on completion of backfilling and shall be no further than 1m from the front and side boundaries when the main is located within the road reserve or neighbouring lot and no further than 1m from the side boundary and the centreline of the main where the main is traversing the lot.

A red survey peg should be used to indicate the location of sewer junctions. The peg should be tied to an underground identification tape, connected to the sewer junction. The contractor should adjust the levels of pegs where necessary to conform to final surface level at the time of notification of completion.

As an alternative to providing a red survey peg, the vertical riser can be constructed. The sewer riser is to be marked red, solvent capped, protected from vandalism and easily identifiable for future internal sewer connection.

The position of each riser, junction or end of sideline, dimensioned relative to at least 2 adjacent property boundaries must be shown on Works As Executed drawings to allow location at future date. Distance to junctions from downstream manhole also to be indicated.

6.1.5 Sewer Pump Station (If Applicable)

- Commissioning of each pump.
- Duty cycle operation.
- Low level/high level alarm operation.
- SCADA connection.
- Telemetry operation.
- Pressure testing required for outlet pressure line.
- Inspection of discharge manhole as per approved detail

6.2 Stormwater

6.2.1 Stormwater Pits

- Ensure the cover is flush with the surrounding surface.
- If inlet pit, ensure the surrounding surface is graded towards the pit.
- Class D cover for trafficable areas and Class B cover for non-trafficable areas.
- Compaction of the base before installing/pouring pit base.
- GPS Locating with description of pits including description, dimensions, materials, no. of inlets and their sizes, drop structures, outlet size. Also needs additional information including catchment area.

6.2.2 Stormwater Drainage

- GPS Locating of stormwater pipes, channels, culverts including description, dimensions, grade.
- Rocking, erosion control and water dissipation to be inspected as per the approved plans.
- 6m subsoil drainage tails to be terminated (grouted) in each pit. Applicable for all lines flowing into the pit.
- Subsoil drainage lines for culverts to be terminated (grouted) in each headwall.
- Swift lift points to be grouted once installed.

6.2.3 Detention Basins

- Three separate Hold Points for each detention basin:
- Pre-works site inspection of post-stripped location. Reviewing set-out, proposed material/s reports and erosion control deployment.
- Post earthworks completion inspection: Survey required for all top of banks and bottom of banks for comparison with approved design plans.
- Final commissioning inspection of site revegetation deployed, supplied level and compaction conformance, and outlet control.

7 ANCILLARY WORKS

7.1 Concrete Driveway/Driveway Entrance

- Driveway to be constructed with approved material.
- Dimension at minimum as per Councils Driveway Specification or approved SWC plans.
- Section 138 approval required for any driveway not part of a rural subdivision.

Concrete:

- Pre-pour inspection of reinforcement, chairs and formwork in accordance with the approved design detail.
- -Black plastic to be used underneath concrete.

7.2 Retaining Walls

- Inspection of footing steel and form prior to concrete pour.
- Post construction inspection for compliance with structural engineer detail approved plans.

7.3 Footpath Inspection

- Pre-pour (formwork, plastic sheet and reinforcement) and post-pour inspections (contraction cuts, expansion jointing and surface finish) and design level and alignment of footpath to be conducted by Council.
- Dimension at minimum as per Councils Footpath Specification or approved SWC plans.
- Jointing requirements for footpath:
 - Contraction joint every 1.5m – 20mm deep groove 12-48 hours after placing concrete.
 - Expansion joint placed every 5 bays and at edges with existing concrete.

7.4 Tree Planting

- Trees to be planted in accordance with the approved tree planting detail and approved locations.
- All trees to be inspected on arrival to site – see standard drawings for tree care.
- Sites for street trees pegged for inspection. Tree backfill material to be discussed at this inspection point.
- Excavations for trees inspected at root barrier placed in fixed location ready to take tree inspection stage.
- Tree placed, backfilled, water pipework in place and mulched inspection.

7.5 Verge Shaping

- Grade of verge to be within 1% of approved design.
- Inspecting officer will determine if the verge is unsafe due to tripping hazards and will provide direction for any required re-shaping or revegetation.

- Verge is to be grassed at $\geq 80\%$. Minimum of first 600mm of grass behind kerb and gutter is to be turfed.

7.6 Electrical, NBN and Gas

- Installed as per requirements from the relevant authority.
- Developer will be responsible for ensuring there is no conflicts between services.
- Conduit to be minimum 600mm deep in residential areas, and minimum 900mm deep in rural areas.

8 DOCUMENT REVIEW

- Works as executed (WAE) plans to be provided to Council for review and approved by Council prior to Practical Completion inspection.
- Final construction costs to be provided to Council for the determination of the 12-month defects bond.

9 PRACTICAL COMPLETION

- Involves final site inspection to assess the completed work in reference to the works as executed drawings. The developer will be notified of any works requiring rectification. If required, a follow-up inspection will be charged to the developer.
- Satisfactory supply of electronic drawings (PDF and SHP files) and final itemized costs forms part of the practical completion review.
- At time of practical completion, site revegetation is to attain $\geq 80\%$ coverage of area that has been stripped.

10 DEFECTS PERIOD (12-MONTHS)

- The developer will be responsible for the erosion and sediment control for any flows leaving the site for the first 12 months.
- Council will conduct 3-monthly inspections to record any damage to the subdivision and formally request any rectification/s as required.
- Developer will be notified following each inspection of any issues to be fixed if required.

APPENDIX A. PIPE LAYING REQUIREMENTS

Table 19.1 MINIMUM COMPACTION OF EMBEDMENT AND TRENCH / EMBANKMENTS / OTHER FILLS

Material type	Test method	Minimum value (%)			
		Trafficable areas		Non-trafficable areas	
		Embedment	Trench/ embankment fill	Embedment	Trench/ embankment fill
Non-cohesive	Density index (I _D) AS 1289.5.6.1	70 (Note 1)	70 (Notes 2,3)	60 (Note 3)	60 (Notes 4, 5)
Cohesive	Dry density ratio (R _D) AS 1289.5.4.1 and AS 1289.5.1.1 (Note 6)	95	95	90	90 (Notes 5,6)

Notes

- (1) Single size coarse aggregates of sizes 7, 10 and 14 mm shall be deemed “self-compacting” and do not require compaction testing when used for pipe embedment (Refer to [16.3.2 Compaction trials / Pre-qualification of embedment compaction method](#)).

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- (2) The road Owner may specify alternative values.
- (3) Degree of compaction of the trench fill in trafficable areas depends on:
- (a) the backfill zone – higher degree of compaction is required in the zones closer to the surface; and
 - (b) the road type – freeways and arterial roads carrying greater loads require higher degrees of compaction.
- (4) The value given is a default where excessive initial surface settlement is not permitted. Specification of an alternative degree of compaction of the trench fill in non-trafficable areas depends on the site requirements.
- (5) Compaction shall be to the degree specified in the project Specification or the default value in [Table 19.1](#) if not specified.
- (6) Graded gravels and sands having fines (silts and clays) greater than 5% have their compaction determined by dry density ratio.

**Table 21.1 FLEXIBLE PIPES – MINIMUM COMPACTION EMBEDMENT,
TRENCH FILL AND EMBANKMENT OF FLEXIBLE PIPES**

Material type	Test method	Minimum value (%)			
		Trafficable areas		Non-trafficable areas	
		Embedment	Trench/ embankment fill	Embedment	Trench/ embankment fill
Cohesionless	Density index (ID) AS 1289.5.6.1	70 ¹	70 ^{2,3}	60 ³	60 ^{4,5}
Cohesive	Dry Density Ratio or Hilf density (RD) AS 1289.5.4.1 and AS 1289.5.1.1 ⁶	95	95	90	90 ^{5,6}

Notes

- (1) Single size coarse aggregates of sizes 7, 10 and 14 mm are deemed "self compacting" and do not require compaction testing when used for pipe **embedment** (Refer to [19.3.2 Compaction trials / Pre-qualification of embedment compaction method](#)).
- (2) The road **Owner** may specify alternative values.
- (3) Degree of compaction of the trench fill in **trafficable areas** depends on:
 - (a) The **backfill** zone – higher degree of compaction is required in the zones closer to the surface and
 - (b) The road type – freeways and arterial roads carrying greater loads require higher degree of compaction.
- (4) The value given is the default where excessive initial surface settlement is not permitted. **Specification** of alternative degree of compaction of the **trench fill** in non-trafficable areas depends on the site requirements.
- (5) Compaction to be to the degree specified in the **Specification** or the default in [Table 21.2](#).
- (6) Graded gravels and sands having fines (silts and clays) greater than 5% to have their compaction determined by the dry density ratio test method.

Table 21.2 RIGID PIPES – MINIMUM COMPACTION EMBEDMENT, TRENCH FILL AND EMBANKMENT

Material type	Test method	Minimum value (%)			
		Trafficable areas		Non-trafficable areas	
		Embedment	Trench/ embankment fill	Embedment	Trench/ embankment fill
Cohesionless	Density index (ID) AS 1289.5.6.1	60 ¹	70 ^{2,3}	60 ³	60 ^{4,5}
Cohesive	Dry Density Ratio or Hilf density (RD) AS 1289.5.4.1 and AS 1289.5.1.1 ⁶	90	95	90	90 ^{5,6}

Notes

- (1) Single size coarse aggregates of sizes 7, 10 and 14 mm are deemed "self compacting" and do not require compaction testing when used for pipe **embedment** (Refer to [19.3.2 Compaction trials / Pre-qualification of embedment compaction method](#)).
- (2) The road **Owner** may specify alternative values.
- (3) Degree of compaction of the trench fill in **trafficable areas** depends on:
 - (a) The **backfill** zone – higher degree of compaction is required in the zones closer to the surface and
 - (b) The road type – freeways and arterial roads carrying greater loads require higher degree of compaction.
- (4) The value given is the default where excessive initial surface settlement is not permitted. **Specification** of alternative degree of compaction of the **trench fill** in non-trafficable areas depends on the site requirements.
- (5) Compaction to be to the degree specified in the **Specification** or the default in **Table 21.2**.
- (6) Graded gravels and sands having fines (silts and clays) greater than 5% to have their compaction determined by the dry density ratio test method.