

Roads

Master Specification

RD-EW-C2 Trench Excavation and Backfill

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RD-EW-C2 Trench Excavation and Backfill

1 General

- 1.1 This Part specifies the requirements for the excavation, and subsequent backfill of trenches or similar excavations up to the level of the underside of the pavement (or natural surface outside of pavements).
- 1.2 For the purposes of this part, "Trench" includes any excavation constructed for the installation, maintenance or inspection of culverts, drainage structures, cables, conduits, pits and pipes ("Services").
- 1.3 Where the trenching and backfill is for the installation of Utility Services infrastructure, the Contractor must comply with the requirements of the applicable Service Authority in addition to the requirements of this part.
- 1.4 The following documents are referenced in this Part:
 - a) SAPN Technical Standard TS-085.
 - b) AS 2566.2 Buried flexible pipelines - Part 2: Installation.
 - c) Master Specification Part RD-PV-S1 "Supply of Pavement Materials".
 - d) Master Specification Part RD-EW-C6 "Controlled Low Strength Material".
 - e) Pavement Reinstatement Configurations.
 - f) Environmental Protection Act 1993.
 - g) AS/NZS 3678 Structural steel – Hot-rolled plates, floorplate
 - h) AS 5100 Bridge design

2 Removal of Existing Pavement

- 2.1 This clause only applies where excavation takes place in an existing pavement which is to be retained.
- 2.2 The pavement must be saw cut or cold planed prior to excavation. Any additional breakage of the existing pavement edge must be cut out square to the edge of the excavation prior to reinstatement.
- 2.3 All saw cutting must be dampened by water to reduce dust and any resultant slurry must be collected and disposed of in accordance with the requirements of the Environmental Protection Act. The slurry must not enter stormwater drainage systems or dry out on the road surface.
- 2.4 Removal of existing pavements must comply with the following:

Asphalt Surfaced Roads

- 2.5 The trench must be cut or cold planed to the full depth of the existing asphalt surface. Where cement stabilised pavement exists, the pavement must be cut to the full depth, or a minimum cut depth of 200 mm, whichever is the lesser. Note that saw cutting or cold planning in addition to that specified by this clause may be required to meet the requirements of the relevant parts of the Master specification.

Sprayed Bituminous Surfaced Roads

- 2.6 The trench must be saw cut to the full depth of the pavement, or a minimum of 300 mm whichever is the lesser. Longitudinal saw cuts must not be positioned within the wheel path.

3 Excavation

- 3.1 All excavation must be of sufficient width to allow for safe and practical working, including the proper placing and subsequent removal of any formwork, shoring or dewatering systems and for the compaction of the backfill.
- 3.2 The depth of the Trench must be sufficient to achieve the minimum cover of 1.0 m to the Service and the requirements of any applicable Service Authority. This minimum cover does not apply to culverts installed for stormwater, DIT assets (e.g. electrical or telecommunications conduit) and Services installed in unsealed roads.
- 3.3 Where excavation takes place outside of existing pavement, any topsoil present must be stripped and stockpiled to a depth of 100 mm or other depth specified. Unless specified otherwise, any surplus excavated material not used elsewhere in the Works must be removed from the site and disposed of by the Contractor in accordance with the requirements of the Environment Protection Act.

4 Use of Road Plates

- 4.1 Design of road plates must be by one of the following methods:
 - a) Use Table RD-EW-C2 4-2 to determine the road plate thickness, provided that the trench width does not exceed 2.1 m and the other design requirements of this Part are met; or
 - b) Provide a site-specific structural design for the road plates.
- 4.2 Unless otherwise approved:
 - a) Each road plate must be rectangular in plan;
 - b) Plates must be aligned parallel to the line of the trench;
 - c) Plate joints must be located to avoid the wheel paths, where feasible;
 - d) The gap between adjoining plates must not exceed 5 mm;
 - e) Plates must be unstiffened structural steel plate of minimum Grade 250 to AS 3678;
 - f) Plate surfaces must not be otherwise modified (e.g. by use of chequer plates or mesh welded to the plate); and
 - g) Plates must be clearly identified by permanent marks on the uncoated underside or edge of the plate, indicating:
 - i) a serial number provided by the road plate owner, to identify the individual plate, the year and details of its manufacture, and its service history;
 - ii) the steel grade; and
 - iii) the mass of the plate (in kg).
- 4.3 A Site-specific structural design of a road plate must:
 - a) specify the main parameters, including:
 - i) trench width, plate clear span and plate length (in the span direction, i.e. at right angles to line of trench);
 - ii) plate width (at right angles to the span direction);
 - iii) plate thickness and steel grade;
 - iv) number, location and type of fixings per plate; and
 - v) details of holes in plate for fixings, where permitted;
 - b) comply with the following requirements:
 - i) unstiffened steel plates, unless otherwise approved;
 - ii) fully shored trench conditions for the road opening;

- iii) a plate clear span equal to the trench width plus 400 mm to allow for bearing support on each side; and
- iv) design in accordance with AS 5100, using elastic analysis, a limit state stress of first yield and the following live load conditions:
- live loading must be a series of moving 48 kN wheel loads spaced on a repeating 1.2 m square grid (to replicate T44 Truck rear axle group – single or adjacent trucks);
 - each wheel load must be distributed over a contact area of 400 mm × 200 mm, with the 200 mm dimension measured parallel to the direction of traffic;
 - wheel loads must be positioned in the most unfavourable loading position, i.e. along the unsupported edge of plate; and
 - the Live Load Factor (LLF) and Dynamic Load Allowance (DLA) must be as specified in Table RD-EW-C2 4-1.

- 4.4 The thickness of a road plate must be no less than 25 mm and must not exceed 60 mm.
- 4.5 The area of each road plate must be no less than 3.6 m²
- 4.6 The plate length (in the span direction) must exceed the trench width by at least 800 mm.
- 4.7 The length to width ratio of each plate must not exceed 3:1.
- 4.8 Where the trench width exceeds 1.8 m, plate widths in between 1.2 m and 2.2 m are not permitted (to avoid critical load patterns).

Table RD-EW-C2 4-1 Live Load Design Requirements for Road Plates

Road Class	Live Load Factor (LLF)	Dynamic Load Allowance (DLA)
Urban Class 6 Rural Class 1 or 2	1.8	0.6
Urban Class 7 or 8 Rural Class 3 or 4	1.5	0.4

Table RD-EW-C2 4-2 Design Sizes for Road Plates

Trench Width (mm)	Plate Clear Span (Trench Width + 400) (mm)	Minimum Plate Length (Trench Width + 800) (mm)	Minimum Plate Thickness (mm)	
			Urban Class 6 Rural Class 1 or 2	Urban Class 7 or 8 Rural Class 3 or 4
300 or less	700	1100	32	28
450	850	1250	36	28
600	1000	1400	36	32
900	1300	1700	40	36
1200	1600	2000	45	40
1500	1900	2300	50	45
1800	2200	2600	55	55
2100	2500	2900	60	60
> 2100	Site-specific structural design required			

- 4.9 Road plates must meet the following serviceability design requirements under live loads:
- a) The live load deflection must not exceed 11 mm or Plate Clear Span/150, whichever is the lesser.
 - b) Plates must not lift off their bearing supports at any point.
- 4.10 For road openings parallel to the direction of traffic, road plates must extend past each end of the excavated trench:
- a) by a dimension not less than the trench depth; and
 - b) with the same bearing support conditions as for the trench (i.e. by extension of bedding strips).

- 4.11 To prevent edge loading of the trench, provide uniform bearing support conditions under road plates, along all supported sides, to meet the following requirements:
- a) Plates must overlap the adjacent pavement by a minimum 400 mm from the edge of the (shored) trench on each side.
 - b) A 200 mm wide strip of bedding material (consisting of a premium grade proprietary bituminous cold mix) must be provided under each supported side, with the edge of the strip at least 100 mm from the edge of the trench.
 - c) The bedding layer thickness must:
 - i) be uniform, with an average thickness of not less than 5 mm and not more than 10 mm; and
 - ii) ensure that no contact occurs between the plate and the pavement along each edge of the trench under vehicular traffic loading.
- 4.12 The Contractor must ensure that:
- a) the surface of the plate does not create a skidding hazard to motorists;
 - b) a speed restriction of 60 km/h or less is imposed on the section of road where a steel plate is situated;
 - c) there is a smooth transition for traffic from the road surface onto the steel plate by the use of a temporary ramp constructed using a premium grade proprietary bituminous cold mix;
 - d) the plate is treated with an approved anti-skid compound (the use of checker plate or plain steel alone is insufficient); and
 - e) the plate is restrained, pinned or anchored to reduce impact noises caused by vehicular traffic.
 - f) the plates are flat and straight within a tolerance of ± 5 mm at any point from a true, straight and level position
 - g) the plates are inspected daily when in use
 - h) the plates are tested in place with typical heavy vehicle loads before opening to traffic
 - i) the plates are stable and not rock or lift off under vehicular loading
 - j) the plates do not deform by more than 10 mm from a true, straight and level position. Plates failing this requirement must be removed from service and replaced. Such plates must not be turned over and re-used.
- 4.13 Approved anti-skid compounds are listed in the DIT Approved Products List, available from: https://dit.sa.gov.au/contractor_documents/masterspecifications are approved for use on steel plates. The Contractor may submit a request for the approval of additional anti-skid products.
- 4.14 The anti-skid compound must be maintained in good order. The skid resistance must exceed 0.5 GN when tested in accordance with DIT Test Procedure: TP344 "Determination of Skid Resistance with the GripTester", available from: https://dit.sa.gov.au/contractor_documents/masterspecifications

General

- 4.15 This clause applies to the backfill of Trenches and to the placement of backfill against Services not in excavation. Prior to, and during backfill operations, all loose rubbish and foreign material must be removed from the Trench. All voids excavated and not occupied by permanent work must be backfilled.
- 4.16 Warning tape which has been specified or is a requirement of a Utility Service Authority must be inserted at the depth specified.

Backfill Material

- 4.17 Where Utility Services infrastructure is being installed, backfill material must comply with the requirements of the applicable Service Authority (for SA Power Network conduits, refer to Clause 15 of SAPN Technical Standard TS-085).

- 4.18 For other Services, backfill material must be either Sa-C Type C Sand in accordance with RD-PV-S1 “Supply of Pavement Materials” or Controlled Low Strength Material (CLSM) in accordance with RD-EW-C4 “Controlled Low Strength Material”.
- 4.19 Excavated material must not be reused for backfill of Trenches below areas of pavement.

Extent of Backfill

Services Installed in Trenches

- 4.20 Below pavement, the backfill material must extend to the underside of the reinstated pavement.
- 4.21 In verges and roadsides (i.e. outside of the pavement area), the backfill material must extend to a level at least 300 mm above the top of the Service after compaction. Unless specified otherwise, excavated material may be used above this level.

Services Installed Within Fill Locations

- 4.22 Backfill material must be placed to a level at least 300 mm above the top of the Service after compaction.

Placement of CLSM Backfill

- 4.23 If CLSM is used, it must be placed in accordance with Appendix K “Controlled Low Strength Materials—CLSM” of AS 2566.2.

Placement of Sand Backfill

- 4.24 Sand backfill must be compacted alternately on each side of the Service. Backfill must not be placed against any cast-in-place concrete within 48 hours of the placing of concrete. Flooding of sand with water is, by itself, not an acceptable method of compaction.

Backfill against Drainage Structures

- 4.25 Backfill placed against drainage structures must:
- be free draining material in locations where it is necessary to prevent the build-up of hydrostatic pressures;
 - develop sufficient strength to ensure it is stable and does not undergo post construction settlement;
 - where backfill is to be placed on both sides of wing walls or retaining walls, the backfill must be brought up level with a maximum height differential of 300 mm;
 - not be placed against concrete which is less than 48 hours old; and
 - not be placed against wing walls or retaining walls until all cast in place concrete has reached the 28 day characteristic compressive strength and is at least 14 days old.

Compaction of Backfill

- 4.26 Unless specified otherwise, the backfilling must be uniformly compacted in horizontal layers not exceeding 200 mm (loose) thickness.
- 4.27 Compaction and the compaction test frequency must comply with Table RD-EW-C2 4-3.
- 4.28 AS 1289, test method 5.2.1 (modified compaction) must be used to determine the Dry Density Ratio.

Table RD-EW-C2 4-3 Compaction

	Minimum Backfill Compaction (Dry Density Ratio – % modified)		
	Below Sealed Pavement	Below Unsealed Pavement and Shoulder	Outside of areas of Pavement
Between 800 mm below finished surface and the underside of pavement	95	95	90
More than 800 mm below finished surface	92	92	90
Minimum Compaction Test Frequency			
Small box culverts and stormwater pipes 1 m or less in diameter:	1 test per 5 m ³ or part thereof		
Large box culverts and stormwater pipes over 1 m in diameter:	1 test per 10 m ³ or part thereof		
All other Services:	1 test per 10 m ³ or part thereof unless an approved compaction methodology has been implemented		

4.29 A minimum of 3 compaction tests must be carried out.

4.30 Submission of test results shall constitute a **Hold Point**.

5 Hold Points

5.1 The following is a summary of Hold Points referenced in this Part:

Document Ref.	Hold point	Response time
4.30	Submission of test results	10 Working Days

6 Verification Requirements and Records

The Contractor must supply the following records:

Table RD-EW-C2 6-1 Verification Requirements

Document Ref.	Subject	Record to be provided
4.29	Compaction testing	Test results specified in Table RD-EW-C2 4-3.