

Master Specification

Part RD-EW-C2

Trench Excavation and Backfill

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RD-EW-C2 Trench Excavation and Backfill

1 General

- a) This Master Specification Part specifies the requirements for Trench excavation and backfill, including 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), including:
 - i) the documentation requirements, as set out in section 2;
 - ii) the removal of existing pavement requirements, as set out in section 3;
 - iii) the excavation requirements, as set out in section 4;
 - iv) the use of road plate requirements, as set out in section 5;
 - v) the backfill requirements, as set out in section 6;
 - vi) the compaction of backfill requirements, as set out in section 7;
 - vii) the embedment zone requirements, as set out in section 8;
 - viii) the Hold Point requirements, as set out in section 9; and
 - ix) the verification requirements and records, as set out in section 10.
- b) For the purposes of this Master Specification Part, a reference to:
 - i) “Services” means culverts, drainage structures, cables, conduits, pits, and pipes; and
 - ii) a “Trench” includes any excavation constructed for the installation, maintenance, or inspection of Services.
- c) Where the Trench excavation and backfill is for the installation of Utility Service infrastructure, the Contractor must comply with the requirements of the applicable Utility Service Authority.
- d) Trench excavation and backfill must comply with the Reference Documents, including:
 - i) AS 1289 Methods of testing soils for engineering purposes;
 - ii) AS 1742.3 Manual of uniform traffic control devices, Part 3: Traffic control for works on roads;
 - iii) AS/NZS 2566.2 Buried flexible pipelines, Part 2: Installation;
 - iv) AS 5100 Bridge design;
 - v) AS/NZS 3678 Structural steel - Hot-rolled plates, floorplate and slabs;
 - vi) Department Pavement Reinstatement Manual (available from: <https://dit.sa.gov.au/standards/manuals>);
 - vii) Department Test Procedure TP344 Determination of Skid Resistance with the GripTester (available from: https://dit.sa.gov.au/standards/test_procedures);
 - viii) Department Field Guide Traffic Control Devices for Workzone Traffic Management (available from: https://dit.sa.gov.au/standards/standards_and_guidelines);
 - ix) Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices, Part 2 - Code of Technical Requirements (available from: https://dit.sa.gov.au/standards/standards_and_guidelines); and
 - x) SA Standards for Workzone Traffic Management (available from: https://dit.sa.gov.au/standards/standards_and_guidelines).
- e) Trench excavation and backfill must comply with:
 - i) all applicable Laws including the *Environmental Protection Act 1993* (SA); and

- ii) the requirements of PC-US1 "Utility Services".
- f) Where Services are to be installed:
 - i) longitudinally under an existing road pavement, the use of under-road boring in preference to the excavation and reinstatement of Trenches is encouraged; and
 - ii) transversely under an existing road pavement, the Contractor must use under-road boring to install the Services,and any boring must be carried out in accordance with RD-EW-C3 "Boring".

2 Documentation

2.1 Construction Documentation

In addition to the requirements of PC-CN3 "Construction Management", where a site-specific structural design for road plates is conducted in accordance with section 5c), the Construction Documentation must include a road plate structural design report in accordance with the requirements of section 5d).

2.2 Quality Management Records

In addition to the requirements of PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable), the Quality Management Records must include the verification records required by Table RD-EW-C2 10-1.

3 Removal of existing pavement

3.1 General

Where excavation takes place within existing sealed pavement which is to be retained:

- a) the pavement must be saw cut or cold planed prior to excavation;
- b) any additional breakage of the existing pavement edge must be cut out square to the edge of the excavation prior to reinstatement;
- c) 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 all applicable Laws including the *Environmental Protection Act 1993* (SA). The slurry must not enter stormwater drainage systems or dry out on the road surface;
- d) removal of existing pavements associated with Trench excavation must comply with the following requirements:
 - i) for asphalt surfaced roads:
 - A. the Trench must be saw cut or cold planed to the full depth of the existing asphalt surface in accordance with the requirements of the Contract Documents;
 - B. where cement stabilised pavement exists, the pavement must be cut to the lesser of the full depth, or a minimum cut depth of 200 mm; and
 - C. saw cutting or cold planning in addition to that specified by this section 3.1d)i) may be required to meet the requirements of the relevant parts of the Master Specification;
 - ii) for sprayed bituminous surfaced roads, the Trench must be saw cut to the lesser of the full depth of the pavement, or a minimum cut depth of 300 mm; and
 - iii) in relation to reinstatement:

- A. where removal of existing pavement is undertaken, reinstatement of the pavement must be carried out; and
 - B. pavement reinstatement must be undertaken in accordance with the Department Pavement Reinstatement Manual and the Contract Documents, including RD-PV-C6 "Reinstatement of Existing Pavements"; and
- e) longitudinal saw cuts must not be positioned in the wheelpath.

4 Excavation

- a) All excavation must be of sufficient width to allow for safe and practical works to take place, including the proper placing and subsequent removal of any formwork, shoring or dewatering systems and for the compaction of the backfill.
- b) The depth of the excavated Trench must be sufficient to achieve:
 - i) subject to section 4c), a minimum cover of 1.0 m to any Service; and
 - ii) the requirements of any applicable Utility Service Authority.
- c) The minimum cover requirements of section 4b)i) do not apply to:
 - i) culverts installed for stormwater;
 - ii) Department assets (such as electrical or telecommunications conduits); or
 - iii) Services installed in unsealed roads.
- d) Where excavation takes place outside of existing pavement, any topsoil present must be stripped to a depth of 100 mm and stockpiled for subsequent respreading.
- e) Any surplus excavated material not reused in the Works must be removed from the Site and disposed of by the Contractor in accordance with the requirements of the Contract Documents, including all applicable Laws.

5 Use of road plates

- a) The design of road plates used for Trench excavation must:
 - i) where the Trench width does not exceed 2.1 m and the requirements of this Master Specification Part are met, adopt a road plate thickness in accordance with Table RD-EW-C2 5-2; or
 - ii) adopt a site-specific structural design prepared in accordance with the requirements of section 5d).
- b) The Contractor must ensure that:
 - i) road plates are suitable for the job intended;
 - ii) road plates are rectangular in plan;
 - iii) road plates are aligned parallel to the line of the Trench;
 - iv) road plate joints are located to avoid the wheel paths where feasible;
 - v) the gap between adjoining road plates does not exceed 5 mm;
 - vi) road plates are unstiffened structural steel plate of minimum Grade 250 in accordance with AS/NZS 3678 Structural steel - Hot-rolled plates, floorplate and slabs;
 - vii) road plate surfaces are not otherwise modified (including by use of chequer plates or mesh welded to the plate);
 - viii) road plates are clearly identified by permanent marks on the uncoated underside or edge of the plate, indicating:

- A. 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;
 - B. the steel grade; and
 - C. the mass of the plate in kg;
- ix) the thickness of each road plate is no less than 25 mm and does not exceed 60 mm;
 - x) the area of each road plate is no less than 3.6 m²;
 - xi) the road plate length (in the span direction) exceeds the Trench width by at least 800 mm;
 - xii) the length to width ratio of each road plate does not exceed 3:1;
 - xiii) where the Trench width exceeds 1.8 m, road plate widths between 1.2 m and 2.2 m are not used (to avoid critical load patterns);
 - xiv) the surface of the plate does not create a skidding hazard to motorists;
 - xv) a speed restriction of 60 km/h or less (in accordance with the Contractor's risk assessment) is imposed on the section of road where a road plate is situated;
 - xvi) a smooth transition for traffic from the road surface onto the road plate must be provided by the use of a temporary ramp constructed using a premium grade proprietary bituminous cold mix;
 - xvii) temporary ramps must comply with the requirements of section 10.5 "Raised Pavements" of the Manual of Legal Responsibilities and Technical Requirements for Traffic Control Devices, Part 2 Code of Technical Requirements;
 - xviii) the road plate is treated with an anti-skid compound (the use of checker plate or plain steel alone is insufficient), which:
 - A. is in accordance with the Department Approved Products List;
 - B. is maintained in good working order; and
 - C. exceeds 0.5 GN when tested in accordance with Department Test Procedure TP344 Determination of Skid Resistance with the GripTester;
 - xix) the road plate is restrained, pinned or anchored to eliminate movement under trafficking and reduce impact noises caused by vehicular traffic;
 - xx) the road plates are flat and straight, within a tolerance of ± 5 mm at any point from a true, straight and level position;
 - xxi) the road plates are inspected daily when in use;
 - xxii) the road plates are tested in place with typical heavy vehicle loads before opening to traffic;
 - xxiii) the road plates are stable and not rock or lift off under vehicular loading; and
 - xxiv) where the road plates deform by more than 10 mm from a true, straight and level position, they are immediately removed, replaced, and are not turned over and re-used.
- c) Site-specific structural design for road plates must:
- i) use unstiffened steel plates;
 - ii) use fully shored Trench conditions for the road opening;
 - iii) adopt a plate clear span equal to the Trench width plus 400 mm to allow for bearing support on each side; and
 - iv) be conducted in accordance with AS 5100 Bridge design, using elastic analysis, a limit state stress of first yield and the following live load conditions:

- A. 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);
 - B. 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;
 - C. wheel loads must be positioned in the most unfavourable loading position, such as along the unsupported edge of plate; and
 - D. the live load factor and dynamic load allowance must be as specified in Table RD-EW-C2 5-1.
- d) Where a site-specific structural design for road plates is conducted in accordance with section 5c), the Contractor must submit a road plate structural design report as part of the Construction Documentation, which must include the following information:
- 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.
- e) Road plates must meet the following serviceability design requirements under live loads:
- i) the live load deflection must not exceed (the lesser of):
 - A. 11 mm; or
 - B. plate clear span/150; and
 - ii) road plates must not lift off their bearing supports at any point.
- f) For road openings parallel to the direction of traffic, road plates must extend past each end of the excavated Trench:
- i) by a dimension not less than the Trench depth; and
 - ii) with the same bearing support conditions as for the Trench (such as by extension of bedding strips).
- g) To prevent edge loading of the Trench, the Contractor must provide uniform bearing support conditions under road plates, along all supported sides, to meet the following requirements:
- i) road plates must overlap the adjacent pavement by a minimum 400 mm from the edge of the (shored) Trench on each side;
 - ii) 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; and
 - iii) the bedding layer thickness must:
 - A. be uniform, with an average thickness of not less than 5 mm and not more than 10 mm; and
 - B. ensure that no contact occurs between the plate and the pavement along each edge of the Trench under vehicular traffic loading.
- h) Prior to the installation of road plates, the Contractor must give due consideration to seeking advice from a suitable professional, such as a structural engineer, to assess whether the proposed road plate(s) are suitable for the job intended.

- i) The Contractor must provide appropriate signage to alert road users to the presence of road plates, in accordance with the relevant approved WTMP, the SA Standards for Workzone Traffic, and AS 1742.3 Manual of uniform traffic control devices, Part 3: Traffic control for works on roads.

Table RD-EW-C2 5-1 Live load design requirements for road plates

Road class	Live load factor	Dynamic load allowance
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 5-2 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)	
			Road class	
			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
1,200	1600	2000	45	40
1,500	1900	2300	50	45
1,800	2200	2600	55	55
2,100	2500	2900	60	60

6 Backfill

6.1 General

- This section 6 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 suitably backfilled.
- Warning tape which has been specified or is a requirement of a Utility Service Authority must be inserted at the depth specified.
- Where Utility Service infrastructure is being installed, backfill must comply with the requirements of the applicable Utility Service Authority.

6.2 Backfill material

- For other services that are not Utility Services (or where the Utility Service Authority does not have specific requirements), backfill material must be either:
 - Sa-C Type C Sand in accordance with RD-PV-S1 "Supply of Pavement Materials"; or
 - CLSM in accordance with RD-EW-C4 "Controlled Low Strength Material".
- Where the Contractor proposes to reuse excavated material for backfill of Trenches below areas of pavement, evidence of the suitability of the material for reuse must be provided, which will constitute a **Hold Point**. The reuse of the excavated material for backfill must not occur until the Hold Point has been released.

6.3 Extent of backfill

- a) For Services installed in Trenches:
 - i) below pavement, the backfill material must extend to the underside of the reinstated pavement; and
 - ii) in verges and roadsides (outside of the pavement area, which includes the sealed carriageway and the unsealed shoulder), the backfill material must extend to a level at least 300 mm above the top of the Service after compaction. Excavated material may be used above this level.
- b) For Services installed within fill locations, backfill material must be placed to a level at least 300 mm above the top of the service after compaction.

6.4 Placement of CLSM backfill

If CLSM is used, it must be placed in accordance with the requirements of RD-EW-C4 "Controlled Low Strength Material".

6.5 Placement of sand backfill

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

6.6 Backfill against drainage structures

Backfill placed against drainage structures must:

- a) be free draining material in locations where it is necessary to prevent the build-up of hydrostatic pressures;
- b) be of sufficient strength to ensure it is stable and does not undergo post construction settlement;
- c) 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;
- d) not be placed against concrete which is less than 48 hours old; and
- e) 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.

7 Compaction of backfill

- a) Where Utility Service infrastructure is being installed, compaction of backfill must comply with the requirements of the applicable Utility Service Authority.
- b) Backfill (including backfill placed within the embedment zone) must be placed in horizontal layers not exceeding 200 mm (loose) thickness and uniformly compacted in horizontal layers.
- c) The method of compaction and the compaction test frequency must comply with Table RD-EW-C2 7-1 or where applicable, the requirements of the relevant Utility Service Authority.
- d) The dry density ratio of the backfill must be determined using:
 - i) method 5.2.1 of AS 1289.5.2.1, Methods of testing soils for engineering purposes — Soil compaction and density tests — Determination of the dry density/moisture content relation of a soil using modified compactive effort; and

- ii) AS 1289.5.4.1 Methods of testing soils for engineering purposes — Soil compaction and density tests — Compaction control test — Dry density ratio, moisture variation and moisture ratio.
- e) A minimum of 3 backfill compaction tests must be carried out, and the results must be submitted as part of the Quality Management Records.
- f) Results of the backfill compaction tests required by section 7e) must be submitted within 10 Business Days of testing and will constitute a **Hold Point**. Pavement construction must not continue until the Hold Point has been released.

Table RD-EW-C2 7-1 Compaction

Location	Minimum backfill compaction (dry density ratio - % modified)		
	Below sealed pavement	Below unsealed pavement	Outside of areas of pavement
Between 800 mm below finished surface and the underside of pavement	95	92	90
More than 800 mm below finished surface	92	92	90
Service type	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		

8 Embedment zone

8.1 General

- a) The requirements of this section 8 apply to the embedment zone of Trenches.
- b) Prior to, and during placement of embedment zone layers, all loose rubbish and foreign material must be removed from the Trench.
- c) The embedment zone must extend from the base of the Trench to 100 mm above the Services.

8.2 Embedment zone fill material

- a) Where Utility Services infrastructure is being installed, embedment zone fill material must comply with the requirements of the applicable Utility Service Authority.
- b) For other services that are not Utility Services (or where the Utility Service Authority does not have specific requirements), embedment zone fill material must be either Sa A Type A sand in accordance with RD-PV-S1 "Supply of Pavement Materials".
- c) Excavated material must not be reused for fill in the embedment zone of Trenches.
- d) Embedment zone material fill must be compacted in lifts not exceeding the thicknesses specified in section 7 and must be placed and compacted alternately on each side of the Service.
- e) Compaction requirements specified in section 7 do not apply to the embedment zone.
- f) Embedment zone fill must not be placed against any cast-in-place concrete within 48 hours of the placing of concrete.

9 Hold Points

Table RD-EW-C2 9-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

Table RD-EW-C2 9-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
6.2b)	Evidence of the suitability of the excavated material for reuse for backfill of Trenches below areas of pavement	Documentation	10 Business Days review
7f)	Submission of test results	Documentation	10 Business Days review

10 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-EW-C2 10-1 have been complied with.

Table RD-EW-C2 10-1 Verification requirements

Section reference	Subject	Record to be provided
7e)	Backfill compaction testing	Test results in accordance with Table RD-EW-C2 7-1.