# Brisbane Infrastructure Division

# Reference Specifications for Engineering Work

# S145 Installation and Maintenance of Utility Services

## Amendment Register

|  |  |  |  |
| --- | --- | --- | --- |
| Ed/Rev Number | Section Number | Description | Date |
| 1.0 |  | Original issue.Sections moved from Reference Specification for Civil Engineering Works S140 Earthworks | Apr 2014 |
| 2.0 | General | External References Updated and Corrected | May 2016 |
| 1.4 and 1.5 | Reference list expanded to show all referenced documents |
| 3.0 | General | Document name changed from ‘*Reference Specifications for Civil Engineering Work*’ to ‘*Reference Specifications for Engineering Work*’ | May 2020 |
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| 1.4 | Australian Standards references updated. |
| 1.6 | ‘Major roads’ and ‘Minor roads’ definitions updated and ‘Primary freight routes and primary freight access’ definitions updated. |
| 5.0 | Root barrier specification updated, proprietary product reference removed. |
| Primary freight routes and primary freight access added to Table 5.1 |
| 6.0 | New Sub-section 6.2 *REDUNDANT CONDUITS, PITS, SERVICES AND OTHER ASSETS* added to Section *6.0 UTILITY SERVICE INSTALLATION*. |
| 8.0 | Nominal stone size for Type 3 asphalt mixed updated. |
| 9.4 | ‘Village Precinct Projects’ included in specialist areas. |
| Primary freight routes and primary freight access added to Table 9.1 |
| 10.0 | Restoration requirements for private verge gardens added. |

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## GENERAL

### SCOPE

This specification applies to the installation and maintenance of utility services. These services may be installed as part of new construction projects or across or along existing assets owned by Brisbane City Council. These assets may include road carriageways, footpaths, and bikepaths within the road reserves or within other Council controlled land such as parks.

### INSTALLATION TECHNIQUES – NEW CONSTRUCTION PROJECTS

Installation of services as part of new construction projects are to be undertaken prior to constructing pavements, footpaths, bikepaths and the like. Should this not occur, the service shall be installed using trenchless technology methods for all categories of roads.

### INSTALLATION TECHNIQUES – EXISTING COUNCIL ASSETS

The following options, listed in preference order, are available where it is necessary to place underground services beneath existing assets such as the road pavement:

* Trenchless technology methods;
* Utilise existing conduits/culverts; or
* Trench excavation and reinstatement.

**Trenchless technology methods**

Where underground services are to be placed beneath all existing District, Suburban, Industrial Access and Arterial Roads and any existing conduits or culverts cannot be used, trenchless technology methods shall be used unless otherwise approved in writing by Council. Trenchless technology methods may also be used to cross all other categories of existing Council roads.

Based on a total life cycle, the cost of trenchless technology methods can often be less than that for trench excavation and reinstatement.

**Using existing conduits or culverts**

Where services can be installed in existing Council owned conduits or culverts, Council approval must be obtained prior to any installation being undertaken. Generally culverts should not be used for permanent installations as these interfere with water flow.

Culverts should only be used for temporary situations where there is little risk to the road integrity.

**Trench excavation and reinstatement**

Where services are installed across or along existing assets owned by Brisbane City Council, reinstatement of the trench backfill, pavement and surfacing layers shall be undertaken in accordance with this specification.

### Standards

|  |  |  |
| --- | --- | --- |
| Australian Standard | AS 289.5.1.1 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using standard compactive effort |
| Australian Standard | 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 |
| Australian Standard | AS 1289.5.3.1 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the field density of a soil – Sand replacement method using a sand-cone pouring apparatus |
| Australian Standard | AS 1289.5.3.5 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the field dry density of a soil – Water replacement method |
| Australian Standard | 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 |
| Australian Standard | AS 289.5.6.1 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Compaction control test – Density index method for a cohesionless material |
| Australian Standard | AS 1289.5.8.1 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of field density and field moisture content of a soil using a nuclear surface moisture–Density gauge – Direct transmission mode |
| Australian Standard | AS 1289.5.8.4 | Methods of testing soils for engineering purposes – Soil compaction and density tests – Nuclear surface moisture-density gauges – Calibration using standard blocks |
| Australian Standard | AS 1379 | Specification and supply of concrete |
| Australian/New Zealand Standard | AS/NZS 1477 | PVC pipes and fittings for pressure applications |
| Australian/New Zealand Standard | AS/NZS 2032 | Installation of PVC pipe systems |
| Australian/New Zealand Standard | AS/NZS 2033 | Installation of polyethylene pipe systems |
| Australian/New Zealand Standard | AS/NZS 2053 | Conduits and fittings for electrical installations – General requirements |
| Australian/New Zealand Standard | AS/NZS 2648 | Underground marking tape – Non-detectable tape |
| Australian Standard | AS 3706.4 | Geotextiles - Methods of test – Determination of burst strength – California Bearing Ratio (CBR) – Plunger method |
| Australian/New Zealand Standard | AS/NZS 4130 | Polyethylene (PE) pipes for pressure applications |
| ASTM International Standard | ASTM D412 | Tensile strength properties of rubber and elastomers |

## References

|  |  |  |  |
| --- | --- | --- | --- |
| Queensland Department of Transport and Main Roads |  | MUTCD | Queensland Manual or Uniform Traffic Control Devices |
| Queensland Department of Transport and Main Roads | Technical Specification | MRTS05 | Unbound Pavements |

Refer to the following other Reference Specifications for Engineering Works:

|  |  |
| --- | --- |
| S110 | General Requirements |
| S120 | Quality |
| S140 | Earthworks |
| S160 | Drainage |
| S200 | Concrete Work |
| S300 | Quarry Products |
| S310 | Supply of Dense Graded Asphalt |
| S320 | Laying of Asphalt |
| S330 | Sprayed Bituminous Surfacing |

### Definitions

Major roads: Arterial roads, Suburban roads, District roads, Primary freight routes, Primary freight accesses as defined in the *Infrastructure design planning scheme policy*, and as shown in the *Road hierarchy overlay*, of [*Brisbane City Plan 2014*](http://eplan.brisbane.qld.gov.au/).

Primary freight routes, Primary freight accesses: Primary freight routes, Primary freight accesses as defined in the *Infrastructure design planning scheme policy*, and as shown in the *Road hierarchy overlay*, of [*Brisbane City Plan 2014*](http://eplan.brisbane.qld.gov.au/). Design standards relating to the installation and maintenance of utility services are as those for Major roads.

Minor roads: Neighbourhood roads, Local roads and Laneways as defined in the *Infrastructure design planning scheme policy*, and as shown in the *Road hierarchy overlay*, of [*Brisbane City Plan 2014*](http://eplan.brisbane.qld.gov.au/).

Non-rippable material: As defined for confined excavation in *Clause* *7.8* of *Reference Specification S140 Earthworks*.

Subgrade: The prepared formation on which a pavement or slab is constructed or the top portion of earthworks immediately below the pavement or slab. Subgrade is considered to be the top 150 mm in cuttings and the top 300 mm in embankment unless stated otherwise.

Relative compaction: The ratio between the field bulk density and the bulk density of the material when compacted in the laboratory.

### Measurement

General

If provisional quantities are specified, or there have been variations to the designed dimensions of excavations, do not commence backfilling until the quantities of excavation and backfilling have been agreed and recorded.

Measurement of non-rippable material

If payment is to be claimed for excavation in non-rippable material, do not remove the material until the level and (if applicable) class of material have been determined.

## QUALITY

### Inspection

Witness points

*Refer annexure*. Give sufficient notice so that inspection may be made of the following stages:

* Trenches excavated before laying the service or drain.
* Services or drains laid in trenches and ready for backfilling.
* Any boring or jacking operation.
* Service conduits ready for testing.

### Conduit Testing

Time: Test all conduits after completion of subgrade preparation or trench backfilling and before commencement of pavement construction.

Test: Conduits must be tested by easily passing a mandrel at least 80% of the conduit’s nominal internal diameter through the conduit.

### Compaction Testing Requirements

**General**

Compaction testing is not required for isolated patches less than 2 m2 in size. Patches are usually associated with the installation of service connections or carrying out repair work. Patches are typically characterised by width to length ratios less than two.

Trench backfill to subgrade level

Maximum dry density: Standard compactive effort to *AS 1289.5.1.1*.

Field dry density: To *AS 1289.5.3.1*, *AS 1289.5.3.5* or *AS 1289.5.8.1*.

Density index for cohesionless soils: Determine in accordance with *AS 1289.5.6.1*.

Test frequency: 1 field density test per 2 layers for every 40 linear metres of trench or for the part thereof.

Unbound pavement

Maximum dry density: Modified compactive effort in accordance with *AS 1289.5.2.1*.

Field dry density: To *AS* *1289.5.3.1*, *AS* *1289.5.3.5* or *AS 1289.5.8.1*.

Test frequency: 1 in-situ density test per single compacted layer of work for every 40 linear metres of trench or for the part thereof.

Asphalt

Test frequency: 1 density test per single compacted layer of work for every 40 linear metres of trench or for the part thereof.

Concrete

Concrete supply: Supply concrete that is subject to production assessment by the supplier in accordance with *AS 1379*.

Slump: Test at least one sample from each batch before placing concrete from that batch in the work. Take the samples at the point of discharge on site.

### CCTV Inspection

**Existing enclosed stormwater drains**

Where the new trench or service passes an existing stormwater pipe (either vertically or horizontally) within a distance equal to diameter of the existing stormwater pipe or 0.5m, whichever is greater, pipe surveys are required to determine the condition of existing enclosed stormwater drains at the pre- and post-construction stages. The applicant must submit both a hardcopy report and a video display of the pre- and post-construction closed circuit television camera (CCTV) inspections.

The CCTV inspection report and video must be viewed and accepted by a suitably qualified Registered Professional Engineer, Queensland (RPEQ) prior to submission to Council. Any additional defects should be identified, and remedial measures recommended by the RPEQ. Remedial measures for all additional defects must be submitted to Council for approval. Once the remedial measures have been completed, a follow up survey is required to demonstrate that they have been carried out to Council’s satisfaction.

**New enclosed stormwater drains**

Undertake closed circuit television camera (CCTV) inspection of new enclosed stormwater drains to demonstrate that the pipes have not sustained any premature cracking during installation.

## Site management

### Traffic Control

General: Traffic control shall be undertaken in accordance with the approved Traffic Management Plans and Permits.

Method: Provide for traffic while undertaking the works in accordance with the requirements of *Manual of Uniform Traffic Control Devices (Queensland), Part 3: Works on Roads*.

### Temporary Surfacing

All roads, footways, bikeways and other accessible areas must be made safe for the passage of vehicle and pedestrian traffic before the area is opened to traffic, either temporarily or permanently.

All surfaces opened to vehicles or pedestrians must be either permanently or temporarily sealed. Reinstatement of the final permanent surface may be delayed while the full length of the service is being installed and until testing is completed. Any temporary restorations must have a level and sealed surface that is flush with the surrounding surface. Use steel plates, turf, cold mix asphalt or hot mix asphalt. It is not acceptable to leave gravel, crusher dust, decomposed granite material (“deco”), any other unbound material or lean mix concrete exposed as the temporary surfacing.

Use of steel plates must comply with *Brisbane City Council Technical Note, TN01 Temporary Access Covers*.

### Barricades

Provide and maintain signs, barricades, lights, trench covers and trench crossovers required for vehicular and pedestrian management until such time as services are installed and the surface reinstated.

Regularly inspect the condition of barricades used around trenches and access points and immediately rectify any deficiencies that present a potential hazard.

### Tree Protection

Comply with the requirements of *Reference Specification* *S140 Earthworks.*

If there is a chance that root systems or canopies of any street trees may be damaged, notify Council’s arboriculture officer and arrange an inspection prior to commencing work.

### Existing Services

Approval: Obtain approval from service owner to undertake excavation in the vicinity of their services.

Marking: Before commencing ground works, locate, mark and identify existing underground services in the areas that will be affected by the earthworks operations. Hand excavation of trial holes may be necessary to determine the alignment and depth of services prior to excavating with machinery.

Protection: Protect existing services from damage during the works.

Completion: Prior to completion of surface reinstatement, remove any temporary marks (eg paint) used to locate, mark and identify underground services.

## trenchless technologies

General

*Refer Annexure.* There are numerous methods available for the installation of underground services without the need to excavate a trench. There is no single trenchless technology method that is best for all types of crossings. Site conditions and constraints as well as the purpose of the crossing must be considered when a method is selected. Trenchless technology methods that may be approved by Council include the following:

* Auger Boring;
* Slurry Boring;
* Micro-tunnelling;
* Horizontal Directional Drilling;
* Pipe Ramming;
* Pipe Jacking; and
* Thrust Boring.

Execution

Undertake boring or jacking by specialist operators with experience in similar works (diameter, length, ground conditions), using purpose-made equipment capable of maintaining correct lines and levels of completed conduits. Ensure a tight fit to the service pipe or casing.

Protective conduits, concrete encasement, ducts or enveloping pipes

Extend protective casing a minimum of one (1) metre beyond batters and table drains and a minimum of 300 mm beyond the rear of existing or proposed kerb. Provide protective casing to all pressurised services (such as high-pressure gas, combustible fluids, water mains and rising sewer mains); any service that conveys potentially hazardous substances which may be damaged during construction or maintenance operations; and in any one of the following instances:

* Where the cover provided is less than minimum requirement.
* Near the footings of a bridge or other structure.
* Near other locations where there may be a hazard.

The protective casing shall be either Class 4 reinforced concrete pipe or steel pipe designed to withstand the pressure in the carrier pipe should it fail.

Cased bore hole: The diameter of the bored hole must not exceed the diameter of the pipe or service by more than 50 mm.

Uncased bore hole: The diameter of the uncased hole under pavements must not exceed 100 mm unless the void surrounding the pipe or service is filled.

Cavities and voids: Fill cavities and voids by pressure grouting. Fill voids between the bored hole and the pipe or service where the diameter of the bored hole exceeds 200mm with non-compressible material. Where required by the service authority, fill voids between the service and the enveloping casing.

## tRENCH technologies

*Refer Annexure.*

Existing surfaces

Saw cutting: Before excavating trenches, saw cut existing concrete and bituminous surfaces to provide a straight even joint during the restoration.

In road carriageway, saw cut to requirements of *Standard Drawing BSD-2042*.

In road verge, footpaths and bikeways, saw cut to requirements of *Standard Drawing BSD-2043*.

Any other locations, saw cut 150 mm clear of the trench walls.

Position saw cut to coincide with any grooved pattern line or contraction joint or expansion joint in concrete paving, if the saw cutting is undertaken within 600 mm of these elements.

Unit paving: Lift and store unit paving for later reinstatement.

Excavation

Alignment: Excavate for underground services to the required lines, levels and grades. Generally make the trenches straight between maintenance access points, inspection points and junctions, with vertical sides and uniform grades.

Timing: In new construction projects, excavate trench before any paving or topsoiling and grassing operations, unless approved otherwise by the Superintendent.

Trench widths

Keep trench widths to the minimum consistent with the laying and bedding of the relevant service, construction of maintenance access points and pits, and compaction of the trench backfill. For drainage trenches, comply with *Standard Drawing BSD-8011*.

Trench depths

Excavate as required to achieve the following minimum cover over the top of the conduit or service, where the service is not placed in a conduit. If the relevant Service Authority specifies minimum cover, ensure that the minimum cover will be maintained during future pavement rehabilitation – allow for 600 mm to be removed on major roads and freight routes and 250 mm on minor roads as part of future pavement rehabilitation.

Table 5.1 – Minimum cover requirements

|  |  |
| --- | --- |
| Location of service | Minimum cover |
| Major Road*(1)* pavements | 1,200 mm |
| Primary Freight Routes and Primary Freight Accesses*(1)* pavements |
| Minor Road*(1)* pavements | 750 mm |
| Road verges, footpaths, bikeways | 600 mm |
| All other areas | 600 mm |

*(1) Refer to Section 1.6 for Definition of Major and Minor Roads and Primary freight routes, Primary freight accesses.*

Support of adjacent construction

Shoring of trench and excavation: Where required, erect and maintain shoring to prevent trench collapse or to provide supports to adjacent structures, sufficient to prevent damage arising from the works.

Lateral supports: Provide lateral support using shoring.

Vertical supports: Provide vertical support where necessary using piling or underpinning or both.

If permanent supports for adjacent structures are necessary and are not described, give notice and obtain instructions.

Obstructions

Remove sharp projections from trenches. Remove other obstructions including stumps and boulders, which may interfere with services or bedding.

Before cutting back roots of street trees encountered in trenches to be clear of services, notify Council’s arboriculture officer.

Where the service trench passes between existing street trees and the road pavement, install a High-Density Polyethylene (HDPE) root barrier to a minimum of 600 mm depth to the tree side of the trench in accordance with *Standard Drawing BSD-9082*. The HDPE root barrier shall have the following characteristics:

* Nominal mass: 750 gm/m2;
* Desirable nominal wall thickness: 1.0 mm;
* Minimum nominal wall thickness: 0.75 mm;
* Nominal Tensile strength (MD to *ASTM D412*): 19 kN/m;
* Nominal Tensile strength (TD to *ASTM D412*): 19 kN/m;
* Burst strength (to *AS 3706.4*): 1100 N

Dewatering

Keep trenches free of water. Place bedding material, services and backfilling on firm ground free of surface water.

Where surrounding material becomes saturated during excavation e.g. emergency repairs to water and sewerage services, remove saturated material surrounding the excavation to expose dry, stable material and replace with trench backfill in accordance with this Specification.

Excess excavation

If trench excavation exceeds the correct depth, ensure that the surface of the native material is uniformly graded (that is free of low spots) and reinstate to the correct depth and bearing value using compacted bedding material or grade N20 concrete.

**Non-rippable Material**

Where the methods of measurement require differentiation of non-rippable material, refer to *Reference Specification* *S140 Earthworks*.

Explosives

Do not use explosives.

## UTILITY service installation

### General

**New Developments**

Locate services within the designated corridors to comply with the relevant *Standard Drawings BSD-1013* and *BSD-1014* or *BSD-1015* and *BSD-1016* where applicable. Provide minimum cover to service as specified in Table 5.1 or as required by the service owner, whichever is greater.

**Existing Developed Areas**

Use the horizontal alignment assigned to that service type at the time that the area was originally developed. Consult with Council to confirm the alignment for that particular service.

When upgrading or replacing existing services, reuse the existing alignment and remove old conduits and equipment where practical.

Services installed across existing pavements are to be perpendicular (90°) to the kerb or shoulder. Services installed along existing pavements are to be parallel to the centreline and are not to be installed directly beneath the normal ‘wheel paths’ of road users. Manhole(s), valve(s) or other surface mounted structures are not to be installed directly beneath the normal ‘wheel paths’ of road users.

### Redundant Conduits, Pits, Services and Other Assets

Where an installation is to replace, abandon or make redundant an existing asset such as a conduit, pit, service or any other asset, this redundant or abanoned asset shall be exhumed from its location and the area restored in accordance with this specification.

**Exceptions**

Where is not practicable to exhume an existing asset due to site constraints such as protected vegetation, adverse topography or ground conditions, or not being located within Council controlled area, the redundant asset shall be:

* Cap/seal both ends;
* Completely filled with a non-compressible, flowable, self-setting material so as to ensure that the redundant service cannot collapse or fail; and
* Ensure that the redundant asset is recorded, and is reportable, on location services such as *Dial Before You Dig*.

#### Redundant Asbestos Material

All redundant asbestos materials are to be either:

* Removed in a safe manner in accordance with current legislation and guidelines; and/or
* Sealed or encapsulated in-situ in a manner so that the material will not be disturbed or accidently accessed by any future works or excavation.

Any asbestos material left in-situ shall be clearly identified and recorded on a location services such as *Dial Before You Dig* and remains the property and responsibility of the original service authority and/or owner. The cost for any future removal and remediation shall be borne by the original service authority and/or owner.

### Marking Services

Temporary markers: Provide clearly labelled 50 mm x 50 mm stakes directly above the ends of each conduit run.

Underground marking tape: Provide buried marking tape to all public utility services in accordance with the requirements of *AS/NZS 2648*.

Brass marker discs: Install brass marker discs embossed with the relevant symbols at the kerb and channel to indicate location of each service or conduit crossings. In location where there is no kerb and channel, construct 225 mm wide x 450 mm long x 75 mm thick grade N25 concrete block, with an indentation for the indicator disc centrally placed on the top face of each block. The concrete block shall be located 500 mm from and with the long edge parallel to sealed edge of the pavement and set flush with the surrounding surface.

### Service Installation

Requirement: Supply and install stormwater pipes and culverts in accordance with *Reference Specification S160 Drainage*. Install pipes and bedding for reticulated pipe network systems (water, sewerage, gas etc), pipes conveying combustible or flammable liquids and communication and electrical cables and conduits in accordance with the requirements of the appropriate service provider. Backfill trenches and reinstate existing Brisbane City Council assets in accordance with this specification.

### Service Conduits

Provide conduits that pass inspections and tests required by the appropriate Service Authority.

Materials

Electricity conduit: Supply conduit to comply with the “Heavy Duty” requirements of *AS/NZS 2053*. Also refer to Energex publication titled *Underground Distribution Construction*.

Gas conduit: Supply conduit to comply with *AS/NZS 4130*.

Water conduit: Supply conduit to comply with *AS/NZS 1477*.

Telecommunications conduit: Supply white uPVC conduit to comply with *AS 1477*. Class PN9 shall be used for 80 mm and 100 mm diameter, and class PN12 for 65 mm and smaller diameters.

Installation

UPVC pipe systems: Conform to the installation requirements of *AS/NZS 2032* except where specified herein.

Polyethylene pipe systems: Conform to the installation requirements of *AS/NZS 2033* except where specified herein.

Bedding material: Bedding sand consisting of clean sharp washed river sand or 5 - 7 mm nominal size screenings (recycled concrete or clean crushed rock) free of salt, clay or organic contaminants. Comply with Table 6.1 for grading requirements. If the relevant Service Authority requires a different form of bedding material, provide that bedding material.

Table 6.1 – Grading of bedding material

| A.S. sieve (mm) | Percentage passing by weight |
| --- | --- |
| Bedding sand | 5 – 7 mm screenings |
| 9.50 |  | 100 |
| 6.70 |  | 85 - 100 |
| 4.75 | 100 | 30 - 85 |
| 2.36 | 80 - 100 | 0 -  30 |
| 1.18 |  | 0 - 5 |
| 0.075 | 0 - 15 |  |

Pipe support: Use identical bedding material for pipe underlay, side support and overlay. Place pipe on a minimum 75 mm thick compacted underlay. Extend bedding material to provide a minimum cover of 150 mm over the conduit.

Draw rope: For electricity and telecommunications conduits, provide a 4 mm diameter synthetic polypropylene filament rope. Install draw ropes with a minimum of 1.5 m of slack in each pit and rope ends firmly secured to prevent the ends being lost in the conduit. Provide joints in the rope capable of resisting the same tensile load as the unjointed rope and that do not appreciably increase the diameter of the rope.

End plugs: Plug or cap the ends of all conduits with suitable fittings to prevent the entry of foreign matter.

## BACKFILLING

### General

Extent of backfill: Unless specified otherwise, above the pipe surround but terminate at the underside of the pavement, that is, at the subgrade level. Do not cause discontinuity in the pavement structure. Do not re-use excavated materials in the pavement structural layers.

Timing: Backfill trenches as soon as possible after the pipe or service has been laid and bedded, if possible on the same working day.

Construction loads: Select appropriate compaction plant compatible with the minimum pipe cover to the service in accordance with manufacturer/supplier recommendation and to ensure that the pipe or conduit is not overstressed at any stage during the construction activity. The compactive effort used for each layer of backfill must be less than the live load capacity of the pipe with the depth of cover appropriate to that layer.

### Permitted Materials

New construction projects: Choose backfill material to suit the permeability characteristics of the surrounding soil to ensure that the completed trench does not hold water nor obstruct existing drainage paths through the soil. Choose backfill material that will provide uniform support to match the adjoining subgrade material.

Under existing road carriageways:

* Granular fill or “no fines” concrete in stormwater drainage trenches (*Standard Drawing BSD-2042*).
* Stabilised sand, controlled low strength cementitious material or lean mix concrete in trenches as shown on *Standard Drawing BSD-2042*.
* Lean mix concrete in isolated patches less than 2 m2 in size or where the minimum specified cover to service cannot be achieved.

Under footpaths and bikeways: Excavated material, provided adequate compaction can be obtained (*Standard Drawing BSD-2043*). Alternatively use Class 3 material, stabilised sand, controlled low strength material or lean mix concrete in trenches where free drainage points are not available or trenches in impermeable soils. Use granular fill or sand in trenches where free drainage points are available or where trenches are located in permeable soils.

### Permeability Characteristics

Field test: Collect a handful of representative soil material, discarding particles larger than 10 mm in diameter. Spray a fine water mist evenly throughout the soil particles to achieve the optimum moisture content. Mould the moist sample by hand pressure. The soil material is considered relatively impervious if the moulded sample remains intact after being tossed lightly from one hand to the other. The soil material is considered relatively permeable if there is difficulty in maintaining the moulded shape or the moulded sample crumbles after being tossed lightly from one hand to the other.

Permeable soils: Generally coarse grained soils including sand, gravel, sand-gravel mixtures. A soil is of basic type sand or gravel if, after the removal of any cobbles or boulders, over 65% of the material is of sand and gravel sizes.

Impermeable soils: Generally fine grained soils including clay, silt, gravelly or sandy clay, gravelly or sandy silt. A soil is of basic type silt or clay if, after the removal of any cobbles or boulders, over 35% of the material is of silt and clay sizes.

### Requirements of Acceptable Backfill Materials

Class 3 material: Comply with the requirements of Reference Specification *S300 Quarry Products* except that the Plasticity Index shall not be < 4%. Alternatively, use Queensland Department of Transport and Main Roads Type 2 unbound material, Subtype 2.2, 2.3 or 2.4 or Type 3 unbound material, Subtype 3.1, 3.2 or 3.3 (to *DTMR Technical Specification MRTS05*), provided the soaked CBR is ≥ 15% and the Plasticity Index is not < 4%.

Controlled low-strength material (Flowable fill): An approved proprietary flowable fill that contains a mixture of cementitious binder, water and aggregate. The cementitious binder may include Portland Cement, Fly Ash and Ground Granulated Blast Furnace Slag. Provide 28 day compressive strengths of 0.5 - 2.0 MPa under footpaths and 3 - 5 MPa under roads.

Excavated material: Well graded inorganic non-perishable material, maximum size 75 mm, Plasticity Index £ 55%.

Granular fill: 75 mm maximum size crushed rock, non-plastic open graded material or crusher run recycled concrete*.*

Lean mix concrete: Achieve 28 day characteristic compressive strength of 5 MPa for concrete. Use nominal maximum aggregate size of 40 mm. Achieve target slumps of 80 - 100 mm for wet concrete and less than 15 mm for dry concrete.

No fines concrete: Comply with the requirements of Reference Specification *S200 Concrete Work.*

Sand: Natural sand or manufactured sand or a blend of natural and manufactured sand, comprising hard durable particles. Comply with Table 7.1 for material properties.

Table 7.1 – Sand properties

|  |  |
| --- | --- |
| Property | Natural, blended and manufactured sand |
| % by weight passing the 6.7 mm A.S. sieve | 100 |
| % by weight passing the 0.075 mm A.S. sieve | 20 maximum |
| Plasticity index | 10 maximum |

Stabilised sand: 1 part either Type GP or Type GB cement to 12 parts sand (by volume) mixed with a minimum quantity of water sufficient to allow ease of placement and compaction.

### Execution

Compacted layer method of construction

This construction method applies to Class 3 material, excavated material, sand where puddling and jetting is not approved, dry stabilised sand, and dry lean mix concrete. Place and compact fill material uniformly in layers with loose layer thickness not exceeding 200 mm. Achieve the minimum relative compaction standards specified in Table7.2 for Class 3 material, sand and excavated material.

Table 7.2 – Minimum density schedule

| Location | Minimum relative compaction (standard)(Cohesive soils generally)*(refer Notes 1, 2, 3, 4)* | Minimum density index(Cohesionless soils)*(refer Notes 1, 5)* |
| --- | --- | --- |
| Road and structural (other than building) formations including embankments, footpaths, paved areas and shoulders *(refer Note 6)* |  |  |
| (a) > 0.3 m below subgrade level | 95% | 65% |
| (b) £ 0.3 m below subgrade level | 100% | 80% |
| All other areas e.g. parks  |  |  |
| (a) > 0.3 m below finished surface level | 90% | 62% |
| (b) £ 0.3 m below finished surface level | 95% | 65% |

Notes:

1. *Field dry density to AS 1289.5.3.1, AS 1289.5.3.5 or AS 1289.5.8.1. If using AS 1289.5.8.1, calibrate the surface moisture-density gauge in accordance with AS 1289.5.8.4 before use.*
2. *Standard maximum dry density to AS 1289.5.1.1.*
3. *Relative compaction (% of maximum dry density) to AS 1289.5.4.1.*
4. *For plastic soils (designated under the unified classifications system as OH CH MH) compact to not less than 92% nor greater than 96% of standard maximum dry density at moisture contents of between 90% and 120% of optimum moisture content.*
5. *Density index to AS 1289.5.6.1. Maximum and minimum dry densities to AS 1289.5.5.1.*
6. *In the context of this specification, road formation is deemed to include all the area within the designated road reserve. Structural formation is deemed to include the area under the paving plus a nominal 1 m from the edge of the paved area.*

Mechanical interlock method of construction

This construction method applies to granular fill. Place and compact coarse granular fill materials uniformly in layers. Roll each layer until no permanent visible lowering of the surface occurs. The minimum thickness of uncompacted layers is 150 mm. Determine the maximum thickness of uncompacted layers from Table7.3 for the specified module weights, which apply to both drawn and self-propelled single drum rollers. Interpolate layer thickness for module weights between the listed values.

Table 7.3 – Maximum thickness of uncompacted layers

|  |  |
| --- | --- |
| Static module weighty or vibrating drum equivalent (tonnes) | Maximum thickness of uncompacted layer (mm) |
| Voids not filled | Voids filled\* |
| 5 | 400 | 300 |
| 10 | 600 | 400 |
| 15 | 900 | 600 |
| 20 | 1200 | 800 |

*\* Proportion of finer grained materials to completely fill the voids between rocks*

Asphalt supply and placement

Asphalt manufacture: In accordance with *Reference Specification* *S310 Supply of Dense Graded Asphalt*.

Asphalt transportation and placement: In accordance with Reference Specification *S320 Laying of Asphalt*. Place and compact hot mix asphalt so that the edges (saw cut or edge planed) are flush with the existing pavement. A slight crown (maximum camber above the existing pavement of 5 mm for trench £ 0.5 m wide or 10 mm for trench > 0.5 m wide) may be formed to allow for subsequent consolidation of the trench.

Surface Preparation: The top surface of the backfill and the remaining sides of the trench shall be thoroughly broomed to remove any loose material before placing the tack coat.

Tack coat: Tack coat the top surface of the backfill and the remaining sides of the trench with a light sprayed application of a liquid bituminous material (0.2l/m2 residual bitumen) prior to placing the asphalt layers.

Asphalt spreading: Use hand spreading method for trenches less than 1 m wide and machine spreading method (use a tamper spreader) for trenches more than 1 m wide.

Hand spreading: Take asphalt directly from the receiving hopper (or other approved location), distribute immediately into place using shovels, spread to the required loose depth using metal rake or board rakes (lutes), and compact immediately.

Cold planing: If required, prepare for resurfacing by cold planing the existing asphalt surface. Take out ruts, bumps depressions or other uneven areas of pavement to allow a uniform thickness of new asphalt to be placed.

Compaction: Select rollers or plates (such as vibrating plate compactor, vibrating rammer, pedestrian roller, small tandem vibrating roller) to suit the size of the job. Keep the drum or plate moist to prevent the adherence of asphalt. Complete rolling while the mix temperature is above 95ºC. The relative compaction (ratio of the in situ density or the compacted asphalt and the representative maximum density of the asphalt) must not be less than 94%.

Cemented materials

Place material by discharging directly from a concrete agitator truck. Alternatively use a concrete pump where access is restricted.

Controlled low-strength material (Flowable fill): Use freely flowing material capable of completely filling horizontal trenches, over lengths of up to 100 metres, without the aid of pumping, vibration, rodding or other mechanical action.

Dry lean mix concrete: Use compacted layer method of construction.

No fines concrete: Rod sufficiently only to ensure the trench is completely filled. Screed to the required levels without tamping or vibrating.

Wet lean mix concrete: Deposit concrete in horizontal layers not exceeding 400 mm thick. Commence compaction of concrete immediately after deposition. Use high frequency immersion vibrators to achieve compaction.

Puddling and jetting

This construction method applies to sand and is NOT to be used for trenches under existing pavements and footpaths. Compact by flooding and the use of immersion vibrators. Do not use puddling or jetting of material, unless prior approval is obtained from the Superintendent. Flooding will only be permitted where the process does not cause damage to adjacent works. Where puddling and jetting is not approved, use the compacted layer method of construction.

## base RESTORATION

**Existing Granular Pavements**

Use Class 1 unbound pavement material or structural asphalt to match depth of existing pavement unless approved otherwise. Where structural asphalt is used, subsoil drainage (*Standard Drawing BSD-2041*) is to be installed on the uphill side of the trench unless approved otherwise by Council.

**Existing Asphalt Pavements**

Reinstate existing sub-surface drainage to comply with *Standard Drawing BSD-2041*.

**Sub-surface Pavement Drainage**

Material selection: Choose base course material to suit the permeability characteristics of the existing pavement base to ensure that the reinstated pavement does not hold water nor obstruct existing drainage paths through the pavement.

**Materials**

Permitted materials: Comply with the requirements of *Standard Drawing BSD-2042*. For isolated patches less than 2 m2 in size, use full depth asphalt.

Material selection: Choose base course material to suit the permeability characteristics of the existing pavement base to ensure that the reinstated pavement does not hold water nor obstruct existing drainage paths through the pavement.

Structural asphalt: Brisbane City Council Type 3 mix (14 mm nominal aggregate size) or Brisbane City Council Type 4 mix (35 mm nominal aggregate size), both containing multigrade bitumen binder. Limit the thickness of each compacted layer to 50 - 80 mm for Brisbane City Council Type 3 mix and 70 - 100 mm for Brisbane City Council Type 4 mix.

Class 1 unbound pavement material: Comply with the requirements of Reference Specification *S300 Quarry Products*. Alternatively, use Queensland Department of Transport and Main Roads Type 2 unbound material, Subtype 2.1. Achieve a minimum relative compaction of 95% of the modified maximum dry density to *AS 1289.5.2.1*.

## Surface RESTORATION

### General

*Refer Annexure.*

Scope: This section applies to trench restoration work associated with the installation and maintenance of services placed in existing road carriageways, footpaths and bikepaths. Installation of services as part of new construction projects are to be undertaken prior to constructing pavements, footpaths, bikepaths and the like.

Reinstatement of surfaces: Reinstate existing surfaces removed or disturbed by trench excavations to match the texture, surface type and colour of the existing and adjacent work. Join smoothly to adjacent work. Reinstate paved surfaces and other surface features (such as line marking) disturbed or removed during excavation of trenches to provide structural adequacy and serviceability that is at least equal to that in existence prior to the disturbance.

Confirm with Council, the current standards required for replacing the disturbed infrastructure.

### Extent of Surface Reinstatement

**Road Pavements**

Transverse trench crossing: Reinstate as shown on *Standard Drawing BSD-2042*.

Longitudinal trench: The whole of the road lane width shall be resurfaced to match the existing road surface. A road lane refers to half of unmarked roadways, a width of 2.5m from kerbs where it forms a parking only lane or the width of marked lanes. Where an existing section of roadway adjacent to kerbs and other pavement edges is undamaged for less than 1.0m, resurface the undamaged section of roadway as part of restoration of the trench.

Where the trench disturbance is greater than half the total width of a road without lane line-marking that is less than 10m wide, then the whole road shall be cold planed and resurfaced after the appropriate restoration of the trench.

Damage to existing surface: The adjacent road surfaces shall be appropriately protected from damage from construction vehicles, placement of material, excavated rock indentations etc. Where damage occurs to the existing adjacent road/driveway surface, i.e. gouges, scrapes or potholes; the surface shall be returned to its previous condition by resurfacing the entire road pavement (lane) or resurfacing of the total driveway crossing area at the discretion of Council.

Parallel Cracking: Where parallel cracking of the existing road surface occurs along the edge of a trench then the reinstatement shall be widened to a line at least 200mm beyond the extremity of the cracking and parallel to the trench so as to produce a consistent width of restoration.

**Footpaths and bikeways**

Concrete – Transverse trench crossing: Remove and replace full section between existing adjoining joints e.g. contraction joints, shrinkage control joints or pattern lines.

Concrete – Longitudinal trench: Remove and replace surface for length of trench for full width or to the nearest longitudinal joint or existing pattern lines. Commence and end reinstatement at existing transverse joints e.g. contraction joints, shrinkage control joints or pattern lines.

Asphalt – Transverse trench crossing: Reinstate as shown for road crossings on *Standard Drawing BSD-2042*.

Asphalt – Longitudinal trench: The width of the existing footpath surfacing for the length of trench shall be resurfaced to match the current regulations for width and surface finish.

### Surface Profile Tolerances

Timing: Record surface profile tolerance measurement following completion and within 30 days prior to the expiry date of the maintenance or defects liability period. This period is deemed to be 12 months from the work completion date.

Paved roadway and paved pedestrian surfaces: Reinstate surfaces to match existing features such as pit covers or driveways so that the pavement edges are within 0 mm to + 5 mm. Limit the maximum deviation relative to a 1.2 m straightedge to 5 mm, unless the crown camber overrides this requirement.

Unpaved pedestrian areas: No visual evidence of surface irregularities.

### Final Surface Reinstatement

**Grassed and landscaped areas**

Provide 100 mm of loam and turf over trench and other disturbed areas.

Trees, shrubs, plants and garden beds that are damaged or removed shall be replaced by shrubs and plants as specified by Council’s arboriculture officer. The areas shall be mulched as necessary to match surroundings or previous condition.

Asphalt surfacing course

Asphalt surfacing course: Place the asphalt in one or more layers complying with Table8.1 to achieve the specified total asphalt thickness.

Table 8.1 – Surfacing course reinstatement

| Location | Asphalt Mix Type | Asphalt Thickness |
| --- | --- | --- |
| Brisbane City Council | Alternative QDTMR | Layer | Total |
| Footpaths | Type 1 | DG7 | 15 - 25 mm | 25 mm or the adjacent asphalt thickness, whichever is greater |
| Bikepaths | Type 1 or 2 | DG7 or DG10 | 15 – 25 mm (Type 1) or 25 – 40 mm (Type 2) | 25 mm or the adjacent asphalt thickness, whichever is greater |
| Minor Roads*(2)* | Type 2 | DG10 | 25 – 40 mm | 50 mm or the adjacent asphalt thickness, whichever is greater |
| Major Roads*(2)* | Type 3*(1)* | DG14*(1)* | 50 – 60 mm | 100 mm or the adjacent asphalt thickness, whichever is greater |
| Primary Freight Routes*(2)* |
| Primary Freight Access*(2)* |

*(1) Brisbane City Council Type 3 and DTMR DG14 asphalt to contain Multigrade bitumen binder.*

*(2) Refer to Section 1.6 for Definition of Major and Minor Roads and* *Primary Freight Routes and primary Freight Access.*

**Unit paving**

Provide base course and bedding to match the existing. Reinstate using whole paving units. Do not use concrete infill.

**Rigid (concrete) pavement**

Requirement: Reinstate concrete surfaces to the original level. Additional concrete beyond the damaged area shall be removed and replaced back to the nearest existing joint even if undisturbed by the trench works. Where specified, epoxy grout steel dowels into the adjacent concrete and provide reinforcement to prevent the reinstated concrete from subsiding or cracking. Comply with the requirements of Table 8.2.

Surface finish: Where the trench has been constructed longitudinally in the verge with a full width path constructed path, then the final surface repair width is to match the existing surface width (i.e. full width). For Central Business District, Neighbourhood Centres, Village Precinct Projects (VPP) including previous Suburban Centre Improvement Projects (SCIP) and other high finish areas, reinstate the surface to the finish requirements of the *Infrastructure Design Planning Scheme Policy*.

Table 8.2 – Reinstatement of concrete pavement

| Location | Concrete type | Steel reinforcement | Thickness |
| --- | --- | --- | --- |
| Road carriageways | Grade N32 minimum | Steel reinforcement as required by design, provide 500 mm long (full length) Y20 dowels spaced at 400 mm centres | Match adjacent concrete |
| Reinforced concrete footpaths | Grade N25 | F72 mesh placed centrally, 300 mm long (full length) R12 dowels spaced at 400 mm centres | 100 mm or the adjacent concrete thickness, whichever is greater |
| Unreinforced concrete footpaths | Grade N25 | Not required | 100 mm or the adjacent concrete thickness, whichever is greater |
| Reinforced concrete bikepaths | Grade N25 | F72 mesh placed centrally, 300 mm long (full length) R12 dowels spaced at 300 mm centres | 125 mm or the adjacent concrete thickness, whichever is greater |
| Unreinforced concrete bikepaths | Grade N25 | Not required | 100 mm or the adjacent concrete thickness, whichever is greater |

## RESTORATION OF OTHER ASSETS

*Refer Annexure.* Replace, repair, reinstate or otherwise restore to their pre-existing condition all road assets, other Brisbane City Council assets, buried utilities, surfaces, services and other private or public assets that are disturbed, destroyed or damaged.

“Other private or public assets” includes but is not limited to: existing shrubs, landscaping gardens, retaining walls, fences, signs, shelters and all other structures. Record the condition of such assets before and after the service installation.

### Verge Gardens

Private landscaping and gardens with in the verge are to be reinstated in accordance with the Brisbane City Council ‘*Verge garden guidelines*’ (<https://www.brisbane.qld.gov.au/clean-and-green/natural-environment-and-water/plants-trees-and-gardens/verge-gardens>) and with the agreement with the adjacent property owner.

### Traffic Signal Loops and Traffic Management Facilities

Where loops for traffic signals or traffic management facilities, or traffic delineation or pavement delineation (e.g. line marking, pavement markers), are disturbed or damaged:

* Immediately notify the Brisbane City Council Contact Centre (07 3403 8888) when loops for traffic signals or traffic management facilities are disturbed or damaged.
* Provide alternative signposting and/or temporary measures for pavement delineation.
* Arrange with Brisbane City Council for the permanent reinstatement of loops for traffic signals or traffic management facilities and pavement delineation to be carried out at the installers expense.