



CIS Excavation Standard


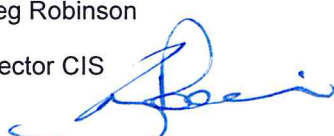
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1 PURPOSE

The CIS Excavation Standard sets out the University of Sydney's minimum requirements for the excavation, backfilling and reinstatement of trenches at the University of Sydney. It ensures that post-excavation surfaces are of high quality, well-compacted to prevent subsidence, covered with acceptable surfaces described in this standard, and are cost efficient to operate and maintain. Applicable requirements documented in Workplace Health and Safety legislation, Disability Discrimination legislation, State Environmental Planning legislation, Commonwealth and State legislation, National Construction Codes (NCC), the Building Code of Australia (BCA) and Australian and New Zealand Standards (AS/NZS) are the minimum and mandatory compliance requirements. Where any ambiguity exists between this standard and the aforementioned mandatory requirements then:

- a. the highest performance requirements must apply
- b. applicable requirements must follow this order of precedence:
 - I. Workplace Health and Safety legislation
 - II. Disability Discrimination legislation
 - III. State Environmental Planning and Assessment legislation
 - IV. All other Commonwealth and State legislation
 - V. NCC and BCA
 - VI. AS/NZS
 - VII. This standard and other University standards

2 SCOPE

This standard covers minimum requirements for projects and maintenance works involving excavation, backfilling and reinstatement of narrow services trenches only. The scope of works covers five separate categories of surfacing:

- a. Flexible pavements with asphalt surfacing
- b. Concrete paving
- c. Paving blocks
- d. Gardens
- e. Lawns and sports fields

The standard does not cover directional drilling or excavation, backfilling and reinstatement for major structures such as large drainage culverts/pipes, backfilling of large underground facilities such as basements or directional drilling to install pipelines and conduits.

The standard applies to planners, project managers, consultants, contractors, sub-contractors, tenants, managing agents, University staff and others involved in the excavation, backfilling and reinstatement works.

3 GLOSSARY OF TERMS

Not Applicable

4 AUTHORITIES & RESPONSIBILITIES

The design standard is owned by CIS. It is approved and signed-off by the Director CIS and the Facilities Management Grounds Unit is responsible for reviewing and maintaining the standard and keeping it up-to-date. The standard must be reviewed and kept up-to-date at least biennially.

5 TECHNICAL REQUIREMENTS

5.1 PERMIT TO DIG

Prior to any excavation works a permit to dig must be submitted by the Contractor's supervisor to the University Project Manager for approval. The permit to dig form **CIS-ENG-F003** provided in **Attachment 3** must be completed and authorised.

If any proposed works are likely to impede pedestrian or vehicle access then the University Project Manager must notify affected stakeholders.

5.2 EXISTING SERVICES

The Contractor must obtain any plans of services in the vicinity of the excavation areas from CIS through the University Project Manager. The contractor must:

- Do visual inspection of the excavation area to confirm plan information and determine potential risks of encountering underground services
- Survey and/or locate all services along the excavation route shown on the plans
- Identify the location of any unmarked visible not shown on plans services using an approved cable/pipe locator
- Use safe non-destructive digging using hand digging or sensitive vacuum/water blasting techniques to uncover known services prior to commencing mechanical excavation
- Support services across trenches during excavation where there is risk of damage

Any dyes used to locate the route of sewerage or stormwater must be approved vegetable base types only. Use of hydrocarbon based dyes is not permitted.

If during the excavation of trenches, unknown services are encountered, work must cease and the Campus Infrastructure Services must be immediately notified through Campus Assist On line. Works must not recommence until the service has been correctly identified and precautions taken to ensure that no damage occurs.

Under no circumstances must services be cut or disconnected without prior approval of the Campus Infrastructure Services.

The contractor will be responsible for the repair of any services identified before excavation commenced or could reasonably have been located during the preliminary exploration.

The University of Sydney will be responsible for cost of repairs of any unknown services damaged provided the contractor has complied with the permit to dig process, refer to **CIS-ENG-F003**.

5.3 INSPECTIONS

Inspections of the trench excavations must be undertaken by the CIS Grounds Unit Manager at the following stages:

- Once formal approval has been issued through the permit to dig process, refer to **CIS-ENG-F003**
- before excavation commences to discuss the location of services and to undertake a dilapidation survey of surrounding environment
- upon completion of the excavation to check depths
- before backfilling commences to verify that services are laid to required levels and confirm reinstatement requirements
- on final reinstatement.

The Contractor must notify the CIS Grounds Unit Manager 48 hours in advance of the above stages to ensure that the appropriate inspections are performed.

5.4 TRENCH EXCAVATION

Trench excavation using mechanical excavators must only be performed with a spotter supporting the plant operator. Trenches for underground services must be excavated in a straight line using a mechanical excavator or similar approved means. The trench width must be 300 mm wider than the service to be laid and must be excavated to the depths shown on **Figures 1 to 4** attached. Wider trenches may be approved by the Grounds Unit Manager only where the space is necessary for personnel to safely enter the trench to connect services.

Trenches must be wider than 150mm to ensure adequate compaction of the backfill. Where the depth of a trench exceeds 1.2m and personnel need to enter the trench, the contractor must adequately and safely support trench walls to safeguard personnel entering the trench. This may require shoring or battering the excavation at a suitable angle depending material being excavated. The contractor must comply with all WorkCover requirements for trench support.

Soft, yielding or other unsuitable material must be removed and replaced with compacted clean, low plasticity soils or stabilised sand. Unsuitable material must be removed from the site at full cost of the contractor.

5.5 HAZARDOUS MATERIALS

The Contractor must give notice immediately to the Project Manager of any hazardous materials or conditions found, including but not limited to the following:

- Asbestos or material containing asbestos;
- Flammable or explosive liquids / gases;
- Toxic, infective or contaminated materials;
- Radiation or radio-active materials;
- Noxious or explosive chemicals; and
- Tanks or containers that have been used for storage of explosive, toxic, infective or contaminated substances.

5.6 EXCAVATION NEAR TREES

If excavations in pathways, gardens, lawn areas encounter tree roots in excess of 50mm diameter, work must cease until approval is obtained from the CIS Grounds Unit Manager. The Contractor must dig using hand tools whenever digging in the vicinity of tree roots. All care must be taken to ensure that no tree roots are damaged during all excavation activities. Roots that are greater than 50mm in diameter measured at a distance of three metres from the tree trunk, must not be cut without prior approval from the CIS Grounds Unit Manager. Approval be denied if it is possible to easily lay avoid important tree roots.

5.7 EXCAVATION NEAR UTILITY SERVICES

The Contractor must dig using hand tools whenever within 0.3m of a service pipe as required by the permit to dig, CIS-ENG-F002. Typically there are more service pipes than listed on the Dial Before You Dig drawings. Abandoned service lines may not be removed without approval of the managing Utility Authority. Further investigation around the conduit may be required to determine the owner of the service line. Dial Before You Dig plans note transmission cables such as high voltage gas or

water mains that may need a Utility Authority representative present when excavating near their service. The Contractor is responsible for coordinating any service authority supervision.

5.8 BACKFILLING

Services conduits must be laid on fine grained sand which must be extended to at least 100 mm above the top of the conduit. Backfilling of the service conduits in the trench must be in accordance with **Attachment 1, Figures 1 to 5**. Hydraulic services must be laid in accordance with AS/NZS3500 Plumbing and Drainage.

5.9 COMPACTION

All backfilling must be compacted by mechanical vibration using vibrating plate compactors (whacker packers) or similar equipment to the approval of the CIS Grounds Unit Manager. Backfilling must take place in layers not exceeding 150 mm loose thickness and be compacted to the densities shown on **Attachment 1, Figures 1 to 4**.

Compaction of backfilling must be carried out without damaging services. The laying of services and backfilling and compaction will not be permitted in trenches containing ponded water or mud either from rainfall, surface runoff or groundwater flow.

Unless otherwise shown on the drawings or otherwise specified for the particular type of pipe installed, relative compaction in trenches must be as follows:

1. Pipe zone - 90% relative compaction.
2. Trench zone - 90% relative compaction.
3. Structural section in paved areas - 95% minimum.
4. Imported Granular Material for over excavation or foundation stabilization - 90% relative density.

Over excavations shall be corrected by backfilling with approved imported granular material or crushed rock, compacted to 90% relative compaction

5.10 RESTORATION OF ANCILLARY STRUCTURES

Where excavations pass beneath kerb and guttering, vehicular crossings, etc, proper support must be provided for these structures until backfilling is completed. If compaction to the required standard is not possible, backfilling in trenches passing beneath ancillary road structures must consist of lean mix concrete (minimum 10 MPa) or similar approved material.

5.11 ROADWAYS

Backfilling to the subgrade level in trenches across roadways must be carried out using sand stabilised with 6% cement by weight unless otherwise directed. In all cases, compaction must be to minimum 95% of the standard maximum dry density as determined in tests AS/NZS1289 Methods of testing soils for content relation of a soil using standard compactive effort.

Prior to backfilling and compaction of vehicle trafficable trenches, trench stops/bulkheads consisting of polyethylene or hessian bags filled with clay or other approved material and sealed in an approved manner, must be placed across the full width of the excavated trench directly beneath the kerb to contain the compacted materials. The trench/bulkheads must extend from the top of the service backfill surrounding material to the underside of kerb level (see **Attachment 1, Figure 5**).

5.12 PAVEMENT MATERIALS

The pavement must be reinstated to the minimum depths shown in **Table 1**. Materials must comprise good quality, durable, fine crushed rock and bituminous concrete (asphalt). Fine crushed rock must conform to Road and Traffic Authority Specification No. 3051 specifically for the supply of "Unbound and Modified Base and Sub base Materials for Surfaced Road Pavements". Fine crushed rock must be DGB20 (20 mm nominally sized densely graded base) and must be compacted to 95% modified maximum dry density.

TABLE 1 - MINIMUM PAVEMENT THICKNESSES (mm)

	A	B	C
Flexible Pavements: (Fig 1)			
Heavy Traffic	30	300	150
Light Traffic	30	200	N/R
Car Parks	30	150	N/R
Concrete Pavements: (Fig 2)			
Roadways	150	150	-
Footpaths	75	75	-
Paving Blocks: (Fig 3)			
Heavy Traffic	80	50	250
Light Traffic	80	50	150
Pedestrian	50	50	50

N/R = Not required

Refer to **Attachment 1, Figures 1 - 3**

Where the total volume of material to be used in the backfilling of road trenches is to exceed 10 cubic metres, the contractor must provide tests certificates verifying that the material conforms to the relevant the RTA Specification.

5.13 PAVING BLOCKS

Where service trenches are to be laid beneath existing paving block pavements, the pavers must be carefully removed by the contractor prior to excavation. Any pavers broken during their removal must be replaced at the contractor's expense. Backfilling of trenches beneath paving block pavers must be carried out using sand stabilised with 6% cement by weight compacted to a density of at least 95% of the standard maximum dry density. General backfilling must finish at least 150 mm below the underside of the sand bedding to allow for fine crushed rock base material to be placed and compacted. Paving block base must be constructed in a manner similar to fine crushed rock beneath roadways. Paving blocks must be relaid on sand bedding as recommended by the manufacturer so that the line and level are consistent with the surrounding pavers. A maximum tolerance in level between the undisturbed pavers and the relaid pavers is 3mm.

5.14 CONCRETE PAVING

Existing concrete paving must be sawn cut along the line of the proposed trench to the full depth of paving and the concrete material disposed of offsite when excavated. Excavation must then be carried out in the approved manner and backfilling performed as for roadways. Concrete paving must be provided with a base layer consisting of 75mm or 150mm thickness of fine crushed rock if the concrete is for pedestrian or vehicular usage respectively. Fine crushed rock must be compacted to the same standard as paving materials for roadways. Concrete to used in the restoration of concrete paving must have the following compressive strengths:

- Roadways 25 MPa
- Footpath 15 MPa

Thickness of concrete paving must be similar to that removed during the excavation but must not be less than 75mm for footpaths, or 150 mm for roadways.

In most instances, there will be no requirement for strength testing of concrete, however, Campus Infrastructure Services reserves the right to carry out tests. If concrete testing is required it must be carried out at the expense of the contractor by a NATA accredited laboratory.

The joints between the existing concrete and the restored concrete paving must be filled with an approved jointing material to prevent ingress of water. Jointing material should preferably be a bitumen impregnated fibre board or similar, placed while the concrete is plastic. Alternatively, the joint may be grooved and filled with a silicon based joint sealant.

5.15 LAWNS AND SPORTS FIELDS

Backfilling of trenches across lawns and sports fields must be in accordance with **Attachment 1, Figure 4**.

Lawns and sports fields must be restored with turf cut from the trench prior to excavation and set aside from the original surface, or with turf of the same species imported from a source approved by the CIS Grounds Unit Manager.

5.16 GARDENS

Where trenches are to pass through garden areas, the contractor must seek direction from the Grounds Unit Manager or representative as to whether plants disturbed are to be transplanted or replaced and reinstated at the completion of the work. Excavation and backfilling must then be undertaken in generally in accordance with **Attachment 1, Figure 4**.

5.17 COMPACTION TESTING

Compaction testing of the backfilling must be carried out on every third lift at a rate of one test per 50 lineal metres of trench. A minimum of one test must be carried out for all backfilling of trenches beneath pavements, roadways, paving blocks and concrete paving areas. Testing of the backfilling must be undertaken in accordance with Australian Standard AS1289 - "Methods of Testing of Soil for Engineering Purposes".

Compaction testing is to be undertaken by a NATA accredited laboratory and the results forwarded directly to the CIS Project Manager for approval. All layers will be tested to the full depth of the layer. An in-situ density test by sand placement or other NATA approved means will be required. The cost of all testing must be borne by the contractor and must be included the contract sum.

5.18 BARRIERS AND LIGHTS

Barriers and lights are to be erected on each side of open trenches to ensure the safety of pedestrians and to prevent traffic entering construction areas. If necessary fencing must be erected by the contractor to ensure that unauthorised entry into the trenches does not occur.

5.19 PEDESTRIAN SAFETY

It is the contractor's responsibility to ensure the safety of pedestrians using the area in which trenching is being undertaken. All necessary barriers and fences must be erected to safely guide pedestrians

around the work area. These barriers and fences must not be removed until the surface has been restored to the satisfaction of the Campus Infrastructure Services. Trenches which have to be accessed by pedestrians must be safely spanned by a trafficable floor plate.

5.20 PROVISION FOR TRAFFIC

Where services are to be laid across roadways or other areas used by vehicular traffic, provision must be made for traffic by providing detour signage or constructing the trench not more than half the road width. If required, trenches may be covered by a safe and secure trafficable floor plate suitable for expected vehicle traffic.

5.21 EROSION SEDIMENT CONTROL

Virtually all construction activities which require the disturbance of soil surfaces and the existing vegetation predispose the construction site to erosion. The contractor must implement erosion and sediment controls to prevent contaminated stormwater entering the drainage system or any watercourses. The contractor must also carry out progressive revegetation of the site where possible to minimise the area disturbed by construction activities.

5.22 CLEAN-UP

Vehicle and mobile plant wheels must be washed to prevent soils leaving the construction site and polluting roadways.

Following completion of the excavation, backfilling and restoration, the contractor must clean the adjacent areas to the satisfaction of the Campus Infrastructure Services. Clay soils must be removed from roadways, paving blocks or concrete areas using a high pressure water blaster to clean the surface. Wet mortar spills on adjacent pavements, grass or other surfaces must be cleaned before drying.

6 COMMISSIONING

All reinstatement works must be inspected by the CIS Grounds Unit Manager at the completion of excavation works prior to the reopening of any pedestrian paths or roadways.

7 DOCUMENTATION & RECORDS

7.1 PERMIT TO DIG

The Project Manager and Contractor must complete and keep records of the permit to dig forms, **CIS-ENG-F003**.

7.2 EXCAVATION PROJECTS INVOLVING INFRASTRUCTURE CHANGES

The University Project Manager must provide underground services plans to the Contractor showing any known services in the vicinity of the proposed excavation.

The Contractor must prepare and submit as-built drawings indicating the location, size, route and depths of underground services as per the University's CAD specifications.

8 OPERATIONS

Not applicable

9 AUTHORISATION OF VARIATIONS

Project managers, consultants, contractors, commissioning agents and facilities maintenance personnel must ensure compliance with these requirements is achieved.

Variations to this standard must only be considered where:

- a. the University Standard's requirement cannot physically or technically be achieved.
- b. the alternative solution delivers demonstrated and proven superior performance for the same capital and life cycle cost or better.

Consultants and contractors must identify and justify requirements of the standard that do not apply to the project or which need to be varied and these must be approved by the issuer of this standard. Formal requests for all variations to this Standard must be submitted using the **CIS Request Dispensation from Standard Form (CIS-ENG-F001)**. The issuer of this standard or their delegated authority must review and consider requirements of stakeholders from clients, projects and facilities management before deciding whether to approve variations. Their formal sign-off is required for acceptance of any non-compliances and departures from this standard's requirements.

10 QUALITY CONTROL

10.1 DESIGN STANDARD COMPLIANCE

Compliance with requirements of this standard must be checked throughout the design, construction and commissioning phases of projects by:

- a. The CIS project consultant
- b. The issuer of this standard or their delegate

Competent CIS representatives must check compliance with this standard during design reviews and formal site inspections. Any non-compliances with requirements of this standard must be documented in the Non-conformance Report Form, **CIS-SYS-F001** and provided to the CIS Project Manager for issue to contractors and their consultants. Project Managers must maintain a register of non-conformances and manage close out of outstanding non-conformances. Contractors and their consultants issued with non conformances must take appropriate corrective or preventive actions. Proposed corrective or preventive actions and close out of non-conformances must first be formally approved by issuer of the standard or their delegate.

10.2 DESIGN STANDARD CERTIFICATION

Contractors and their consultants must certify compliance to the design standard by completing and submitting the CIS Project Design Certification Form, **CIS-PROJ-F001** to the CIS Project Manager at each of the following project phases:

- a. Design and Documentation
- b. Tender
- c. Construction

Notwithstanding CIS' internal quality control processes, contractors and their consultants must implement their own robust quality assurance and control procedures to ensure compliance with requirements of this standard.

11 REFERENCES

Standard	Title
AS/NZS 1152	Specification for Test Sieves
AS/NZS 1289	Methods of Testing Soils for Engineering Purposes (inc. supplements & amendments)
AS/NZS 1348	Road and Traffic Engineering, Glossary of Terms. Part 1 - Road Design & Construction
AS/NZS 1726	Geotechnical Site Investigation Code (inc. amendments)
AS/NZS 2436	Guide to Noise Control on Construction, Maintenance and Demolition Sites
AS/NZS 2601	Demolition of Structures
AS/NZS 2865	Safe Working in a Confined Place
AS/NZS 3500	Plumbing and Drainage
AS/NZS 3798	Guidelines on Earthworks for Commercial and Residential Development
--	All Health Authority Requirements
--	All Local Council regulations
--	City of Sydney Sydney Streets Technical Specifications B2. Earthworks
--	Electricity Safety (Installations) Regulation
--	Landcom Publication (2004): Volume 1 – Managing Urban Stormwater: Soils & Construction
--	Requirements from all Authorities and services / Utility Providers such as Telstra, Powertel, Optus, Sydney Water, AGL, Agility, City of Sydney, Ausgrid and others as required
--	State Fire Brigade requirements
--	WorkCover Authority of NSW Code of Practice – Excavations
--	WorkSafe Australia – Asbestos: Code of Practice and Guidance Notes.

12 NOTES

N/A

13 DOCUMENT AMENDMENT HISTORY

Revision	Amendment	Commencing

14 ATTACHMENTS

Attachment 1 – Conceptual Trench Excavation Details

Attachment 1 Conceptual Trench Excavation Details

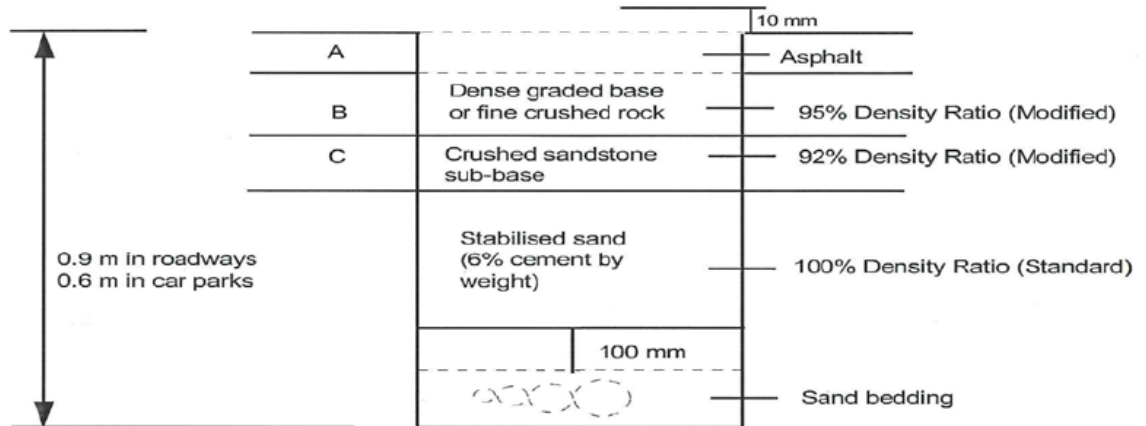
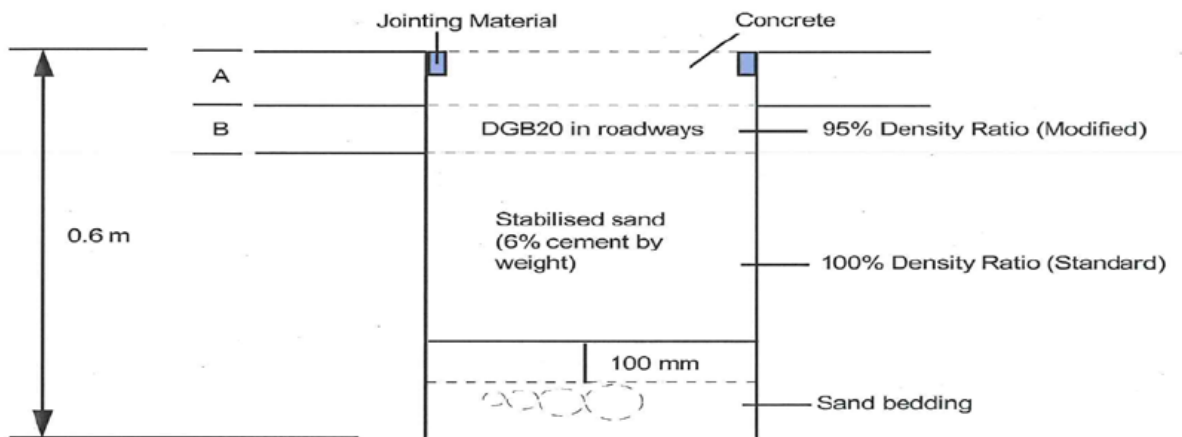


Figure 1 Flexible pavements with asphalt surfacing



Note: Where concrete reinforcement is present, new concrete sections shall be reinstated with similar reinforcement

Figure 2 Concrete pavements and footpaths

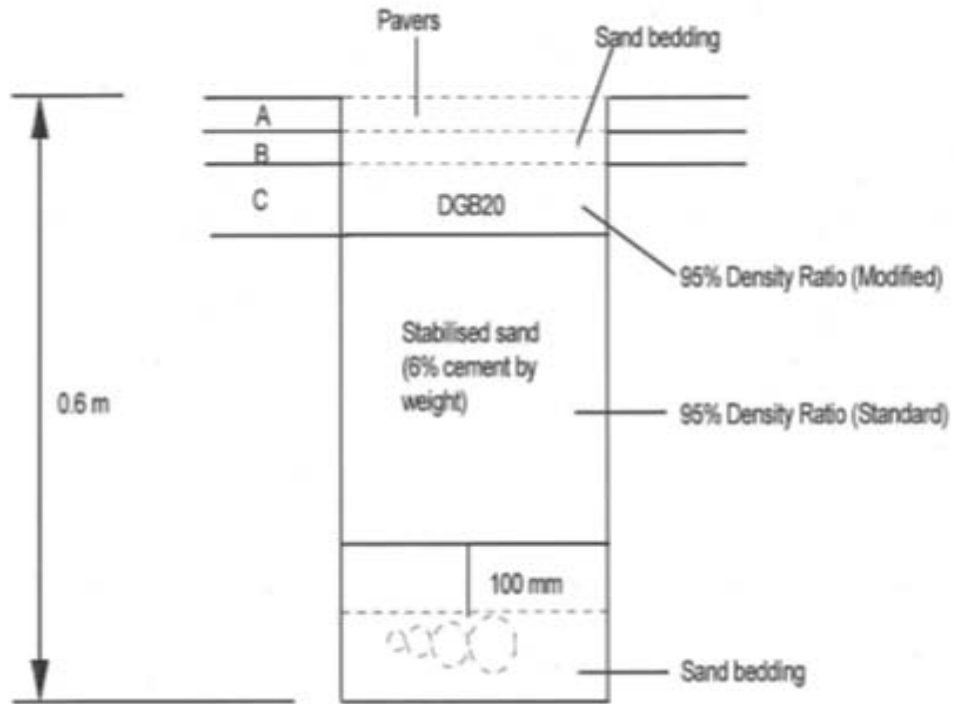


Figure 3 Paving Blocks

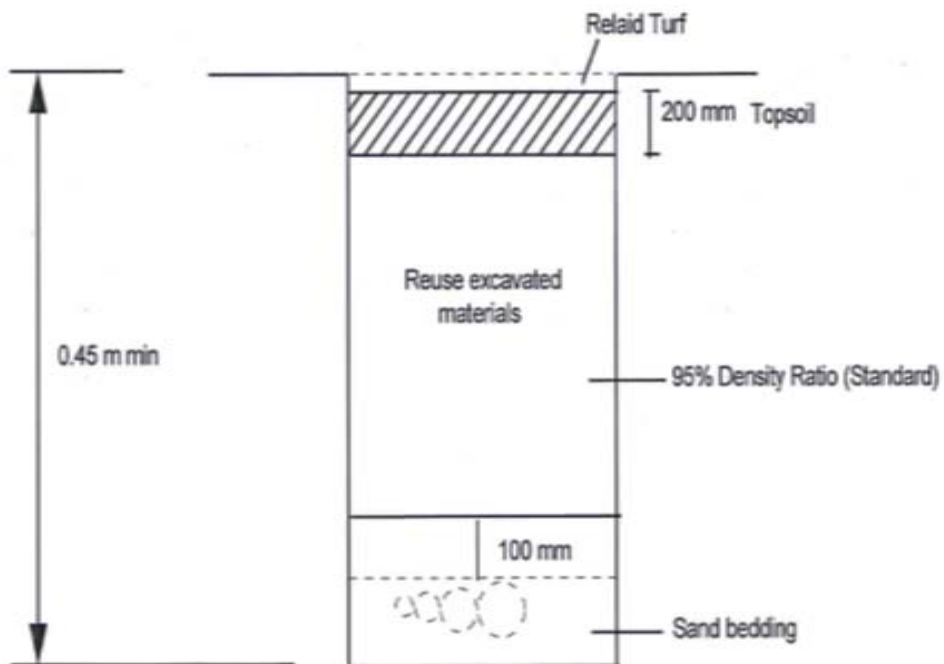


Figure 4 Lawns and sports fields

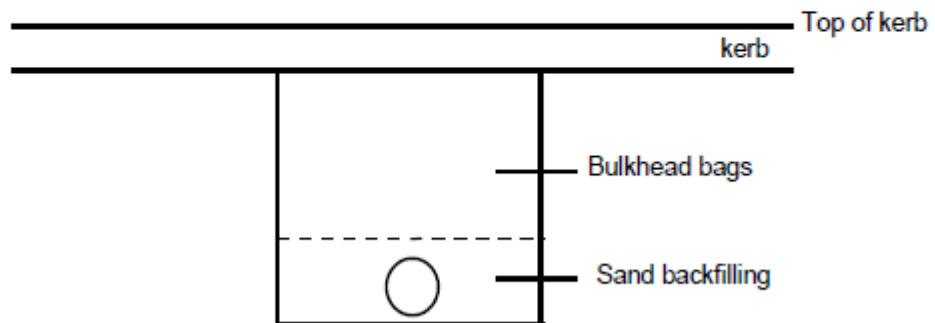
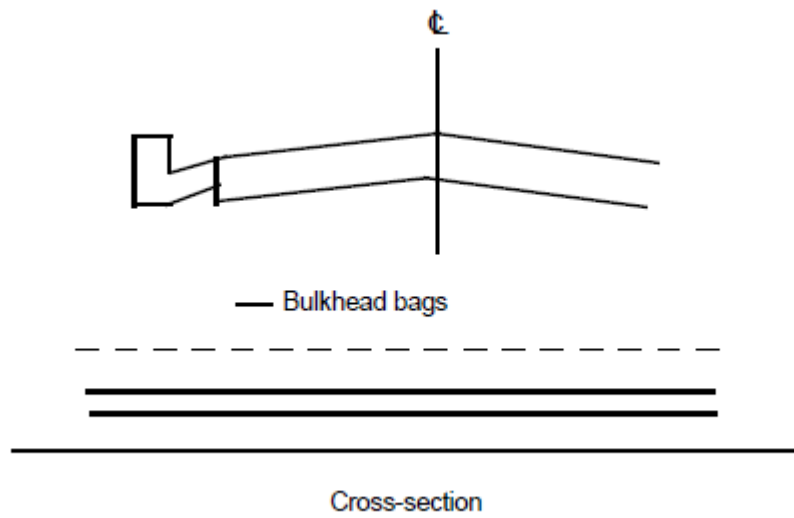


Figure 5 Backfilling at roadway edges