

COFFS HARBOUR CITY COUNCIL



**DEVELOPMENT SPECIFICATION
DESIGN**

0222 Earthwork

Version 1 01 January 2009

0222 EARTHWORK**1 GENERAL****1.1 CROSS REFERENCES****General**

General: Conform to the *General requirements* worksection.

Associated worksections

Associated worksections: Conform to the following:

- *Site management*.

0021 Site regrading

0075 Control of erosion and stormwater management

0161 Quality (Construction)

0250 Open space – landscaping

1101 Control of traffic

1102 Control of erosion and sedimentation

1111 Clearing and grubbing

1112 Earthworks (Roadways)

1.2 INTERPRETATION**Definitions**

General: For the purposes of this worksection the definitions given below apply.

- Standard: To AS 1348.
- Description and classification of soils: To AS 1726.
- Site classification: To BCA clause 3.2.4.
- Bad ground: Ground unsuitable for the purposes of the works, including fill liable to subsidence, ground containing cavities, faults or fissures, ground contaminated by harmful substances and ground which is or becomes soft, wet or unstable.
- Base: One or more layers of material usually constituting the uppermost structural element of a pavement and on which the surfacing may be placed, which may be composed of fine crushed rock, natural gravel, broken stone, stabilised material, asphalt or Portland cement concrete.
- Discrepancy: A difference between contract information about the site and conditions encountered on the site, including but not limited to discrepancies concerning the following:
 - . The nature or quantity of the material to be excavated or placed.
 - . Existing site levels.
 - . Services or other obstructions beneath the site surface.
- Line of influence: A line extending downward and outward from the bottom edge of a footing, slab or pavement and defining the extent of foundation material having influence on the stability or support of the footings, slab or pavement.
- Rock: Monolithic material with volume greater than 0.5 m³ which cannot be removed until broken up either by explosives or by rippers or percussion tools.
- Site topsoil: Soil excavated from the site which contains organic matter, supports plant life, conforms generally to the fine to medium texture classification of AS 4419 (loam, silt, clay loam) and is free from:
 - . Stones > 25 mm diameter.
 - . Clay lumps > 75 mm diameter.
 - . Weeds and tree roots > 75 mm.
 - . Sticks and rubbish.
 - . Material toxic to plants.

- Subbase: The material laid on the subgrade below the base either for the purpose of making up additional pavement thickness required, to prevent intrusion of the subgrade into the base, or to provide a working platform.
- Subgrade: The trimmed or prepared portion of the formation on which the pavement or slab is constructed. Generally taken to relate to the upper line of the formation.

1.3 GEOTECHNICAL AND ENVIRONMENTAL SITE INVESTIGATION

Report

General: The geotechnical and environmental site investigation report provided is for information only. The geotechnical information and information on contaminants given is information on the nature of the ground at each tested part. It is not a complete description of conditions existing at or below ground level.

1.4 NOTICE

As found site conditions

General: If the following are encountered, give notice immediately and obtain instructions before carrying out any further work in the affected area:

- Bad ground.
- Discrepancies.
- Rock.
- Springs, seepages.
- Topsoil > 100 mm deep.

1.5 RECORDS OF MEASUREMENT

Excavation and backfilling

Agreed quantities: If a schedule of rates applies, provisional quantities are specified, or there are variations to the contract levels or dimensions of excavations, do not commence backfilling or place permanent works in the excavation until the following have been agreed and recorded:

- Depths of excavations related to the datum.
- Final plan dimensions of excavations.
- Quantities of excavations in rock.

Method of measurement: To be by registered surveyor unless otherwise agreed.

Rock

Level and class: If rock is to be measured for payment purposes, whether as extra over excavation of material other than rock or for adjustment of provisional measurements, do not remove the rock until the commencing levels and the classes of rock have been determined.

1.6 PROVISIONAL DEPTHS

Contract depths

General: The footing or pier depths shown on the drawings are provisional.

1.7 EXPLOSIVES

General

General: Do not use explosives.

If required, Council approval is to be obtained.

To be in accordance with 1112 – Earthworks (Roadways), Section 5

1.8 INSPECTION

Notice

Inspection: Give notice so that inspection may be made of the following:

- Items to be measured as listed in *Records of measurement*.
- Areas to be cleared and/or stripped of topsoil.
- Areas stripped of topsoil.
- Excavation completed to contract levels or founding material.

- Proof roll subgrade prior to placing fill.
- Filling completed to contract levels.
- Stockpiled topsoil before spreading.

1.9 TESTS

Geotechnical testing authority

General: Use a NATA registered geotechnical testing authority.

Level of responsibility to AS 3798 Section 8:

Compaction control tests

Compaction control tests: To AS 1289.5.4.1 or AS 1289.5.7.1.

Compaction control test frequency

Standard: To AS 3798 Table 8.1.

Site area > 1500 m²: At least (whichever requires the most tests):

- 1 test per layer per material type per 2500 m².
- 1 test per 500 m³ distributed evenly throughout full depth and area.
- 3 tests per lot.

Site area greater than 500 m²: At least (whichever requires the most tests):

- 1 test per layer per 1000 m².
- 1 test per 200 m³ distributed evenly throughout full depth and area.
- 1 test per residential lot per layer.

Site area < 500 m²: At least (whichever requires the most tests):

- 1 test per layer per 500 m².
- 1 test per 100 m³ distributed evenly throughout full depth and area.
- 3 tests per visit.

Confined operations: 1 test per 2 layers per 50 m².

Imported fill tests

Imported fill: to comply with AS 3798 Section 4 and 7,. Also AS 1289 – Methods of testing soils for engineering purposes.

1.10 SUBMISSIONS

Design

Calculations: Submit calculations to show that proposed excavations and temporary supports, including where applicable supports for adjacent structures, will be stable and safe.

Tests

Imported fill: Submit certification or test results which establish the compliance of imported fill with the contract.

Compaction: Submit certification and/or test results in accordance with the specified level of responsibility to AS 3798.

Materials

General: Submit details of materials proposed, including the following:

- Sources of imported fill.

Execution

General: Submit the methods and equipment proposed for the groundworks, including the following:

- Dewatering and groundwater control and disposal of surface water.
- Excavation methods, stages, clearances, batters and temporary supports.
- Stockpiles and borrow pits.
- Placing and compaction methods and stages.

1.11 TOLERANCES

Tolerances

Finish: Finish the surface to the required level, grade and shape within the following tolerances:

- Under building slabs and loadbearing elements: + 0, -25 mm.
- Pavement subgrades; + 0, - 40 mm.
- Batters: No steeper than the slope shown on the drawings. Flatter slopes shall not impact on boundaries or required clearances to buildings, pavements or landscaping.
- Other ground surfaces: ± 50 mm, provided the area remains free draining and matches adjacent construction where required. Provide smoothness as normally produced by a scraper blade.

2 PRODUCTS

2.1 FILL MATERIALS

Fill material generally

General: Inorganic, non-perishable material.

Sulphur content: Do not provide filling with sulphur content exceeding 0.5 % within 500 mm of cement bound elements (for example concrete structures or masonry) unless such elements are protected by impermeable membranes or equivalent means.

Excluded materials:

- Organic soils.
- Materials contaminated through past site usage.
- Materials which contain substances which can be dissolved or leached out, or which undergo volume change or loss of strength when disturbed and exposed to moisture.
- Silts or silt-like materials.
- Fill containing wood, metal, plastic, boulders or other deleterious material.

Site based material

Re-use of excavated material: to comply with AS 3798, Section 4. As approved by the Superintendent

Borrow material: to comply with AS 3798, Section 4. As approved by the Superintendent

Borrow pits:

- Location: > 3 m from any fence line, boundary, edge of excavation or embankment.
- Strip and stockpile topsoil.
- Provide erosion protection during winning operations of subsoil and ensure free drainage.
- On completion of winning operations grade abrupt changes of slope, re spread topsoil and apply hydroseeded grassing.

Imported fill

Imported fill: Material complying with the following: AS 3798, Section 4. As approved by the Superintendent

3 EXECUTION

3.1 REMOVAL OF TOPSOIL

General

Extent: Areas to be cut and areas to be filled and areas to be occupied by structures, pavements, embankments and the like.

Maximum depth: 200 mm.

Re-use of removed topsoil

Re-use of removed topsoil as approved by the Superintendent

Topsoil stockpiles

General: Stockpile site topsoil intended for re-use and imported topsoil where necessary. Establish stockpiles to heights not exceeding 1.5 m. Identify stockpiles of different soil types. Provide adequate drainage and erosion protection. Do not burn off or remove plant growth which may occur during storage. Do not allow traffic on stockpiles. If a stockpile is to remain for more than four weeks, sow with temporary grass. Protect the topsoil stockpiles from contamination by other excavated material, weeds and building debris.

3.2 EXCAVATION

Extent

Site surface: Excavate over the site to give correct levels and profiles as the basis for structures, pavements, filling and landscaping. Make allowance for compaction or settlement.

Footings: Excavate for footings, pits, wells and shafts, to the required sizes and depths. Confirm that bearing capacity is adequate.

Crawl space: Provide clear space under timber floor bearers.

- Minimum clearance: 400 mm.

Existing footings

Requirement: If excavation is required below the line of influence of an existing footing, use methods including (temporary) shoring or underpinning which maintain the support of the footing and ensure that the structure and finishes supported by the footing are not damaged.

Existing services

Location: Identify existing underground services and give notice. Do not excavate by machine within 1 m of underground services.

Proof rolling

Extent: Proof roll excavations for pavements, filling and non-spanning slabs on ground to determine the extent of any bad ground.

Disposal of excess excavated material

General: Remove excess excavated material from the site and dispose of legally.

3.3 SUBGRADES AFFECTED BY MOISTURE

General

General: If the subgrade is unable to support construction equipment, or it is not possible to compact the overlying pavement only because of a high moisture content, perform one or more of the following:

- Allow the subgrade to dry until it will support equipment and allow compaction.
- Scarify the subgrade to a depth of 150 mm, work as necessary to accelerate drying, and recompact when the moisture content is satisfactory.
- Excavate the wet material and remove to spoil, and backfill excavated areas.

3.4 BEARING SURFACES

General

General: Provide even plane bearing surfaces for loadbearing elements including footings. Step to accommodate level changes. Make the steps to the appropriate courses if supporting masonry.

Deterioration

General: If the bearing surface deteriorates because of water or other cause, excavate further to a sound surface before placing the loadbearing element.

3.5 REINSTATEMENT OF EXCAVATION

General

Requirement: If the excavation exceeds the required depth, or deteriorates, reinstate to the correct depth, level and bearing value.

Line of influence: Below or within the 'line of influence' of footings, beams, or other structural elements, use concrete of strength equal to the structural element, minimum 15 MPa.

Below slabs or pavements: Provide selected filling compacted to the specified density. In cut subgrades if the over excavation is less than 100 mm, do not backfill, but make good by increasing the thickness of the layer above. Backfill rock depressions and over excavation of subsoil drains using coarse subsoil filter.

3.6 SUPPORTING EXCAVATIONS

Removal of supports

General: Remove temporary supports progressively as backfilling proceeds.

Voids

General: Guard against the formation of voids outside sheeting or sheet piling if used. Fill and compact voids to a dry density similar to that of the surrounding material.

3.7 ADJACENT STRUCTURES**Temporary supports**

General: Provide supports to adjacent structures where necessary, 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.

Permanent supports

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

Encroachments

General: If encroachments from adjacent structures are encountered and are not shown on the drawings, give notice and obtain instructions.

Line of influence

Angle from horizontal: 45 degrees

3.8 ROCK BOLTING**General**

General: Provide proprietary high strength steel bars or tubes anchored into holes drilled in the rock and tensioned against plates bearing on the rock face to provide temporary or permanent support for the rock face.

Reference: AS 4678.

Protection

General: Protect permanent rock bolts by grouting the drilled hole with cement grout after tensioning the rock bolt. Protect the bearing plate and the exposed portion of rock bolt and anchorage with a protective coating or by embedment in concrete.

3.9 PREPARATION FOR FILLING**General**

General: Prepare the ground surface before placing fill (including topsoil fill), ground slabs or load bearing elements. Shape to assist drainage. Remove materials which will inhibit or prevent satisfactory placement of fill layers, loose material, debris and organic matter. Compact the ground exposed after stripping or excavation in conformance with the **Compaction schedule**.

Benching

General: If fill is to be placed on a surface which slopes more than 1:4, bench the surface to form a key for the fill. As each layer of fill is placed, cut the existing ground surface progressively to form a series of horizontal steps > 1 m in width and > 100 mm deep. Recompact the excavated material as part of the filling. Shape to provide free drainage.

Under earth mounds

General: Cultivate the ground to a depth of 200 mm before mound formation.

Under slabs, paving and embankments

General: Compact the ground to achieve the densities specified in the **Compaction schedule**. If necessary loosen the ground to a depth of > 200 mm and adjust the moisture content before compaction to a density consistent with subsequent filling.

Rock ledges

General: Remove overhanging rock ledges.

3.10 FILTER FABRIC**Geotextile**

Material: Polymeric fabric formed from a plastic yarn composed of at least 85% by weight of propylene, ethylene, amide or vinylidenechloride and containing stabilisers or inhibitors to make the filaments resistant to deterioration due to ultraviolet light.

Identification and marking: To AS 3705.

Preparation: Trim the ground to a smooth surface free from cavities and projecting rocks.

Placing: Lay the fabric flat, but not stretched tight, and secure it with anchor pins. Overlap joints 300 mm minimum.

3.11 PLACING FILL

General

Layers: Place fill in near-horizontal layers of uniform thickness, deposited systematically across the fill area.

Extent: Place and compact fill to the designated dimensions, levels, grades, and cross sections so that the surface is always self draining.

Edges: At junctions of fill and existing surfaces, do not feather the edges.

Mix: Place fill in a uniform mixture.

Previous fill: Before placing subsequent fill layers, ensure that previously accepted layers still conform to requirements, including moisture content.

Protection: Protect the works from damage due to compaction operations. Where necessary, limit the size of compaction equipment or compact by hand. Commence compacting each layer at the structure and proceed away from it.

Protective covering: Do not disturb or damage the protective covering of membranes during backfilling.

Placing at structures

General: Place and compact fill in layers simultaneously on both sides of structures, culverts and pipelines to avoid differential loading. Carefully place first layers of fill over the top of structures.

Concrete: Do not place fill against concrete retaining walls until the concrete has been in place for 28 days unless the structure is supported by struts.

3.12 PLACING TOPSOIL

Stockpiled topsoil

Cultivation: Rip to a depth of 100 mm or to the depth of rippable subgrade if less. Cultivate around services and tree roots by hand. Trim to allow for the required topsoil depth.

Herbicide: Apply before placing topsoil.

Placing: Spread and grade evenly.

Disposal of excess topsoil

On site: Dispose of surplus topsoil remaining on site by spreading evenly over the areas already placed.

Off site: Remove excess topsoil from the site and dispose of legally.

Compaction: Lightly compact topsoil so that the finished surface is smooth, free from lumps of soil, at the required level, ready for cultivation and planting.

Edges: Finish topsoil flush with abutting kerbs, mowing strips and paved surfaces. Feather edges into adjoining undisturbed ground.

3.13 COMPACTION REQUIREMENTS FOR FILL AND SUBGRADE

Density

General: Other than rolled fill to AS 2870 clause 6.4.2(b). Compact the subgrade and each layer of fill to the required depth and density, as a systematic construction operation and to conform to the **Compaction table**. Shape surfaces to provide drainage and prevent ponding.

Compaction table

Location	Cohesive soils. Minimum dry density ratio (standard compaction) to AS 1289.5.4.1	Cohesionless soils. Minimum density index to AS 1289.5.6.1
Residential: -Lot fill, house sites.	95	70

Location	Cohesive soils. Minimum dry density ratio (standard compaction) to AS 1289.5.4.1	Cohesionless soils. Minimum density index to AS 1289.5.6.1
Commercial: -Fills to support minor loadings incl. floor loadings < 20 kPa and isolated pad or strip footings < 100 kPa.	98	75
Pavements: -Fill to support pavements -Subgrade to 300 mm deep	95 98	70 75

Excavated and stripped ground surface: After excavation and/or stripping, compact these surfaces in conformance with the **Compaction table** to a minimum depth of 150 mm.

Maximum rock and lump size in layer after compaction: 2/3 compacted layer thickness.

Fill batter faces: Either compact separately, or overfill and cut back. Form roughened surfaces to the faces.

Moisture content

General: Adjust the moisture content of fill during compaction within the range of 85 – 115% of the optimum moisture content determined by AS 1289.5.1.1 or AS 1289.5.2.1 as appropriate, in order to achieve the required density.

3.14 GRADING

External areas

General: Grade to give falls away from buildings, minimum 1:100.

Subfloor areas

General: Grade the ground surface under suspended floors to drain ground or surface water away from buildings without ponding.

3.15 COMPLETION

Temporary works

Tree enclosures: Remove temporary tree enclosures at completion.

Tree marking: Remove temporary marks and tags at completion.

Temporary supports: Remove temporary supports to adjacent structures at completion.

Records

Certified records of measurement: Submit a certified copy of the agreed records of measurement.

Construction records

General: Submit the following:

- Geotechnical site visit record; and
- Earthworks summary report, or daily geotechnical reports.

Content: At least the following:

- The areas in which fill is placed.
- Levels after stripping.
- Location of any trees or large shrubs that may have been removed.
- Materials exposed after stripping and the criteria upon which the decision to cease stripping was made.
- Levels after completion of the filling.
- Types of fill materials in various zones.
- Location and level of each compliance test, together with test results. State if a test is a retest of an area which was previously rejected.
- Action taken where testing indicated that the specified criteria had not been met.

- Any areas where fill material or compaction was to be of a greater or lesser standard than elsewhere on site.
 - Site Classification to AS 2870.
- Format: To AS 3798 Appendix B.

3.16 SITE RESTORATION

Requirement

General: Where existing ground surfaces are not required to be varied as part of the works, restore them to the condition existing at the commencement of the contract.
