

## Policy 11: Land Development Guidelines

### SS4

#### Specification for Earthworks and Imported Topsoil

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## 1.0 General

- 1.1 This specification covers the requirements for topsoiling, excavation, filling, grading, compaction, roadworks (including table drains), parking areas, Site works and allotments as specified and/or shown on the drawings.
- 1.2 This specification applies to supply and transport of materials, and includes imported materials, unsuitable material and disposal of spoil.

## 2.0 Acts, Regulations and Local Laws

- 2.1 The Contractor shall comply with all Acts, Local Laws and Regulations having jurisdiction over work under the Contract and shall be fully responsible for any breaches thereof.

## 3.0 Extent of Works, Lines and Levels

- 3.1 The extent of earthworks shall be as shown on the drawings, described in the Contract Documents and/or as directed by the Superintendent.
- 3.2 The Contractor shall be responsible for the cost and full reinstatement of all areas outside the Site which have been disturbed or damaged as a consequence of work under the Contract.
- 3.3 The Contractor shall give written agreement to the information supplied on the drawings regarding existing surface levels within fourteen (14) days of the close of Tenders or in any event prior to the Date of the Letter of Acceptance. If no such notification is received by the Superintendent the information supplied on the drawings regarding existing surface levels shall be taken as final and shall not be subject to negotiation.  
Furthermore, no subsequent claim for any variation to the Lump Sum Contract for alleged base survey inaccuracies shall be entertained.
- 3.4 Finished lines and levels unless otherwise specified and/or shown on the drawings are the finished design geometry and include topsoil, paving and surfacing.
- 3.5 Dimensions for excavation of pavement boxing are minimum requirements and shall be increased when and as directed by the Superintendent to allow for the required pavement thickness as determined after subgrade testing.
- 3.6 Prior to the commencement of earthworks, the Contractor shall establish for each centre line peg an offset peg clear of the earthworks. The Contractor shall set such line and level pegs as are necessary for the adequate control of earthworks and pavement construction. The Contractor shall submit to the Superintendent in writing details of all offset pegs and construction pegs placed. The Contractor shall make available as and when required by the Superintendent such staff as may be required for the checking of line and level of all Works covered by the Contract and for the measuring up and recording by the Superintendent of all Works under the Contract.

## 4.0 Existing Services and Work by Others

- 4.1 Before undertaking any work which may interfere with any existing drain, public utility, railway, road, watercourse or tidal waters or with any structure, the Contractor shall give the required notice in writing to the Authority concerned. The Contractor shall not commence the work until it has received any necessary permit and it shall carry out the work in accordance with the conditions set out in the permit. A copy of the permit shall be submitted to the Superintendent.
- 4.2 Where the design of the Works requires alterations to existing services, the Principal may arrange with the Department or Authority concerned to make such alterations. If the Principal elects to have such work carried out by the particular Department or Authority and pays the required fees and charges then such work shall be excluded from this Contract.  
Where however, the Superintendent instructs the Contractor in writing to arrange such alterations, the Contractor shall make all necessary arrangements to either carry out the work or have same performed by the relevant Department or Authority. Costs incurred by the Contractor will, in these circumstances, be reimbursed under Provisional Sum Items unless provided for otherwise in the Contract.
- 4.3 All fees and charges (other than those arising from the requirements of **Clause 4.2** herein), the cost of restoration of existing services damaged by the Contractor's activities and the cost of alterations to suit the Contractor's methods of construction shall be borne by the Contractor.

- 4.4 Should the Contractor elect to vacate the Site while public utilities or other services are being installed by others, no adjustment to the Contract Sum will be made. Any reasonable delays caused by such early vacation will be considered by the Superintendent in respect of an extension to the Date for Practical Completion. All costs associated with de-establishment and re-establishment shall be borne by the Contractor.

## 5.0 Topsoil

- 5.1 Prior to the commencement of earthworks, areas which will be excavated, covered by fill material or covered by proposed earthworks, roadworks or pavements, shall have the existing topsoil removed and stockpiled. The Contractor shall submit samples of this topsoil to an approved Soils Laboratory in order to ascertain the type and amount of chemicals/fertilisers to be mixed with it prior to seeding. The Superintendent shall be furnished with a copy of the report from the approved Soils Laboratory. This topsoil shall be spread as directed on the Site upon completion of other relevant work.

The cost of stripping, stockpiling, and subsequent respreading of existing topsoil shall be deemed to be included in the earthworks items and the Lump Sum of the Contract generally.

- 5.2 Imported topsoil shall be an approved material consisting of a friable sandy loam textured material and shall be free from any material toxic to plant growth, free from noxious weeds, seeds and roots. Imported topsoil shall have the properties specified in **Table 3 – Topsoil Properties** for the respective applications.

**Table 1 – Types and Applications**

Soil Type	Application
Type A	Quality turf areas, playing fields and footpaths
Type B	Secondary grassed areas or roadside verges

The material should conform to the sieve analysis prescribed in **Table 2 – Topsoil Particle Size Distribution** for the soil type specified.

**Table 2 – Topsoil Particle Size Distribution**

Australian Standard Sieve Size (mm)	Percentage Passing by Mass	
	Type A	Type B
2.36	100	100
1.18	90 -100	90-100
0.600	70-100	70-100
0.300	30-85	30-95
0.150	16-40	16-60
0.075	6-30	6-45

**Table 3 – Topsoil Properties**

Property	Limit
Texture	Light – medium friable (ie. capable of being handled when moist, but lacking cohesion, so that it will fall apart easily when dry)
Organic Matter by mass (minimum)	2%
Chloride Content (maximum)	500mg/kg
Electrical Resistivity of a 1 in 5 soil/water mixture (maximum)	1mS/cm
pH (minimum) pH (maximum)	5.5 6.5
Linear Shrinkage (maximum)	3% – Type A 5% – Type B

The Contractor shall conduct ongoing compliance testing of the soil being supplied at a frequency of not less than one complete suite of tests per 1,000m<sup>3</sup> supplied or per change in source or, for soil blends, per change in source of any of the soil's component parts, which ever occurs sooner.

- 5.3 Prior to placing existing and imported topsoil all areas heavily compacted by construction equipment, shall be loosened by tining with disced plough or similar to a minimum depth of 75mm to the satisfaction of the Superintendent.
- 5.4 The cost of testing the existing and imported topsoil referred to in **Clauses 5.1** and **5.2** herein shall be deemed to be included in the relevant Bill Items (if part of the Contract) and the Lump Sum of the Contract generally.

The cost of incorporating the recommended chemical treatment resulting from the Soils Laboratory tests referred to in **Clauses 5.1** and **5.2** herein shall be paid for in the relevant Bill Item (if part of the Contract).

## 6.0 Earthworks

- 6.1 Excavation shall be taken to include all operations necessary to excavate earth and rock from the Site or nominated borrow areas irrespective of type and subsurface conditions, to remove abandoned services and service connections, to dispose of all surplus and unsuitable materials at areas designated in the Contract Documents or as directed by the Superintendent, to compact the ground surface below all fill embankments and to shape and trim the subgrade and slopes, all as specified in the Contract Documents and as directed by the Superintendent.
- 6.2 In excavations the thickness of the pavement shall be determined by the Superintendent when the level has reached the minimum depth of pavement below the finished levels as shown on the drawings. Variations to the thickness shown may then be ordered.  
It is the Contractor's responsibility to notify the Superintendent in writing when the earthworks under carriageways are at the minimum depth of pavement below the finished levels shown on the drawings.
- 6.3 The whole of the excavated material unless otherwise specified, shall remain the property of the Principal.
- 6.4 Unless specified otherwise, no claim shall be entertained on account of any rock or hard material in any excavation. The intending Contractor shall satisfy itself as to the nature of the material before tendering and any rock or hard material met with in the excavation shall be removed at the Contract price. The rate tendered in the Bill of Quantities shall be deemed to cover excavation in all classes of material whether rock or otherwise.
- 6.5 Excavations and borrow pits shall be so worked that the best material available is used to form the upper 300mm of embankment for the full width of the carriageway. There shall be no stone greater than 80mm in the upper 300mm.
- 6.6 Filling shall be taken to include all operations necessary to load and haul material from roadways and allotments or to win load and haul material from borrow areas shown in the Contract Documents or approved by the Superintendent and to place compact and trim the material, all as specified in the Contract Documents and as directed by the Superintendent.
- 6.7 Quantities shown on the drawings and in the Bill of Quantities are net quantities and the Contractor shall make its own assessment of compaction and/or bulking factors as are appropriate.
- 6.8 Notwithstanding any outline of methods included in the Contract, the attainment of the specified standards of compaction is the sole responsibility of the Contractor, and the cost of watering, compacting and any other necessary operations is deemed to be included in the relevant Bill Items (if part of the Contract) and the Lump Sum of the Contract generally.
- 6.9 Suitable filling materials shall comprise material which is acceptable in accordance with the Contract for use in the Works and which is capable of being compacted in accordance with the Contract.
- 6.10 Unsuitable filling material shall mean other than suitable material and shall include:
- a) material from swamps, marshes or bogs;
  - b) peat, logs, stumps and perishable material;
  - c) material susceptible to spontaneous combustion;
  - d) contaminated materials.

- 6.11 Unless specified otherwise, all unsuitable filling material shall be removed from the Site by the Contractor as directed. All such removal shall be deemed to be included in the earthworks items, and the Lump Sum of the Contract generally.
- 6.12 The longitudinal profile of the finished surface shall be evenly graded in accordance with the levels on the drawings. All grades shall be joined by vertical curves unless otherwise directed by the Superintendent.
- 6.13 The cross profile for finished road subgrades shall be in accordance with the drawings. On curves and elsewhere as specified the formation shall be widened to provide for the widening of the paving as shown on the drawings.
- 6.14 Wherever a road or an intersection to be constructed under this Contract has a gradient falling towards the limits of the Works, or where the inverts of channels and table drains to be constructed in this Contract, are below the natural surface level the Contractor shall construct outlet drains as directed by the Superintendent. The cost thereof shall be deemed to be included in the earthworks items and the Lump Sum of the Contract generally.

6.15 **Use of Explosives:**

Where approved, rock may be carefully excavated by blasting procedures. Prior to commencing any blasting operation the Contractor shall, pursuant to **Clause 2.0** herein, obtain any blasting permit required. The depth, spacing, location, type of explosive and method of firing shall comply with any permit issued for blasting operations.

In the handling, storage and use of explosives, the Contractor shall comply with all state and local authority laws and by-laws, and with **AS2187, SAA Explosives Code**. The Contractor shall in particular comply with **Section 11.2** of the **Code**.

Where directed the Contractor shall provide measurements from a vibograph or similar instrument. If these measurements indicate that the requirements specified herein are not being complied with the Contractor shall reduce the amount of charge used or take such other action as will ensure compliance with the Code.

The Contractor may be required to carry out trial blasting in order that the Superintendent may determine the peak vibration effects caused by the trial charges and so limit the maximum charge to be employed. The Contractor shall be responsible for all costs associated with the supply, operation and reporting of the vibograph or similar instrument.

The Contractor shall give the Superintendent at least three (3) days' notice of any intention to excavate by blasting and shall furnish full details of the location thereof and the methods it proposes to adopt. Subject to approval by the Superintendent for blasting at any location, such blasting shall be carried out only at times approved by the Superintendent.

The Contractor shall provide screens, barriers, mats and/or other protective devices as directed by the Superintendent to limit the effects of blasting. Notwithstanding the provision of such protective devices, the Contractor shall be responsible for any loss, damage or injury sustained by the public, workmen, the Works and for damage to property or public utilities of any description whatsoever caused directly or indirectly by such blasting.

Secure storage places shall be provided for explosives and all such places shall be clearly marked with warning signs. Only persons trained and experienced in the handling of explosives shall be allowed to use them on the work under the Contract, and no shot shall be fired until a warning has been sounded and all persons within the radius of danger removed. The warning device shall give an audible warning clearly different from any other sound normally heard on the Site.

In the event that the vicinity of work under the Contract is accessible to the general public, the Contractor shall, before any shots are fired, post personnel about the Works in various directions to warn all persons of the danger existing and to prevent them approaching closer than safety will permit.

Where blasting is likely to endanger life or property, the Superintendent shall have the power to prohibit the use of explosives or prescribe and enforce such rules and regulations as it may deem necessary but the prescribing or failure to prescribe such rules and regulations shall not relieve the Contractor from any responsibility under the Contract.

No explosives shall be left in holes overnight.

Where explosives are used in rock excavation, the charges shall be so proportioned and placed that they will not loosen the rock outside of the excavation lines shown on the drawings or as provided for in the Contract. If the rock below the line or slopes designated should be loosened by blasting to such an extent as to render it (in the Superintendent's opinion) liable to slide, fall

or have a detrimental effect to the Works such loosened rock shall be removed by the Contractor. The removed material shall be made good with material acceptable to and in a manner approved by the Superintendent.

All work associated with the use of explosives shall be deemed to be included in the relevant Bill Item (if part of the Contract) and/or the lump sum of the Contract generally.

### 7.0 Embankments

- 7.1 The existing surface upon which embankments are to be constructed shall first be stripped as specified. The top 150mm of the existing ground shall be compacted to the same degree as specified for the material which is to be placed thereon.
- 7.2 The Contractor shall prevent fill material from escaping beyond the embankment slope limits by the erection of barriers of rock, boulder, earth or by other suitable methods approved by the Superintendent.
- 7.3 Where an embankment is to be constructed across low swampy ground that will not support the weight of trucks or other handling equipment, the lower part of the fill shall be constructed by methods approved by the Superintendent up to the thickness not greater than necessary to support hauling equipment while placing subsequent layers.
- 7.4 Embankment material shall be placed in successive horizontal layers. On hillsides of solid rock it may be placed in a single layer to the minimum elevation permitting the operation of placing and compacting equipment; the rock first having been benched as directed by the Superintendent to ensure satisfactory stability of the embankment. Hillsides other than solid rock shall be excavated inward from the embankment to a sufficient distance to permit operation of placing equipment.
- 7.5 Material containing more than 25 per cent of rock greater than 150mm in greatest dimension shall be placed in layers of minimum compacted depth of 1.5 times the maximum size rock present in the material; provided however, that the thickness of layers before compaction does not exceed 600mm.
- 7.6 Each layer before starting the next shall be levelled and trimmed by means of power driven graders, dozers and other suitable equipment. Hauling and spreading shall be operated over the full width of each layer.
- 7.7 Batters shall be trimmed to the slopes shown on the drawings or as directed by the Superintendent.

### 8.0 Excavation

- 8.1 The batters shall be carried around all bends in even, regular curves, cut clean and sharp into side drains, so that there is be no impediment to the flow of water.
- 8.2 The sides of excavations shall be neatly trimmed to batters as shown on the drawings or as directed by the Superintendent.
- 8.3 In excavations where strata consists of rock overlain by earth, the latter shall be stripped back for a distance of 300mm from the face of the rock and shall then be trimmed to such slope as the character of the material may require to ensure stability.
- 8.4 In rock excavations the specified batter means the average rate of batter of the face of the excavation which (unless otherwise specified) need not be accurately trimmed. However, no rock shall project beyond the vertical line through the toe of the batter.  
Any rock or material affected by the operations of the Contractor (and which in the opinion of the Superintendent is not safe) shall be removed by the Contractor without extra payment.
- 8.5 Any benching or widening of excavations, which is indicated on the drawings for the purpose of improving the visibility around curves or for any other purpose, shall be carried out to the details as specified herein. The quantities of excavation required are included in the quantities of earthworks in the Bill of Quantities and the cost of all work involved in such benching or widening of cuttings shall be included in the earthworks items and in the Lump Sum of the Contract generally.

## 9.0 Protection of Structures

9.1 Proper precautions shall be taken by the Contractor to ensure that the method of operation in embankment and/or excavation does not cause movement of or undue strain in any structure. Embankments over and around culverts and bridges shall be of selected materials carefully placed in accordance with the Contract Documents.

## 10.0 Compaction

10.1 Each layer of the earthworks shall be moistened or dried to a uniform moisture content suitable for the compaction and then thoroughly compacted by rolling.

The uncompacted thickness of each layer (except material covered by **Clause 7.5** herein) shall not exceed 300mm. While earthworks are in progress the Contractor shall maintain at least one watercart and one appropriate roller in operation.

10.2 The amount of watering, rolling and compactive effort necessary to attain the standards specified in **Table 4** herein shall be solely the Contractor's responsibility.

**Table 4**

Area of Work	Relative Compaction Required		Min Test Frequency <sup>1,3</sup>
	Cohesive Material	Non-Cohesive Material <sup>2</sup>	
<b>Fill Platforms<sup>4</sup></b>			
Residential Development	≥ 95% Std Density Ratio	≥ 65% Density Index	<b>AS3798 Table 8.1</b>
Commercial Development	≥ 98% Std Density Ratio	≥ 70% Density Index	
Fill to Support Pavements	≥ 95% Std Density Ratio	≥ 65% Density Index	
<b>Pavement Subgrade</b>			
Pavement subgrade to a depth of 0.3m	≥ 98% Std Density Ratio	≥ 80% Density Index	a) 1 test per 50 lineal metres for 2-lane roads b) 1 test per 1000m <sup>2</sup> for carparks c) 3 tests per visit, whichever requires the most tests
<b>Backfill to Trenches</b>			
Under roads to a depth 0.3m below subgrade level	≥ 98% Std Density Ratio	≥ 80% Density Index	1 test per 2 layers per 40 linear metres
Commercial developments areas	≥ 98% Std Density Ratio	≥ 70% Density Index	
Elsewhere including under roads	≥ 95% Std Density Ratio	≥ 65% Density Index	

**Notes:**

- 1** Unless directed otherwise by the Superintendent.
- 2** Non-cohesive material shall be defined as material which contains up to 5% by mass of soil particles passing a 75 µm sieve, except that silty sands with non-plastic fines may contain up to 12% passing a 75 µm sieve.
- 3** For non-cohesive material, each compaction test may be replaced by three (3) Perth sand penetrometer tests provided that a correlation between the penetrometer test and the compaction test is established by the NATA accredited testing authority and approved by the Superintendent.
- 4** Refer notes 3, 4 and 5 Table 5.1 AS3798.

## 11.0 Testing

- 11.1 The Contractor shall arrange for compaction control testing of all backfill by a NATA accredited testing authority approved by the Superintendent. Testing shall be carried out in accordance with the appropriate test methods, sourced from either **Australian Standard AS1289** or the **Queensland Department of Main Roads, Materials Testing Manual**. The selection/application of test methods shall be made on a consistent basis. Inter-related tests shall be performed by methods from the same Standard/Testing Manual.
- 11.2 The Superintendent may order additional testing and the Contractor shall arrange to have such tests carried out without delay.
- 11.3 The tests set out in **Table 1 – Types and Applications** herein do not include normal job control tests and other tests carried out by the Contractor at its cost.
- 11.4 Should the compaction of earthworks as specified not be acceptable, the whole of the relevant area shall be re-worked and re-compacted by the Contractor at its expense until further testing for compliance (also at the Contractor's expense), shows the compaction to be acceptable as specified.

## 12.0 Maintenance of Earthworks

- 12.1 The Contractor shall be responsible for the stability of all embankments, excavations and slopes constructed under the Contract until final acceptance of the Work. The Contractor shall replace any sections which have become displaced due to carelessness or negligence on the Contractor's part or to damage resulting from natural causes such as storms, etc. and not attributable (in the opinion of the Superintendent) to unavoidable movement of ground upon which the embankment is constructed.
- 12.2 Adequate provisions for temporary drainage shall be made by the Contractor to ensure that ponding, flooding, erosion or siltation of the Site or external to the Site does not result from earthworks. The earthworks shall not affect drainage outfalls into or out of the Site.
- 12.3 If storm damage occurs external to the Site and if such damage (in the Superintendent's assessment) has resulted from the Contractor's failure to make adequate provisions at the Site or its surroundings to prevent such damage then it shall be the Contractor's responsibility to effect repairs and restitution at no cost to the Principal.

## 13.0 Reinstatement of Real Property Pegs and Fences

- 13.1 Any such survey pegs or marks which were established at the time of Possession of Site on areas not to be cleared, excavated or covered by embankments and which are disturbed, displaced, damaged, or covered over or obliterated prior to the commencement of the Defects Liability Period shall be replaced at the Contractor's expense.
- 13.2 The Principal will arrange for the replacement of such survey pegs or marks by a Licensed Surveyor, and the cost for such work will initially be paid by the Principal, and deducted from any moneys due to the Contractor.
- 13.3 At the commencement of the Defects Liability Period all boundary fences removed or damaged by the Contractor shall be reinstated to their original condition, to the satisfaction of the Superintendent.

## 14.0 Construction Tolerance

The Contractor shall construct the works within the following tolerances:

### Earthworks:

Horizontal  $\pm 1500\text{mm}$

Vertical Finished Surface  $+ 150\text{mm}$

Specific job tolerances have been met.

### Retaining Structures:

Horizontal  $\pm 150\text{mm}$

Vertical  $\pm 150\text{mm}$

## 15.0 Measurement and Payment

### 15.1 General

The cost of all work covered by this specification shall be included in the relevant Bill Items (if part of the Contract) and/or the Lump Sum of the Contract generally.

### 15.2 Measurement

- i) All earthwork quantities are net quantities calculated on the basis of the dimensions, contours and information shown on the drawings unless otherwise specified.
- ii) All quantities of cut and fill allow for the existing thickness of topsoil (which is to be stripped prior to construction) and exclude the quantity of any imported topsoil which shall be applied to the completed earthworks.
- iii) The Contractor shall make its own assessment in regard to compaction values when assessing the quantity of loose fill material required to achieve the specified lines and levels.
- iv) The quantities of earthworks in cut and fill allow for the minimum pavement thicknesses as specified and shown on the drawings.
- v) Quantities for replacement of unsuitable material shall include excavation, removal of unsuitable material and subsequent replacement thereof with specified material.
- vi) Where imported fill, or spoil from excavation, is identified in the Bill of Quantities the quantities are net volumes calculated from net quantities of cut and fill based on the dimensions and information on the drawings, or represent (when so specified), net volumes measured in place. The Contractor shall make its own assessment of bulking factors.
- vii) Imported topsoil quantities are based on measured topsoil areas to be covered by specified thickness in place, unless otherwise specified in the Contract.

### 15.3 Payment

- i) Payment for earthworks in cut or fill will be for the relevant Bill Item which shall include all expenses, plant, labour and control to complete the work item as specified herein.
- ii) Payment for replacement of subgrade material will be paid for by applying the unit rate in the Bill to the measured net volume. The rate shall be deemed to include for excavation and disposal of the subgrade material as directed by the Superintendent and all expenses for the supply, placing and compaction of the specified replacement material.
- iii) Imported fill shall be paid for under the relevant Bill Item (if such an item is provided).

## 16.0 Standards and Codes

16.1 This specification makes reference to the following Australian Standards and Queensland Department of Main Roads documents:

**AS1289 Methods of Testing Soils for Engineering Purposes**

**AS2187 Explosives – Storage, Transport and Use**

**AS3798 Guidelines on Earthworks for Commercial and Residential Developments**

**QDMR Materials Testing Manual, Volumes 1 – 4, Third Edition 1978, including Amendment Sheet No. 26, June 1996**

16.2 In this specification Australian Standards are referred to only by their allocated AS number. The latest available edition at the date of close of Tenders shall be deemed to apply.