SECTION 204 - EARTHWORKS

~~##This section cross-references Sections 173, 175, 205, 210, 290, 304, 702 and 720.~~
~~If any of the above sections are relevant, they should be included in the specification.~~
~~If any of the above sections are not included in the specification, all references to those sections should be struck out, ensuring that the remaining text is still coherent:~~

204.01 DESCRIPTION

This section covers the requirements for forming and grading of earthworks for roadworks and allotments including excavation, placement and compaction of topsoil, Type A, Type B, Type C, permeable, oversize and unsuitable materials, disposal of surplus materials, the trimming of batters, surface drains and formation, and the preparation of the final earthwork surfaces and subgrade.

Rock fills shall be constructed in accordance with Section 205.

Geotextiles in earthworks shall be in accordance with Section 210.

Lime stabilisation of earthworks shall be in accordance with Section 290.

Section 175 details the relevant references to Australian Standards (AS), Test Methods and Codes of Practice referenced in this section.

204.02 DEFINITIONS

Allotments

All areas outside the future road reserve and includes future residential lots, reserves and other areas.

Batter

The uniform side slope of a cut or a fill.

Batter Point

The intersection of the batter with the natural surface disregarding any batter rounding.

Boxing

The space above the subgrade to be occupied by the pavement bounded by the subgrade level and the inside faces of the constructed verges, or unsealed shoulders.

Capping

A Type A material layer of low permeability placed immediately below the pavement subbase or selected material to minimise changes in moisture content in the material below the capping layer. ~~Where a capping layer is provided, the top of this layer will typically be subgrade level.~~

Catch Drain

An open cut surface drain above a cut batter or below a fill batter to intercept and divert surface water to drainage outlets.

CBR

California Bearing Ratio.

Cut

Excavation below the natural surface level after removal of topsoil.

Cut Floor Level

The theoretical level of the formation in a cut after completion of excavation to the underside of ~~any capping or selected material. Where no capping or selected material is required, the cut floor level is subgrade level and the underside of~~ pavement or fill layer or final topsoil layer.

Within the Boxing the Cut Floor Level and Subgrade are the same.

Fill

The compacted embankment placed above natural surface level after removal of topsoil.

Fill Material

Fill material includes:

- **Type A material** – a superior quality material complying with the requirements of Table 204.041 and used principally as capping, selected material, structural material and/or verge material.
- **Type B material** – a medium quality material that does not meet the requirements of Type A material, and is usually specified with a minimum CBR value.
- **Type C material** – a lesser quality material that does not meet the requirements of Type A or Type B material, which may be used in Type C material zones of embankments as indicated on the drawings.
- **Rock Fill material** – a material comprised of larger rock and rock fragments which may be used within Type B and Type C material zones at lower levels of high embankments in accordance with Section 205.
- **Permeable Fill material** – self draining material, typically sand or aggregate.

Formation

The horizontal and vertical extent of the surface of the formed earthworks. The completed formation includes ~~capping,~~ selected material, verges, batters, batter roundings and table drains.

Pavement

Pavement shall consist of subbase, base and surfacing courses.

Recycled Material

Various products derived from resource recovery of: construction and demolition waste from building waste; reclaimed asphalt pavement (RAP) from maintenance and rehabilitation activities; and reclaimed glass from the glass disposal industry blended to produce Type A, Type B, and Type C products.

Rock Subgrade

The surface prepared at or below subgrade level by trimming the otherwise undisturbed in situ floor for the full width of the cutting in consistent, medium to high or higher strength rock, as defined in Table A8 of AS 1726 (1993) – Geotechnical Site Investigations, and which is free of soil and loose material.

Areas shall not be considered as a rock subgrade where they do not extend the full width of subgrade and for a continuous length of at least 200 m of a carriageway.

Selected Material

A Type A material layer placed immediately below pavement subbase to provide greater strength to support the pavement.

Silt

A material with properties below the ‘A line’ on the Plasticity Index (PI) / Liquid Limit (LL) graph per Table A1 in AS 1726 (1993).

Structural Material

A zone of Type A material that is placed at a bridge or a culvert structure or in other areas as specified and/or as shown on the drawings.

Subgrade is the trimmed or prepared portion of the formation on which the pavement (including shoulders) and any paved area (examples including footpath, parking bays and vehicle crossings) is constructed.

Subgrade Level

The level of the prepared subgrade defined as follows:

- **On Fills** – subgrade level is the level of the top of ~~capping and/or~~ selected material or where no capping or ~~selected material~~ is to be placed~~,~~ the top of Type B material.
- **In Cuts** – subgrade level is the level of the top of ~~capping/or~~ selected material or where no capping or ~~selected material~~ is to be placed, the cut floor level and the underside of pavement.

Surface Drain

An open drain to collect and drain surface water to drainage outlets.

Surplus Material

Material which is surplus to the total quantity of material required.

Table Drain

A surface drain adjacent to the shoulder or verge with an invert level designed to be lower than the top of the Type B material or the Cut Floor Level wherever possible.

Topsoil

The layer of fertile, organic soil immediately below natural surface or placed to the finished formation level outside areas to be paved.

Unsuitable Material

Material that is soft, excessively wet, unstable or otherwise not suitable for the specified use.

Verge

The portion of the formation between the outer edge of the shoulder and the start of the batter slope, or as detailed on the drawings.

204.03 CONFORMITY WITH DRAWINGS

Earthworks shall be finished to conform to the levels, lines, grades and cross sections specified or shown on the drawings within the following limits:

(a) Formation Width and Alignment

The widths measured either side of the specified centreline or design line to the tops and toes of cut batters and fill batters shall be not less than the widths specified or shown on the drawings.

(b) Formation Level and Shape (outside subgrade width, excluding batters)

Verges shall be constructed such that they match the finished surface level at the outer edge of shoulder or pavement, or where installed the level of kerb and channel or concrete edgings.

Both prior to and after completion of placement of topsoil, the level at any point on the surface outside those areas to be paved shall not differ by more than 50 mm from the specified level and the surface shall be free from depressions capable of retaining water. No point on these surfaces shall lie more than 25 mm below a 3 m straightedge laid on the surface.

(c) Boxing Width and Alignment

The boxing width shall not be less than specified or shown on the drawings and the edges of boxing shall not deviate by more than 50 mm from the designed offset from the centreline or design line.

(d) Type A Material

The thickness, width and shape of placed Type A material shall not be less than the specified thickness, width and shape at any point.

(e) Type B Material immediately below Capping and/or Selected Material

Where capping and/or selected material is to be placed on Type B material to subgrade level, the level at any point on the surface of Type B material immediately below capping and/or selected material shall not differ by more than 15 mm above or 30 mm below the specified level, unless assessment by random levelling is specified in which case the surface shall comply with Clause 204.03(h) and Table 204.161.

(f) Cut Floor Level

Where capping and/or selected material is to be placed above the Cut Floor Level to subgrade level, the level at any point on the surface of the Cut Floor Level immediately below capping and/or selected material shall not differ by more than 15 mm above or 30 mm below the specified level, unless assessment by random levelling is specified in which case the surface shall comply with Clause 204.03(h) and Table 204.161.

Where capping and/or selected material is not required, the Cut Floor Level shall be prepared to the appropriate tolerance for the subgrade.

(g) Subgrade Level and Shape

The subgrade shall be constructed to the surface level requirements of Scale B unless otherwise approved by Council. ~~either Scale A, Scale B or Scale C as nominated in Clause 204.16~~.

Where Scale A or Scale B is approved by Council, ~~nominated,~~ the surface shall be assessed by random levelling and shall comply with the requirements of Clause 204.03(h). Where Scale C is nominated, random levelling is not required; however no point on the subgrade surface shall be more than 10 mm above or 30 mm below the specified level.

For either Scale A, B or C level tolerances, the level at any point on the subgrade shall not lie more than 20 mm below a 3 m straightedge laid in any direction, except across a crown and water shall not pond at any point. Where the scale of testing has not been specified, Scale A of Clause 204.03(h) shall apply.

(h) Random Level Assessment - Scale A and B Surface Level Requirements

Level measurements shall be taken at random locations over the area of the lot in accordance with Section 173 – Examination and Testing of Materials and Work (Roadworks). The number of measurements taken within each lot shall not be less than the number specified in Table 204.031. Random level assessments of the surface shall be undertaken in lots not exceeding 4000 m2.

The mean and standard deviation of the departures from the theoretical surface level within each lot shall meet the requirements of Table 204.031.

Table 204.031 Minimum Number of Level Measurements and Tolerances

Scale of Surface Level Measurement	Minimum Number of Measurements per Lot	Tolerance	
		$\bar{x}$ Range (mm)	Maximum S (mm)
Scale A	80	+5 to -15	12
Scale B	40	+5 to -25	15

Notes:
1. $\bar{x}$ is the mean value of all level readings taken in the lot
2. S is the standard deviation of all level readings taken in the lot
3. A negative value designates a measured departure below the design level and positive value designates a surface level above the design level

~~(i) Batter Slope and Shape~~

At any cross section the batter slope shall be not steeper than the slope specified. The batter face shall be finished to uniform shape.

(j) Batter Line

Cut batters shall be constructed so that the batter point is not more than 10% of the batter height outside the calculated batter line.

Fill batters shall be constructed so that the toe of the batter is not more than 10% of the batter height outside the calculated batter line.

The dimensions of batter rounding shall be within 10% of the dimensions shown on the drawings.

On all sections beneath bridges, and on other sections where it becomes necessary to confine the lateral spread of the earthworks to closer limits due to site constraints, the tops of cut batters and the toes of fill batters shall be not more than 300 mm outside the calculated batter lines.

(k) Surface Drains

Surface drain invert levels and side slopes shall be finished to within 50 mm of the specified level at any point and shall be free from depressions capable of retaining water.

204.04 MATERIALS

Testing of materials shall be undertaken in accordance with VicRoads Code of Practice 500.16.

Materials shall meet the requirements described below:

(a) Topsoil

Topsoil placed on formations and disturbed areas shall be capable of supporting healthy, full cover of grass growth, be friable, contain organic material and unless further defined in Section 740~~720~~, shall be free from subsoil, tree roots, clay balls, stones, rocks, rubbish, contaminants, weeds, pathogens and toxic levels of any element with a pH in the range of 5 to 8.

(b) Type A Material

Type A material shall comply with the requirements of Table 204.041 and shall be free of topsoil, deleterious and/or perishable matter.

HP **Material classified as silt, either before or after compaction, is not acceptable as Type A material without stabilisation to the satisfaction of ~~the Superintendent~~ Council.**

******* **Table 204.041**

Location and Use of Type A Material	Physical Properties			Limits of Grading (% passing by mass) Post Compaction Sieve Size AS (mm)					PI x % passing 0.425 mm Post Compaction (max)	PI Range Post Compaction
	Assigned CBR (min) % (1)	Swell % (1)	Permeability (max) m/s (2)	75.0	37.5	4.75	0.425	0.075		
Capping Layer	~~6~~ 10	≤ 1.5	5 x 10^{-9}	100	90-100	~~40~~ 44-80	14-40	~~10-40~~ 6-25	1000	6-25
~~Selected Material~~	~~##:6~~	~~≤ 1.5~~	~~Not Applicable~~	~~##:100~~	~~##:-~~	~~##:40-80~~	~~##:-~~	~~##:10-40~~	~~##:1000~~	~~##:6-25~~
~~Verge Material~~	~~##:6~~	~~≤ 1.0~~	~~5 x 10^{-9}~~	~~##:100~~	~~##:-~~	~~##:40-80~~	~~##:-~~	~~##:10-40~~	~~##:1000~~	~~##:6-25~~
~~Structural Material~~	~~##:6~~	~~≤ 1.5~~	~~Not Applicable~~	~~##:100~~	~~##:-~~	~~##:40-80~~	~~##:-~~	~~##:10-40~~	~~##:1000~~	~~##:6-25~~
Other Type A Material	~~6~~ 10	≤ 1.5	~~Not Applicable~~ 5 x 10^{-9}	100	-	40-80	–	~~10~~ 8-40	~~1000~~1600	6-25
##:										

Notes: (1) The Assigned CBR and percentage swell values are to be determined in accordance with VicRoads Code of Practice RC 500.20. Sampling for CBR testing shall be undertaken after field compaction.

(2) The permeability value is to be determined in accordance with VicRoads Code of Practice RC 500.16. The permeability value is to be determined on specimens manufactured from that fraction of material which passes a 19.0 mm AS sieve, compacted at optimum moisture content and 98% of maximum dry density as determined by testing using standard compactive effort for CBR and swell.

(3) The Assigned CBR for the Capping Layer is 10 minimum unless shown otherwise on the Drawings.

(c) Type B Material

Type B material shall be totally free of organic content, topsoil, deleterious and/or perishable matter such as bricks, concrete, glass, plastic, timber, steel or steel by-products. After compaction Type B material shall have a maximum particle dimension of not more than:

(i) 150 mm within 400 mm of the top of Type B material; and

(ii) 400 mm at depths greater than 400 mm below the top of Type B material.

*** Type B material shall have a minimum Assigned CBR of the subgrade as shown on the drawings~~##:2%~~, and Assigned Percent Swell less than 2.5% which has been determined in accordance with VicRoads Code of Practice RC 500.20.

Materials that exhibit swells greater than or equal to 2.5% shall be classified as expansive and shall only be used as Type B material if approved by ~~the Superintendent~~ Council.

Where the highest quality Type B materials are available they shall be reserved for placement in higher levels of the fills being constructed. Material within the top 400 mm of top of Type B material shall have a swell less than 2.5%.

Materials that exhibit swells of 5% or greater are not permitted.

Sampling for CBR testing shall be undertaken after field compaction.

Material classified as expansive or silt, either before or after compaction, shall not be used as Type B material.

(d) Type C Material

Type C material shall be capable of being spread in layers of not more than 500 mm and compacted as specified to achieve a stable condition.

(e) Recycled Materials

Blends of crushed recycled materials such as crushed concrete, crushed brick, reclaimed asphalt pavement (RAP), slag and crushed glass may be used as Type A, B and C materials in earthworks applications.

Any blend of recycled materials proposed for use shall be registered with ~~on~~ VicRoads. ~~contracts shall be registered~~.

The blend of recycled materials shall only be obtained from a VicRoads accredited source and manufactured in a controlled manner which ensures the blended product has consistent physical properties.

The registered blend of recycled materials shall meet all relevant requirements and properties as listed in Clause 204.04.

Low density foreign materials such as plastic, rubber, plaster, clay lumps and other friable material shall not exceed 3% by mass. Wood and other vegetable or decomposable matter shall be limited to a maximum of 0.5% by mass and assessed using test method RC 372.04 ‘Foreign Materials in Crushed Concrete Products’ shown in Section 175.

Crushed glass used in any recycled material blends shall be crushed to a cubic shape and able to pass the 4.75 mm AS sieve.

Any blend of recycled materials shall be able to be classified as ‘clean fill’ in accordance with Environment Protection Authority, Victoria guidelines.

(f) Permeable Fill Material

Permeable fill material shall be a mixture of hard, durable, clean sand, gravel or crushed aggregate complying with the requirements shown on the drawings ~~of Table 204.042~~, which is free of clay balls and perishable matter.

~~**Table 204.042 Permeable Fill Material**~~

~~**Location**~~	~~**Type of Permeable Fill Material**~~
~~##:Against Structures~~	~~##:Grade A4, A5 or A6 (1)~~
~~##:Backfill for Open Jointed Pipes~~	~~##: Grade A4, A5 or A6 (1)~~
~~##:Drainage Blanket Material~~	~~##: Grade A6, B4 (1)~~

~~**Note:** (1) Grading requirements are specified in Section 702.~~

(g) Oversize Material

Oversize material shall have a maximum particle dimension after compaction not greater than that specified for the type of material and depth of layer being placed.

204.05 STRIPPING OF TOPSOIL

Topsoil shall be stripped for the full area of cut and fill. ~~width of the formation~~:

~~(a) defined by the line through batter points extended to include any rounding and any surface and catch drains;~~

~~(b) by a means which avoids contamination with subsoil and does not increase the extent of unstable areas; and~~

~~(c) placed in stockpile or prepared areas.~~

Unless there is an excess of topsoil to be removed from site, topsoil shall not be removed from the site.

The Contractor shall treat and manage site topsoil before stripping, and after spreading, to remove and/or minimise the spread of weeds and other pathogens and pest organisms throughout the site.

Stockpiles shall be maintained in a neat, well shaped state capable of shedding water. Topsoil shall be re-spread as soon as practicable.

Stripped surfaces shall be graded to an even self-draining surface.

204.06 SITE EXCAVATION

(a) General

Site excavation shall be excavation within the limits of the batters, open and underground drainage and approved borrow areas from within the Site, and shall include the handling of excavated material to the point of disposal.

(b) Catch Drains and Batter Rounding

The Contractor shall construct catch drains where shown on the drawings or where required for the temporary collection and diversion of surface runoff or as otherwise agreed to by ~~the Superintendent~~ Council.

Permanent catch drains and batter rounding at the top of cut batters shall be constructed at the commencement of the cutting excavation.

(c) Material Category

~~HP~~ **Prior to commencing excavation in any area and during excavation work, ~~the Superintendent~~ Council and the Contractor shall inspect each type of material encountered and subject to verification by appropriate laboratory testing, agree on the category of the material in accordance with Clause 204.04.**

(d) Excavation Operations

The Contractor shall conduct its operations such that the area outside the limits of the excavation is not unduly disturbed. Any falls or slips of material that occur shall be removed and the area treated to prevent recurrence.

If any area on cut batters becomes unstable or unsafe, the Contractor shall install suitable measures to restrict access to the area, e.g. the erection of warning signs and fencing. The affected area shall be inspected and assessed by a geotechnical engineer, and made safe prior to excavation proceeding in the affected area.

Oversize material shall be treated in accordance with Clause 204.08.

(e) Treatment of Cuttings at Cut Floor Level

The material within 400 mm below Subgrade ~~Cut Floor Level~~ shall have an Assigned CBR of not less than the Design CBR for the pavement. ~~that specified for Type B material and shall have a swell less than 2.5%.~~

(i) ~~(i)~~ In situ material below Cut Floor Level having an Assigned CBR less than ~~that specified for Type B material, or a swell of 2.5 % or greater,~~ the Design CBR shown on the Drawings shall be removed to a depth of 400 mm below Cut Floor Level and replaced with conforming Type A~~B~~ material as approved by Council to the underside of the ~~capping or selected material layer, or where no capping or selected material is required, to~~ subgrade level.

~~(ii) Where removal and replacement of material below the Cut Floor Level is not required, the surface shall be loosened to a depth of 150 mm and re-compacted to meet the specified requirements.~~

Where the subgrade ~~cut floor~~ on which capping ~~or selected material~~ or pavement is to be placed consists of soil and rocky materials meeting the specification requirements but is too rocky to trim to the tolerances specified in Clause 204.03(f), the material shall be ripped to a minimum depth of 150 mm, loosened and broken down to a maximum particle size of 50 mm. Any rocks or boulders larger than 50 mm shall be removed and any resulting depressions shall be backfilled with Type B material and such backfilling together with the loosened material shall be reworked and compacted as specified to the Cut Floor Level.

(f) Treatment of Rock Subgrade

Where rock exists in a cut below subgrade level ~~but within the designed capping or selected material layer~~, the material shall be excavated to a depth of not less than 150 mm below subgrade level in all areas on which pavement is to be placed and all loose material and soil shall be removed from the rock floor. Any resulting depressions lower than 150 mm below subgrade level shall be cleaned of loose material and backfilled with 20 mm Class 3, 3% cement treated crushed rock and compacted as specified.

A regulating layer of Class 4, 20 mm Crushed Rock shall then be placed above the rock to subgrade ~~level in lieu of the specified capping or selected material,~~ in layers not exceeding a compacted thickness of 150 mm in accordance with Section 304.

HP **Prior to construction of the regulating layer, the areas of rock subgrade shall be presented to ~~the Superintendent~~ Council for acceptance.**

The Contractor shall submit details of any necessary amendments to the subsurface drainage design including transverse subsurface drainage at the interfaces to ~~the Superintendent~~ Council for review.

~~No adjustment to the Contract Sum will be considered for the treatment of a rock subgrade, or for the construction of the regulating layer in lieu of capping or selected material, or for any modifications to the subsurface drainage.~~

(g) Treatment of Cut to Fill Zones

All pavement and verge areas at cut to fill zones shall be excavated to a minimum depth of 600 mm below the Cut Floor Level or top of Type B material, for a distance of not less than 15 m into the cut and 30 m under the fill from the cut-fill line at the upper surface of Type B material earthworks.

In sideling cut areas, the cut shall be excavated to a depth of 600 mm below the Cut Floor Level for the full cut width to be occupied by pavement and verge material.

The above excavations shall be backfilled in layers with Type B material.

(h) Groundwater

HP **Where groundwater or seepage is encountered the Contractor shall notify ~~the Superintendent~~ Council and submit the proposed action to be taken to ~~the Superintendent~~ Council for review.**

The Contractor shall submit any necessary approvals from relevant authorities for the treatment and disposal of this groundwater.

(i) Surface Finish of Cut and Fill Batters

The surface of cut and fill batters to be topsoiled shall be textured by scarifying or horizontal grooving.

204.07 UNSUITABLE MATERIALS

(a) General

Excavation of unsuitable material shall be undertaken such that the extent of unstable areas is not increased.

Material used to replace excavated unsuitable material shall be Type B material and / or approved by Council.

(b) Cuts

Where in situ material within 400 mm below capping, selected material and/or pavement has an Assigned CBR less than that specified at that level, or has a swell of 2.5% or greater, it shall be treated in accordance with Clause 204.06(e)~~(i)~~.

Other unsuitable materials below the Cut Floor Level on which pavement subbase, capping or selected material is to be placed shall be either treated in situ or excavated and replaced with Type B material and / or approved by Council. All treated areas or replacement material shall be spread and/or compacted to the specified density in layers not exceeding a compacted thickness of 200 mm.

~~Where material:~~

~~(i) is unsuitable and does not exceed 150 mm in depth, it shall be treated in situ or excavated and replaced and no additional payment will be made for this work;~~

~~(ii) is unsuitable and exceeds 150 mm in depth, it shall be treated in situ or excavated and replaced. Separate payment if applicable (i.e. if the Contract is a schedule of rates contract or the work is covered by a Provisional Item under a lump sum Contract) will be made for the volume of material below the Cut Floor Level so treated or excavated and replaced;~~

~~(iii) has become unsuitable to any depth due to the Contractor's negligence or use of inappropriate methods it shall be treated in situ or excavated and replaced and no additional payment will be made for this work.~~

(c) Areas Upon Which Fill is to be Placed

After completion of clearing, grubbing and stripping of areas upon which fill is to be placed, any unsuitable material immediately below these areas shall be treated in situ or be excavated and replaced with suitable material which shall be spread and compacted as specified.

~~If the Contract is a schedule of rates Contract or the work is covered by a Provisional Item under a lump sum Contract, payment will be made for the full volume of material so treated or excavated and replaced except that, where material has become unsuitable due to the Contractor's negligence or use of inappropriate methods, no additional payment will be made for this work.~~

(d) Treatment of Unsuitable Materials

HP **Where unsuitable material is encountered the Contractor shall submit the proposed in situ treatment or extent of excavation to ~~the Superintendent~~ Council for review.**

~~(e) Fills~~

~~Unsuitable materials in fills shall be treated in situ or be excavated and replaced at the Contractor's cost.~~

~~(f) Stockpiles~~

~~Material complying with the requirements of Type A, B or C material, which is unsuitable for immediate use due to being over wet, may be stockpiled for later use.~~

204.08 SURPLUS EXCAVATED MATERIAL

No material shall be transported offsite, where such material can be used within the designed earthworks ~~under the Contract.~~

~~**Surplus material shall be disposed of off site at the Contractor's cost.**~~

204.09 BORROW EXCAVATION

Borrow excavation shall be limited to the quantity of material necessary to complete the work ~~under the Contract~~ and will not be permitted where sufficient suitable material is available from within the limits of site excavation. The Contractor shall obtain all necessary permits and approvals for borrow areas ~~outside the road reservation~~.

Borrow excavations within the road reservation will not be permitted without the prior approval of ~~Superintendent~~ Council.

Where ~~the Superintendent~~ Council's approval is obtained the Contractor shall be responsible for obtaining all other necessary permits and approvals prior to the commencement of borrow excavation.

204.10 FILL CONSTRUCTION

(a) General

Fill construction includes the preparation of areas upon which fills are to be constructed and the selection, placement, and compaction of material.

(b) Areas Upon Which Fills are to be Constructed

Areas upon which fills are to be constructed shall be prepared for test rolling by the Contractor. The surface of the prepared area shall be test rolled in accordance with Clause 204.12. Any unstable areas detected by test rolling shall be rectified.

Where the height of fill to be placed to top of Type B material level over the stripped surface is less than 1.0 m, material immediately below the surface exposed after stripping of topsoil or removal of existing pavements shall be scarified to a depth of not less than 150 mm and re-compacted to the specified density ratio for the location and type of material being placed.

Existing pavements under areas upon which fills are to be constructed, that are not required to be salvaged shall be scarified to a depth of not less than 150 mm and compacted as specified.

If groundwater is encountered, the requirements of Clause 204.06(h) shall apply.

HP **The Contractor shall not commence placing any fill on the prepared areas until the area has been reviewed by ~~the Superintendent~~ Council.**

(c) Benching

Where a fill is to be constructed on steep sideling ground or against an existing embankment with side slope steeper than 4 horizontally to 1 vertically, benches shall be progressively cut over the full area to be covered by new fill. The width of each bench shall be such as to permit safe and effective operation of plant but shall be not less than 1 m.

Material excavated during benching may be used in construction of fills if it meets the requirements specified in Clause 204.04 for the type of material being placed.

(d) Placing of Fill

(i) General

Fill material shall be placed and spread in uniform layers and shall be compacted to meet the specified requirements for the location and type of material being placed.

Each layer of fill shall be keyed into the layer above by creation of a textured surface.

Any rocky material present in a layer of fill shall be uniformly distributed throughout the layer and the whole shall be compacted to meet specified requirements.

During the placement of fill material the surface of each layer shall be kept generally parallel to the surface of the subgrade. Prior to the cessation of work each day, the top of the fill shall be shaped and compacted to minimise damage resulting from wet weather.

The Contractor shall establish a procedure to verify that compacted layers do not exceed the specified maximum thickness. Verification records must provide evidence of measurements taken at least every three layers in consistent locations across the filled areas, and must be retained with the lot records.

(ii) Filling on Allotments and Reserves

All filling work and subsequent compaction shall be undertaken to Level 1 inspection and testing requirements in accordance with AS 3798 “Guidelines on earthworks for commercial and residential developments”.

(iii) Type A Material

Type A material shall be placed in locations shown on the drawings or, if surplus Type A material is available, it may be used in locations specified for Type B material.

Type A material shall be spread and compacted in layers not exceeding a compacted thickness of 200 mm.

Type A structural material shall be placed in accordance with the requirements of Clauses 204.11 and 204.13.

(iv) Type B Material

Type B material shall be placed in locations shown on the drawings, or if surplus Type B material is available, it may be used in locations specified for Type C material. The highest quality Type B materials available shall be reserved for placement in the higher levels of Type B fills being constructed.

Type B material shall be spread and compacted in layers not exceeding a compacted thickness of 200 mm.

Where Type B material contains 25% or more of rock by volume, which will not break down during compaction to meet the maximum particle dimension required for a 200 mm thick layer, the loose thickness of each layer may equal 125% of the typical maximum particle dimension of the rock up to a maximum layer thickness of 500 mm. Any rock with a maximum particle dimension greater than 80% of the loose thickness of the layer shall be removed. The material shall be placed and compacted such that voids are completely filled with fine material.

Type B material containing rock with a particle dimension greater than 150 mm after compaction shall not be placed within 400 mm of the top of Type B and/or Type C material zones.

(v) Type C Material

Type C material shall be placed in locations shown on the drawings or in other areas approved by ~~the Superintendent~~ Council.

Type C material shall be spread and compacted in layers not exceeding a compacted thickness of 300 mm.

Where Type C material contains 25% or more of rock by volume, which will not break down during compaction to meet the maximum particle dimension required for a 300 mm thick layer, the loose thickness of each layer may equal the maximum particle dimension of the rock up to a maximum layer thickness of 500 mm.

Rocks with a maximum particle dimension of less than 800 mm may be placed in Type C material zones as specified, with sufficient spacing between larger rocks to enable full compaction of the Type C material.

The material shall be placed and compacted such that voids are completely filled with fine material.

204.11 FILL AT STRUCTURES

(a) General

This clause covers the requirements for the placement and compaction of fill material adjacent to or preparatory to the construction of structures such as bridge abutments, retaining walls, wing walls, crown units and culverts with an opening height greater than 1200 mm. Such material shall be placed at locations as specified or shown on the drawings.

(b) Fill at Structures

HP **No fill shall be placed against or within 3 m of a structure until the foundation for the fill has been reviewed ~~by~~ and approved by ~~the Superintendent~~ Council.**

In addition to the placement of Type A material at bridge abutments as structural material, embankment material or backfilling within 3 metres of retaining walls, wing walls, all crown units, and culverts with an opening height greater than 1200 mm, shall be material of at least Type A material quality.

No material shall be placed against concrete within 14 days of casting.

Unless a geocomposite drainage mat is specified as a drainage medium, material to be placed within 300 mm of bridge abutments, retaining walls, wing walls or large culverts shall consist of permeable fill material which meets the requirements of Clause 204.04. The permeable fill material shall be placed in conjunction with the adjacent fill in layers not exceeding 150 mm compacted thickness, and compacted to refusal using hand held mechanical equipment. The bottom of the permeable fill material or any geocomposite drainage mat shall be connected to suitable drainage outfalls by subsurface drainage pipes as shown on the drawings or as otherwise specified.

Material to be placed adjacent to permeable fill material or geocomposite drainage mat within 3 m of the face of structures shall be Type A structural material which meets the requirements of Clause 204.04. Such material shall be spread and compacted as specified in horizontal layers not exceeding 150 mm compacted thickness.

Compaction plant shall not be operated within the minimum distances from structures shown in Table 204.111. These minimum distances apply until the fill reaches the level above the top of the structure corresponding to the relevant specified minimum cover.

The difference in level of any fill being placed on opposite sides of a structure or structural component shall not exceed H/4 or 500 mm, whichever is the lesser, where H is the height of the structure.

Table 204.111 Fill at Structures

Non Vibrating Rollers - Static Weight * (tonne)	Vibrating Rollers - Total Applied Force ** (kN)	Minimum Distance from Compaction Plant to Side of Structures (m)	Minimum Distance from Compaction Plant to Abutments, Retaining Walls and Wing Walls (m)	Minimum Cover over Top of Culverts (m)
Less than 2	Less than 20	0.15	0.15	0.15
2 – 5	21 - 50	0.3	0.3	0.15
6 – 10	51 - 100	1.2	1.2	0.4
11 – 20	101 - 200	2.4	1.2	0.4
21 – 35	201 - 350	2.4 or height of structure (whichever is greater)	1.2 or height of structure (whichever is greater)	0.7

* Includes vibrating rollers operating in non-vibrating mode.

** Total Applied Force is the sum of the static weight and the vertical component of the centrifugal force.

(c) Fill Placed Prior to Erection of Structures

Material placed within 3 m of any future structure shown on the drawings shall be Type A structural material.

204.12 TEST ROLLING

Areas upon which fills are to be constructed, all layers of fill, and material within 150 mm of the cut floor level in cuts, shall be test rolled in accordance with Section 173. The Contractor's quality plans and procedures shall include test rolling as a hold point.

HP The Contractor shall provide for ~~the Superintendent~~ Council to be present during all test rolling.

~~The Superintendent~~Council reserves the right to direct the Contractor to undertake further test rolling on any layer prior to it being covered by a successive layer~~. No additional payment will be made for any requirement to carry out such further test rolling.~~

204.13 TESTING AND ACCEPTANCE OF COMPACTION AND MOISTURE CONTENT

Fills shall be compacted to ~~either~~ Compaction ~~Scale A,~~ Scale B unless otherwise approved by Council. ~~or Scale~~ C ~~as nominated in Clause 204.16. Where the compaction scale has not been specified, Compaction Scale A shall apply~~. Testing for compaction shall be undertaken in accordance with VicRoads Code of Practice 500.05.

(a) Test Lots

A test lot shall be as defined in Section 173. The lot size for Type A, Type B and Type C material shall be a maximum of 500m2 under paved areas or as specified in Table 204.142 in all other areas.

The calculation of density ratio and moisture ratio shall be based on laboratory values determined using standard compactive effort.

For work to be tested for compliance with Scale A or Scale B compaction requirements, the number of tests per lot shall be six, unless the lot is to be treated as a small lot in accordance with Section 173.

For work to be tested for compliance with Scale C compaction requirements, the number of tests per lot shall be three.

(b) Compaction

(i) Material of Nominal Size 40 mm or Less after Compaction

Fill material, and material within 150 mm of the Cut Floor Level having a nominal size after compaction of 40 mm or less shall be compacted to comply with the requirements of Table 204.131.

Each lot to be tested for compaction shall be test rolled in accordance with Section 173. Any unstable areas shall be excluded from the lot and shall be rectified by the Contractor and assessed separately. If the total area of the excluded areas exceeds 20% of the area of the lot, the whole of the lot shall be rejected.

Table 204.131 Compaction Requirements

Location	**Material Type and Location**	**Scale A**	**Scale B**	**Scale C**
		Minimum Characteristic Value of Density Ratio (%)	**Minimum Characteristic Value of Density Ratio (%)**	**Minimum Mean Value of Density Ratio (%)**
Within the Future Road Reserve	All Type A Material	99.0	98.0	100.0
	Type B Material placed within 400 mm of top of Type B Material			
	Ripped and re-compacted material below Cut Floor Level			
	Type B Material placed more than 400 mm below top of Type B Material	97.0	95.0	95.0
	The top 150 mm of areas where fill is to be constructed			
	Type C Material	95.0	93.0	92.0
All Other Areas including Allotments	**Type A and Type B Material**	**95.0**	**95.0**	

(ii) Material of Nominal Size Greater than 40 mm (after Compaction)

All fill material and ripped and re-compacted material in cuts below Cut Floor Level with a nominal size after compaction greater than 40 mm shall be compacted using a grading, mixing, watering and rolling procedure as agreed by ~~the Superintendent~~ Council.

~~The Superintendent~~Council may require that trial sections be constructed to verify that the proposed compaction routine is acceptable. ~~No additional payment will be made for any requirement to construct trial sections.~~

All fill material and material below the Cut Floor Level shall be compacted at minimum moisture ratio of 80%. The moisture ratio shall be determined using the material which passes the 37.5 mm sieve, where the material contains less than 20% oversize material. If the material contains more than 20% oversize material, the moisture ratio shall be determined using an alternative method in accordance with the appropriate test method or Code of Practice.

Acceptance of work for compaction will be based on compliance with the accepted placement and compaction procedure and test rolling carried out in accordance with Section 173.

Any unstable areas detected by test rolling shall be rectified. Where unstable areas exceed 20% of the area being test rolled, the whole of the area shall be ripped, re-compacted as specified above, and re-presented for test rolling.

(c) Treatment of Expansive Materials

All material with a percentage swell equal to or greater than 2.5% shall be considered as expansive and shall be treated in accordance with Clause 204.06(e)(i) and Clause 204.10(d)(iii).

All layers of Type A material placed over expansive Type B or expansive in situ material, shall be maintained at a characteristic moisture ratio of not less than 90% for the period between completion of compaction and placement of the overlying layer.

Expansive material shall be placed at a characteristic moisture ratio of 90% to 110% during compaction, maintained through test rolling and up to placement of the overlying layer.

The Contractor may nominate a lesser characteristic moisture ratio for agreement of ~~the Superintendent~~ Council if it can demonstrate that complying with the above requirement will result in ~~the~~ material being unstable under a test roll performed in accordance with the requirements of Section 173.

Where the nominal size of material after compaction is greater than 40 mm, the moisture ratio shall be determined on that material which passes the 19.0 mm sieve, otherwise the moisture ratio shall be determined on the material passing the 37.5 mm sieve or 19.0 mm sieve taking into account oversize material as required by the test method.

204.14 FREQUENCY OF TESTING

The Contractor shall carry out testing at a frequency which is sufficient to ensure that the materials and work supplied ~~under the Contract~~ complies with the specified requirements. Notwithstanding this requirement, testing shall be undertaken at either Scale A or Scale B level of testing, at a frequency not less than that specified below. Where the scale of testing has not been specified, Scale A shall apply.

(a) Material Properties Testing - Scale A

(i) CBR and Percentage Swell

Materials shall be tested to demonstrate compliance with the material property requirements specified in Clause 204.04. Where Scale A is specified, the following frequency of testing shall apply.

The initial lot of each material type shall be tested to determine the Assigned CBR (strength) and percentage swell of the material and shall be carried out in accordance with VicRoads Code of Practice RC500.20. Unless otherwise approved by ~~the Superintendent~~ Council sampling for CBR testing shall be undertaken after field compaction of the initial lot. If either the Assigned CBR value or percentage swell value does not meet the requirements specified in Clause 204.04, the lot shall be rejected and all subsequent material from that source will be considered as non-conforming for that use.

Where both the Assigned CBR and percentage swell values meet the requirements of Clause 204.04 the material will be considered to be conforming subject to it complying with other specified requirements, and the Contractor may seek ~~the Superintendent~~ Council's agreement to undertake future testing for CBR and percentage swell at the reduced frequency specified in Table 204.141.

The continued acceptance of Assigned CBR and percentage swell will be assessed against the CBR and percentage swell values of a single CBR test and a single percentage swell test. Provided that the single CBR test value is greater than the specified Assigned CBR value and that the percentage swell value is less than the specified percentage swell value, the lot shall be accepted for CBR and percentage swell.

Should either the single CBR value be less than the specified Assigned CBR or the percentage swell value be greater than the specified swell value, the lot shall be retested for Assigned CBR and percentage swell values.

The values obtained from the new Assigned CBR and percentage swell tests shall comply with the requirements of Clause 204.04 and shall be considered to be the new Assigned CBR and percentage swell values. Subject to compliance to Clause 204.04, single test verification of the Assigned CBR and percentage swell shall continue at the reduced testing frequency.

Should either the verification tests for the Assigned CBR and/or percentage swell value not comply with the requirements of Table 204.041, the material from that source will be considered as non conforming and the lot and any subsequent lots from that source will be rejected.

(ii) Gradings, PI, LL, Permeability and Particle Dimension

Testing for grading, PI, LL, permeability and maximum particle dimension shall be undertaken at the initial testing frequency specified in Table 204.141 until three consecutive lots of like material and work have achieved the specified requirements. After satisfying this requirement, the Contractor may seek ~~the Superintendent~~ Council's agreement to reduce the frequency of testing of subsequent lots to the reduced testing frequency specified in Table 204.141.

If the Contractor has obtained ~~the Superintendent~~ Council's agreement to reduce the frequency of testing and any lot fails to achieve the specified requirements, all testing of all subsequent lots shall be undertaken in accordance with the initial testing frequency in Table 204.141 until three consecutive lots of like material and work have achieved the specified requirements in the first test. After satisfying this requirement, the Contractor may again reduce the frequency of testing to the reduced testing frequency specified in Table 204.141.

If a material source changes, or the properties of a material differ from the material initially tested, a new testing regime shall be established in accordance with this clause.

Table 204.141 Frequency of Testing for Material Properties

Material Properties	Material	Initial Testing	Reduced Testing Frequency (minimum)
CBR and percentage swell	Type A Material	1 Lot Test to determine Assigned CBR and swell	Single CBR test to confirm Assigned CBR and swell per every ##:2 lots
	Type B Material	1 Lot Test to determine Assigned CBR and swell	Single CBR test to confirm Assigned CBR and swell per every ##:8 lots
	In situ material in cuts within 400 mm below Cut Floor Level	1 Lot Test to determine Assigned CBR and swell	Single CBR test to confirm Assigned CBR and swell per every ##:4 lots
Grading	Type A Material	1 Test for each lot tested for compaction	1 test for every second lot tested for compaction
	Permeable Fill Material	1 Test per lot	1 Test per every ##:2 lots
PI and calculation of PI x % Passing 0.425 mm	Type A Material	1 Test per 2 lots	1 test per every ##:4 lots
LL and comparison of PI against LL, (identification of silt)	Type A Material Type B Material	1 Test per 2 lots	1 test per every ##:4 lots
Permeability	Capping and Verge Materials and Other Type A Material	1 Test per 2 lots	1 test per every ##:4 lots
Maximum Particle Dimension [1]	Type A Material, Type B and Type C Material containing rock greater than 150 mm	Every lot Every lot	Every lot Every lot
Note: [1] Visual inspection, assessment and measurement of larger rock particles.			

(b) Material Properties Testing - Scale B

Where Scale B is specified in Table 204.161, the first lot of each material type shall be tested to demonstrate compliance with the material property requirements specified in Clause 204.04.

Where the first lot of each material type satisfies the material property requirements in Clause 204.04 as applicable to that material type, no further testing will be required for that material except where changes to the physical properties of the material are observed or where directed by ~~the Superintendent~~ Council.

Where the first lot of each material type does not satisfy the material property requirements in Clause 204.04 as applicable to the material type, the lot will be rejected.

(c) Compaction and Moisture Content Testing Frequency

Every lot shall be tested ~~initially~~ to demonstrate compliance with the requirements for compaction and moisture content. ~~Testing of every lot shall continue until three consecutive lots of like material and work have achieved the specified requirements in the first test. After satisfying this requirement and establishing a compaction procedure to the satisfaction of the , the Contractor may seek the Superintendent's agreement to reduce the frequency of testing of subsequent lots to the minimum requirements specified in Table 204.142.~~

~~If the Contractor has obtained the Superintendent's agreement to test for compaction and moisture content at the minimum testing frequency and any lot fails to achieve the specified requirements, testing of all subsequent lots shall be undertaken until three consecutive lots of like material and work have achieved the specified requirements in the first test. After satisfying this requirement, the Contractor may submit changes to the compaction procedure for the Superintendent's review and may again seek approval to reduce the frequency of testing to the minimum requirements.~~

~~For the purposes of this sub-clause, small areas as defined in Section 173 shall not be included in the initial consecutive lots tested for compliance, nor any subsequent set of consecutive lots.~~

Table 204.142 Minimum Frequency of Testing for Compaction and Moisture Content

Material	Acceptable Lot Size in a Single Layer of Work	Minimum Testing Frequency
Type A Material	One day's production or 5,000 m^2, whichever is the lesser	Every second lot of like material and work
Type B Material		
• ripped and re-compacted below Cut Floor Level	One day's production or 10,000 m^2, whichever is the lesser	Every second lot of like material and work
• placed within 400 mm of top of Type B Material	One day's production or 10,000 m^2, whichever is the lesser	Every second lot of like material and work
• placed more than 400 mm below top of Type B material	One day's production	Every third lot of like material and work
Type C Material	One day's production	Every sixth lot of like material and work

204.15 PREPARATION AND MAINTENANCE OF FINAL EARTHWORK SURFACES AND SUBGRADE

The top of the Type B material, Cut Floor Level and subgrade surfaces shall be prepared to level and shape within the tolerances specified in Clause 204.03(g) to produce a smooth, hard, tightly bound surface, free from depressions capable of holding water.

Material within 150 mm of subgrade shall be maintained such that its moisture content is not less than 70% of optimum moisture content prior to the placement of any pavement layer.

204.16 SCHEDULES FOR TOLERANCES, MATERIAL PROPERTIES AND COMPACTION TESTING

Table 204.161 nominates the level of testing required for acceptance of Surface Level Measurement as specified in Clause 204.03, for acceptance of material properties as specified in Clauses 204.04 and 204.14, and for acceptance of compaction as specified in Clause 204.13.

*** **Table 204.161 Schedule for Surface Tolerance, Material Properties and Compaction Testing**

Road Name	Chainage / Location	Scale of Surface Level Measurement (A, B or C)	Scale of Material Property Testing (A or B)	Scale of Compaction (A, B or C)
~~##:Freeway M Roads~~	~~Within Limits of Works~~	~~A~~	~~A~~	~~A~~
~~##:Arterial A Roads~~	Within Limits of Works	~~A~~	~~B~~	~~A~~
~~##:Arterial B Roads~~	~~Within Limits of Works~~	~~B~~	~~B~~	~~B~~
~~##:Arterial C Roads~~	~~Within Limits of Works~~	~~C~~	~~Not Applicable~~	~~C~~

Note: Where no level of testing is nominated, Scale A applies.

204.17 TOPSOILING – REFER TO SECTION 740 – SOFT LANDSCAPING WORKS

~~Topsoiling shall not be placed over cut and fill areas until the Contractor has verified that such areas comply with the requirements in Clause 204.03~~

~~All unpaved cut and fill areas within the limits of the batters, including batter roundings but excluding cut batters steeper than 1.5 to 1 (horizontal to vertical), and any other area disturbed by the Contractor's operations, shall be topsoiled to the following thicknesses measured normal to the slope:~~

~~(a) batters with slopes of 2 to 1 (horizontal to vertical) or steeper - 50 mm minimum~~

~~(b) tree and shrub plantation bed areas other than (a) above - 100 mm minimum~~

~~(c) verges: In areas without kerb and channel or concrete edging strips the depth of topsoil shall vary uniformly from 50 mm deep at the outside edge of verge to 20 mm deep within 100 mm of the edge of seal or asphalt surface treatment~~

~~(d) all other areas - 75 mm minimum.~~

~~Topsoil shall be placed and levelled but not compacted except for verge areas, which shall be compacted. Topsoil on batters shall be placed so as to prevent rilling.~~

~~The surface level of topsoil shall match the finished surface level, or level of back of kerb or concrete edging, as appropriate.~~