

SECTION 703 - GENERAL CONCRETE PAVING

~~##This section cross-references Sections 175, 304, 610, 687, 714, 812 and 820.~~

~~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:~~

703.01 GENERAL

This section specifies the requirements for the supply of materials and construction of portland cement-based and geopolymer binder-based concrete paving for edgings, footpaths, other surfacing, and shared use paths, together with the necessary excavation and backfilling. This section also specifies the requirements for concrete which contains fine glass aggregate.

In the context of general concrete paving, portland cement concrete and geopolymer binder concrete are equivalent products.

Concrete for edgings, footpaths, and other surfacings shall be normal class to AS 1379 as specified or equivalent geopolymer concrete as defined in this section.

Concrete for shared use paths shall be concrete grade VR330/32 in accordance with Section 610 or equivalent geopolymer concrete.

Requirements for structural concrete for bridgeworks and other major concrete components and structures are specified in Section 610.

703.02 STANDARDS

Australian Standards are referenced in an abbreviated form (e.g. AS 1379).

(a) Australian Standards

AS 1012.3.1	Methods of testing concrete, Method 3.1: Determination of properties related to the consistency of concrete—Slump test
AS 1379	Specification and supply of concrete
AS 1478.1	Chemical admixtures for concrete, mortar and grout – Part 1: Admixtures for concrete
AS 2876	Concrete kerbs and channels (gutters) - Manually or machine placed
AS 3582.1	Supplementary cementitious materials for use with portland and blended cement – Part 1: Fly ash
AS 3582.2	Supplementary cementitious materials for use with portland and blended cement – Part 2: Slag - Ground granulated iron blast furnace
AS 3582.3	Supplementary cementitious materials for use with portland and blended cement – Part 3: Amorphous silica
AS 3610	Formwork for concrete
AS 3799	Liquid membrane-forming curing compounds for concrete
AS 3972	General purpose and blended cements
AS/NZS 4671	Steel reinforcing materials
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

(b) Other Standards and Referenced Specifications

ISO 3310	Test sieves – Technical requirements and testing
ASTM C1116	Standard Specification for Fiber Fibre-Reinforced Concrete
ASTM C1609	Standard Test Method for Flexural Performance of Fiber Fibre-Reinforced Concrete (Using Beam With Third-Point Loading)
ASTM C1399	Standard Test Method for Obtaining Average Residual-Strength of Fiber Fibre -Reinforced Concrete
ASTM D792	Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
ASTM D3822	Standard Test Method for Tensile Properties of Single Textile Fibers -Fibre's
ASTM A820	Standard Specification for Steel Fibres for Fibre-Reinforced Concrete

(c) VicRoads Test Methods

ISO 3310 RC 377.01 Determination of the Fibre Content of Fresh Concrete (Wash-out Method)

Section 175 details the relevant references to these documents.

703.03 DEFINITIONS

For the purpose of this section, the following definitions apply:

Alkaline Component: Combinations of alkali and alkali earth containing salts, minerals and glasses.

Cement: Material complying with the requirements of AS 3972.

Cementitious Material: Portland cement or a mixture of portland cement with one or more of Fly Ash, Ground Granulated Blast Furnace Slag (GGBF Slag), or Amorphous Silica complying with the requirements of AS 3582.1, AS 3582.2 and AS 3582.3 respectively.

Edgings: Kerbs, channels, mowing and other edge strips including those behind kerbs and channels.

Fine Glass Aggregate: Recycled glass cullet crushed to a cubic shape and passing the 4.75 mm aperture sieve, as designated in the ISO 3310 series.

Geopolymer Binder: Binder containing greater than 80% Fly Ash, Ground Granulated Blast Furnace Slag (GGBF Slag) or Amorphous Silica complying with the requirements of AS 3582.1, AS 3582.2 and AS 3582.3 respectively, metakaolin and up to 20% alkaline components.

Geopolymer Concrete: Concrete which comprises geopolymer binder, aggregates, water and admixtures.

Glass Aggregate Concrete: Concrete which contains fine glass aggregate as a proportion of the total fine aggregate content.

Glass Cullet: Glass which has been recovered, sorted and crushed from postconsumer waste, which shall be primarily container glass and which shall not include glass from ceramics, cathode ray tubes, fluorescent light fittings and laboratory glassware.

Local Streets: Collector roads and all other local roads and streets.

Macro Synthetic Fibres: Fibres used to provide the concrete with significant post-cracking capacity and which, subject to satisfactory test results, provide the same performance as steel reinforcement in ground supported concrete paving and shared use paths.

Micro Synthetic Fibres: Fibres that create a support network within the concrete which increases its tensile strain capacity for control of plastic shrinkage cracking, but do not offer concrete post-cracking bearing capacity.

Portland Cement: General purpose portland cement Type GP complying with the requirements of AS 3972.

Shared Use Path: Path which is designated for shared use by pedestrians, cyclists and maintenance vehicles.

Steel Fibres: Straight or deformed pieces of cold-drawn steel wire, straight or deformed cut sheet fibres, melt extracted fibres, shaved cold drawn wire fibres and fibres milled from steel blocks, which are suitable for homogeneous mixing into concrete or mortar to improve prescribed properties.

Surfacings: Traffic islands, median slabs, grass mowing strips, bicycle paths, footpaths, vehicle and pram crossings and other similar slabs or pathways on prepared bedding.

Traffic Routes: Highways, freeways and arterial roads (M, A, B, C roads).

703.04 KERB AND CHANNEL AND OTHER EDGINGS

Kerb and channel and other edgings shall comply with the requirements of AS 2876.

703.05 SUPPLY OF PREMIXED CONCRETE**(a) Portland Cement-based Concrete**

Portland cement-based concrete shall be either N20, N25 or N32 standard strength grade, as specified for concrete paving complying with the requirements of AS 1379; or concrete grade VR330/32 for shared use paths.

(b) Kerb and Channel

Concrete used in kerb extrusion machines will not be subject to compressive strength requirements but shall have a minimum cementitious material content in the finished concrete as follows:

- Traffic Routes – a minimum of, or equivalent to, 320 kg of cementitious material or geopolymer binder per cubic metre of concrete
- Local Streets – a minimum of, or equivalent to, 280 kg of cementitious material or geopolymer binder per cubic metre of concrete.

Where kerb and channel is placed and compacted with internal vibration between previously placed formwork, concrete shall be:

- Traffic Routes – N32 portland cement-based concrete or 32 MPa geopolymer concrete standard strength grade; and
- Local Streets – N25 portland cement-based concrete or 25 MPa geopolymer concrete standard strength grade as specified.

(c) Geopolymer Concrete**(i) General**

Geopolymer concrete for concrete paving shall be manufactured to comply with the minimum 28 day compressive strength requirements for each strength grade ranging from 20 MPa to 32 MPa; or for shared use paths, geopolymer concrete equivalent to concrete grade VR330/32.

The mix design for each geopolymer concrete strength grade shall have a unique identification number.

Geopolymer concrete shall not be mixed when the air temperature is lower than 5°C or greater than 35°C.

Water may be added to the freshly mixed geopolymer concrete prior to commencement of discharge subject to the manufacturer's approval and provided a means of accurately measuring the volume of water is available.

No water shall be added after commencement of discharge of geopolymer concrete unless expressly approved by the manufacturer.

Geopolymer concrete which has begun to stiffen shall not be used in the works.

Prior to the discharge of geopolymer concrete at the site, the mixer or agitator shall be operated at mixing speed for not less than three minutes, until the geopolymer concrete achieves the required uniformity.

(ii) Water

The quality of water used in the manufacture of geopolymer concrete shall comply with the requirements of Clause 610.09, except that no recycled water shall be allowed.

(iii) Moisture Content of Aggregates

The determination of moisture content of the fine and coarse aggregates shall comply with the requirements of Clause 610.13(d).

(iv) Addition of Water at the Slump Stand

Addition of water to the mixed batch of concrete at the slump stand shall comply with the requirements of Clause 610.13(h).

(v) Delivery Docket

All information recorded on the delivery docket shall comply with the requirements of Clause 610.13(e).

(vi) Period for Completion of Discharge

The period for completion of discharge shall comply with the requirements of Clause 610.13(f) except that this time may be extended beyond 60 minutes provided the geopolymer concrete complies with the specified requirements.

(vii) Water Left in the Mixer or Agitator

Water left in the mixer or agitator from the previous load shall comply with the requirements of Clause 610.13(g).

(viii) Calibration of Weighing and Metering Equipment

All batch plant weighing and water metering equipment shall comply with the requirements of Clause 610.13(i).

(ix) Manufacturer Competency

Manufacturers and/or licensed technology providers utilised in the supply of geopolymer concrete shall have a minimum of three years continuous experience in commercial supply and a demonstrated competency in the technology of the geopolymer concrete to be applied.

Documented evidence shall be available to demonstrate supply experience and competency of manufacturers in the geopolymer concrete technology.

(d) Glass Aggregate Concrete

Concrete specified in this section, including concrete grade VR330/32 specified for use in shared use paths in accordance with Section 610, may contain up to 30% of fine glass aggregate as a replacement of the total mass of fine aggregate in the concrete mix.

Fine glass aggregate shall comply with the requirements of Clause 610.11(e) for alkali aggregate reactivity (AAR).

Where concrete specified in this section contains fine glass aggregate, blended cement consisting of a minimum amount of deemed to comply supplementary cementitious material shall be used in the concrete in accordance with the minimum proportions as shown in Table 610.112 to mitigate AAR.

Any proposed blended cement deviations from the minimum blended cement requirements of Table 610.112 shall demonstrate compliance with both the maximum mortar bar and concrete prism expansion limits stated in Clause 610.11, and as determined by both the VicRoads accelerated mortar bar test method RC 376.03 and the VicRoads concrete prism test method RC 376.04.

The Contractor shall submit the glass aggregate concrete mix design details for review by the Superintendent Council not less than 4 weeks prior to the placement of concrete, which shall also include verification of the addition of the minimum amount of supplementary cementitious materials to mitigate AAR in accordance with Table 610.112. Concrete shall not be placed until the glass aggregate concrete mix design has been reviewed by the Superintendent Council,

703.06 AGGREGATES

(a) General

Concrete aggregates shall comply with the requirements as set out in Section 610.

(b) Fine glass aggregate

In addition to the requirements of Clause 703.06(a) fine glass aggregate shall:

- (i) consist of a uniformly graded product manufactured by crushing of recycled glass cullet
- (ii) be cubical in shape, and not sharp edged or elongated
- (iii) be generally free of contaminants such as paper, corks, metals, glues and other harmful materials (maximum limit of 2% by mass)

- (iv) be thoroughly washed and be free from sugar, clay balls and organic matter
- (v) comply with the grading limits specified in Table 610.111 when tested with standard sieves. When combined in the required proportions the resulting fine aggregate mix shall also comply with the grading requirements of Table 610.111
- (vi) comply with the minimum frequency of testing requirements of Table 610.121.

703.07 CHEMICAL ADMIXTURES

Chemical admixtures shall comply with the requirements of AS 1478.1. They shall be used in accordance with the requirements of Clause 2.5 of AS 1379 and the manufacturer's recommended method of use.

Air entraining admixtures shall not be used unless approved by the Superintendent Council.

Chemical admixtures containing calcium chloride, calcium formate or triethanolamine shall not be used.

Chemical admixture dispensers shall be subject to regular maintenance and calibrated in accordance with the requirements of AS 1379, except that in the case of geopolymer concrete production, they shall be calibrated as specified in Section 610.

703.08 PLACING, COMPACTING AND FINISHING CONCRETE

Concrete shall be transported, handled and placed to prevent segregation, loss or leakage of materials. Fresh concrete shall not be placed against concrete which has taken its initial set, except at properly formed construction joints. Concrete shall be thoroughly compacted by means of continuous tamping and internal vibration and shall be worked around any embedments and into corners of formwork or excavations to produce a dense concrete free from voids, honeycombing, segregation or surface defects.

Unformed surfaces shall be hand tamped to ensure a smooth surface with a uniform colour and appearance, and screeded to achieve the specified level, dimensions, falls and tolerances.

Geopolymer concrete shall be placed and finished in accordance with this clause and the geopolymer manufacturer's placement guidelines.

Any concrete repairs shall be carried out using a method and materials accepted by the Superintendent Council.

703.09 AMBIENT WEATHER FOR CONCRETING OPERATIONS

Concreting operations shall comply with the requirements of Clauses 610.17(a), 610.17(b), 610.17(c) and 610.17(d) for limits, restrictions and treatments to be applied for concreting in hot, cold and wet weather, except that curing shall be in accordance with Clause 703.10.

703.10 CURING OF CONCRETE

(a) General

The curing of exposed concrete surfaces shall commence immediately after finishing operations are progressively completed and shall continue uninterrupted for a period of not less than 7 days after placing the concrete, with the exception of concrete edgings which shall be cured for a period of not less than three days after placing the concrete.

Concrete shall be cured either by water curing, wet hessian, polyethylene sheeting which is adequately sealed, curing compound or a combination of these. Freshly finished exposed concrete surfaces shall be effectively protected from rain or damage from other sources, until hard set has occurred.

Curing compounds shall comply with AS 3799. The curing compound shall be applied in two coats using a fine spray at the rate stated on the certificate of compliance. The curing membrane shall be maintained intact for not less than the specified period of curing. Any damage to the curing membrane during the period of curing shall be repaired immediately at the original rate of application.

At the end of the curing period, concrete paving and shared use paths shall provide a dense, hard wearing surface.

(b) Curing of Geopolymer Concrete

Geopolymer concrete shall be cured in accordance with the requirements of Clause 703.10(a), including the specified minimum curing periods, and as follows:

- (i) The curing methods acceptable for curing of geopolymer concrete are:
 - (1) covering with polyethylene sheet
 - (2) maintaining the formwork in place in accordance with the requirements of Clauses 610.23(e) and Clause 610.23(f) respectively
 - (3) covering with wet hessian blankets. Hessian or burlap mats shall consist of at least two layers of hessian having a combined weight of at least 0.5 kg/m² dry and shall have a width after shrinkage of at least 300 mm greater than necessary to cover the entire width and vertical faces of concrete paving and shared use paths. The hessian blankets or mats shall be new or have only been used for curing concrete, shall be free from tears and shall be soaked in water for at least one hour prior to concrete placement proceeding.
- (ii) Further to the requirements of this clause curing of geopolymer concrete shall also be carried out in conjunction with the procedures as stated in the manufacturer's placement guidelines.

703.11 CONFORMANCE TESTING FOR CONCRETE STRENGTH AND CONSISTENCY

The minimum compressive strength requirements for each strength grade shall be as shown in Table 703.111.

Table 703.111

Portland Cement Concrete Strength Grade	Geopolymer Binder Concrete Strength Grade	Minimum Compressive Strength at 28 days (MPa)
N20	20	20
N25	25	25
N32	32	32
VR330/32	32	32

Sampling and testing of the strength of concrete shall be carried out in accordance with Clause 6.2 of AS 1379. The frequency of sampling and testing shall provide at least one sample at the point of discharge to be tested of each 50 m³ or part thereof of each strength grade placed on any one day. Where less than 50 m³ is provided for any one day then one sample shall be tested of each strength grade.

The consistency of the concrete shall be determined by a slump test of each concrete strength sample in accordance with AS 1012.3 and Clause 5.2 of AS 1379. The concrete represented by the samples shall be deemed to comply with the nominated concrete slump if the measured slump is within the limits given in Table 5.1 of Clause 5.2 of AS 1379.

Sampling and testing for concrete used in shared use paths shall be in accordance with Section 610.

Compressive strength testing and slump testing shall not be required for concrete used in extruded kerbs and channels and other edgings.

703.12 FORMWORK

The materials, design, construction and stripping of formwork shall comply with the relevant requirements of AS 3610. Joints in formwork shall be constructed such that loss of mortar is prevented.

Prior to placing concrete in an earth excavation, formwork shall be erected so that fresh concrete is not placed directly against the sides of the excavation.

Formwork shall not be stripped until the minimum times specified in AS 3610 Table 5.4.1 have elapsed from the time of completion of the placing of concrete. The minimum time shall also not be less than:

- (a) 2 days for vertical formwork on external surfaces; and
- (b) 1 day for vertical forms on permanently hidden surfaces or otherwise approved by Council.

703.13 STEEL REINFORCEMENT

Steel reinforcement shall comply with the relevant requirements of AS/NZS 4671.

Galvanising where specified shall be in accordance with the requirements of AS/NZS 4680.

The minimum cover of any steel reinforcement to the nearest concrete surface shall be 50 mm unless shown on the drawings.

Reinforcement shall be supported using either concrete or plastic chairs. Wire chairs with or without plastic tips, bricks or pieces of timber or coarse aggregate shall not be used to support steel reinforcement.

~~703.14 FIBRE REINFORCED CONCRETE~~~~(a) General~~

~~Concrete paving and shared use paths may be constructed with fibre reinforced concrete in lieu of steel reinforcement, provided the fibre reinforced concrete provides equivalent performance to steel reinforced concrete in accordance with this section.~~

~~(b) Macro Synthetic Fibres~~

~~Where it is proposed to replace up to SL82 steel mesh with synthetic fibres, such fibres shall be in the form of fine macro synthetic high performance fibres produced from virgin polypropylene or copolymer. Macro synthetic fibres shall be collated or supplied in water soluble pucks and supplied in fully biodegradable bags to ensure that fibres are uniformly distributed.~~

~~Micro synthetic fibres shall not be used alone to replace steel reinforcement or to achieve long term crack control. Where required micro synthetic fibres shall only be used for control of plastic shrinkage cracking, impact and abrasion resistance and explosive spalling resistance of concrete. Where specifically designed into concrete paving and shared use paths, micro synthetic fibres shall only be used in conjunction with macro synthetic fibres or steel fibres or with steel reinforcement.~~

~~(c) Steel Fibres~~

~~Where specified the type and quantity of steel fibres used shall as a minimum provide equivalent performance to concrete paving and shared use paths constructed with steel reinforcement.~~

~~The use of steel fibres in concrete paving and shared use paths shall be such that the steel fibres are not exposed at the surface to eliminate any potential injury to users.~~

~~(d) Performance Requirements~~

~~Fibres shall comply with the requirements of ASTM C1116 and shall be supported with documentary evidence confirming their long term resistance to deterioration when in contact with the moisture and alkalis present in cementitious paste or the substances present in chemical admixtures and shall have nil absorption. A current certificate of compliance shall be provided to the Superintendent.~~

Fibres shall be tested to the requirements of ASTM C1609 (flexural toughness) and ASTM C1399 (average residual strength of fibre reinforced concrete).

Fibres shall be added to the concrete in such a manner to ensure that they are uniformly distributed, balling does not occur, and the concrete mix remains workable and cohesive without any segregation.

~~—(i) Macro synthetic fibres~~

~~The macro synthetic fibre shall be capable of absorbing maximum energy without breakage and shall be designed to retain its cross sectional shape and avoid brittle failure.~~

~~(1) Properties of macro synthetic fibre~~

~~The macro synthetic fibres shall possess the following properties:~~

- ~~• Tensile strength (ASTM D3822) ————— > 400 MPa~~
- ~~• Modulus of elasticity (ASTM D3822) ————— > 5.0 GPa~~
- ~~• Specific gravity (fibre density) (ASTM D792) ————— > 0.91 g/cm³~~
- ~~• Fibres shall be at least 45 mm or at least twice the length of the aggregate that will be used in the concrete mix (i.e. 20 mm aggregate requires minimum 40 mm fibre).~~
- ~~• Where specifically designed and tested, macro synthetic and micro synthetic fibres may be used in combination to address both early age and long term crack control provided the minimum performance requirements of this clause are satisfied.~~

~~(2) Properties of macro synthetic fibre reinforced concrete~~

~~Macro synthetic fibre reinforced concrete shall possess the following properties:~~

- ~~• Average residual strength (ASTM C1399) ————— > 0.56 MPa~~
- ~~• Flexural toughness (ASTM C1609) ————— > 1.5 MPa~~
- ~~• Re3 (Flexural toughness factor) (ASTM C1609) ————— > 30%~~

~~Note: Re3 = % of flexural strength at 3 mm deflection of standard beam test.~~

~~Macro synthetic fibres shall have supporting evidence in the form of satisfactory test results by an accredited and independent testing facility stating that the fibres, at the dosage rate specified by the manufacturer, provide the same performance as the steel reinforcement being replaced.~~

~~Where macro synthetic fibres are proposed to replace SL82 steel mesh, they shall be added into the concrete mix at the minimum dosage rate of 5.6 kg per cubic metre in fully degradable and disintegrating bags. Where macro synthetic fibres are proposed to replace up to SL72 steel mesh, they shall be added into the concrete mix at the minimum dosage rate of 4.6 kg per cubic metre.~~

~~—(ii) Steel fibres~~

~~Steel fibre reinforcement shall comply with the requirements of ASTM A820 for Type I, cold drawn wire, or Type II, cut sheet.~~

~~All fibres shall be deformed and have a minimum tensile strength of 800 MPa and an aspect ratio between 40 and 70.~~

~~(e) Fibre Content~~

~~The fibre content of fresh concrete shall be determined in accordance with the VicRoads fibre wash-out test method RC 377.01 as described in the VicRoads Code of Practice RC 500.16.~~

~~**The worksheet and/or report for determination of fibre content shall be submitted for review by the Superintendent.**~~

~~(f) Sampling and Testing for Fibre Content~~

~~The fibre content of fresh concrete shall be determined by sampling at the minimum sampling and testing frequency as stated in Clause 703.11.~~

~~The concrete represented by the sample shall be deemed to comply if the fibre content as determined is within 1% of the fibre content in the approved mix design.~~

703.15 TOLERANCES ON LINE, LEVEL AND SHAPE

All surfaces shall be finished in conformity with the lines, grades, thicknesses and cross sections shown on the drawings or as specified, within the following limits:

- (a) Concrete paving including footpaths, edgings, other surfacings and shared use paths shall be shaped to match existing fixtures, e.g. pit covers, edgings and vehicle crossings, within 5 mm.
- (b) The departure of the finished work from line or level shall not exceed 10 mm at any point, and the rate of change of deviation from line or level shall not exceed 10 mm in 10 m. Except on curves or in shaped areas, the deviation of the finished work from a 3 m straightedge shall not exceed 5 mm at any point.
- (c) Section dimensions shall not differ from those shown on the drawings by more than 5 mm except that overall width shall not exceed the specified width by more than 15 mm; and on dimensions less than 25 mm the tolerance shall be ± 3 mm.
- (d) Where median surfacings are to be constructed between edge sections of the same level, paving shall be crowned to produce a crossfall between 1% and 3% towards the edges.
- (e) Kerb and channel shall be constructed to the level of the adjoining pavement with a tolerance of -0 to +10 mm. Except on curves or in shaped areas, the deviation of the finished work from a 3 m straightedge shall not exceed 5 mm at any point.

703.16 THICKNESS AND STEEL MESH REQUIREMENTS

Unless shown on the drawings, refer to the Standard Drawings for the thickness of concrete paving and steel mesh reinforcement.

The following thickness and steel mesh requirements shall apply:

- ~~(a) Concrete paving including footpaths, edgings and other surfacings shall be 125 mm thick, and when steel reinforcement is specified, they shall be reinforced with SL72 steel mesh.~~
- ~~(b) Shared use paths shall be 150 mm thick, and when steel reinforcement is specified, they shall be reinforced with SL82 steel mesh.~~
- ~~(c) Median surfacings within 2 m of the edges of medians and bays of footpath adjacent to intersecting kerb and channel shall be 150 mm thick and reinforced with SL72 steel mesh.~~
- ~~(d) Private entrance vehicle crossings shall be 150 mm thick and when steel reinforcement is specified, they shall be reinforced with SL72 steel mesh.~~
- ~~(e) Commercial vehicle crossings shall be 170 mm thick, and when steel reinforcement is specified, they shall be reinforced with SL82 steel mesh.~~

703.17 SETTING OUT

The Contractor shall set out the work in accordance with the drawings and as specified.

HP ~~The Superintendent~~ **Council will review and confirm the set out. The work shall be constructed in accordance with the confirmed set out to the line and level and cross-sectional profiles as shown on the drawings.**

703.18 PROVISION FOR DRAINAGE DURING CONSTRUCTION

Before obstructing any waterway, channel or culvert, the Contractor shall make appropriate provision for its temporary diversion, and obtain prior written approval from the relevant waterway authority. The Contractor shall make provision for the safe discharge of drainage and stormwater at all times during construction.

703.19 HOUSEHOLD DRAINAGE CONNECTIONS

Existing household drains which are not connected to underground stormwater drains shall be altered as necessary and connected through the kerbing to drain into the channel.

Provision shall be made for connection of future household drains as specified or shown on the drawings.

703.20 EXCAVATION

The Contractor shall carry out any necessary excavations and disposal of excavated material.

The Contractor shall box out to a sufficient depth to allow for the required compacted thickness of bedding material under the full width of concrete paving.

Where it is necessary to excavate existing pavement, the excavation shall not extend more than 150 mm from the edge of the adjacent face. Existing asphalt or bituminous surfacing shall be saw cut for a sufficient depth to produce a neat vertical face.

703.21 BEDDING PREPARATION

All bedding material used for cast in place concrete paving works shall be compacted size 20 mm Class 3 ~~or Class 4~~ crushed rock or Class 3 ~~or Class 4~~ crushed concrete, manufactured and supplied in accordance with Sections 812 or 820 respectively.

Bedding material for shared use paths shall be compacted size 20 mm Class 3 crushed rock or Class 3 crushed concrete in accordance with Section 812 or 820 respectively, and Section 304.

(a) Edgings

Where edgings are constructed over pavement layers, bedding shall be provided between the pavement layer and the underside of the edging, or the edging thickened to match the pavement layer.

Where edgings are not constructed over pavement layers, bedding shall be as shown on the drawings or if not shown not less than 100 mm compacted thickness.

(b) Shared Use Paths

Bedding shall be as shown on the drawings. ~~not less than 150 mm thick compacted in accordance with Section 304.~~

(c) Footpaths, Crossovers and other Surfacing

Bedding shall be as shown on the drawings. ~~not less than 100 mm compacted thickness.~~

Bedding shall be trimmed to the appropriate levels, moistened as necessary, and firmly compacted.

For footpaths, crossovers, other surfacings and shared use paths the foundation shall be true to grade and cross section as shown on the drawings by filling and excavating as necessary. All soft wet or unstable material shall be removed to a depth of not less than 100 mm below the design level of the underside of bedding and filled with bedding material moistened and compacted to form a stable foundation. Any service trenches under paved areas shall be backfilled in accordance with Section 733.06 (c).

Immediately before concrete is placed, the bedding shall be moist but shall have no free water on the surface.

703.22 PROVISION FOR PERMANENT SIGNS

Sign post sockets shall be supplied and placed by the Contractor to provide for erection of permanent signs in the areas to be paved.

Sockets shall be placed at the locations shown on the drawings.

Socket depths, dimensions and installation requirements shall be in accordance with Section 714.06(d). Any concrete which falls into the sleeve shall be removed.

703.23 MACHINE EXTRUSION

Where an extrusion or slip-form machine is used, the datum for grade and alignment of the section to be extruded shall be established by the Contractor.

Concrete shall be fed to the machine at a uniform rate. The machine shall be operated to produce a satisfactorily compacted, dense mass of concrete free of any faulty or honeycombed patches. Surfaces shall be substantially free from surface pitting larger than 5 mm diameter.

Where work using fixed forms is combined with extruded work and similar concrete mixes are used for both, the concrete in the fixed form sections shall be compacted with internal vibration to produce a satisfactory compacted mass of concrete.

703.24 PROFILE TRANSITIONS AND MATCHING EXISTING SECTIONS

Where it is necessary to join to an existing section of profile different from that being constructed, the change of profile shall be made at a constant rate between 10 and 20 mm per metre. Transitions between different profiles shall be made in accordance with the drawings.

Matching of new to existing concrete paving shall be such that it appears identical to the existing section. When replacing damaged sections of concrete paving or shared use paths, the damaged section shall be removed completely to the nearest construction joint and replaced with identical material to the existing.

703.25 SURFACE FINISH

Exposed surfaces shall be treated as follows:

(a) Edgings

All edgings shall be rendered and have a steel trowel finish.

Rendering shall be applied within 30 minutes of placing or extruding concrete. The mortar used shall consist of two parts of fine aggregate, one part of cement, and sufficient water to produce a mix of suitable consistency. The thickness of rendering shall not exceed 3 mm. Exposed surfaces shall be given a steel trowel finish.

(b) Footpaths, other Surfacing and Shared Use Paths

Fresh concrete shall be compacted with internal vibration and worked until all the coarse aggregate is below the surface and the mortar comes to the top. It shall then be struck off and finished to grade and cross section with a wooden float to produce a lightly textured non skid surface. All outside edges of slabs and all joints shall be finished with a suitable edging tool.

After finishing, all work shall present a consistently neat appearance of uniform colour. All edges shall be sharp and clean and bullnoses shall be regular and of uniform radius. All discoloured concrete shall be cleaned or replaced by the Contractor.

Permanently hidden concrete surfaces of concrete paving including footpaths, edgings, other concrete surfacing, and shared use paths shall have a Class 4 surface finish in accordance with AS 3610.

All other concrete elements constructed with reference to Section 703 shall have a Class 3 surface finish for external surfaces and a Class 4 surface finish for permanently hidden surfaces in accordance with AS 3610.

703.26 JOINTS

Unless shown on the drawings, refer to the Standard Drawings for the joint detailing.

~~Transverse Weakened plain~~ joints shall be constructed at right angles to the back of edgings and the edge of footpaths and shared use paths. Joints in footpaths and shared use paths shall be opposite to joints in adjacent edgings.

(a) Edgings

(i) ~~Transverse Weakened Plain~~ Joints

~~Weakened Plain Joints~~ ~~Transverse joints~~ shall be constructed at ~~regular~~ intervals not exceeding ~~2.5 m~~ the width of path. For extruded edgings this shall be done by a method which does not damage or distort the adjacent surfaces. For edging constructed using fixed forms, templates shall be removed as soon as practicable after finishing the work. The guillotine (for extruded work) or template (for fixed work) shall cut between 40% and 70% of the area of the section. In both cases the resultant slot in the edging shall be tooled to a depth of ~~20~~30 mm to produce a neat groove not less than 5 mm wide on the exposed surfaces, ~~following which a vertical cut shall be made through the base of the groove to a depth not less than 50 mm from the surface.~~

(ii) Expansion Joints

Expansion joints shall be placed at junctions with bridges, and shall be ~~45 mm wide and~~ filled with ~~cork or bituminous impregnated particle board strip~~ an approved expansion material in accordance with the Standard Drawings or as shown on the drawings, extending for the full width and full depth of the edging. The filler shall be placed in position before concrete is placed, and shall be held firmly in position during the placing of the concrete.

(b) Footpaths, other Surfacing and Shared Use Paths

(i) Expansion Joints

Expansion joints in accordance with the Standard Drawings or as shown on the drawings shall be placed, at intervals not exceeding ~~40~~12 m, on either side of vehicle crossings, at junctions with existing footpaths and shared use paths, at junctions with bridges and around all abutting structures such as pits, utility services, power poles, kerbs and other such features. The expansion joint shall be ~~45 mm wide and~~ filled with an approved expansion material in accordance with the Standard Drawings or as shown on the drawings, ~~cork or bituminous impregnated particle board strip~~ extending for the full width and full depth of the paving. The filler shall be placed in position before concrete is placed, and shall be held firmly in position during the placing of the concrete.

~~Where required dowelled expansion joints shall be installed in accordance with the details and locations as shown on the drawings.~~

(ii) ~~Control Joints~~ Weakened Plain Joints

Weakened Plain Joints ~~Control joints~~ at least 25% of the paving thickness 30 mm deep and 5 mm wide in accordance with the Standard Drawings or as shown on the drawings, shall be ~~formed with a cutting tool~~ placed at ~~2.5 m~~ intervals not exceeding the width of path along the full width of footpaths, other surfacings and shared use paths, within four hours of placing the concrete where the air temperature measured at the time of placement is between 20°C and 35°C and within 24 hours of placing the concrete where the air temperature measured at the time of placement is less than 20°C or otherwise approved by Council.

~~(c) Between Concrete Paving and Shared Use Path~~

~~Except on narrow medians (less than 2.0 m wide) surfaced full width, bonding between the concrete paving or shared use path and the edging shall be prevented by painting the back of the edging with bitumen, or by using a strip of bituminous felt material between the edging and the concrete paving or shared use path.~~

703.27 PROTECTION OF CONCRETE

All concrete shall be protected from damage from early loading by pedestrians, animals, vehicles and from rain or any other cause.

The Contractor shall ensure that no vehicles are permitted to cross over private entrance or commercial vehicle crossings a minimum of four days after completion of casting of the concrete. Vehicles equal to or less than 1.5 tonnes in weight may be permitted to cross after 4 days, vehicles greater than 1.5 tonnes may be permitted to cross after 7 days.

703.28 MARKING OF CONDUIT POSITIONS

The positions of any existing conduits passing under edgings shall be marked by a chase in the edging immediately above the conduit together with a suitable identification mark.

703.29 BACKFILLING AND PAVEMENT RESTORATION

As soon as the concrete has cured sufficiently and not earlier than 3 days after placing, topsoil material, free from perishable matter and lumps, shall be placed and firmly compacted in layers not exceeding 150 mm in thickness and to a width not less than 300 mm behind the edging to the top of the edging.

Where edging has been constructed alongside an existing pavement, part of which has been excavated to permit the construction of the edging, the excavated space shall be backfilled to the surface level of the existing pavement. Size 7 or Size 10 asphalt shall be used for this work and firmly compacted in layers not exceeding 100 mm in thickness.

703.30 CRACKING OF CONCRETE

The concrete shall have no surface cracks at any stage after construction of width greater than 0.2 mm. Where such cracks exist, they shall be identified as a non-conformance.

Cracked sections of concrete shall be either removed and replaced, or repaired in accordance with Section 687, as directed by the Superintendent Council.

For damaged kerb and channel and edgings, a length of at least 1 m shall be removed and the replacement section shall be:

- (a) constructed on compacted bedding;
- (b) dowelled into the adjoining sections with 12 mm diameter hot dip galvanised dowels embedded at least 100 mm each side of the joint; and
- (c) shaped and finished with curved trowels to match the profile and surface finish of adjoining sections.