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1.0 Brick Paving Specifications

The specifications must be read in conjunction with Crossover Guidelines.

1.1 General information

Brick Paving Unit

A manufactured unit with plain or dentate sides and parallel top and bottom faces preferably with chamfers, for use in roadways, parking areas, industrial hard standings, and areas subject to pedestrian movement and/or vehicular traffic.

Concrete Interlocking Brick Paving Units

Concrete brick paving units supplied shall comply with the Concrete Masonry Association of Australia MA20-1986 'Specification for Concrete Segmental Paving Units'.

Clay Brick Paving Units

Clay bricks paving units supplied must conform to AS/NZS 4455–1997/AS/NZS 4456.

Dimensional Tolerance

Brick shall have ± 1 mm tolerance on all dimensions, providing the brick complies with the length to width relationship as determined by AS1255, clay building bricks.

The right angle face will be determined by diagonal measurements on all faces of the brick. These dimensions shall not vary by more than 1 mm.

Compressive Strength of Paving units

The minimum compressive strength for brick paving unit shall be in accordance with AS/NZS 4456-5.

Manufacturer's Guarantees

Brick paving units used in brick paved crossovers shall be covered by a manufacturer's guarantee for structural adequacy, soundness and satisfactory performance for a minimum period of 10 years, from the date of laying the brick paving.

1.2 Excavation and preparation of sub-grade

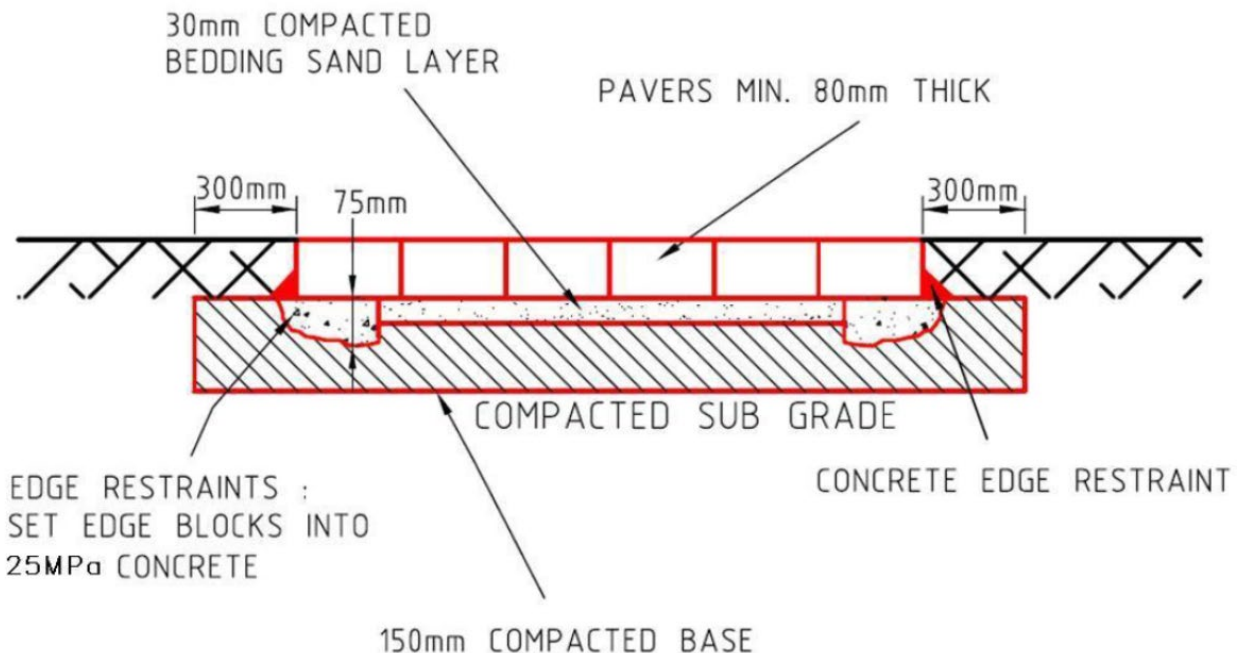
- 1.2.1 The existing ground and topsoil will need to be excavated to allow for the required finished levels which include a 150 mm thick base course layer.
- 1.2.2 Once the existing ground and topsoil has been removed to the required depth, the exposed ground surface (sub-grade) shall be properly compacted and trimmed to provide a uniform surface true to the levels and cross-sections. Compaction tests shall achieve no less than seven (7) blows per 300 mm as measured on a standard Perth penetrometer.

1.3 Base course construction

- 1.3.1 The base course shall consist of a uniform layer, 150 mm thick, of either crushed limestone or road base.
- 1.3.2 The base course material shall be loosely spread in a single layer to the required levels and compacted using overlapping passes of a vibrating plate compactor or vibrating pedestrian roller. After compaction, the material shall be trimmed to the final shape and grade.

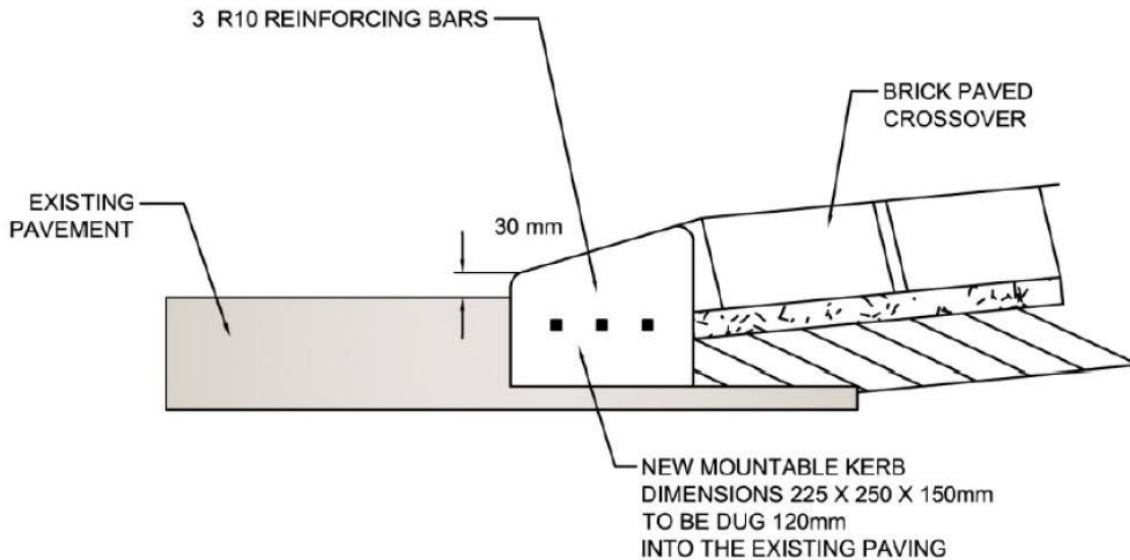
1.4 Edge restraints

- 1.4.1 Side edge restraint



- 1.4.2 The edge restraint shall consist of 25 mpa concrete with a maximum nominal aggregate size of 10 mm
- 1.4.3 All edge restraints shall be without any cold joints throughout the whole length of the edge that is being restrained.

1.4.4 Front kerb edge restraint



1.5 Sand bedding layer

1.5.1 Bedding sand shall be well-graded sand passing a 4.75 mm sieve and be free from soluble and deleterious salts or other contaminants that may cause efflorescence on the paving.

1.5.2 Grading limits shall be as follows

AS Sieve Size (mm)	4.75	2.36	1.18	0.60	0.30	0.15	0.075
% Passing	95-100	80-100	50-85	25-60	10-30	5-15	0.10

1.5.3 Bedding sand shall be protected against rain when stockpiled on site. It shall be spread after being brought to uniform moisture content in the range of 4% to 8%. Spreading shall produce a sand bed of precise and even depth. The sand bedding shall be screeded in a loose condition to the design profile to enable the bedding layer to be 30 mm thick with -0 to +10 mm allowable variation after compaction.

1.6 Laying and compaction of brick paving units

1.6.1 Before laying the paving units, the sand bedding is to be brought to design levels and profiles by not less than two (2) passes of a suitable plate compactor.

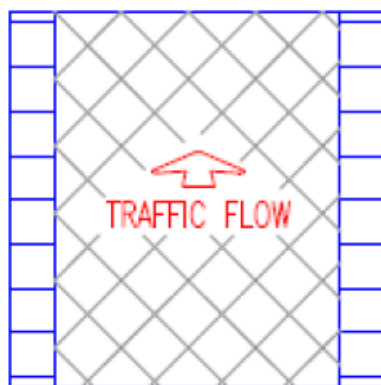
1.6.2 Brick paving units shall be placed on the screeded sand bed to the nominated laying pattern.

1.6.3 Brick paving units shall be placed with 2 to 4 mm gaps between adjacent units ensuring all joints are correctly aligned

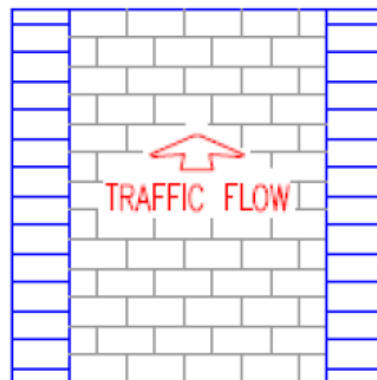
1.6.4 Header courses should adjoin and be secured against an edge restraint.

1.6.5 Full paving units shall be laid first in each row.

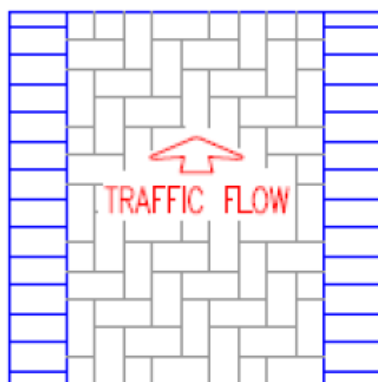
- 1.6.6 Closure paving units shall be sawn and fitted accordingly. Such closure units shall be sized not less than 25% of a full paving unit.
- 1.6.7 Brick paving units must be cut using a purpose built brick-cutting machine utilising running water. Gaps between the paving units of between 25 mm and 50 mm wide shall be filled with 20 mpa concrete with a nominal aggregate size of 10 mm. The concrete shall be colour-matched to the proposed surrounding pavement colour with approved oxide pigmentation.
- 1.6.8 Brick paving units shall be neatly sawn to finish flush around any road reserve infrastructure assets.
- 1.6.9 Use of dry packed mortar (water added after packing) to fill gaps between paving units is unacceptable.
- 1.6.10 The compaction of the brick paving units shall be undertaken by a high frequency low amplitude mechanical flat plate compactor having a plate area sufficient to cover a minimum of 12 units and an energy output suitable to compact the bedding sand layer.
- 1.6.11 Compaction shall proceed as closely as possible to follow the laying of the brick paving units and prior to any traffic load.
- 1.6.12 Any brick paving units damaged and cracked during compaction shall be immediately removed and replaced.
- 1.6.13 Brick paving patterns shall be constructed in accordance with the following laying patterns:



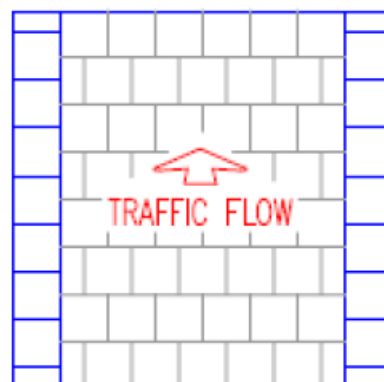
45 DEGREE DIAMOND
(190 x 190mm BLOCKS)



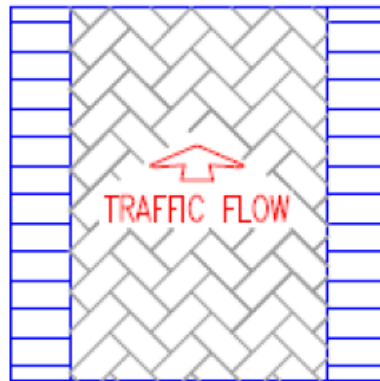
STRETCHER BOND (RECTANGULAR)
(230 x 115mm STANDARD)



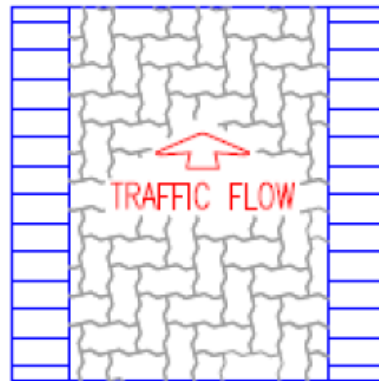
90 DEGREE HERRINGBONE
(230 x 115mm STANDARD
& 230 x 152mm PAVERS)



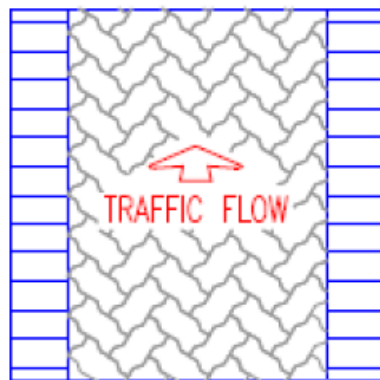
STRETCHER BOND (BLOCKS)
(190 x 190mm BLOCKS)



45 DEGREE HERRINGBONE
(230 x 115mm STANDARD
& 230 x 152mm PAVERS)



90 DEGREE HERRINGBONE
(230 x 115mm INTERLOCK)



45 DEGREE HERRINGBONE
(230 x 115mm INTERLOCK)

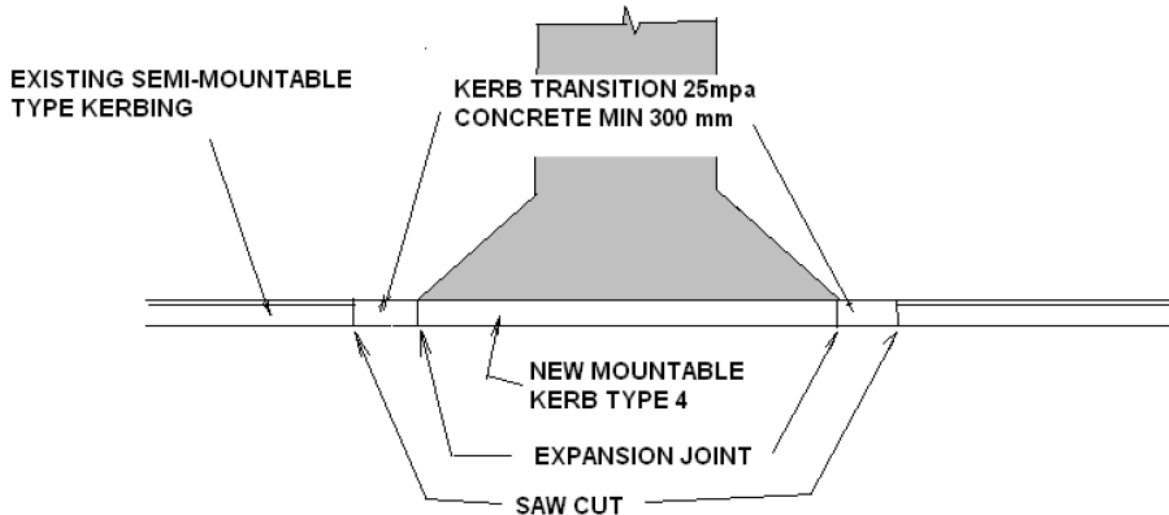
1.6.14 Paving shall be laid in accordance with manufacturer's recommendations and specifications.

1.7 Filling joints

- 1.7.1 For all reinstatement and new works, the joint filling sand shall be spread over the pavement as soon as practical after compaction of the paving units.
- 1.7.2 The joint filling sand shall pass a 1.18 mm sieve and have 10% of material passing a 75 micron sieve.
- 1.7.3 The joint filling sand must be clean, free of all soluble and deleterious salts or other contaminants and not stain the paving units.
- 1.7.4 The sand should be placed onto the brick paving units and swept into all joints by means of a stiff broom. When joints are filled, the paving units should be run over with a vibrating plate compactor and then topped up and swept.
- 1.7.5 The sand must be swept to completely fill all joints.
- 1.7.6 All excess dry sand shall be removed immediately following works. This operation will be particularly important if the brick paving units are to be coated later.

1.8 Kerbing

1.8.1 The adjacent existing kerb on either side of the crossover splays shall be neatly sawn as shown below:



1.8.2 The cut out kerb segment shall be filled with 25 mpa strength concrete with maximum aggregate size of 10 mm with the kerbing infill formed to rise gradually from a 30 mm height at the splay tip, to the height of the existing kerb at the point of the saw cut.

1.9 Tolerances to design profile

1.9.1 The completed brick pavement shall not vary in level from the designed or specified level by more than + 5 mm at any location, nor shall the finished levels vary by more than 5 mm against a 3 m straight edge when placed along a constant grade line.

1.9.2 The property owner shall finish all pavements to lines and levels to ensure positive drainage at 2% fall towards the road.

1.10 Clean-up

1.10.1 The clean-up of a job site is the responsibility of the property owner including the removal and responsible disposal of all spoil generated by the works.

1.10.2 Clean-up shall be undertaken immediately on completion of works, or if works continue for more than one (1) day, on a daily basis.

1.10.3 If clean-up work is not to the City's satisfaction, the City may make good the site and charge the property owner accordingly.

2.0 Concrete specifications

The specifications must be read in conjunction with Crossover Guidelines.

2.1 Placing concrete in inclement weather conditions

- 2.1.1 Concrete to be placed when the ambient temperature is between 10o - 36o Celsius and when the weather is dry.
- 2.1.2 The concrete is to be mixed, transported, placed, compacted and finished as rapidly as possible to avoid the risk of reworking the concrete during the curing period. The concrete surface is to be covered to prevent excessive dehydration and the resultant loss of strength of the crossover.

2.2 Concrete thickness and dimension tolerances

- 2.2.1 The following dimensions and tolerances are required:
- The thickness of the finished concrete will be 150 mm (-0 mm, +10 mm)
 - Reinforcement shall be F82 steel mesh
 - Crossover surfaces will be true to line and not deviate more than 10 mm under a 3 metre straight edge and
 - Surface irregularities, including adjoining to service authority manholes, etc, will not exceed 3 mm.

2.3 Excavation

- 2.3.1 Excavation work shall
- Be carried out to the levels, lines and grades as given for a job site
 - Be executed cleanly to produce a sound base, free of depressions or soft spots or any deleterious materials to give the minimum required depth of the concrete works
 - Ensure reticulation in close proximity to the work is either removed or capped prior to construction, and reinstated prior to the backfill operation
 - Ensure that bitumen that adjoins an existing crossover is cut neatly to provide a straight interface between the bitumen and new paving.
 - Ensure that the excavated material is removed from the site and the site is left in a clean and tidy condition.

2.4 Compaction

- 2.4.1 All sub-grades (i.e. ground level at underside of concrete) to be thoroughly compacted to produce a minimum Perth Penetrometer reading of seven (7) blows per 300 mm (calibrated to 95% Maximum Dry Density).

2.5 Formwork

- 2.5.1 Formwork will be of such cross-section, strength and so secured to resist the pressure of the concrete when placed, without springing or settlement.
- 2.5.2 The method of connection between sections will be such that the joints will not move in any direction.
- 2.5.3 The maximum deviation of the top surface of the form will not exceed 4 mm in 3 metres of the inside face and not more than 4 mm in 3 metres longitudinally.
- 2.5.4 When set, the form will be uniformly supported for its entire length at the specified elevation.

- 2.5.5 All forms will be clean prior to use and treated such that when stripped, concrete will not adhere to the form.
- 2.5.6 Forms are only to be removed from the concrete after a period of at least eight (8) hours has elapsed from time of placement.

2.6 Concrete

- 2.6.1 Only commercial pre-mixed concrete that complies with Australian Standard AS1379 is to be used.
- 2.6.2 Concrete to have a minimum compressive strength of 25 MPA at 28 days.
- 2.6.3 The maximum aggregate size shall be 20 mm.
- 2.6.4 The slump at the point of delivery shall be 75 mm (-0 mm, +15 mm).
- 2.6.5 A high early strength cement or additive to be used to give rapid hardening as per AS 1478 and AS 1479, "Chemical Admixtures for Concrete".

2.7 Placing and finishing

2.7.1 Placing

All work performed will be of the highest quality, uniform appearance and executed in a tradesman-like manner including:

- Concrete to be placed by shovelling or alternative suitable placement methods to ensure maximum density. The concrete is to be placed in one (1) continuous pour.
- Thorough compaction of concrete against the formwork.

2.7.2 Finishing

- a) The final finishing is not to be undertaken until the bleed water has disappeared from the surface.
- b) All finished concrete surfaces to be non-slip.
- c) The overall preferred final surface is to be a broom (scarification approximately 2 mm deep) with a picture-framing finish. This is mandatory in the footpath alignment of the crossover.
- d) The final surface finish to be free of depressions, float marks, air voids, dust or deleterious material.

2.8 Concrete curing

- 2.8.1 To avoid premature stiffening of the fresh concrete mix and to reduce water absorption and evaporation losses, the following is required:
- a) Immediately prior to placing concrete, the sub-grade (the ground directly under the crossover) is to be thoroughly and uniformly moistened.
 - b) The concrete shall be cured for at least three (3) days after placement using a liquid membrane compound. Liquid membrane compounds shall comply with ASTM Standard Specification C309-74, "Liquid Membrane Forming Compounds for Curing Concrete".
 - c) The concrete is to be cured after placement using a liquid membrane compound in accordance with the manufacturer's instructions.
 - d) Liquid membrane compounds which adversely affect the non-slip character of the concrete surface or decrease the quality of surface finish shall not be used.

2.9 Expansion / contraction joints

2.9.1 Once laid, concrete can expand and contract and control joints are needed to make allowance for this movement. Cracking will eventually occur and the contraction joints are placed to accommodate these.

2.9.2 The required joints and their maximum spacing are as shown on the sketch below.

2.9.3 When paths are repaired, any existing joints are to be reinstated.

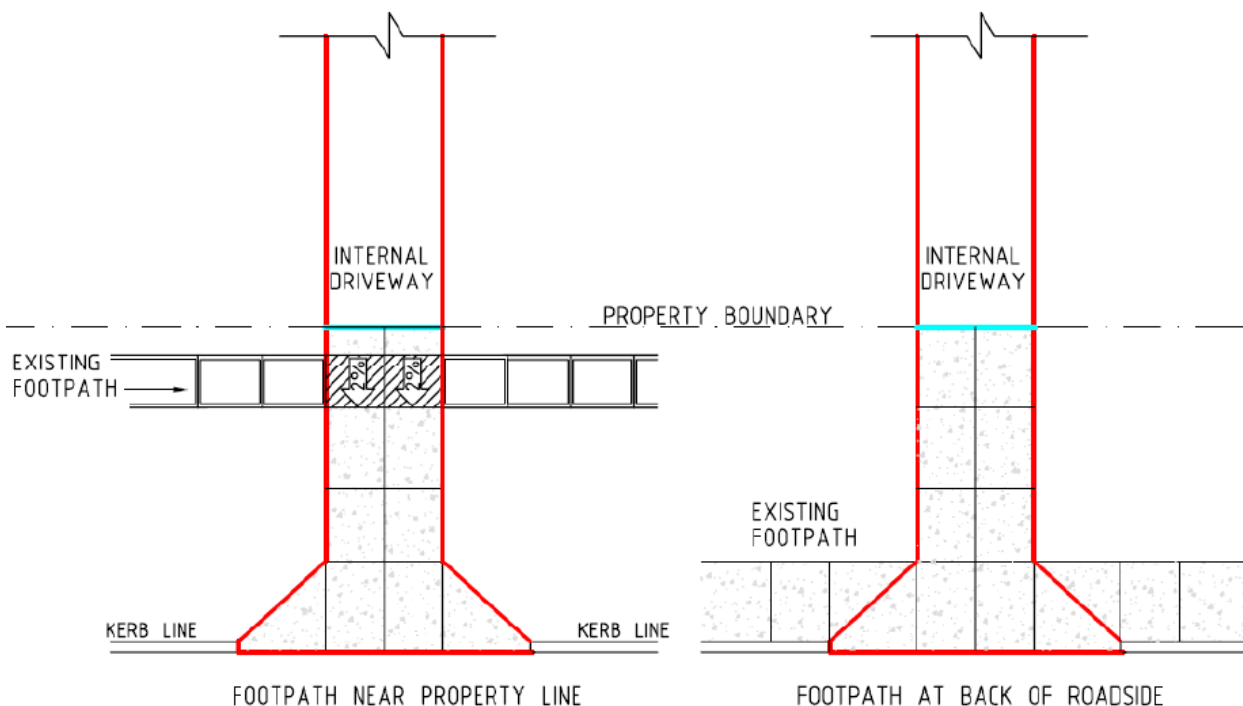
2.9.4 Proprietary concrete edging and jointing tools are to be used on all joints and edges.

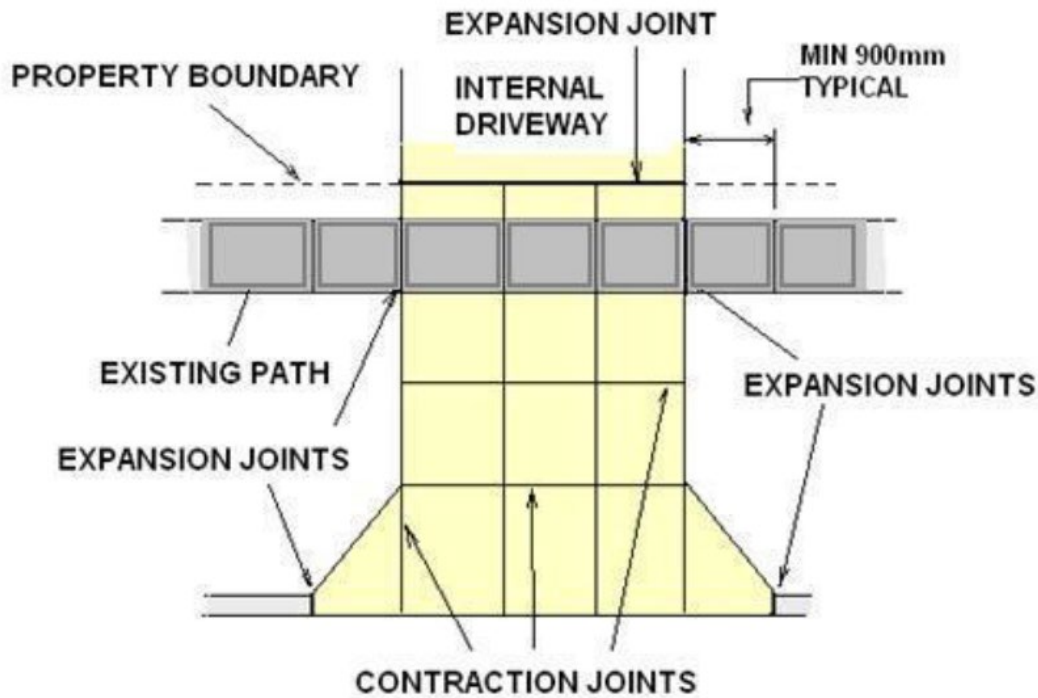
2.9.5 Expansion Joints:

- Are to be “Meljoint” or similar materials that are commonly used for the construction of concrete footpaths and crossovers
- Are to be 12 mm thick
- Are required at the property boundary line between the internal driveway and the new crossover
- Be spaced at a maximum interval of 10 metres
- To be installed at the junction of the crossover splay and the road side kerb
- To be continuous from form to form and extend vertically the full depth of the adjoining concrete
- The joint material shall at no point protrude above the surface of the concrete; and
- Expansion joints to be placed at right angles to the centre line of the footpath or crossover.

2.9.6 Contraction joint

- To be a straight-line 'dummy' joint in the surface of the concrete.
- To match those existing on the adjoining internal driveway where possible.



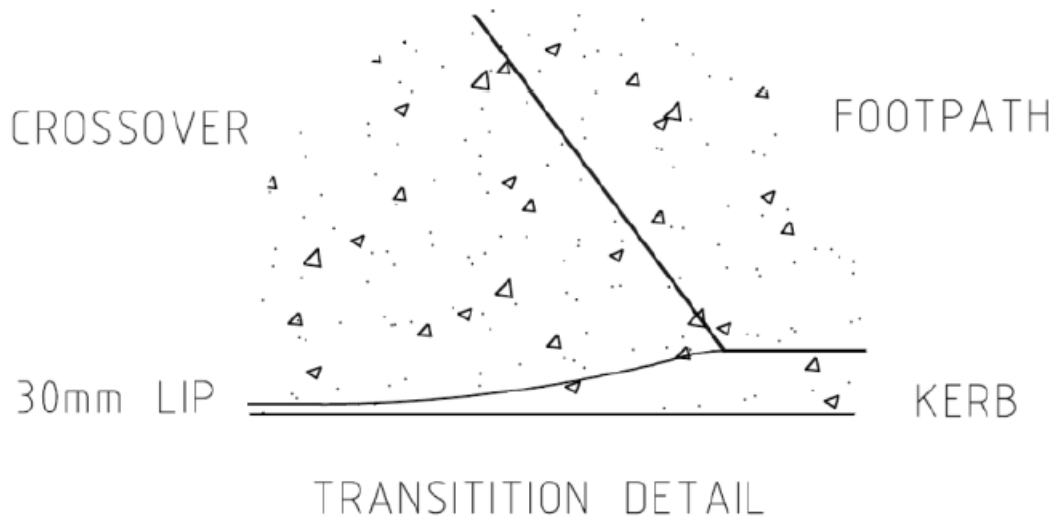


2.10 Backfill

2.10.1 Clean sand is to be used for backfill and uniformly compacted and levelled out to blend in with the existing verge.

2.11 Kerbing

2.11.1 Crossover splays shall be formed to rise gradually to blend into the existing adjoining kerbing as shown below:

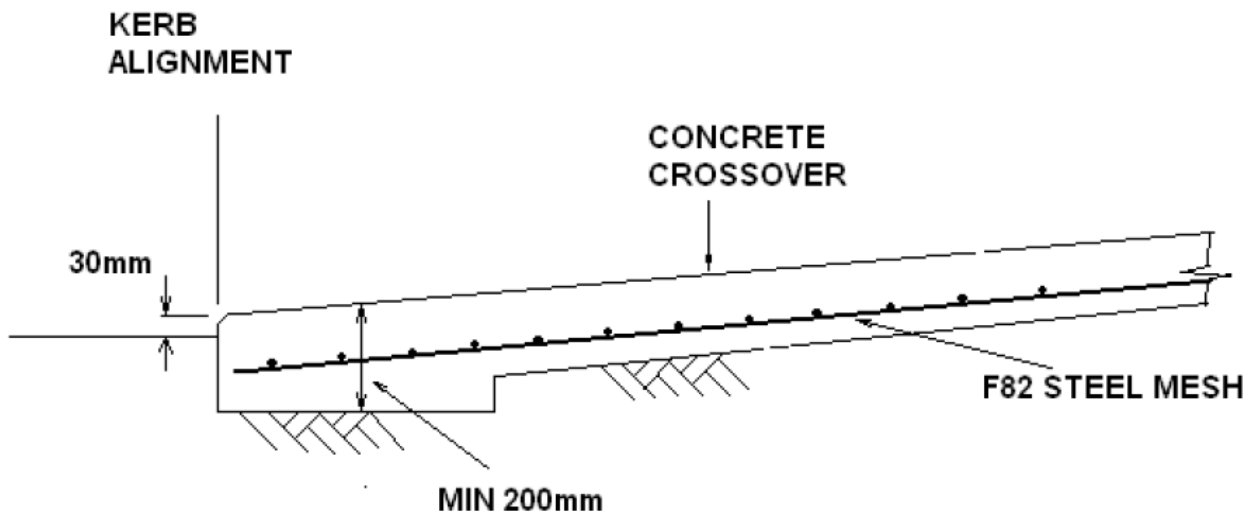


2.11.2 Existing kerbing in the alignment of the proposed concrete crossover is to be removed as part of the excavation works.

2.11.3 The kerbs are to be cut at full depth using a concrete cutting saw prior to its removal.

2.11.4 Existing pre-cast kerbing shall be removed in a manner as not to cause damage to existing kerbs or road pavement.

2.11.5 The part of the new concrete crossover that is in the alignment of the existing kerb shall be thickened to a minimum of 200 mm as shown below:



3.0 Bitumen specifications

Non-residential bitumen crossovers shall be designed to meet the requirements of the specific traffic loads and vehicle access requirements.

3.1 Bitumen reinstatement

3.1.1 There are two (2) acceptable methods to repair bitumen surfaces that have been damaged during crossover works, as shown below:

3.1.1.1 Method 1

- Remove loose material and excess concrete from area to be reinstated
- Place and compact base course material utilising mechanical compaction
- Base course material will be emulsion-stabilised limestone or equivalent
- Provide single coat emulsion seal with aggregate (diorite or granite) maximum size 7 mm
- Seal excess emulsion with aggregate
- Sweep excess aggregate away from the repair and remove excess material.

3.1.1.2 Method 2

Repair the bitumen surface with hot or cold asphalt to a minimum thickness of 30 mm.