SECTION 6 - CONCRETE

SECTION 6 - CONCRETE

6.1 DESCRIPTION

This section covers the requirements for the supply and placement of concrete for paving, kerb and channel, pit construction and miscellaneous works, all as shown on the drawings as specified.

All concrete used shall be ready mixed concrete or concrete mixed in a central plant.

6.2 MATERIALS

(a) Concrete Materials

Unless otherwise specified or shown on the drawings or directed by the Superintendent, concrete materials and ready mix concrete shall comply with the following Australian Standards:

AS 3972 Portland and Blended Cements
AS 2758 Concrete Aggregates
AS 1478 Chemical Admixtures for Use in Concrete
AS 1479 Code of Practice for the Use of Chemical Admixtures in Concrete
AS 1379 Ready Mixed Concrete

The quality of mixing water used in the concrete mix shall comply with Clause 2.4 of AS 1379 – 1991. However, the amounts of chloride and chlorine in the water shall not be greater than 0.03%. The maximum size of aggregate to be used shall be 20 mm.

(b) Reinforcement

Unless otherwise specified or shown on the drawings or directed by the Superintendent, steel reinforcement shall comply with the following Australian Standards:

AS 1302 Steel Reinforcing Bars for Concrete
AS 1303 Hard Drawn Steel Reinforcing Wire for Concrete
AS 1304 Welded Wire Reinforcing Fabric for Concrete

Steel reinforcement shall be thoroughly cleaned of all loose scale, rust and any other coating which will reduce or prevent bonding of the concrete to the steel.

6.3 STRENGTH

The concrete used shall be a dense uniformly graded mix, and when tested in a N.A.T.A. Registered Laboratory, shall develop the following strengths:

At 7 days - Not less than 18 mPa
At 28 days - Not less than 25 mPa

Concrete used in kerb extrusion machines will not be subject to these compressive strength requirements but shall have a minimum cement content of 280 kg per cubic metre of finished concrete. Concrete kerb and channel shall develop the following strength:

At 28 days using in place testing (cores) - Not less than 20 mPa

6.4 TESTING OF CONCRETE

The Contractor shall carry out sampling and testing of concrete in conformance with the following requirements at the Contractor's expense. Testing shall be carried out by an independent NATA Registered Laboratory using the relevant procedures set out in AS 1012, AS 1379 and AS 3600.

Not less than three (3) specimens shall be made and tested for any sample representative of the day's concrete.

Where more than 15 cubic metres of concrete is place in one day, three test cylinders shall be made for each 15 cubic metre or part thereof. Until despatched to the laboratory, the cylinders shall be stored

undisturbed at the site in a moist condition, sheltered from the sun and wind and protected from extremes of temperature. The Contractor shall be responsible for providing the necessary curing facilities and for curing the test cylinders on the site.

One test cylinder of each of the three specimens shall be tested at 7 days, one at 28 days and the third when required by the Superintendent. Should any two test cylinders of a set fail to fulfil the compressive strength specified, the Superintendent may reject the whole or part of the concrete represented by these specimens in which case it shall be removed and replaced in accordance with clause 6.14.

6.5 CONSISTENCY

Concrete shall be of such consistency that it can be readily placed and compacted in the forms without segregation of the materials and without excess free water collecting on the surface.

The consistency of the concrete shall be determined by a slump test. Concrete with a slump exceeding 100 mm shall not be used. The Superintendent will determine the maximum slump to be sued for each portion of the work.

Concrete for use in kerb extrusion machines shall contain the maximum amount of water which will produce such consistency that, after extrusion, the shape of the kerb will be maintained.

6.6 FORMWORK

(a) General

Formwork shall conform to the shape, lines and dimensions required in the finished concrete. Formwork shall be rigid, watertight and braced and fixed so that it will remain in position and shape during the casting of the concrete. Formwork shall be constructed so that it can be removed without damage to the concrete.

(b) Materials

Formwork shall be constructed of one of the following:

(i) seasoned or kild-dried timber;
(ii) metal shutters with joints flush fitting and adequately sealed;
(iii) pressed wood or plywood supported with timber of size and spacing approved by the Superintendent.

All exposed edges shall be chamfered not less than 20 mm x 20 mm to prevent mortar runs and to preserve smooth, straight lines. Internal angles shall be filleted where shown on the drawings.

Timber formwork shall be in long lengths free from loose knots and surface defects and uniform in thickness. Form materials before reuse shall have all protruding nails withdrawn, holes and surfaces to be in contact with concrete thoroughly cleaned. Forms shall not be reused if bulged or warped. All inside surfaces of formwork shall be coated with non-staining mineral oil, grease or other approved agent to ensure non-adhesion of the mortar.

All dirt, sawdust, shavings or other debris mus be removed from the inside of forms before pacing concrete.

HP **Placing of concrete will not be permitted to commence until the formwork has been checked and approved by the Superintendent. Such approval will not relieve the Contractor of responsibility for any defects in the works which may become apparent during or after placing of concrete.**

6.7 REINFORCEMENT

Reinforcement shall be carefully formed to the dimensions and shapes shown on the drawings. For mild steel reinforcing bars, cold bends shall be made around a pin having a diameter of four or more times the nominal diameter of the bars.

Reinforcement shall not be bent or straightened in a manner that will damage the material. Bars with kinks or bends not shown on the plans shall not be used. Heating of reinforcement bars will not be permitted.

Where practicable, all reinforcement shall be supplied in the full lengths shown in the drawings. Where not practicable, the Contractor shall splice the reinforcement by lapping where directed. The lap shall not be less than 40 times the nominal diameter of the bars.

All reinforcement shall be accurately placed in the positions shown on the plans, and shall be securely held during the placing and compacting of the concrete by wiring together with annealed iron wire of not less than 1.2 mm diameter, and by blocking and supporting the forms with plastic or metal chairs, or by other approved methods. Unless otherwise shown on the drawings, the minimum clear cover to reinforcement shall be as specified in AS 3600 – Concrete Structures.

Reinforcement supports shall be made of durable materials string enough to withstand the imposed loads without movement of the reinforcement. They shall be positively attached to the reinforcement and of such size as to maintain the specified cover. Bars shall be tied at all intersections except where spacing is less than 300 mm in any direction when alternative intersections shall be tied.

Wooden supports shall not be used, nor shall metal supports or tie wires which extend to the surface of the concrete. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted.

All reinforcement when placed shall present a clean surface free from grease, tar, paint, oil, mud, loose mill scale, loose or thick rust.

HP Placing and fastening of reinforcement in each section of the work shall be inspected and approved by the Superintendent before any concrete is poured in the section.

6.8 PLACING OF CONCRETE

HP Concrete shall not be placed until the contractor has submitted details of the proposed method of placing and compaction to the Superintendent for review and approval.

After mixing, concrete shall be placed without delay. The methods of transport, handling and placing shall be such as will prevent the segregation or loss of the ingredients. Dropping the concrete a greater height than 1.5 metres will not be permitted.

Depositing large quantities of concrete at any point and moving or working it along the forms will not be permitted. Any concrete which has developed its initial set, or which is not placed in the forms and compacted within 20 minutes after discharge from the mixer, shall not be used.

Concrete shall be placed in one continuous operation between ends of members and construction joints, thereby forming one unit of construction. Concrete shall be placed in the forms within such intervals of time that the contact surface of the proceeding concrete is still in a plastic condition.

Concrete shall not be placed under water.

6.9 COMPACTION OF CONCRETE

(a) General

During and immediately after placing, the concrete shall be thoroughly compacted by means of continuous tamping, spading, slicing and vibration.

Care shall be taken to fill every part of the forms, to force the concrete under and around the reinforcement without displacing it, to work coarse aggregate back from the face and to remove air bubbles and voids.

Workers employed in compacting concrete shall be competent and experienced in this work. Any worker who is deemed by the Superintendent to be unsatisfactory, shall be replaced immediately at the request of the Superintendent.

(b) Vibration

Vibration shall be applied at the point of deposit and in the areas of freshly deposited concrete. The vibrators shall be inserted and withdrawn out the concrete slowly. The vibration shall be of sufficient duration and intensity to thoroughly compact the concrete, but shall not be continued so as to cause segregation or allow localised areas of grout to form at any point. Application of vibrators shall be at points uniformly spaced and not further apart than twice the radius over which the vibration is visibly effective.

Vibration shall not be applied directly or through the reinforcement to sections or layers of concrete which have hardened to the degree that the concrete ceases to be plastic under vibration. It shall not be used to make concrete flow in the forms over distances so great as to cause segregation, and vibrators shall not be used to transport concrete in the forms.

Vibrators (internal and external) shall have a minimum frequency of vibration such that the intensity of vibration will visibly affect a mass of concrete of 25 mm slump over a radius of at least 500 mm.

Vibration shall be supplemented by such hand tamping as is necessary to ensure smooth surface and dense concrete along surfaces and in corners and locations impossible to reach with the vibrators.

(c) Kerb Extrusion Machines

Concrete used in kerb extrusion machines shall have a density not less than 96% of density achieved in a specimen cylinder prepared in accordance with AS 1012.8 – 1986 clause 1.7.5.

The Contractor shall carry out concrete core tests in accordance with AS 1012.14 – 199. Intervals of such tests shall be one (1) test per lot. A lot shall be the kerb and channel cast in one day's production. The location for testing shall be the kerb and channel tray or where there is not channel, the top of the kerb, on the steepest downhill grade on which the kerb machine is travelling.

On incidental, isolated, or on works where the total length of kerb cast in one days production, is less than 150 linear metres, three (3) core tests shall be conducted. The Contractor shall request the Superintendent to nominate the position of each test.

The Contractor shall fill holes due to core sampling with a suitable concrete mix coloured to match the kerb and channel within 48 hours of testing.

6.10 JOINTS

(a) Construction Joints

Wherever the work of placing concrete is stopped until the concrete has taken its initial set, this point shall be deemed a construction joint. The location of construction joints shall be as shown on the plans or as required and approved by the Superintendent.

The placing of concrete shall proceed continuously from joint to joint. These joints shall be perpendicular to the principal line of stress, and in general shall be located at points of minimum shear.

Before placing new concrete against concrete which has set, the forms shall be re-tightened and the surface of the set concrete shall be roughened, cleaned of foreign matter, latent and loose or porous material and saturated with water.

The surface shall then be covered uniformly with a thin coat of neat cement and water to ensure bond and concreting shall then proceed immediately.

(b) Sawn Joints

The location of sawn joints shall be as shown on the plans or as required and approved by the Superintendent. Sawing shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without excessive ravelling, regardless of time or weather conditions.

The line of the joint shall be without any discontinuities. Neither edge shall deviate from a 3 m straight edge by more than 10 mm.

The joint surface shall not exhibit more than 5 mm of vertical or horizontal edge ravelling. The length of edge ravelling shall not be more than 300 mm in any one (1) metre length of joint on each edge. Saw debris shall be washed from the joint and pavement immediately after sawing.

Immediately after cleaning, a continuous UP stabilised PVC spline seal 5 mm ± 1 mm diameter shall be installed in the sawcut, and where transverse joints cross longitudinal joints the transverse seal shall pass under any seal inserted in the longitudinal sawn joints. The seal shall not stretch in order to fit the groove and any increase in length of the seal after installation shall not exceed 10% of the original length. Joints in the seal shall not be less than 5 mm nor more than 7 mm below the surface of the concrete.

6.11 CURING

Concrete surfaces exposed to conditions causing premature drying shall be protected by covering as soon as possible with canvas, hessian, sand, plastic or other satisfactory material and kept moist; or if the surfaces are not covered they shall be kept moist by flushing or sprinkling. Curing shall continue for a period of not less than 7 days after placing the concrete.

When frosts and freezing temperatures are likely, special precautions shall be taken to maintain the concrete temperature of the surface of the setting concrete above 5° C.

Freshly finished concrete surfaces shall be effectively protected from rain or injury from other sources, until hard set has occurred.

If requested by the Contractor, consideration will be given to the use of a curing compound for curing purposes but, in general, moisture curing shall be adopted. Curing compounds shall be effective during the whole period of curing, and shall not be applied to surfaces which are to be bonded later to another surface.

Full details shall be submitted for the approval of the Superintendent and shall include the time and rate of application and the effectiveness of the curing compound as a curing agent. Such compounds may be colourless or preferably white and shall not have a deleterious effect of the concrete nor stain the surface or cause the concrete to darken or yellow appreciably.

6.12 REMOVAL OF FORMS

HP **Unless adequate supports are provided, forms shall not be removed until the concrete has achieved adequate strength. Forms shall not be removed without the permission of the Superintendent.**

6.13 SURFACE FINISH

All concrete surfaces shall be true and even, free from honeycombed surfaces, depressions or projections. All unexposed surfaces not specified to be rendered shall be rendered.

As soon as forms are removed, all mortar pins shall be tooled away to expose a face of dense sound concrete. Rough or porous areas and holes shall be filled with mortar consisting of three parts fine aggregate to one part of cement mixed with water to produce a mix of suitable constituency.

Bolts, wires or other appliances passing through the concrete to hold forms shall be cut off or set back 50 mm below the surface and the ends covered with mortar mixed as specified above.

6.14 DEFECTIVE CONCRETE

The Contractor shall be fully responsible for employing effective methods of mixing, placing, protecting and curing concrete, and for the adequacy of forms. Approval of any such work or methods by the Superintendent will not relive the Contractor of his responsibility.

Concrete which is not placed and completed in accordance with this specification or which, in the opinion of the Superintendent, is defective shall be removed and replaced by the Contractor at the Contractor's expense.