



# Joint Free Slabs On Grade

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## Specification

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## Contents

<b>PREAMBLE</b>	3
<b>SECTION 1: SCOPE</b>	3
<b>SECTION 2: SUB-GRADE PREPARATION</b>	3
2.1 Bulk Earthworks	3
2.2 Proof Rolling	3
2.3 Bulk Filling	3
2.4 Sand Blinding	3
2.5 Service Trenches	4
2.6 Vapour Barrier	4
2.7 Protection of Natural Surface	4
2.8 Wetting Down Prior to Placing Concrete	4
2.9 Ground Restraints	4
<b>SECTION 3: CRACK INDUCER GRID</b>	4
3.1 Supply	4
3.2 Size of Crack Inducer Tube	4
3.3 Assembly	5
3.4 Installation	5
<b>SECTION 4: REINFORCEMENT</b>	5
4.1 Reinforcement types	5
4.2 Cover	5
4.3 Support	5
4.4 Laps	6
4.5 Trimmer Bars	6
<b>SECTION 5: CONCRETE SUPPLY AND PLACING</b>	6
5.1 Compressive Strength	6
5.2 Slump	6
5.3 Drying Shrinkage	6
5.4 Mix Design	6
5.5 Admixtures	6
5.6 Addition of Water	6
5.7 Placing and Compaction	7
5.8 Hot Weather Placing	7
5.9 Pour Size	7
5.10 Preparation and Detail at Construction Breaks	7
5.11 Compressible Fillers	7
<b>SECTION 6: CONCRETE CURING</b>	7
<b>SECTION 7: APPLIED FINISHES</b>	7
7.1 Vinyl Tiles	7
7.2 Sheet Vinyl	8
7.3 Carpet	8
7.4 Ceramic Tiles	8
7.5 Terrazzo	8
7.6 Epoxy Concrete Topping	8
7.7 Epoxy Paint Finish	9
<b>SECTION 8: STRUCTURAL DESIGN &amp; CERTIFICATION</b>	9
8.1 Consulting Engineer	9
8.2 Design loads	9
8.3 Construction Phase Inspections	9
8.4 Structural Certification	9

## **PREAMBLE**

Joint free slabs on grade refers to slabs constructed without the traditional control and Isolation joints. The slab is cast over a crack inducer grid with the intention of inducing fine cracks at close centres in order to distribute setting and drying shrinkage as evenly as possible throughout the entire area of the slab. Reinforcement is placed over the grid to provide resistance to the excessive opening of any cracks.

The novelty of this method of constructing slabs on grade is the subject of Australian Patent No 726864, and Building Innovations Pty Ltd owns the intellectual property. Joint Free Slabs Pty Ltd is the only legal supplier of the crack inducer grid, and the cost of the grid supplied to any project includes a license fee to use the system on that particular project.

## **SECTION 1: SCOPE**

This specification provides guidance on essential preparation works and the construction of joint free slabs, and it focuses attention on issues of good building practice that are important for the successful performance of the slabs.

All concrete work including but not limited to formwork, reinforcement supply and fixing, and concrete supply, placing, sampling, testing, curing and protection, shall be in accordance with the ACSE Concrete Specification (current edition) unless specifically varied by this specification or the drawings.

## **SECTION 2: SUB-GRADE PREPARATION**

### **2.1 Bulk Earthworks**

The site preparation, bulk excavation, placing and compaction of fill, and trimming to level shall be in accordance with the civil earthworks specification where such exists, the Geotechnical Engineer's recommendations, and shall comply also with the following clauses. Any discrepancies shall be referred to the structural consultant for written instruction.

All earthworks and testing of earthworks shall be completed in accordance with AS3798-1996 Guidelines on Earthworks for Commercial and Residential Developments.

All topsoil, organic matter and deleterious material shall be stripped from all areas on which a joint free slab is to be constructed.

### **2.2 Proof Rolling**

Proof roll using equipment recommended by the geotechnical consultant, and remove any soft spots. Make good with approved low plasticity cohesive fill material compacted to 98% SRDD.

### **2.3 Bulk Filling**

Raise the building platform to the underside of the slab if necessary with approved low plasticity cohesive fill compacted to 98% SRDD, or as otherwise specified by the geotechnical consultant. The surface shall preferably be irregular for maximum frictional resistance to shrinkage of the concrete, but shall not be such that it causes damage to the membrane.

### **2.4 Sand Blinding**

Do not use a blinding sand layer. Trim the surface such that the specified slab thickness will be achieved with a tolerance of +/- 10mm.

## 2.5 Service Trenches

All service trenches in the sub-floor region shall be backfilled with fully consolidated granular material or stabilised material such that there is no appreciable long term differential settlement between the backfill and the general sub-grade. The backfill must also comply with the requirements of the services consultant and the relevant authority.

## 2.6 Vapour Barrier

- a) Interior Slabs - Provide a virgin polyethylene moisture barrier throughout as an underlay to all interior slabs, no thicker than 200 micron unless noted otherwise on the drawings, lapped 200 and taped at all joints and at all penetrations. The membrane must be loosely fitted to all ground restraints, thickenings, setdowns, and other depressions in the surface of the sub-grade such that the concrete completely fills such thickenings and depressions and makes continuous contact with the ground surface.
- b) Exterior Slabs - A moisture barrier underlay is not required under exterior slabs unless specifically noted otherwise on the drawings.

## 2.7 Protection of Natural Surface

Install a fully compacted base course of approved road base material where the exposed surface of any natural material in the building platform will be adversely affected by the elements.

## 2.8 Wetting Down Prior to Placing Concrete

When no moisture barrier underlay is to be installed, moisten the surface of the sub-grade immediately before placing concrete sufficiently to prevent absorption of water from freshly placed concrete but not to the extent that it makes the surface untrafficable.

## 2.9 Ground Restraints

Install ground restraints at maximum 15m centres in two directions approximately at right angles. Ground restraints shall be a minimum 300mm wide x 200mm deep measured from underside of the slab, and shall be left rough on excavation. Throughout, however, the prepared surface of the sub-grade shall be such that it does not cause damage to the vapour barrier.

Provide a ground restraint to the full perimeter of a joint free slab, and provide a ground restraint at all construction joints. A perimeter ground restraint may be omitted wherever the slab edge is continuously tied into tilt-up panels, footings, retaining walls or the like in such a manner that there is full restraint to in line and transverse shrinkage movement of the slab.

Remove all loose material from the excavated trenches of ground restraints.

# SECTION 3: CRACK INDUCER GRID

## 3.1 Supply

All components of the crack inducer grid shall be obtained from Joint Free Slabs Pty Ltd. A written order is required to initiate any supply, and a minimum 14 days shall be allowed for delivery to site after a written order is received by Joint Free Slabs Pty Ltd.

## 3.2 Size of Crack Inducer Tube

The overall dimension of the crack inducer tube shall be varied to suit the design thickness of the slab.

For slabs reinforced with steel wire mesh, the overall height of the crack inducer tube shall be approximately 25 to 30% of the slab thickness.

### **3.3 Assembly**

The builder shall provide all on site labour and equipment required to take delivery of, assemble and install the crack inducer grid.

The crack inducer tubes are supplied to site cut to length suitable for assembly in a 1m x 1m square grid. The grid is to be assembled dry (without adhesive) by pressing the tubes firmly into or onto the connectors as appropriate. When assembled the connectors are to be at 1m centres in both directions with a tolerance of +/- 5mm. The centre to centre dimensions are to be regularly checked when assembling and installing the grid to ensure there is no creep in the 1m grid. If necessary adjustments are to be made in the way the grid is assembled to ensure the 1m grid dimension is maintained.

### **3.4 Installation**

The assembled crack inducer grid is to be laid directly on the moisture barrier or the sub-grade, with the base of each connector and the underside of each tube in contact with the membrane or the sub-grade as appropriate. Connectors shall not generally be located to coincide with ground restraints and the job shall be set out accordingly. Adhere to any setout dimensions provided on the drawings. Note that all connectors shall be installed with the flat base facing downwards.

All crack inducer grids shall be installed with the tubes aligned in straight lines in both directions so that each connector can be used as a bar chair to support the steel mesh reinforcement.

Crack inducer tubes around the outermost perimeter of a joint free slab shall be cut on site as and if necessary so that they terminate no less than 100mm and no more than 500mm clear of any visible vertical face. When set out accordingly in most installations there is no need to cut the crack inducer tubes to length.

Reasonable care shall be taken during the construction to ensure the crack inducer grid is not damaged, dislodged or displaced. Any damaged components shall be replaced, and any displaced components shall be re-installed.

## **SECTION 4: REINFORCEMENT**

### **4.1 Reinforcement types**

Joint free slabs shall be constructed with reinforcement throughout. General reinforcement shall be in the form of hard drawn wire mesh. All trimmer bars shall be Grade D500N deformed bars or as otherwise specified on the drawings. All reinforcement bars shall comply with AS4671, and all reinforcement mesh shall comply with AS1304.

### **4.2 Cover**

The minimum top and edge cover to reinforcement shall be 30mm in applications where the slabs are not exposed to the elements, and 40mm in applications where slabs are permanently exposed to the elements.

### **4.3 Support**

All mesh reinforcement shall be supported on the crack inducer grid junctions at 1m spacing in both directions, except around the perimeter where standard plastic bar chairs shall be used. Special attention shall be paid to the support of mesh and trimmer bars at re-entrant corners and penetrations.

Install conventional bar chairs as necessary. Do not allow the reinforcement to lay on the ground.

### **4.4 Laps**

All reinforcement mesh shall be placed with rows of sheets lapped end to end. Successive rows of sheets shall be staggered by one half of a sheet length so that not more than three sheets are lapped at any one location. All side laps shall be nested to minimise the bulking up of the laps, whereas end laps shall not be nested. Nominal 200mm side laps and end laps shall be used so that a 200mm square grid of bars is maintained throughout. This is required so that the mesh can be supported on each and every grid connector. Bar reinforcement shall be lapped a full tensile development length where required.

#### **4.5 Trimmer Bars**

Install a minimum 2N12 trimmer bar around the full perimeter of all joint free slabs as detailed, including the full perimeter of each pour. Extend perimeter trimmer bars at pour breaks so that they are fully anchored into subsequent pours. Install diagonal trimmer bars as detailed at the corners of all penetrations and at all re-entrant corners.

## **SECTION 5: CONCRETE SUPPLY AND PLACING**

The objective with joint free slabs is to place quality concrete with low shrinkage characteristics, and with a hardness and surface finish that suits the proposed in-service conditions. An increase in concrete compressive strength usually results in increased shrinkage, hence concrete compressive strength should not be over specified. It should also be noted that a primary objective with joint free slabs is to induce cracks prior to any significant gain in concrete tensile strength, hence high early shrinkage is desirable whilst high early strength is not.

#### **5.1 Compressive Strength**

The concrete is to be of a compressive strength that suits the purpose and that satisfies the durability requirements of the client and AS3600 Section 4.

#### **5.2 Slump**

The design slump shall be 80mm.

#### **5.3 Drying Shrinkage**

The design 56 day drying shrinkage shall be 600 microstrain for slabs which are to be covered with applied finishes. Special consideration shall be given to reducing the design drying shrinkage in slabs that have no applied finishes and for slabs where the applied finish is epoxy paint.

#### **5.4 Mix Design**

The concrete mix design is to be carried out by the concrete supply company using readily available local aggregates. Details of the mix design are to be provided to the design engineer for review, and a copy of the final mix design is to be provided to Joint Free Slabs Pty Ltd for its records.

#### **5.5 Admixtures**

Water reducing admixtures may be used to improve workability provided they have negligible effect on the early strength of the concrete, provided they do not increase the drying shrinkage, and provide they do not affect the durability of the surface.

#### **5.6 Addition of Water**

No water shall be added to the concrete after the truck has left the batching plant. Any concrete that has had water added shall be rejected and the truck ordered to leave the site.

## **5.7 Placing and Compaction**

All concrete shall be placed in such a manner as to avoid segregation or loss of materials, and all concrete shall be thoroughly compacted by means of mechanical vibration. See also ACSE Specification Section 7.

## **5.8 Hot Weather Placing**

In hot and/or windy conditions, evaporation of water from the surface of a freshly placed slab shall be minimised by the use of aliphatic alcohol sprayed onto the surface.

## **5.9 Pour Size**

The size of a concrete pour shall be limited only by the availability of supply, and the capacity of the contractor to place and finish the concrete. Daily pour sizes of 1,500 to 2,000 square metres are readily achievable. Any partial pour of a floor slab or pavement shall be restrained around its full perimeter with ground restraints or physical attachment to other building elements. All construction joints shall be formed as detailed on the drawings.

## **5.10 Preparation and Detail at Construction Breaks**

Before concrete is placed against hardened concrete, surface shall be cleaned of all laitance, dust and loose material, and shall be wetted down immediately prior to placing concrete. A smooth vertical surface at construction joints is to be avoided, and the mesh reinforcement is to continue through the joint and be fully lapped with the mesh in the subsequent pour.

## **5.11 Compressible Fillers**

Compressible jointing is not generally required at internal columns and walls, as these elements help restrain the shrinkage movement of the slabs. Refer to the details on the drawings for special cases.

# **SECTION 6: CONCRETE CURING**

The exposed surfaces of all joint free slabs on grade shall be cured for seven days after the placing of concrete. Except in extreme adverse weather conditions, curing compounds may be applied the morning after the pour.

# **SECTION 7: APPLIED FINISHES**

Joint free slabs are suitable for applied finishes such as vinyl tiles, sheet vinyl, carpet, ceramic tiles, terrazzo, epoxy concrete topping and the like provided correct procedures are adopted in the preparation of the surface and the fixing or application of the materials.

## **7.1 Vinyl Tiles**

Prior to the fixing of vinyl tiles, the concrete surface shall be thoroughly cleaned of all dust and foreign material, and any irregularities in the surface ground flush and smooth. Pressure sensitive adhesive shall be used for fixing the tiles and this shall be spread using a notched spreader of a type and size

recommended by the adhesive manufacturer. The tiles may be placed continuously over all induced cracks in the joint free slab.

Preparation of the slab surface and laying of the floor covering shall be in accordance with AS1884. Take special note of the need to lay the floor covering on a dry slab.

## **7.2 Sheet Vinyl**

Prior to fixing sheet vinyl, the concrete surface shall be thoroughly cleaned of all dust and foreign material, and any irregularities in the surface ground flush and smooth. Acrylic adhesive shall be used for fixing the vinyl and this shall be spread using a notched spreader of a type and size recommended by the adhesive manufacturer. The sheet vinyl shall be placed continuously over all induced cracks in the joint free slab.

Preparation of the slab surface and laying of the floor covering shall be in accordance with AS1884. Take special note of the need to lay the floor covering on a dry slab.

## **7.3 Carpet**

Prior to the fixing of carpet, the concrete surface shall be thoroughly cleaned of all dust and foreign material, and any irregularities in the surface ground flush and smooth. The carpet shall be placed continuously over all induced cracks in the joint free slab and fixed in the normal manner for the particular carpet. Note that carpet must only be laid on dry concrete floors.

## **7.4 Ceramic Tiles**

Prior to fixing ceramic tiles, the concrete surface shall be thoroughly cleaned of all dust and foreign material, and any irregularities in the surface ground flush and smooth. All relevant requirements of 'AS3958.1-1991 Ceramic tiles - Guide to the installation of ceramic tiles' shall be complied with. Ceramic tiles shall not be laid on freshly placed concrete.

A quality flexible adhesive shall be used (Davco Tradeflex or equal) for fixing all ceramic tiles. The adhesive shall be spread using a 10mm x 10mm or 12mm x 12mm square notched trowel, and the tiles fully bedded such that there are no voids. The finished thickness of the adhesive shall be no less than 3mm, and tiles shall be removed from time to time so that the thickness of the adhesive can be checked measured.

The ceramic tiles shall be laid continuously over all induced cracks in the joint free slab, however expansion joints shall be installed at centres recommended by the tile manufacturer for the particular tile being laid.

## **7.5 Terrazzo**

In situ terrazzo shall be placed on a minimum 50mm thick bed of sand and cement reinforced with galvanised chicken wire. The sand and cement bed shall be separated from the surface of the joint free slab by means of a 200 micron polyethylene membrane or a suitable bituminous membrane so that there is no bond.

Prior to installing the bond breaker, all irregularities in the slab surface shall be ground or treated so that the surface to receive the bond breaker is flat and smooth.

Control joints shall be installed in the terrazzo as required to control shrinkage of the terrazzo itself and the bedding material, and to achieve the desired surface pattern.

## **7.6 Epoxy Concrete Topping**

Prior to placing epoxy concrete topping, all irregularities in the slab surface shall be ground or treated to produce a flat and smooth slab surface.

Install a 200 micron virgin polyethylene membrane or a suitable bituminous membrane so that there is no bond between the epoxy concrete topping and the slab surface. Install the epoxy concrete topping continuously over the induced cracks in the joint free slab, however install control joints in the epoxy concrete topping as and if recommended by the product manufacturer to control shrinkage or thermal movement of the material.



## 7.7 Epoxy Paint Finish

If an epoxy paint finish is to be applied directly to the surface of a joint free slab, increase the reinforcement locally as shown on the plans and prepare the surface of the joint free slab as specified by the epoxy paint manufacturer. Allow to touch up by hand brushing from time to time any induced cracks in the epoxy paint finish that are unacceptable. Re-paint the floor with a liberal coat of epoxy paint after at least two years to conceal the induced cracks.

# SECTION 8: STRUCTURAL DESIGN & CERTIFICATION

## 8.1 Consulting Engineer

All joint free slabs on grade shall be designed by an experienced and competent practising structural engineer in accordance with all of the requirements of this specification. All designs and construction details shall be reviewed by Building Innovations' consulting engineer prior to commencement of construction.

## 8.2 Design loads

All slabs shall be designed for all applied dead loads and the minimum design live load specified in AS1170.1 unless a heavier design live load is specified in the client design brief, in which case the heavier design live load shall be adopted.

The builder shall take every necessary care to ensure the slabs are not overloaded or damaged in any way during construction. Any damaged sections of slab shall be reinstated to the detail provided by the consulting engineer.

## 8.3 Construction Phase Inspections

The design engineer or his representative shall attend to periodic site inspections of the joint free slab on grade on at least the following occasions:

- upon preparation of the sub-grade, including the excavation of ground restraints, prior to placing the plastic vapour barrier for at least the first slab pour.
- upon installation of the crack inducer grid and all reinforcement, but prior to the placing of concrete for every slab pour
- during the placing and finishing of the concrete in at least the first slab pour.

Any representative of the design engineer who attends to periodic site inspections on his or her behalf, shall also be a suitably qualified and experienced practising structural engineer.

Prior to departing the site after each inspection the inspecting engineer shall provide to the builder a hand written inspection report noting the scope of the inspection, the extent and detail of any works outstanding at the time, and approval or otherwise to place concrete. Concrete shall not be placed unless such inspection report is received.

## 8.4 Structural Certification

Upon completion of the slab, the inspecting engineer shall prepare a certificate for submission to council stating that the slabs have been inspected during construction, and that they have been constructed generally in accordance with the intent of the structural design and documentation.