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At all times during the procurement and construction process, Contractors should direct any queries to BDANZ:

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Fax: 08 6253 5199
Email: info@bubbledeck.com.au
Introduction

BubbleDeck is a structural voided flat slab system that reduces dead weight of a floor slab by up to 33%, allowing longer spans between column supports. The system offers substantial benefits for construction projects including:

- lower overall cost of installed floors due to reductions in material use and increased productivity;
- reduced operating risk due to off-site fabrication and a trafficable platform; and
- faster construction with no formwork and no downstand beams.

A BubbleDeck slab is formed using BubbleDeck semi-precast panels in combination with in-situ concrete. The panel included a 60mm thick precast concrete “plank” that provides a permanent soffit to the slab.

The semi-precast panels are manufactured off-site and combine a precast concrete plank with a steel reinforcement “cage”. The cage holds hollow void formers (plastic balls) between a top and bottom steel reinforcement mat, which are joined through longitudinal trusses. These panels are delivered to site for erection before being cast with in-situ concrete to form the finished BubbleDeck slab.

This Guide is intended to provide Contractors and sub-Contractors with the information needed to understand how to construct BubbleDeck slabs in typical project situations. Further assistance is available by contacting BubbleDeck Australia & New Zealand Pty Ltd (“BDANZ”).
A. Pre-Construction Activities with BubbleDeck

Deliverables
BDANZ will work with the Project Structural Engineer to provide information and technical support to the Builder to construct the BubbleDeck slabs, including review of installation procedures, review of temporary propping design and advice on stripping times, as required by the Contractor.

BDNAZ will work with the Project Structural Engineer to provide the following assistance and drawing information to the Contractor.

Finalising the Detailed Design
- BDANZ will work closely with the Project Structural Engineer to finalise the design from contract award. The design must be based on AutoCAD “dwg” format for construction “Setting out” Architectural plans and approved “Loading Plans” prepared by the Project Structural Engineer;
- The design is carried out in accordance with the BCA Part B and is based on AS3600 and Eurocode 2;
- BDANZ will work with the Project Structural Engineer to prepare drawings for construction, targeting both Off-Site manufacture and On-Site activities as described below

Drawings for Off-Site Manufacture
- BDANZ will review the design in conjunction with the Contractor and the selected precaster to prepare a final panel layout, and to provide all structural information required by the precaster to commence the production of Shop Drawings – note that the selected precaster is responsible for the production of Shop Drawings;
- The Contractor shall confirm the penetrations that will require pre-forming off site, in order that these are including the precaster’s Shop Drawing process;
- The Contractor shall agree with the selected precaster on the planned sequence of erection on site in order for the precaster to prepare a production sequence accordingly;
- BDANZ will review and approve the structural adequacy of the panel shop drawings, detailing the typical reinforcement and ball requirements – note that the approval for the dimensioning and setting out of the panels on site remains with the Contractor and precaster.
Drawings for On-Site Construction

BDANZ will work with the Project Structural Engineer to prepare the following On-Site information:

- Layout and details of the site bottom splice reinforcement steel for tying across the precast planks;
- Layout and details of the site top reinforcement steel for resisting bending over the slab supports;
- Layout and details of the site shear reinforcement steel for resisting slab punching over the supports;
- Bubbledeck slab and interface details as approved by the Project Structural Engineer; and
- Layout and details of the site U-bar and edge reinforcement for continuous free edges.

![Image of reinforcement](image-url)

*Figure 2 - Example of column shear reinforcement. Also visible are bottom splice bars.*

Procurement & Planning

Figure 3 below shows a typical BubbleDeck section slab formed from in-situ concrete cast on top of BubbleDeck semi-precast panels. Bubbledeck semi-precast panels can be procured from the licensed precasters listed in this guide.
Project programmers should allow sufficient lead time from contract award to the first panel delivery, which is typically 4 to 6 weeks. This is required in order to finalise the design, prepare the Shop Drawings, and procure the components of the semi-precast panels. The lead in time needs to be confirmed by the precaster, and it is generally off the critical path and concurrent with site establishment and groundworks activities.

A programme for the BubbleDeck semi-precast panels can be agreed with the precaster. This would account for the delivery sequence and timing, and, where appropriate, be aligned with the construction programme for erection and pouring of the in-situ concrete to form the BubbleDeck slabs.
B. The Typical Stages of Construction with BubbleDeck Slabs

Stage 1 - Production of Precast Panels

The select precaster shall submit relevant QA procedures to demonstrate compliance of the production line with the design intent, Project Specification and with relevant Australian Standards, including (but not limited to) AS 1170, AS 3600, AS 3610 and AS3850.

The concrete in the precast panels must be placed using rigid formwork and intense compaction to comply with the requirement of table 4.10.3.3 of AS 3600 : 2009.

The top and bottom steel mats shall be connected to the trusses by welding. The precaster shall ensure that welds between the trusses and the top reinforcement steel mat be capable of resisting the uplift forces from the displaced concrete on site, as well as the stresses that will occur through handling of the panels.

The precaster must develop a procedure for lifting the panels safely. Where the lifting occurs from the trusses the following applies:

a. The trusses shall have 2 x 6mm diameter webs connecting a 10mm top longitudinal bar to two bottom longitudinal bars through a “Warren Truss” pattern at 200mm pitch;
b. The maximum allowable cover to the bottom layer of reinforcement shall be 25mm, with a maximum bottom layer bar diameter of 12mm;
c. The maximum Safe Working Load at each lifting point is 500kg, provided that concrete has reached a compressive strength of 25N/mm².

The exposed face of the panel must achieve a surface roughness of 3mm showing coarse aggregate firmly fixed to the matrix.

BDANZ will visit the production facility from time to time, to monitor that the design intent has been interpreted correctly in the manufacture of the panels.

All relevant QA documentation (including, but not limited to concrete test results and mill certificates) associated with the production of the panels shall be provided to the Contractor for submission to the Project Structural Engineer.

Stage 2 - Delivery

BubbleDeck semi-precast panels can be stacked for delivery on a trailer. They can be stacked seven high provided the height does not exceed a maximum of 2100mm. Working at height regulations may apply to off-loading procedures.

BubbleDeck semi-precast panels are typically erected directly from the trailer, through an 8-point lift. The mass of the panels are generally limited to 4000kg.

If BubbleDeck semi-precast panels must be stored on site, they should be stored on timber packers placed on a level surface at 2000mm centres at right angles to the lattice girders in the
panel. Panels may be stacked to a maximum of seven high with the timber packers placed on the top reinforcement between the bubbles.

The semi-precast panels incorporate lattice girders that are used as slinging points for unloading and erection. The lifting points shall be clearly marked by the precaster, and should always be located where the webs of the truss meet the top chord of the truss. The lifting hook must go through both webs of the truss — note that the top chord must never be used to lift the panel.

The minimum SWL of the lifting gear must be 6000kg commensurate with the 4000kg mass of the panels. Lifting rigs must be self-leveling, either by use of pulleys or spreader beams, and guide ropes should be tethered to the panels to assist with the positioning control. A typical lifting arrangement is shown on the appended sketch drawing.

**Stage 3 - Temporary Supports**

During installation, the BubbleDeck semi-precast panels need to be supported on falsework, purposely designed to carry the project-specific construction loading. The falsework typically consists of props and bearers, adequately braced for temporary stability. Note that the Contractor remains responsible for the design of temporary works and lateral stability of the falsework system adopted in the temporary stage.

The supporting bearer beams of the temporary falsework support system require to run in parallel rows, typically not more than 2000mm apart and at right angles to the lattice girders in the semi-precast panels. The beams must not be more than 400mm from a panel edge where panels abut, and not more than 300mm from a supporting member such as a column or load-bearing wall (see figure 4 below).
Any project-specific falsework and back-propping requirements will be noted on BubbleDeck’s drawings.

**Stage 4 - Joint Sealing**

Joints between panels need only be sealed against slurry seepage during pouring of the in-situ concrete. The semi-precast panels are manufactured with tight tolerances, and generally, a tight joint between the panels is sufficient to minimise seepage. Where the joints are larger because of cumulative tolerances, a 10mm foam backing strips placed in the splay joint between the panels shall be used. Alternatively, joints can be sealed with silicone sealant, taped from the soffit, or simply shuttered with ply. The Contractor should allow for some ancillary shuttering to take up any gaps caused by tolerance between the panels. For each 1000sqm of BubbleDeck slab, an allowance should be made for 150m of 150mm wide ply propped at 2m centres.

*Under no circumstances should expanding foam be used for joint sealing.*

Acceptable joint sealing details are shown in the appended drawing.

**Stage 5 - Construction Shuttering**

Perimeter panels can be delivered with either pre-cast concrete upstands or pre-installed sheet metal edge. The provision and final detailing of such edge forming must be agreed with the precaster.
Figure 5 below shows a metal edge form incorporated in the BubbleDeck panels. Where such detail is used, no additional perimeter formwork is required.

![Image of BubbleDeck panels with metal edge form](image)

**Figure 5 – Metal edge form shown in the foreground**

Column and wall margins require shuttering. This can be done using 18mm ply fixed to the face of the support and the slab soffit (see figure 6 below).

![Image of column margin shuttering in progress](image)

**Figure 6 - Column margin shuttering in progress**

**Stage 6 – Fixing Loose reinforcement**

There are three main types of reinforcement required to be installed on site.
Splice Reinforcement

The structural reinforcement incorporated within the BubbleDeck semi-precast panels need to be lapped on site to re-establish the continuity of the reinforcement steel for both top and bottom reinforcement.

The bottom reinforcement splice steel is typically placed on top of the 60mm precast plank and consists of a number of 12mm or 16mm diameter bars. The splicing bars must be placed with adequate spacing to allow bond is developed between the reinforcement bar and the concrete.

*Note that when conduits are present in the slab, these must never be allowed to interfere with the location of the splice reinforcement – in particular, the conduits should be routed away from panel joints. If conduits must run along a panel joint, then the conduits must be suspended from the top steel reinforcement such that they are a minimum of 40mm clear of the bottom splice reinforcement.*

The top splice reinforcement continuity is achieved through general development length requirement between panels.

Bending reinforcement over columns

The reinforcement required for resisting the bending forces on the slab are detailed on the construction drawings prepared in conjunction with the Project Structural Engineer. Placing of this reinforcement is carried out as normal best practice for steel fixing on site.

Perimeter reinforcement

Edge reinforcement in the shape of U bars and continuous slab edge tying reinforcement is detailed on the construction drawings prepared in conjunction with the Project Structural Engineer and should be placed as per normal best practice for steel fixing on site.

Stage 7 – Pouring In-Situ concrete

The Contractor is to provide adequate sign-off sheets confirming that the panels have been installed to the correct levels, that the shuttering and joint sealing has been carried out adequately and that the on-site reinforcement has been placed in accordance with the project documentation prior to pouring the concrete.

The Project Structural Engineer and BDANZ must be notified 3 working days before a slab is to be poured to allow sufficient time for any pre-pour inspection. Any items noted for rectification must be completed before pouring.

The upper surface of the precast biscuit must be clear of debris and excess material. Immediately prior to pouring concrete the surface must be kept damp (not wet) to encourage a bond between the precast panel and the poured concrete.

When pouring, the concrete must be evenly distributed across the slab. A poker or vibrating tool must be used to ensure good placement of concrete between the bubbles.
Floating and finishing procedures are as for solid concrete slabs and according to the Structural Project Specification, and accepted best practice.

When ordering site concrete for pouring BubbleDeck slabs, the following quantities should be used:

<table>
<thead>
<tr>
<th>Slab Width</th>
<th>Quantity/㎡</th>
</tr>
</thead>
<tbody>
<tr>
<td>BD230</td>
<td>0.12m³</td>
</tr>
<tr>
<td>BD280</td>
<td>0.15m³</td>
</tr>
<tr>
<td>BD340</td>
<td>0.16m³</td>
</tr>
<tr>
<td>BD390</td>
<td>0.21m³</td>
</tr>
<tr>
<td>BD450</td>
<td>0.24m³</td>
</tr>
</tbody>
</table>

Note that the values given above exclude the solid areas around the columns. As the extent of these areas is project specific, please refer to the Project Documentation to calculate final quantities.

**Stage 8 – Back-Propping**

Slabs shall be struck after adequate curing and typically no earlier than 7 days unless otherwise agreed with the Project Structural Engineer and BDANZ. **Note that the backpropping requirement is project specific and shall need to be reviewed by BDANZ and the Project Structural Engineer on a project by project basis.**

Typically, at the time of striking the latest BubbleDeck slab, the Contractor should ensure that at least three storeys below are provided with propping, providing for 100% of the propping requirement in the falsework above for the first storey and 50% for each of the two storeys below that. Refer to the backpropping sketch provided at the end of this guide.

Reduced backpropping may be investigated for specific projects depending on floor cycles and concrete mix designs.

The props may be removed 28 days after the slab was poured, or as agreed with BDANZ and the Project Structural Engineer.
C. Subsequent Site Operations

Penetrations

After completion of the slab, penetrations can be easily cored for small openings (usually less than 250mm). Larger penetrations are generally precast, and coordinated with the design and incorporated in the Shop Drawing approval and precast panel manufacture process.

Where the penetration passes through a bubble, all plastic material from the bubble must be removed. Any exposed reinforcement must be treated to achieve adequate durability requirement.

Fixings

Fixings into the slab are generally made using industry accepted methods for hollow slabs such as plugs or expanding anchors, which are suitable for most services applications, such as conduits, water and sewer pipes and ventilation ducts.

Where the fixing cannot be moved from the thinnest concrete zone below a bubble, a range of adhesive or self-grouting anchors from suppliers such as Hilti are used. For loads up to 6kN a hybrid system consisting of Hilti HIT-RE500 with HIT-SC Composite sleeves (HIT-SC 16x85 for M10 and HIT-SC 22x85 for the M12), and HIT HAS anchor rods (M10 and M12) can be used in the bubble.

Where pull out forces higher than 6kN are needed, they shall be designed and coordinated with the Shop Drawing approval and precast panel manufacture process.
**Location:** | **Licensed Precasters:**
---|---
**Western Australia** | **Austral Precast**  
12 Wildfire Road  
Maddington WA 6109  
P: 08 9261 9880  
Contact: Mr Yuen Leow  
**Cro-cast**  
23 Fairbrother Street  
Belmont WA 6104  
P: 08 9477 4250  
Contact: Mr Jure Denona  
**Perth Precast**  
61 Baile Road  
Canning Vale WA  
P: 08 9256 4748  
Contact: Mr Rob Spadanuda

**South Australia** | **Bianco Precast**  
535 Grand Junction Rd  
Gepps Cross SA 5094  
P: 08 8359 0666  
Contact: Mr Dino Pietrobon

**Victoria** | **Euro Deck Systems Pty Ltd**  
698 Old Geelong Rd  
Brooklyn VIC 3012  
P: 03 8787 8991  
Contact: Mr George Spiropoulos

**Licensing in NSW, TAS, NT and QLD to be confirmed.**  

**Support**  
At all times during the procurement and construction process, contractors should direct any queries to BDANZ:  
BubbleDeck Australia & New Zealand Pty Ltd  
G11, 59 Albany Highway  
VICTORIA PARK WA 6100  
Phone: 1300 BUBLDK (1300 282 535)  
Fax: 08 6253 5199  
Email: info@bubbledeck.com.au
TYPICAL PROPPING PLAN
SCALE 1:NTS

PRELOAD BACK PROPPING
450kg/m² MAX PROPS AT 2m × 2m CENTRES FOR 3 FLOORS MINIMUM

NOTE:
1. MINIMUM SOLEPLATE ON SOIL TO BE 800×225×38 HARDWOOD

<table>
<thead>
<tr>
<th>HEIGHT (m)</th>
<th>PROP SIZE</th>
<th>PROP CENTRES (m) (X × Y)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Na2</td>
<td>2 × 2.0</td>
</tr>
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<tr>
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<td>Na3</td>
<td>2 × 0.9</td>
</tr>
</tbody>
</table>

TYPICAL PROPPING ELEVATION
SCALE 1:NTS
BUBBLEDECK GENERAL LIFTING ARRANGEMENT

Scale 1:100

Note: Maximum 500kg per lift point

4 x Equalising Blocks

Top Mesh

Bubbledeck Girder Truss

60 Thick Precast Biscuit

-end view-

Scale 1:100
BUBBLEDECK EDGE DETAIL

SCALE 1:10

BUBBLEDECK JOINT DETAIL 1

12×12 PVC ANGLE

SCALE 1:10

BUBBLEDECK JOINT DETAIL 2

BACKING ROD

SCALE 1:10

BUBBLEDECK JOINT DETAIL 3

EXPOSED CEILING

SCALE 1:10