BUBBLEDECK

BUILDING MORE WITH LESS

Biaxial Hollow Precast Concrete Slab System

BUBBLEDECK®
Construction Sdn Bhd

www.bubbledeck.com.my

BubbleDeck is a unique system which radically improves building design & performance while reducing the overall cost by eliminating dead weight concrete from the middle of a floor slab.

The system virtually eliminates dead weight concrete from the middle of a floor slab by incorporating recycled plastic bubbles as void.

The system can facilitate up to 50% longer spans between columns and the construction does not require beams, which allows architects greater design freedom.

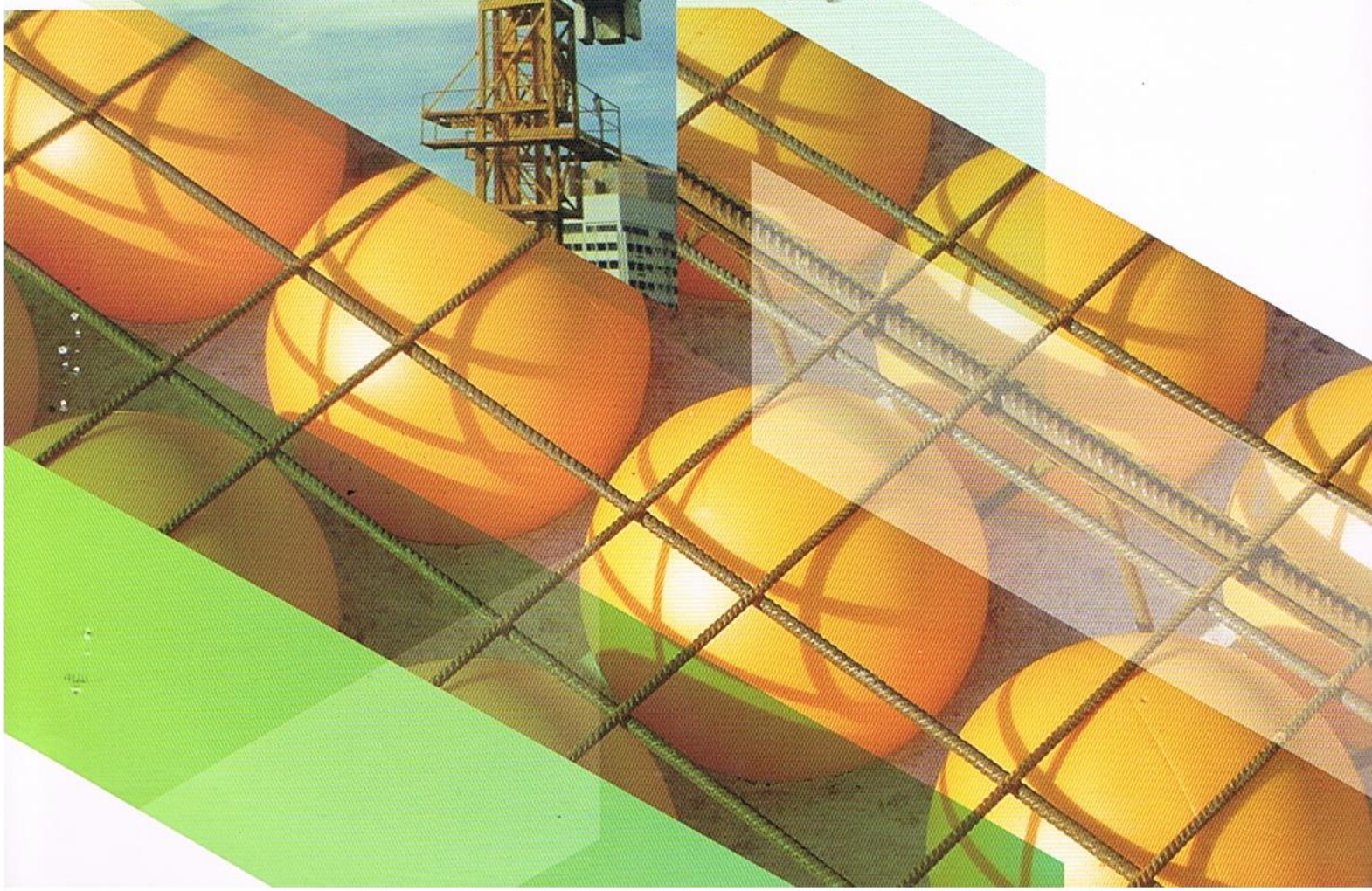
The slab is connected directly to in-situ concrete columns producing a wide range of cost and construction benefits.

BubbleDeck is particularly advantageous due to its load bearing behavior with equal efficiency in longitudinal as well as in transverse direction by the use of embedded spherical hollow bodies (bubbles).

BubbleDeck offers a substantial amount of savings from the total construction project costs and the percentage varies from one project to another. It forms a fireproof construction which will withstand significant earth tremors and offers high sound and heat insulation.

Replacing 100kg of concrete by 1kg of recycled plastic helps in reducing construction energy and carbon emissions.

An award winning innovative system, BubbleDeck is the only light flat slab system officially certified for use in the United Kingdom and is granted Dutch Technical Certification CUR 86 as recognized by the Building Regulations.



Element Types

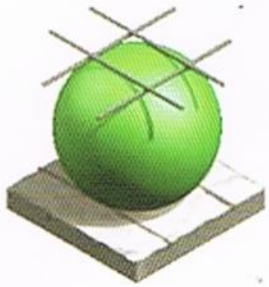
BubbleDeck system can be supplied in 2 types of manufactured elements:

Precast Half Slab Version

Where the bottom of the bubble-reinforcement sandwich includes a 60mm thick precast concrete layer acting as permanent formwork within part of the finished slab depth replacing the need for soffite shuttering. The elements are placed on temporary propping, loose joint, shear & edge reinforcement added, perimeter and tolerance joints shuttered and then the remaining slab concreted.

Cast In-Situ Version

Reinforcement Modules comprising pre-fabricated 'bubble-reinforcement' sandwich elements. The modules are placed on traditional site formwork, loose joint, shear & edge reinforcement added and then concreted in 2 stages to the full slab depth. Suitable for suspended ground floor slab and alteration / refurbishment projects, particularly where site access is extremely restricted. Can be manually lifted into position.



Precast Half Slab Version

In the precast half-slab BubbleDeck system, the bottom side of the 'bubble-lattice' unit is furnished with a precast concrete layer which on the building site replaces the horizontal part of the formwork.

Cast In-Situ Version

The simple BubbleDeck slab is cast over the pre-fabricated 'bubble-lattice' on traditional formwork. The simple BubbleDeck may also be delivered to the building site as precast factory-made slabs.

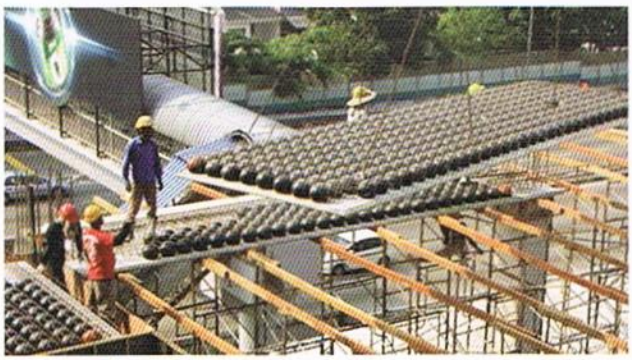
The Advantages

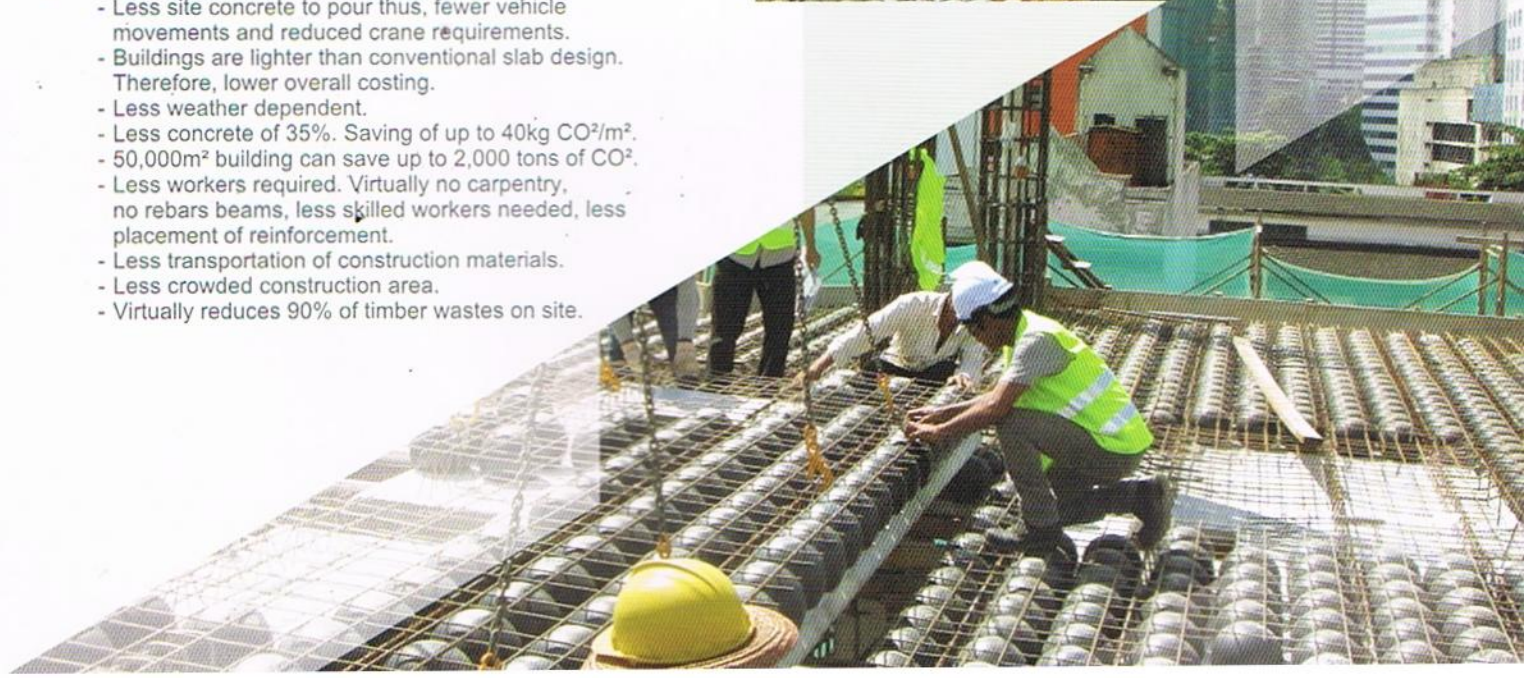
Architectural & Engineering Advantages

- Reduced overall weight of the structure.
- Increased strength of the slab.
- Provide larger spans and cantilever.
- Greater flexibility - free choice of shape.
- Fewer columns.
- No beams or ribs under the ceiling.
- The floor slab is lighter by up to 35%, less columns is required.
- Less foundation required. Lighter floor slabs, less columns, no beams and less steel.
- Less false ceiling. The soffite itself can be used as the actual ceiling. This will eliminate the use of gypsum false ceiling.
- Headroom can be reduced and overall floor height can be reduced to add in additional floor to the same building.

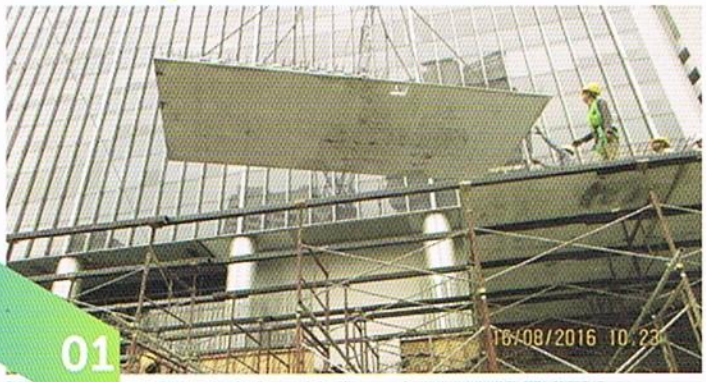
Economic Advantages

- Savings in the materials are substantial (up to 35%).
- Faster construction time (reduction in installation cycles up to 50%).
- Subsequent faster installation of M&E services.
- Less site concrete to pour thus, fewer vehicle movements and reduced crane requirements.
- Buildings are lighter than conventional slab design. Therefore, lower overall costing.
- Less weather dependent.
- Less concrete of 35%. Saving of up to 40kg CO^2/m^2.
- 50,000m^2 building can save up to 2,000 tons of CO^2.
- Less workers required. Virtually no carpentry, no rebars beams, less skilled workers needed, less placement of reinforcement.
- Less transportation of construction materials.
- Less crowded construction area.
- Virtually reduces 90% of timber wastes on site.



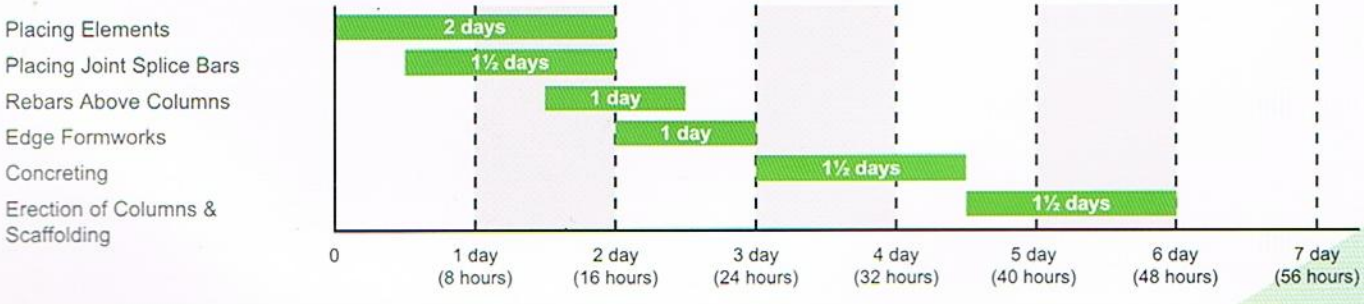


Installation Process



01. Temporary supporting props (scaffolding) placed on site.
02. BubbleDeck precast panel being positioned onto the temporary props.
03. BubbleDeck precast panels have been properly aligned and launched onto the temporary props according to the drawings.
04. Stitching elements by inserting additional reinforcement bars on the top and bottom.
05. Concrete topping.
06. Levelling and compacting the concrete.
07. Completed building, beamless, wide span between columns.

Standard Implementation Cycle of BubbleDeck system based on 800sqm



Fire Resistant

Opinion & Conclusion:

EPRESSION OF RESULTS

The standards describe methods for the fire resistance of load bearing floors required to withstand fire exposure from the underside. The fire resistance of a load bearing floor is determined with respect to its load bearing capacity and its integrity and insulation.

(A) LOAD BEARING CAPACITY

The fire resistance of a load bearing floor shall be determined with respect to load bearing capacity, the rest specimen shall be deemed to have failed if it is no longer able to support the test load.

(a) A deflection of L/20: or

(b) Where the rate of deflection (in mm/minute) calculated over 1 minute internals, starting at 1 minute from the commencement of the heating period, exceeds the limit set by the following equation:-

Rate of the deflection = L2 / 9000d

Where L is the clear span of the specimen in mm. Where d is the distance from the top of the specimen to the bottom of the design tension zone in mm.

This rate of deflection limit shall not apply before a deflection of L/30 is exceeded.

(B) INTEGRITY

A failure of the test construction to maintain integrity shall be deemed to have occurred when collapse or sustained flaming on the unexposed face occurs or the criteria given below for impermeability are exceeded.

Impermeability

Failure shall be deemed to have occurred when one or other of the following conditions prevail:-

(a) For situation where the cotton pad is suitable, failure shall be deemed to have occurred when flames and/or hot gases cause flaming or glowing of the cotton fiber pad.

(b) For situation where the use of the cotton pad is not suitable, failure shall be deemed to have occurred when either:-

(i) The 6mm diameter gap gauge can penetrate a through gap such that the end of the gauge projects into the furnace and the gauge can be moved in the gap for a distance of at least 150mm; or

(ii) The 25mm diameter gap gauge can penetrate a through gap such that the end of the gauge projects into the furnace.

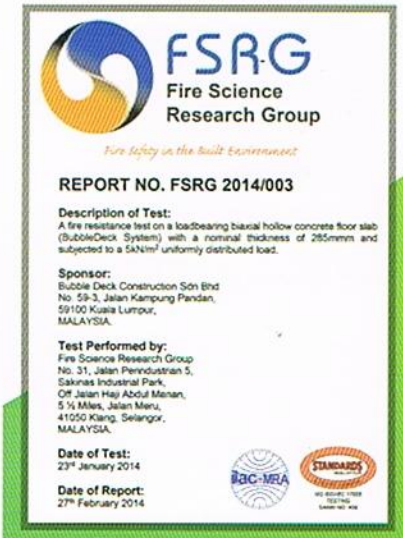
(C) INSULATION

Failure shall be deemed to have occurred when one of the following occurs:-

(a) If the mean unexposed face temperature increases by more than 140°c above its initial value;

(b) If the temperature recorded at any position on the unexposed face, either by a fixed thermocouple or by the roving thermocouple is in excess of 180°c above the initial mean unexposed face temperature.

(c) When integrity failure occurs.



FSRG
Fire Science Research Group
Fire safety in the built environment

REPORT NO. FSRG 2014/003

Description of Test:
A fire resistance test on a loadbearing biaxial hollow concrete floor slab (BubbleDeck System) with a nominal thickness of 265mmm and subjected to a 5kN/m² uniformly distributed load.

Sponsor:
Bubble Deck Construction Sdn Bhd
No. 59-3, Jalan Kampung Pandan,
59100 Kuala Lumpur,
MALAYSIA.

Test Performed by:
Fire Science Research Group
No. 31, Jalan Perindustrian 5,
Sakinas Industrial Park,
Off Jalan Haji Abdul Menan,
5 ½ Miles, Jalan Meru,
41050 Klang, Selangor,
MALAYSIA.

Date of Test:
23rd January 2014

Date of Report:
27th February 2014

A load bearing floor system comprising of structural voided flat concrete floor slab when tested with a 5kN/m² uniformly distributed load in accordance with BS 476: Part 20: 1987 and BS476: Part 21: 1987, was found to have the following fire resistance:

- Load bearing capacity: **121 minutes** (test terminated)
- Integrity: **121 minutes** (test terminated)
- Insulation: **121 minutes** (test terminated)

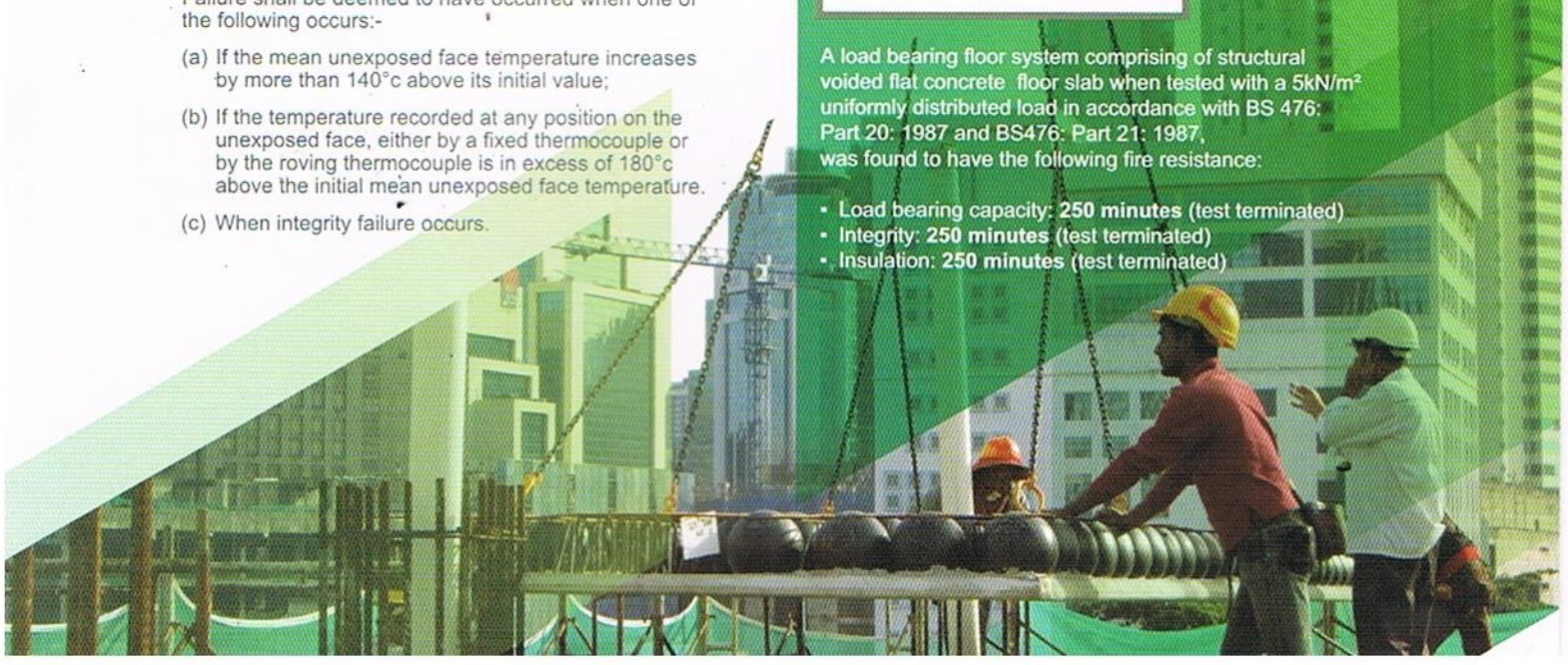
SIRIM QAS

TEST REPORT

REPORT NO. : 2015FE0410 PAGE 1 OF 66

A load bearing floor system comprising of structural voided flat concrete floor slab when tested with a 5kN/m² uniformly distributed load in accordance with BS 476: Part 20: 1987 and BS476: Part 21: 1987, was found to have the following fire resistance:

- Load bearing capacity: **250 minutes** (test terminated)
- Integrity: **250 minutes** (test terminated)
- Insulation: **250 minutes** (test terminated)



Product Information

MAXIMUM INDICATIVE SPANS

The appropriate BubbleDeck slab version is engineered to suit building configuration, span length between supports, applied loading and vertical alignment of support. Indivative spans, based on our standard Grade 30 concrete (cube strength) as guide to what can be achieved.

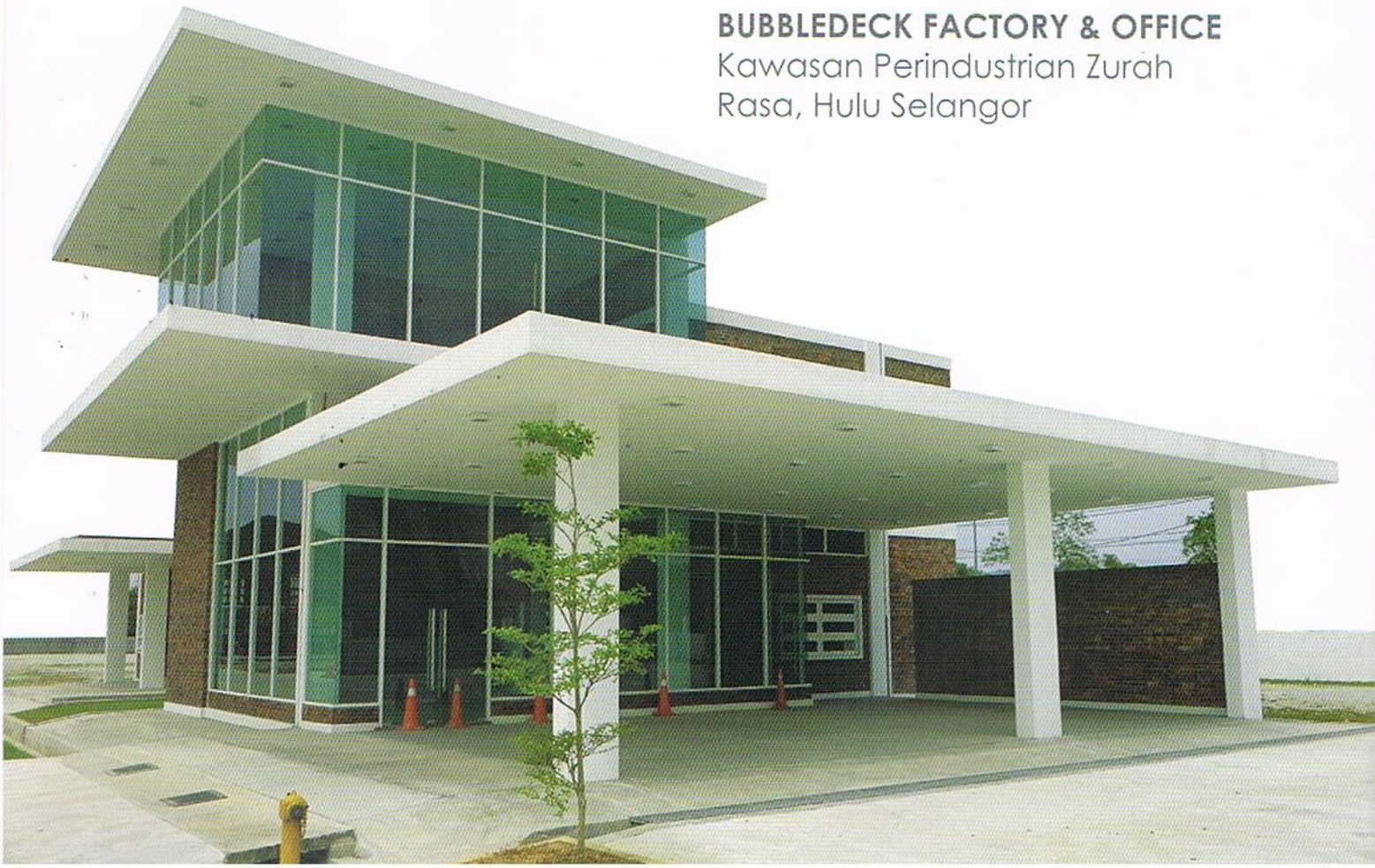
Maximum spans indicated are based on 25mm concrete cover to bottom rebar (2 hours fire resistance); live load 3 +1 6kN/m² and lightweight external envelope maximum 6 kN/m line load. Completed slab mass and Site Concrete Quantity based on 2.4 metre x 8 metre precast elements with approximate 20 kg/m² total reinforcement.

*** Subject for a variation of 5mm~10mm and depending on the actual design.*

Version	** Slab Thickness (Adjustable Cover) mm	Bubbles mm	Span (Multiple Bays) metres *Depends on the loading	Span (Single Bays) metres *Depends on the loading	Cantilever Maximum Length metres *Depends on the loading	Completed Slab Mass kN/m²	Site Concrete Quantity m³/m²
BD230	230	ø180	5 - 8.3	5 - 6.5	2.8	4.34	0.109
BD285	285	ø225	7 - 10.1	6 - 7.8	3.3	5.17	0.142
BD340	340	ø270	9 - 12.5	7 - 9.5	4.0	6.25	0.186
BD395	395	ø315	11 - 14.4	9 - 10.9	4.7	6.93	0.213
BD450	450	ø360	13 - 16.4	10 - 12.5	5.4	7.94	0.245

BUBBLEDECK FACTORY & OFFICE

Kawasan Perindustrian Zurah
Rasa, Hulu Selangor



CONSIDER THE BENEFITS

Data based on typical 4,500m² offices building with 7.5m x 7.5m multiple spans between in-situ or precast concrete columns.

	Slab Depth mm	Site Concrete Volume m^3/m^2	Site Concrete Quantity m^3	Total Slab Dead Load tonnes	Embodied Energy giga joules	CO^2 Emissions tonnes
Solid Slab	310	0.31	1,395	3,376	3,278	125
BubbleDeck	230	0.11	495	1,758	1,707	65
BD Slab saves	80	0.20	900	1,618	1,571	60

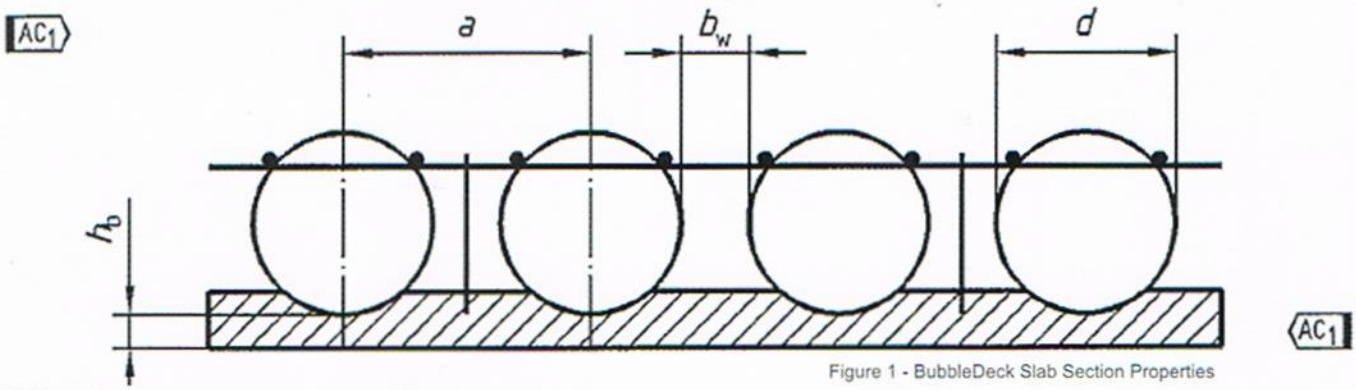


Figure 1 - BubbleDeck Slab Section Properties

hb = Concrete cover
a = Bubble centre to centre spacing
bw = Spacing in between bubbles
d = Bubble diameter

THE REGIONE PIEMONTE TOWER TURIN, ITALY

The construction of the Regione Piemonte Tower, close to the Lingotto area, is on a building area of 95,000m². The master plan consists of a total surface of 317,350m².

*The tower, that inserts itself into the skyline of Turin, is going to be the **highest in Italy with its 205 meters** in height and 42 floors above ground and 2 floors underground.*

EUROCODE BS EN 13747 +A2 : 2010
Dimension and Positions of Ball Void Formers

BubbleDeck system is specified in BS EN 13747 +A2 : 2010.

The void formers should be positioned so that the space between adjacent units is sufficient for correct concreting of the cast-in place mortar and to fulfill the static actions in the hardened situation. Inherent to this (see Figure 1 above).

ASSUMPTION :

1. Lightweight external envelope (curtain walling or equal).
2. Typical office live load 2.5 kN/m² for lightweight partitions, computer floor, finishes & services.
3. Overall stability braced by stair / lift core shear walls in both cases BubbleDeck slab transfers lateral loads to cores.

BubbleDeck structures are also sustainable with the system allowing frame re-use for future purposes. The envelope and all internal work can be removed from a BubbleDeck building and the original frame simply refitted for a new purpose. The two way spanning nature of BubbleDeck slabs allow any internal layout to be reconfigured to new uses within the original design load parameters.

Green Credential

ENVIRONMENT ADVANTAGES

- Less material consumption - cement, aggregates and steel.
- 1kg of recycled plastic bubble replaces 100kg of concrete.
- Less energy consumption - during production, transportation and lifting on site.
- Less emission - saving in CO^2 emission up to 40kg/m².
- No waste generation - every component can be recycled.
- Less steel up to 20%, as the slab dead weight has been removed by 35%. Less is required to support the slab.
- No beams are required so less steel.
- Virtually no plywood. 50,000m² saves 215 trees.

Reducing the amount of concrete in the middle of a BubbleDeck slab makes a significant contribution to the environmental impact. Guidance from ODPM requires the direct environment effects of building to be considered, including usage of natural resources and emissions resulting from construction. Not only is concrete usage reduced up to 50% within a building structure but the additional benefits, can be realized through reduced foundation sizes.

Every 5,000 m² of BubbleDeck floor slab can save up to:-

1,000m³
site concrete

1,798
tonnes of foundation loads

166
ready mix lorry trips

278
tonnes of CO^2
- green house gas emissions in concrete production and haulage

Green Building Index (GBI)

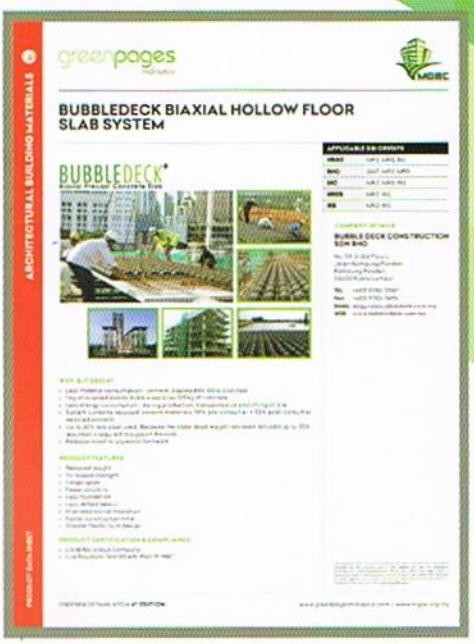
PRODUCT FEATURES

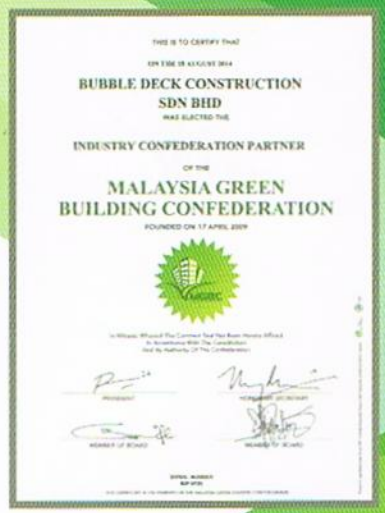
- Reduced weight
- Increased strength
- Longer span
- Fewer columns
- Less foundation
- Less labour
- Improved sound insulation
- Faster construction time
- Greater design flexibility
- Beamless building design

PRODUCT CERTIFICATION & COMPLIANCE

- Highest IBS Factor for floor structural system
- Integrated structurally to optimize Green Building Index (GBI) score
- Certified ISO9001 QMS manufacturing process
- Fire Resistant Tested BS 476: Part 21: 1987 by SIRIM & FSRG

CIDB MALAYSIA IBS





Industrial Recognition

WHAT IS IBS?

The Industrialized Building Systems (IBS) is a construction process that utilizes techniques, products, components, or building systems which involve prefabricated components and on-site installation. From the stuctural classification, there are five IBS main groups identified as being used in this country, and there are:-

PRECAST CONCRETE FRAMING, PANEL & BOX SYSTEM

Precast columns, beams, slabs, 3D components (balconies, staircases, toilets, lift chambers), permanent concrete formworks, etc.

STEEL FORMWORK SYSTEMS

Tunnel forms, beams and columns moulding forms, permanent steel formworks (metal decks, etc.)

PREFABRICATED TIMBER FRAMING SYSTEMS

Timber frames, roof trusses, etc;

BLOCK WORK SYSTEMS

Interlocking concrete masonry units (CMU), lightweight concrete blocks, etc.

The use of IBS assures valuable advantages such as the reduction of unskilled workers, less wastage, less volume of building materials, increased environmental and construction site cleanliness and better quality control, among others.

These advantages also promote a safer and more organised construction site, and reduces the completion time of construction. Many world-class Malaysian developers have chosen IBS over the conventional methods ofr important projects such as the Petronas Twin Towers, Putrajaya, KL Sentral and KLIA.

BDC Concrete Sdn Bhd, BubbeDeck Malaysia's precast partner for Malaysia & Singapore

Prizes & Awards

RECOGNIZATIONS

- 'Best New Eco Product Award' at ECO-B Malaysia 2013
- 'Best New Product' at Green Build Asia Malaysia 2012
- Windesheim Building X awarded 'BNA Building of the Year', Holland 2011
- Vexpan Parkeergarage Award, Holland 2009
- 'Best New Product' at Designex/Form & Functioin, Australia 2009
- Jersey Construction Awards: 'Best Use of Innovation', Jersey 2005
- 'Building Of the Year' for Office Buildings, Denmark 2004
- RIO Award, Germany 2003
- Innovation Award, the Netherlands 2000
- The Stubeco Building Prize for Execution, Netherlands 2000
- The Industrial Environment Prize, Holland 1999
- The Dutch Building Prize, Holland 1999
- Nominated for the 'European Environmental Prize for Sustainable Development'.

APPROVALS

- British Standard: Fire Test by SIRIM based on BS 476: Part 21: 1987.
- British Standard: Fire Test by Construction Research Institute of Malaysia (CREAM) of CIDB based on BS 476: Part 21: 1987.
- Dutch Standards: From November 2001, The BubbleDeck system is incorporated in the Dutch Standards (by CUR - Civieltechnisch Centrum Uitvoering Research en Regelgeving).
- UK Standards: The BubbleDeck system can be treated as a normal flat slab supported on columns (BS 8110) according to CRIC (Concrete Research & Innovation Centre under the Imperial College of Science, Technology & Medicine), 1997.
- Danish Standards: The BubbleDeck system can be calculated from recognized principles and within existing standards - Directorate of Building and Housing, Municipality of Copenhagen, 1996.
- German Standards: The BubbleDeck system can be used according to existing technical standards according to Deutsches Institutefur Bautechnik, 1994.

Implementation

DESIGN

- Examination of advantages.
- Obtain final & approved architectural & C&S drawings from client.
- Obtain specification and design brief from client.
- Prepare preliminary engineering design of BubbleDeck slab.

PLANNING

- Preparation of detailed design drawings.
- Obtain approval from client's consultant on detailed design drawings.
- Preparation of fabrication drawings.
- Procurement of materials base don approved fabrication drawings.

PRODUCTION

- Preparation of module shop drawings.
- Production of half-cast panels QA/QC prior delivery.

EXECUTION

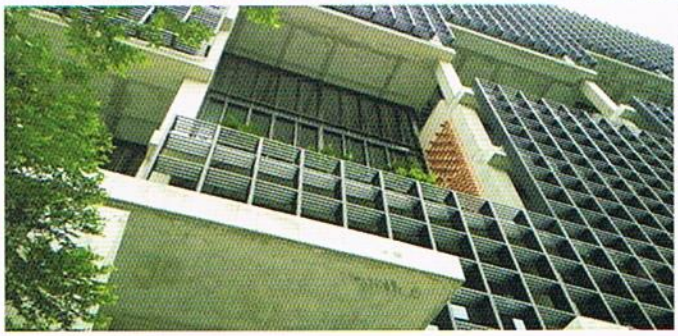
- Delivery BubbleDeck slab panels to site.
- Installation of half-cast BubbleDeck panels at site.
- Pour concrete topping to complete the BubbleDeck slab installation.

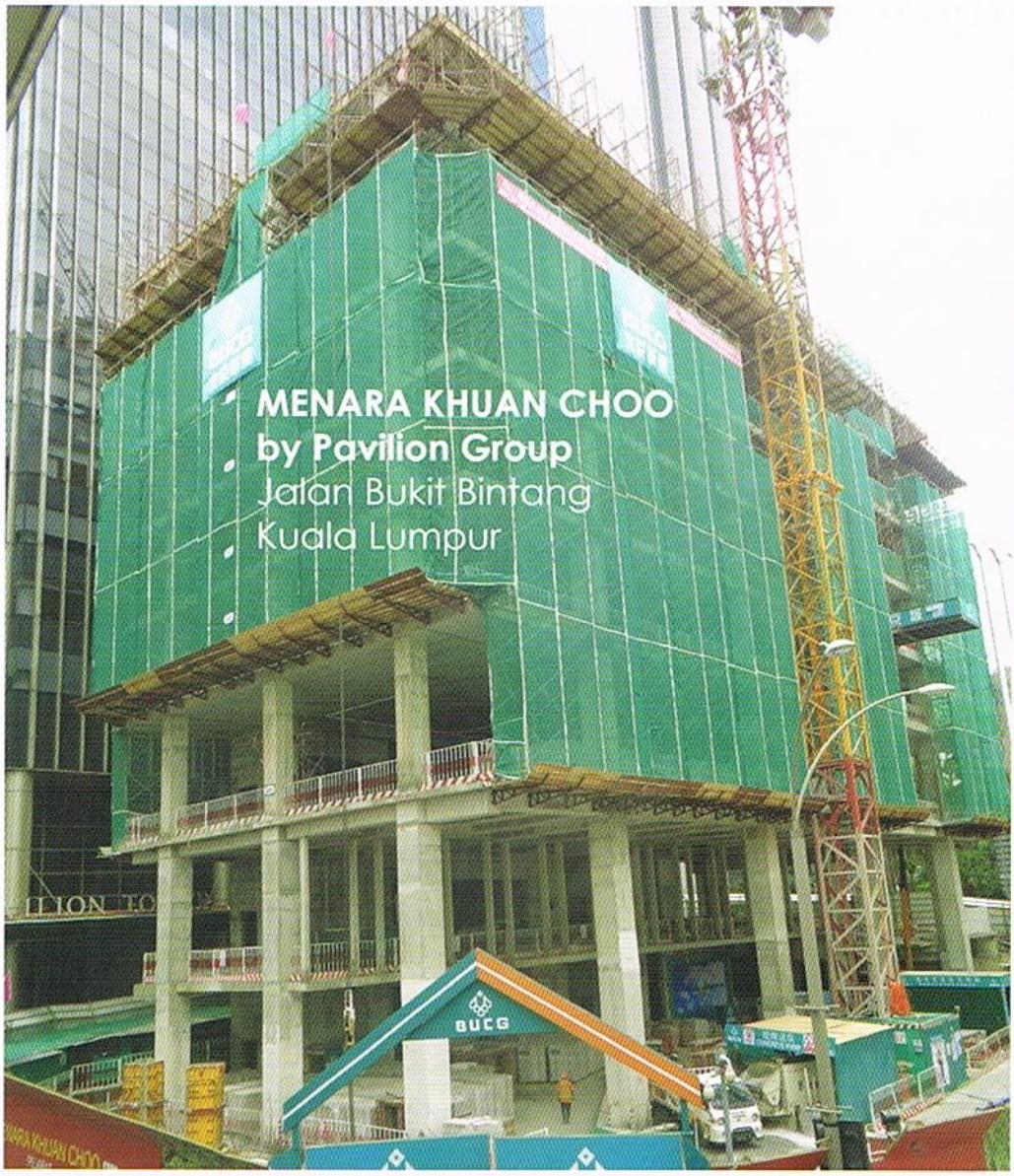
09

NEW PAM CENTRE

by Pertubuhan Arkitek Malaysia

Bangsar, Kuala Lumpur



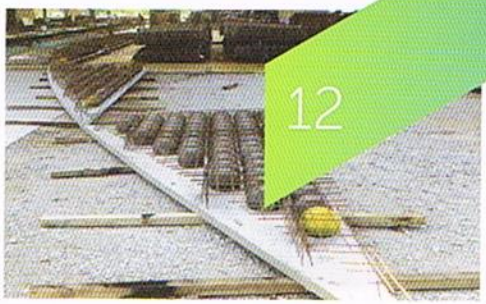

MENARA KHUAN CHOO
by Pavilion Group
Jalan Bukit Bintang
Kuala Lumpur
BUCG

11

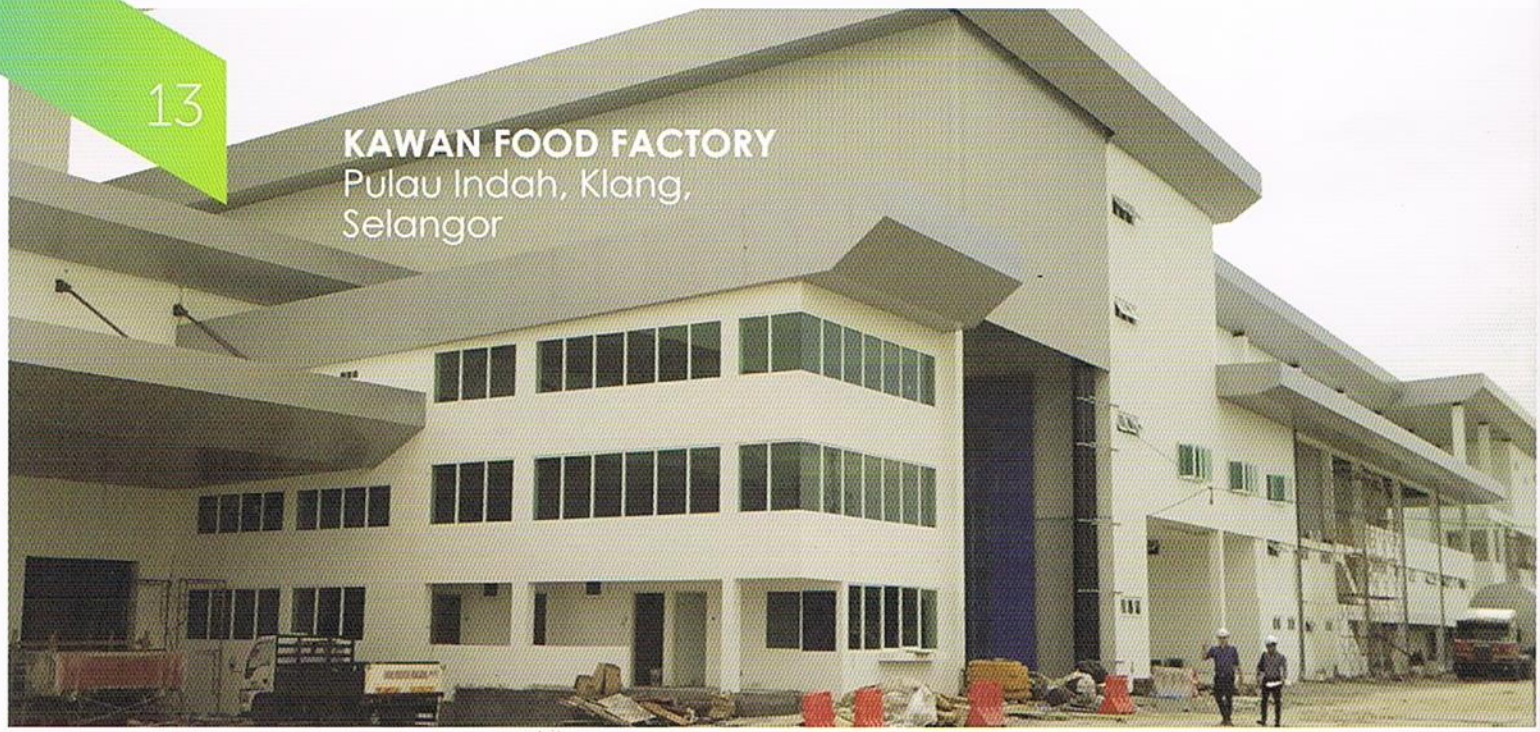
WP BOUTIQUE HOTEL

Jalan Tunku Abdul Rahman
Kuala Lumpur

MAJU LINQ
Bandar Tasik Selatan
(BTS) Kuala Lumpur

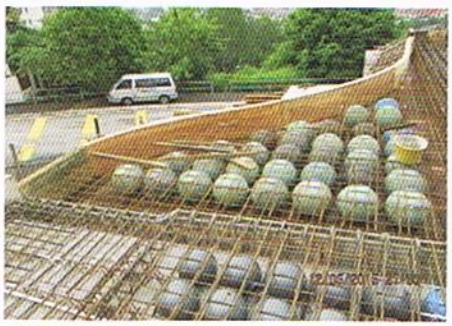


KAWAN FOOD FACTORY
Pulau Indah, Klang,
Selangor

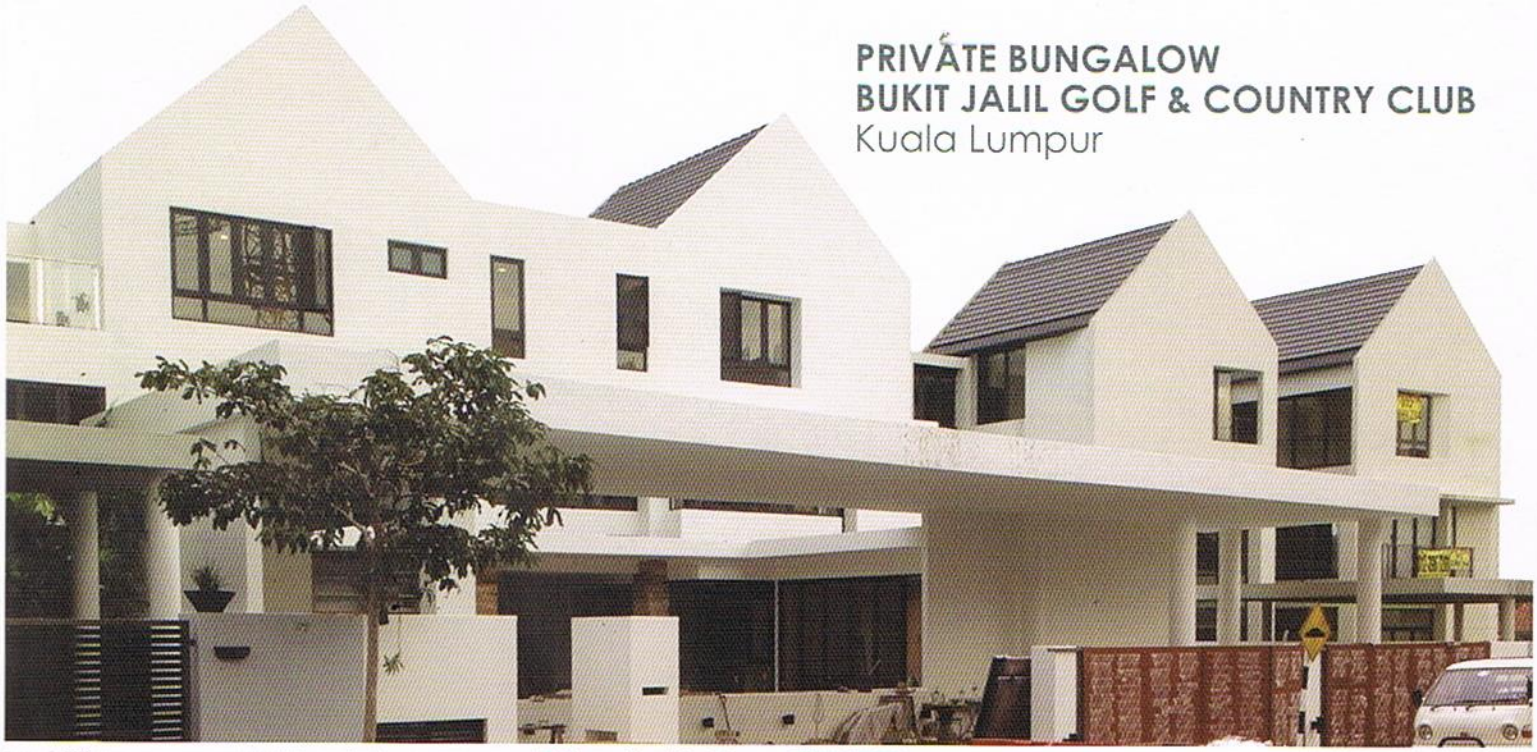


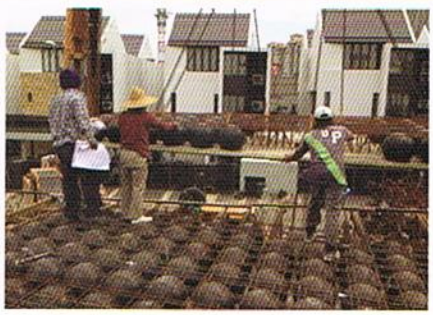
LANGKAWI VILLA
Pulau Langkawi, Kedah

PRIVATE BUNGALOW
Bukit Gambir
Pulau Pinang



PRIVATE BUNGALOW
BUKIT JALIL GOLF & COUNTRY CLUB
Kuala Lumpur





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SOLE LICENSEE FOR MALAYSIA & SINGAPORE

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