TRANSLATING

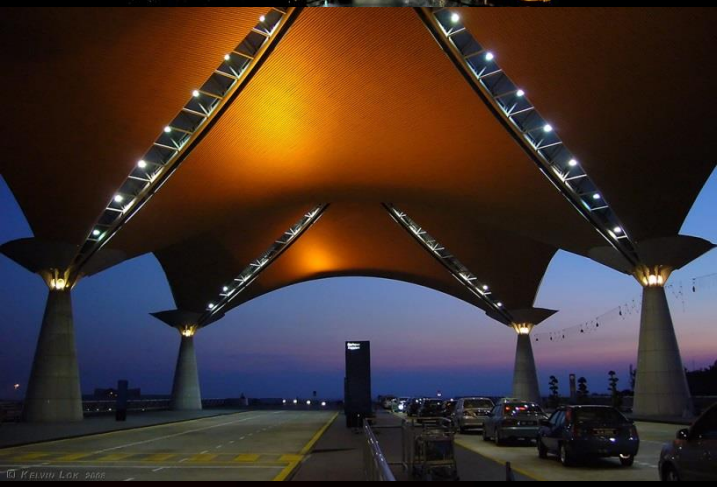
INNOVATIVE CONSTRUCTION METHOD

INTO

COST SAVING

by Ar Haji Abdul Halim Suhor

HASA Arkitek Sdn Bhd
Hollistic Approach Sustainable Architecture
www.hasaarkitek.com



What is innovative construction?

The successful introduction of new technologies or procedure into industry.

Jamie Dale, Chartered Institute of building

Conventional method

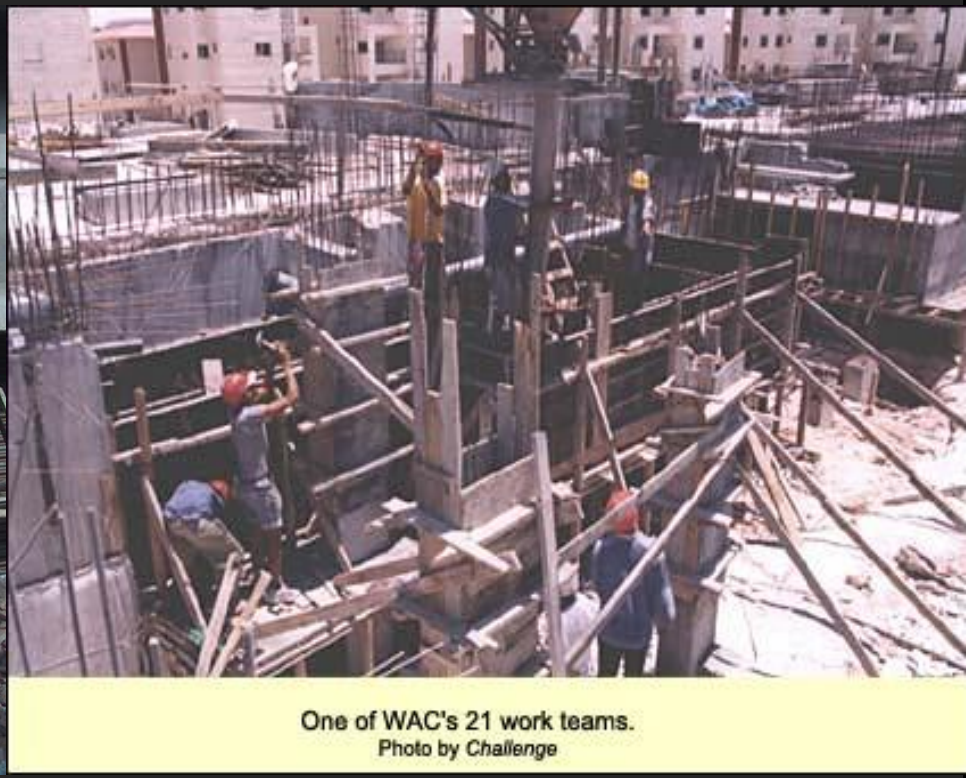
cement sand

timber

clay brick

cement sand brick

The Current Scenario of Malaysian Construction Industry



One of WAC's 21 work teams.
Photo by *Challenge*

This can contributes : Messy Sites, High Wastage, Low Quality and Delays due to climate in Malaysia.

Influx of foreign workers

a) Currently, there are **2.1 million** foreign workers with permits and it is estimated that there are **6 million** of illegal workers in Malaysian Construction Industry

b) Quality issues due to unskilled workers; training to improve their capabilities

c) This cause social problems with locals, infectious disease & high outflow of Ringgit

source: Ministry of Immigration Malaysia,2015

IBS

The Industrialized Building Systems (IBS) is a construction process that utilizes techniques, products, components, or building systems that involve prefabricated components and on-site installation.

IBS method

prefab timber frame

blockwork

steel formwork

precast concrete

Off-site cast → installed → On-site → Complete building

Industrialised Building System **IBS**

Benefits

Reduced labour

CAD CAM

Modern design and manufacturing method using CAD/CAM

Less site material

Systematic Quality Control i.e ISO 9000

Minimal Wastage

Controlled quality Neater and safer sites. Faster project completion

Industry become better productivity, quality and safety to be globally competitive

The Construction Industry Development Board (CIDB) established in July 1994 has made an effort to promote IBS since their early years 1998.

The characteristics of IBS are:

-Industrial production of components though prefabrication; or highly mechanised in-situ processes i.e. slip-forms, posttensioning, tunnel shutters.

-Reduced labour during prefabrication of components and site works.

-Modern design and manufacturing methods i.e. involvement of Computer Aided Design (CAD)

-Systematic Quality Control i.e. ISO 9000 principles.

-Open Building Concept i.e. permitting hybrid applications, adaptable to standardisation and Modular Coordination.

IBS roadmap GOAL

- To sustain the existing momentum of 70% IBS content for public sector building projects through to 2015
- To increase the existing IBS content to 50% for private sector building projects by 2015

IBS gallery

The opening of IBS Gallery was on 15 October 2008.
The gallery is located on the Ground Floor of IBS Centre Office at Block E, Jalan Chan Sow Lin, Kuala Lumpur.

Its offers various information on IBS in the form of educational posters, printed publications, multimedia publications, models of IBS Buildings and samples of products.

Industrialised Building System IBS

IBS roadmap 2003-2010

IBS for INDUSTRY PLANNING

IBS for PROMOTION & MARKETING

IBS for TECHNOLOGY

IBS for CERTIFICATION, VERIFICATION & TESTING

IBS for INDUSTRY TRAINING

IBS roadmap 2011-2015

Good quality designs, components and buildings are the desired outcomes of IBS.

Aesthetics should be promoted through innovations.

(efficiency)
To ensure that, by using IBS, completion time of a building is speedier, more predictable and well managed.

(competency)
To have a ready pool of component IBS professionals and workers throughout the entire project lifecycle : from design, manufacture, build and maintenance.

To create a financially sustainable IBS industry that balances users affordability and manufacturers viability.

Four workstreams have been established as an action plan to achieve the new roadmap pillars :

Workstreams 1 — Institutional Strengthening

Action Plan R8
Conduct organizational review of the existing Pusat IBS

Action Plan R13
Implement and report progress of Roadmap, identify gap closing measures

Workstreams 2 — Focusing on User

Action Plan R15
Provide IBS training to the workforce

Action Plan R17
Increase emphasis on technical and vocational training colleges

Workstreams 3 — Product Focus

Action Plan R22
Increase availability of quality controlled and standardize IBS product

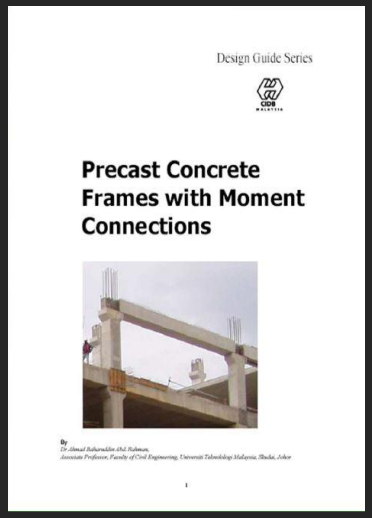
Action Plan R24
Asses impact of IBS in private sector projects

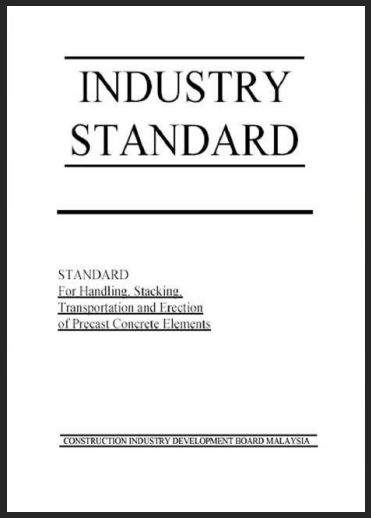
Workstreams 4 — Industry Focus

Action Plan R30
Facilitate the setting up of IBS manufacturer Forum / Assosiation

Action Plan R34
Review supply chain to find areas for improvement

MALAYSIAN precast concrete standards





Source: CIBD

IBS components are expensive ?

- True. The components cost higher than conventional, but in-situ construction has hidden costs that usually lead to higher expenditure; due to rectifications, wastages, etc
- IBS components currently cost a bit higher because **:**

  - Low demand

  - Low standardization of components

  (moulds need to custom made or adjusted to suit orders)

IBS methods in MALAYSIA

BLOCKWORKS SYSTEM

STARKEN AAC SB
ZENBES Sdn Bhd

BINAAN DESJAYA Sdn Bhd

SYSTEM FORMWORK

MFE TECHNOLOGY Sdn Bhd
HIFORM (M) Sdn Bhd
WESTFORM INDUSTRIES Sdn Bhd

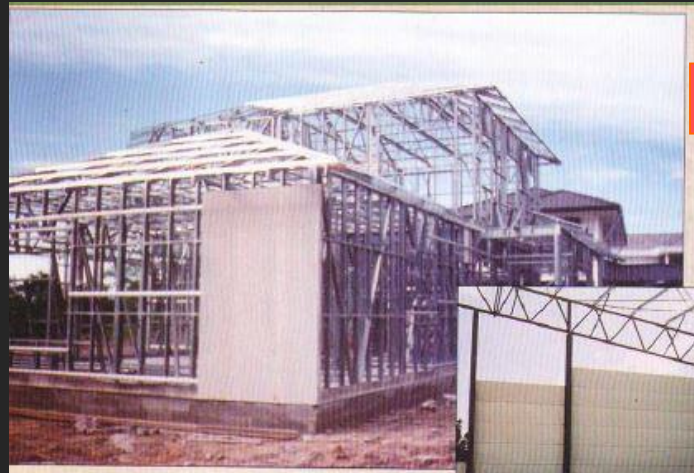
PRECAST CONCRETE

Eastern Pretech SDN BHD
PRECAST PRODUST Sdn Bhd
SETIA PRECAST Sdn Bhd

blockwork components

FLOORS

WALL



Blockwork

Load bearing ACC blocks on ground floor

Arranged up to 1.2m to 3.0m

The basic starting point is the load bearing light weight blocks 100, 150, 175 & 200mm thick

Where spans are too large the Engineer may introduce rc columns & beams

Blockwork

The first floor beams as seen from the outside.

Note: the horizontal laying of blocks is able to give **accurate external wall** features with

accurate dimensions

not controlled by plasterer skill

Cost comparison with clay & sand cement brick

DESCRIPTION	STARKEN AAC BLOCK			CLAYBRICK			CEMENT SAND BRICK	
Application	Int. Walls	Ext. Walls	Party Walls	Int. Walls	Ext. Walls	Party Walls	Int. Walls	Ext. Walls
Material Thickness	100mm	125mm	200mm	100mm	100mm	100mm	100mm	100mm
Finished Wall Thickness	110mm	140mm	210mm	150mm	150mm	200mm	150mm	150mm
Finishes-Internal Face	3-5mm skimcoat	3-5mm skimcoat	3-5mm skimcoat	25mm plaster	25mm plaster	25mm plaster	25mm plaster	25mm plaster
Finishes-External Face	3-5mm skimcoat	10-12mm skimcoat	3-5mm skimcoat	25mm plaster	25mm plaster	25mm plaster	25mm plaster	25mm plaster
Cost	RM/m²	RM/m²	RM/m²	RM/m²	RM/m²	RM/m²	RM/m²	RM/m²
Material (AAC Blocks/ Bricks)	29.20	36.50	58.40	19.20	19.20	38.40	12.60	12.60
Labour+Installation tools	13.20	14.80	17.00	12.80	12.80	25.60	12.80	12.80
Skim Coat (Material+Labour+Mesh)	11.00-15.00	5.50-7.50	11.00-15.00	-	-	-	-	-
External Render (Material+Labour)	-	14.00	-	-	-	-	-	-
Plastering (Material+Labour)	-	-	-	36.00	44.00	36.00	36.00	44.00
Wastage (3% ACC & 5% Brick)	0.88	1.00	1.76	0.96	0.96	1.92	0.63	0.63
TOTAL COST	54.28-58.28	71.90-75.90	88.16-92.16	68.96	76.96	101.92	62.03	70.03
Supply& Install Rate (inclusive of proof margin)	62.42-67.02	82.69-84.99	101.38-105.98	79.30	68.50	117.21	71.33	80.53
	100%	100%	100%	123%	106%	113%	110%	96%

System formwork

No dimensions modularization required

Difficult components are mocked up in the factory

Each piece uniquely bar coded before being shipped out to site

70% of formworks can be re-use for next project

System formwork

The complete components assembled & installed.

System formwork

Electrical & water services accurately pre-positioned for repetition on each floor

System formwork

5 days per floor work cycle

Precast

Hollow core slab

Precast double or single tee slab

Precast column

Precast column

Planks

Precast walls

Precast Staircase

PRECAST COMPONENTS

Precast System

TAYLOR'S LAKESIDE CAMPUS

Full precast building

Total precast (precast column,beams, slabs, staircase)

7 months installation duration

Precast Components

TAYLOR'S LAKESIDE CAMPUS

PRECAST STRUCTURE – LARGE SPAN

PRECAST STRUCTURE – SKYLIGHTS

PRECAST STRUCTURE - COBEL

PRECAST FLOOR SLABS

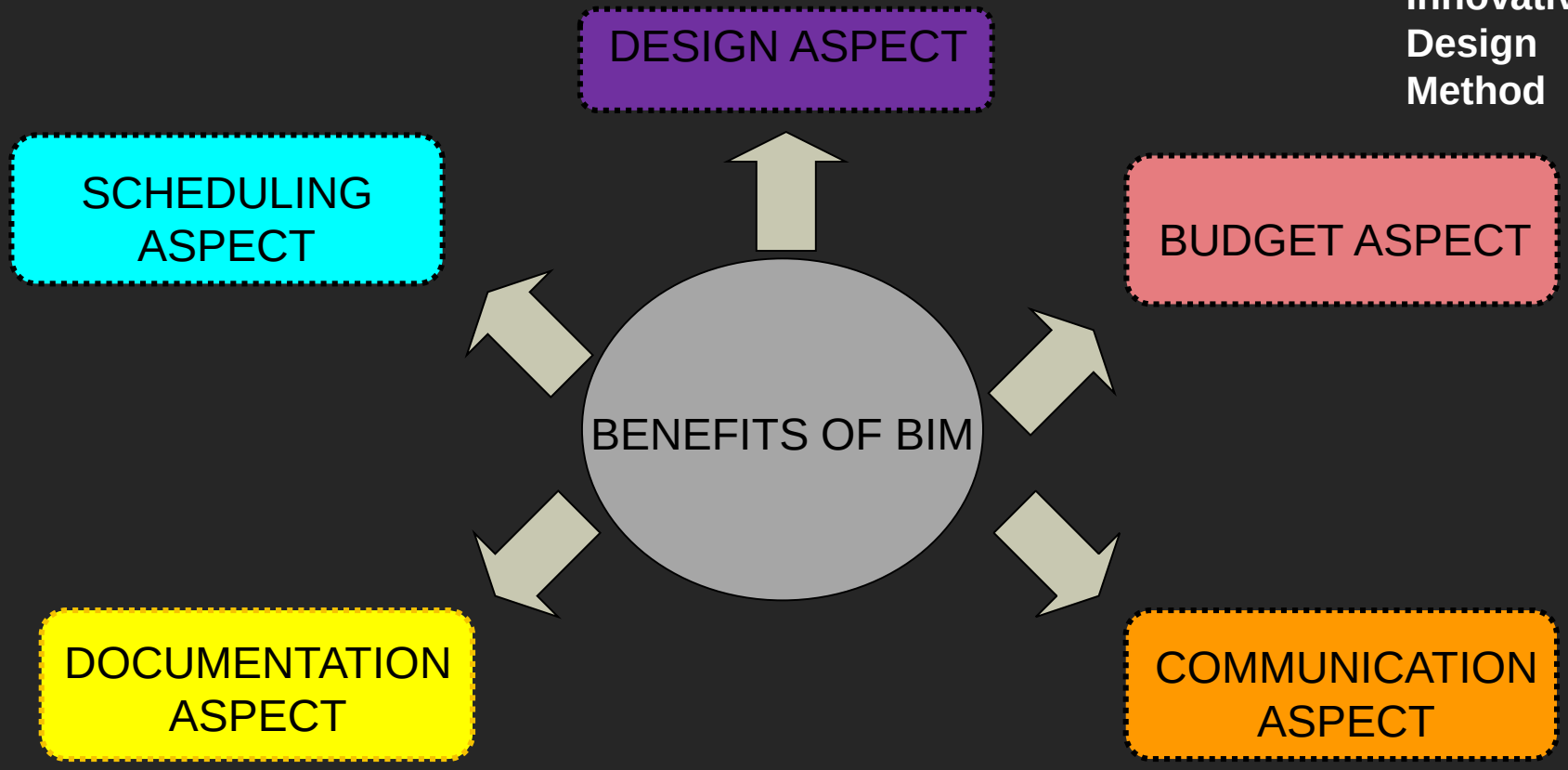
BUILDING INFORMATION MODELING (BIM)

Innovative Design Method

Building information modeling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of a facility. The resulting building information models become shared knowledge resources to support decision-making about a facility from earliest conceptual stages, through design and construction, through its operational life and eventual demolition.

Advantages:

- 3D collaboration with all members of the team with automated detection of clashes. e.g. Is the service void designed by the architect sufficient for the M&E services.
- Visualisation of projects to enable greater understanding of all members of the team. For example, it is far easier to schedule scaffolding requirements looking at a 3D model than in 2D.
- 4D visualisation i.e. linking the 3D model to the programme to explore logistics.
- Faster to incorporate change into a Revit (3D) CAD layout as no need to update loads of individual drawings.
- 5D potential introducing costs into elements of model e.g electronic drawing take-off.
- Ability to incorporate additional information into model elements e.g maintenance and life span information for Facilities Management or sustainability information, etc



Building information modeling software for architects, structural engineers, engineers, MEP engineers, designers and contractors. It allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements and access building information from the building models database. Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later demolition.

Application of new & reused material

Innovative Design Method

Introduction

The concept of sustainable building incorporates and integrates a variety of strategies during the design, construction and operation of building projects. The use of green building materials and products represents one important strategy in the design of a building.

Integrating green building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these building industry source materials.

Wall Cladding

High-end finished from recycled materials.

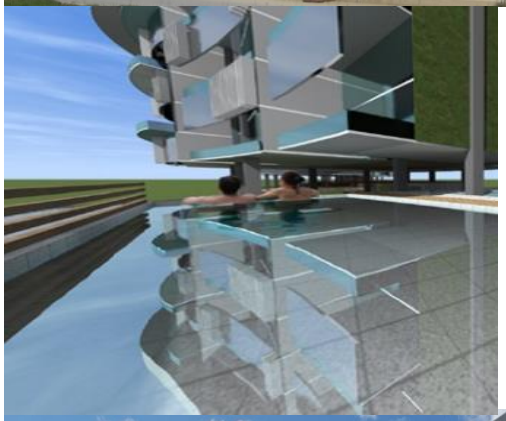
Innovative
Design
Method

Cabin Container

Innovative Design Method

Tube Hotel or TUBOTEL

Popularized in Japan, tube or capsule hotels is constructed using a precast concrete which provide a cheap, basic but comfortable place to stay.



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Innovative method by

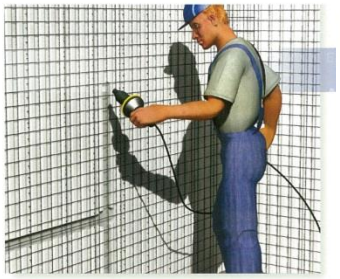
HASA ARKITEK SDN BHD

IBS SYSTEM – ‘MM2’

Plaster application

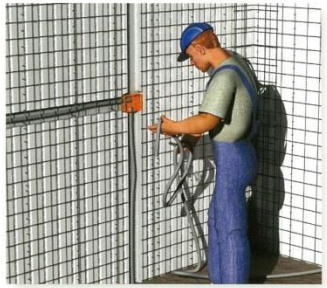
Once the panels have been joined one another, the plumbing system has been completed, the concrete casting, in the case of double panels, has been done and once the pipes have been arranged, the plaster can be applied directly onto the panel.

Here again, if compared to other systems, the advantages of the EMMEDUE® system are evident. The galvanizing of the support mesh does not prevent the use of different types of plaster. Moreover, the plaster, if applied on joined walls and if reinforced with metal meshes, will turn out to be monolithic, excluding any possible phenomenon of flaw due to mechanical and/or thermal strains. What is more, since there are no patches of the system chases - that are, instead, always visible in the traditional systems - the plaster will turn out to be homogeneous and improved as for quality and even from an aesthetic point of view.

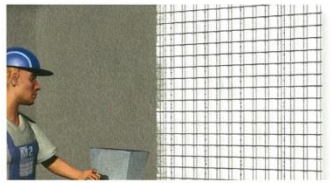


Chases are made by melting polystyrene behind the meshwork by means of a hot-air gun or any other source of heat.

Pipes (electricity, water, gas, etc) are easy and rapid to place behind the metal meshwork.



Spraying of the coating layer on the panel by using the plaster sprayer.



Technical characteristics and advantages of the EMMEDUE® product

Sustainability and Energy Saving

The considerable improvement of the thermal comfort inside the houses built with the **EMMEDUE® system** is guaranteed by the widespread presence of polystyrene and i ts very low heat conductivity which, eliminating the heat bridges, reduces dramatically the **consumption of energy** and favours those strategies aiming at sustainable development.

Lightness

The EMMEDUE® panels are lightweight and sufficiently rigid at the same time, even before their finishing with spritz-beton, so that they turn out to be extremely manageable and easy to handle and to assemble even in the most uncomfortable operating conditions.

Rapid Installation

Several experiences carried out in various conditions, in many countries of the world and using different labourers, have shown a remarkable shortening of the time of realization as for the constructions carried out with the EMMEDUE® system if compared to those carried out with the traditional systems, thanks to the use of an industrial product which optimizes the assembling sequences and reduces the operations of the construction site personnel to a minimum.

Convenience

The EMMEDUE® panels represent a real advantage both for the final users and the firms since they permit to obtain better performances than the traditional products and at more reduced costs.

Versatility

The EMMEDUE® building system favours absolute design flexibility, since it is equipped with a full range of building elements: load-bearing walls, curtain walls, floors and stairs. Furthermore any kind of geometrical form, either plane or curve, is easily obtainable just by simply cutting the elements at the site.

Load Resistance

Several laboratory tests carried out in different areas of the world as well as in Italy have put into evidence the high load resistance of the EMMEDUE® panels. For example, compression tests with centred load carried out on a finished single panel, cm 270 high, have shown that the same panel can sustain a maximum load of 1530 kN/m.

Wide choice of finishing

As for their finishing, the walls realized with the EMMEDUE® panels can be completed both with the application of a thickness covering directly on the raw plaster and, as an alternative or a traditional paint on the smoothened plaster. Finishing of any type are possible without any limitation.

Fire Resistance

The quality of the foam polystyrene used for our panels is of the self-extinguishing type; moreover, the two concrete layers which coat the panel sides prevent its combustion. The fire resistance has been also verified in tests carried out at different laboratories, complying in full with the minimum requirements of the most demanding regulations. For example, a wall realized using the PSM80 panel has shown a fire resistance greater than REI120.

Earthquake Resistance

Laboratory tests carried out on one of the EMMEDUE® prototypes made up of two stairs in true scale have shown that the structure withstands, with no damages, strains greater than those calculated for a First Class Earthquake, that is the maximum provided for by the Italian Earthquake regulation. The results obtained during these tests represent the scientific confirmation of what has already been experimented in nature many times.

Cyclones and Tornados Resistance

Buildings realized with the EMMEDUE® system in areas with high risk of cyclones have proved, throughout the years, their capacity to withstand the passing of the most destroying cyclones, thus confirming the high resistance of the EMMEDUE® buildings to the complex strains and thrusts of the force generated by cyclones.

Blast Resistance

EMMEDUE® has evaluated for blast resistance some panels of different combinations of high strength cement together with different styles of EMMEDUE® steel reinforced EPS building panels. The panels were tested against a commercial high explosive in a test chamber optimized to produce a uniform blast wave at the face of the panels. EMMEDUE® panels have successfully overcome the various tests.

Integrating

EMMEDUE® is a versatile construction system which is completely compatible with all other existing construction systems; in fact, EMMEDUE® products are suitable for completing reinforced concrete or steel structures. In addition, EMMEDUE® products can be easily associated with other construction elements, such as wooden roofs and pre-stressed, brick or slab floors, and can even be utilised with plasterboard walls. EMMEDUE® products can also be used in conjunction with any type of finish available on the market and can be adapted to all types of doors and windows. EMMEDUE® structures do not limit designers to choosing certain products for completing their buildings.

Soundproofing

The soundproofing of the EMMEDUE® panels represents one of the advantages of the building system. The possible application of acoustic insulation materials onto the panel (such as cork, cocoa fibre, plasterboard, rock wool, etc…) optimizes the insulation of the walls in accordance with the hardest acoustic legislation.

Advantages of the ‘mm2’ building system

- Lightweight – Min. 33% lighter than brickwalls or concrete. Also applies to MM2 suspended slabs and staircases. Savings in foundation design.
- Speed of construction – 30% faster than conventional
- Fire resistance – up to 4 hrs
- Energy savings – 35% less on power consumption
- Sound insulation – can achieve up to STC 50. STC of Brickwall 35 to 40
- Load capacity – up to 1,500 kN/m wall for single panel.
- Integration with other building systems – Not a problem due to ‘MM2’ system versatility.
- Earthquake resistance – up to Richter Scale 8.5

Classification of green product

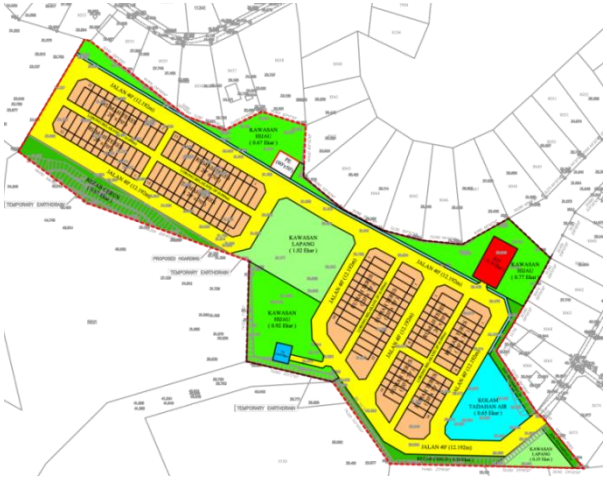
- **Use less natural resources of sand, cement and aggregates (25%)**
- **Less carbon imprint by 40% compared to brickwall in manufacturing process and lesser use of heavy construction equipment due to its lightweight nature**
- **Energy Saving up to 35% compared to conventional brickwalls or concrete walls for air-conditioning during hot weather as well as during cold weather.**
- **Quieter Environment with capability of achieving Sound Transmission Class of 50.**

Adaptability to other building system – renovation

Renovation can be carried out easily with adaptability to other building systems. Guidelines are available for wall extensions, wall demolition, making openings for doors, windows, aircond ducts, floor and wall additions, etc.

MASTER PLAN

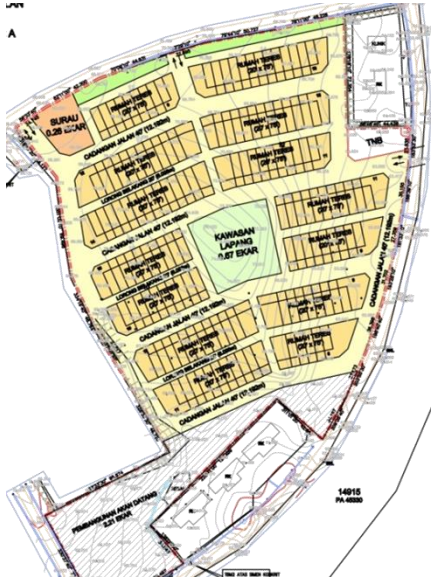
PLAN LAYOUT



FELDA BUKIT TAJAU (100UNIT)

BUKIT SAGU 1, PAHANG (300UNIT)

PLAN LAYOUT



PALONG 12,NEGERI SEMBILAN (150UNIT)

SG TIANG, KEDAH (80UNIT)

FELDA, 2nd generation housing

FRONT PERSPECTIVE

FRONT ELEVATION

SIDE ELEVATION

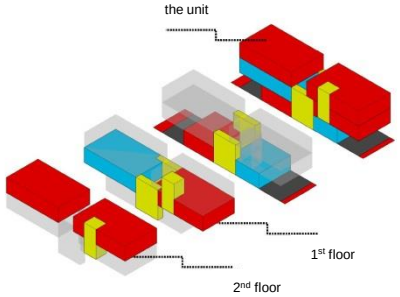
PERSPECTIVE

Bungalow. Ulu Melaka, Langkawi

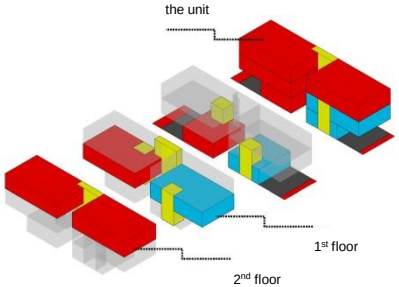
PERSPECTIVE

Townhouse

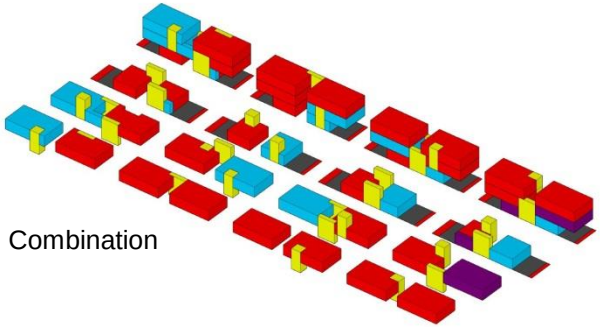
FLEXIBILITY IN DESIGN (OPEN PLANNING)



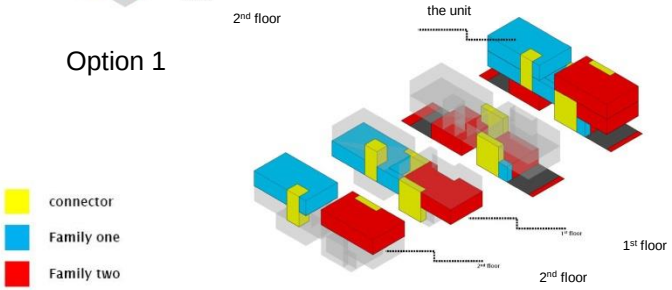
Option 1



Option 3



Combination



Option 2

Plan

LRT station carpark

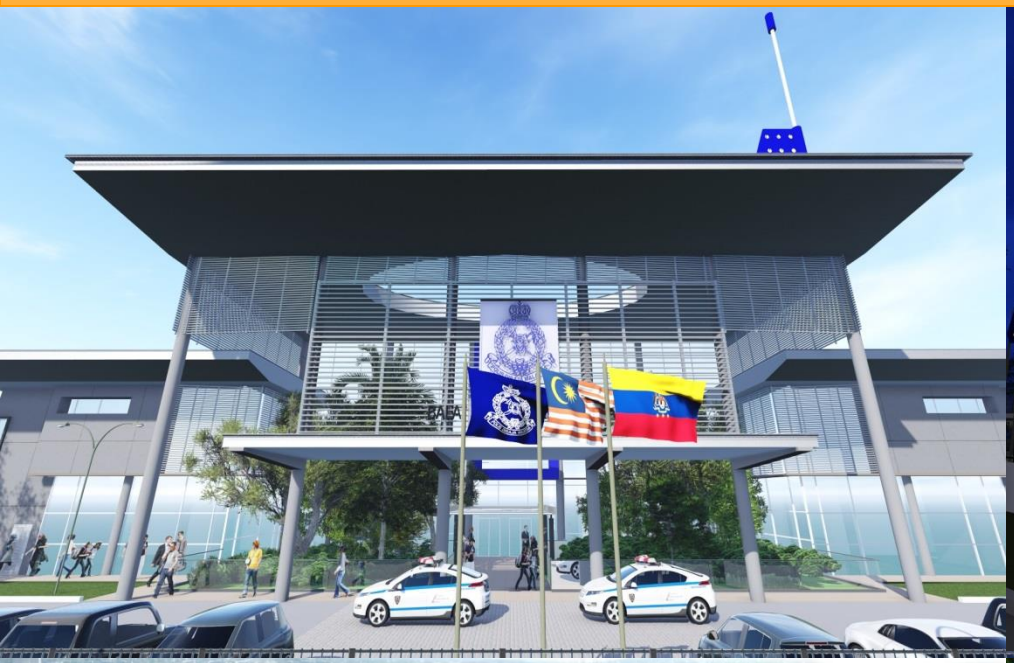
PERSPECTIVE

UMP – Fakulti Pembuatan

PERSPECTIVE

Balai Polis.

PERSPECTIVE



Service apartment, Melaka

MODULAR UNIT DESIGN

Mixed Development, Kuala Lumpur

PERSPECTIVE

Mixed Development, Kuala Lumpur

PERSPECTIVE

THANK YOU

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