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The Institution of Engineers, Malaysia

THE INSTITUTION OF ENGINEERS MALAYSIA (SARAWAK BRANCH)

in collaboration with

NS BLUESCOPE LYSAGHT SARAWAK

presents

STRUCTURAL DECKING: HIGH RISE BUILDINGS AND IBS ADOPTION

Date: 16th March 2019
Venue: Imperial Hotel, Kuching
Time: 8:30am-1:30pm

SPEAKER: MS SURAYA JOHARI
TECHNICAL & DESIGN MANAGER
(NS BLUESCOPE LYSAGHT MALAYSIA)

JP1

IBS Content Scoring System

Suraya Johari,
Technical & Design Manager

March 16, 2019

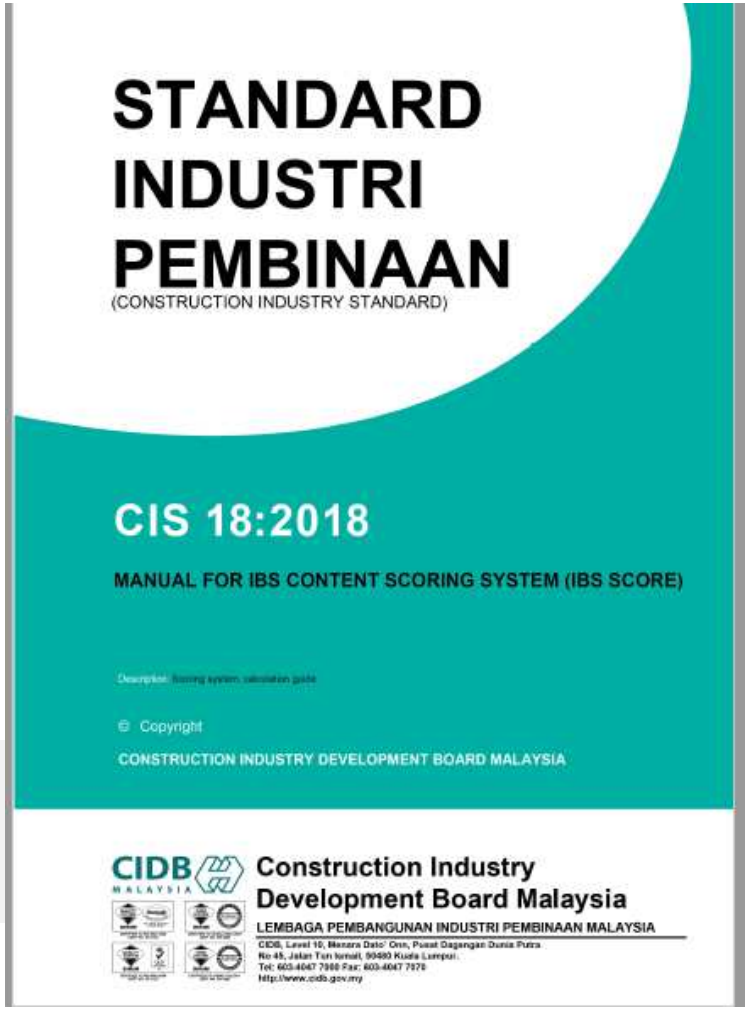
Slide 2

JP1 Title Slide- The Master Title will be in CAPITAL, Font Size 26, Font Color White, Background 1; Font Type-Calibri

Joshi, Punit, 11/20/2018

AGENDA

1. Recap on IBS component
2. IBS Score for Structural System, Wall Systems, Other Simplified Construction Solutions & Project with Group of Buildings
3. IBS Score Calculation Examples
4. Calculation for construction area & wall lengths



Source: CIS 18:2018

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IBS

Industrialized Building System

xxxxx


CIDB
MALAYSIA

SOME DEFINITIONS

- One may view IBS/ICS as systems, processes, approaches or industrial philosophy in construction.
- **Some other names:**
  1. Off-Site Construction (OSC)
  2. Modern Method of Construction (MMC)
  3. Off-Site Manufacturing (OMC)
  4. Off-Site Production (OSP)

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IBS - Industrialized Building System Definition

"A construction technique in which components are manufactured in a controlled environment (on or off site), transported, positioned and assembled into a structure with minimal additional site works" - CIDB

Industrial Building System (IBS) is one of modern construction technologies that can improve productivity.

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Types of IBS - Industrialized Building System

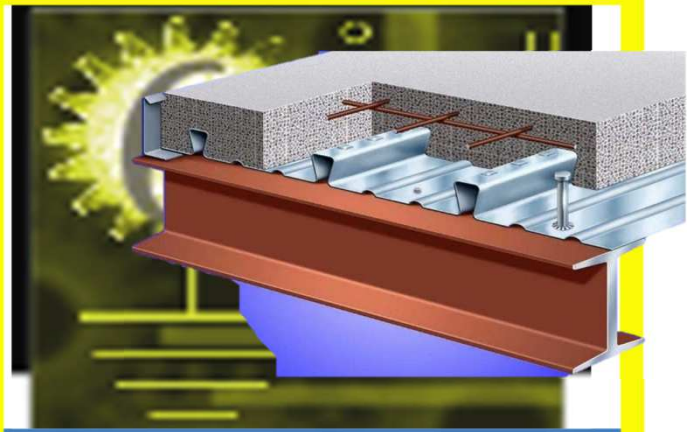
Prefabricated/ Precast concrete

Reusable Formwork

Block

Steel Framing

Prefabricated timber



Other Innovation System

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- The Government of Malaysia, has mandated that all public projects worth above RM10 million must adopt IBS and achieve a minimum IBS score of **70**.
- All private projects worth above RM50 million or 50,000m^2 compulsory to achieve a minimum IBS score of **50** will be implemented in stages from 2018 and to be enforced by 2020.

Source: Opening Address by YB Dato' Sri Haji Fadillah Bin Haji Yusof - Minister of Works
IBS Seminar 2018, 28 March 2018

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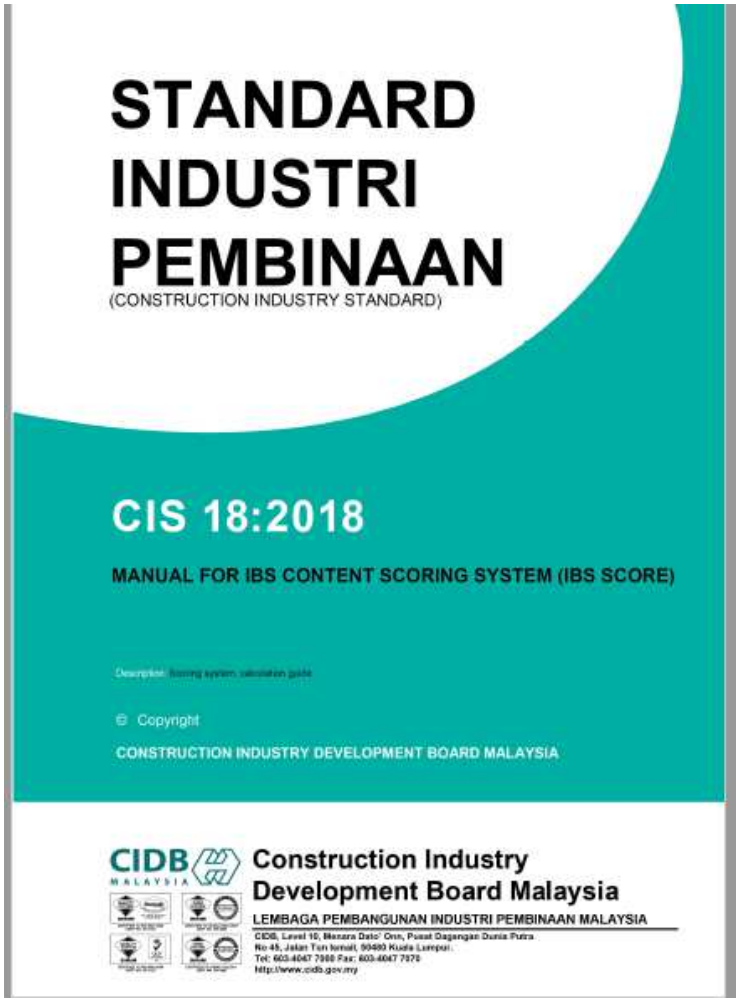
Therefore;

- It’s important to know the method of determining the IBS Score by all project team members.
- Consider IBS at the early design stage.
- Construction Industry Standard (CIS 18).

Construction Industry Standard – CIS 18:2018



IBS SCORE?

Assessment system

Well-structured and systematic

As a tool for computing the total IBS components usage in a building project

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PRINCIPLES OF IBS SCORE

Usage of IBS components

Utilisation of standardised components based on MS 1064

Repetition of structural layout

Usage of other productivity enhancing solutions

- Volumetric modular units, Building Information Modelling (BIM) and Modular gridlines

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PRINCIPLES OF IBS SCORE

Usage of IBS components

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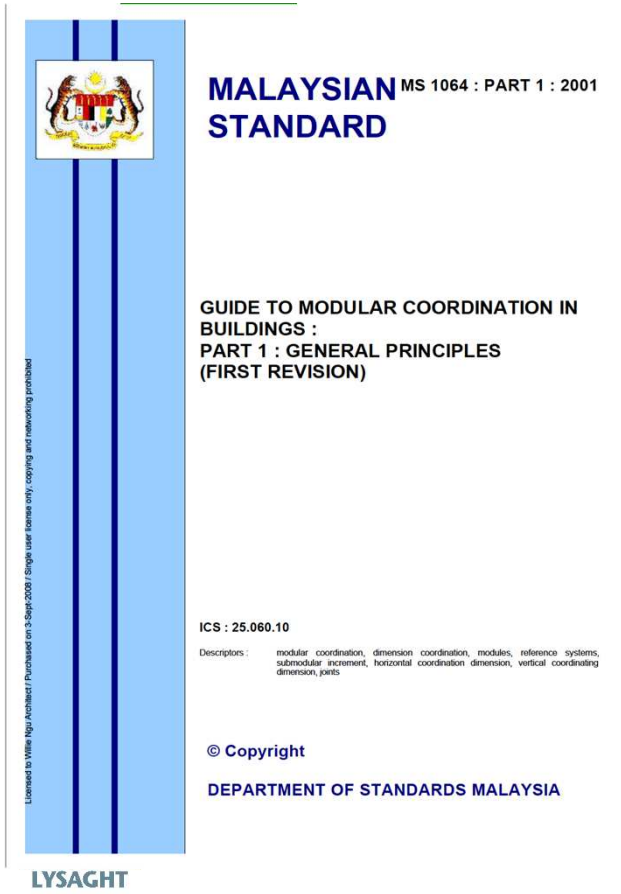
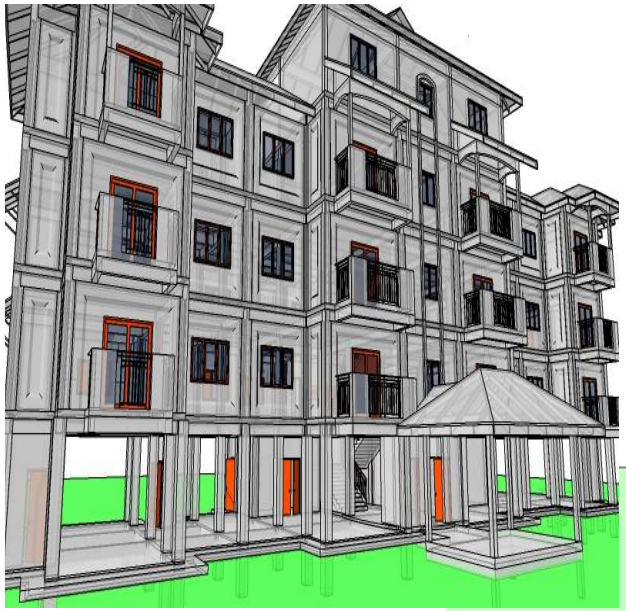
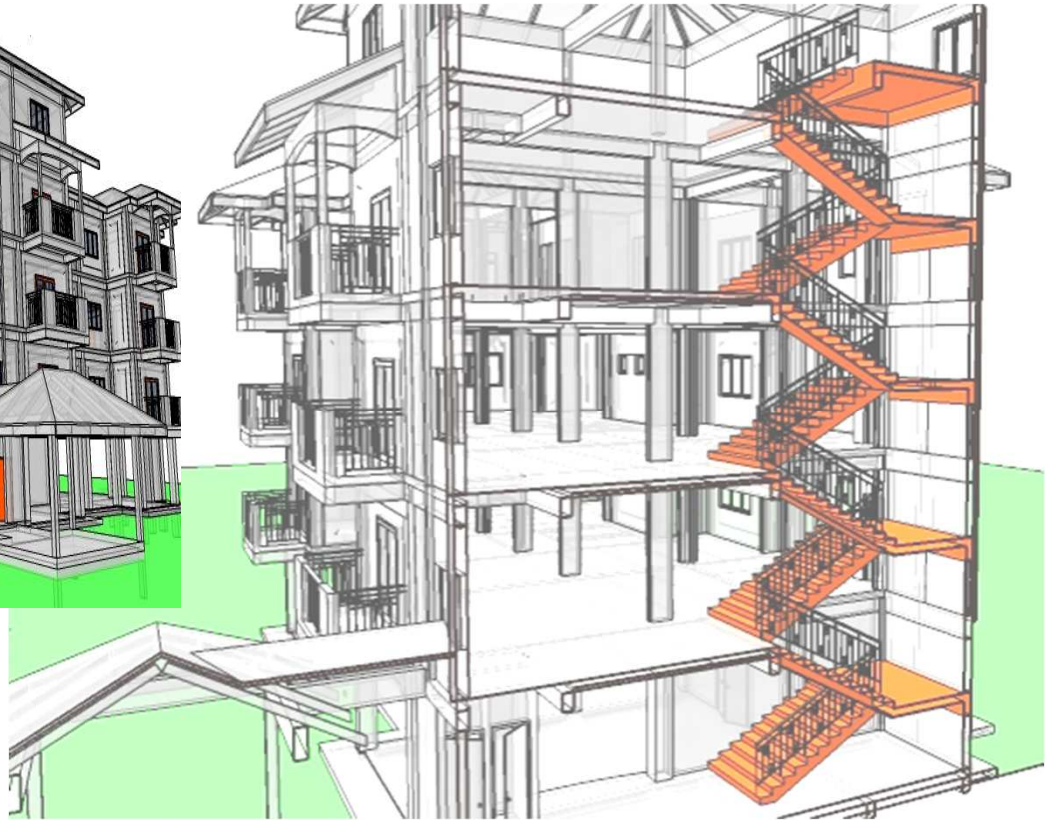
PRINCIPLES OF IBS SCORE

Utilisation of standardised components based on MS 1064







PRINCIPLES OF IBS SCORE

Repetition of structural layout

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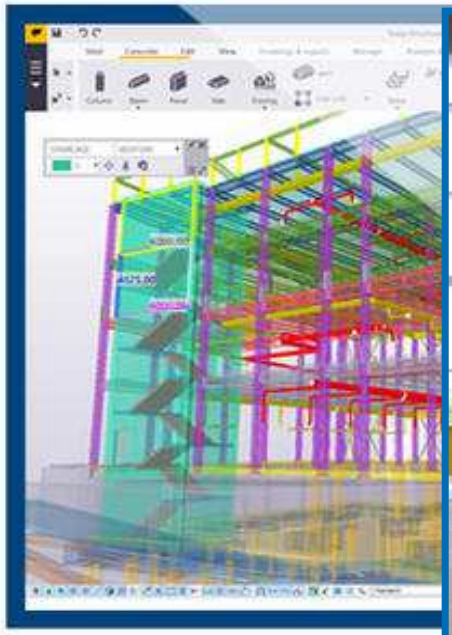
PRINCIPLES OF IBS SCORE

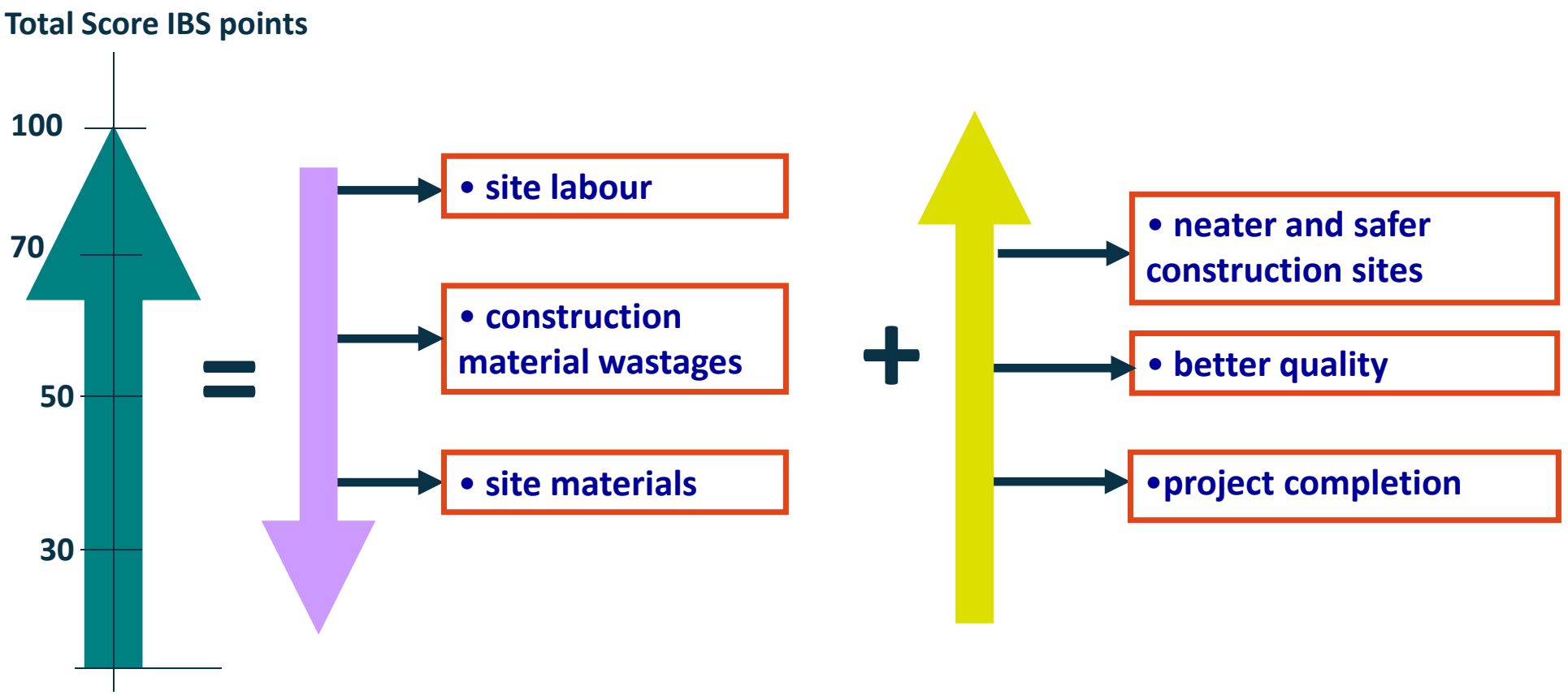
Usage of other productivity enhancing solutions

Volumetric modular units, Building Information Modelling (BIM) and Modular gridlines

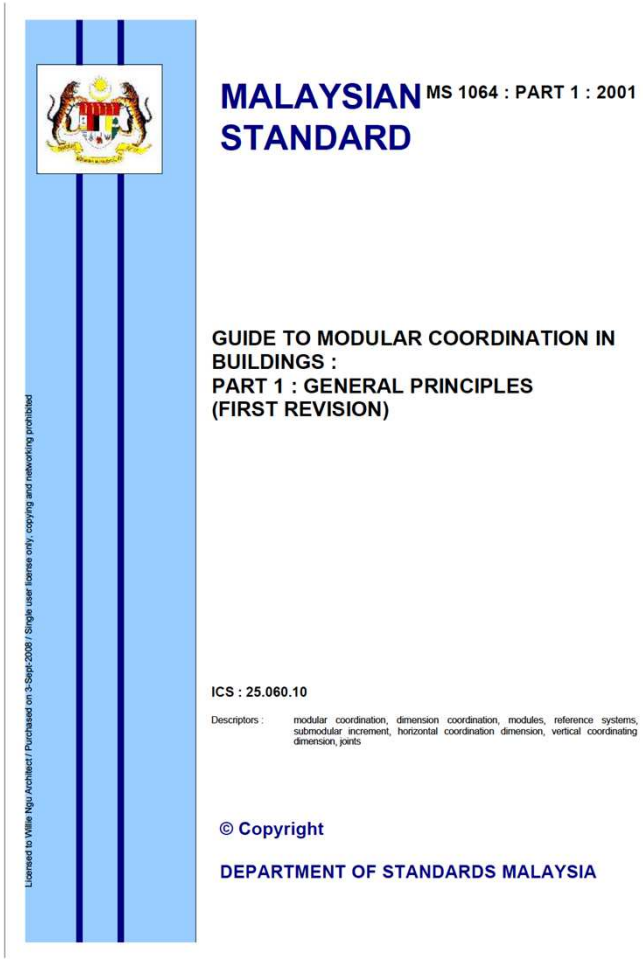


So

INDICATOR OF IBS SCORE



UTILISATION OF STANDARDISED COMPONENTS BASED ON MS 1064



MALAYSIAN STANDARD

MS 1064 : PART 1 : 2001

GUIDE TO MODULAR COORDINATION IN BUILDINGS :
PART 1 : GENERAL PRINCIPLES
(FIRST REVISION)

ICS : 25.060.10

Descriptors : modular coordination, dimension coordination, modules, reference systems, submodular increment, horizontal coordination dimension, vertical coordinating dimension, joints

Modular coordination in Buildings -Dimensions

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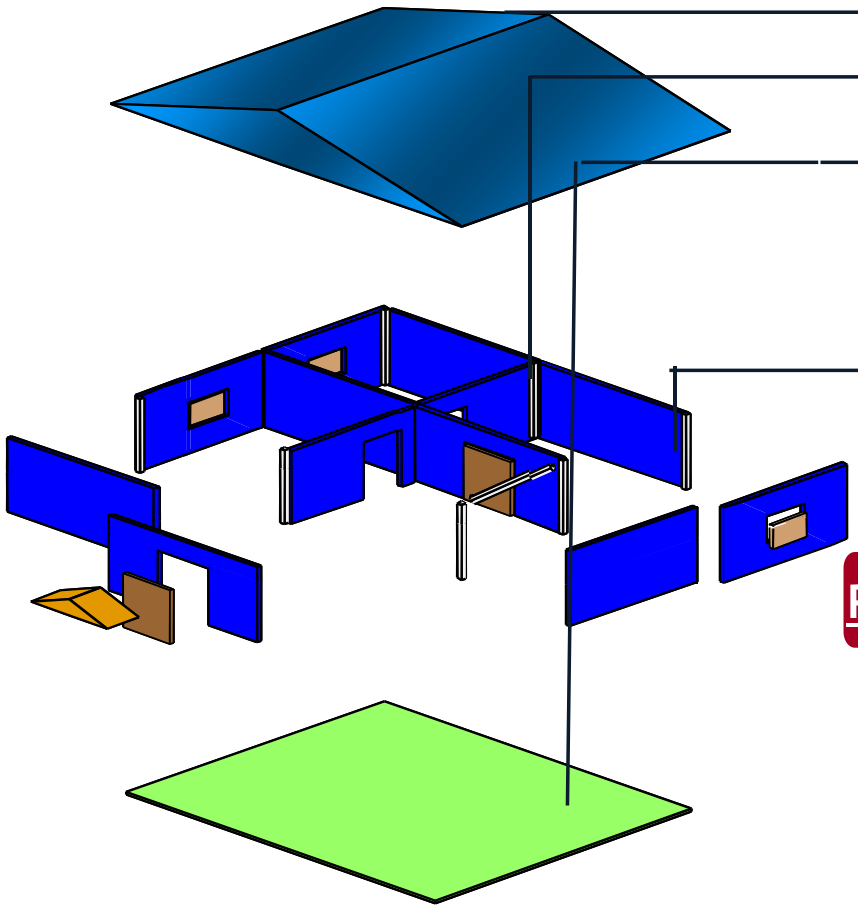
Method to determine

IBS Score

xxxxx

IBS Scoring System (IBS Score)



Part 1: Structural systems

Roof Structure

Beams, Columns

slabs

Part 2 - Wall Systems

external and internal wall

Part 3 - Other Simplified Construction Solutions

Modular MS 1064

Repetitiveness

Productivity

Formula: IBS Score

$$50\Sigma\left[\frac{Q_S}{Q_{ST}}\ F_S\right] + 20\Sigma\left[\frac{Q_W}{Q_{WT}}\ F_W\right] + S$$

Part 1 – Structural Systems	Part 2 – Wall Systems	Part 3 – Other Simplified Construction Solutions

The IBS Content Scoring System

The maximum IBS Score for a building is capped at 100 points

Part 1 – Structural Systems	Part 2 – Wall Systems	Part 3 – Other Simplified Construction Solutions
Maximum = 50 points	Maximum = 20 points	Maximum = 30 points

$$50\sum\left[\frac{Q_S}{Q_{ST}}F_S\right] + 20\sum\left[\frac{Q_W}{Q_{WT}}F_W\right] + S$$

Where:
Σ - Sum of
Q S - Construction area of a structural system
Q ST - Total construction area of building; including roof
*F*S - IBS Factor for structural system from Table 2 and Table 3
Q W - Length of a wall system (external and internal wall)
Q WT - Total wall length (external and internal wall)
*F*W - IBS Factor for wall system from Table 4
S - IBS Score for other simplified construction solutions from Table 5

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RATIONAL OF COMPONENT WEIGHTAGE

Part 1 – Structural Systems

Part 2 – Wall Systems

Part 3 – Other Simplified Construction Solutions

Rational

75% wet trade in construction

There are many system providers available in IBS components market in Malaysia

Encourage of repetition of structural layout, volumetric modular units, Building Information Modelling (BIM) and Modular gridlines

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IBS Score

•Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

- •Precast components i.e. Beam, Column & Slab.
- •Precast load bearing wall
- •Steel column and beam
- •Timber frame system
- • Prefabricated Roof Truss system
- • PPVC/ Modular System

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IBS Score

- **Part 2 – Wall Systems**

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

- Precast concrete panel
- Metal cladding
- Prefabricated timber panel
- Drywall system
- Precision blockworks
- Full height glass panel

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IBS Score

- Part 3 – Other Simplified Construction Solutions

+ S

- MS1064 Modular coordination in Buildings
- Repetition of structural layout
- volumetric modular units
- Building Information Modelling (BIM)

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IBS score for structural systems:

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right] = 50 \text{ points}$$

Version 2010 : Table 1

SYSTEM	FLOOR / COLUMN / BEAM [5]	Precast concrete slab[1]	In-situ concrete on permanent metal formwork	In-situ concrete using reusable[2] system formwork	In-situ concrete using timber[4] formwork	Steel flooring system	Timber frame flooring system	No Floor[8]
CONCRETE	Precast column and beam	1.0	0.9	0.7	0.6	1.0	1.0	1.0
	Precast column and In-situ beams using reusable[2] system formwork	0.9	0.8	0.6	0.5	0.9	0.9	0.8
	Precast column and in-situ beams using timber[4] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.7
	Precast beams and in-situ columns with reusable[2] system formwork	0.9	0.8	0.6	0.5	0.9	0.9	0.8
	Precast beams and in-situ columns using timber[4] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.7
	In-situ column and beams using reusable[3] system formwork	0.7	0.6	0.5	0.3	0.7	0.7	0.6
	In-situ column and beams using timber[4] formwork	0.6	0.5	0.3	0.0	0.6	0.6	0.0
LOAD BEARING BLOCKWORK[7]	Vertical and horizontal member systems / structure	0.8	0.7	0.6	0.5	0.8	0.8	0.7
STEEL	Steel columns and beams	1.0	0.9	0.7	0.6	1.0	1.0	1.0

Revised version 2018 : Table 2

MATERIALS / SYSTEM	NO.	DESCRIPTIONS / SLAB & COLUMN & BEAM [10]	A: Precast concrete slab[1]	B: In-situ concrete on permanent formwork	C: In-situ concrete using reusable[2] formwork	D: In-situ concrete using timber[3] formwork	E: Steel flooring system	F: Timber frame flooring system	G: No slab[4]
CONCRETE /REUSABLE FORMWORK	1	Precast column and beam	1.0	0.8	0.6	0.5	1.0	1.0	1.0
	2	Precast column and in-situ beam using reusable[2] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	3	Precast column and in-situ beam using timber[3] formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	4	Precast beams and in-situ columns using reusable[2] formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	5	Precast beams and in-situ columns using timber[3] formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	6	In-situ column and beams using reusable[2] formwork	0.6	0.5	0.4	0.2	0.6	0.6	0.6
	7	In-situ column and beams using timber[3] formwork	0.5	0.4	0.2	0.0	0.5	0.5	0.5
METAL	8	Metal columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
TIMBER	9	Timber columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
BLOCKWORK[8]	10	Load bearing blocks	0.8	0.7	0.5	0.4	0.8	0.8	0.8
INNOVATIVE	11	Metal framing with permanent formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7

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New material / system added

Revised Factor

IBS score for structural systems:

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

= 50 points

MATERIALS/ SYSTEMS	NO.	DESCRIPTIONS	A	B	C	D	E	F	G
		SLABS/ COLUMNS & BEAMS	Precast Concrete Slabs[1]	In Situ Concrete on Permanent Formwork	In Situ Concrete Using Reusable[2] Formwork	In Situ Concrete Using Timber[3] Formwork	Steel Flooring System	Timber Frame Flooring System	No Slab[4]
Concrete/ Reusable Formwork	1	Precast columns and beams	1	0.8	0.6	0.5	1	1	1
	2	Precast columns and in situ beams using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	3	Precast columns and in situ beams using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	4	Precast beams and in situ columns using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	5	Precast beams and in situ columns using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	6	In situ columns and beams using reusable formwork	0.6	0.5	0.4	0.2	0.6	0 .6	0.6
	7	In situ columns and beams using timber formwork	0.5	0.4	0.2	0	0.5	0.5	0.5
Metal[5]	8	Metal columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Timber	9	Timber columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Blockwork[6]	10	Load bearing blocks	0.8	0.7	0.5	0.4	0.8	0.8	0.8
Innovative	11	Metal framing with permanent formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7

Revised version 2018 : Table 2

NOTES:

1. Precast concrete slabs include half slabs, hollow core slabs, planks, etc. Precast concrete includes products of factory precasting and site precasting.
2. Reusable formwork includes plastic, fibreglass, steel, aluminium and other formworks that can be used not less than 20 times.
3. Timber formwork can be described as timber components that are cut to size and fabricated in situ to be used in forming concrete elements.
4. This is for structures without slabs. Refer examples in Section 4.3.
5. This refers to hot-dipped galvanized metal.
6. Load bearing blocks include interlocking blocks, concrete masonry units, hollow blocks, autoclaved lightweight blocks, etc.

ADDITIONAL NOTES:

1. An additional 0.05 on top of the IBS Factor will be given if prefabricated reinforcement cages are used in all cast in situ structures.
2. An additional 0.05 on top of the IBS Factor will be given if self-compacting concrete is used in all cast in situ structures.
3. The IBS Factor for tunnel formwork or self-climbing formwork system that casts wall together with slab is 0.5.
4. The IBS Factor for usage of volumetric modular units (also known as Prefabricated Prefinished Volumetric Construction (PPVC)), free-standing factory-produced volumetric modules that are completed with finishes for frames/walls, floors and ceilings), is 1.0.
5. For a structural system using load bearing walls, the factor can be determined from the Table 2 by referring to the beams/columns with similar construction system.
6. For structural systems that are not mentioned in Table 2, please refer to IBS Center, CIDB Malaysia for the IBS Factor.

IBS score for structural systems: $50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$ = 50 points

Revised version 2018 : Table 3

NO.	ROOF SYSTEM	IBS FACTOR
1	Prefab timber roof trusses	1.0
2	Prefab metal roof trusses	1.0
3	Conventional timber roof trusses[1]	0

NOTES:

1. Conventional timber roof trusses consist of timber elements that are cut, sized and constructed on site.

ADDITIONAL NOTES:

1. For roof's structural systems that are not mentioned in Table 3, please refer to IBS Center, CIDB Malaysia for the IBS Factor.

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IBS score for wall systems : $20\sum\left[\frac{Q_W}{Q_{WT}}F_W\right]$ = 20 points

Version 2010 : Table 2

NO	WALL SYSTEM	IBS FACTOR
1	Precast concrete panel[1]	1.0
2	Wall cladding[2]	1.0
3	Prefabricated timber panel	1.0
4	Full height glass panel[3]	1.0
5	Dry wall system[4]	1.0
6	In-situ concrete with reusable[5] system formwork	0.5
7	In-situ concrete with timber[6] formwork	0.0
8	Blockwork system[7]	0.5
9	Pre-assemble brickwall/ blockwall[8]	1.0
10	Common brickwall	0.0

Revised version 2018 : Table 4

NO.	WALL SYSTEM	IBS FACTOR
1	Precast concrete panel[1]	1.0
2	Wall cladding[2]	1.0
3	Prefabricated timber panel	1.0
4	Full height glass panel[3]	1.0
5	Dry wall system[4]	1.0
6	In-Situ concrete with reusable[5] formwork	0.4
7	In-Situ concrete with permanent formwork	0.7
8	Blockwork system[7]	0.5
10	Common brickwall	0.0
11	In-situ concrete with timber[6] formwork	0.0

New system added

Revised Factor

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IBS score for wall systems : $20\sum\left[\frac{Q_W}{Q_{WT}}F_W\right]$ = 20 points

Revised version 2018 : Table 4

NO	WALL SYSTEM	IBS FACTOR
1	Precast concrete panels[1]	1.0
2	Wall cladding[2]	1.0
3	Prefabricated timber panels	1.0
4	Full height glass panels[3]	1.0
5	Dry wall systems[4]	1.0
6	In-situ concrete with reusable system formwork[5]	0.4
7	In-situ concrete with permanent formwork	0.7
8	Blockwork systems[6]	0.5
9	Common brickwalls	0.0
10	In-situ concrete with timberformwork[7]	0.0

NOTES:

1. Precast concrete panels include; sandwich panels, solid panels and bay windows. Precast concrete includes products of factory precasting and site precasting.
2. Wall cladding consists of panels acting as wall or façade and not as a skin to brick wall.
3. For full height windows, use the IBS factor for panel glass. For a wall with non-full height windows, take the highest or widest material, e.g. brickwall, precast wall, glass, etc.
4. Dry walls include cementitious panels, gypsum boards, calcium silicate boards and other types of composite panel products.
5. Reusable formwork includes plastic, fibre glass, steel, aluminium and other formworks that can be used not less than 20 times.
6. Blocks include interlocking blocks, concrete masonry units, hollow blocks, autoclaved lightweight blocks, etc.
7. Timber formwork can be described as timber components that are cut to size and fabricated in-situ; to be used in forming concrete elements.

ADDITIONAL NOTES:

1. The IBS Factor for tunnel formwork or self climbing formwork system that casts wall together with slab is 0.5.
2. For structural systems that are not mentioned in Table 4, please refer to IBS Center, CIDB Malaysia for the IBS Factor.

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IBS score for other simplified construction solutions : S = 30 points

Version 2010 : Table 3

No	DESCRIPTION	UNIT	IBS SCORE	
			PERCENTAGE OF USAGE	
			50%≤X<75%	75%≤X≤100%
1	UTILISATION OF STANDARDISED COMPONENTS BASED ON MS 1064			
	i. Beams[1]	Nos	2	4
	ii. Columns[1]	Nos	2	4
	iii. Walls[1]	m	2	4
	iv. Slabs[1]	m^2	2	4
	v. Doors[2]	Nos	2	4
	vi. Windows[3]	Nos	2	4
2	REPETITION OF STRUCTURAL LAYOUT			
	a) For building more than 2 storeys			
	i. Repetition of floor to floor height	Nos	1	2
	ii. Vertical repetition of structural floor layout	Nos	1	2
	iii. Horizontal repetition of structural floor layout	Nos	1	2
	b) For building 1 or 2 storeys			
	Horizontal repetition of structural floor layout	Nos	3	6

New description added

Revised version 2018 : Table 3

No	DESCRIPTION	UNIT	IBS SCORE	
			PERCENTAGE OF USAGE	
			50% ≤x ≤75%	75% ≤x ≤100%
1	**UTILISATION OF STANDARDISED COMPONENTS BASED ON MS 1064**			
	i) Beams [1]	Nos	2	4
	ii) Columns [1]	Nos	2	4
	iii) Walls [1]	M	2	4
	iv) Slabs [1]	m^2	2	4
	v) Doors [2]	Nos	2	4
	vi) Windows [3]	Nos	2	4
2	**REPETITION OF STRUCTURAL LAYOUT**			
	a) For building more than 2 storeys			
	i) Repetition of floor to floor height	Nos	1	2
	ii) Vertical repetition of structural floor layout	Nos	1	2
	iii) Horizontal repetition of structural floor layout	Nos	1	2
	b) For building 1 or 2 storey(s)			
	i) Horizontal repetition of structural floor layout	Nos	3	6
3	**OTHER PRODUCTIVITY ENHANCING SOLUTIONS**			
	i) Usage of prefab bathroom units (PBU)	Nos	1	2
	i) Usage of prefab staircases		1	2
	i) Usage of BIM – Level 1 or i) Usage of BIM – Level 2	Nos	3 / 6	
	i) Usage of Modular Gridlines in drawings	Nos	4 (for ≥ 50% usage)	

IBS score for other simplified construction solutions : S = 30 points

Revised version 2018 : Table 5

NO	DESCRIPTION	UNIT	IBS SCORE PERCENTAGE OF USAGE	
			50% ≤x<75%	75% ≤x≤100%
1	**Utilisation of Standardised Components Based on MS 1064**			
	i) Beams[1]	Nos	2	4
	ii) Columns[1]	Nos	2	4
	iii) Walls[1]	m	2	4
	iv) Slabs[1]	m	2	4
	v) Doors[2]	Nos	2	4
	vi) Windows[3]	Nos	2	4
2	**Repetition of Structural Ayouts**			
	a) For building more than 2 storeys			
	i) Repetition of floor to floor height	Nos	1	2
	ii) Vertical repetition of structural floor layout	Nos	1	2
	iii) Horizontal repetition of structural floor layout	Nos	1	2
	b) For building 1 or 2 storey(s)			
	iii) Horizontal repetition of structural floor layout	Nos	3	6
3	**Other Productivity Enhancing Solutions**			
	i) Usage of prefab bathroom units (PBU)[4]	Nos	1	2
	ii) Usage of prefab staircases[5]	Nos	1	2
	ii) Usage of BIM models for IBS Score submission	Level 1[6]	3	
		Level 2[7]	6	
	iii) Usage of Modular gridlines in drawings[8]	Nos	4 (for ≥ 50% usage)	

NOTES:

1. Refer to the latest MS 1064 Part 10: Coordinating sizes and preferred sizes for reinforced concrete components. Values to use are the preferred sizes as listed in the tables: beams and columns - width & depth, walls and slabs - thickness. The reference to Part 10 for preferred sizes is for all beams, columns, walls and slabs; including non-concrete elements.
2. Refer to the latest MS 1064 Part 4: Coordinating sizes of wall opening for doorsets. Values to use are dimensions in the increments of 100mm (1M).
3. Refer to the latest MS 1064 Part 5: Coordinating sizes of wall opening for window sets. Values to use are dimensions in the increments of 100mm (1M).
4. Prefab bathroom units (PBU) or prefab bathroom pods are volumetric modular units (also known as Prefabricated Prefinished Volumetric Construction (PPVC)); free-standing factory-produced volumetric bathroom modules that are completed with finishes.
5. Prefab staircases include completed staircases units made of precast, steel, engineered timber or any other prefab materials.
6. BIM Level 1 - Single disciplinary use of object-based 3D modelling software within one discipline.
7. BIM Level 2 - Sharing of object based models and data between two or more disciplines using IFC (Industry Foundation Class) or COBie (Construction Operations Building Information Exchange) file formats.
8. Modular gridlines are the major plan grids (x and y) that are in the increments of 300mm (3M).

ADDITIONAL NOTES:

1. For structures using load bearing wall systems (without beams and columns), four (4) points each are provided automatically under the beams and columns sections.

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IBS SCORE CALCULATION EXAMPLES

IBS Score - Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

*Q*S - Construction area of a structural system
*Q*ST - Total construction area of building; including roof
*F*S - IBS Factor for structural system from Table 2 and Table 3

Total Construction area, Q_{st} = 1,000 m²

Q_s = 300m²	Q_s = 700m²

Area of precast concrete beam/column/slab

= 700m² = $\frac{Q_S}{Q_{ST}} = \frac{700}{1000} = 0.7$

Area of conventional method (in-situ)

= 300 m² = $\frac{Q_S}{Q_{ST}} = \frac{300}{1000} = 0.3$

Table 2, for precast beam/column/slab, F = 1.0

BLUESCOPE LYSAGHT

Table 2. IBS Factor for Structural Systems

MATERIALS/ SYSTEMS	NO.	DESCRIPTIONS SLABS/ COLUMNS & BEAMS	A Precast Concrete Slabs[1]	B In Situ Concrete on Permanent Formwork	C In Situ Concrete Using Reusable[2] Formwork	D In Situ Concrete Using Timber[3] Formwork	E Steel Flooring System	F Timber Frame Flooring System	G No Slab[4]
Concrete/ Reusable Formwork	1	Precast columns and beams	1	0.8	0.6	0.5	1	1	1
	2	Precast columns and in situ beams using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	3	Precast columns and in situ beams using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	4	Precast beams and in situ columns using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	5	Precast beams and in situ columns using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	6	In situ columns and beams using reusable formwork	0.6	0.5	0.4	0.2	0.6	0 .6	0.6
	7	In situ columns and beams using timber formwork	0.5	0.4	0.2	0	0.5	0.5	0.5
Metal[5]	8	Metal columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Timber	9	Timber columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Blockwork[6]	10	Load bearing blocks	0.8	0.7	0.5	0.4	0.8	0.8	0.8
Innovative	11	Metal framing with permanent formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7

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IBS Score - Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

*Q*S - Construction area of a structural system
*Q*ST - Total construction area of building; including roof
*F*S - IBS Factor for structural system from Table 2 and Table 3

Total Construction area, Q_{st} = 1,000 m²

Q_s = 300m²	Q_s = 700m²

Area of precast concrete beam/column/slab

= 700m² = $\frac{Q_S}{Q_{ST}} = \frac{700}{1000} = 0.7$

Table 2, for precast beam/column/slab, F = 1.0

Area of conventional method (in-situ)

= 300 m² = $\frac{Q_S}{Q_{ST}} = \frac{300}{1000} = 0.3$

Table 2, for in-situ, F = 0

BLUESCOPE LYSAGHT

Table 2. IBS Factor for Structural Systems

MATERIALS/ SYSTEMS	NO.	DESCRIPTIONS	A	B	C	D	E	F	G
		SLABS/ COLUMNS & BEAMS	Precast Concrete Slabs[1]	In Situ Concrete on Permanent Formwork	In Situ Concrete Using Reusable[2] Formwork	In Situ Concrete Using Timber Formwork	Steel Flooring System	Timber Frame Flooring System	No Slab[4]
Concrete/ Reusable Formwork	1	Precast columns and beams	1	0.8	0.6	0.5	1	1	1
	2	Precast columns and In situ beams using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	3	Precast columns and In situ beams using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	4	Precast beams and In situ columns using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	5	Precast beams and In situ columns using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	6	In situ columns and beams using reusable formwork	0.6	0.5	0.4	0.2	0.6	0 .6	0.6
	7	In situ columns and beams using timber formwork	0.5	0.4	0.2	0	0.5	0.5	0.5
Metal[5]	8	Metal columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Timber	9	Timber columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Blockwork[6]	10	Load bearing blocks	0.8	0.7	0.5	0.4	0.8	0.8	0.8
Innovative	11	Metal framing with permanent formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7

BLUESCOPE LYSAGHT

IBS Score - Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$

*Q*S - Construction area of a structural system
*Q*ST - Total construction area of building; including roof
*F*S - IBS Factor for structural system from Table 2 and Table 3

Total Construction area, Q_{st} = 1,000 m²

Q_s = 300m²	Q_s = 700m²

Area of precast concrete beam/column/slab

= 700m² = $\frac{Q_S}{Q_{ST}} = \frac{700}{1000} = 0.7$

Table 2, for precast beam/column/slab, F = 1.0

Area of conventional method (in-situ)

= 300 m² = $\frac{Q_S}{Q_{ST}} = \frac{300}{1000} = 0.3$

Table 2, for in-situ, F = 0

IBS Score for Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right] = 50 \Sigma [(0.7 \times 1.0) + (0.3 \times 0)] = 35$$

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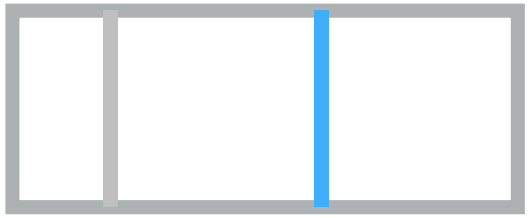
IBS Score - Part 2 Wall Systems

$$20 \Sigma \left[\frac{Q_W}{Q_{WT}} F_W \right]$$

Q_W / Q_{WT} - The ratio of the length of a particular wall system (external or internal) used out of the total wall length of the building

F_W - IBS Factor for the particular wall system, from Table 4.

Total length of wall, QWT = 10,000 m run



Length of In-situ concrete with permanent formwork
= 7,500m = Q_W / Q_{WT} = 7,500m/10,000m = 0.75

Table 4 , for In-situ concrete with permanent formwork, F = 0.7

Length of Precast concrete panels
= 2,500 m = Q_W / Q_{WT} = 2,500m/10,000m = 0.25

Table 4 , Precast concrete panels, F = 1.0

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Table 4. IBS Factor for Wall Systems

NO	WALL SYSTEM	IBS FACTOR
1	Precast concrete panels[1]	1.0
2	Wall cladding[2]	1.0
3	Prefabricated timber panels	1.0
4	Full height glass panels[3]	1.0
5	Dry wall systems[4]	1.0
6	In-situ concrete with reusable system formwork[5]	0.4
7	In-situ concrete with permanent formwork	0.7
8	Blockwork systems[6]	0.5
9	Common brickwalls	0.0
10	In-situ concrete with timberformwork[7]	0.0

BLUESCOPE LYSAGHT

IBS Score - Part 2 Wall Systems

$$20 \Sigma \left[\frac{Q_W}{Q_{WT}} F_W \right]$$

Q_W / Q_{WT} - The ratio of the length of a particular wall system (external or internal) used out of the total wall length of the building

F_W - IBS Factor for the particular wall system, from Table 4.

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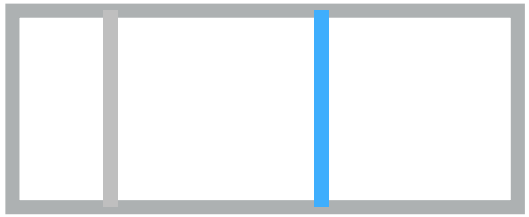

Length of In-situ concrete with permanent formwork
= 7,500m = Q_W / Q_{WT} = 7,500m/10,000m = 0.75

Table 4 , for In-situ concrete with permanent formwork, F = 0.7

Length of Precast concrete panels
= 2,500 m = Q_W / Q_{WT} = 2,500m/10,000m = 0.25

Table 4 , Precast concrete panels, F = 1.0

IBS Score for Part 2 Wall Systems

$$20 \Sigma \left[\frac{Q_W}{Q_{WT}} F_W \right] = 20 \Sigma [(0.75 \times 0.7) + (0.25 \times 1)] = 11.5$$

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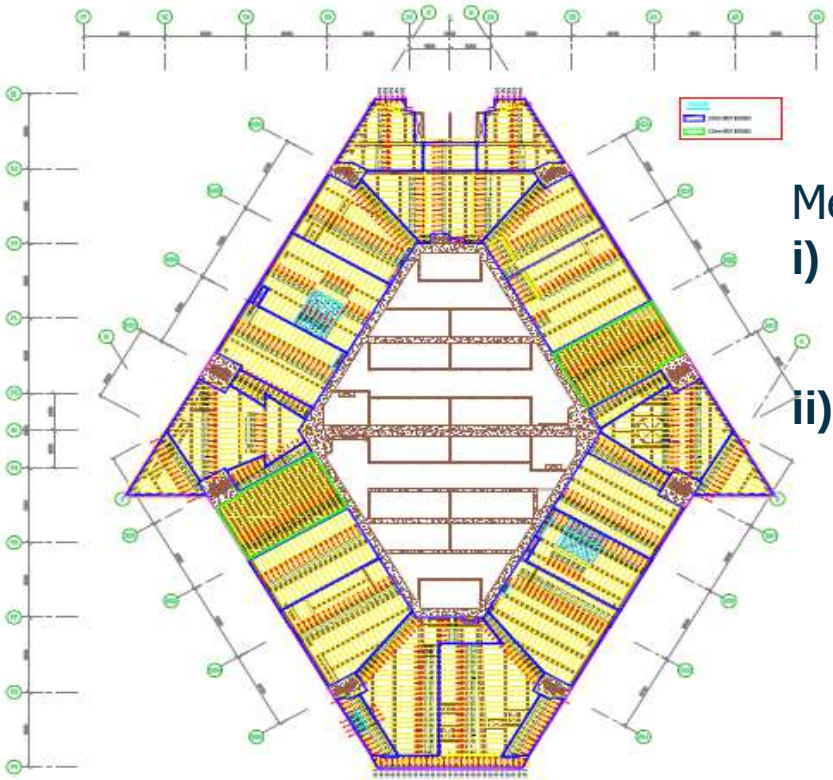
IBS Score - Part 1: Structural Systems

$$50 \sum \left[\frac{Q_S}{Q_{ST}} F_S \right]$$



*Q*S - Construction area of a structural system
*Q*ST - Total construction area of building; including roof
*F*S - IBS Factor for structural system from Table 2 and Table 3

Measurement taken from drawings:

i) Construction area

- Area for one floor = = 1400 m^2

ii) Structural systems

- Main structures: Steel Colum and Beam/ Composite slab with permanent formwork
- Roof trusses : Prefab steel

Table 2, F = 08

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Table 2. IBS Factor for Structural Systems

MATERIALS/ SYSTEMS	NO.	DESCRIPTIONS	A	B	C	D	E	F	G
		SLABS/ COLUMNS & BEAMS	Precast Concrete Slabs[1]	In Situ Concrete on Permanent Formwork	In Situ Concrete Using Reusable[2] Formwork	In Situ Concrete Using Timber[3] Formwork	Steel Flooring System	Timber Frame Flooring System	No Slab[4]
Concrete/ Reusable Formwork	1	Precast columns and beams	1	0.8	0.6	0.5	1	1	1
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	3	Precast columns and In situ beams using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	4	Precast beams and In situ columns using reusable formwork	0.8	0.7	0.5	0.4	0.8	0.8	0.8
	5	Precast beams and In situ columns using timber formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7
	6	In situ columns and beams using reusable formwork	0.6	0.5	0.4	0.2	0.6	0 .6	0.6
	7	In situ columns and beams using timber formwork	0.5	0.4	0.2	0	0.5	0.5	0.5
Metal[5]	8	Metal columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Timber	9	Timber columns and beams	1.0	0.8	0.6	0.5	1.0	1.0	1.0
Blockwork[6]	10	Load bearing blocks	0.8	0.7	0.5	0.4	0.8	0.8	0.8
Innovative	11	Metal framing with permanent formwork	0.7	0.6	0.4	0.3	0.7	0.7	0.7

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Part 3 – Other Simplified Construction Solutions

Table 5. IBS Score for Other Simplified Construction Solutions

NO	DESCRIPTION	UNIT	IBS SCORE	
			PERCENTAGE OF USAGE	
			50% ≤x<75%	75% ≤x≤100%
1	**Utilisation of Standardised Components Based on MS 1064**			
	i) Beams[1]	Nos	2	4
	ii) Columns[1]	Nos	2	4
	iii) Walls[1]	m	2	4
	iv) Slabs[1]	m^2	2	4
	v) Doors[2]	Nos	2	4
	vi) Windows[3]	Nos	2	4

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Part 3 – Other Simplified Construction Solutions

Table 5. IBS Score for Other Simplified Construction Solutions

2	**Repetition of Structural Ayouts**			
	a) For building more than 2 storeys			
	i) Repetition of floor to floor height	Nos	1	2
	ii) Vertical repetition of structural floor layout	Nos	1	2
	iii) Horizontal repetition of structural floor layout	Nos	1	2
	b) For building 1 or 2 storey(s)			
	iii) Horizontal repetition of structural floor layout	Nos	3	6
3	**Other Productivity Enhancing Solutions**			
	i) Usage of prefab bathroom units (PBU)[4]	Nos	1	2
	ii) Usage of prefab staircases[5]	Nos	1	2
	ii) Usage of BIM models for IBS Score submission	Level 1[6]	3	
		Level 2[7]	6	
	iii) Usage of Modular gridlines in drawings[8]	Nos	4 (for ≥ 50% usage)	

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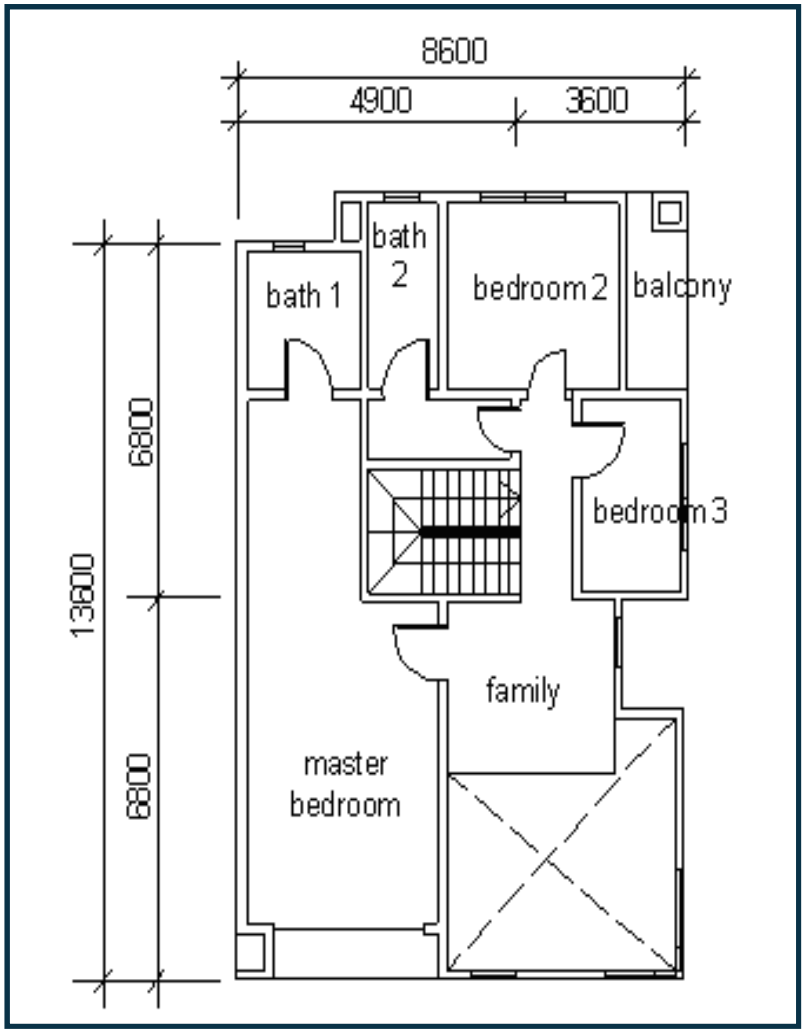
IBS Score Calculation Examples

calculation methods for determining the IBS score for various types of building.

Example 1 - Double-storey terrace house



Measurement taken from drawings:

i) Construction area

- Construction area for ground floor = 117.0 m^2
- Construction area for first floor = 117.0 m^2
- Construction roof area = 117.0 m^2

Total construction area = 351.0 m^2

ii) Structural systems

- Beams : Precast concrete
- Columns : In situ concrete using steel formwork
- Floor slab : Precast half slabs on first floor
- Roof trusses: Prefab timber

iii) Wall system

- Internal wall : Precast concrete panels (total 79.5 m length)
- External wall : Precast blocks (total 87.8 m length)

iv) Other simplified construction solutions

a) Beams : 60% comply with MS 1064 Part 10
Columns : 100% comply with MS 1064 Part 10
Walls and Slabs : Less than 50% comply with MS 1064 Part 10
Doors : 80% comply with MS 1064 Part 4
Windows : 0% comply with MS 1064 Part 5

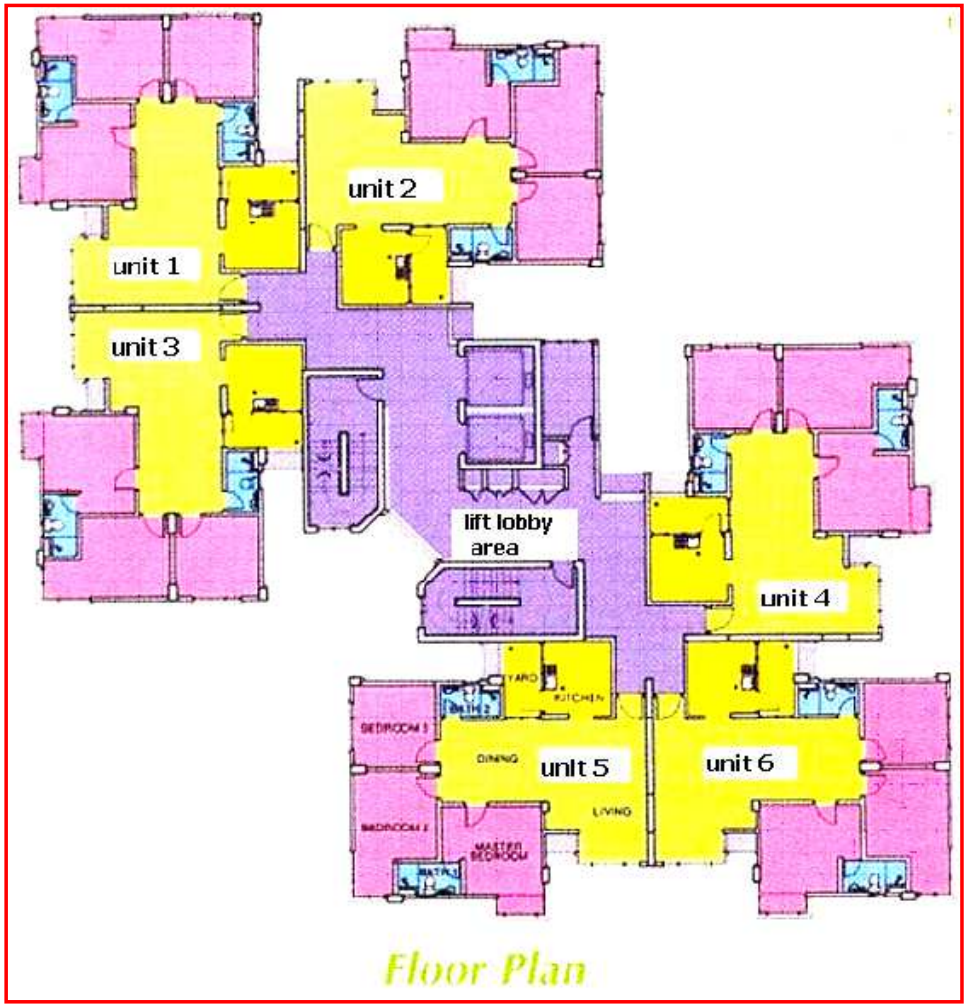
b) Horizontal repetition of structure = 100%

BLUESCOPE LYSAGHT

ELEMENTS	AREA (m^2) or Length (m)	IBS FACTOR[(1)]	COVERAGE	IBS SCORE
Part 1: Structure Elements				
Precast beams + in situ columns with reusable formwork + precast concrete half slab. Ground floor area = 117.0m^2	117.0 m^2			
Precast beams + in situ columns with reusable formwork (no slab) 1st floor area = 117.0m^2	117.0 m^2			
Roof truss using prefab timber Roof area = 117.0m^2	117.0 m^2			
Total Part 1	**351.0 m^2**		**1.00**	**42.9**
Part 2: Wall System				
External wall using precast concrete blockworks	87.8m			
Internal wall using precast concrete panel	79.5m			
Total Part 2	**167.3m**			
Part 3: Other simplified construction solutions				
i) 60% beam sizes follow MS 1064 Part 10: 2001				
ii) 100% of column sizing follow MS 1064 Part 10: 2001				
iii) 80% of door sizing follow MS 1064 Part 4: 2001				
iv) Horizontal repetition of structure = 100%				
Total Part 3				
IBS CONTENTS SCORE OF PROJECT (Part 1 + Part 2 + Part 3)				

BLUESCOPE LYSAGHT

Example 2 - 18 Storey Condominium



Measurement taken from drawings:

i) Construction area

- Area for one unit of condominium = 94.4 m^2
- Lift lobby area = 140.0 m^2
- Area for one floor = (94.4 x 6 units) + 140 = 706.4 m^2

ii) Structural systems

- Main structures : Tunnel formwork system
- Roof trusses : Prefab steel

iii) Wall systems - per floor (6 units + lift lobby area)

- Precast blocks wall = 263 m total length
- Tunnel formwork system = 120 m total length

iv) Other simplified construction solutions

- Doors : 100% comply with MS 1064 Part 4
- Windows : 100% comply with MS 1064 Part 5
- Repetition of floor to floor height = 90%

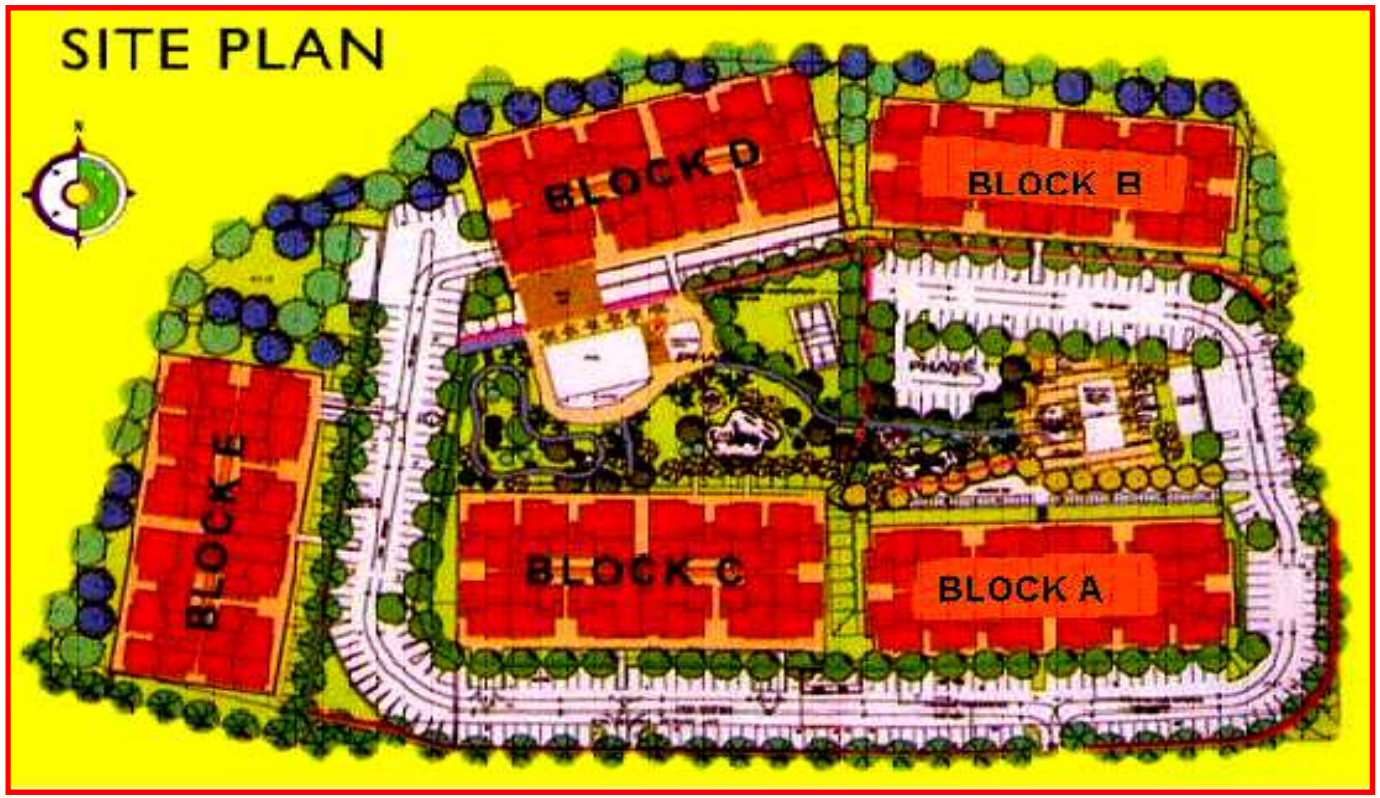
  Vertical repetition of structure = 80%
- PBU : 100% out of total bathrooms

- Prefab staircases : 50% out of total staircases
- Submission of IBS Score calculation is using Level 2 BIM model
- Modular gridlines : 90% out of total major plan grids (x and y)

BLUESCOPE LYSAGHT

ELEMENTS	AREA (m^2) or Length (m)	FACTOR	COVERAGE	IBS SCORE
Part 1: Structure Elements				
i) Tunnel formwork system Total area = 706.4m^2 x 18 storey = 12,715m^2	12,715.2 m^2	0.5	12,715.2 / 13,421.6 = 0.95	0.95 x 0.5 x 50 = 23.75
ii) Roof truss - prefab steel Roof area = 706.4m^2	706.4 m^2	1.0	706.4 / 13,421.6 = 0.05	0.05 x 1.0 x 50 = 2.5
Total Part 1	13,421.6 m^2		1.00	**26.25**
Part 2: Wall System				
External wall using tunnel formwork = 120 m x 18 storey	2,160 m	0.5	2,160 / 6,894 = 0.31	0.31 x 0.5 x 20 = 3.1
Internal wall using precast blocks = 263 m x 18 storey	4,734 m	0.5	4,734 / 6,894 = 0.69	0.69 x 0.5 x 20 = 6.9
Total Part 2	6,894 m		1.00	10.0
Part 3: Other simplified construction solutions				
i) 100% of door sizes follow MS 1064 Part 4			100%	4
ii) 100% of windows complies to MS1064 Part 5			100%	4
iii) Repetition of floor to floor height = 90%			90%	2
iv) Vertical repetition of structure = 80%			80%	2
v) Usage of PBU = 100%			100%	2
vi) Usage of prefab staircases = 50%			50%	1
vii) Submission using Level 2 BIM Model			Level 2	1
viii) Usage of modular gridlines = 90%			90%	4
Total Part 3				25
IBS CONTENTS SCORE OF PROJECT (Part 1 + Part 2 + Part 3)				**61.25**

Example 3 - Ibs score for project (group of buildings)

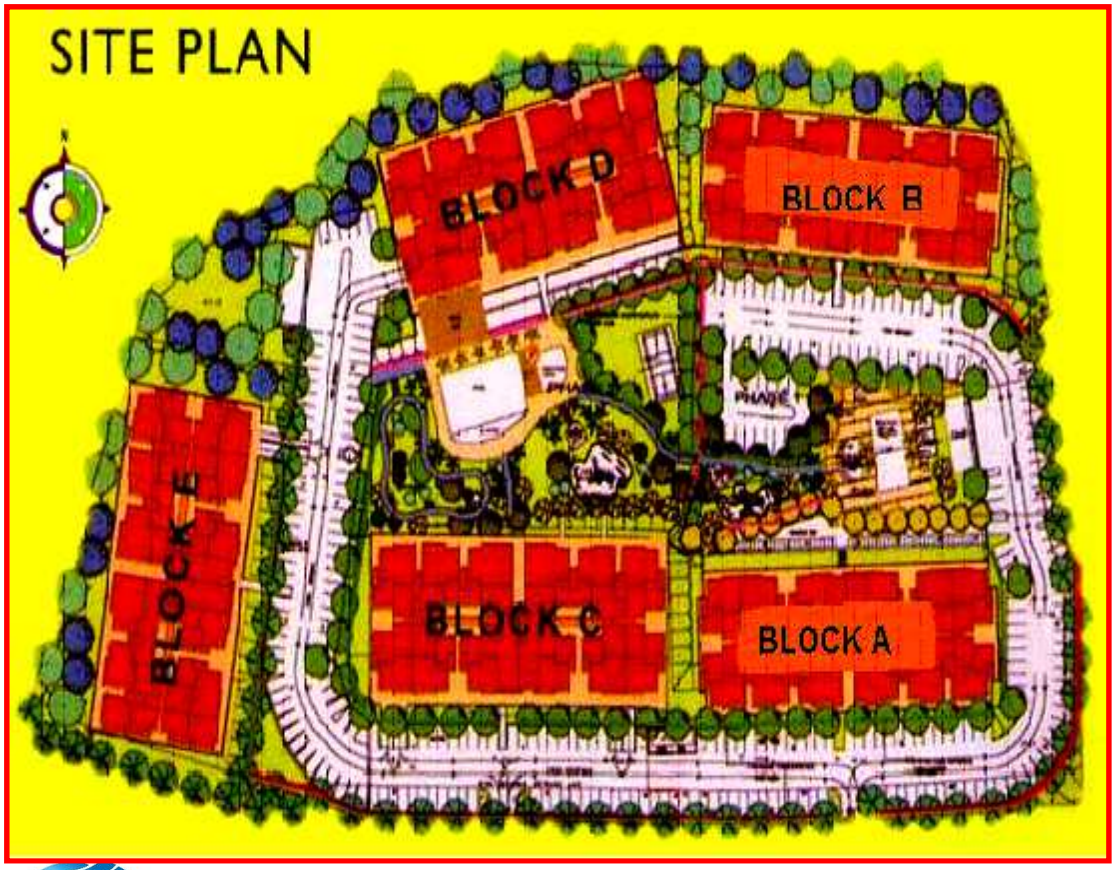


$$\text{IBS Score for project} = \Sigma\left[\text{IBS SCORE FOR BUILDING X}\frac{Q_{ST\,(building)}}{Q_{ST\,(project)}}\right]$$

Example 3 - Group of buildings

$$\Sigma\left[\text{IBS SCORE FOR BUILDING X}\frac{Q_{ST(building)}}{Q_{ST(project)}}\right]$$

Project information:
- Main buildings in the development consist of 5 blocks of buildings.



i) Block A - 5-storey apartment
- Construction area, QST (Building A) = 3,000 m²
- IBS Score (Building A) = 83

ii) Block B - 5-storey apartment
- Construction area, QST (Building B) = 3,000 m²
- IBS Score (Building B) = 87

iii) Block C - 4-storey apartment
- Construction area, QST (Building C) = 3,200 m²
- IBS Score (Building C) = 35

iv) Block D - 4-storey apartment
- Construction area, QST (Building D) = 3,200 m²
- IBS Score (Building D) = 47

v) Block E - 3-storey office block
Construction area, QST (Building E) = 3,000 m²
IBS Score (Building E) = 75

Total construction area
(Block A+ B + C + D + E) = 15,400 m m²

BLUESCOPE LYSAGHT

IBS SCORE FOR PROJECT (GROUP OF BUILDINGS)

Example 3 - Group of buildings

IBS Score for project = $\Sigma\left[\text{IBS SCORE FOR BUILDING} \times \frac{Q_{ST\,(building)}}{Q_{ST\,(project)}}\right]$

The IBS score for each building are:-

i) Block A - 5-storey apartment
- Construction area, QST (Building A) = 3,000 m²
- IBS Score (Building A) = 83

ii) Block B - 5-storey apartment
- Construction area, QST (Building B) = 3,000 m²
- IBS Score (Building B) = 87

iii) Block C - 4-storey apartment
- Construction area, QST (Building C) = 3,200 m²
- IBS Score (Building C) = 35

iv) Block D - 4-storey apartment
- Construction area, QST (Building D) = 3,200 m²
- IBS Score (Building D) = 47

v) Block E - 3-storey office block

Construction area, QST (Building E) = 3,000 m²

IBS Score (Building E) = 75

Total construction area

(Block A+ B + C + D + E) = 15,400 m m²

BLOCK	CONSTRUCTION AREA (m²)	COVERAGE	IBS SCORE (BUILDING)	IBS SCORE (PROJECT)
A	3,000	3,000 / 15,400 = 0.195	83	0.195 x 83 = 16.2
B	3,000	3,000 / 15,400 = 0.195	87	0.195 x 87 = 17.0
C	3,200	3,200 / 15,400 = 0.21	35	0.21 x 35 = 7.4
D	3,200	3,200 / 15,400 = 0.21	47	0.21 x 47 = 9.9
E	3,000	3,000 / 15,400 = 0.195	75	0.195 x 75 = 14.6
Total	**15,400**	**1.0**	-	**65.1**


Thank
You!!!