

# Industry Briefing on Enhanced Buildability Framework

*For Consultants*

*10 May 2011*

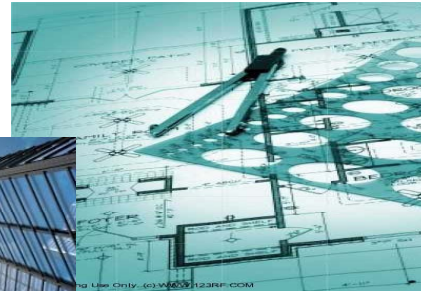


We shape a **safe**, **high quality**, **sustainable** and **friendly** built environment

# Updates on Enhanced Buildability Framework



**Buildability Development Department**



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10 May 2011

# Agenda

- Enhancement to Buildability Framework
- Key Changes to Buildable Design Requirements
- Impact to Industry
- New Constructability Appraisal System

# Buildability Framework

- Implemented since 2001
- Construction Productivity Roadmap to attain higher productivity level
- A key strategy : strengthen existing Buildability Framework



15 April 2011

Our Ref.: BCA BC 15.0.3 Building Plan and Management Division

15 Apr 2011

See Distribution

Dear Sir/Madam

**CIRCULAR TO PROFESSIONAL INSTITUTES / ASSOCIATIONS**

**ENHANCED BUILDABILITY FRAMEWORK TO IMPROVE PRODUCTIVITY**

**Objective**

1 This circular is to inform the industry of the Enhanced Buildability Framework which shall include a new requirement on Constructability Score by builders under the Building Control (Buildability) Regulations 2011.

**Effective date**

2 The Building Control (Buildability) Regulations 2011 was published in the Singapore Gazette on 15 April 2011 and shall come into operation on 15 July 2011.

**Background**

3 Since 2001, BCA's mandatory Buildability Framework has encouraged more labour efficient building designs and is one key contributing factor to improving site productivity. To steer the construction industry towards a higher level of productivity, BCA has formulated a Construction Productivity Roadmap aimed at achieving a 2% - 2.5% annual value-added productivity growth over the next 10 years. One of the key strategies under the Construction Productivity Roadmap is to strengthen the existing Buildability Framework to require designers to deliver more buildable designs upstream and builders to adopt more labour-efficient construction methods / technologies downstream. In this regard, BCA would be tightening the existing Buildable Design Score and mandating a new minimum Constructability Score

standard to influence builders to switch towards dry construction and technology adoption.

**Details of the Enhanced Framework**

4 The enhancement to the Buildability Framework covers two aspects:

**A. Tightened Buildable Design Requirements**

5 To bring about wider use of buildable designs and easy-to-build construction that would help to reduce dependence on labour, the existing Buildable Design Score has been tightened by dis-incentivising designs which need labour-intensive construction processes such as brick walls and walls with plastering finishes. For example, the Labour Saving Index (LSI) for brickwall has been significantly reduced from 0.30 to 0.05. At the same time, new buildable features such as the use of off-form external finished walls and industry-wide standardised floor heights with standardised precast staircases have been introduced to encourage more labour-saving designs.

6 With the above changes, although the current minimum buildable design scores remain and have not been raised, designers will need to improve their designs for better buildability downstream. Building works with GFA of 2,000m<sup>2</sup> or more which are submitted for planning permission on and after 15 July 2011 would be subjected to the tightened buildable design requirements.

**B. New Constructability Requirement**

7 A new component called Constructability Score has been introduced in the enhanced Buildability framework to encourage builders to move away from traditionally labour-intensive construction methods and switch to more labour-efficient construction processes. This Score is the responsibility of the builders. Builders would be required to comply with a new minimum Constructability Score for affected building works which encourages, for example, the use of system formwork in lieu of traditional formwork, climbing scaffolding in place of external scaffolding, and other innovative construction technologies and methods which reduce labour usage.

8 The Constructability Score requirement applies to all new building works and projects involving repairs, alterations or additions to existing buildings (A&A works) with GFA of 5,000m<sup>2</sup> or more which are submitted for planning permission on and after 15 July 2011. Builders are required to submit the Constructability Score for their projects:

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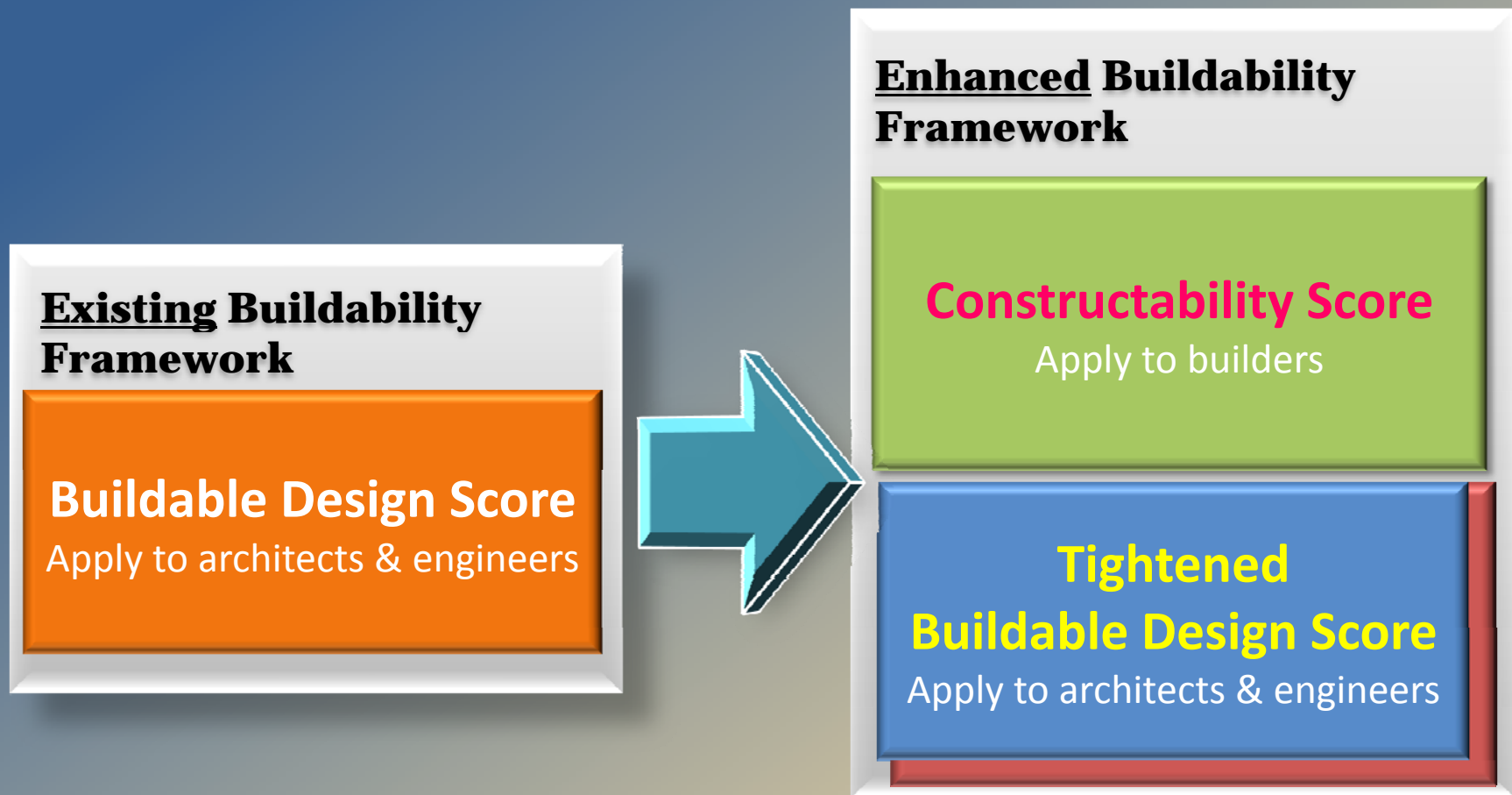
# New Code of Practice on Buildability

To be implemented on **15 July 2011**

*(Affects projects with planning application made on or after this date)*



# Enhancement to Buildability Framework





# Minimum Buildable Design Scores

No Change

Year	From Aug 2008 onward		
Category	GFA $\geq$ 2000m <sup>2</sup>	GFA $\geq$ 5000m <sup>2</sup>	GFA $\geq$ 25000m <sup>2</sup>
Residential (Landed)	60	65	68
Residential (non-landed)	67	72	75
Commercial	69	74	77
Industrial	69	74	77
Schools	64	69	72
Institutional & others	60	66	69



# Key Changes to Buildable Design Score Requirements

(1) Table 1 Structural System

(a) Changes to Precast Concrete System

STRUCTURAL SYSTEM	DESCRIPTION	LABOUR SAVING INDEX $S_s$
Precast Concrete System	Full precast	1.00
	Precast column/wall with flat plate and no perimeter beams	0.95
	Precast column/wall with flat plate and perimeter beams (beam depth $\leq 600$ mm)	0.85
	Precast column/wall with flat plate and perimeter beams (beam depth $> 600$ mm)	<b>0.80 (new)</b>
	Precast column/wall with flat slab and no perimeter beams	0.90
	Precast column/wall with flat slab and perimeter beams (beam depth $\leq 600$ mm)	0.80
	Precast column/wall with flat slab and perimeter beams (beam depth $> 600$ mm)	<b>0.75 (new)</b>
	Precast beam and precast slab	0.90
	Precast beam and precast column/wall	<b>0.85 <math>\rightarrow</math> 0.90</b>
	Precast column/wall and precast slab	<b>0.80 <math>\rightarrow</math> 0.90</b>
	Precast beam only	<b>removed</b>
	Precast slab only	<b>0.75 <math>\rightarrow</math> 0.70</b>
	Precast column/wall only	<b>0.75 <math>\rightarrow</math> 0.70</b>

# Key Changes to Buildable Design Score Requirements

(1) Table 1 Structural System (continued)

(b) Changes to Cast In-situ System

STRUCTURAL SYSTEM	DESCRIPTION	LABOUR SAVING INDEX $S_s$
Structural Steel System	Steel beam and steel column ( <i>without concrete encasement</i> )	0.95
	( <i>applicable only if steel decking or precast slab is adopted</i> ) Steel beam and steel column ( <i>with concrete encasement</i> )	0.85
Cast In-situ System	Flat plate with <b>no perimeter beams (<i>slab/beam ratios replaced</i>)</b>	0.90
	Flat plate with <b>perimeter beams (beam depth <math>\leq 600</math> mm) [<i>slab/beam ratios replaced</i>]</b>	0.80
	Flat plate with <b>perimeter beams (beam depth <math>&gt; 600</math> mm)</b>	<b>0.75 (new)</b>
	Flat slab with <b>no perimeter beams (<i>slab/beam ratios replaced</i>)</b>	0.85
	Flat slab with <b>perimeter beams (beam depth <math>\leq 600</math> mm) [<i>slab/beam ratios replaced</i>]</b>	0.75
	Flat slab with <b>perimeter beams (beam depth <math>&gt; 600</math> mm)</b>	<b>0.70 (new)</b>
	One-directional beam ( <b>renamed</b> )	<b>0.75 <math>\rightarrow</math> 0.70</b>
	Two-directional beam ( <b><i>slab/beam ratios removed</i></b> )	<b>0.45</b>

# Key Changes to Buildable Design Score Requirements

(1) Table 1 Structural System (continued)

(c) No Changes to Roof System

STRUCTURAL SYSTEM	DESCRIPTION	LABOUR SAVING INDEX $S_s$
Roof System  (non-RC)	Integrated metal roof on steel truss	0.90
	Metal roof on steel truss or timber truss	0.85
	Tiled roof on steel beam or precast concrete beam or timber beam	0.75
	Metal roof on cast in-situ beam	0.60
	Tiled roof with cast in-situ beam	0.55

# Key Changes to Buildable Design Score Requirements

(1) Table 1 Structural System (continued)

(d) Prefabricated reinforcement in cast In-situ components

Structural System	Description	Existing LSI $S_s$	Remarks
Prefabricated reinforcement in cast in-situ components	Floor mesh – in areas	0.03	No change
	Beam cages – in nos.	0.03	No change
	Column cages – in nos.	0.03	No change
	Wall mesh – in nos.	0.04*	<b>0.03 (revised)</b>
	Continuous stirrup – in nos.	N.A.	<b>0.03 (new)</b>

*\* Placed as part of CIS wall system under existing Table 2 – Wall System*

# Key Changes to Buildable Design Score Requirements

(2) Table 2 Wall System

(a) Revisions to LSIs

WALL SYSTEM	DESCRIPTION	LABOUR SAVING INDEX $S_w$
Curtain wall / full height glass partition / dry partition wall / prefabricated railing	Curtain wall / Full height glass partition	1.00
	Prefabricated railing	1.00
	Dry partition wall	1.00
	Dry Partition wall with tile / stone finishes	0.90 (new)
Precast Concrete Panel / Wall	Precast concrete panel / wall with skim coat	0.90
	Precast Concrete panel / wall with plastering, tile / stone finishes	0.80 → 0.60
PC Formwork	PC formwork with skim coat	0.75
	PC formwork with plastering, tile / stone finishes	0.50 → 0.40

# Key Changes to Buildable Design Score Requirements

(2) Table 2 Wall System (continued)

(a) Revisions to LSIs (continued)

WALL SYSTEM	DESCRIPTION	LABOUR SAVING INDEX $S_w$
Cast In-situ RC Wall	Cast in-situ RC wall with skim coat	0.70
	Cast in-situ RC wall with plastering, tile / stone finishes	<b>0.50 → 0.40</b>
Cast In-situ RC Wall with prefabricated reinforcement	<b>Placed in Table 1 : Prefabricated reinforcement in cast in-situ components</b>	
Precision Blockwall	Precision blockwall with skim coat	<b>0.45 → 0.40</b>
	Precision blockwall with plastering, tile / stone finishes	<b>0.40 → 0.10</b>
	Precision blockwall (external wall)	<b>removed</b>
Brickwall / Blockwall	Brickwall / blockwall with or without plastering	<b>0.30 → 0.05</b>

# Key Changes to Buildable Design Score Requirements

(2) Table 2 Wall System (continued)

(b) New Bonus Points

DESCRIPTION	LABOUR SAVING INDEX $S_s$
Off-form external finished wall/column (for Cast in-situ RC wall and PC formwork)	0.15 (new)



# Key Changes to Buildable Design Score Requirements

(3) Table 3 Other Buildable Design Features

(a) Revisions to Standardisation of Column, Beam, Door Opening & Window Sizes

BUILDABLE FEATURES		MODULE	UNIT OF COVERAGE	N VALUE
				PERCENTAGE OF COVERAGE
				≥ 90% (existing : ≥ 80%)
1. Standardisation				
1.1	Columns (3 most common sizes)	0.5M	no.	2.00
1.2	Beams (3 most common sizes)	0.5M	no.	2.00
1.3	Door leaf openings (width) (3 most common sizes)	0.5M	no.	1.00
1.4	Windows (3 most common sizes)	1M/1M	no.	1.00

# Key Changes to Buildable Design Score Requirements

(3) Table 3 Other Buildable Design Features (continued)

(b) Revisions to Grids

BUILDABLE FEATURES		MODULE	UNIT OF COVERAGE	N VALUE	
				PERCENTAGE OF COVERAGE	
				≥70% to < 90% (existing : ≥65% to < 80%)	≥90% (existing : ≥ 80%)
2. Grids					
2.1(a)	<b>Repetition of floor-to-floor height (For blocks more than 6 storey)</b> <i>The repetition should omit bottom floor, top floor and above.</i>	0.5M	no.	1.50	2.00
2.1(b)	<b>Repetition of floor-to-floor height (For blocks up to 6 storey)</b> <i>The repetition should omit bottom floor, top floor and above. Only applicable if there are at least 2 floor heights remaining after the floor omission.</i>	0.5M	no.	0.75	1.00
2.2(a)	<b>Vertical repetition of structural floor layout (For blocks more than 6 storey)</b> <i>The repetition should omit bottom floor, top floor and above.</i>		area	1.50	2.00
2.2(b)	<b>Vertical repetition of structural floor layout (For blocks up to 6 storey)</b> <i>The repetition should omit bottom floor, top floor and above. Only applicable if there are at least 2 floors remaining after the floor omission.</i>		area	0.75	1.00
2.3	Repetition of Horizontal Grids	6M	no.	1.50	2.00

# Key Changes to Buildable Design Score Requirements

(3) Table 3 Other Buildable Design Features (continued)

(c) Revisions to Others

BUILDABLE FEATURES		UNIT OF COVERAGE	N VALUE
			PERCENTAGE OF COVERAGE
			≥90% (existing : ≥ 80%)
3. Others			
3.1	Multi-tier precast columns	no.	2.00
3.2	Precast or pre-assembled/ metal staircases	no.	2.00
3.3	Precast meter chambers (for landed residential developments)	no.	1.50 → 1.00
3.4	Precast refuse chutes	no.	1.50
3.5	Precast service risers	no.	1.00
3.6	No screeding for any flooring	area	1.00 → 3.00
3.7	No column stumps	no.	removed
3.8	Precast bay windows	no.	removed
3.9	Precast planter boxes	no.	removed

# Key Changes to Buildable Design Score Requirements

(3) Table 3 Other Buildable Design Features (continued)

(d) Revisions to Bonus Points

Bonus Points		UNIT OF COVERAGE	PERCENTAGE OF COVERAGE	
			≥65% TO < 80%	≥ 80%
Single Integrated Components				
A.1	Prefabricated bathroom/toilet units complete with piping/wiring	no.	2.00 → 3.00	3.00 → 4.00
A.2	Precast household shelter	no.	2.00	3.00
Industry Standardisation				
A.3(a)	Typical storeys standardised to either 2.8m, 3.15m, 3.5m, 4.2m or 4.55m height and with precast staircase of riser height of 175mm & tread width of 250mm or 275mm	no.		2.00 (new)
A.3(b)	Typical storeys standardised to either 3.15m or 4.2m height and with precast staircase of riser height of 150mm & tread width of 300mm	no.		2.00 (new)

# Impact to Industry

1. Use more precast construction

2. Use more buildable wall systems with or without skim coat

3. Increase Percentage Coverage for Size Standardisation and  
Grids Repetition

4. Use Industry Standardisation of typical floor height with  
precast staircases

# Submission Procedures

## *Current*

- As-built Buildable Design Score to be submitted ***within 1 month after TOP***

## *Change*

- As-built Buildable Design Score to be submitted **together with TOP/CSC application**

# New Constructability Appraisal System

	Main Components	Construction Methods / Technologies
1	<b>Structural System</b> <div>Max 60 points</div>	<ul style="list-style-type: none"> <li>• External access system</li> <li>• Formwork system</li> <li>• Innovative method, system, process</li> </ul>
2	<b>Architectural, Mechanical, Electrical &amp; Plumbing System</b> <div>Max 50 points</div>	<ul style="list-style-type: none"> <li>• No screed on floors</li> <li>• No plastering of RC / block walls</li> <li>• Spray Painting</li> <li>• Air conditioning mechanical ventilation</li> <li>• Innovative method, system, process</li> </ul>
3	<b>Good Industry Practices</b> <div>Max 10 points</div>	<ul style="list-style-type: none"> <li>• Use of BIM</li> <li>• Trade productivity monitoring system</li> <li>• Work manuals and site mock-ups</li> <li>• Monthly work study sessions to improve work processes</li> <li>• Real time monitoring on site</li> <li>• Tool box meeting and sub-contractors coordination meeting</li> </ul>



# Structural Component

80% manpower in structural works

- Focus on external access system and formwork systems



- Traditional construction methods given much lower points compared to labour efficient systems
- Minimum points stipulated

# Architectural Component



No screed on floor - to immediately receive tile/stone finish using thin bed adhesive



No plaster on walls – to immediately receive tile/ stone/ wallpaper/ paint

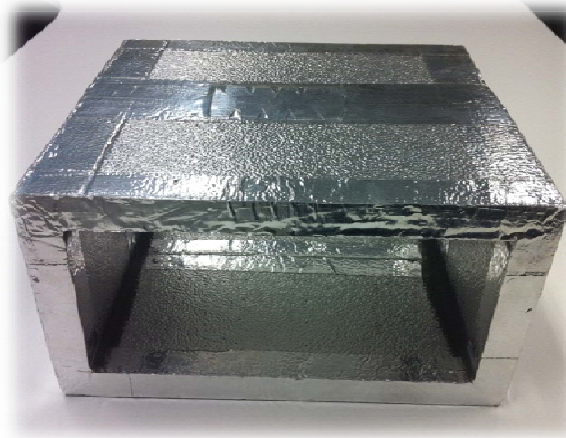


Use of spray painting

# Mechanical, Electrical and Plumbing



Pre-insulated pipe



Pre-fabricated duct

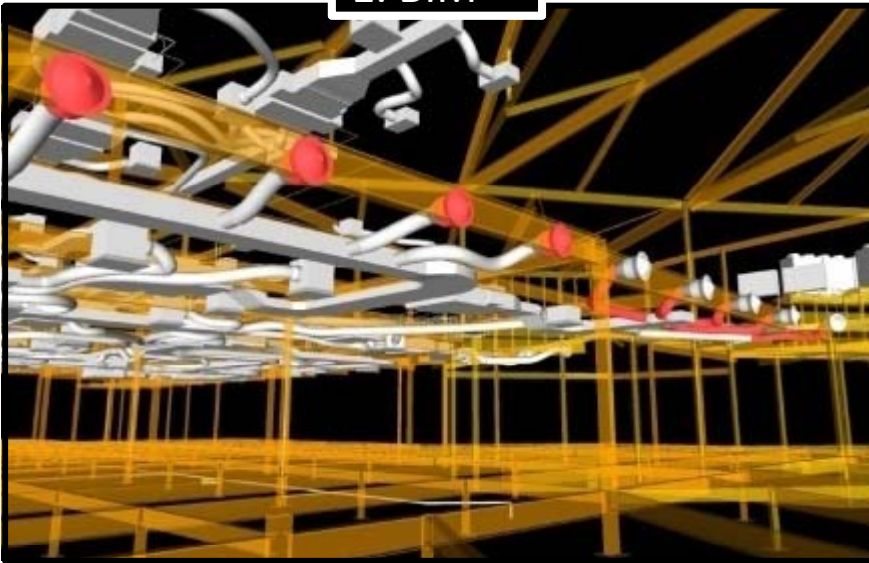


Flexible water pipe



# Good Industry Practices

1. BIM



Use of BIM to check for clashes between M&E services, structural provision and architectural objects

2. Mock up



Site mock-ups (till the end of the project) to show how works should be done properly

# Good Industry Practices

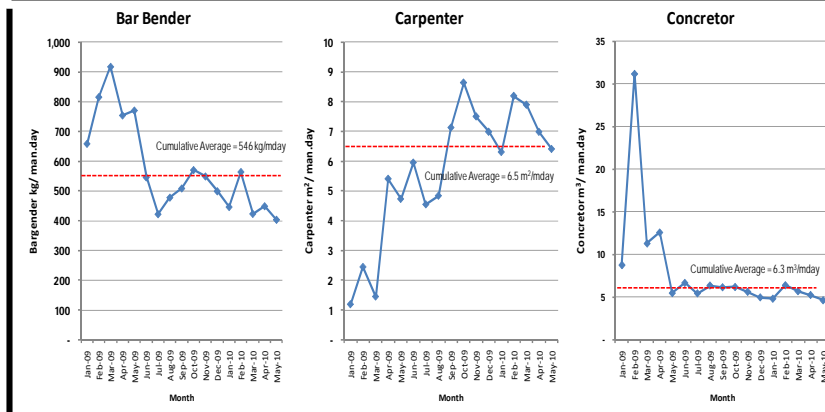
## 3. Monthly work study session



## 5. Real time monitoring on site



## 4. Trade productivity monitoring system



# Minimum Constructability Score

Implement on 15 July 2011

CATEGORY OF BUILDING WORK / DEVELOPMENT	MINIMUM CONSTRUCTABILITY SCORE	
	$5,000 \text{ m}^2 \leq \text{GFA} < 25,000 \text{ m}^2$	$\text{GFA} \geq 25,000 \text{ m}^2$
Residential (landed)	<b>40</b>  (Minimum <b>25</b> points from Structural System)	<b>50</b>  (Minimum <b>35</b> points from Structural System)
Residential (non-landed)		
Commercial		
Industrial		
School		
Institutional and others		

# Submission Process

- Constructability Score requirement will apply to **projects with GFA  $\geq 5,000\text{m}^2$**
- Builders to submit the Constructability Score:
  - when they apply for the **permit to commence work OR**
  - within **3 months (or 6 months for D&B projects)** after the permit has been issued if they require more time to plan for the type of construction methods / technologies to be adopted in the project
- Developer to submit **Certificate of Compliance** of Constructability Score at **TOP / CSC**



**THANK YOU**

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