

# Construction Cost Handbook SINGAPORE 2018

Arcadis Singapore Pte Ltd



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Twenty-fourth Edition 2018

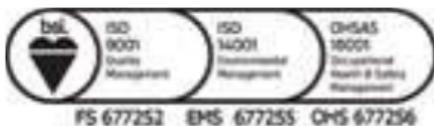
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Unless otherwise stated, costs reflected in this handbook are current as at **4<sup>th</sup> Quarter 2017**.

*Business Registration No:* 199508550H



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## Electronic Cost Handbook

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## INTRODUCTION

Arcadis Singapore has been involved in the publication of construction costs handbooks for countries such as China and Hong Kong, India, Indonesia, Korea, Malaysia, Philippines, Thailand and Vietnam and is also the editor of the Spon's Asia Pacific Construction Costs Handbook.

As in the previous editions, the Arcadis Handbook - Singapore 2018 focuses on the construction cost profile of Singapore and those of the major cities in Asia.

The handbook is structured to serve as a general reference guide on construction cost indicators in Asia.

The information contained in this handbook has been compiled by Arcadis Singapore Pte Ltd. Any further information and/or if advice relating to particular projects is required, please contact any of the regional offices listed under the Directory of Offices at the end of this handbook.

Arcadis Singapore Pte Ltd

## OUR CORE VALUES



### People First

We care for each other and create a safe and respectful working environment where our people can grow, perform, and succeed.



### Integrity

We always work to the highest professional and ethical standards and establish trust by being open, honest and responsible.



### Client Success

We are passionate about our clients' success and bring insights, agility, and innovation to co-create value.



### Collaboration

We value the power of diversity and our global capabilities and deliver excellence by working as One Arcadis.



### Sustainability

We base our actions for clients and communities on environmental responsibility and social and economic advancement.

# 2017

	January						February				
Week No.	52	1	2	3	4	5	5	6	7	8	9
Monday		2	9	16	23	30		6	13	20	27
Tuesday		3	10	17	24	31		7	14	21	28
Wednesday		4	11	18	25		1	8	15	22	
Thursday		5	12	19	26		2	9	16	23	
Friday		6	13	20	27		3	10	17	24	
Saturday		7	14	21	28		4	11	18	25	
Sunday	1	8	15	22	29		5	12	19	26	
	March					April					
Week No.	9	10	11	12	13	13	14	15	16	17	
Monday		6	13	20	27		3	10	17	24	
Tuesday		7	14	21	28		4	11	18	25	
Wednesday	1	8	15	22	29		5	12	19	26	
Thursday	2	9	16	23	30		6	13	20	27	
Friday	3	10	17	24	31		7	14	21	28	
Saturday	4	11	18	25		1	8	15	22	29	
Sunday	5	12	19	26		2	9	16	23	30	
	May					June					
Week No.	18	19	20	21	22	22	23	24	25	26	
Monday	1	8	15	22	29		5	12	19	26	
Tuesday	2	9	16	23	30		6	13	20	27	
Wednesday	3	10	17	24	31		7	14	21	28	
Thursday	4	11	18	25		1	8	15	22	29	
Friday	5	12	19	26		2	9	16	23	30	
Saturday	6	13	20	27		3	10	17	24		
Sunday	7	14	21	28		4	11	18	25		
	July						August				
Week No.	26	27	28	29	30	31	31	32	33	34	35
Monday		3	10	17	24	31		7	14	21	28
Tuesday		4	11	18	25		1	8	15	22	29
Wednesday		5	12	19	26		2	9	16	23	30
Thursday		6	13	20	27		3	10	17	24	31
Friday		7	14	21	28		4	11	18	25	
Saturday	1	8	15	22	29		5	12	19	26	
Sunday	2	9	16	23	30		6	13	20	27	
	September					October					
Week No.	35	36	37	38	39	39	40	41	42	43	44
Monday		4	11	18	25		2	9	16	23	30
Tuesday		5	12	19	26		3	10	17	24	31
Wednesday		6	13	20	27		4	11	18	25	
Thursday		7	14	21	28		5	12	19	26	
Friday	1	8	15	22	29		6	13	20	27	
Saturday	2	9	16	23	30		7	14	21	28	
Sunday	3	10	17	24		1	8	15	22	29	
	November					December					
Week No.	44	45	46	47	48	48	49	50	51	52	
Monday		6	13	20	27		4	11	18	25	
Tuesday		7	14	21	28		5	12	19	26	
Wednesday	1	8	15	22	29		6	13	20	27	
Thursday	2	9	16	23	30		7	14	21	28	
Friday	3	10	17	24		1	8	15	22	29	
Saturday	4	11	18	25		2	9	16	23	30	
Sunday	5	12	19	26		3	10	17	24	31	

## 2018

● Public Holidays

■ School Holidays

	January					February						
Week No.	1	2	3	4	5	5	6	7	8	9		
Monday	1	8	15	22	29		5	12	19	26		
Tuesday	2	9	16	23	30		6	13	20	27		
Wednesday	3	10	17	24	31		7	14	21	28		
Thursday	4	11	18	25	1	8	15	22				
Friday	5	12	19	26	2	9	16	23				
Saturday	6	13	20	27	3	10	17	24				
Sunday	7	14	21	28	4	11	18	25				
	March					April						
Week No.	9	10	11	12	13	13	14	15	16	17	18	
Monday		5	12	19	26		2	9	16	23	30	
Tuesday		6	13	20	27		3	10	17	24		
Wednesday		7	14	21	28		4	11	18	25		
Thursday	1	8	15	22	29		5	12	19	26		
Friday	2	9	16	23	30		6	13	20	27		
Saturday	3	10	17	24	31		7	14	21	28		
Sunday	4	11	18	25	1	8	15	22	29			
	May					June						
Week No.	18	19	20	21	22	22	23	24	25	26		
Monday		7	14	21	28		4	11	18	25		
Tuesday	1	8	15	22	29		5	12	19	26		
Wednesday	2	9	16	23	30		6	13	20	27		
Thursday	3	10	17	24	31		7	14	21	28		
Friday	4	11	18	25	1	8	15	22	29			
Saturday	5	12	19	26	2	9	16	23	30			
Sunday	6	13	20	27	3	10	17	24				
	July					August						
Week No.	26	27	28	29	30	31	31	32	33	34	35	
Monday		2	9	16	23	30		6	13	20	27	
Tuesday		3	10	17	24	31		7	14	21	28	
Wednesday		4	11	18	25	1	8	15	22	29		
Thursday		5	12	19	26	2	9	16	23	30		
Friday		6	13	20	27	3	10	17	24	31		
Saturday		7	14	21	28	4	11	18	25			
Sunday	1	8	15	22	29	5	12	19	26			
	September					October						
Week No.	35	36	37	38	39	40	41	42	43	44		
Monday		3	10	17	24		1	8	15	22	29	
Tuesday		4	11	18	25		2	9	16	23	30	
Wednesday		5	12	19	26		3	10	17	24	31	
Thursday		6	13	20	27		4	11	18	25		
Friday		7	14	21	28		5	12	19	26		
Saturday	1	8	15	22	29		6	13	20	27		
Sunday	2	9	16	23	30		7	14	21	28		
	November					December						
Week No.	44	45	46	47	48	48	49	50	51	52	1/19	
Monday		5	12	19	26		3	10	17	24	31	
Tuesday		6	13	20	27		4	11	18	25		
Wednesday		7	14	21	28		5	12	19	26		
Thursday	1	8	15	22	29		6	13	20	27		
Friday	2	9	16	23	30		7	14	21	28		
Saturday	3	10	17	24		1	8	15	22	29		
Sunday	4	11	18	25		2	9	16	23	30		

# 2019

	January					February					
Week No.	1	2	3	4	5	5	6	7	8	9	
Monday		7	14	21	28		4	11	18	25	
Tuesday	1	8	15	22	29		5	12	19	26	
Wednesday	2	9	16	23	30		6	13	20	27	
Thursday	3	10	17	24	31		7	14	21	28	
Friday	4	11	18	25		1	8	15	22		
Saturday	5	12	19	26		2	9	16	23		
Sunday	6	13	20	27		3	10	17	24		
	March					April					
Week No.	9	10	11	12	13	14	15	16	17	18	
Monday		4	11	18	25	1	8	15	22	29	
Tuesday		5	12	19	26	2	9	16	23	30	
Wednesday		6	13	20	27	3	10	17	24		
Thursday		7	14	21	28	4	11	18	25		
Friday	1	8	15	22	29	5	12	19	26		
Saturday	2	9	16	23	30	6	13	20	27		
Sunday	3	10	17	24	31	7	14	21	28		
	May					June					
Week No.	18	19	20	21	22	22	23	24	25	26	
Monday		6	13	20	27		3	10	17	24	
Tuesday		7	14	21	28		4	11	18	25	
Wednesday	1	8	15	22	29		5	12	19	26	
Thursday	2	9	16	23	30		6	13	20	27	
Friday	3	10	17	24	31		7	14	21	28	
Saturday	4	11	18	25		1	8	15	22	29	
Sunday	5	12	19	26		2	9	16	23	30	
	July					August					
Week No.	27	28	29	30	31	31	32	33	34	35	
Monday	1	8	15	22	29		5	12	19	26	
Tuesday	2	9	16	23	30		6	13	20	27	
Wednesday	3	10	17	24	31		7	14	21	28	
Thursday	4	11	18	25		1	8	15	22	29	
Friday	5	12	19	26		2	9	16	23	30	
Saturday	6	13	20	27		3	10	17	24	31	
Sunday	7	14	21	28		4	11	18	25		
	September					October					
Week No.	35	36	37	38	39	40	40	41	42	43	44
Monday		2	9	16	23	30		7	14	21	28
Tuesday		3	10	17	24		1	8	15	22	29
Wednesday		4	11	18	25		2	9	16	23	30
Thursday		5	12	19	26		3	10	17	24	31
Friday		6	13	20	27		4	11	18	25	
Saturday		7	14	21	28		5	12	19	26	
Sunday	1	8	15	22	29		6	13	20	27	
	November					December					
Week No.	44	45	46	47	48	48	49	50	51	52	1
Monday		4	11	18	25		2	9	16	23	30
Tuesday		5	12	19	26		3	10	17	24	31
Wednesday		6	13	20	27		4	11	18	25	
Thursday		7	14	21	28		5	12	19	26	
Friday	1	8	15	22	29		6	13	20	27	
Saturday	2	9	16	23	30		7	14	21	28	
Sunday	3	10	17	24		1	8	15	22	29	

## 2020

	January					February					
Week No.	1	2	3	4	5	5	6	7	8	9	
Monday		6	13	20	27		3	10	17	24	
Tuesday		7	14	21	28		4	11	18	25	
Wednesday	1	8	15	22	29		5	12	19	26	
Thursday	2	9	16	23	30		6	13	20	27	
Friday	3	10	17	24	31		7	14	21	28	
Saturday	4	11	18	25		1	8	15	22	29	
Sunday	5	12	19	26		2	9	16	23		
	March					April					
Week No.	9	10	11	12	13	14	14	15	16	17	18
Monday		2	9	16	23	30		6	13	20	27
Tuesday		3	10	17	24	31		7	14	21	28
Wednesday		4	11	18	25		1	8	15	22	29
Thursday		5	12	19	26		2	9	16	23	30
Friday		6	13	20	27		3	10	17	24	
Saturday		7	14	21	28		4	11	18	25	
Sunday	1	8	15	22	29		5	12	19	26	
	May					June					
Week No.	18	19	20	21	22	23	24	25	26	27	
Monday		4	11	18	25		1	8	15	22	29
Tuesday		5	12	19	26		2	9	16	23	30
Wednesday		6	13	20	27		3	10	17	24	
Thursday		7	14	21	28		4	11	18	25	
Friday	1	8	15	22	29		5	12	19	26	
Saturday	2	9	16	23	30		6	13	20	27	
Sunday	3	10	17	24	31		7	14	21	28	
	July					August					
Week No.	27	28	29	30	31	31	32	33	34	35	36
Monday		6	13	20	27		3	10	17	24	31
Tuesday		7	14	21	28		4	11	18	25	
Wednesday	1	8	15	22	29		5	12	19	26	
Thursday	2	9	16	23	30		6	13	20	27	
Friday	3	10	17	24	31		7	14	21	28	
Saturday	4	11	18	25		1	8	15	22	29	
Sunday	5	12	19	26		2	9	16	23	30	
	September					October					
Week No.	36	37	38	39	40	40	41	42	43	44	
Monday		7	14	21	28		5	12	19	26	
Tuesday	1	8	15	22	29		6	13	20	27	
Wednesday	2	9	16	23	30		7	14	21	28	
Thursday	3	10	17	24		1	8	15	22	29	
Friday	4	11	18	25		2	9	16	23	30	
Saturday	5	12	19	26		3	10	17	24	31	
Sunday	6	13	20	27		4	11	18	25		
	November					December					
Week No.	44	45	46	48	49	50	50	51	52	53	54
Monday		2	9	16	23	30		7	14	21	28
Tuesday		3	10	17	24		1	8	15	22	29
Wednesday		4	11	18	25		2	9	16	23	30
Thursday		5	12	19	26		3	10	17	24	31
Friday		6	13	20	27		4	11	18	25	
Saturday		7	14	21	28		5	12	19	26	
Sunday	1	8	15	22	29		6	13	20	27	







# CONSTRUCTION TRENDS

# 1

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Construction Outlook

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Tender Price Indices

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Material Price Indices

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## CONSTRUCTION OUTLOOK<sup>1</sup>

### Construction Market Review in 2017

Total construction demand<sup>2</sup> moderated further from \$26.4 billion in 2016 to a preliminary estimate of \$24.5 billion in 2017 as the private sector construction demand continued to decline in 2017 and registered less than half of what it had been during the peak years from 2010-2014. Public sector construction demand held steady at \$15.5 billion, up slightly from \$15.4 billion in 2016. Although a higher public sector projection was shared in January 2017, longer preparation times for a small number of very major public sector infrastructure projects resulted in a rescheduling of these works to 2018. On the other hand, the preliminary private sector construction demand of \$9.0b was within the original forecast range of \$8.0 billion to \$11.0 billion.

Following the reduction in private sector construction demand since 2015, total nominal construction output<sup>3</sup> declined from \$35.2 billion in 2016 to about \$28 billion in 2017. In tandem with the slowdown in the construction sector, its share of economic GDP fell from 4.7% in 2016 to 4.2% in 2017 amid the recovery in other economic sectors such as the manufacturing sector.

### Construction Demand Outlook in 2018

Looking ahead, total construction demand is projected to expand from \$24.5 billion in 2017 to between \$26 billion and \$31 billion in 2018, based on the Building and Construction Authority (BCA)'s latest forecast which takes into account the prevailing market developments and economic outlook. The public sector construction demand is projected to strengthen from \$15.5 billion in 2017 to between \$16 billion and \$19 billion in 2018, boosted by an anticipated increase in demand for institutional & other buildings such as healthcare facilities and civil engineering works in 2018. Likewise,

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<sup>1</sup> All currencies stated in this paper are in nominal Singapore dollars unless otherwise stated.

<sup>2</sup> Construction demand is measured by the total value of construction contracts awarded; and all demand figures in this paper exclude reclamation projects.

<sup>3</sup> Construction output is measured by the total value of certified progress payments.

the private sector's construction demand is expected to improve from \$9 billion in 2017 to between \$10 billion and \$12 billion in 2018 as construction activity benefits from a strengthened economic outlook and the upturn in property market sentiment.

## **Residential Construction Demand**

### **Public Housing**

The total public residential construction demand is expected to remain steady at between \$2.8 billion and \$3.1 billion in 2018. These will come from new public housing developments planned in various areas such as Sengkang, Tampines and the upcoming Tengah town as well as upgrading works like the Home Improvement Programme (HIP) including Enhancement for Active Seniors (EASE) to provide conducive and elder-friendly living environment for residents in various precincts.

### **Private Housing**

The Singapore's property market has shown nascent signs of improved market sentiment as evidenced by the higher take-up rate in new launches and the surge in en bloc deals in 2017. However, given the time-lag between the en bloc sales and the redevelopment of en bloc sites owing to statutory processes, the impact of the recent wave of collective sales on residential construction demand is likely to be felt more significantly only in the later part of 2018. Hence, private residential construction demand is projected to improve moderately from the \$3 billion recorded in 2017 to between \$3.0 billion and \$3.6 billion in 2018.

## **Commercial Construction Demand**

On the back of improved economic prospects and anticipated uptick in demand for commercial space driven by multinational corporations, commercial construction demand is projected to increase steadily from \$2.1 billion in 2017 to between \$2.2 billion and \$2.8 billion in 2018.

## **Industrial Construction Demand**

Total industrial construction demand is projected to be

between \$3.3 billion and \$4.6 billion in 2018, as compared to \$4.3 billion in 2017. The private sector industrial construction demand is expected to take the lead, backed by the recent turnaround in the manufacturing sector which is likely to sustain the development of private sector industrial space in 2018.

## **Institutional & Other Building Construction Demand**

Total institutional & other building construction demand is projected to increase to between \$5.0 billion and \$5.7 billion in 2018, from the \$3 billion registered in 2017. The public sector will continue to underpin the bulk of total institutional building demand through the construction of more healthcare facilities as well as various educational facilities for Institutes of Higher Learning (IHL). In addition, a significant amount of private sector investments in developing nature themed attractions and recreational facilities for tourists at Mandai Park are also likely to bolster the construction demand of this category.

## **Civil Engineering Construction Demand**

A total of \$9.6 billion to \$11.2 billion worth of civil engineering projects is anticipated to be awarded in 2018, driven by a number of sizeable public sector infrastructure projects, such as various major contracts for the North-South Corridor, rail systems and Deep Tunnel Sewerage System (DTSS) phase 2. Moreover, the rolling out of the remaining package of the Runway 3 by Changi Airport Group is also anticipated to boost the private sector civil engineering construction demand in 2018.

## **Construction Outlook for 2019-2022**

BCA anticipates a continual improvement of construction demand over the medium term. The construction demand is projected to reach between \$26 billion and \$33 billion per annum for 2019-2020 and continue to pick up to between \$28 billion and \$35 billion per annum for 2021-2022. The public sector will continue to lead demand and is expected to contribute \$16 billion to \$20 billion per annum in 2019-2022 with similar proportions of demand coming from building projects and civil engineering works.

## Conclusion

Construction demand moderated further from between \$26 billion and \$27 billion per year in 2015 and 2016 to \$24.5 billion in 2017 as a result of the slowdown in private sector construction demand. Looking ahead to 2018 and beyond, the industry is poised for a gradual recovery, supported by a strong pipeline of major public infrastructure projects, more positive market sentiment arising from improved economic climate as well as emerging opportunities associated with upcoming redevelopment works of collective sale sites.

Overall, construction output is expected to stay muted at between \$26 billion and \$28 billion in 2018 but is likely to strengthen over the medium term beyond 2018, in view of the steady pipeline of public sector projects intended to keep Singapore globally competitive. New investments in Changi Airport Terminal 5, Tuas mega port and new MRT lines to enhance air, sea and land connectivity, and new housing developments in Jurong Lake District, Punggol and Woodlands have been lined up to shape the future built environment landscape.

*Contributed by:  
Economic Research Department, Strategic Planning Office  
Building and Construction Authority  
23 January 2018*

# 1 CONSTRUCTION TRENDS

**Table 1: Private Sector Contracts Awarded (\$billion)**

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
2008	6.4	8.3	3.7
2009	3.9	1.6	1.8
2010	8.7	3.1	3.7
2011	9.1	4.2	5.7
2012	8.5	2.9	6.1
2013	9.6	3.7	5.2
2014	6.5	3.7	6.0
2015	4.0	1.9	4.5
2016	3.2	2.9	2.8
2017#	3.0	2.0	2.6
2018##	3.0 - 3.6	2.1 - 2.5	2.8 - 3.3

**Table 2: Public Sector Contracts Awarded (\$billion)**

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
2008	4.7	0.1	0.1
2009	2.8	0.1	0.2
2010	2.8	0.2	1.1
2011	6.2	0.05	0.5
2012	3.3	0.1	0.3
2013	6.4	0.1	0.3
2014	4.8	0.1	0.6
2015	3.8	0.3	1.2
2016	3.3	0.1	0.8
2017#	3.1	0.1	1.7
2018##	2.8 - 3.1	0.1 - 0.3	0.5 - 1.3

Note: # preliminary figure, ## forecast

INSTITUTIONAL	TOTAL BLDG	CIVIL ENG*	TOTAL
0.9	19.3	0.9	20.2
0.5	7.8	0.8	8.6
2.7	18.2	0.8	19.0
0.6	19.6	0.6	20.2
1.0	18.6	2.7	21.2
1.1	19.5	1.4	20.9
1.9	18.1	1.4	19.5
1.7	12.1	1.7	13.8
0.6	9.5	1.5	11.0
0.7	8.3	0.6	9.0
1.1 - 1.3	9.0 - 10.7	1.0 - 1.3	10.0 - 12.0

INSTITUTIONAL	TOTAL BLDG	CIVIL ENG*	TOTAL
2.9	7.8	7.7	15.5
2.6	5.7	8.2	13.9
2.3	6.4	2.2	8.6
2.4	9.2	6.1	15.3
3.7	7.4	2.1	9.5
2.6	9.4	5.5	14.9
5.2	10.8	8.5	19.2
4.1	9.4	3.8	13.3
3.7	7.9	7.5	15.4
2.3	7.3	8.3	15.5
3.9 - 4.4	7.3 - 9.2	8.7 - 9.8	16.0 - 19.0

Source : BCA as at 11 January 2018; \* Without Reclamation

## TENDER PRICE INDICES

### Generally

Tender Price Index (TPI) is used to track the historical trends in the movement of tender price level of construction contracts let out during the respective periods. In addition to reflecting the changes in material and labour costs, TPI also takes into account the elements of competition in the market place and the risk and profit factored in the Contractors' bids. Besides being use to establish historical cost trends, TPI also serve as a useful tool to provide an indication of future cost trends.

### Indices

Besides Arcadis Singapore Tender Price Index (TPI), the other established index is the Building and Construction Authority Tender Price Index (BCA TPI).

BCA TPI provides information on the general movement of tender prices in Singapore construction industry for the three sectors namely Public Residential (HDB flats), Private Non-Landed Residential and Commercial Office whereas Arcadis Singapore TPI gives an indication of tender price movements based on the projects handled by Arcadis Singapore Pte Ltd.

### Price Movement

Based on Arcadis Singapore's data, tender prices for 2017 have declined approximately 2.5% year-on-year (i.e. 4th Quarter 2017 versus 4th Quarter 2016).

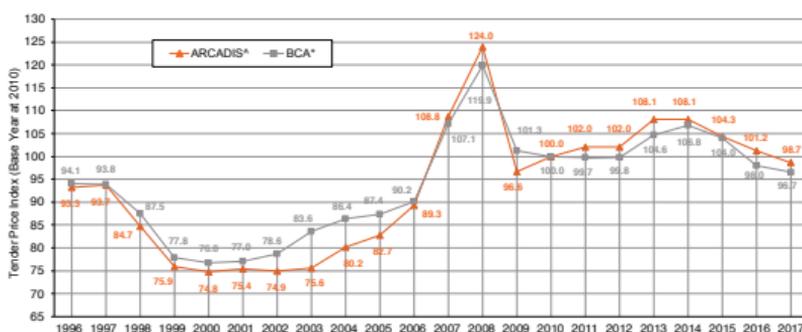
According to preliminary figures published by BCA on 6 February 2018, total construction demand in 2017 was \$24.8 billion, a decline of approximately 6% as compared to 2016. Public sector construction demand increased slightly from \$15.4 billion in 2016 to \$15.8 billion in 2017. While private sector construction demand fell from \$11.0 billion in 2016 to \$9.0 billion in 2017, albeit within the original forecast range of \$8 billion to \$11.0 billion.

Based on BCA's forecast, total construction demand (excluding reclamation works) for 2018 is projected to expand to between \$26 billion and \$31 billion. Public sector construction demand is projected to strengthen to between \$16 billion and \$19 billion, contributing to approximately 60% of the total construction demand. Likewise, private sector construction demand is expected to improve to between \$10 billion and \$12 billion.

Looking ahead, with the anticipated rise in commodity and raw construction material prices as well as the project demand in private sector market arising from the surge in en-bloc redevelopment projects, tender prices are anticipated to remain competitive as contractors are filling up their order books.

Nonetheless, the price movement (if any) for the whole year of 2018 is anticipated to be in the range of -1% to +2%, the actual level depending on the prevailing market situation and any adverse ramifications of the prevailing economic instability.

YEAR	ARCADIS <sup>A</sup>		BCA <sup>A</sup>	
	INDEX	INFLATION	INDEX	INFLATION
1996	93.3	-	94.1	-
1997	93.7	0.4%	93.8	-0.3%
1998	84.7	-9.6%	87.5	-6.7%
1999	75.9	-10.4%	77.8	-11.1%
2000	74.8	-1.4%	76.8	-1.3%
2001	75.4	0.8%	77.0	0.3%
2002	74.9	-0.7%	78.6	2.1%
2003	75.6	0.9%	83.6	6.4%
2004	80.2	6.1%	86.4	3.3%
2005	82.7	3.1%	87.4	1.2%
2006	89.3	8.0%	90.2	3.2%
2007	108.8	21.8%	107.1	18.7%
2008	124.0	14.0%	119.9	12.0%
2009	96.6	-20.0%	101.3	-15.5%
2010	100.0	3.5%	100.0	-1.3%
2011	102.0	2.0%	99.7	-0.3%
2012	102.0	0.0%	99.8	0.1%
2013	108.1	6.0%	104.6	4.8%
2014	108.1	0.0%	106.8	2.1%
2015	104.3	-3.5%	104.0	-2.6%
2016	101.2	-3.0%	98.0	-5.8%
2017	98.7	-2.5%	96.7	-1.3%



Source: <sup>A</sup>Building and Construction Authority as at 9 February 2018. With effect from the 1<sup>st</sup> Quarter of 2015, BCA has implemented the new TPI series with Base Year 2010 = 100. The TPI chart shown above has been amended accordingly to reflect the Base Year as Year 2010.

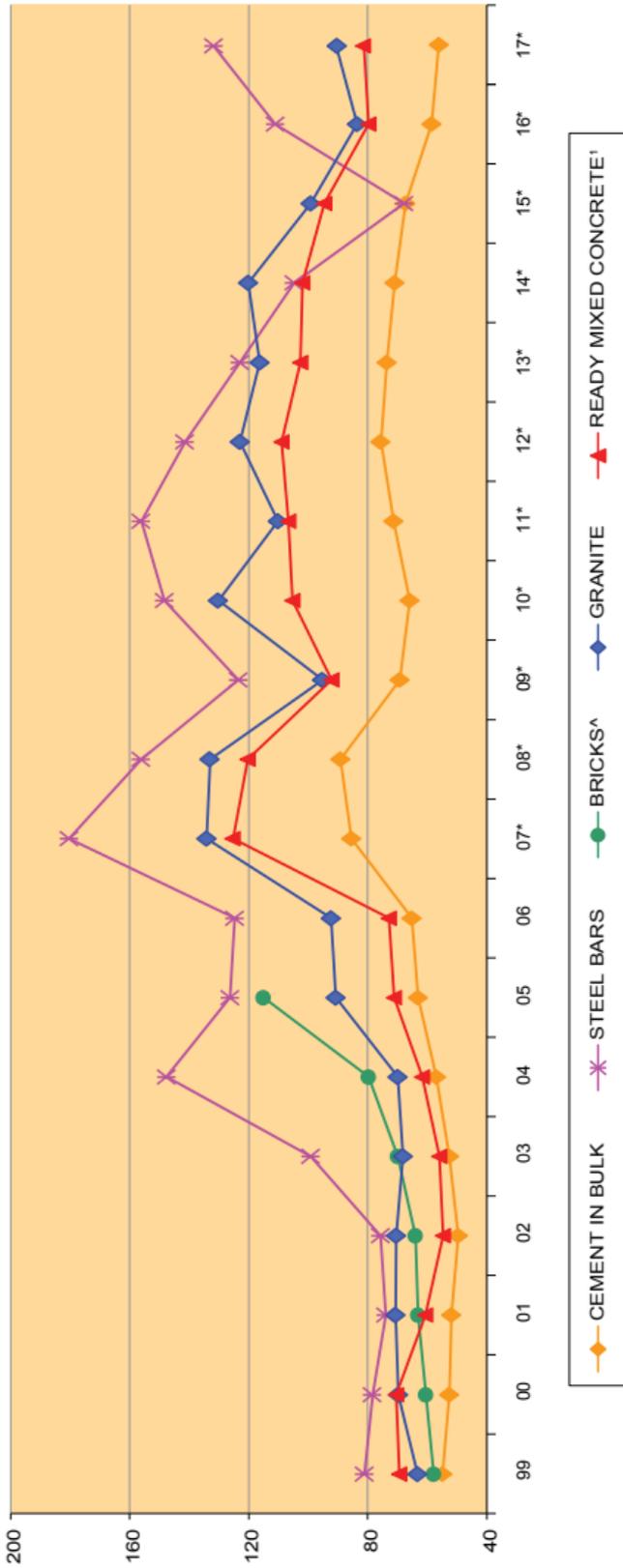
<sup>A</sup>From 2009 onwards, Arcadis Singapore TPI based on 4<sup>th</sup> Quarter index and inflation reflected based on year-on-year comparison (e.g. 4Q09 vs 4Q08).

## MATERIAL PRICE INDICES

YEAR	CEMENT IN BULK			STEEL BARS			BRICKS <sup>^</sup>			GRANITE			READY MIXED CONCRETE <sup>1</sup>		
	\$/TONNE	INDEX (BASE 1994)	INFLATION	\$/TONNE	INDEX (BASE 1994)	INFLATION	\$/000 BRICKS	INDEX (BASE 1994)	INFLATION	\$/TONNE	INDEX (BASE 1994)	INFLATION	\$/m <sup>3</sup>	INDEX (BASE 1994)	INFLATION
00	71.00	52.6	-	458.65	78.4	-	141.00	60.5	-	12.55	69.8	-	71.32	70.4	-
01	70.00	51.9	-1.3%	432.81	74.0	-5.6%	147.00	63.1	4.3%	12.69	70.6	1.1%	61.40	60.6	-13.9%
02	67.00	49.6	-4.4%	442.92	75.7	2.3%	149.00	63.9	1.3%	12.65	70.4	-0.3%	55.41	54.7	-9.7%
03	71.00	52.6	6.0%	579.62	99.1	30.9%	163.00	70.0	9.5%	12.25	68.2	-3.1%	56.75	56.0	2.4%
04	76.76	56.9	8.2%	863.40	147.6	48.9%	185.77	79.7	13.9%	12.57	69.9	2.5%	62.50	61.7	10.2%
05	85.21	63.1	10.9%	738.44	126.2	-14.5%	267.86	115.0	44.3%	16.29	90.7	29.8%	72.13	71.2	15.4%
06	88.02	65.2	3.3%	729.52	124.7	-1.2%	-	-	-	16.58	92.3	1.8%	73.88	72.9	2.4%
07*	115.40	85.5	31.1%	1,054.60	180.3	44.6%	-	-	-	24.10	134.1	45.3%	127.00 <sup>2</sup>	125.3 <sup>3</sup>	71.9%
08*	120.40	89.2	4.3%	913.00	156.1	-13.4%	-	-	-	23.90	133.0	-0.8%	121.90 <sup>2</sup>	120.3 <sup>3</sup>	-4.0%
09*	93.40	69.2	-22.4%	722.50 <sup>^</sup>	123.5 <sup>^</sup>	-20.9%	-	-	-	17.10	95.2	-28.4%	93.30 <sup>3</sup>	92.1 <sup>3</sup>	-23.4%
10*	89.00	65.9	-4.8%	867.50	148.3	20.1%	-	-	-	23.40	130.2	36.8%	106.70 <sup>4</sup>	105.3 <sup>4</sup>	14.3%
11*	96.20	71.3	8.2%	913.40	156.1	5.3%	-	-	-	19.80	110.2	-15.4%	108.00 <sup>4</sup>	106.6 <sup>4</sup>	1.2%
12*	102.10	75.6	6.0%	827.50	141.4	-9.4%	-	-	-	22.10	123.0	11.6%	110.40 <sup>4</sup>	108.9 <sup>4</sup>	2.2%
13*	99.30	73.6	-2.6%	718.80	122.9	-13.1%	-	-	-	20.90	116.3	-5.4%	104.00 <sup>4</sup>	102.6 <sup>4</sup>	-5.8%
14*	95.70	70.9	-3.7%	612.50	104.7	-14.8%	-	-	-	21.60	120.2	3.4%	103.30 <sup>4</sup>	101.9 <sup>4</sup>	-0.7%
15*	90.80	67.3	-5.1%	397.10 <sup>^</sup>	67.9 <sup>^</sup>	-35.1%	-	-	-	17.80	99.1	-17.6%	95.90 <sup>4</sup>	94.6 <sup>4</sup>	-7.2%
16*	79.00	58.6	-13.0%	649.60 <sup>^</sup>	111.1 <sup>^</sup>	63.6%	-	-	-	15.00	83.5	-15.7%	80.80 <sup>4</sup>	79.7 <sup>4</sup>	-15.7%
17*	75.40	55.9	-4.6%	783.00 <sup>^</sup>	133.9 <sup>^</sup>	20.5%	-	-	-	16.30	90.7	8.6%	83.30 <sup>4</sup>	82.2 <sup>4</sup>	3.1%

Source: Building and Construction Authority as at 13 February 2018

Note: <sup>^</sup>From 1st Quarter 2006, statistics on bricks have been discontinued. <sup>\*</sup>Market prices from 2007 to 2017 are based on prices as at the month of December. <sup>^</sup>The market prices of rebar (without cut and bend) from 2009 onwards are based on fixed supply contracts with contract period 6 months or less. <sup>^</sup>From January 2015, the market prices of rebar (without cut and bend) are based on fixed price supply contracts with contract period 1 year or less. <sup>1</sup>Prior to 2007, the market prices of ready mixed concrete (RMC) were for Grade 30. <sup>2</sup>The market prices of RMC were for Grade 35. <sup>3</sup>The market prices of RMC were based on non-fixed price contract for Grade 35 Pump. <sup>4</sup>The market prices of RMC are based on contracts with non-fixed price, fixed price and market retail price for Grade 40 Pump.







# CONSTRUCTION COST DATA **2**

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Preambles

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Construction Costs For Singapore

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Construction Costs For Selected  
Asian Cities

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Construction Cost Specification

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Cost Breakdown For Different  
Building Types

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Major Rates For Selected Asian Cities

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M&E Costs For Singapore

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M&E Costs For Selected Asian Cities

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Office M&E Cost Components

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M&E Cost Charts

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Utility Costs For Selected Asian Cities

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### PREAMBLES

The construction costs for the respective categories given on the following pages are average costing at 4<sup>th</sup> Quarter 2017. They are based on interpolation of competitive tenders received.

Based on Arcadis Singapore's data, tender prices for 2017 have declined approximately 2.5% year-on-year (i.e. 4th Quarter 2017 versus 4th Quarter 2016).

Looking ahead, with the anticipated rise in commodity and raw construction material prices as well as the projected demand in private sector market arising from the surge in en-bloc redevelopment projects, tender prices are anticipated to remain competitive as contractors are filling up their order books.

Nonetheless, the price movement (if any) for the whole year of 2018 is anticipated to be in the range of -1% to +2%, the actual level depending on the prevailing market situation and any adverse ramifications of the prevailing economic instability.

The construction cost serves as a guide for preliminary cost appraisals and budgeting. It must be understood that the actual cost of a building will depend upon the design and many other factors such as major infrastructure of the buildings/structures, etc. and may vary from the figures shown. The costs per square metre are based on construction floor areas measured to the outside face of the external walls/external perimeter including lift shafts, stairwells, plant rooms, water tanks and the like.

As a guide, it might be worth to note that construction costs generally may vary accordingly depending on the following specific requirements:

- a. Complexity of the project
- b. Site encumbrances
- c. The need of special structural such as heavy transfer structures over MRT/RTS structures/tracks/boxes, etc. or due to close proximity to nearby infrastructure such as canals, bridges, etc.
- d. The types of structural system (i.e. reinforced concrete or structural steel system, precast/prefabrication, etc.)
- e. The types of temporary works required (i.e. diaphragm walls, sheet piling, etc.)

- f. The method of construction e.g. conventional or top down
- g. Basement works which are carried out in phases may require additional temporary works and different types of construction sequence
- h. Deep basement (i.e. levels of basement)
- i. Selection of Contractor (i.e. local or foreign)
- j. Shape of the existing site as longish sites would generally attract higher cost due to higher wall to floor ratio
- k. The level of Green Mark rating, Buildability-Scores, Constructability-Scores, etc.
- l. Economic and political issues (e.g. disruption in supply of materials, etc.)

All buildings are assumed to have no basements (except otherwise stated) and are built on flat ground with normal soil conditions. The costs exclude the following:

- Professional fees
- Authorities' plan processing charges
- Land cost
- Financing charges
- Site inspectorate
- Administrative expenses
- Legal costs and disbursements
- Demolition of existing building(s)
- Furniture and fittings (unless otherwise stated)
- Operating equipment
- External works
- Prefabricated Prefinished Volumetric Construction (PPVC) / Prefabricated Bathroom Units (PBUs) / Structural Steel Structure
- Cross Laminated Timber (CLT) / Glued Laminated Timber (Glulam)
- Cost escalation
- Goods and Services Tax

The codes and standards for each category of building vary from country to country and do not necessarily follow those of Singapore.

### CONSTRUCTION COSTS FOR SINGAPORE

TYPES	OVERALL COST	
	LOW S\$/m <sup>2</sup>	HIGH S\$/m <sup>2</sup>
<b><u>RESIDENTIAL</u></b>		
Terraced Houses	2,350	2,650
Semi-Detached Houses	2,550	3,000
Detached Houses	3,000	4,000
Average Standard Condominium	1,800	2,050
Above Average Standard Condominium	2,050	2,800
Luxury Condominium	2,800	4,200
<b><u>OFFICE</u></b>		
Average Standard Offices	2,350	2,650
Prestige Offices	2,650	2,900
<b><u>COMMERCIAL</u></b>		
Shopping Centres, Average Quality	2,650	2,800
Shopping Centres, High Quality	2,800	3,100
<b><u>CAR PARKS</u></b>		
Multi-Storey Car Parks	880	1,280
Basement Car Parks	1,280	1,730

The above costs are at 4<sup>th</sup> Quarter 2017 levels.  
For latest costs information, please refer to our 'Arcadis Singapore Quarterly Cost Publication'.

TYPES	OVERALL COST	
	LOW S\$/m <sup>2</sup>	HIGH S\$/m <sup>2</sup>
<b><u>INDUSTRIAL</u></b>		
Flatted Light Industrial Buildings	1,230	1,380
Flatted Heavy Industrial Buildings	1,380	1,880
Single Storey Industrial Buildings	1,130	1,280
Flatted Warehouses	1,130	1,280
Single Storey Warehouses	1,000	1,280
<b><u>HOTEL (Including Furniture and Fittings)</u></b>		
Resort Hotels	2,850	3,100
3-Star Hotels	2,950	3,250
4-Star Hotels	3,150	3,750
5-Star Hotels	3,800	4,300
<b><u>HEALTH</u></b>		
Private Hospitals	3,800	4,000
Polyclinics, Non Air-conditioned	1,600	1,800
Nursing Homes, Non Air-conditioned	1,600	1,900
Medical Centres	2,900	3,100

## CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES

BUILDING TYPE	US\$/m <sup>2</sup> CFA					
	SINGAPORE <sup>Ⓐ</sup>	KUALA LUMPUR	BRUNEI	BANGKOK <sup>Ⓒ</sup>	HONG KONG <sup>Ⓔ</sup>	MACAU <sup>ⓑ</sup>
<b>DOMESTIC</b>						
Apartments, high rise, average standard	1,325 - 1,510	375 - 520 <sup>▶</sup>	726 - 998	695 - 864	3,080 - 3,620	2,229 - 2,740
Apartments, high rise, high end	2,060 - 3,090	780 - 945	897 - 1,168	988 - 1,188	4,150 - 4,830	3,126 - 4,770
Terraced houses, average standard	1,730 - 1,950	225 - 330 <sup>▲</sup>	470 - 740	463 - 556	4,220 - 4,920	3,823 - 4,545
Detached houses, high end	2,210 - 2,945	755 - 940	713 - 985	803 - 972	5,460 - 6,220	4,645 - 6,040
<b>OFFICE / COMMERCIAL</b>						
Medium/high rise offices, average standard	1,730 - 1,950 <sup>#</sup>	615 - 710 <sup>▼</sup>	726 - 998	648 - 803	3,010 - 3,580	2,578 - 3,325
High rise offices, prestige quality	1,950 - 2,135 <sup>#</sup>	880 - 1,200 <sup>▼</sup>	1,026 - 1,297	880 - 1,111	3,720 - 4,490	3,325 - 3,636
Out-of-town shopping centre, average standard	1,950 - 2,060	560 - 690	704 - 975	633 - 818	3,080 - 3,590	2,428 - 3,636
Retail malls, high end	2,060 - 2,280	690 - 955	929 - 1,199	849 - 880	4,080 - 4,850	3,823 - 4,583
<b>HOTELS</b>						
Budget hotels - 3-star, mid market	2,170 - 2,390	1,020 - 1,420	1,373 - 1,643	1,158 - 1,281	3,910 - 4,230	3,387 - 3,836
Business hotels - 4/5-star	2,795 - 3,165	1,760 - 2,065	1,936 - 2,206	1,482 - 1,698	4,100 - 4,870	4,608 - 5,504
Luxury hotels - 5-star	2,795 - 3,165	1,965 - 2,290	1,987 - 2,258	1,729 - 2,006	4,810 - 5,580	5,504 - 6,513

<b>INDUSTRIAL</b>	735 - 945	325 - 410	334 - 605	494 - 617	N/A	N/A
Industrial units, shell only (Conventional single storey framed units)						
Owner operated factories, low rise, light weight industry	N/A	440 - 500	456 - 727	N/A	2,360 - 3,000	N/A
<b>OTHERS</b>						
Underground/basement car parks (<3 levels)	945 - 1,275	365 - 510	N/A	556 - 725	2,320 - 2,880	2,005 - 2,964
Multi storey car parks, above ground (<4 levels)	650 - 945 <sup>^</sup>	230 - 300	372 - 643	185 - 296	1,450 - 1,710	1,108 - 1,457
Schools (primary and secondary)	N/A	255 - 295 <sup>▲</sup>	544 - 815	N/A	2,530 - 2,740	2,217 - 2,578
Students' residences	1,585 - 1,730	300 - 330 <sup>♦</sup>	638 - 908	N/A	2,490 - 2,880	1,768 - 2,042
Sports clubs, multi purpose sports/leisure centres (dry sports)	1,985 - 2,135	595 - 695	1,465 - 1,735	N/A	3,850 - 4,360	N/A
General hospitals - public sector	2,795 - 2,945	875 - 1,105	1,646 - 1,917	N/A	5,000 - 5,640	N/A
Exchange Rate Used : US\$1 =	S\$ 1.36	RM 4.08	B\$ 1.36	BAHT 32.39	HK\$ 7.80	MOP 8.03

The above costs are at 4th Quarter 2017 levels, inclusive of preliminaries but exclusive of contingencies.

- ◆ Rates are nett of GST.
- # Includes raised floor and ceiling to tenanted areas but excludes office carpets (normally under tenant's fit-out).
- ▲ Open on all sides with parapet.
- ⊖ Rates exclude VAT.
- ♣ Rates are exclusive of any management contract fee.
- £ Offices of average standard are built to the following provisions:
  - (i) Curtain wall/window wall facade
  - (ii) Tenant are with screeded floor, painted wall and ceiling
- ♣ Schools (primary and secondary) are of public authority standard, no air and complete with basic external works.
- ▶ 6 - 12 units per floor, 46m<sup>2</sup> - 83m<sup>2</sup> per unit, exclude air-conditioning equipment.
- ▲ Terraced houses exclude air-conditioning.
- ▼ Offices are average standard and exclude tenant fitout.
- ♣ Schools (primary and secondary) are standard government provisions.
- ♦ Student hostels to university standard.

(Cont'd)

## CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES

### CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	US\$/m <sup>2</sup> CFA			
	SHANGHAI +	BEIJING +	GUANGZHOU/ SHENZHEN +	CHONGQING/ CHENGDU +
<b>DOMESTIC</b>				
Apartments, high rise, average standard	691 - 766	638 - 701	529 - 585	541 - 648
Apartments, high rise, high end	1,620 - 1,769	1,545 - 1,760	886 - 971	889 - 1,126
Terraced houses, average standard	465 - 497	465 - 543	402 - 442	445 - 541
Detached houses, high end	694 - 771	701 - 780	550 - 605	591 - 682
<b>OFFICE / COMMERCIAL</b>				
Medium/high rise offices, average standard	898 - 1,195	892 - 1,201	773 - 855	865 - 1,005
High rise offices, prestige quality	1,195 - 1,492	1,201 - 1,973	1,062 - 1,170	1,089 - 1,476
Out-of-town shopping centre, average standard	N/A	680 - 909	736 - 808	692 - 894
Retail malls, high end	1,270 - 1,640	1,230 - 1,693	1,082 - 1,189	1,089 - 1,536
<b>HOTELS</b>				
Budget hotels - 3-star, mid market	985 - 1,209	1,006 - 1,240	995 - 1,095	958 - 1,189
Business hotels - 4/5-star	1,619 - 2,205	1,681 - 2,220	1,605 - 1,768	1,839 - 2,303
Luxury hotels - 5-star	2,205 - 2,644	2,142 - 2,755	2,186 - 2,409	N/A

<b>INDUSTRIAL</b>						
Industrial units, shell only (Conventional single storey framed units)	287 - 350	281 - 343	505 - 556	448 - 571		
Owner operated factories, low rise, light weight industry	446 - 557	543 - 623	N/A	N/A		
<b>OTHERS</b>						
Underground/basement car parks (<3 levels)	762 - 1,062	777 - 854	508 - 812	N/A		
Multi storey car parks, above ground (<4 levels)	395 - 546	467 - 473	364 - 400	309 - 386		
Schools (primary and secondary)	544 - 697	541 - 699	403 - 444	417 - 464		
Students' residences	388 - 543	383 - 541	262 - 294	N/A		
Sports clubs, multi purpose sports/leisure centres (dry sports)	988 - 1,213	927 - 934	747 - 824	N/A		
General hospitals - public sector	1,474 - 1,912	1,218 - 1,525	N/A	N/A		
Exchange Rate Used : US\$1 =	RMB 6.60	RMB 6.60	RMB 6.60	RMB 6.60		

The above costs are at **4th Quarter 2017** levels, inclusive of preliminaries but exclusive of contingencies.

- + Houses are built to shell and core standard ONLY, where all tenant or occupant areas are unfurnished.
- Schools (primary and secondary) are of public authority standard, no a/c and complete with basic external works.

(Cont'd)

## CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES

### CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	US\$/m <sup>2</sup> CFA			
	MANILA <sup>Ω</sup>	INDIA <sup>Ⓔ</sup>	JAKARTA <sup>Ⓢ</sup>	HO CHI MINH &
<b><u>DOMESTIC</u></b>				
Apartments, high rise, average standard	923 - 1,088	550 - 630	713 - 807	630 - 780
Apartments, high rise, high end	1,227 - 1,712	830 - 1,000	981 - 1,107	800 - 920
Terraced houses, average standard	760 - 906	380 - 400	378 - 492	425 - 500
Detached houses, high end	1,570 - 2,353	500 - 525	1,027 - 1,149	485 - 590
<b><u>OFFICE / COMMERCIAL</u></b>				
Medium/high rise offices, average standard	897 - 1,048	415 - 450	703 - 778	735 - 855
High rise offices, prestige quality	1,264 - 1,385	520 - 550	1,035 - 1,157	850 - 1,160
Out-of-town shopping centre, average standard	727 - 888	405 - 440	604 - 669	N/A
Retail malls, high end	1,059 - 1,504	565 - 610	667 - 721	690 - 900
<b><u>HOTELS</u></b>				
Budget hotels - 3-star, mid market	1,193 - 1,335	780 - 865	1,222 - 1,443	1,370 - 1,670
Business hotels - 4/5-star	1,322 - 1,650	1,215 - 1,440	1,666 - 1,800	N/A
Luxury hotels - 5-star	1,612 - 2,175	1,535 - 1,680	1,770 - 1,996	1,725 - 2,070

<b>INDUSTRIAL</b>						
Industrial units, shell only (Conventional single storey framed units)	445 - 501	325 - 380	325 - 354	305 - 380		
Owner operated factories, low rise, light weight industry	598 - 677	345 - 405	352 - 389	370 - 490		
<b>OTHERS</b>						
Underground/basement car parks (<3 levels)	499 - 568	275 - 295	501 - 616	625 - 750		
Multi storey car parks, above ground (<4 levels)	457 - 678	210 - 230	325 - 354	400 - 440		
Schools (primary and secondary)	693 - 798	260 - 295	N/A	525 - 575		
Students' residences	750 - 895	295 - 325	N/A	525 - 680		
Sports clubs, multi purpose sports/leisure centres (dry sports)	1,200 - 1,585	575 - 600	1,075 - 1,611	780 - 835		
General hospitals - public sector	1,301 - 1,504	630 - 690	N/A	N/A		
Exchange Rate Used : US\$1 =	PHP 50.50	INR 65	IDR 13,055	VND 22,600		

The above costs are at **4th Quarter 2017** levels, inclusive of preliminaries but exclusive of contingencies.

Ω Rates include 12% VAT.

₹ Rates are nett of VAT.

Ⓖ Rates are based on projects in Bangalore and are nett of GST. Mumbai costs are generally 8% higher.

& Rates are nett of VAT and contingencies.

## CONSTRUCTION COST SPECIFICATION

BUILDING TYPE	OUTLINE SPECIFICATION
<b><u>DOMESTIC</u></b>	
Apartments, high rise, average standard	Apartment units with fit-out, including air-conditioning (a/c), kitchen cabinets and home appliances, but <b>excluding</b> decorative light fittings and loose furniture
Apartments, high rise, high end	Apartment units with good quality fit-out, including a/c, kitchen cabinets and home appliances, but <b>excluding</b> decorative light fittings and loose furniture
Terraced houses, average standard	Houses with fit-out, including a/c, kitchen cabinets and home appliances, but <b>excluding</b> decorative light fittings, loose furniture, garden and parking
Detached houses, high end	Houses with good quality fit-out, including a/c, kitchen cabinets and home appliances, but <b>excluding</b> decorative light fittings, loose furniture, garden and parking
<b><u>OFFICE / COMMERCIAL</u></b>	
Medium/high rise offices, average standard	RC structure, curtain wall, including public area fit-out, tenant area with raised floor/ carpet, painted wall and false ceiling
High rise offices, prestige quality	

Out-of-town shopping centre, average standard	Including public area fit-out and M&E, but <b>excluding</b> shop fit-out
Retail malls, high end	
<b><u>HOTELS</u></b>	
Budget hotels - 3-star, mid market	1) Interior decoration 2) Furniture (fixed and movable) 3) Special light fittings (chandeliers, etc.) 4) Operating Supplies and Equipment (OS&E) <b>excluded</b>
Business hotels - 4/5-star	
Luxury hotels - 5-star	
<b><u>INDUSTRIAL</u></b>	
Industrial units, shell only (Conventional single storey framed units)	RC structure with steel roof and M&E to main distribution, but <b>excluding</b> a/c, heating and lighting
Owner operated factories, low rise, light weight industry	RC structure, including small office with simple fit-out and M&E, but <b>excluding</b> a/c and heating

(Cont'd)

## CONSTRUCTION COST SPECIFICATION

### CONSTRUCTION COST SPECIFICATION (Cont'd)

BUILDING TYPE	OUTLINE SPECIFICATION
<b><u>OTHERS</u></b>	
Underground/basement car parks (<3 levels)	RC structure
Multi storey car parks, above ground (<4 levels)	RC structure, natural ventilation, no facade enclosure
Schools (primary and secondary)	Including fit-out and a/c, but <b>excluding</b> educational equipment
Students' residences	Including fit-out, loose furniture and a/c
Sports clubs, multi purpose sports/leisure centres (dry sports)	Dry sports (no swimming pool) and are for 'leisure centre' type schemes including main sports hall, ancillary sports facilities, changing and showers, restaurant / cafe, bar, etc. Costs include Furniture, Fittings and Equipment (FF&E)
General hospitals - public sector	Excluding medical and operating equipment

**Notes:**

1. The costs for the respective categories given above are averages based on fixed price competitive tenders. It must be understood that the actual cost of a building will depend upon the design and many other factors and may vary from the figures shown.
2. The costs per square metre are based on Construction Floor Areas (CFA) measured to the outside face of the external walls / external perimeter including lift shafts, stairwells, balconies, plant rooms, water tanks and the like.
3. All buildings are assumed to have no basements (except otherwise stated) and are built on flat ground, with normal soil and site condition. The cost excludes site formation works, external works, land cost, professional fees, finance and legal expenses.
4. The standard for each category of building varies from region to region and do not necessary follow that of each other.
5. All costs are in US\$/m<sup>2</sup> CFA. Fluctuation in exchange rates may lead to changes in construction costs expressed in U.S. dollars.

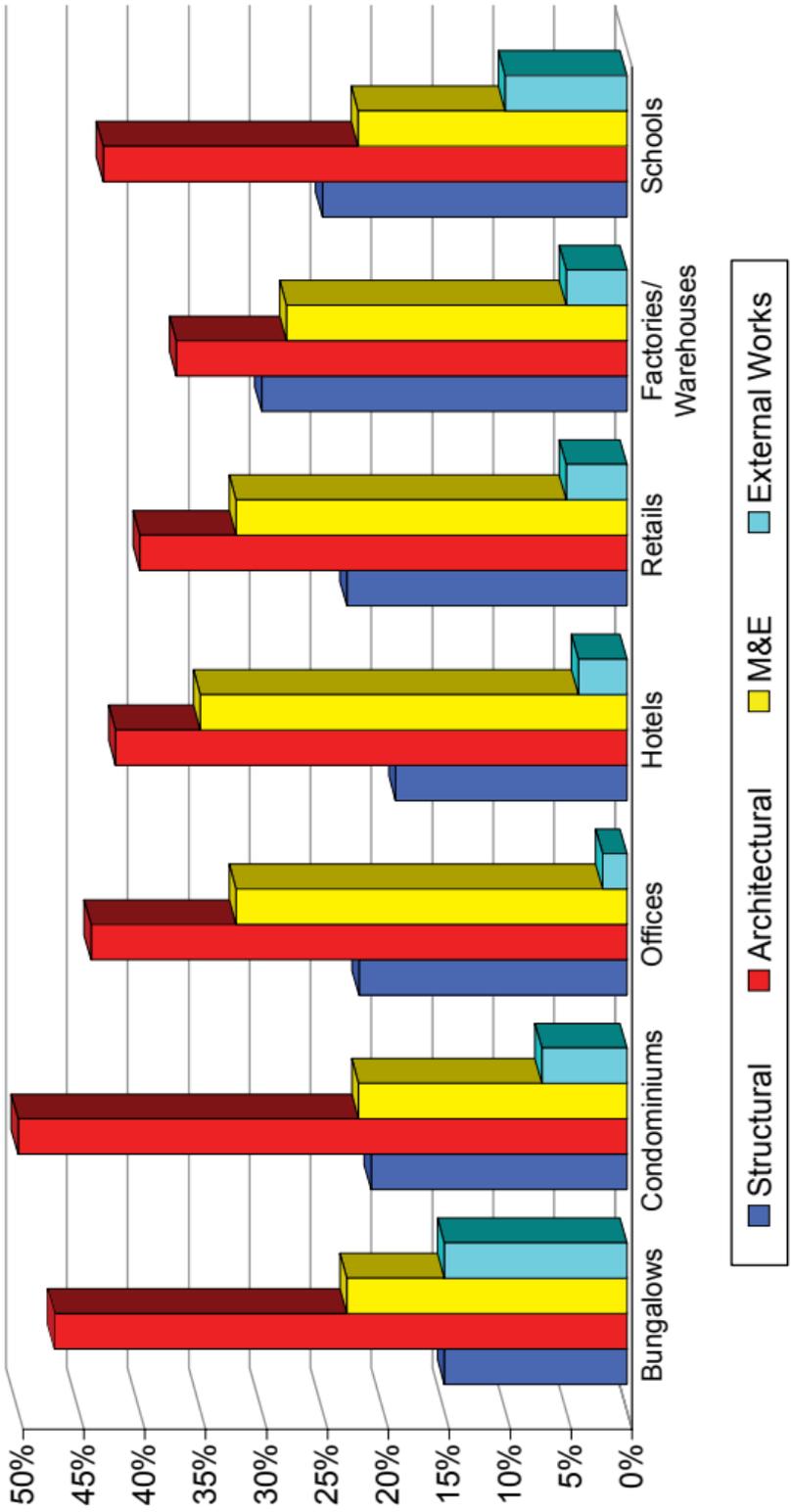
### COST BREAKDOWN FOR DIFFERENT BUILDING TYPES

BUILDING TYPES	STRUCTURAL	ARCHITECTURAL	M&E SERVICES	EXTERNAL WORKS
Bungalows	15%	47%	23%	15%
Condominiums	21%	50%	22%	7%
Offices	22%	44%	32%	2%
Hotels	19%	42%	35%	4%
Retails	23%	40%	32%	5%
Factories / Warehouses	30%	37%	28%	5%
Schools	25%	43%	22%	10%

Note : a) Structural includes Piling, Foundation and Structure.

b) Architectural includes External Walls, Internal Walls, Roof Finishes & Drainage, Wall Finishes, Ceiling Finishes, Floor Finishes, Sanitary Fittings & Accessories, Windows & Doors and Joinery Fittings.

c) M&E includes Electrical Services, Fire Protection, Plumbing & Sanitary, Vertical Transportation and ACMV.



## MAJOR RATES FOR SELECTED ASIAN CITIES

DESCRIPTION	UNIT	SINGAPORE *		KUALA LUMPUR		BRUNEI		BANGKOK ° HONG KONG		MACAU		
		S\$		RM		B\$		BHT		HK\$		MOP
1. Excavating basement ≤ 2.00m deep	m <sup>3</sup>	20		15 - 25		3.40		120 - 140		220		130
2. Excavating for footings ≤ 1.50m deep	m <sup>3</sup>	20		15 - 25		2.90		140 - 180		200		150
3. Remove excavated materials off site	m <sup>3</sup>	15 - 20		20 - 30		2.90		110 - 150		300 °		100
4. Hardcore bed blinded with fine materials	m <sup>3</sup>	50		70 - 95		42		650 - 750		950		1,200
5. Mass concrete grade 15	m <sup>3</sup>	175 - 185**		240 - 315		115		2,300 - 2,500		1,100		1,350
6. Reinforced concrete grade 30	m <sup>3</sup>	115 - 120		260 - 320		130		2,500 - 2,700		1,300		1,250
7. Mild steel rod reinforcement	kg	1.2 - 1.3		3.2 - 3.7		1.2		24 - 25		9.7		7.1
8. High tensile rod reinforcement	kg	1.2 - 1.3		3.2 - 3.7		1.2		23 - 24		9.7		7.1
9. Sawn formwork to soffits of suspended slabs	m <sup>2</sup>	40		38 - 45		15		400 - 450		410		250
10. Sawn formwork to columns and walls	m <sup>2</sup>	40		38 - 45		15		400 - 450		410		250
11. 112.5mm thick brick walls	m <sup>2</sup>	35 - 40		45 - 50		16		650 - 750		400		450
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m <sup>2</sup>	43		55 - 65		58		1,200		870		N/A

13. Aluminium casement windows, single glazed	m <sup>2</sup>	290	380 - 600	160 - 210	7,000	3,200	4,000
14. Structural steelwork - beams, stanchions and the like	kg	4 - 4.5	7.5 - 9	3	50 - 60	36	35
15. Steelwork - angles, channels, flats and the like	kg	4 - 4.5	7.5 - 9	3	50 - 60	38	40
16. 25mm cement and sand (1:3) paving	m <sup>2</sup>	21	17 - 23	8	200 - 240	150	120
17. 20mm cement and sand (1:4) plaster to walls	m <sup>2</sup>	22	18 - 23	8	220 - 260	155	150
18. Ceramic tiles bedded to floor screed (measured separately)	m <sup>2</sup>	74	50 - 70	33	1,200	400	450
19. 12mm fibrous plasterboard ceiling lining	m <sup>2</sup>	30	35 - 45	28	750 - 850	600	650
20. Two coats of emulsion paint to plastered surfaces	m <sup>2</sup>	3.5 - 4	3.3 - 4.5	5	110 - 140	75	200
Average expected preliminaries	%	12 - 15	6 - 15	5 - 8	12 - 18	10 - 15	10

The above costs are at **4th Quarter 2017** levels and are based on lump sum fixed price contract rates exclusive of preliminaries and contingencies.

♣ Rates are nett of GST.

♣♣ Rate for lean concrete blinding.

⊖ Rates including dumping charges.

⊖ Rates are nett of VAT.

(Cont'd)

## MAJOR RATES FOR SELECTED ASIAN CITIES

## MAJOR RATES FOR SELECTED ASIAN CITIES (Cont'd)

DESCRIPTION	UNIT	SHANGHAI			BEIJING			GUANGZHOU/ SHENZHEN			CHONGQING/ CHENGDU		
		RMB	RMB	RMB	RMB	RMB	RMB	RMB	RMB	RMB	RMB	RMB	
1. Excavating basement ≤ 2.00m deep	m <sup>3</sup>	30	26	32	22								
2. Excavating for footings ≤ 1.50m deep	m <sup>3</sup>	30	31	26	26								
3. Remove excavated materials off site	m <sup>3</sup>	130	37	80 - 100	67								
4. Hardcore bed blinded with fine materials	m <sup>3</sup>	180	170	190	160								
5. Mass concrete grade 15	m <sup>3</sup>	450	410	470	320								
6. Reinforced concrete grade 30	m <sup>3</sup>	485	480	500	360								
7. Mild steel rod reinforcement	kg	5.2	4.9	5.5	5.2								
8. High tensile rod reinforcement	kg	5.2	4.9	5.5	5.2								
9. Sawn formwork to soffits of suspended slabs	m <sup>2</sup>	85	85	85	60								
10. Sawn formwork to columns and walls	m <sup>2</sup>	85	73	85	60								
11. 112.5mm thick brick walls	m <sup>2</sup>	85 @	72	75	70								
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m <sup>2</sup>	N/A	N/A	N/A	N/A								

13. Aluminium casement windows, single glazed	m <sup>2</sup>	700	815*	650	650
14. Structural steelwork - beams, stanchions and the like	kg	9.5	9.35	11	11.1
15. Steelwork - angles, channels, flats and the like	kg	8.5	8.5	9	11.1
16. 25mm cement and sand (1:3) paving	m <sup>2</sup>	30	27	32	25
17. 20mm cement and sand (1:4) plaster to walls	m <sup>2</sup>	30	28	30	35
18. Ceramic tiles bedded to floor screed (measured separately)	m <sup>2</sup>	155	140	155	130
19. 12mm fibrous plasterboard ceiling lining	m <sup>2</sup>	150	162	190	150
20. Two coats of emulsion paint to plastered surfaces	m <sup>2</sup>	40	32	35	35
Average expected preliminaries	%	5 - 10	7 - 10	5 - 10	5 - 10

The above costs are at **4th Quarter 2017** levels and are based on lump sum fixed price contract rates exclusive of preliminaries and contingencies.

@ Rates for 120mm thick concrete block walls.

\* Rates for double glazed window.

(Cont'd)

## MAJOR RATES FOR SELECTED ASIAN CITIES

### MAJOR RATES FOR SELECTED ASIAN CITIES (Cont'd)

DESCRIPTION	UNIT	MANILA		INDIA <sup>Ⓒ</sup>		JAKARTA #		HO CHI MINH #	
		PHP	INR	INR	IDR	IDR	VND		
1. Excavating basement ≤ 2.00m deep	m <sup>3</sup>	270	190		40,000		92,400		
2. Excavating for footings ≤ 1.50m deep	m <sup>3</sup>	300	215		75,000		92,400		
3. Remove excavated materials off site	m <sup>3</sup>	160	N/A		30,000		84,700		
4. Hardcore bed blinded with fine materials	m <sup>3</sup>	890	4,400		500,000		280,900		
5. Mass concrete grade 15	m <sup>3</sup>	2,940	5,950		1,050,000		1,696,400		
6. Reinforced concrete grade 30	m <sup>3</sup>	3,780	7,450		1,000,000		1,955,800		
7. Mild steel rod reinforcement	kg	43	67		12,000		18,500		
8. High tensile rod reinforcement	kg	44	69		12,000		18,000		
9. Sawn formwork to soffits of suspended slabs	m <sup>2</sup>	1,000	675		200,000		201,800		
10. Sawn formwork to columns and walls	m <sup>2</sup>	950	725		195,000		220,000		
11. 112.5mm thick brick walls	m <sup>2</sup>	N/A	1,100		250,000		312,780		
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m <sup>2</sup>	1,100	1,700		300,000		401,110 - 597,600		

13. Aluminium casement windows, single glazed	m <sup>2</sup>	10,500 <sup>Ω</sup>	6,000	1,650,000	6,315,000
14. Structural steelwork - beams, stanchions and the like	kg	125	120	26,000	52,650
15. Steelwork - angles, channels, flats and the like	kg	125	120	26,000	52,650
16. 25mm cement and sand (1:3) paving	m <sup>2</sup>	400	475	90,000	94,000
17. 20mm cement and sand (1:4) plaster to walls	m <sup>2</sup>	360	390	100,000	144,000
18. Ceramic tiles bedded to floor screed (measured separately)	m <sup>2</sup>	1,600	1,700	200,000	674,180
19. 12mm fibrous plasterboard ceiling lining	m <sup>2</sup>	1,090	1,350	215,000 <sup>⌘</sup>	205,920
20. Two coats of emulsion paint to plastered surfaces	m <sup>2</sup>	390	240	30,000	88,900
Average expected preliminaries	%	12 - 18	8 - 12	8 - 10	8 - 12

The above costs are at **4th Quarter 2017** levels and are based on lump sum fixed price contract rates exclusive of preliminaries and contingencies.

Ω Rate for aluminium with anodized finish; 6mm thick.

# Rates are nett of VAT.

⌘ All rates above are Supply and Fix, based on projects in Bangalore and are nett of VAT and Service tax. Mumbai costs are generally 8% higher.

⌘ Rate for 9mm gypsum board.

\$ Rates include labour costs and are nett of VAT.

### M&E COSTS FOR SINGAPORE

TYPES	ACMV	ELECTRICAL
	S\$/m <sup>2</sup>	S\$/m <sup>2</sup>
<b><u>RESIDENTIAL</u></b>		
Detached Houses	109 - 155	161 - 214
Average Standard Condominium	90 - 111	97 - 137
Luxury Condominium	102 - 170	167 - 228
<b><u>OFFICE</u></b>		
Average Standard Offices	153 - 197	158 - 201
Prestige Offices	185 - 249	182 - 258
<b><u>INDUSTRIAL</u></b>		
Flatted Factories	57 - 117	72 - 136
Warehouses	34 - 65	55 - 87
<b><u>HOTEL</u></b>		
Resort Hotels	129 - 182	181 - 249
3-Star Hotels	224 - 257	292 - 352
5-Star Hotels	243 - 278	332 - 356
<b><u>OTHERS</u></b>		
Multi-Storey Car Parks	20 - 32	15 - 35
Basement Car Parks	27 - 47	25 - 41
Shopping Centres	147 - 246	160 - 304

The above costs are at 4<sup>th</sup> Quarter 2017 levels.

HYDRAULIC	FIRE	LIFTS	BAS
S\$/m <sup>2</sup>	S\$/m <sup>2</sup>	S\$/m <sup>2</sup>	S\$/m <sup>2</sup>
132 - 189	0 - 24	-	-
72 - 103	25 - 35	41 - 49	-
90 - 141	30 - 49	49 - 113	-
26 - 46	33 - 52	63 - 103	10 - 25
36 - 55	38 - 56	80 - 162	15 - 28
18 - 36	37 - 51	41 - 35	5 - 15
18 - 27	23 - 51	41 - 104	0 - 10
91 - 108	48 - 57	67 - 108	5 - 25
128 - 166	28 - 54	49 - 69	25 - 36
138 - 172	34 - 57	64 - 82	28 - 38
5 - 15	18 - 33	0 - 23	0 - 5
10 - 19	28 - 43	0 - 23	5 - 10
46 - 80	37 - 56	56 - 90	10 - 32

## M&E COSTS FOR SELECTED ASIAN CITIES

### M&E COSTS FOR SELECTED ASIAN CITIES

BUILDING TYPE	SINGAPORE *		KUALA LUMPUR	BRUNEI	BANGKOK <sup>Ⓞ</sup>	HONG KONG	MACAU
	S\$/m <sup>2</sup> CFA		RM/m <sup>2</sup> CFA				
<b><u>MECHANICAL SERVICES</u></b>							
Offices	153 - 249		355 - 515	178 - 220	4,200 - 4,700	2,000 - 2,800	N/A
Industrial *	34 - 117		85 - 190	23 - 38	1,550 - 1,600	200 - 300	N/A
Hotels	129 - 278		300 - 580	283 - 326	4,600 - 5,100	2,200 - 2,750	2,600 - 3,000
Shopping Centres	147 - 246		315 - 505	201 - 239	4,200 - 4,700	2,300 - 2,850	2,200 - 2,800
Apartment	90 - 170		195 - 285	208 - 239	4,200 - 4,500	850 - 1,750	900 - 1,100
<b><u>ELECTRICAL SERVICES</u></b>							
Offices	158 - 258		310 - 510	226 - 283	3,400 - 3,800	1,750 - 2,500	N/A
Industrial **	55 - 136		145 - 190	188 - 226	1,950 - 2,200	650 - 900	N/A
Hotels	181 - 356		285 - 595	283 - 369	3,800 - 4,500	1,900 - 2,600	2,600 - 3,100
Shopping Centres	160 - 304		310 - 495	308 - 369	2,800 - 3,200	1,900 - 2,500	2,600 - 2,800
Apartment	97 - 228		105 - 220	244 - 308	2,800 - 3,350	1,100 - 1,750	1,000 - 1,300
<b><u>HYDRAULIC SERVICES</u></b>							
Offices	26 - 55		30 - 60	16 - 38	780 - 900	700 - 900	N/A
Industrial	18 - 36		40 - 50	11 - 19	750 - 790	500 - 700	N/A
Hotels	91 - 172		180 - 250	59 - 81	1,400 - 1,650	2,000 - 3,000	1,800 - 2,200

Shopping Centres	46 - 80	30 - 35	12 - 40	790 - 950	700 - 900	600 - 800
Apartment	72 - 141	20 - 50	37 - 58	1,200 - 1,400	1,500 - 2,400	1,500 - 2,000
<b><u>FIRE SERVICES</u></b>						
Offices	33 - 56	60 - 80	31 - 38	780 - 850	550 - 700	N/A
Industrial	23 - 51	45 - 65	12 - 19	730 - 750	400 - 500	N/A
Hotels	28 - 57	65 - 95	25 - 48	780 - 890	600 - 850	900 - 1,100
Shopping Centres	37 - 56	65 - 85	31 - 64	780 - 820	550 - 700	600 - 800
Apartment	25 - 50	20 - 30	25 - 50	720 - 850	200 - 450	250 - 300
<b><u>LIFTS / ESCALATORS</u></b>						
Offices	63 - 162	95 - 395	9 - 31	1,100 - 1,350	700 - 1,200	N/A
Industrial	41 - 104	55 - 190	4 - 19	N/A	550 - 750	N/A
Hotels	49 - 108	85 - 365	12 - 44	1,100 - 1,400	550 - 850	600 - 800
Shopping Centres	56 - 90	85 - 110	12 - 35	250 - 450	850 - 1,000	450 - 700
Apartment	41 - 113	65 - 105	11 - 25	500 - 580	450 - 850	450 - 600

The above costs are at **4th Quarter 2017** levels, exclusive of contingencies.

\* Generally without A/C.

\*\* Excludes special power supply.

♣ Rates are nett of GST and excluding BAS.

∅ Based upon nett enclosed area and nett of VAT.

(Cont'd)

## M&E COSTS FOR SELECTED ASIAN CITIES

### M&E COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	SHANGHAI	BEIJING	GUANGZHOU/ SHENZHEN	CHONGQING/ CHENGDU
	RMB/m <sup>2</sup> CFA	RMB/m <sup>2</sup> CFA	RMB/m <sup>2</sup> CFA	RMB/m <sup>2</sup> CFA
<b><u>MECHANICAL SERVICES</u></b>				
Offices	776 - 985	760 - 1,050	760 - 1,050	690 - 990
Industrial *	176 - 295	170 - 280	150 - 280	140 - 230
Hotels	990 - 1,290	950 - 1,200	1,080 - 1,350	730 - 1,180
Shopping Centres	1,050 - 1,103	790 - 950	700 - 960	590 - 990
Apartment	315 - 415	140 - 450	150 - 400	110 - 300
<b><u>ELECTRICAL SERVICES</u></b>				
Offices	605 - 664	460 - 703	530 - 780	430 - 660
Industrial **	311 - 440	320 - 450	310 - 450	260 - 360
Hotels	664 - 847	705 - 943	700 - 1000	520 - 770
Shopping Centres	530 - 664	481 - 676	490 - 680	410 - 660
Apartment	257 - 375	253 - 398	280 - 500	230 - 340
<b><u>HYDRAULIC SERVICES</u></b>				
Offices	110 - 163	95 - 140	125 - 180	60 - 120
Industrial	89 - 131	95 - 140	86 - 120	60 - 120
Hotels	368 - 488	370 - 480	390 - 500	280 - 350

Shopping Centres	137 - 184	140 - 200	110 - 165	60 - 120
Apartment	168 - 226	170 - 230	145 - 280	100 - 180
<b><u>FIRE SERVICES</u></b>				
Offices	225 - 315	180 - 265	225 - 350	200 - 260
Industrial	153 - 255	150 - 225	140 - 270	130 - 230
Hotels	285 - 385	220 - 375	280 - 420	200 - 320
Shopping Centres	255 - 380	220 - 375	245 - 375	250 - 350
Apartment	53 - 102	70 - 135	70 - 150	60 - 110
<b><u>LIFTS / ESCALATORS</u></b>				
Offices	280 - 550	294 - 577	295 - 500	340 - 590
Industrial	135 - 390	145 - 400	150 - 440	150 - 350
Hotels	220 - 495	232 - 520	250 - 470	290 - 490
Shopping Centres	325 - 495	327 - 520	325 - 470	290 - 440
Apartment	165 - 325	175 - 289	125 - 300	140 - 240

The above costs are at **4th Quarter 2017** levels, exclusive of contingencies.

\* Generally without A/C.

\*\* Excludes special power supply.

(Cont'd)

## M&E COSTS FOR SELECTED ASIAN CITIES

### M&E COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	MANILA <sup>Q</sup>	INDIA <sup>G</sup>	JAKARTA #	HO CHI MINH
	PHP/m <sup>2</sup> CFA	INR/m <sup>2</sup> CFA	IDR/m <sup>2</sup> CFA	VND/m <sup>2</sup> CFA
<b><u>MECHANICAL SERVICES</u></b>				
Offices	3,000 - 5,200	4,585 - 6,500	981,000 - 1,154,000	1,885,000 - 2,687,000
Industrial *	700 - 1,500	2,110 - 3,750	301,000 - 710,000	N/A
Hotels	3,500 - 7,200	5,615 - 6,130	976,000 - 1,313,000	N/A
Shopping Centres	2,500 - 5,000	4,380 - 5,735	863,000 - 1,037,000	N/A
Apartment	700 - 3,600	2,500 - 3,100	873,000 - 1,226,000	1,423,000 - 1,950,000
<b><u>ELECTRICAL SERVICES</u></b>				
Offices	3,300 - 7,000	4,050 - 5,575	792,000 - 1,057,000	2,136,000 - 2,547,000
Industrial **	2,000 - 3,500	2,390 - 3,965	449,000 - 700,000	N/A
Hotels	4,700 - 10,000	4,500 - 6,135	797,000 - 1,124,000	N/A
Shopping Centres	3,600 - 6,000	3,870 - 5,175	690,000 - 868,000	N/A
Apartment	3,600 - 6,300	1,950 - 2,680	838,000 - 1,062,000	1,884,000 - 2,379,000
<b><u>HYDRAULIC SERVICES</u></b>				
Offices	900 - 2,200	710 - 1,080	199,000 - 281,000	306,000 - 572,000
Industrial	700 - 1,300	485 - 850	112,000 - 204,000	N/A
Hotels	1,950 - 4,300	3,695 - 5,565	797,000 - 1,124,000	N/A

Shopping Centres Apartment	700 - 1,600 1,800 - 3,000	1,050 - 1,900 1,665 - 2,300	189,000 - 291,000 848,000 - 1,144,000	N/A 596,000 - 693,000
<b><u>FIRE SERVICES</u></b>				
Offices	800 - 1,300	1,130 - 1,475	271,000 - 398,000	664,000 - 1,101,000
Industrial	750 - 2,000	540 - 710	112,000 - 204,000	N/A
Hotels	700 - 1,200	1,315 - 1,680	271,000 - 393,000	N/A
Shopping Centres Apartment	700 - 1,300 800 - 1,300	1,080 - 1,250 600 - 715	266,000 - 312,000 281,000 - 327,000	N/A 456,000 - 572,000
<b><u>LIFTS / ESCALATORS</u></b>				
Offices	1,600 - 3,600	940 - 1,195	424,000 - 1,134,000	635,000 - 1,212,000
Industrial	0 - 400	610 - 785	N/A	N/A
Hotels	1,800 - 3,400	1,365 - 1,990	414,000 - 1,052,000	N/A
Shopping Centres Apartment	800 - 2,300 850 - 2,200	1,600 - 2,050 850 - 1,100	312,000 - 838,000 414,000 - 853,000	1,293,000 - 1,830,000 721,000 - 1,044,000

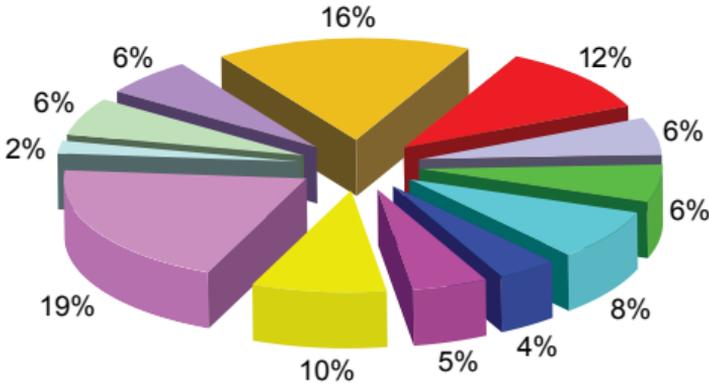
The above costs are at **4th Quarter 2017** levels, exclusive of contingencies.

- \* Generally without A/C.
  - \*\* Excludes special power supply.
  - Ω Transformer, included in Electrical Services.
  - Ⓒ Rates are based on projects in Bangalore and are nett of VAT and Service Tax. Mumbai costs are generally 8% higher.
- # All rates are nett of VAT. Rates for Electrical Services are excluding genset. Rates for Hydraulic Services are excluding STP. Rates for Mechanical Services refer to ACMV Rates only.
- \$ Rates are nett of VAT.

(Cont'd)

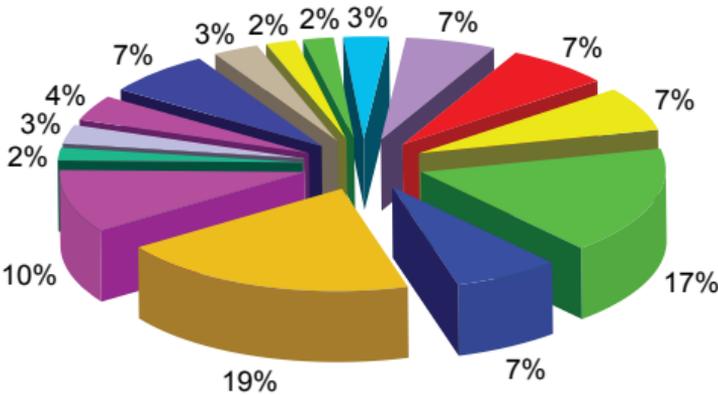
## OFFICE M&E COST COMPONENTS

### ACMV Installation Cost Breakdown for Office Building



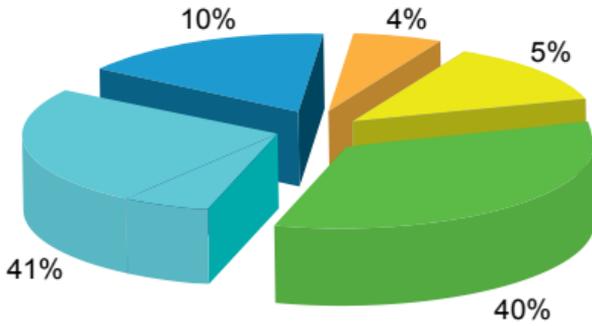
- |  |   |
|--|---|
| <span style="color: red;">■</span> Chillers plant                | <span style="color: yellow;">■</span> Chilled water AHU / FCU system            |
| <span style="color: lightblue;">■</span> Cooling towers          | <span style="color: purple;">■</span> AC ductworks, diffusers and accessories   |
| <span style="color: green;">■</span> Chilled water pumps         | <span style="color: lightcyan;">■</span> Split type air-conditioning units      |
| <span style="color: cyan;">■</span> Chilled water pipeworks      | <span style="color: lightgreen;">■</span> Mechanical ventilation fan system     |
| <span style="color: blue;">■</span> Condenser water pumps        | <span style="color: lavender;">■</span> MV ductworks, diffusers and accessories |
| <span style="color: magenta;">■</span> Condenser water pipeworks | <span style="color: orange;">■</span> Electrical and automatic control works    |

### Electrical Installation Cost Breakdown for Office Building



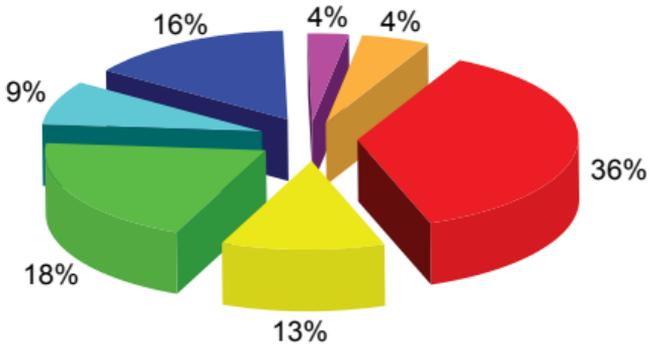
- |   |   |
|---|---|
| <span style="color: red;">■</span> Sub-station, HV & LV switchgear                  | <span style="color: purple;">■</span> Telephone distribution system |
| <span style="color: yellow;">■</span> Power transformer                             | <span style="color: blue;">■</span> Underfloor trunking system      |
| <span style="color: green;">■</span> LV mains & sub-mains distribution system       | <span style="color: brown;">■</span> Public address system          |
| <span style="color: blue;">■</span> Standby generator                               | <span style="color: yellow;">■</span> MATV/SCV system               |
| <span style="color: orange;">■</span> Final sub-circuit for lighting & power points | <span style="color: green;">■</span> CCTV/Guard Patrol System       |
| <span style="color: magenta;">■</span> Luminaries                                   | <span style="color: cyan;">■</span> Intercom/Card access system     |
| <span style="color: teal;">■</span> Earthing system                                 | <span style="color: lavender;">■</span> External lighting           |
| <span style="color: lightblue;">■</span> Lightning protection system                |   |

### Plumbing and Sanitary Installation Cost Breakdown for Office Building



- Water tank
- Water pumps
- Plumbing distribution system
- Sanitary distribution system
- Delivery and installation of sanitary wares and fittings

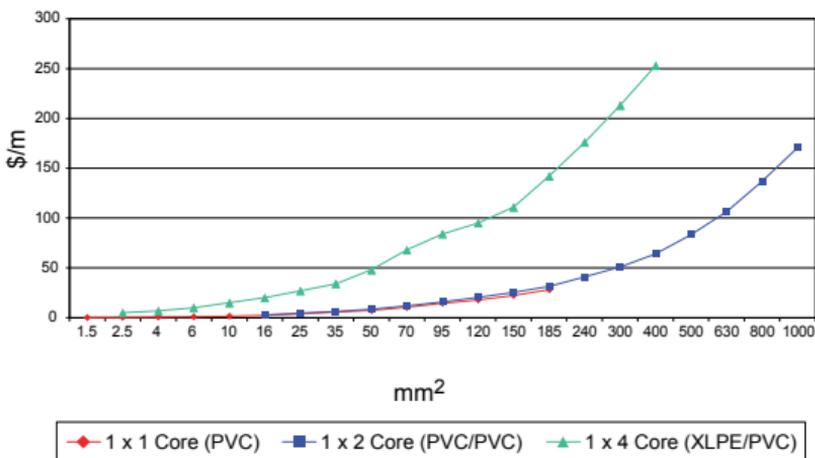
### Fire Protection Installation Cost Breakdown for Office Building



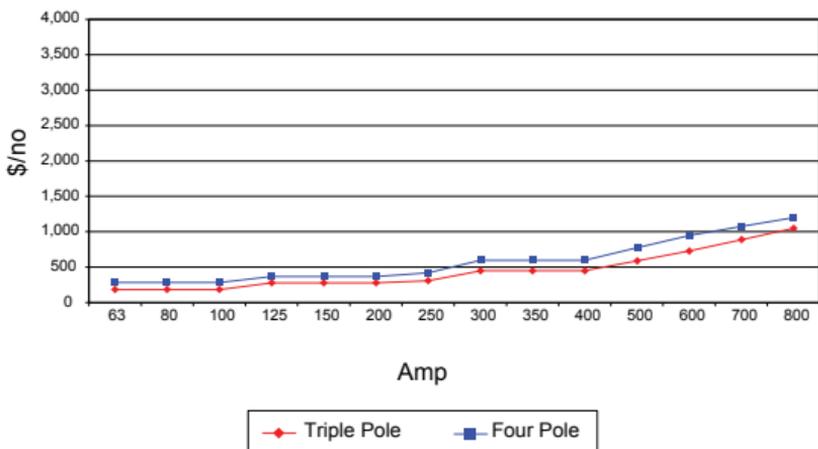
- Sprinkler System
- Hose reel System
- Wet riser System
- Dry riser System
- Automatic fire alarm & detection system
- Portable fire extinguisher
- External fire hydrants

## M&E COST CHARTS

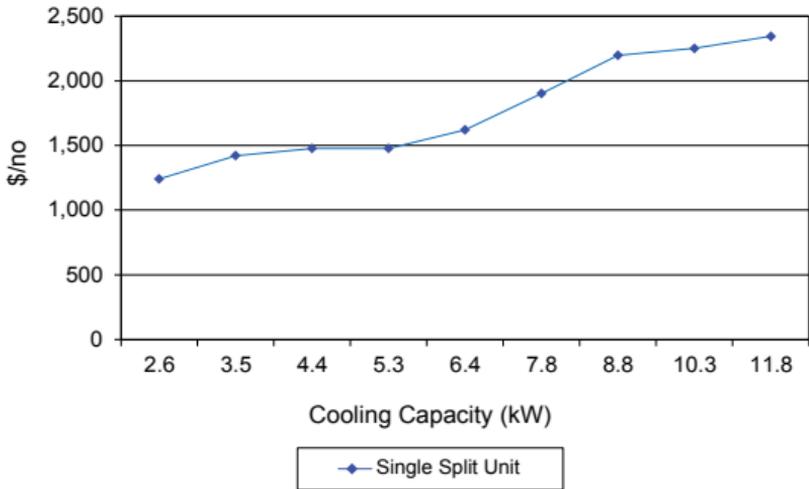
### Single Core PVC Cables



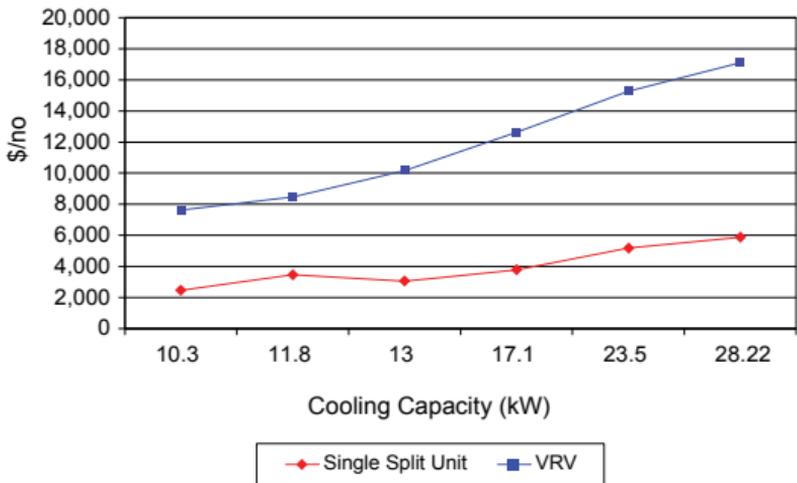
### 22kA MCCB



### Wall Mounted Direct Expansion Fan Coil Unit

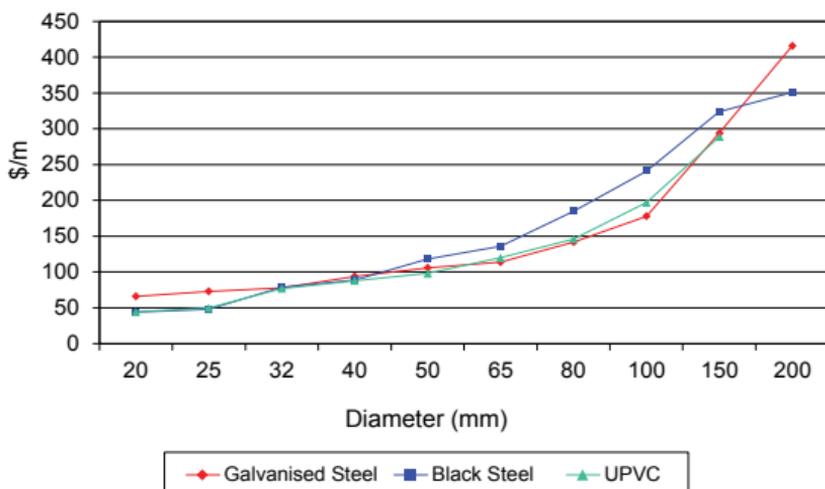


### Condensing Unit

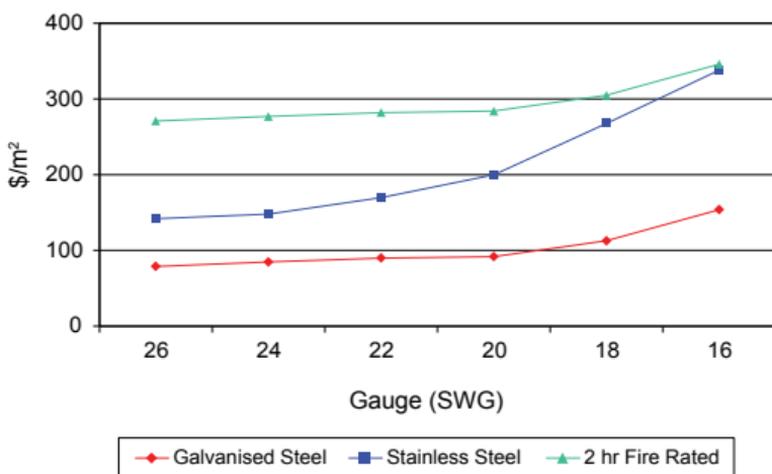


## M&E COST CHARTS

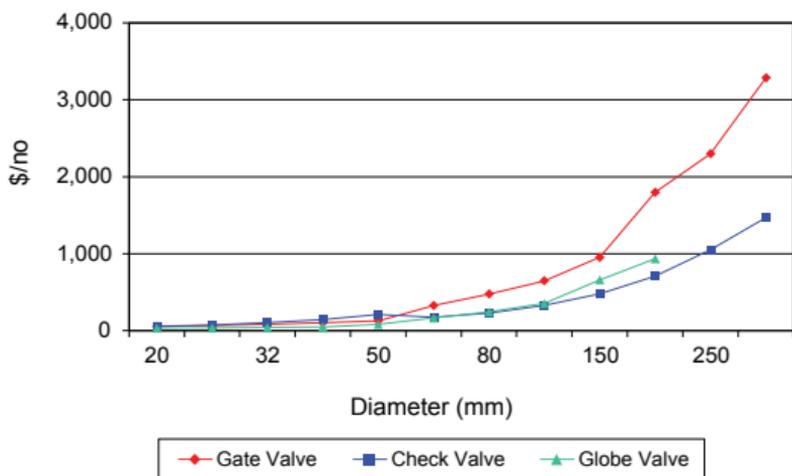
### Pipework



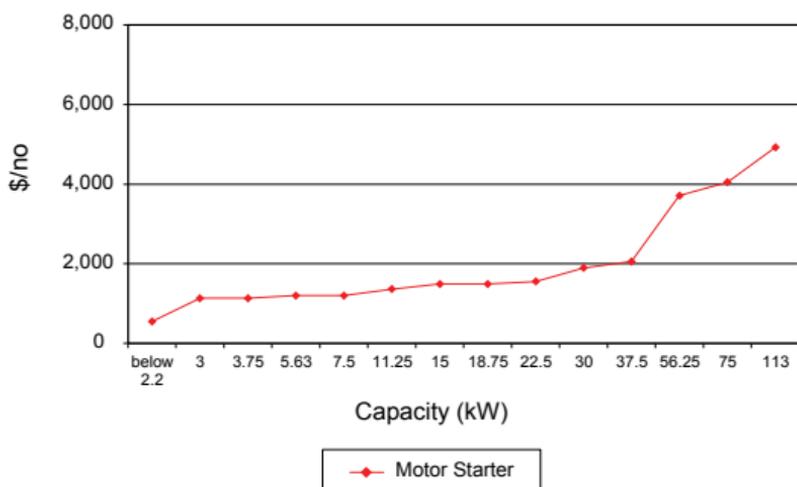
### Ductwork



## Valve



## Motor Starter

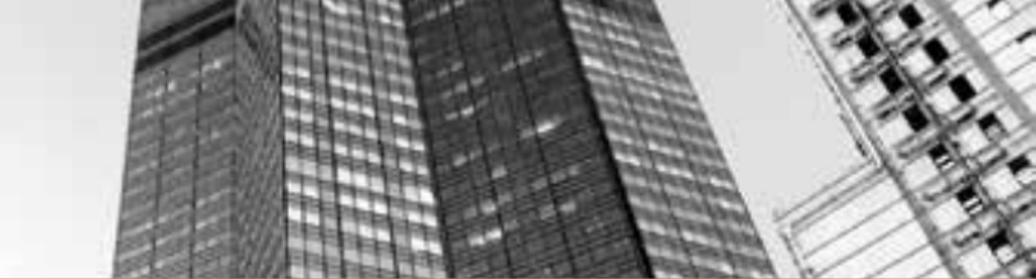


## UTILITY COSTS FOR SELECTED ASIAN CITIES COSTS ARE AT 4<sup>TH</sup> QUARTER 2017

CITIES	EXCHANGE RATE USED US\$1=	ELECTRICITY (US\$/kWh)		WATER (US\$/m <sup>3</sup> )		FUEL (US\$/LITRE)		
		DOMESTIC	COMMERCIAL/ INDUSTRIAL	DOMESTIC	COMMERCIAL/ INDUSTRIAL	DIESEL	LEADED	UNLEADED
Singapore*	S\$1.36	0.15 <sup>^</sup>	0.15 <sup>^</sup>	1.76 <sup>^^</sup> -2.01 <sup>^^^</sup>	1.76 <sup>^^^</sup> -2.01 <sup>^^^</sup>	1.10 <sup>^^^</sup>	N/A	1.75 <sup>^^^</sup>
Bangalore	INR65	0.050-0.114	0.130-0.132	0.400-0.692	1.358	0.908	N/A	1.077
Bangkok	BAHT32.39	0.072-0.136 <sup>**</sup>	0.097-0.099	0.262-0.446	0.293-0.488	0.814	N/A	0.859*
Beijing	RMB6.60	0.07-0.119	0.23 (peak) 0.133 (normal)	0.758-1.364	1.364-1.439	0.92	N/A	1.04 <sup>**</sup>
Brunei	B\$1.39	0.009-0.13	0.065-0.182	0.099-0.398	0.552-0.596	0.343	0.461	0.479
Chongqing	RMB6.60	0.08	0.13	0.53	0.69	0.86	N/A	0.98*
Guangzhou	RMB6.60	0.1	0.14	0.44	0.74	0.94	N/A	1.06 <sup>^</sup>
Ho Chi Minh <sup>+</sup>	VND22,700	0.11 <sup>++</sup>	0.09-0.14/ 0.06-0.11	0.27-0.57	0.79/0.48	0.64 <sup>+++</sup>	N/A	0.80-0.83 <sup>++++</sup>
Hong Kong	HK\$7.80	0.11 <sup>ss</sup>	0.13	0.83 <sup>ss1</sup>	0.59	1.57	N/A	1.99
Jakarta	IDR13,570	0.108	0.108	0.077-0.549	0.503-1.080	0.538	N/A	0.608
Kuala Lumpur	RM4.08	0.053-0.140	0.093-0.108	0.252-0.490	0.507-0.559	0.539	N/A	0.551
Macau	MOP8.03	0.17 <sup>oo</sup>	0.17 <sup>oo</sup>	0.56 to 0.91 <sup>o</sup>	0.75 <sup>ooo</sup>	1.54	N/A	1.28
Manila	PHP50.50	**0.21-0.22'	**0.15'	**0.48-0.80'	**1.12'	0.600	N/A	0.900
New Delhi	INR65.00	0.063-0.132	0.141-0.164	0.288-1.037	1.318-5.886	0.890	N/A	1.074
Shanghai	RMB6.60	0.093 (peak) 0.047 (normal)	0.160 (peak) 0.079 (normal)	0.53	0.72	0.93	N/A	1.05

Singapore	*	All rates are nett of GST
	A	Electricity tariff is based on low tension power supply
	AA	Domestic water tariff effective from 1 July 2017 to 30 June 2018. Rate includes water conservation tax, water-borne fee, sanitary appliance fee and is an average for the 1 <sup>st</sup> 40m <sup>3</sup>
	AAA	Domestic water tariff effective from 1 July 2018. Rate includes water conservation tax, water-borne fee, sanitary appliance fee and is an average for the 1 <sup>st</sup> 40m <sup>3</sup>
	AAAA	Non-domestic water tariff effective from 1 July 2017 to 30 June 2018. Rate includes water conservation tax, water-borne fee and sanitary appliance fee
	AAAAA	Non-domestic water tariff effective from 1 July 2018. Rate includes water conservation tax, water-borne fee and sanitary appliance fee
	AAAAAA	As at 2 November 2017
	AAAAAAA	98 Unleaded petrol as at 2 November 2017
Bangkok	*	Unleaded gasoline 95
	**	For normal tariff with consumption not exceeding 150kWh per month
Beijing	***	Unleaded gasoline 97
Brunei		Electricity (Domestic): Tariff effective from 1 January 2012. 1-10kWh 10c, 11-60kWh 8c, 61-100kWh 12c, above 100kWh 15c
Chongqing	*	Unleaded 93# = US\$1.09/litre; Unleaded 97# = US\$1.15/litre
Guangzhou	□	Unleaded gasoline 97#
Ho Chi Minh	+	All rates are VAT inclusive
	++	Domestic electricity rates are applied to the 301kW above wards
	+++	D.O - 0.05%
	++++	92 & 95 Unleaded petrol as at October 2012
Hong Kong	SS	Electricity - (Dom): 0-400kWh = US\$0.10; 400-1,000kWh = US\$0.12; 1,000-1,800kWh = US\$0.14; 1,800-2,600kWh = US\$0.18; 2,600-3,400kWh = US\$0.21; 3,400-4,200kWh = US\$0.22; Above 4,200kWh = US\$0.22 (Based on tariff scheme of CLP Holding Limited and is charged on bi-monthly consumption)
	SS1	Water - (Dom): 0-12m <sup>3</sup> = F.O.C; 12-43m <sup>3</sup> = US\$0.53; 43-62m <sup>3</sup> = US\$0.83m <sup>3</sup> ; Above 62m <sup>3</sup> = US\$1.16/m <sup>3</sup>
Kuala Lumpur		Unleaded petrol Ron 95
Macao	0	Water: Consumption charge : US\$0.55/m <sup>3</sup> for 28m <sup>3</sup> or below, US\$0.62/m <sup>3</sup> for 29-60m <sup>3</sup> , US\$0.70/m <sup>3</sup> for 61-79m <sup>3</sup> and US\$0.78/m <sup>3</sup> for 80m <sup>3</sup> or above; Other charges (Depending on meter size 15-200mm): Meter rental = US\$0.34-58.00/month
	00	Electricity tariff are composition of demand charges, consumption charges, fuel clause adjustment and government tax
	000	Charges for ordinary users (e.g. Business, government buildings, schools, associations, hospitals and others) only.
	**	Special users (e.g. Gaming industries, hotels, saunas, golf courses, construction, public infrastructures and other temporary consumption) are excluded.
Mamila	*	Actual Billing: Include misc. charges such as Environmental Charge, Currency Exchange Rate adjustment (CERA), VAT, etc.
	*	Electricity - (Dom): 190-860kWh; (Comm/Ind): 150,000kWh; Water - (Dom): 29-41m <sup>3</sup> ; (Comm/Ind): 4,030m <sup>3</sup>
Seoul	***	Plus electricity basic rates; domestic: US\$1.41/month + US\$0.05-0.165/kWh (300kWh below in use) and commercial: US\$6.31/month + US\$0.06-0.11/kWh (300kWh below in use)
	****	Plus water basic rates; domestic: US\$0.95/month (the usage of 15mm caliber) and commercial: US\$78.35/month (the usage of 100mm caliber)
Shanghai		Unleaded 93# = US\$1.09/litre; Unleaded 97# = US\$1.15/litre



A black and white photograph of several tall skyscrapers, viewed from a low angle looking up. The buildings are made of glass and steel, with many windows visible. The sky is a uniform light gray.

**CONTRACT PROCUREMENT**

**3**

### COMMON STANDARD FORMS OF CONTRACT IN SINGAPORE - CURRENT AS OF 2018

- Articles and Conditions of Building Contract published by the Singapore Institute of Architects, 9<sup>th</sup> Edition, Reprint August 2011 [Measurement Contract]
- Articles and Conditions of Building Contract published by the Singapore Institute of Architects, 9<sup>th</sup> Edition, Reprint August 2011 [Lump Sum Contract]
- Articles and Conditions of Contract for Minor Works 2012 published by the Singapore Institute of Architects, 1<sup>st</sup> Edition, December 2012
- Conditions of Sub-Contract for use in conjunction with the Singapore Institute of Architects Main Building Contract, 4<sup>th</sup> Edition, 2<sup>nd</sup> Reprint August 2011

Note that SIA has also recently released several new forms, all in their 1<sup>st</sup> Edition in November 2016:

- SIA Building Contract 2016 Without Quantities (Lump Sum), 1<sup>st</sup> Ed, Nov 2016.
- SIA Building Contract 2016 Without Quantities (Lump Sum)(International), 1<sup>st</sup> Ed, Nov 2016.
- SIA Building Contract 2016 Design and Build with Employer's Design, 1<sup>st</sup> Ed., Nov 2016.
- SIA Building Contract 2016 Design and Build with Employer's Design (International), 1<sup>st</sup> Ed, Nov 2016.
- SIA Sub Contract, 1<sup>st</sup> Ed., Nov 2016.
- SIA Sub Contract (International), 1<sup>st</sup> Ed., Nov 2016.
- REDAS Design and Build Conditions of Main Contract published by the Real Estate Developers' Association of Singapore, 3<sup>rd</sup> Edition (renamed as the Main Contract), July 2013
- REDAS Design and Build Conditions of Sub-Contract published by the Real Estate Developers' Association of Singapore, 1<sup>st</sup> Edition, July 2013
- FIDIC Forms of Conditions of Contract published by the Federation Internationale des Ingenieurs-Conseils, 1<sup>st</sup> Edition 1999
  - Conditions of Contract for Construction for Building and Engineering Works designed by the Employer

- Conditions of Contract for Plant and Design-Build for Electrical and Mechanical Plant and for Building and Engineering Works designed by the Contractor
- Conditions of Contract for EPC/Turnkey Projects
- Short Form of Contract
- Public Sector Standard Conditions of Contract for Construction Works published by the Building and Construction Authority, 7<sup>th</sup> Edition, July 2014
- Public Sector Standard Conditions of Contract for Design and Build published by the Building and Construction Authority, 6<sup>th</sup> Edition, July 2014
- Standard Conditions of Nominated Sub-Contract for use in conjunction with the Public Sector Standard Conditions of Contract for Construction Works published by the Building and Construction Authority, 5<sup>th</sup> Edition December 2008

## **STANDARD FORMS (PRIVATE SECTOR) - MAIN FEATURES**

### ***SIA Articles and Conditions of Building Contract***

- (1) Contractor's rates include all other works necessary to complete the Works, whether or not specifically mentioned in the Contract Documents [Article 5]
- (2) Architect's orders must be expressed as 'directions' or 'instructions' [Clause 1(2)]
- (3) Contractor is responsible for own design and of his sub-contractors or suppliers [Clause 3(1)]
- (4) Contractor must supply a make-up of his prices [Clause 5]
- (5) Provision is made for staged possession of the site and phased completion of the Works [Clauses 10 and 25]
- (6) No provision for Employer to take out insurances [Clauses 19 and 20]
- (7) Contractor's notification within 28 days of any event, direction or instruction entitling the Contractor to an extension of time with condition precedent to an extension of time [Clause 23(2)]
- (8) Following failure of Contractor to remedy any defects

within 3 months from the date of issue of Schedule of Defects (or such other time as stated in the Appendix), Architect must direct the Contractor, within 14 days from the expiry of 3 months from the issue of the Schedule of Defects, that a defect need not be remedied. In lieu thereof, the Employer may deduct from any monies due to or recover from the Contractor based on the estimated cost incurred by the Employer to employ other Contractors to remedy the defects [Clause 27.4]

- (9) After the expiry of the Maintenance Period and all defects are either remedied, or dealt with under Clause 27.4, Architect to issue Maintenance Certificate [Clause 27.5]
- (10) Contractor is responsible for Designated/Nominated Sub-Contractors in respect of design, delays, etc. [Clause 28(2)]
- (11) Contractor entitled to serve payment claim (which is defined as having the same meaning ascribed in the Building and Construction Industry Security of Payment Act) on Employer on the last day of each month following the month in which the contract is made (or otherwise by such time or on such day specified in Appendix) where interim payment is based on periodic valuation, or on certified completion of the relevant stage where interim payment is by stage instalments [Clause 31(2)]
- (12) Architect issues Interim Certificates within 14 days after receipt of payment claim [Clause 31(3)]
- (13) Second release of Retention monies shall be paid under the Final Certificate issued by the Architect at the expiry of the Maintenance Period or the issuance of Maintenance Certificate, whichever is the later [Clause 31(10)]
- (14) Architect has no power to certify compensation to Contractor for breaches of contract by Employer [Clause 31(14)]
- (15) Employer responds to payment claim by providing, or causing to be provided, a payment response within 21 days after service of payment claim by Contractor [Clause 31(15)]
- (16) Contractor entitled to serve Notice of Termination following failure of payment of adjudicated amount by Employer [Clause 33(3)]

- (17) Contractor entitled to suspend work pursuant to provisions of Building and Construction Industry Security of Payment Act [Clause 33(6)]
- (18) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 38]
- (19) Parties may refer technical disputes to expert determination; provision for expert determination does not affect or prejudice right to refer dispute to mediation or arbitration [Clause 38A]
- (20) Optional clauses permit fluctuations on specified materials [Clause 39] and insurance excesses [Clause 40]

### ***SIA Conditions of Sub-Contract***

- (1) Contractor issues directions and instructions to the Sub-Contractor [Clause 5.1]
- (2) Contractor orders variations on sub-contract works [Clause 7.1]
- (3) Application for extension of time is made to the Contractor, not the Architect [Clause 11.2]
- (4) Time period for notification of any event, direction or instruction entitling the Sub-Contractor to an extension of time is 21 days [Clause 11.2]
- (5) Extension of time is assessed and granted by the Contractor [Clause 11.2]
- (6) The following certificates are issued by the Contractor:
  - Sub-Contract Completion Certificate [Clause 11.3]
  - Sub-Contract Maintenance Certificate [Clause 12.2]
  - Sub-Contract Termination Certificate [Clause 13.1]

### 3 CONTRACT PROCUREMENT

- (7) Provision for recovery of general damages only - amount is set off and deducted from monies due to the Sub-Contractor after condition precedents are satisfied [Clause 11.4]
- (8) Contractor can terminate sub-contract without the need for the Architect to issue notices [Clause 13.1]
- (9) Sub-Contractor is entitled to serve Notice of Termination following failure of payment of adjudicated amount by Contractor [Clause 13.6]
- (10) Sub-Contractor entitled to serve payment claim (which is defined as having the same meaning ascribed in the Building and Construction Industry Security of Payment Act) on Contractor on the last day of each month following the month in which the sub-contract is made where interim payment is based on periodic valuation, or on certified completion of the relevant stage where interim payment is by stage instalments [Clause 14.4]
- (11) Contractor responds to payment claim by providing, or causing to be provided, a payment response within 21 days after service of payment claim by Sub-Contractor [Clause 14.5]
- (12) Where sub-contract is a supply contract, Contractor to respond to payment claim by paying Sub-Contractor claimed amount or such amount as Contractor agrees to pay [Clause 14.6]
- (13) Contractor has no power to revise or correct any certificates issued by him save for clerical, computational or typographical errors, or errors of a similar nature [Clause 14.10]
- (14) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 16]
- (15) Parties may refer technical disputes to expert determination; provision for expert determination does not affect or prejudice right to refer dispute to

mediation or arbitration [Clause 16A]

***REDAS Design and Build Conditions of Main Contract***

- (1) No order of priority for Contract Documents; in the event of any discrepancies between the documents, Employer's Requirements shall prevail [Clause 1.7]
- (2) Provision for Named Sub-Contractors; Contractor is entitled to rights of objection [Clause 2.4 and 2.5]
- (3) Contractor's Works and design shall be fit for their intended purpose in accordance with the Employer's Requirements; Contractor also responsible for the sufficiency and correctness of the Employer's designs, specifications and calculations in the Employer's Requirements [Clause 4.1]
- (4) Administration of the Contract is carried out by the Employer's Representative appointed by the Employer; Employer's Representative's duties can be delegated to assistants with Employer's consent [Clause 5]
- (5) Provision is made for completion of the Works in whole or in phases/sections [Clause 10]
- (6) Contractor must satisfy extensive criteria before handing over [Clause 11]
- (7) Employer may occupy any parts of the Works upon issuance of the Handing Over Certificate of Occupied Part by the Employer's Representative [Clause 12]
- (8) Contractor's application for extension of time within 28 days of occurrence of cause of delay is condition precedent to an extension of time [Clause 16.2]
- (9) Contractor entitled to serve payment claim (which is defined as having the same meaning ascribed

### 3 CONTRACT PROCUREMENT

in the Building and Construction Industry Security of Payment Act 2004) (“the SOP Act”) on the Employer on the last day of each month following the month in which the Contract is made (or otherwise by such time or on such day as stated in Appendix 1) [Clause 22.1]

- (10) Employer’s Representative issues Interim Payment Certificate within 14 days of receipt of payment claim [Clause 22.2]
- (11) Interim payment certificate or final payment certificate issued by the Employer’s Representative shall be deemed the payment response from the Employer under the SOP Act if the Employer does not provide any response within 21 days of service of payment claim. Where the Employer provides a payment response within 21 days of service of payment claim, such response shall take precedence over the interim payment certificate or final payment certificate [Clause 22.4]
- (12) Application for final payment claim by Contractor to issuance of final payment certificate by the Employer’s Representative is regulated by a procedure [Clause 24]
- (13) Claims for additional payment are regulated by a claims procedure [Clause 29]
- (14) Employer may at his convenience at any time to terminate the Contract without cause [Clause 30.1]
- (15) Contractor entitled to suspend work pursuant to provisions of SOP Act [Clause 31.1]
- (16) Contractor entitled to serve Notice of Termination following failure of payment of adjudicated amount by Employer [Clause 31.2]
- (17) Upon issuance of a Notice of Taking Over, Employer may take over design and construction of a part of the Works where termination for default is not practical as a default may relate to a

specific part only [Clause 32]

- (18) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 33]
- (19) Additional optional clause permit fluctuations on specified materials used for permanent works only [Clause 34]
- (20) Option Module (with Employer's Architectural Design) where the Employer retains his own design consultants to provide the architectural design works and make the statutory submissions

***FIDIC Conditions of Contract for Construction for Building and Engineering Works designed by the Employer***

- (1) Documents forming the Contract are accorded a sequence of priority for purposes of interpretation [Clause 1.5]
- (2) Employer upon request by the Contractor has to submit reasonable evidence that financial arrangements have been made and are being maintained which will enable him to pay the Contractor. If he intends to make any material change to his financial arrangements, he shall inform the Contractor with detailed particulars [Clause 2.4]
- (3) Administration of the Contract and supervision of the execution of the Works are carried out by the Engineer appointed by the Employer [Clause 3.1]
- (4) Provision is made for the Contractor to design the Works to the extent specified in the Contract [Clause 4.1]
- (5) Contractor is obliged to submit detailed time programme within 28 days from receipt of notice of the Commencement Date [Clause 8.3]
- (6) Employer may take over any part of the Works upon issue of a Taking-Over Certificate by the

Employer [Clause 10.2]

- (7) Employer is entitled to an extension of the Defects Notification Period (by not more than two years) if the Works or a Section thereof cannot be used by reason of a defect or damage [Clause 11.3]
- (8) Contractor may submit to the Engineer value engineering proposals to accelerate completion, reduce cost of construction, maintenance and operation, or improve efficiency or value to the Employer [Clause 13.2]
- (9) Quantities in the Bill of Quantities are estimated quantities [Clause 14.1]
- (10) Provision for advance payment to the Contractor upon submission of an Advance Payment Guarantee, if Employer agrees [Clause 14.2]
- (11) Amount certified in Interim Payment Certificate is paid by the Employer within 56 days from receipt of the Contractor's Statement and supporting documents [Clause 14.7]
- (12) Employer is entitled to terminate the Contract without cause at any time for his convenience subject to certain provisions [Clause 15.5]
- (13) Insuring party is the Contractor unless otherwise stated in the Particular Conditions that the Employer wishes to effect insurances [Clause 18.2]
- (14) Provision is made for disputes to be adjudicated by a Dispute Adjudication Board [Clause 20]
- (15) Claims for additional payment and extension of time are regulated by a claims procedure which inter alia, requires the Engineer or Employer to respond within a given time period [Clause 20]

## STANDARD FORMS (PUBLIC SECTOR) - MAIN FEATURES

### ***Public Sector Standard Conditions of Contract for Construction Works (PSSCOC)***

- (1) Superintending Officer, Superintending Officer's Representative and assistants to Superintending Officer and Superintending Officer's Representative are appointed for design, cost control and contract administration [Clause 2]
- (2) Failure to comply with the Superintending Officer's instructions entitles the Employer to recover any cost, loss, expense and damage incurred in employing another contractor and any other loss or damage as a result of the Contractor's default [Clause 2]
- (3) Contractor must provide a security deposit (either as cash deposit or guarantee from a bank or Monetary Authority of Singapore approved insurer) within 14 days from letter of acceptance or such other longer period as stated in Appendix [Clause 4.5]
- (4) Employer may provide geotechnical information but it does not relieve the Contractor from carrying his own investigation or search for existing and other additional relevant information [Clause 5.1]
- (5) If Contractor encounters adverse physical conditions (which include unforeseen sub-surface and ground conditions and underground services), he may be granted extension of time and loss and expense provided such conditions could not have been reasonably foreseen by an experienced contractor [Clause 5.2]
- (6) Superintending Officer has express power to suspend the Works, and if suspension is more than 90 days, Contractor may regard it as omission of the affected part (which is suspended) or a termination (where the suspension affected the whole Works) [Clause 13]

### 3 CONTRACT PROCUREMENT

- (7) If progress or completion of the Works will be delayed, Contractor has to notify the Superintending Officer within 60 days of occurrence of the delaying event, the submission of the notice being a condition precedent [Clause 14.3]
- (8) Superintending Officer may require the Contractor to submit quotation for any proposed variation before issuing an instruction [Clause 19.3]
- (9) Superintending Officer has 60 days from the date of certified substantial completion of the variation works to value the amount due and notify the Contractor [Clause 20.2(2)]
- (10) Provision is made for Contractor to recover loss and expense as a result of regular progress and/or completion of the Works having been disrupted, prolonged or materially affected by variation instructions, failure to give site possession, suspension, late supply of information, Superintending Officer's instructions (which Employer is liable to pay loss and expense), unforeseeable adverse physical conditions, acts or omissions of other contractors and Employer's act of prevention or breach of contract [Clause 22]
- (11) Superintending Officer has power to certify amounts payable to the Contractor for all work executed until termination (where such termination is without default of the Contractor) and any loss and expense suffered by the Contractor [Clause 31.4]
- (12) Superintending Officer has to issue a Payment Certificate to the Contractor within 14 days of receipt of a Payment Claim (which is defined as having the same meaning ascribed in the Building and Construction Industry Security of Payment Act) [Clause 32.2(1)]
- (13) Payment Certificate issued by Superintending Officer shall be deemed the Payment Response from the Employer under the Building and Construction Industry Security of Payment Act if

the Employer does not provide any response within 14 days from the Payment Claim [Clause 32.2(2)]

- (14) Where the Employer provides a Payment Response within 14 days from the Payment Claim, such response takes precedence over the Superintending Officer's Payment Certificate [Clause 32.2(2)]
- (15) Contractor has 90 days from the Date of Substantial Completion to submit Final Payment Claim which shall constitute a Payment Claim under the Building and Construction Industry Security of Payment Act [Clause 32.4]
- (16) Superintending Officer has 21 days from receipt of Final Payment Claim to provide Contractor with an Interim Final Account and at the same time issue a Payment Certificate [Clause 32.5(1)]
- (17) Where Contractor fails to submit a Final Payment Claim, Superintending Officer has 150 days from the Date of Substantial Completion to issue Interim Final Account, and a further 30 days thereafter to issue a payment certificate. Interim Final Account and payment certificate under such circumstances are not subject to the Building and Construction Industry Security of Payment Act [Clause 32.5(2)]
- (18) Mechanism for fluctuation of materials prices applicable to specified materials in Appendix [Clause 33]
- (19) Any dispute or difference which involves a Payment Claim or Payment Response to which the Building and Construction Industry Security of Payment Act applies, entitles the Contractor to make an adjudication application [Clause 35.5(1)]
- (20) Employer can only recover from the Contractor any sum due or to become due under this contract (and not from any other contract between the Employer and the Contractor) [Clause 36.1]

## **3** CONTRACT PROCUREMENT

***Public Sector Standard Conditions of Contract for Design and Build (PSSCOC D&B) (only main features which differ from the 'Build' form are highlighted below)***

- (1) Contractor is responsible for choice of plant, materials, goods, workmanship and coordinating all design work [Clause 4.1]
- (2) Contractor to engage and include all fees, costs, etc. in the Contract Sum for suitable qualified personnel viz, Registered Inspector, Resident Engineer and any others as required by statute; such persons cannot be replaced without prior consent of the Superintending Officer [Clause 4.2]
- (3) Contractor must indemnify the Employer against all claims and proceedings for infringements of any patent rights, design, trademark name or copyright [Clause 4.6]
- (4) Contractor warrants that the Contractor's Proposals meet the Employer's Requirements and are fit for the purpose [Clause 6.1]
- (5) Contractor indemnifies the Employer for any breach of design responsibility in contract and under common law [Clause 6.1]
- (6) When the Works are substantially completed and the Temporary Occupation Permit obtained, Contractor gives notice plus an undertaking to complete any outstanding work during the defects liability period; Superintending Officer has 21 days from the notice to either issue certificate or instructions on works still to be completed [Clause 17]
- (7) No provision for Named Sub-Contractors

### **CONTRACTUAL ARRANGEMENTS**

Contractual arrangements are concerned with the type of agreement to be entered into and the obligations, responsibilities, rights and liabilities assumed by the parties under a contract. It deals with the situation that

exists from the time when a contract is formed until the time when all the obligations created by it have been discharged.

Contractual arrangements may comprise the following:

### ***Conventional Contracts***

The commonest form of contract is one based upon the SIA Conditions of Contract. The design is prepared by a Consultant and the price of the works determined before award, usually by competition but occasionally by negotiation. Small projects tend to be based upon specification and drawings whilst large projects are usually based upon bills of quantities.

### ***Design and Build Contracts***

A design and build contract is a contractual arrangement where the Employer employs a Contractor to design and build the project.

The Contract Sum is inclusive of design work, management and construction costs.

### ***Develop and Construct Contracts***

A develop and construct contract is a contractual arrangement where the Employer engages consultants to design the project to a certain stage; the Contractor then develops and completes the design and constructs the building.

### ***Term Contracts***

Under term contracts, the Contractor signs a contract to carry out an indefinite amount of work within a certain framework over a time period or 'term'. While exactly what is to be done may be uncertain, the general character of the work will usually be fairly easy to define.

Orders for work are issued progressively from time to time throughout the contract period. The work is measured, valued and the Contractor is paid accordingly subject to the tendered adjustment on the Schedule of Rates.

### ***Guaranteed Maximum Price (GMP) Contracts***

A GMP, effectively a guaranteed lump sum price for a

project, is a set of conditions that can be introduced and used in conjunction with any standard form of contract, e.g. SIA Standard Form (for traditional procurement), JCT Standard Form with Contractor's Design or REDAS Design and Build Standard Form (for design-build procurement) and JCT Management Contract Standard Form (for management contracting). It is not a standard form of contract.

The guaranteed price is not subject to upward adjustment except for fundamental and material changes in the client scope of work or as a result of legislation or statutory requirements.

The benefits of GMP include greater price certainty, early start as design and construction can overlap, contractor's input and contribution on buildability, best practice construction methods and mutually beneficial partnering-style relationship.

### ***Management Contracts***

A management contract is one in which the Management Contractor is appointed to manage the planning and construction of a project and in which the construction work is executed by Sub-Contractors working under him, selected and appointed as the job proceeds.

The Management Contractor prepares the programme, decides on the contents of each work package to be sub-contracted, organises and manages the construction of all works which are undertaken by Sub-Contractors, each selected in competition.

### ***Construction Management Contracts***

Construction management contracts entail an interactive procurement concept involving combined efforts of the Employer, Construction Manager, design consultants and multitude of work package contractors.

Under construction management contracts, the Construction Manager is appointed to manage the entire delivery process from inception to completion while construction work is executed by a myriad of

work package contractors engaged by the Employer, selected and appointed as the job proceeds.

### ***Public-Private Partnership (PPP)***

Public-Private Partnership (PPP) is a generic term which describes the various structures possible whereby the public and private sectors work together in the delivery of services and the provision and operation of assets. Typical forms of project structures under PPP include PFI (Private Finance Initiative), DBFO (Design, Build, Finance, Operate), DCMF (Design, Construct, Manage, Finance), BOO (Build, Own, Operate), BOT (Build, Operate, Transfer) and BOOT (Build, Own, Operate, Transfer).

Broadly, a typical PPP model involves the procuring authority (or public agency) contracting with the Special Purpose Vehicle (SPV) under a long-term service purchase agreement for the design, construction, maintenance and operation of the facility. The SPV enters into a range of sub-contracts for the building works, and operations and maintenance of the new asset.

### ***Early Contractor Involvement (ECI)***

Early Contractor Involvement (ECI) is a project delivery method whereby a contractor is engaged either during the earlier stages of design (i.e. concept design or schematic design stages) or during an extended period of tendering to seek the contractors' expertise especially in the areas of buildability, constructability, construction scheduling and planning, value management or value engineering and the latest construction technologies or methods. It has been said that ECI promotes "partnering" in a tendering environment.

An ECI exercise is to engage the contractors and to seek their input on certain project risks which as an end result could create greater certainty on the estimated cost and expected delivery of the project.

ECI is not a contract form but rather a procurement process that could be adopted on any form of contract.





## OTHER INFORMATION

# 4

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Exchange Rates

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Prime Rates

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Currency Fluctuations

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Conversion Factors

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IDD Codes & Time Differences

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Relevant Websites

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Current Construction Regulations

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### EXCHANGE RATES

Approximate current rates at 4 October 2017

COUNTRY	PER UNIT	S\$
Australia	dollar	1.0693
China	rmb	0.2047
Europe	eur	1.6005
Hong Kong	100 HKd	0.1743
India	100 rupees	2.0833
Indonesia	100 Rp	0.01009
Japan	100 yen	1.2096
Korea	won	0.00119184
Malaysia	ringgit	0.3221
Philippines	100 peso	0.026674
Taiwan	NT dollar	0.04484
Thailand	100 baht	0.04082
United Kingdom	pound	1.8044
USA	dollar	1.3606
Vietnam	dong	0.00005983

Source: The Hongkong and Shanghai Banking Corporation Limited

## PRIME RATES

Indicative prime rates as at 4<sup>th</sup> Quarter 2017

COUNTRY	RATE (% pa)
Brunei	5.50
China**	4.75
Hong Kong	5.00
India	9.55
Indonesia	5.00
Macau	5.25
Malaysia^^^	4.35
Philippines	4.14
Singapore	5.28
Thailand#	7.00
United Kingdom	0.50
United States of America	4.50
Vietnam##	9.00

Note: Depending on the circumstances, prime rates may vary from time to time

China\*\* = 5-Year Benchmark Lending Rate

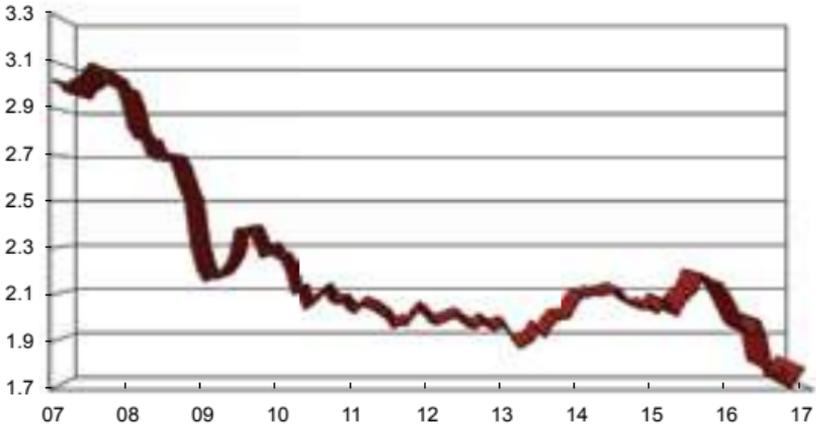
Malaysia^^^ = Indicative Effective Lending Rate

Thailand# = Minimum Loan Rate % per annum (Average based on local bank)

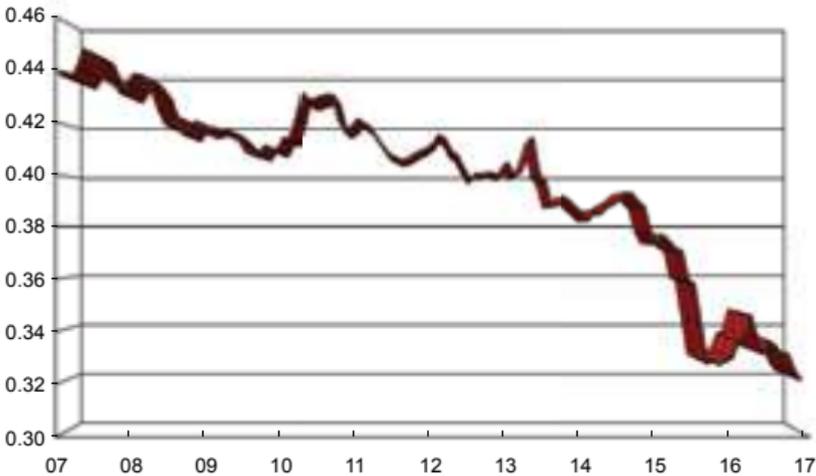
Vietnam## = Minimum and in VND per year

CURRENCY FLUCTUATIONS

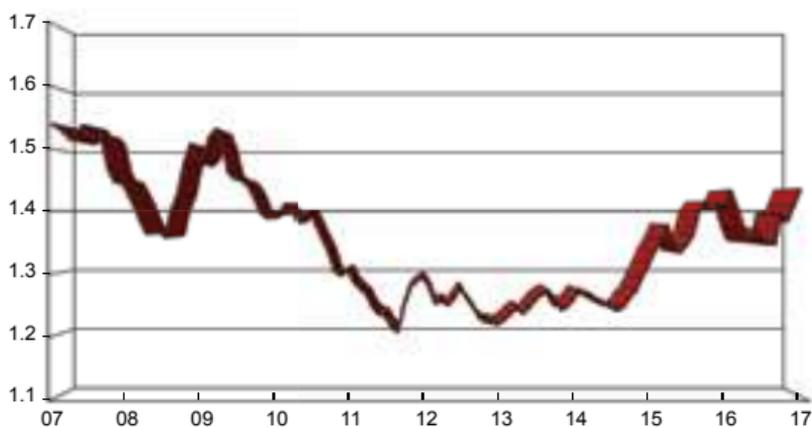
**Sterling Pound**  
S\$ per 1 STGP



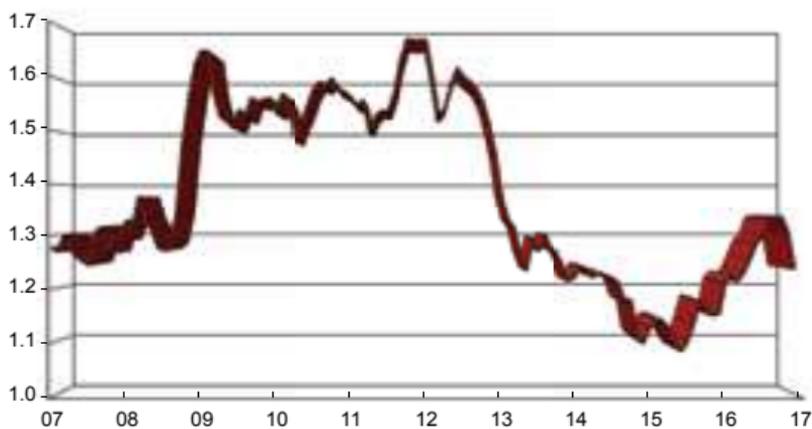
**Ringgit Malaysia**  
S\$ per 1 RM



**US Dollar**  
**S\$ per 1 US\$**



**Japanese Yen**  
**S\$ per 100 Yen**



## CONVERSION FACTORS

### UNIT

#### LENGTH

10 mm	=	1 cm	12 in	=	1 ft
100 cm	=	1 m	3 ft	=	1 yd
1,000 m	=	1 km	1,760 yd	=	1 mile

#### AREA

10,000 m <sup>2</sup>	=	1 ha	9 ft <sup>2</sup>	=	1 yd <sup>2</sup>
100 ha	=	1 km <sup>2</sup>	4,840 yd <sup>2</sup>	=	1 acre
			640 acre	=	1 mile <sup>2</sup>

#### VOLUME

1,000 ml	=	1 l	(UK) 8 pt	=	1 gal
			(US) 8 pt	=	1 gal

#### MASS

1,000 g	=	1 kg	16 oz	=	1 lb
1,000 kg	=	1 tonne	2,240 lb	=	1 ton
16 tael	=	1 catty			

#### POWER

#### TEMPERATURE

TO METRIC (APPROX)		TO IMPERIAL (APPROX)	
1 in	= 25.400 mm	1 cm	= 0.394 in
1 ft	= 30.480 cm	1 m	= 3.281 ft
1 yd	= 0.914 m	1 m	= 1.094 yd
1 mile	= 1.609 km	1 km	= 0.621 mile
1 ft <sup>2</sup>	= 0.093 m <sup>2</sup>	1 m <sup>2</sup>	= 10.764 ft <sup>2</sup>
1 yd <sup>2</sup>	= 0.836 m <sup>2</sup>	1 m <sup>2</sup>	= 1.196 yd <sup>2</sup>
1 acre	= 0.405 ha	1 ha	= 2.471 acres
1 mile <sup>2</sup>	= 2.590 km <sup>2</sup>	1 km <sup>2</sup>	= 0.386 mile <sup>2</sup>
(UK) 1 pt	= 0.568 l	(UK) 1 l	= 1.760 pt
(US) 1 pt	= 0.473 l	(US) 1 l	= 2.113 pt
(UK) 1 gal	= 4.546 l	(UK) 1 l	= 0.220 gal
(US) 1 gal	= 3.785 l	(US) 1 l	= 0.264 gal
1 oz	= 28.350 g	1 gram	= 0.035 oz
1 lb	= 0.454 kg	1 kg	= 2.205 lb
1 ton	= 1.016 tonne	1 tonne	= 0.984 ton
1 catty	= 0.605 kg		
1 hp	= 0.746 kw	1 kw	= 1.340 hp
°C = (°F-32) x 5/9		°F = (°C x 9/5) + 32	

## 4 OTHER INFORMATION

### IDD CODES & TIME DIFFERENCES

DESTINATION	IDD COUNTRY CODE	TIME DIFFERENCE (HOURS)*
Australia :		
Melbourne	61	+3
Perth	61	0
Sydney	61	+3
Bahrain	973	-5
Brunei	673	0
China	86	0
France	33	-6
Germany	49	-6
Hong Kong	852	0
India	91	-2.5
Indonesia	62	-1
Italy	39	-6
Japan	81	+1
Korea (North)	850	+0.5

\* Allowance should be made for seasonal time variations.

DESTINATION	IDD COUNTRY CODE	TIME DIFFERENCE (HOURS)*
Korea (South)	82	+1
Macau	853	0
Malaysia	60	0
Myanmar	95	-1.5
Philippines	63	0
Qatar	974	-5
Singapore	65	0
Spain	34	-6
Taiwan	886	0
Thailand	66	-1
United Arab Emirates	971	-4
United Kingdom	44	-7
United States of America :		
Los Angeles	1	-15
New York	1	-12
Vietnam	84	-1

### RELEVANT WEBSITES

#### Singapore Government

Accounting and Corporate Regulatory Authority

Board of Architects Singapore

Building and Construction Authority

Central Provident Fund Board

Housing & Development Board

Inland Revenue Authority of Singapore

Integrated Land Information Service

Intellectual Property Office of Singapore

International Enterprise Singapore

Land Surveyors Board Singapore

Land Transport Authority

Ministry of Communications and Information

Ministry of Culture, Community and Youth

Ministry of Defence

Ministry of Education

Ministry of Finance

Ministry of Foreign Affairs

Ministry of Health

Ministry of Home Affairs

Ministry of Law

Ministry of Manpower

Ministry of National Development

Ministry of Social and Family Development

Ministry of the Environment and Water Resources

Ministry of Trade and Industry

Ministry of Transport

Monetary Authority of Singapore

National Parks Board

Professional Engineers Board Singapore

Public Utilities Board

[www.acra.gov.sg](http://www.acra.gov.sg)  
[www.boa.gov.sg](http://www.boa.gov.sg)  
[www.bca.gov.sg](http://www.bca.gov.sg)  
[www.cpf.gov.sg](http://www.cpf.gov.sg)  
[www.hdb.gov.sg](http://www.hdb.gov.sg)  
[www.iras.gov.sg](http://www.iras.gov.sg)  
[www.sla.gov.sg](http://www.sla.gov.sg)  
[www.ipos.gov.sg](http://www.ipos.gov.sg)  
[www.iesingapore.gov.sg](http://www.iesingapore.gov.sg)  
[www.mlaw.gov.sg](http://www.mlaw.gov.sg)  
[www.lta.gov.sg](http://www.lta.gov.sg)  
[www.mci.gov.sg](http://www.mci.gov.sg)  
[www.mccy.gov.sg](http://www.mccy.gov.sg)  
[www.mindef.gov.sg](http://www.mindef.gov.sg)  
[www.moe.gov.sg](http://www.moe.gov.sg)  
[www.mof.gov.sg](http://www.mof.gov.sg)  
[www.mfa.gov.sg](http://www.mfa.gov.sg)  
[www.moh.gov.sg](http://www.moh.gov.sg)  
[www.mha.gov.sg](http://www.mha.gov.sg)  
[www.mlaw.gov.sg](http://www.mlaw.gov.sg)  
[www.mom.gov.sg](http://www.mom.gov.sg)  
[www.mnd.gov.sg](http://www.mnd.gov.sg)  
[www.msf.gov.sg](http://www.msf.gov.sg)  
[www.mewr.gov.sg](http://www.mewr.gov.sg)  
[www.mti.gov.sg](http://www.mti.gov.sg)  
[www.mot.gov.sg](http://www.mot.gov.sg)  
[www.mas.gov.sg](http://www.mas.gov.sg)  
[www.nparks.gov.sg](http://www.nparks.gov.sg)  
[www.peb.gov.sg](http://www.peb.gov.sg)  
[www.pub.gov.sg](http://www.pub.gov.sg)

### RELEVANT WEBSITES

#### Singapore Government (Cont'd)

Singapore Civil Defence Force  
Singapore Department of Statistics  
Singapore Economic Development Board  
Singapore Government Website  
Singapore Land Authority  
Strata Titles Boards  
Urban Redevelopment Authority

#### Construction-Related Associations in Singapore

Real Estate Developers' Association of Singapore  
Singapore Green Building Council  
Singapore Institute of Planners  
Singapore Institute of Architects  
Association of Consulting Engineers Singapore  
The Institution of Engineers Singapore  
Society of Project Managers  
Singapore Institute of Surveyors and Valuers  
Association of Property and Facility Managers  
Singapore Institute of Building Limited  
The Law Society of Singapore  
Singapore Power Ltd

#### Others

Arcadis  
Arcadis Singapore Pte Ltd  
Arcadis Project Management Pte Ltd

[www.scdf.gov.sg](http://www.scdf.gov.sg)  
[www.singstat.gov.sg](http://www.singstat.gov.sg)  
[www.edb.gov.sg](http://www.edb.gov.sg)  
[www.gov.sg](http://www.gov.sg)  
[www.sla.gov.sg](http://www.sla.gov.sg)  
[www.mnd.gov.sg/stb/](http://www.mnd.gov.sg/stb/)  
[www.ura.gov.sg](http://www.ura.gov.sg)

[www.redas.com](http://www.redas.com)  
[www.sgbc.sg](http://www.sgbc.sg)  
[www.planning.org.sg](http://www.planning.org.sg)  
[www.sia.org.sg](http://www.sia.org.sg)  
[www.aces.org.sg](http://www.aces.org.sg)  
[www.ies.org.sg](http://www.ies.org.sg)  
[www.sprojm.org.sg](http://www.sprojm.org.sg)  
[www.sisv.org.sg](http://www.sisv.org.sg)  
[apfm.org.sg/](http://apfm.org.sg/)  
[www.sibl.com.sg](http://www.sibl.com.sg)  
[www.lawsociety.org.sg](http://www.lawsociety.org.sg)  
[www.spgroup.com.sg](http://www.spgroup.com.sg)

[www.arcadis.com](http://www.arcadis.com)  
[www.arcadis.com](http://www.arcadis.com)  
[www.arcadis.com](http://www.arcadis.com)

## CURRENT CONSTRUCTION REGULATIONS

### BCA Contractors Registry System (CRS)

The Contractors Registry was established in 1984 to register contractors who provide construction-related goods and services to the public sector. Contractors who wish to be registered with the Registry must show that they have the relevant experience, financial, technical and management capability.

The table below summarise the registration requirements for general building (CW01) and civil engineering works (CW02):

GRADE (NOTE 1)	FINANCIAL (NOTES 3 & 4)	TRACK RECORD (PAST 3 YEARS) (NOTES 5-8)		PERSONNEL (NOTES 9-12)	MANAGEMENT & DEVELOPMENT (NOTES 13-15)	ADDITIONAL REQUIREMENTS
		CW01	CW02			
A1	\$15.0m	\$150.0m of which - \$75.0m PS - \$112.5m MC - \$37.5m SP	\$150.0m of which - \$75.0m PS - \$75.0m MC - \$37.5m SP	24RP/P/T of which -min 8RP -1RP/P/T with SDCP/CCPP -Annual CET declaration	ISO9001:2008 (SAC)  ISO14001  OHSAS18001  GGBS	General Builder Licence - Class 1 (GB1)
A2	\$6.5m	\$65.0m of which - \$32.5m PS - \$48.75m MC - \$16.25m SP	\$65.0m of which - \$32.5m PS - \$32.5m MC - \$16.25m SP	12RP/P/T of which -min 4RP -1RP/P/T with SDCP/CCPP -Annual CET declaration		
B1	\$3.0m	\$30.0m of which - \$22.5m MC - \$7.5m SP	\$30.0m of which - \$15.0m MC - \$7.5m SP	6RP/P/T of which -min 2RP -1RP/P/T with SDCP/CCPP	ISO9001:2008 (SAC)  ISO14001	
B2	\$1.0m	\$10.0m of which - \$7.5m MC - \$2.5m SP	\$10.0m of which - \$5.0m MC - \$2.5m SP	3RP/P/T of which -min 1RP -1RP/P/T with ACCP	OHSAS18001  GGBS	
C1	\$300,000	\$3.0m	\$3.0m	1RP/P + 1T of which -1RP/P/T with BCCPE	SMC/OHSAS 18000  BizSAFE	General Builder Licence Class 1 or Class 2 (GB1 or GB2)
C2	\$100,000	\$1.0m	\$1.0m	1RP/P or 2T of which -1RP/P/T with BCCPE	Level 3/ OHSAS18001	
C3	\$25,000	\$100,000	\$100,000	1RP/P/T with BCCPE		

Source: Building and Construction Authority as at October 2017.

Note:

- 1) Please refer to Page 100 for the tendering limits
- 2) m stands for million

#### Financial

- 3) Both minimum (min) paid-up capital and min net worth must be met separately. C3 firms are required to submit the latest management accounts (not more than 12 months old).
- 4) Grades A1 to B2 firms are required to submit the following annually (not more than 4 months for SGX listed companies and not more than 6 months for non-SGX listed companies from the accounts closing date):
  - i) Audited accounts and meet the financial requirement in order to retain in their respective grades
  - ii) Complete and submit Annual Return of the Construction Industry conducted by BCA's Economic Research Department

#### Track Record

- 5) Completed projects in the past three years for all cases. For renewal, projects completed satisfactorily in the past 5 years including on-going and newly awarded projects are acceptable. For CW02-A1 registration, projects completed satisfactorily in the past 5 years can be considered as track record.
- 6) Contractors are expected to complete:
  - i) PS – minimum projects executed in Singapore
  - ii) MC – minimum main contracts (nominated sub-contracts may be included)
  - iii) SP – minimum size single main contract or nominated sub-contract (if sub-contract, please refer to note 7)
- 7) Percentage of sub-contract value taken into consideration shall be 50% for CW01 and 75% for CW02.

### CURRENT CONSTRUCTION REGULATIONS

- 8) For CW02, only the value of the civil engineering project will be accepted.

#### Personnel

- 9) RP – Professional with qualifications recognised by Professional Engineers Board (PEB) of Singapore, Board of Architects (BOA) of Singapore or Building and Construction Authority (BCA), recognized for Resident Engineer

P/T – Professional and Technical personnel with relevant qualifications

CCPP – Certified Construction Productivity Professional

SDCP – Specialist Diploma in Construction Productivity conducted by BCA Academy

ACCP – Advanced Certificate of Construction Productivity conducted by BCA Academy

BCCPE – Basic Concept in Construction Productivity Enhancement (Certificate of Attendance) conducted by BCA Academy. A director with BCCPE (Certificate of Attendance) is acceptable for one company only

CET – The Continuing Education and Training (CET) requirement has been implemented since 1 November 2010. In order to retain their respective grades (i.e. A1 and A2), each registered personnel is required to complete 14 hours of structured CET courses annually over a 12-month period from 1 November to 31 October (of the next calendar year)

- 10) For A1, A2 and B1, 1RP/P/T to register or obtain SDCP by the renewal date after 1 January 2016. For B2, 1RP/P/T to register or obtain ACCP by the renewal date after 1 January 2016.
- 11) A1 and A2 require at least one-third of the RP/P/T with minimum 24 months of relevant experience in Singapore. Out of the 24 months, at least 12 months of relevant experience in Singapore within the latest three years.

12) First time application for A1 require every technical personnel to be interviewed by BCA.

Management & Development

13) ISO 9001:2008 must be SAC accredited i.e. the certificate to bear the SAC logo

14) GGBS (Green & Gracious Builders Scheme)

15) BizSAFE Level 3 issued by WSHC or OHSAS 18001 required for C1 and C2

In June 2006, BCA adopted a credit rating system to indicate the financial standing of larger construction firms in its Contractors Registry. The adopted credit rating system is similar to one developed by credit and business information bureau DP Information Group to assess the financial health of companies.

However, the BCA system applies only to the larger construction companies (i.e. those in the top categories of A1, A2 and B1).

Government agencies will use the DP credit rating as an additional reference on the financial standing of the firms when evaluating public tenders.

## CURRENT CONSTRUCTION REGULATIONS

### Tendering Limits for BCA Registered Contractors

In 2002, BCA launched a Tender Limit Variable Component (TLVC) to the tender limits of all registration grades in the Contractors Registry System (CRS). TLVC is determined using the Tender Price Index (TPI) to reflect the impact of tender price movements on project value. Over the years, the TPI has moved up significantly, hence resulting a need to adjust the tender limits of the various CRS registration grades to better reflect the fluctuations in the construction costs in the market.

In November 2007, BCA announced that the tendering limits will be adjusted once a year on the first of July. The current new tendering limits shown below are based on the latest TLVC updated on 22 September 2017.

<b>CONSTRUCTION WORKHEADS (CW01 &amp; 02)</b>	<b>A1</b>	<b>A2</b>	<b>B1</b>	<b>B2</b>	<b>C1</b>	<b>C2</b>	<b>C3</b>
Tendering limit (\$million) 1 Jul 16 to 30 Jun 17	Unlimited	85.0	40.0	13.0	4.0	1.3	0.65
Tendering limit (\$million) 1 Jul 17 to 30 Jun 18	Unlimited	85.0	40.0	13.0	4.0	1.3	0.65
<b>SPECIALIST WORKHEADS (CR, ME, MW &amp; SY)</b>	<b>Single Grade</b>	<b>L6</b>	<b>L5</b>	<b>L4</b>	<b>L3</b>	<b>L2</b>	<b>L1</b>
Tendering limit (\$million) 1 Jul 16 to 30 Jun 17	Unlimited	Unlimited	13.0	6.5	4.0	1.3	0.65
Tendering limit (\$million) 1 Jul 17 to 30 Jun 18	Unlimited	Unlimited	13.0	6.5	4.0	1.3	0.65

Source: Building and Construction Authority as at 22 September 2017

## Man-Year Entitlement (MYE)

The Man-Year Entitlement (MYE) system is a work permit allocation system implemented by the Ministry of Manpower (MOM) in April 1998. Under this system, main contractors are given entitlements to employ foreign workers from Non-Traditional Sources and the People's Republic of China either directly or indirectly from their sub-contractors based on the nature and value of their projects.

To reduce the construction industry's heavy reliance on foreign workers and to raise the productivity levels, MOM has been tightening the MYE formula so as to meet the Construction 21 (C21) targets for MYE to be further reduced to 70% of 1999-level by 2005 and eventually to 50% of 1999-level by 2010, or earlier.

In line with the C21 blueprint, MOM has since implemented MYE cuts/adjustments as follows:

### June 2002

- 70% of 1998 MYE level for all upgrading projects
- 80% of 1998 MYE level for all civil engineering projects
- 65% of 1998 MYE level for all building projects below S\$10 million
- 60% of 1998 MYE level for all building projects at or above S\$10 million

### December 2004

- Based on the feedback given by the industry, MYE allocation was increased by 10% of 2002 MYE level for all new and on-going construction projects

### January 2007

- 5% reduction from 2004 MYE level for all projects except for projects above \$100 million

### April 2007

- 5% restoration of January 2007 MYE level for all new and on-going projects except for projects above \$100 million

### CURRENT CONSTRUCTION REGULATIONS

In March 2010, the Singapore Government made an announcement that, with effect from 1 July 2010, the progressive reduction in the MYE in phases, leading to a cumulative 25% cut in MYE allocation by July 2012.

On 21 February 2011, the Government announced an additional 15% cut in the MYE quota for new projects in July 2013.

Further to the above, on 17 February 2012, the Government announced in the *Budget 2012 Speech* that a further reduction in the MYE by an additional 5% for new projects awarded with effect from 1 July 2012. This will bring cumulative MYE cuts to 45% by July 2013.

The progressive reduction in the MYE in phases, leading to a cumulative 45% cut in MYE allocation by July 2013 is as follows:

- Reduce MYE by 45% over 4 phases
  - 1 July 2010 = 5%
  - 1 July 2011 = 10%
  - 1 July 2012 = 15%
  - 1 July 2013 = 15%

The tabulation below illustrates the MYE allocation for different project values:

PROJECT VALUE	BUILDING PROJECTS	CIVIL ENGINEERING PROJECTS
	W.E.F. 1 JUL 13	W.E.F. 1 JUL 13
\$400,000	0	0
\$600,000	8	3
\$7,000,000	61	25
\$15,000,000	103	46
\$35,500,000	194	84

Source: Ministry of Manpower as at 30 August 2013

\*For CE Projects with contract value above \$100 million, the MYE are to be decided on a case-by-case basis.

To address the impact of fluctuating tender prices on MYE allocation, MOM and BCA have implemented the TPI adjusted MYE allocation formula, which will take into account the effect of fluctuating tender prices.

The MYE formula will be adjusted with the Man-Year Adjustment Factor (MYAF) on 1 January each year for all project categories. The MYAF is computed based on the TPI tabulated for the previous financial year and is reviewed annually. For the period of 1 January 2018 to 31 December 2018, the MYAF is 1.040.

The example below illustrates the adjusted MYE:

		FROM 1 JANUARY 2018 - 31 DECEMBER 2018	
NOMINAL PROJECT VALUE	MYE ALLOCATION (NO TPI ADJUSTMENT)	MYAF	MYE ALLOCATION (WITH TPI ADJUSTMENT)
\$15 Million	103	1.040	$103 \times 1.040 = 107$

Source: Building and Construction Authority as at 8 December 2017

### CURRENT CONSTRUCTION REGULATIONS

#### Minimum Buildable Design Scores

The legislation on buildability came into effect on 1 January 2001. Projects submitted for planning after 1 January 2001 are affected by the legislation and are required to comply with a minimum buildable design scores (B-Scores) as stipulated in the Code of Practice on Buildability.

Over the years, the minimum B-Scores have been progressively raised.

In September 2005, all new building works with gross floor area equals to or greater than 2,000m<sup>2</sup> is required to comply with the minimum B-Scores.

The minimum B-Scores requirement shall also apply to building works consisting of repairs, alterations and/or additions (A&A work) to an existing building if the building works involve the construction of new floor and/or reconstruction of existing floor for which their total gross floor area is 2,000m<sup>2</sup> or more.

In an effort to further promote higher productivity improvement in the built environment sector, BCA has issued a circular on 1 August 2013 to encourage the adoption of more productive technologies. The Building Control (Buildability) (Amendment) Regulations 2013 came into effect on 1 September 2013.

In November 2014, BCA raised the minimum B-Scores by 7 points in order to meet the needs of wider adoption of buildable designs to further raise construction productivity.

In December 2015, BCA raised the minimum B-Scores by 3 points for all new building projects. With this increase, the minimum B-Scores have been brought to the same level as those imposed for projects by key Government Procurement Entities (GPEs) since 1 November 2014.

BCA has issued a circular on 15 April 2017, announcing that project submitted for planning permission on or after 1 May 2017 will be required to meet separate minimum B-Scores for superstructure and basement works, where applicable. The minimum B-Scores for superstructure works remains unchanged. The new minimum B-Scores for basement works is set at 68 points and will apply to all categories of development.

The minimum B-Scores for superstructure works for all new building projects:

YEAR	FROM 1 MAY 2017*		
	2,000m <sup>2</sup> ≤ GFA < 5,000m <sup>2</sup>	5,000m <sup>2</sup> ≤ GFA < 25,000m <sup>2</sup>	GFA ≥ 25,000m <sup>2</sup>
Residential (Landed)	73	78	81
Residential (Non-Landed)	80	85	88
Commercial	82	87	90
Industrial	82	87	90
School	77	82	85
Institutional & Others#	73	79	82

Source: Building and Construction Authority

Note: \* - based on date of planning submissions made to Urban Redevelopment Authority (URA) except for building works built on land sold under GLS Programme which are based on the date the GLS land is sold.

# - MRT underground station projects are classified under this category and subjected to the corresponding minimum scores stated above

The new minimum B-Scores for basement works for all new building projects:

YEAR	FROM 1 MAY 2017*
CATEGORY OF BUILDING WORK / DEVELOPMENT	GFA ≥ 2,000m <sup>2</sup>
Residential (Landed)	68
Residential (Non-Landed)	
Commercial	
Industrial	
School	
Institutional & Others	

Source: Building and Construction Authority

Note: \* - based on date of planning submissions made to URA except for building works built on land sold under GLS Programme which are based on the date the GLS land is sold.

### CURRENT CONSTRUCTION REGULATIONS

#### Minimum Constructability Scores

To steer the construction industry towards higher level of productivity, BCA has tightened the existing Buildability Framework and mandate a new component called Constructability Scores (C-Scores). In this connection, contractors are expected to adopt more labour-efficient construction methods or technologies.

The constructability requirements apply to all planning permissions submitted on or after 15 July 2011. This extends to all new building works and projects involving repairs, alterations and/or additions (A&A work) to existing buildings with GFA of 5,000m<sup>2</sup> or more. The C-Scores of a project is made up of 3 parts:

- Part A – Maximum of 60 points for Structural System. Points are awarded for various methods and technologies adopted during the construction of structural works.
- Part B – Maximum of 45 points for Architectural, Mechanical, Electrical and Plumbing (AMEP) Systems. Points are awarded for various methods and technologies adopted during the construction of AMEP works.
- Part C – Maximum of 15 points for Good Industry Practices. Points are awarded for good industry practices adopted on site to improve productivity.

BCA further issued a circular on 1 August 2013 to encourage the adoption of more productive technologies. The Building Control (Buildability) (Amendment) Regulations 2013 came into effect on 1 September 2013.

In November 2014, BCA raised the minimum C-Scores by 4 points in order to meet the needs of wider adoption of efficient construction technologies to further raise construction productivity.

In a circular issued on 30 November 2015, BCA announced that the legislated minimum C-Scores including the minimum C-Scores for the Structural System (structural C-Scores) for **all new building projects** which are submitted for planning permission

on and after 1 December 2015 to be raised by 3 points. A new category of low-rise building projects of 6-storey and below has also been introduced. The minimum structural C-Scores for this category however remained unchanged. The revised minimum C-Scores shall apply to any building works relating to any building on land sold under the Government Land Sales (GLS) Programme (including industrial GLS) on or after 1 December 2015.

Based on the latest Code of Practice on Buildability 2017 edition (applicable to projects with planning applications made on or after 1 May 2017), the minimum C-Scores remains unchanged.

The minimum C-Scores for different building types:

- For all building projects comprising buildings more than 6 storeys

YEAR	FROM 1 MAY 2017*	
	5,000m <sup>2</sup> ≤ GFA < 25,000m <sup>2</sup>	GFA ≥ 25,000m <sup>2</sup>
CATEGORY OF BUILDING WORK/DEVELOPMENT		
Residential (Landed)	50  (Min 35 points from Structural System)	60  (Min 45 points from Structural System)
Residential (Non-Landed)		
Commercial		
Industrial		
School		
Institutional & Others		

Source: Building and Construction Authority

Note: \* - based on date of planning submissions made to Urban Redevelopment Authority (URA) except for building works built on land sold under the GLS Programme which are based on the date the GLS land is sold.

- For all building projects comprising buildings of 6 storeys and below

YEAR	FROM 1 MAY 2017*	
	5,000m <sup>2</sup> ≤ GFA < 25,000m <sup>2</sup>	GFA ≥ 25,000m <sup>2</sup>
CATEGORY OF BUILDING WORK/DEVELOPMENT		
Residential (Landed)	50  (Min 32 points from Structural System)	60  (Min 42 points from Structural System)
Residential (Non-Landed)		
Commercial		
Industrial		
School		
Institutional & Others		

Source: Building and Construction Authority

Note: \* - based on date of planning submissions made to Urban Redevelopment Authority (URA) except for building works built on land sold under the GLS Programme which are based on the date the GLS land is sold.

### CURRENT CONSTRUCTION REGULATIONS

#### **Amendments to Building Control (Buildability and Productivity) Regulations 2011 and Revisions to Code of Practice on Buildability to Raise Productivity in the Built Environment Sector**

On 10 March 2017, BCA announced the new buildability requirement of mandatory adoption of minimum level of structural steel construction for buildings constructed for the sole or part use as an office on selected land parcels sold under the GLS Programme. This new requirement came into effect on 28 February 2017.

The minimum level of use of structural steel construction is 80% of the total office floor area of a building. "Total office floor area", in relation to a building, refers to the total super-structural floor area of the building less any floor area that is not constructed for use as an office.

On 15 April 2017, BCA further announced to the construction industry of the changes to the Building Control (Buildability and Productivity) Regulations 2011 and the enhancements made to the Code of Practice on Buildability. The following changes came into effect on 1 May 2017:

- Higher minimum level of use of prefabrication systems for developments on sites sold under the Industrial Government Land Sales (IGLS) Programme.
- Enhanced Buildable Design Appraisal System (BDAS) incorporating more Design for Manufacturing and Assembly (DfMA) technologies.
- Separate minimum Buildable Design Scores (B-Scores) for basement and superstructure works.

#### **(a) Higher Minimum Prefabrication Level for Industrial Sites Sold under IGLS Programme**

To promote greater adoption of prefabrication, any building to be built for use as an industrial building with a Gross Floor Area (GFA) greater than or equal to 5,000m<sup>2</sup> on State land sold under the IGLS Programme on or after 1 May 2017 is required to meet the minimum level of use of prefabrication system:

MINIMUM PREFABRICATION LEVEL	5,000m <sup>2</sup> ≤ GFA < 25,000m <sup>2</sup>	GFA ≥ 25,000m <sup>2</sup>
Structural system in respect of total structural floor area of the building works	25% (20%)	40% (35%)
Wall system in respect of total wall length of the building works	45% (35%)	60% (50%)

Source: Building and Construction Authority

Note: Figures in parentheses denote existing requirements implemented for IGLS sites sold on or after 1 November 2014 and before 1 May 2017.

## **(b) Enhanced Buildable Design Appraisal System (BDAS)**

The BDAS was established as a method to measure the potential impact of a building design on the usage of site labour.

The enhanced BDAS will incorporate the following key changes with the objective to encourage designs to place greater emphasis on DfMA:

- A new Table comprising a continuum of DfMA technologies from prefabricated components to fully integrated assemblies across the structural, architectural, as well as Mechanical, Electrical and Plumbing (MEP) disciplines is added. The total points allocated to this DfMA Table is 20 points.
- The Buildable Design Features under Table 3 of BDAS will be incorporated under either the Structural System Table or Wall System Table, where appropriate. The total points for Structural System and Wall System remains at 45 points each.
- The maximum Buildable Design Score achievable for a building design under the 3 main parts of Structural System, Wall System and DfMA Technologies is 110 points instead of the current 100 points.

(c) **Separate Minimum Buildable Design Scores (B-Scores) for Basement Works and Superstructure Works**

As highlighted in the earlier articles, the minimum B-Scores for superstructure works remains unchanged. The new minimum B-Scores for basement works is set at 68 points and this will apply to all categories of development.

For more information, please refer to BCA's website for the Code of Practice on Buildability, 2017 edition.

## Earth Control Measures

Public Utilities Board (PUB) has amended its Code of Practice on Surface Water Drainage\* to provide comprehensive guidelines on how the industry can apply more effective erosion and sedimentation control measures, this came into force in October 2006.

The Code of Practice on Surface Water Drainage contains information pertaining to the basic planning, design and procedural requirements for surface water drainage, and specifies the minimum engineering requirements for the provision of functional facilities for surface water drainage. This Code of Practice is issued under Section 32 of the Sewerage and Drainage Act (Chapter 294).

As part of our commitment of excellent service to our clients, Arcadis Singapore has responded to the amendments with changes in our contractual clauses and front-end documents.

*\*Code of Practice on Surface Water Drainage (Sixth Edition – December 2011 with amendments under Addendum No. 1 - June 2013)*

### CURRENT CONSTRUCTION REGULATIONS

#### **Building Control Act (Chapter 29)**

The salient features incorporating the Building Control (Amendment) Act 2007 are highlighted below:

#### ***Require Site Supervision Teams to Ensure Adequate Supervision of Structural Works***

Under this requirement, both the Qualified Person (QP) and the Builder are required to provide their own supervision team. The actual number and compositions of the supervision team will depend on the project cost as prescribed in the Regulations. Appointment of supervision teams will be required for projects where the first application for a permit is made on or after the effective date of the Act.

While this supervision team does not apply to projects which had already obtained a permit earlier, QPs are nonetheless encouraged to adopt the supervision team where necessary.

#### ***Strict Regulation on Major Geotechnical Works***

The Act imposes more stringent regulation of major underground building works that have significant safety impact, in particular on the design of Earth Retaining or Stabilising Structures (ERSS) in excavations. The Act stipulates that the design of such ERSS be carried out by a Registered Professional Engineer (PE) and reviewed by a Registered Accredited Checker (AC). A PE is also required to supervise the construction of ERSS.

In addition, the geotechnical aspects of major underground building works including ERSS in excavations more than 6 metres deep, will also require the inputs from PEs and ACs who are specialists in geotechnical engineering.

#### ***Appointment of Instrumentation Specialist Builder (ISB)***

The Developer of the building works shall appoint a Specialist Builder to monitor instruments measuring

pore pressures for saturated and unsaturated levels, ground water levels and ground movements or building movements where the building works comprise wholly or partly of any underground building works.

Underground building works generally mean the following:

- A tunnel with a diameter, width or height of more than 2 metres
- Excavation with a depth of more than 6 metres
- Foundation works for buildings of 30 or more storeys high

Any of the above case would require the appointment of an ISB and the Act stipulates that the appointment shall be made by the Developer.

### ***Licensing of Builders***

This is a licensing scheme to set minimum standards of professionalism for general builders and six selective specialist builders whose works have significant safety impact.

To be licensed, builders must be financially sound, have good safety records and appoint key personnel with suitable qualifications and experience to manage the firm and supervise the construction works.

The licensing of builders came into effect on 16 December 2008. There was a grace period of six months (till 16 June 2009) for builders to apply for the licence. There are two types of licences – the General Builder licence and the Specialist Builder licence. After 16 June 2009, all builders who had been granted or to be granted a permit to carry out general building works, as well as builders carrying out work in the six selective specialists work areas must possess a licence issued by the Commissioner of Building Control.

Licensed Class 1 General Builders with project contract value of more than \$20 million are required to deploy a minimum number of Construction Registration of Tradesmen (CoreTrade) personnel in their projects.

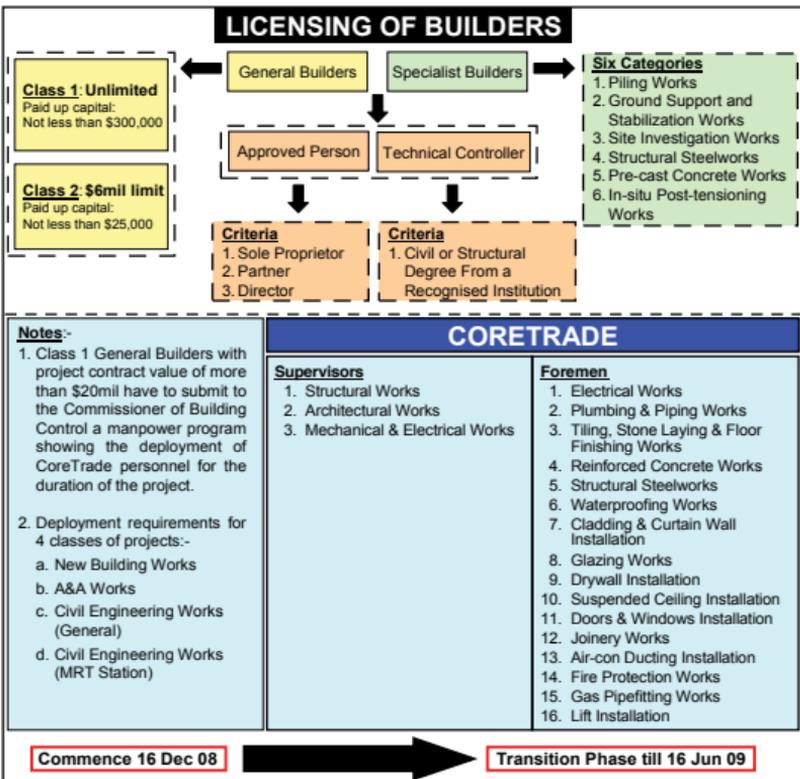
## CURRENT CONSTRUCTION REGULATIONS

The following shall apply to construction projects for which the permits to commence structural works are submitted to BCA from 15 October 2011:

- There are 4 project categories under CoreTrade:
  - New Building Works
  - Addition & Alteration (A&A) Works
  - Civil Engineering Works (General)
  - Civil Engineering Works (MRT Station)

With the new minimum Higher Skilled (or R1) Work Permit Holders (WPHs) proportion requirement at the firm-level to be implemented from 1 January 2017, **BCA will phase out the project-level CoreTrade deployment requirement for Tradesmen**, and focus on building up key construction personnel at the Foremen and Supervisory levels with effect from 1 January 2015. Once implemented, all new and on-going CoreTrade projects will not be required to comply with the deployment requirements for the category of Tradesmen. Construction firms will still need to comply with the deployment requirements of Trade Foremen and Supervisors.

- CoreTrade Man-Year deployment requirements



The table below shows the deployment requirements for New Building Works, A&A Works and Civil Engineering Works (MRT Station):

CLASS OF CORETRADE PERSONNEL	TRADES	TOTAL CONTRACT VALUE (INCLUSIVE OF GST)		REMARKS
		FIRST \$100m	EXCESS OF \$100m	
SUPERVISORS	1. Structural Works	0.25 MY per \$10m, or part thereof	0.25 MY per \$20m, or part thereof	
	AND			
	1. Architectural Works 2. Mechanical & Electrical Works	0.25 MY per \$10m, or part thereof	0.25 MY per \$20m, or part thereof	Combination of man-years between these 2 trades is allowed.
<b>(Deployment of CoreTrade Supervisors is applicable to projects whose permits to carry out structural works are submitted to BCA from 1 April 2013 onwards.)</b>				
FOREMEN	Structural trades: 1. RC Works 2. Structural Steel Works	1.0 MY per \$10m, or part thereof	1.0 MY per \$20m, or part thereof	Combination of man-years between these 2 trades is allowed.
	AND			
	Architectural trades: 1. Cladding & Curtain Wall Installation 2. Doors & Windows Installation 3. Drywall Installation 4. Glazing Works 5. Joinery Works 6. Suspended Ceiling Installation 7. Tiling, Stone Laying and Floor Finishing Works 8. Waterproofing Works Mechanical & Electrical trades: 9. Air-Conditioning Ducting Installation 10. Electrical Works 11. Fire Protection Works 12. Gas Pipefitting Works 13. Lift Installation 14. Plumbing & Piping Works	1.0 MY per \$10m, or part thereof	1.0 MY per \$20m, or part thereof	Combination of man-years between these 14 trades is allowed.

Source: Building and Construction Authority

The table below shows deployment requirements for Civil Engineering Works (General):

CLASS OF CORETRADE PERSONNEL	TRADES	TOTAL CONTRACT VALUE (INCLUSIVE OF GST)		REMARKS
		FIRST \$100M	EXCESS OF \$100M	
SUPERVISORS	1. Structural Works	0.25 MY per \$10m, or part thereof	0.25 MY per \$20m, or part thereof	
<b>(Deployment of CoreTrade Supervisors is applicable to projects whose permits to carry out structural works are submitted to BCA from 1 April 2013 onwards.)</b>				
FOREMEN	Structural trades: 1. RC Works 2. Structural Steel Works	0.75 MY per \$10m, or part thereof	0.75 MY per \$20m, or part thereof	Combination of man-years between these 2 trades is allowed.

Source: Building and Construction Authority

### CURRENT CONSTRUCTION REGULATIONS

#### *Registration of CoreTrade Personnel*

With effect from 16 June 2009, all Class 1 General Builders\* undertaking a project of value which is \$20 million or more are required to deploy a prescribed minimum number of construction personnel who are registered under the CoreTrade Scheme.

The objective of this requirement is to build up a core group of competent and experienced workers in key construction trades to anchor and lead the workforce, and raise its quality and productivity levels.

All CoreTrade personnel whose CoreTrade license expiring from 1 October 2013 onwards and seeking renewal of CoreTrade registration are required to undergo Continual Educational Training (CET). Applicants can attend CET 6 months prior to the expiration of their CoreTrade registration.

In addition to the existing CoreTrade Foremen and Tradesmen, a new registration category of CoreTrade Supervisors came into effect on 1 April 2012. This will extend the career progression path for CoreTrade personnel to move up from Tradesmen, Foremen to Supervisor level.

\*Class 1 General Builder licence allows the holder to carry on the business of a general builder for any project.

With the new minimum Higher Skilled (or R1) Work Permit Holders (WPHs) proportion requirement at the firm-level to be implemented from 1 January 2017, **BCA will phase out the project-level CoreTrade deployment requirement for Tradesmen**, and focus on building up key construction personnel at the Foremen and Supervisory levels with effect from 1 January 2015. Once implemented, all new and on-going CoreTrade projects will not be required to comply with the deployment requirements for the category of Tradesmen. Construction firms will still need to comply with the deployment requirements of Trade Foremen and Supervisors.

## ***Enhance Independence of Parties in Construction Projects***

To avoid any situations of conflicts of interest, the Act imposes restrictions to insulate the QP and Contractor supervising the structural works from the influence of the developer or builder by requiring that the QP responsible for supervision should not be associated with the developer or builder.

## ***Standards on Environmental Sustainability***

Please refer to Page 125 for details.

## ***Maintenance of Barrier-Free Provisions***

Please refer to Page 151 for details.

## ***Stiffer Penalties for Non-Compliance***

The penalties provided in the new Act are set at a higher level than those found in the previous Act in order to align them with the relevant provisions of the Workplace Safety and Health Act (WSHA).

## ***Statutory Duty on Developers to Report Any Contravention of the Building Control Act and Regulations to the Commissioner of Building Control (CBC)***

Under the Act, the developer, who is one of the key parties in the project, has a duty to report to the CBC of any contravention of the Building Control Act/ Regulations relating to the project that he knows or ought reasonably to know.

## ***New Requirements under the Building Control (Amendment) Regulations 2013 and Their Commencement Dates***

On 28 October 2013, BCA issued a circular to announce the changes to requirements under the Building Control (Amendments) Regulations and their commencement dates.

The changes were implemented in the following 2 stages:

## CURRENT CONSTRUCTION REGULATIONS

### Stage 1: Amendments that came into effect on 28 October 2013

REG	AMENDMENT
38A	All ready-mixed concrete used for structural elements in major building works (i.e. works that require the endorsement of an accredited checker) has to be obtained from a plant which holds a valid product conformity certificate, and the specification of the ready-mixed concrete <b>has to be listed in the product conformity certificate. A "product conformity certificate" is a certificate issued by a certification body that is accredited by the Singapore Accreditation Council under the Council's Accredited Scheme for Product Certification Bodies for the certification of ready-mixed concrete.</b> This requirement is also applicable to on-site batching plants and plants supplying concrete for structural precast elements.
38B	The installation of any movable panel that is to be fixed on the exterior surface of a building is <u>prohibited</u> , except for a detached, semi-detached, terrace or linked house used solely as a <b>residence. A "movable panel" includes a board, frame, plank or pane, which is designed to slide along a guide or track, or pivot about a pin, and which is constructed of any material.</b>
41D	Other than an approved window contractor, a licensed builder may now be engaged for window installations. The current requirement for the actual installation to be carried out only by a trained window installer or by someone else under the supervision and guidance of a trained window installer remains unchanged.
41E(1A)	A licensed builder or an approved window contractor carrying out the replacement or modification of windows shall, not later than 14 days after completion of the works, submit a certification of the completion to the Commissioner of Building Control.
42 and 43	All applications for temporary occupation permit or certificate of statutory completion are required, where applicable, to be accompanied by the following: <ul style="list-style-type: none"> <li>(a) clearances, permits or approvals under the Fire Safety Act relating to fire safety from the Commissioner of Civil Defence</li> <li>(b) clearances, permits or approvals under the Sewerage and Drainage Act relating to sewerage and drainage from the Public Utilities Board</li> <li>(c) clearances, permits or approvals under the Environmental Protection and Management Act from the Director-General of Environmental Protection</li> <li>(d) clearances, permits or approvals under the Street Works Act and Parking Places Act from the Land Transport Authority of Singapore</li> <li>(e) clearances, permits or approvals under the Parks and Trees Act from the Commissioner of Parks and Recreation.</li> </ul>
Fourth Schedule	The list of minor works not requiring the certificate of an accredited checker has been amended. Please refer to BCA's website at <a href="http://www.bca.gov.sg">www.bca.gov.sg</a> for details.
Fifth Schedule	Paragraph M, "Safety of windows": The performance requirements will cover all window types (i.e. casement and sliding) and address proper design.
Sixth Schedule	The use of any material on the external surface of the buildings which has daylight reflectance exceeding 20% is prohibited. Daylight reflectance of a material refers to the sum of both the specular and diffuse reflections of the material.

### Stage 2: Amendments that came into effect on 1 April 2014

REG	AMENDMENT
4(1)(e)	Where an alternative solution is to be utilised in any building works and the qualified person for the building works (QP) <u>is not the specialist in that alternative solution</u> , the application for approval of the plans of those building works shall be accompanied by details of the alternative solution, together with <u>the certificate of a specialist in the alternative solution</u> referred to in Section 9(2)(b)(ii) of the Building Control Act.
9(2)(b)	The structural design calculations submitted for approval will not be required to be signed and endorsed by an accredited checker.
4(1)(vi) 10B	An appropriate qualified person (QP) has to be appointed to prepare and submit demolition work plans for approval by the Commissioner of Building Control before a permit is granted for demolition works to commence. The QP has to supervise the demolition works in accordance with Section 9 of the Act.
18(2A) 18(3A)	For deviations involving material changes from <u>approved building plans</u> (i.e. the non-structural plans), amendment plans have to be submitted for approval before the affected works are allowed to commence. No approval is required for deviations involving immaterial changes, which are to be submitted as record plans.
24(4)	Slight revision is made to the list of pre-requisite qualifications for registration as a resident technical officer.
First Schedule	The list of insignificant building works has been revised to include more types of works and to make some of the existing provisions clearer. Please refer to BCA's website at <a href="http://www.bca.gov.sg">www.bca.gov.sg</a> for details.
Fifth Schedule	Amendments have been made to some provisions in the Fifth Schedule to add clarity to the performance requirements. Please refer to BCA's website at <a href="http://www.bca.gov.sg">www.bca.gov.sg</a> for details.

Source: Building and Construction Authority

## Mandatory Higher Green Mark Standard for Government Land Sales (GLS) Sites in Selected Strategic Areas

It was announced in BCA's 2<sup>nd</sup> Green Building Masterplan in 2009 that projects developed on GLS sites in the selected strategic growth areas will be subject to higher Green Mark standards. This requirement aims to maximize the potential for cost-effective energy savings in our built environment.

Any new development located on land sold on or after the stipulated dates under the GLS Programme in the following strategic areas are required to be designed to meet the prescribed Green Mark certification:

<b>SELECTED STRATEGIC AREAS</b> <i>EXACT LOCATION TO REFER TO THE BUILDING CONTROL (ENVIRONMENTAL SUSTAINABILITY) REGULATIONS 2008</i>	<b>REQUIREMENTS FOR BUILDING WHOLLY OR PARTLY WITHIN AREA THAT IS ON LAND SOLD UNDER THE GLS PROGRAMME</b>
<b>(1) On or after 5 May 2010</b>	
Marina Bay	Green Mark Platinum
Downtown Core - including areas within the CBD located next to Marina Bay	Green Mark Gold <sup>PLUS</sup>
Kallang Riverside	
Paya Lebar Central	
<b>(2) On or after 20 July 2012</b>	
Jurong Lake District	Green Mark Gold <sup>PLUS</sup>
<b>(3) On or after 1 September 2014</b>	
Woodlands Regional Centre	Green Mark Gold <sup>PLUS</sup>
Punggol Eco-Town	

Source: Building and Construction Authority as at 30 October 2017

For building works that are subject to this requirement, the QPs need not submit their declarations of the Green Mark scores along with the building plan submission. Instead, the QPs should ensure that, prior to the building plan submission, an application is made to BCA for the project to obtain the Green Mark Certification in accordance with the BCA Green Mark Certification Standard for New Buildings. Upon completion of the building works, the QPs should submit the Green Mark Certification rating achieved for the project along with his application for Temporary Occupation Permit (TOP) or Certificate of Statutory Completion (CSC). The prescribed Green Mark Certification rating for the

## CURRENT CONSTRUCTION REGULATIONS

building has to be obtained before a TOP/CSC can be granted.

The certification standard has been revised from 1 December 2010 in tandem with the changes in the Green Mark Criteria. The compliance with the respective certification standards will be based on the tender award letter issued by URA to the successful developer under the GLS Programmes for the selected strategic areas and as stated in the following table:

DATE OF TENDER AWARD/LAND SOLD UNDER THE GLS PROGRAMMES	COMPLIANCE STANDARD
From 5 May 2010 to 30 November 2010	BCA Green Mark Certification Standards for New Building, <b>GM Version 3.0, May 2010</b> Addendum to Certification Standard (GM Version 3.0), September 2014
From 1 December 2010 to 14 January 2013	BCA Green Mark Certification Standards for New Building, <b>GM Version 4.0, August 2010</b> Addendum to Certification Standard (GM Version 4.0), September 2014
From 15 January 2013 to 30 November 2016 (for Non-Residential Buildings) From 15 January 2013 and onwards (for Residential Buildings)	BCA Green Mark Certification Standards for New Building, <b>GM Version 4.1, October 2012</b> Addendum to Certification Standard (GM Version 4.1), September 2014
From 1 December 2016 onwards (for Non-Residential Buildings)	BCA Green Mark for Non-Residential Buildings : 2015 ( <b>GM NRB : 2015</b> ), August 2016
From 1 December 2017 onwards (for Residential Buildings)	BCA Green Mark for Residential Buildings : 2016 ( <b>GM RB : 2016</b> )

Source: Building and Construction Authority

## BCA Green Mark Schemes

### Green Mark for New Non-Residential Buildings: 2015 (GM NRB: 2015)

In its commemorative 10th year for BCA Green Mark scheme in 2015, BCA on 2 September 2015 released a pilot version of the Green Mark Criteria for New Non-Residential Buildings for piloting and public review for a period of 12 months. This version incorporated key changes to address sustainability in a more balanced and holistic manner.

The finalized criteria titled “Green Mark for Non-Residential Buildings: 2015 (GM NRB: 2015)” came into effect on 1 December 2016.

An extract on the implementation timeline of BCA GM NRB: 2015 for other green building initiatives are outlined in the table below:

GREEN BUILDING INITIATIVE	IMPLEMENTATION TIMELINE (NEW NON-RESIDENTIAL BUILDINGS)
<p><u>Green Mark Gross Floor Area (GM-GFA) Incentive Scheme</u></p> <p>Incentives in the form of additional GFA can be granted by URA if the development attains Green Mark Gold<sup>PLUS</sup> or Platinum Rating</p>	<p>Based on the submission date of BCA GM-GFA application.</p> <p>For projects with GM-GFA applications submitted on or after 1 December 2016, their non-residential portion will be assessed and certified using the revised BCA GM NRB: 2015 Criteria.</p> <p>For projects with GM-GFA applications that are submitted before 1 December 2016, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Non-Residential Buildings. The revised GM NRB: 2015 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>
<p><u>Government Land Sales (GLS) Programmes</u></p> <p>Any new development located on land sold under the GLS programmes and are required to attain higher Green Mark Rating Mark Platinum Rating</p>	<p>Based on the GLS tender closing date.</p> <p>For projects with tender closing date on or after 1 December 2016, their non-residential portion will be assessed and certified using the revised BCA GM NRB: 2015 Criteria.</p> <p>For projects with tender closing date before 1 December 2016, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Non-Residential Buildings. The revised GM NRB: 2015 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>
<p><u>Public Sector Taking the Lead on Environmental Sustainability (PSTLES)</u></p>	<p>Based on the date of tender notices for the consultancy or design and build contract.</p> <p>The revised BCA GM NRB: 2015 Criteria will be applicable to public sector projects with tenders for design that are called on or after 1 December 2016.</p> <p>For projects with tender for design called before 1 December 2016, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Non-Residential Buildings. The revised GM NRB: 2015 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>

Source: Building and Construction Authority’s Circular dated 31 August 2016.

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### Green Mark for New Residential Buildings: 2016 (GM RB: 2016)

On 7 September 2016, BCA introduced the Green Mark for New Residential Buildings GM RB: 2016 to ensure Green Mark-certified residential buildings have greater emphasis on good passive design, façade performance and effective natural ventilation to enhance the well-being of end-users and occupants.

After 12 months of piloting and public review, the finalized criteria titled “Green Mark for Residential Buildings: 2016 (GM RB: 2016)” came into effect on 1 December 2017.

An extract on the implementation timeline of BCA GM RB: 2016 for other green building initiatives are outlined in the table below:

GREEN BUILDING INITIATIVE	IMPLEMENTATION TIMELINE (NEW RESIDENTIAL BUILDINGS)
<p><u>Green Mark Gross Floor Area (GM-GFA) Incentive Scheme</u></p> <p>Incentives in the form of additional GFA can be granted by URA if the development attains Green Mark Gold<sup>PLUS</sup> or Platinum Rating</p>	<p>Based on the submission date of BCA GM-GFA application.</p> <p>For projects with GM-GFA applications submitted on or after 1 December 2017, their residential portion will be assessed and certified using the revised BCA GM RB: 2016 Criteria.</p> <p>For projects with GM-GFA applications that are submitted before 1 December 2017, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Residential Buildings. The revised GM RB: 2016 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>
<p><u>Government Land Sales (GLS) Programmes</u></p> <p>Any new development located on land sold under the GLS programmes and are required to attain higher Green Mark Rating</p>	<p>Based on the GLS tender closing date.</p> <p>For projects with tender closing date on or after 1 December 2017, their residential portion will be assessed and certified using the revised BCA GM RB: 2016 Criteria.</p> <p>For projects with tender closing date before 1 December 2017, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Residential Buildings. The revised GM RB: 2016 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>
<p><u>Public Sector Taking the Lead on Environmental Sustainability (PSTLES)</u></p>	<p>Based on the date of tender notices for the consultancy or design and build contract.</p> <p>The revised BCA GM RB: 2016 Criteria will be applicable to public sector projects with tenders for design that are called on or after 1 December 2017.</p> <p>For projects with tender for design called before 1 December 2017, a grace period of 12 months will be given to complete the Green Mark assessment based on Green Mark Version 4.1 for New Residential Buildings. The revised GM RB: 2016 Criteria will apply if the Green Mark assessment is not completed within the stipulated timeline.</p>

Source: Building and Construction Authority’s Circular dated 22 September 2017.

## **Green Mark Gross Floor Area (GM GFA) Incentive Scheme**

The GM GFA Incentive Scheme came into effect on 29 April 2009 for a period of 5 years with a mid-term review after 2 years of implementation. The Scheme was introduced to encourage building owners/developers to accelerate the adoption of environmental-friendly green building technologies and building design practices that will contribute to the sustainable development of Singapore.

A mid-term review was conducted in 2011/2012 to assess the effectiveness of the Scheme. The results of the review showed a healthy adoption of green building technologies and building design practices, the GM GFA Incentive Scheme continued to be effective from 2 July 2012 to 28 April 2014. BCA has also announced that the extended GM GFA Incentive Scheme has come into effect from 29 April 2014 and shall last for a period of 5 years or such earlier date, as specified by BCA.

Building owners/developers can enjoy additional GFA allowed over and above the Master Plan (MP) Gross Plot Ratio (GPR) should their buildings achieve GM ratings of Gold<sup>PLUS</sup> and above. The quantum of GM GFA allowed under the Scheme is up to 1% for Green Mark Gold<sup>PLUS</sup> and up to 2% for Green Mark Platinum, subject to a cap of 2,500m<sup>2</sup> for Gold<sup>PLUS</sup> and 5,000m<sup>2</sup> for Platinum.

Developments that are eligible for the GM GFA Incentive Scheme include:

- Residential – non-landed, mixed commercial and residential development and others (approved on a case-by-case basis)
- Non-Residential – commercial, office, retail, business parks, industrial, institutional, community building, hotel, hospital, white site development and others (approved on a case-by-case basis)
- New private developments, redevelopments and reconstruction developments which include major additions and alterations to existing buildings and major retrofitting to existing buildings as deemed suitable for the GM GFA Incentive Scheme by BCA

### CURRENT CONSTRUCTION REGULATIONS

- Existing private developments which undergo “substantial energy efficiency (EE) enhancements” to achieve higher GM rating (i.e. GM Platinum and GM Gold<sup>PLUS</sup>) under the ‘New Building’ category. This is applicable to existing buildings of 10 years old and above from the date of the TOP<sup>1</sup>. The building must not have enjoyed other incentives under similar incentives schemes such as GM GFA scheme, Green Mark Incentive Scheme for Existing Building (GMIS-EB), EDB’s Solar Capability Scheme or NEA’s Grant for Energy Efficient Technologies (GREET)

<sup>1</sup> Where the building was granted TOP in parts, the age of the building will be counted from the date of TOP issued for the final part.

The method of determining the GM GFA is based on the following:

$$\text{GM GFA} = \frac{\left[ \begin{array}{c} \text{Proposed GFA (sqm)} \\ \text{(subject to MP allowable intensity)} \end{array} \right] \times \left[ \begin{array}{c} \text{Prescribed Green} \\ \text{Premium (\$/sqm)} \end{array} \right]}{\text{Land Value (\$/sqm) (determined by proxy using DC rates)}}$$

Note: The additional GFA is subject to payment of differential premium or development charge, whichever is applicable.

For more information on the Scheme, please refer to BCA’s website for more details.

### Enhancement of \$5 Million Innovation Grant for Construction Productivity

On 8 October 2013, BCA, with the funding support from the Ministry of National Development (MND), has set aside a \$5 million 2-stage Innovation Grant (iGrant) to help the entire value chain of the building and construction industry to conduct smaller scale R&D projects with near term commercialisation potential.

This initiative focuses on providing assistance to help industry to conduct fast track Proof-of-Concept (POC) type of R&D projects for subsequent quick deployment in a fast moving environment.

The funding scheme operates on a co-funding basis:

- Stage 1 - Proof-of-Concept (POC) Study: Up to 70% of qualifying costs or \$20,000, whichever is lower
- Stage 2 - Project Implementation: Up to 70% of the qualifying costs or \$250,000, whichever is lower

On 1 August 2014, iGrant was further enhanced to include Construction Productivity. The enhanced framework filled in the gaps for experimental type of projects encompassing emerging and game-changing technologies requiring fast-track POC studies to bring these solutions to the market.

On 1 July 2016, BCA announced the extension of iGrant to 31 October 2020 with a total available grant of \$3 million. The existing focus area of energy efficiency and construction productivity will be expanded to include safety, quality and maintainability. This is to provide a wider coverage of support for other strategic pillars beyond green buildings and construction productivity.

The enhanced iGrant is effective from 1 July 2016 till 31 October 2020 or till the \$3 million is exhausted, whichever comes first. Firms can submit their proposals to BCA at any time within this period.

Source: Building and Construction Authority

## **Legislation on Environmental Sustainability for Buildings**

Since the launch of BCA Green Mark Scheme in 2005, BCA has enhanced the Building Control Act to include a minimum environmental sustainability standard that is equivalent to the Green Mark Certified Level for new buildings and existing ones that undergo major retrofitting.

The Building Control (Environmental Sustainability) Regulations 2008 stipulates a minimum Green Mark score of 50 for affected building works. It applies to:

- All new building works with Gross Floor Area of 2,000m<sup>2</sup> or more

### CURRENT CONSTRUCTION REGULATIONS

- Additions or extensions to existing buildings which involve increasing Gross Floor Area of the existing buildings by 2,000m<sup>2</sup> or more
- Building works which involve major retrofitting to existing buildings with existing Gross Floor Area of 2,000m<sup>2</sup> or more

Alterations to existing buildings which does not involve major retrofitting works is not subject to this requirement.

The compliance with the respective environmental sustainability standards will be based on the first submission date for URA planning permission as stated in the following table:

1 <sup>ST</sup> SUBMISSION DATE FOR URA PLANNING PERMISSION	COMPLIANCE STANDARD
From 15 April 2008 to 30 November 2010	Code for Environmental Sustainability for Buildings, 1 <sup>st</sup> Edition, April 2008 Addendum to Code (1 <sup>st</sup> Edition), September 2014
From 1 December 2010 to 14 January 2013	Code for Environmental Sustainability for Buildings, 2 <sup>nd</sup> Edition, August 2010 Addendum to Code (2 <sup>nd</sup> Edition), September 2014
From 15 January 2013 and onwards	Code for Environmental Sustainability for Buildings, 3 <sup>rd</sup> Edition, October 2012 Addendum to Code (3 <sup>rd</sup> Edition), September 2014

The requirements on environmental sustainability of buildings are integrated with the Building Plan process. The Qualified Person (QP) who submits the Building Plan and the other appropriate practitioners will be responsible for assessing and scoring the building works under their charge using the criteria and scoring methodology spelled out in the Code for Environmental Sustainability of Buildings.

Under the Legislation, Green Mark assessments are no longer required to be conducted as an independent third party certification. Compliance to the regulations will be based on QP's declaration and random audit and site checks prior or during Temporary Occupation Permit (TOP).

However, third party assessment by BCA will be conducted to award projects with Green Mark Gold rating and above.

The BCA Green Mark has assessment criteria for four main categories:

- New Buildings;
- Existing Buildings;
- Beyond Buildings; and
- Occupant-Centrics.

New buildings refer to new developments, redevelopments, additions and alterations to existing buildings and major retrofitting to existing buildings. Existing buildings refer to buildings under operations with no significant retrofitting works. In order to promote environmental sustainability, the BCA Green Mark scheme also extent to beyond buildings which includes parks, supporting infrastructures, districts, rapid transit systems, and even occupant-centric spaces within buildings such as supermarkets, restaurants and healthcare facilities.

Append hereunder are the various Green Mark categories:

- BCA Green Mark for Non-Residential Buildings: 2015 (GM NRB:2015) - Applicable for new Non-Residential buildings including commercial buildings (office, retail and hotel), industrial buildings and institutional buildings. The effective date for this scheme is 1 December 2016 onwards.
- BCA Green Mark for Residential Buildings: 2016 (GM RB:2016) - Applicable for new private and public residential developments. The effective date for this scheme is 1 December 2017 onwards.
- BCA Green Mark for Existing Non-Residential Buildings (GM ENRB:2017) (Pilot) - Applicable to existing commercial, industrial and institutional buildings under operation. The effective date for this scheme is 13 September 2017 onwards.

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- BCA Green Mark for Existing Non-Residential Buildings (Version 3.0) - Applicable to existing commercial, industrial and institutional buildings under operation. The effective date for this scheme is 26 July 2012 onwards.
- BCA Green Mark for Non-Residential Existing Buildings (Version NREB 2.1) - Applicable to existing commercial, industrial and institutional buildings under operation. Assessment by this criteria is necessary for application of GMIS (Existing Building). The effective date for this scheme is 1 December 2009 onwards.
- BCA Green Mark for Existing Residential Buildings (Version ERB 1.1) - Applicable for existing private and public residential developments. The effective date for this scheme is 27 March 2015 onwards.
- BCA Green Mark for Existing Schools (Version 2.0) - Applicable to Ministry of Education main stream schools (excluding International schools, Universities and Institute of Higher Learning: Polytechnics and Institute of Technical Education). The effective date for this scheme is 1 January 2016 onwards.
- BCA Green Mark for Healthcare Facilities (Version HC/1.0) - Applicable for healthcare facilities. The effective date for this scheme is 1 July 2014.
- BCA Green Mark for Office Interior (Version 1.1) - Applicable for new offices, existing operating offices and existing offices undergoing renovation. The effective date for this scheme is 1 November 2012 onwards.
- BCA Green Mark for Landed Houses (Version LH/1.0) - Applicable for landed housing projects. The effective date for this scheme is 27 May 2009 onwards.
- BCA Green Mark for Infrastructure (Version 1.0) - Applicable for infrastructure projects (e.g. barrages, roads, bridges). The effective date for this scheme is 27 May 2009 onwards.
- BCA Green Mark for Districts (Version 2.1) - Applicable for district projects. The effective date for

this scheme is 1 January 2017 onwards.

- BCA Green Mark for Restaurants (Version 1.0) - Applicable for restaurants. The effective date for this scheme is 12 September 2011 onwards.
- BCA Green Mark for Supermarket (Version 1.0) - Applicable for supermarket. The effective date for this scheme is 11 October 2012 onwards.
- BCA-IDA Green Mark for Existing Data Centres (Version EDC/1.1) - Applicable for existing data centres. The effective date for this scheme is 11 October 2012 onwards.
- BCA-IDA Green Mark for New Data Centres (Version NDC/1.1) - Applicable for new data centres. The effective date for this scheme is 14 March 2013 onwards.
- BCA Green Mark for Retail (Version 1.0) - Applicable for retail tenants. The effective date for this scheme is 11 October 2012 onwards.
- BCA Green Mark for Laboratories (GM Lab:2017) - Applicable for laboratories within buildings. The effective date for this scheme is 13 June 2017 onwards.
- BCA Green Mark for New Parks (Version 1.0) - Applicable for new parks. The effective date for this scheme is 26 May 2010 onwards.
- BCA Green Mark for Existing Parks (Version 1.0) - Applicable for existing parks. The effective date for this scheme is 22 May 2008 onwards.

The Green Mark rates the environmental friendliness of a building based on a point scoring approach. Depending on the score, the rating is categorized in four levels – Platinum, Gold<sup>PLUS</sup>, Gold and Certified.

## CURRENT CONSTRUCTION REGULATIONS

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 1 DECEMBER 2016 GREEN MARK 2015 NEW NON-RESIDENTIAL BUILDINGS	GREEN MARK POINTS WITH EFFECT FROM 1 DECEMBER 2017 GREEN MARK 2016 NEW RESIDENTIAL BUILDINGS
Green Mark Platinum	70 and above	70 and above
Green Mark Gold <sup>PLUS</sup>	60 to <70	60 to <70
Green Mark Gold	50 to <60	50 to <60
Green Mark Certified	-	-

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 13 SEPTEMBER 2017 GREEN MARK 2017 (PILOT) EXISTING NON-RESIDENTIAL BUILDINGS
Green Mark Platinum	70 and above
Green Mark Gold <sup>PLUS</sup>	60 to <70
Green Mark Gold	>50 to <60
Green Mark Certified	compliance with all pre-requisite requirements

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 26 JULY 2012 VERSION 3.0 EXISTING NON-RESIDENTIAL BUILDINGS	GREEN MARK POINTS WITH EFFECT FROM 1 DECEMBER 2009 VERSION 2.1 NON-RESIDENTIAL EXISTING BUILDINGS
Green Mark Platinum	90 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <90	85 to <90
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	50 to <75

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 27 MARCH 2015 VERSION 1.1 EXISTING RESIDENTIAL BUILDINGS	GREEN MARK POINTS WITH EFFECT FROM 1 JANUARY 2016 VERSION 2.0 EXISTING SCHOOLS
Green Mark Platinum	90 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <90	85 to <90
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	-

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 1 JULY 2014 VERSION 1.0 HEALTHCARE FACILITIES	GREEN MARK POINTS WITH EFFECT FROM 1 NOVEMBER 2012 VERSION 1.1 OFFICE INTERIOR
Green Mark Platinum	90 and above	95 and above
Green Mark Gold <sup>PLUS</sup>	85 to <90	85 to <95
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	50 to <75

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 27 MAY 2009 VERSION 1.0 LANDED HOUSES	GREEN MARK POINTS WITH EFFECT FROM 27 MAY 2009 VERSION 1.0 INFRASTRUCTURE
Green Mark Platinum	95 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <95	80 to <90
Green Mark Gold	75 to <85	70 to <80
Green Mark Certified	50 to <75	50 to <70

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 1 JANUARY 2017 VERSION 2.1 DISTRICTS	PRE-REQUISITES
Green Mark Platinum	100 and above	At least one building (GFA >5,000m <sup>2</sup> ) at Phase 1 to achieve Green Mark Platinum
Green Mark Gold <sup>PLUS</sup>	90 to <100	At least one building (GFA >5,000m <sup>2</sup> ) at Phase 1 to achieve Green Mark Gold <sup>PLUS</sup>
Green Mark Gold	75 to <90	At least one building (GFA >5,000m <sup>2</sup> ) at Phase 1 to achieve Green Mark Gold
Green Mark Certified	60 to <75	Nil

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 12 SEPTEMBER 2011 VERSION 1.0 RESTAURANTS	GREEN MARK POINTS WITH EFFECT FROM 11 OCTOBER 2012 VERSION 1.0 SUPERMARKET
Green Mark Platinum	95 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <95	85 to <90
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	50 to <75

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GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 11 OCTOBER 2012 VERSION 1.1 EXISTING DATA CENTRES	GREEN MARK POINTS WITH EFFECT FROM 14 MARCH 2013 VERSION 1.1 NEW DATA CENTRES
Green Mark Platinum	90 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <90	85 to <90
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	50 to <75

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 11 OCTOBER 2012 VERSION 1.0 RETAIL	GREEN MARK POINTS WITH EFFECT FROM 13 JUNE 2017 GREEN MARK 2017 LABORATORIES
Green Mark Platinum	95 and above	70 and above
Green Mark Gold <sup>PLUS</sup>	85 to <95	60 to <70
Green Mark Gold	75 to <85	50 to <60
Green Mark Certified	50 to <75	-

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 26 MAY 2010 VERSION 1.0 NEW PARKS	GREEN MARK POINTS WITH EFFECT FROM 22 MAY 2008 VERSION 1.0 EXISTING PARKS
Green Mark Platinum	90 and above	90 and above
Green Mark Gold <sup>PLUS</sup>	85 to <90	85 to <90
Green Mark Gold	75 to <85	75 to <85
Green Mark Certified	50 to <75	50 to <75

More information on the BCA Green Mark Scheme can be found in BCA's website. ([http://www.bca.gov.sg/GreenMark/green\\_mark\\_buildings.html](http://www.bca.gov.sg/GreenMark/green_mark_buildings.html))

## BCA Green Mark Champion

The **BCA Green Mark Champion Award** established in May 2008 was an extension to the BCA Green Mark Award introduced in 2005. This award was created to recognise developers/building owners with strong commitment towards corporate social responsibility and outstanding achievements in environmental sustainability. It is given to developers/building owners who achieve a substantial number of Green Mark buildings at Gold level and higher.

There are 2 categories for the award:

- BCA Green Mark Champion
- BCA Green Mark Platinum Champion

In addition to demonstrating strong commitment towards corporate social responsibility and environmental sustainability, developers/building owners must also meet the minimum criteria set out below to qualify for the award:

TOTAL NO. OF BUILDINGS RATED	BCA GREEN MARK CHAMPION	BCA GREEN MARK PLATINUM CHAMPION
Green Mark Gold and above	At least 10	At least 50
Green Mark Gold <sup>PLUS</sup> and above	At least 6	At least 30
Green Mark Platinum	At least 3	At least 15

Source: Building and Construction Authority

### CURRENT CONSTRUCTION REGULATIONS

#### Solar Capability Scheme (SCS)

In May 2008, the Clean Energy Programme Office (CEPO) (now known as Energy Innovation Programme Office (EIPO)) of the Singapore Economic Development Board (EDB) announced the establishment of the Solar Capability Scheme (SCS). The primary purpose of this scheme is to encourage the use of solar energy systems in new developments, and also to build capacity within the local construction industry for the implementation of such systems.

Under the scheme, building owners and developers may enjoy a grant of 30% - 40% of the capital cost (capped at \$1 million per project) of installing solar energy systems in their new developments. It is estimated that savings from the electricity generated by these systems will allow the owner to recover a further 50% of the capital cost incurred. The initial budget for the scheme is \$20 million, and the quantum of grant is expected to be reviewed on a regular basis to factor in changes in the prices of solar systems and energy prices.

Eligibility for the SCS is restricted to new buildings that have attained a minimum Green Mark Gold standard (administered by the Building and Construction Authority), while buildings undergoing extensive retrofit will be considered on a case-by-case basis. To qualify, a minimum system size of 10kWp is required.

The following evaluation criteria determine the actual amount of the grant:

- a) Innovation
  - Innovative application of solar technologies
  - New products, technologies or solutions developed
- b) Design
  - Aesthetics of building and solar system design and integration
  - Integration of solar technologies in the building's sub-system

- c) Effectiveness
  - Cost effectiveness of solar solutions
  - Percentage of conventional electricity replaced
- d) Skill Development
  - Number of man-months of Singapore based staff involved in solar related activities in the project
  - Number of man-months of formal training

Disbursement of the grant is conducted in 2 phases as follows:

- i. Capital Component:  
70% of the grant to be disbursed from the start of the project on a reimbursement basis
- ii. Performance Component:  
30% of the grant to be disbursed 2 years after the system becomes operational, subject to the project meeting submitted plans, including stipulated electricity output

With effect from 1 March 2010, the eligibility for the SCS has been revised as follows:

- a) SCS will offset up to 30% of the total capital cost instead of 30% - 40% of the capital cost
- b) New buildings have to attained minimum Green Mark Gold<sup>PLUS</sup> standard instead of Green Mark Gold standard
- c) Minimum system size of 50kWp is required instead of 10kWp

From 1 May 2012, a minimum system size of 150kWp is required instead of 50kWp. This is in line with the growing number and size of solar PV systems being installed in Singapore.

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### Revised Guidelines for Strata Landed Housing Developments

To better safeguard the pleasant living environment in the landed housing estates, URA has revised the existing guidelines for strata landed housing developments on 22 August 2014.

#### Maximum Number of Allowable Dwelling Units (DUs)

Under the revised guidelines, the maximum number of allowable DUs allowed for the various types of strata landed housing developments is determined by the following formulae:

TYPE OF STRATA LANDED HOUSING DEVELOPMENTS	FORMULA TO CALCULATE MAXIMUM NUMBER OF DUs ALLOWED <sup>1</sup>
Outside Good Class Bungalow Areas (GCBAs)	$\frac{40\% \text{ of Site Area}}{Y}$ <p>Where Y = Typical footprint for the relevant conventional landed housing form<sup>2</sup></p>
Within GCBAs	$\frac{35\% \text{ of Site Area}}{Y}$ <p>Where Y = Typical footprint for a Good Class Bungalow<sup>2</sup></p>
Mixed strata landed housing developments comprising more than one housing form (e.g. a mix of terrace, semi-detached and detached housing units) outside GCBAs	$(B \times Y) + (SD \times Y) + (T \times Y) \leq 40\% \text{ of Site Area}$ <p>Where,</p> <p>B = Number of detached housing units</p> <p>SD = Number of semi-detached housing units</p> <p>T = Number of terrace housing units</p> <p>Y = Typical footprint for the relevant conventional landed housing form<sup>2</sup></p>

With the above revised formulae, it will improve the compatibility of strata landed housing developments with the environment of landed housing estates. It also addresses feedback from residents in landed housing estates that strata landed housing developments could add on a large number of DUs, resulting additional traffic and parking problems along local estate roads and creating a more congested living environment.

## Communal Open Space (COS) Requirement with Minimum On-Ground Greenery Control

To ensure more space for communal facilities and greenery within the strata landed housing developments, the minimal COS requirement has been raised from 30% to 45%. Of the 45%, at least 25% must be set aside for on-grade greenery which complements URA's drive for more greenery in our urban environment through the LUSH 2.0 Programme announced on 12 June 2014.

The revised guidelines apply to all new applications submitted on or after 23 August 2014. Only formal development applications (excluding Outline Applications) submitted before the effective date of 23 August 2014 which have already been granted Provisional Permission or which will result in a Provisional Permission, will not be subject to the revised guidelines<sup>3</sup>.

<sup>1</sup> The number of units will be rounded down to the nearest round figure.

<sup>2</sup> The typical footprint of the various conventional landed housing forms is 100m<sup>2</sup> for terrace and semi-detached housing, 200m<sup>2</sup> for detached housing and 500m<sup>2</sup> for Good Class Bungalows.

<sup>3</sup> Development applications for strata landed housing submitted before the effective date of 23 August 2014 resulting in an Advice or Refusal of Written Permission (RWP) will be evaluated based on the revised guidelines upon resubmission after the Advice or RWP.

Source: Urban Redevelopment Authority

### CURRENT CONSTRUCTION REGULATIONS

#### Changes to Gross Floor Area (GFA) Exemption Guidelines – GFA to include

- i. Bay windows in all developments; and
- ii. Planter boxes within a residential unit.

With effect from 1 January 2009, bay windows in all developments and planter boxes within a residential unit are no longer exempted from GFA calculations. This guidelines do not apply to approved developments and formal development applications (excluding Outline Applications) with a valid Provisional Permission (PP) issued prior to the effective date. For approved developments with approved bay windows and planter boxes exempted from GFA, these approved spaces will remain as GFA exempted until the buildings are redeveloped.

- iii. Private Enclosed Spaces (PES) and Private Roof Terraces (RTs) in non-landed strata-titled residential developments

With effect from 12 January 2013, all PES and private RTs in non-landed strata-titled residential developments, including executive condominiums, are to be counted as GFA but under the 10% maximum bonus GFA allowed beyond the Master Plan (MP) stipulated GPR, subject to the payment of development charge / differential premium.

As these spaces are counted as GFA, coverings over PES and private RTs will be allowed in order to deal with the needs of end-users for weather protection. However, to qualify for the bonus GFA scheme, they will need to satisfy a set of guidelines to retain a semi-outdoor character.

The additional GFA approved under this scheme will not form part of the prescribed GPR for the site under the MP upon redevelopment. The overall budget of 10% for additional GFA allowed beyond the MP under bonus GFA schemes will also apply.

On the other hand, communal roof terraces that are open to sky will continue to be exempted from GFA as these spaces under the management of Management Corporation Strata Title (MCST) serve to provide landscaping and communal facilities for the benefit of all residents and are unlikely to be covered up subsequently. However, covered or enclosed features within these areas will continue to be counted as GFA as per existing treatment.

For non-residential developments, any PES or private RTs proposed in strata-subdivided will be computed as part of the MP allowable GFA. However, if these spaces are managed by the MCST as communal landscaping / roof gardens for the benefit of all occupants in the building, they can continue to be exempted from GFA as per current guidelines.

With effect from 12 June 2014, to align the GFA treatment for planter boxes in both residential and non-residential developments, only communal planter boxes (not exceeding 1 metre width) will enjoy GFA exemption. URA will consider communal planter boxes which are more than 1 metre wide for GFA exemption if the wider planter boxes are part of an overall scheme designed to enhance greenery provision for the development.

The changes are summarise as follows:

OLD GUIDELINES	NEW GUIDELINES
<p>GFA exemption apply to:</p> <ul style="list-style-type: none"> <li>• Bay windows</li> <li>• Planter boxes</li> </ul>	<p><u>With effect from 1 January 2009:</u></p> <p>GFA exemption rescinded for:</p> <ul style="list-style-type: none"> <li>• Bay windows in all developments</li> <li>• Planter boxes within a residential unit</li> </ul> <p>GFA exemption continue to apply to:</p> <ul style="list-style-type: none"> <li>• Planter boxes provided within non-residential developments</li> <li>• Planter boxes provided within the communal areas of residential developments</li> </ul> <p><u>With effect from 12 June 2014:</u></p> <p>GFA exemption rescinded for:</p> <ul style="list-style-type: none"> <li>• Private planter boxes provided within non-residential developments</li> </ul> <p>GFA exemption apply to:</p> <ul style="list-style-type: none"> <li>• Communal planter boxes not exceeding 1 metre width provided within residential and non-residential developments.</li> </ul>
<p>GFA exemption apply to:</p> <ul style="list-style-type: none"> <li>• Private Enclosed Spaces (PES) and Private Roof Terraces (RTs)</li> </ul>	<p><u>With effect from 12 January 2013:</u></p> <p>GFA exemption rescinded for:</p> <ul style="list-style-type: none"> <li>• PES and Private RTs in <u>non-landed strata-titled residential developments</u></li> </ul> <p>GFA exemption continue to apply to:</p> <ul style="list-style-type: none"> <li>• Communal RTs that are open to sky in <u>non-landed strata-titled residential developments</u></li> </ul>

### CURRENT CONSTRUCTION REGULATIONS

On 28 February 2014, URA issued a circular announcing the revision of GFA guidelines for coverings of private outdoor spaces (such as PES and private RTs) within non-landed strata-titled residential developments.

The revised guidelines came into effect on 1 March 2014. It seeks to accord owners of units in existing and earlier approved developments (i.e. those on which the earlier guidelines introduced on 12 January 2013 do not apply) the same flexibility to erect additional covering structures in their outdoor spaces.

The covering of outdoor spaces will be exempted from computation as GFA. For covering structures over PES and private RTs which extend beyond 2m of the external wall of the unit, PP from URA is required. URA will assess all proposals on the basis of prevailing development control guidelines to ensure that such structures are not excessively large and are in compliance with the building setback and/or height controls. The covered spaces shall retain a semi-outdoor character. GFA exemption will not apply if the covered area is enclosed at the sides.

For developments with multiple units in which owners wish to either erect new covers or regularise existing ones, the MCST is encouraged to guide owners towards a consistent design which is agreeable to residents in the development. The MCST should decide on standard design guidelines for the covering structures and pass them in the form of a by-law at the general meeting. For such cases, the MCST may wish to coordinate a joint submission to URA on behalf of the affected units.

Source: Urban Redevelopment Authority

## Revised Balcony Bonus Gross Floor Area (GFA) Scheme for Private Non-landed Residential Developments to Promote Higher Construction Productivity

On 2 September 2013, BCA issued a circular on the revision to the balcony bonus GFA scheme for private non-landed residential development to promote higher construction productivity which took effect from 1 November 2013 in 2 phases and will be effective for the next 5 years.

To further promote higher construction productivity, BCA has issued a circular on 9 December 2014 announcing the revisions of the Building Control (Buildability) Regulations to require higher minimum Buildable Design Scores as well as mandatory use of drywalls for internal dry areas and Prefabricated Bathroom Units (PBUs) for selected developments with effect from 1 November 2014. The revised conditions took effect from 9 December 2014 and have superseded the previous conditions under Phase 2 of the Balcony Bonus GFA scheme.

The details of the revised Balcony Bonus GFA scheme are as follows:

- Phase 1 – Private non-landed residential developments (including executive condominiums) and the residential component of mixed-use projects<sup>1</sup> can apply for the balcony bonus GFA scheme up to the quantum and subject to the conditions specified in the following table with effect from 1 November 2013:

UP TO 3% ADDITIONAL GFA BEYOND THE MASTER PLAN GROSS PLOT RATIO (GPR) FOR BALCONIES IF:	UP TO 10% ADDITIONAL GFA BEYOND THE MASTER PLAN GPR FOR BALCONIES IF:
a. It achieves at least 10 points above the minimum legislated buildable design score; and	a. It achieves at least 10 points above the minimum legislated buildable design score;
b. Uses drywall for all internal dry areas in the development.	b. Uses drywalls for all internal dry areas in the development; and
	c. At least 65% of the bathrooms are PBUs.

- Phase 2 – Private non-landed residential developments (including executive condominiums) and the residential

## CURRENT CONSTRUCTION REGULATIONS

component of mixed-use projects<sup>1</sup> can apply for the balcony bonus GFA scheme up to the quantum and subject to the revised conditions specified in the following table:

PREVIOUS CONDITIONS (1 NOV 2014 TO 8 DEC 2014)	REVISED CONDITIONS (9 DEC 2014 TO 31 OCT 2018)
a. At least 65% of the bathrooms are PBUs	a. At least <b>80%</b> of the bathrooms are PBUs
b. Achieves a buildable design score that is at least 10 points above the minimum legislated score	b. Achieves a buildable design score of at least a) <b>90 points</b> for GFA ≥ 25,000m <sup>2</sup> b) <b>87 points</b> for GFA ≥ 5,000m <sup>2</sup> but less than 25,000m <sup>2</sup> c) <b>82 points</b> for GFA ≥ 2,000m <sup>2</sup> but less than 5,000m <sup>2</sup>
c. Uses drywalls for all internal dry areas in the development	c. See note below

Note: The condition for use of drywall for all internal dry areas is no longer required since drywall is already mandated for all non-landed residential developments under the amended Building Control (Buildability) Regulations.

Where balconies are proposed under the scheme, the prevailing standard guidelines for balconies (e.g. perimeter openness, balcony screening requirements, etc.) will still be applicable. The Balcony Bonus GFA will not form the new prescribed maximum GPR for the site upon redevelopment.

The above scheme will apply to all new applications for private non-landed residential developments (including executive condominiums) and the residential component of mixed-use projects submitted on or after the effective date<sup>2</sup>. Only formal development applications (excluding Outline Applications) submitted before the effective date which have already been granted Provisional Permission (PP) or which will result in a PP, will not be subject to the revised conditions under Phase 2 of the Balcony Bonus GFA Scheme<sup>2</sup>.

<sup>1</sup>Applicable to all new building projects with GFA of 2,000m<sup>2</sup> or more.

<sup>2</sup>Development applications submitted before the effective date resulting in an Advice or Refusal of Written Permission (RWP) will be evaluated based on the revised conditions under Phase 2 of the Balcony Bonus GFA scheme upon resubmission after the Advice or RWP.

Source: Building and Construction Authority

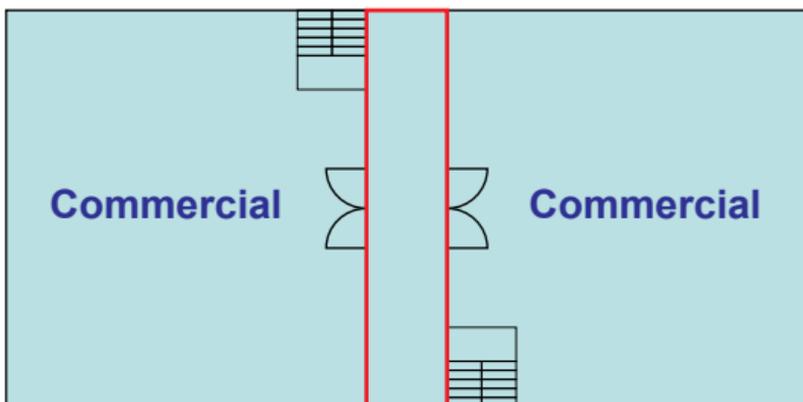
## Revised Gross Floor Area (GFA) Apportionment Rules for Common Areas in Mixed-Use Developments

The apportionment of GFA for common areas such as corridors, lift lobbies and staircases in mixed-use developments will be revised with effect from 5 October 2015. The new rules will apply to all new erection, major and minor additions & alterations and amendment development applications submitted on or after 5 October 2015.

The revised GFA apportionment rules will be based on the following principles:

### a) **Attributable Space**

Where a space is exclusively used for a specific purpose, it will be apportioned to the specific use (See Figure 1 below):



- Used exclusively for commercial purposes: apportioned to commercial use

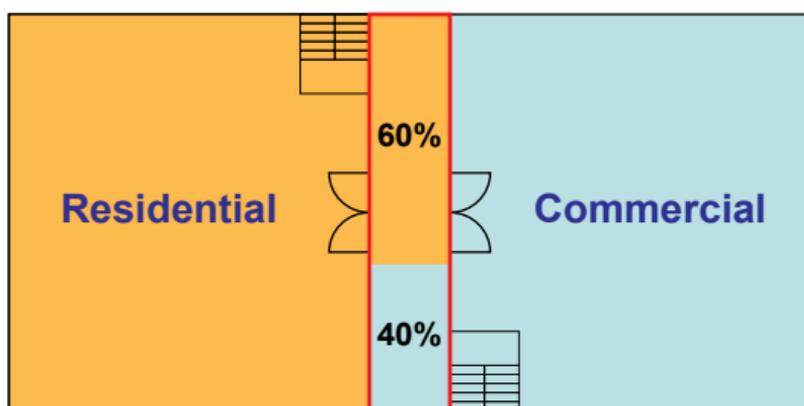
Figure 1: Apportionment of attributable space on a pure commercial floor in a mixed-use development on commercial & residential zone

Source: Building and Construction Authority

## CURRENT CONSTRUCTION REGULATIONS

### b) Non-Attributable Space

Where the space is not exclusively used for a specific purpose (e.g. it is used for two or more purposes), it will be apportioned based on the weighted average, pegged to the prescribed use quantum mix in the Master Plan zoning (See Figure 2 below):



- Used for residential and commercial purposes: apportioned based on weighted average, pegged to the prescribed use quantum mix in the Master Plan zoning

Figure 2: Apportionment of non-attributable space on a mixed floor in a mixed-use development on commercial & residential zone

Source: Building and Construction Authority

The new apportionment rules will be applied on a per floor basis. If a floor is occupied by a single use (e.g. commercial), any vertical circulation GFA areas like staircases on that floor will be apportioned to commercial use, though they may also be used by other uses (e.g. residential) above for escape purposes. However, if the floor is occupied by two or more uses for which the staircase GFA on that floor cannot be exclusively attributed, they will be regarded as non-attributable space and apportioned based on weighted average, pegged to the prescribed use quantum in the Master Plan zoning.

For sites where the tender or lease conditions state that the land is to be developed for a certain use quantum mix, non-attributable common areas will be apportioned based on the specific use quantum mix stated in the tender or lease conditions rather than the Master Plan zoning.

For White sites where the tender or lease conditions stipulate a minimum quantum control on a particular use, this will be taken into account when apportioning the non-attributable common areas with the balance distributed to the other proposed uses in the development on a simple average basis.

For more information, please refer to BCA's website. (<http://www.bca.gov.sg>)

### CURRENT CONSTRUCTION REGULATIONS

#### **Building and Construction Industry Security of Payment Act 2004**

The Building and Construction Industry Security of Payment Act (BCISOP Act) 2004 came into force in Singapore on 1 April 2005.

The BCISOP Act was enacted to facilitate payments for construction work done or for related goods and services supplied, under a contract in the building and construction industry. The Act covers quite a wide spectrum of services within the construction industry relating to construction work which includes professional consultancy services.

The underlining objectives of the BCISOP Act are to:

- improve cash flow by expediting payment
- provide a statutory entitlement to progress payments to contractors, sub-contractors and suppliers for work carried out, even if no such entitlement is provided in their contract
- provide a procedure of adjudication to claim payment; which is intended to be a more cost and time efficient way of resolving disputes on payment claims between the parties
- provide remedies when adjudicated amount not paid

The BCISOP Act provides a new regime of claim, adjudication and enforcement procedures which include the right to suspend work for non-payment. It also renders unenforceable “pay when paid” provisions in contracts. This benefits the sub-contractors and suppliers.

The BCISOP Act is supplemented by the BCISOP Regulations 2005 where the Act confers power on the Minister of National Development to set out the regulations to facilitate the implementation of the Act.

However, the BCISOP Act is not applicable to construction work and goods and services relating to residential property (defined under Residential Property Act) not requiring approval under the BCA Building Control Act, construction work carried outside Singapore, goods and services supplied to construction work outside Singapore and employment contracts.

Notwithstanding the benefits arising from the enactment of the BCISOP Act to facilitate payment in the construction supply chain, it is essential for every player in the industry to have a good understanding of the Act from the operational and practical standpoint.

Arcadis Singapore has streamlined our in-house practices as well as assisted our Clients/Developer organizations to review and make recommendations in their internal operating procedures. Payment protocol with prescribed time frame for payment claim, QS valuation, consultant's certification, payment response and payment term were customized and established with the respective organization.

### CURRENT CONSTRUCTION REGULATIONS

#### Workplace Safety and Health Act (WSHA)

The **Workplace Safety and Health Act (WSHA)** considers the safety, health and welfare of the persons at workplaces. It imposes specific duties on various persons (including Employer). It also provides a range of enforcement methods so as to enable appropriate response to a failure to comply with the Act, depending on the nature of the failure. This Act has replaced the Factories Act, which stipulates that the legal liability for safety and health in a factory lies primarily with the factory occupier.

The following incidents in year 2004 have shown a need for a better work safety standard:

- The Nicoll Highway collapse
- The construction site accident at Fusionopolis
- The fire in the vessel “Almudaina” at a shipyard

In order to put in place a more effective framework to reduce accidents at the workplace, the Workplace Safety and Health Act was passed in Parliament on 17 January 2006 and came into effect on 1 March 2006.

This Act forms the legal framework for the Occupational Safety Health regulatory system. It also contains a penalty framework to reflect the cost of poor safety management. While the maximum fine for the individuals remains at up to \$200,000, the jail term has been increased from 12 months to 24 months whereas for corporations, they can be fined up to \$500,000.

This regulation will require employers to conduct comprehensive risk assessment for all work processes, and provide detailed plans to eliminate or minimise risks. In view of this, the Ministry of Manpower shall work with the construction industries from the design stage to identify potential risks, rather than wait till the plans are submitted.

In addition, the Ministry of Manpower officers also have a new enforcement tool – the power to issue “Remedial Orders” whereby the officers will be empowered to

compel worksites to remove a workplace risk regardless of whether there is an imminent danger. Any non-compliance can lead to stop-work order.

A greater responsibility and accountability will also be assigned to everyone, from rank-and-file workers to managers and directors of companies, even though they may not be directly involved at the workplace or may not be able to physically police safety and health on the ground.

The impact of these regulation changes especially with the stringent regulations and additional requirement on Health and Safety by the authorities has bearing on the overall construction costs, particularly on preliminaries and temporary works associated with construction.

With effect from 1 September 2011, all workplaces are covered under the WSHA. This extension brings on board more than 100,000 organizations with over 1.6 million employees, or about half of the Singapore workforce. Companies and employees now covered under the Act will need to take reasonably practicable measures to ensure their workplaces are safe. This includes proper risk management or taking steps to identify and manage the existing risks in one's workplace so as to prevent work incidents.

Apart from the coverage extension of the WSHA, other key changes were also affected. These include:

- Making the duties and obligations of the principals and the persons at work more defined
- Enhancing the definition of Occupational Diseases to include any diseases that are attributable to chemical and biological agent exposure at work
- The WSH (Noise) Regulations took effect on 1 September 2011 and include all workplaces to be covered under the regulation

### CURRENT CONSTRUCTION REGULATIONS

#### **Workplace Safety and Health (WSH) (Construction) Regulations 2007**

With effect from 1 January 2008, the WSH (Construction) Regulations 2007 has replaced the Factories (Building Operations and Works of Engineering Construction) Regulations (BOWEC).

The main changes of the Regulations are as follows:

- Worksites with Contract Sum of less than \$10 million are required to appoint a WSH Coordinator who shall assist the occupier to identify unsafe condition or unsafe work practice; recommend to the occupier such reasonably practicable measures; remedy the unsafe condition or unsafe work practice; and assist the occupier to implement such reasonable practicable measures
- Inclusion of the recommendations of the MOM-MND Joint Review committee as follows:
  - Imposing statutory duties on Professional Engineers (PEs) undertaking design of temporary works
  - Requiring safety and health training for all supervisors
  - Instituting regular site coordination meetings
  - Implementing a permit-to-work system for selected hazardous work
- Updating of the provisions to make it less prescriptive
- Updating of all relevant terminologies
- Clarifying the intended duty holder for the provision
- Introducing offences and penalties provisions for the breach of the Regulations

On 1 May 2013, the WSH (Construction) Regulations 2007 have been amended to delete replica provisions in the WSH (Work at Heights) Regulations via the WSH (Construction) (Amendment) Regulations 2013.

## **Code on Accessibility in the Built Environment 2013**

In August 2013, BCA introduced its new Code on Accessibility in the Built Environment 2013 (“the Code”). The provisions of the Code will apply to new projects and existing buildings undergoing addition and alteration works to follow the Code for submission to BCA for regulatory approval with effect from 1 April 2014.

The Code was first introduced in 1990 and aimed to make our buildings more user-friendly for the physically challenged. The Code was reviewed and expanded in 2007 to include additional requirements relating to the interconnection between buildings and from buildings to infrastructure and more mandatory requirements on elder-friendly features to prepare for an ageing population.

The Code was reviewed by a tripartite working committee comprising representatives from government agencies, industry stakeholders, academic institution and voluntary welfare organisations. In this fourth revision, the needs of persons with disabilities remain the primary focus. More mandatory requirements are introduced to minimise restrictions to environment to allow persons with disabilities to make full use of the building premises and amenities. The Code also places greater emphasis on universal design concepts and introduces new requirements that will benefit a wider spectrum of the community.

### CURRENT CONSTRUCTION REGULATIONS

#### **Mandatory Water Efficiency Labelling Scheme (MWELS)**

With effect from 1 July 2009, PUB implemented the Mandatory Water Efficiency Labelling Scheme (MWELS) to further promote water conservation, accelerate the adoption of water efficient fittings and products and encourage suppliers to bring in more water efficient models.

The water fittings, appliances, apparatuses and products covered under MWELS include the following:

- a. Shower Taps and Mixers (except concealed shower taps and mixers which are not covered under MWELS for the time being)
- b. Basin Taps and Mixers
- c. Sink/Bib Taps and Mixers
- d. Dual Flush Low Capacity Flushing Cisterns (Dual Flush LCFCs)
- e. Urinal Flush Valves
- f. Waterless Urinals
- g. Clothes Washing Machines Intended for Household Use (with effect from 1 October 2011)

With effect from 1 October 2011, only showerheads will be covered under voluntary WELS.

The Scheme requires the water fittings, appliances, apparatuses and products covered under MWELS to be labelled for the purpose of supply, sale or offer, display or advertisement for supply or sale or installation or use in Singapore.

All water fittings, appliances, apparatuses and products that are required to be labelled under MWELS will be rated. The rating given to a product is determined by its category, and its flow rate/flush capacity. In essence, the more number of ticks, the more water efficiency the product is.

With effect from early 2017, all taps and mixers shall be of at least a 1-tick water efficiency rating under the MWELS. Taps and mixers with 0-tick rating shall not be allowed for sale, supply, display or advertisement as well as registration from the effective date. (See Figure 1 and 2 below.)

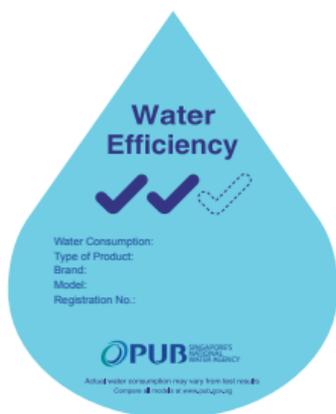


Figure 1: An example of 2-tick showerhead (voluntary WELS).

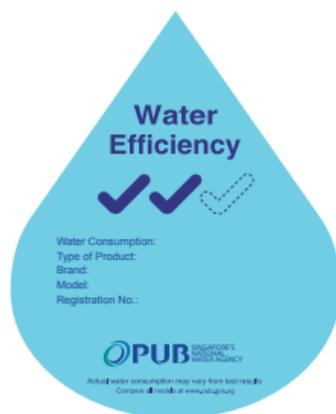


Figure 2: An example of 2 tick taps and mixers, dual-flush low capacity flushing cisterns, urinal flush valves, waterless urinals.

Registration Number is displayed on the Mandatory WELS Label, while Serial Number is displayed on Voluntary WELS Label

With effect from 1 October 2015, clothes washing machines intended for household use are to be labelled with a minimum 2-tick water efficiency rating under MWELS. With effect from early 2017, a 4-tick water efficiency rating for clothes washing machines with water consumption of 6 litres/kg or less will be introduced to encourage consumers to purchase more water efficient clothes washing machines. (See Annex A for the current and revised ratings for clothes washing machines.)

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### Annex A

#### Water Efficiency Labelling Scheme (WELS) Rating for Clothes Washing Machines

Current WELS Rating	
✓✓ 2-ticks	✓✓ 3-ticks
>9 to 12 litres/kg	9 litres/kg or less

Revised WELS rating from early 2017		
✓✓ 2-ticks	✓✓✓ 3-ticks	✓✓✓✓ 4-ticks
>9 to 12 litres/kg	>6 to 9 litres/kg	6 litres/kg or less

The labels for clothes washing machines are as follows:

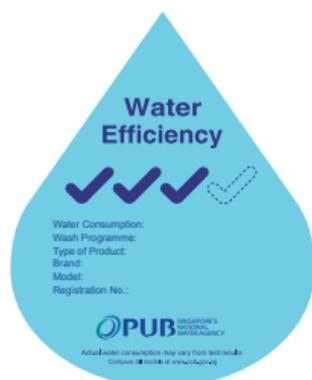


Figure 3: An example of 3-tick clothes washing machines.



Diagram 1: Existing WELS Labels for Clothes Washing Machine (Mandatory to display new WELS label for models registered before early 2017).

Source: Public Utilities Board as at 14 April 2016

In addition, WELS products will be independently assessed and certified by Conformity Assessment Bodies (CABs) accredited by the Singapore Accreditation Council (SAC) for water efficiency and issuance of WELS labels with effect from early 2017. As such, PUB will cease WELS registration for all WELS products from the effective date.

### **Energy, Environment and Financial Impacts of Fuel Switch Solutions for Domestic Water Heating Systems in Singapore**

The National University of Singapore and ZEB Technology Pte Ltd Singapore have carried out an independent study for City Gas Pte Ltd, Singapore in Year 2009 to determine the financial and environmental impact of fuel switch solutions for domestic water heating systems in Singapore. The main objectives of the study are to compare the energy consumption and the carbon reduction between gas and electric type of domestic water heating systems in Singapore.

The key findings of the study are summarised as follows:

1. At the individual user level, the annual energy cost saving (in %) may be as high as 91% for the conservative user, if one was to convert from electric storage heater to the gas continuous flow heater, and leaves the storage heater turn on for a period of approximately 52 minutes before use. On the other hand, if one was to switch from electric instantaneous heaters to gas continuous flow heaters, the savings could range between 14% and 44% of the total hot water energy use.
2. At a national level, the fuel switch from electric storage heater to gas continuous flow heater may reduce the carbon emission by up to 86%. This is equivalent to 0.5 million tons of carbon emission annually. There is a potential savings of up to 64% in energy use with respect to total energy use for hot water generation in Singapore when all households switch to using gas continuous flow heaters. This translates to a saving of 700,000 MWh or \$149 million per year. This is equivalent to planting about 500,000 trees per

### CURRENT CONSTRUCTION REGULATIONS

annum to provide the carbon sink for the absorption of the same carbon; or equivalent to the removal of 72,780 cars from the road.

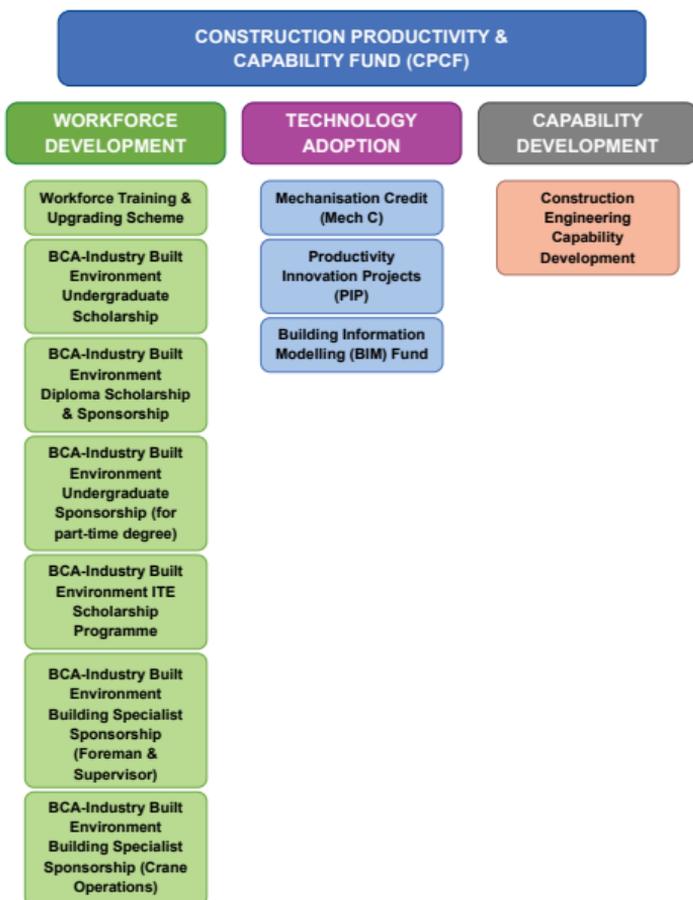
3. For new developments, the increase in installation cost for a gas continuous flow heater may be recovered from energy saving within 9 months for a small apartment to a maximum of 2.1 years for a large condominium. The payback period for a retrofit scenario from electric storage heater to gas continuous flow water heater ranges from 1.5 years to 3.2 years.
4. For Housing Development Board (HDB) developments, the estimated capital costs are in the range from \$750 to \$1,100 for 3-room to 5-room apartments respectively when residents opt for the gas continuous flow heaters. Generally, the payback period is in the range of 0.75 to about 2 years.

## Construction Productivity and Capability Fund

With the emphasis on the need to boost Singapore's productivity level, the Government on 1 June 2010 launched a \$250 million Construction Productivity and Capability Fund (CPCF). The objective is to steer the construction industry towards higher productivity and build capability.

CPCF will also complement other regulatory changes such as the foreign workers' levy framework, the gradual reduction of the Man-Year Entitlements (MYEs) quota and the enhancement of BCA's buildability framework.

The CPCF focuses on the following three broad aspects:



Source: Building and Construction Authority

To further support productivity efforts and extend more help to contractors and consultants (especially for smaller firms) to kick-start their productivity journey, with effect from 1 April 2013, the CPCF has been further enhanced as follows:

### CURRENT CONSTRUCTION REGULATIONS

#### **Mechanisation Credit (MechC) Scheme**

- The MechC Scheme under the CPCF provides funding to contractors to reduce cost incurred in technology adoption, such as purchase and leasing of equipment to improve work processes.
- With effect from 1 April 2013, the funding level has been increased from 50% to 70% for construction firms on the condition that the firm must achieve at least 30% productivity improvement.
- This enhancement aims to benefit smaller contractors as they can now receive higher funding for purchase and leasing of smaller equipment.
- From 1 June 2015, each firm has a new funding cap of \$250,000, of which \$200,000 is for the purchase of equipment and \$50,000 is for the leasing of equipment.

#### **MechC Referral Programme**

- With effect from 1 April 2013, BCA has launched the MechC Referral Scheme to incentivise main contractors who have successfully tapped on the MechC Scheme to share with their smaller sub-contractors the benefits of the scheme and the need to improve productivity.
- Currently, the MechC Scheme has a funding cap of \$250,000 per firm. Under this MechC Referral Programme, the contractor can earn an additional \$20,000 as an incentive for every successful referral.
- Through sharing and partnering between main contractors and sub-contractors, this scheme will help the entire construction value chain to achieve higher productivity.

#### **Productivity Innovation Projects (PIP)**

- The PIP Scheme under the CPCF primarily aims at encouraging contractors and prefabricators to embark on development projects that build up their capability and improve their site processes for achieving higher site productivity.

- With effect from 1 April 2013, the funding level for PIP has been increased from 50% to 70% on the condition that the firm must demonstrate capability development and achieve at least 30% productivity improvement.
- This scheme helps contractors to re-engineer site processes or adopt more labour-efficient construction methods and technologies to reduce the reliance on workers on site and improve on construction productivity.
- On 14 October 2014, the Government announced that they will be giving grants of up to \$5 million per application of the PIP scheme to private sector developments for the adoption of game changing technologies (e.g. Prefabricated Prefinished Volumetric Construction (PPVC), Cross Laminated Timber (CLT) and Glued Laminated Timber (Glulam).
- With effect from 1 June 2015, the funding limit of PIP Scheme has been raised from \$5 million to \$10 million.

During the Budget 2014 Speech, the Government announced to top up an additional \$30 million to the CPCF in order to benefit more companies before it ends in May 2015.

On 14 October 2014, the Government further announced to inject an additional \$55 million to bring the total CPCF to \$335 million. This initiative will support more firms in technology adoption, workforce development and also to build a strong lead demand by having 40 to 50 projects to adopt game changing technologies such as PPVC, CLT and Glulam in the next 5 years.

As part of the initiatives under the 2<sup>nd</sup> Construction Productivity Roadmap, on 10 March 2015, the Government has announced that a fresh funding of \$450 million has been set aside for the 2<sup>nd</sup> tranche of CPCF. With effect from 1 June 2015, this additional funding is expected to help push for higher productivity gains in the industry over the next 3 years to benefit about 7,000 firms in the built-environment sector.

More information on the CPCF can be found in BCA's website. (<http://www.bca.gov.sg/CPCF/cpcf.html>)

## CURRENT CONSTRUCTION REGULATIONS

### Increase in Foreign Worker Levies

As part of the Government's strategy to achieve productivity-led growth, the Government announced on 8 March 2010 on the increase of the monthly levy for foreign workers in phases over 3 years starting from July 2010 to July 2012.

Subsequently in 2011, 2013 and 2014, the Government also made several announcements to further increase the foreign worker levies (FWL) to enhance productivity and competency of the construction workforce and reducing reliance on low-skilled foreign workers.

In the Budget 2015 Speech, the Government announced further changes to the FWL to incentivise the upgrading of existing Basic Skilled or R2 WPH and hiring of Higher Skilled or R1 WPH.

The table below illustrates an overview on the changes of FWL for WPHs in the construction sector from July 2014 to July 2018:

CONSTRUCTION SECTOR		1 JUL 2014 \$/MONTH	1 JUL 2015 \$/MONTH	1 JUL 2016 \$/MONTH	1 JUL 2017 \$/MONTH	1 JUL 2018 \$/MONTH
Basic Tier <sup>[1]</sup>	Higher Skilled <sup>[3a]</sup> (Skilled Workers)	300	300	300	300	300
	Basic Skilled <sup>[3b]</sup> (Unskilled Workers)	550	550	650	700	700
MYE-Waiver <sup>[2]</sup>	Higher Skilled <sup>[3a]</sup> (Skilled Workers)	700	600	600	600	600
	Basic Skilled <sup>[3b]</sup> (Unskilled Workers)	950	950	950	950	900

Note:

- [1] - Basic Tier refers to work permit holders employed **within** the MYE quota.
- [2] - Non-Traditional Source (NTS) or People's Republic of China (PRC) construction workers who have worked with any employer for a cumulative period of two or more years in the construction industry, may be employed by main contractors without the need for MYE (i.e. **beyond** the MYE quota). However, they will be subject to compliance with the Dependency Ratio Ceiling by paying higher MYE-waiver FWL rates.

- [3a]- From July 2011 onwards, the MYE levy rates for and the construction sector refer to **Higher Skilled**
- [3b] (previously known as Skilled Workers) and **Basic Skills** (previously known as Unskilled Workers). Unskilled construction work permit holders have been phased out.

For more information, please refer to the Ministry of Manpower's website.

### CURRENT CONSTRUCTION REGULATIONS

#### Measures to Reduce Noise

The National Environment Agency (NEA) announced on 9 March 2010 that with effect from 1 September 2010, no construction activities would be allowed from 10pm on the night before a Sunday or a Public Holiday to 10am on the day itself. This prohibition by the NEA applies to construction sites located within 150 metres of residential areas and noise-sensitive developments.

The measures have been implemented in 2 phases:

- Phase 1 has been implemented with effect from 1 September 2010 whereby all new projects have to stop work from 10pm on Saturday to 10am on Sunday. This ban applies to any building project within 150 metres of a residential areas and noise-sensitive developments. It also applies to the eve of Public Holidays and Public Holidays.
- Phase 2 took effect from 1 September 2011 onwards, no construction activities are allowed from 10pm on Saturday or eve of Public Holidays to 7am on the following Monday or day after the Public Holidays.

This change in policy has inevitably create a need for construction companies to reschedule their construction work programme. This has resulted in an increase in the contractor's pricing of the preliminaries cost.

From 1 January 2017, NEA will allow selected construction sites to carry out quieter construction works on selected Sundays and Public Holidays. Contractors must obtain a permit from NEA before carrying out such works, which will be granted only for specific construction phases and on a case-by-case basis, subject to stringent conditions.

## Security of Water Storage Tanks

With effect from 1 July 2011, all Town Councils (TCs), Management Corporation Strata Titles (MCSTs) and Building Owners are required to strengthen the security of water tanks on their premises.

Accordingly, the following measures extracted from the Public Utilities (Water Supply) Regulations must be strictly complied with:

- a) Ensure that authorized persons are restricted to the TCs'/MCSTs'/Building Owners' staff or the managing agent
- b) Ensure that personnel authorized to work at rooftops, pump/tank rooms & enclosures and tanks are properly attired (e.g. identification vests, badges, etc.) for easy identification as authorized personnel to work in these designated areas
- c) Conduct spot checks on works carried out at rooftops, pump/tank rooms & enclosures and tanks, and keep proper records of these checks
- d) Ensure that the room/enclosure housing the water tanks, access to high level tanks on the rooftop and the water tank inspection manhole covers are properly locked with the use of high quality padlocks or locksets (e.g. "Abloy", "Kaba", "Medeco", "Mul-T") to deny unauthorized access at all times. The hinges and latches should be of equally high quality and well secured
- e) Ensure that keys to the access doors and the water tank inspection covers are restricted to only the authorized persons
- f) Ensure that the keys to the locks to access doors and the tank inspection covers shall be of a type that cannot be duplicated. To provide separate keys for tank covers, pump room and roof access. One master key each for:

### CURRENT CONSTRUCTION REGULATIONS

- Access doors of not more than 100 blocks
  - Tanks of no more than 20 blocks
  - Corresponding locks shall be replaced if key is lost
- g) The keys for the locks for the tank inspection covers must be housed in a dedicated keypress separate from the other keys and access to these keypress must be strictly controlled by an authorized person
- h) Upon completion of work at the water storage tanks or at the end of the day, whichever is earlier, the authorized person must return the key to the office
- i) In the case of suspected water contamination, to immediately:
- Notify PUB's 24 hour call centre at 1800-284-6600
  - Isolate the water supply and collect water samples
  - Notify verbally, followed by written notice, all the residents/occupants of the building not to consume or use the water due to possible water contamination
  - Shut off the stopcock at the individual meter position of each unit in the building

TCs/MCSTs/Building Owners are advised to segregate the water storage tank area from other activities and services. PUB will also work with the TCs/MCSTs/ Building Owners on further technological solutions such as the use of alarm system and remote monitoring, etc.

Members of the public are encouraged to report any suspected unauthorized access to the premises where water tanks are located to the respective TCs/MCSTs/ Building Owners immediately.

**Note:**

On 30 June 2011, PUB announced the extension of the implementation date for the bolting of water tank covers and the replacement of locksets to 31 December 2011. Most of the operational measures to tighten water security, however, have been implemented.

Source: Public Utilities Board (PUB)

### CURRENT CONSTRUCTION REGULATIONS

#### Implementation of Structural Eurocodes in Singapore

BCA has announced to the construction industry in October 2006 their decision to align with the practice in United Kingdom (UK) in adopting Eurocodes as the structural design standards and together with SPRING formed various technical committees to review the corresponding UK National Annexes of the Eurocodes for adoption as our local standards.

In BCA's circular dated 26 September 2011, it further informed that almost all of the documents for the design of concrete and steel structures have been published as Singapore Standards (SS EN).

The Structural Eurocodes has been implemented since 1 April 2013. There was a 2-year co-existence period when the Singapore Standards/British Standards (SS/BS) and the SS EN are accepted for structural plan submissions. However, mixing the use of SS EN with SS/BS for the same building is not allowed. The same standard shall be used throughout the building design.

As the co-existence period has ended on 1 April 2015, the SS EN/BS EN will be the only prescribed structural design standards to be adopted for plans submissions after 1 April 2015. As such, the SS/BS has been withdrawn from the Approved Document.

In order to meet the market demand, the BCA Academy (BCAA) will continue to offer training courses on Structural Eurocodes. Besides BCAA, professional institutions and local universities are also organising similar courses on the use of the Structural Eurocodes. Details of the various courses and workshops organised by BCAA can be obtained at the following websites:

- [www.bcaa.edu.sg](http://www.bcaa.edu.sg) (and doing a search under "Eurocodes")
- [https://www.bca.gov.sg/academy/courses\\_tests.aspx?txtCourseTestCode=eurocode](https://www.bca.gov.sg/academy/courses_tests.aspx?txtCourseTestCode=eurocode)

Source: Building and Construction Authority

## Installation of Deflector Devices on Escalator Skirting to Prevent Escalator Accidents

Due to the increasing number of injuries to children's toes associated with being too close to the side of escalators, BCA has amended the CP15:2004 (Code of Practice for Installation, Operation and Maintenance of Escalators and Passengers Conveyors) in February 2008 to improve the safety of escalators.

Under clause 5.1.5.6.3, suitable deflector devices such as double lined brushes (also known as safety brushes) shall be permanently installed on the escalator skirting to prevent accidents from happening due to the gap between the skirting and moving steps. The double lined brushes also acts as a reminder for passengers to keep away from the escalator skirting.

The new regulation is not mandatory to older buildings. However, escalator suppliers have been encouraging building owners to install the deflector devices during maintenance for safety reasons. BCA have also issued a circular in March 2011 to advise building owners on the installation of the deflector devices on their escalator skirtings to prevent escalator accidents.

The pictures below shows the absence of the double lined brushes on the escalator skirting (left), installation of the double lined brushes on the escalator skirtings (centre) and close-up of the double lined brushes (right).



Source: Building and Construction Authority

### CURRENT CONSTRUCTION REGULATIONS

#### Standard Tender Schedules for Mechanical and Electrical Works

In 2011, BCA has launched the standard tender schedules for Mechanical and Electrical (M&E) works. It provides a uniform basis for measuring and pricing of M&E work items, and also entails better definition to the scope of M&E works. The aim is to enable the construction industry to build up reliable M&E cost data for expediting the subsequent establishment of a M&E Tender Price Index (TPI).

#### Long-term Benefits of Using the Standard M&E Tender Schedules

1. For contractors, the use of the standard tender schedules will reduce time and effort in tender submissions as it removes the need to price on different templates provided by different consultants as well as minimises cost and manpower to maintain an up-to-date Schedule of Rates.
2. For consultants, standardising measurement and pricing of M&E will facilitate future tender evaluation.
3. Overall, the standard tender schedules will facilitate data retrieval and improve work efficiency for the construction industry.

#### Scope of Standard M&E Tender Schedules

1. The standard M&E tender schedules currently cover 4 major M&E services: Air-Conditioning & Mechanical Ventilation, Electrical, Plumbing & Sanitary and Fire Protection. The standard tender schedules comprise the following:
  - Lump Sum Tender Price Breakdown
  - Approximate Bills of Quantities
2. Generally, major M&E components and cost significant items have been considered and included in the standard tender schedules.

## Guidance Notes

### 1. For M&E Consultants:

- The M&E standard tender schedules can be used as a master template to prepare the tender schedules for tendering purposes.
- Based on the individual project's specifications, M&E consultants may remove items that are not used in the project from the standard tender schedules. For items not found within the standard tender schedules, they may be added to the tender schedules as new items.
- M&E consultants are encouraged to retain the original descriptions of all work items and scope of works defined in the standard tender schedules for the purpose of maintaining a uniform basis for measuring and pricing M&E works.

### 2. For M&E Specialist Contractors and Sub-contractors:

- Quantities in the Approximate Bills of Quantities are not binding contractually except for the unit rates.

Reference: [http://www.bca.gov.sg/tenderschedules/m\\_e\\_tender\\_schedules.html](http://www.bca.gov.sg/tenderschedules/m_e_tender_schedules.html)

### CURRENT CONSTRUCTION REGULATIONS

#### Air Fabric Ducting

Air fabric ducting is an alternative to traditional metal ducting and diffusers. Due to advances in technology, instead of transporting air through steel ductwork, duct made of permeable fabric can also be used. The heat load calculations and equipment sizing for the air fabric ducting remained the same as traditional metal duct system.

#### Fabric Ductwork versus Metal Ductwork

Traditional metal duct system discharges air through side mounted metal diffusers usually spaced 3m to 4.5m apart. The air is directed to specific zones resulting in less efficient mixing of air in the occupied space, and often drafting hot or cold spots. With fabric ductwork, air is discharged more uniformly along the entire length, and provides consistent and uniform air dispersion in the occupied space, with better air mixing and indoor air quality.

#### Why Fabric Ductwork?

Fabric ductwork systems have many advantages, and can be helpful in attaining BCA Green Mark and LEED credits.

- 1. Simplified Design/Uniform Air Dispersion:** The entire system is a diffuser; air can be supplied to the occupied space in a more efficient pattern.
- 2. Cost Savings:** The cost of a fabric ductwork is 20% to 30% lesser as compared to traditional metal ductwork.
- 3. Lightweight/Easy to Transport:** The weight of a fabric ductwork system can be significantly less than a comparable metal ductwork system. It also means lighter roof loads, ease of handling, and reduced need for power lifting equipment. Smaller and lighter packages reduce transportation costs and damage.

4. **Quiet:** With a properly designed fabric air ducting system, air is delivered quietly, and without moving parts and is diffused at a lower velocity. In addition, fabrics provide noise absorption benefits in the occupied space.
5. **Air Porous:** Air passing through the fabric may eliminate condensation and deflect airborne dust from accumulating on the surfaces.
6. **Easy to Maintain/Clean:** Cleaning metal ductwork can be expensive. The fabric ducting can be easily removed, washed and reinstalled when cleaning and maintenance is necessary. This would be useful in places such as food preparation and storage facilities.
7. **Green:** As compared to metal duct/diffuser, fabric duct cools the occupied space faster and more uniformly to satisfy temperature set points, which results in reduced mechanical equipment runtime, thus saving energy in the process. The fabric duct is made from textile with no harmful substances which is environmentally friendly.



### CURRENT CONSTRUCTION REGULATIONS

#### Maximum Allowable Number of Dwelling Units for Non-Landed Residential Developments

In September 2012, URA has acted to manage the proportion of shoebox units in the following suburban areas:

- Outside Central Area
- Within Kovan and Joo Chiat / Jalan Eunus Gross Plot Ratio (GPR) 1.4 Estates

The guidelines which aimed at curbing the number of shoebox units took effect from 4 November 2012.

#### Outside Central Area

The maximum number of Dwelling Units (DUs) for all new flat<sup>1</sup> and condominium<sup>2</sup> developments outside the Central Area (CA) will be based on the following formula:

$$\begin{array}{l} \text{Maximum} \\ \text{number of DUs} \\ \text{per} \\ \text{development} \end{array} \leq \frac{\text{Master Plan Allowable} \\ \text{GPR}^3 \times \text{Site Area}}{70 \text{ sqm}}$$

The DU cap will also apply to the residential component of mixed-use developments. With this guideline, developers will be encouraged to provide a range of unit sizes so that the supply of housing units can cater to the diverse needs of all segments of the market. Also, it will help to safeguard liveability of our residential estates by ensuring that the cumulative number of DUs proposed in new flat and condominium developments in an area over time does not overly strain the infrastructural capacity of the estates.

## Within Kovan and Joo Chiat / Jalan Eunos GPR 1.4 Estates

The maximum number of DUs for all new flat<sup>1</sup> and condominium<sup>2</sup> developments within Kovan and Joo Chiat / Jalan Eunos GPR 1.4 Estates will be based on the following formula:

$$\begin{array}{l}
 \text{Maximum} \\
 \text{number of DUs} \\
 \text{per} \\
 \text{development}
 \end{array}
 \leq
 \frac{\text{Master Plan Allowable} \\
 \text{GPR}^3 \times \text{Site Area}}{100 \text{ sqm}}$$

The DU cap will also apply to the residential component of mixed-use developments within these estates. The revised guideline will ensure that the extent of redevelopment will be in tandem with the provision of local infrastructure within these estates.

<sup>1</sup>Not applicable to Housing & Development Board (HDB) flats

<sup>2</sup>Including Executive Condominium

<sup>3</sup>Excludes bonus Gross Floor Area (GFA)

### CURRENT CONSTRUCTION REGULATIONS

#### **Discontinuing the Use of Pilot Operated Ball Float Valves for Potable Water Storage Tanks**

The Public Utilities (Water Supply) Regulations and Singapore Standard CP 48: Code of Practice for Water Services has mandated that every storage tank shall be watertight and secured against unauthorised access, contamination and pollution of potable water contained therein.

It is noted that the current configuration of pilot float-operated valves for potable water storage tanks is found to be susceptible to security breach and ingress of undesirable elements such rainwater, animals, insects, foreign material, etc.

Potable water storage tanks fitted with pilot float-operated valves have a small opening (25mm - 50mm diameter) to accommodate the rod connecting the float inside the tanks and the control mechanism above the tanks. This however, has caused the opening to be either unsealed or unable to be securely sealed to prevent breach and ingress of undesirable elements.

In view of the above, such openings in potable water tanks are no longer allowed according to the Public Utilities (Water Supply) Regulations and Singapore Standard CP 48: Code of Practice for Water Services.

With effect from 18 April 2012, Professional Engineers and Licensed Water Service Plumbers shall ensure that such pilot-operated valves (with opening at the top or side of the tank) are not installed for new and existing potable water storage tanks.

Source: Public Utilities Board

## **Use of Smoke Detectors or Manual Call Point for Activation of Mechanical Ventilation System in Car Parks**

The Singapore Civil Defence Force (SCDF) has released a circular on the use of smoke detectors or manual call point for activation of mechanical system in car parks on 10 August 2012.

The current design of the ductless jet fan system is based on the following requirements issued in a circular dated 25 November 2008:

- a) The jet fans system is activated by the sprinkler system in the car park level and other areas located within the same level or by the activation of the manual call point.
- b) As the car park space is divided into virtual smoke control zones, the activation of the jet fans system is confined to the smoke control zone on fire and all its adjacent zones. For this purpose, the sprinkler control zone is designed to correspond with that of smoke control zone.

As an alternative method, SCDF has no objection to the use of smoke detectors to activate the jet fans system, provided that the following requirements are met:

- a) The detectors are positioned at the effective mid-range of the jet fan profile
- b) In-duct smoke detector is located at the start point of the exhaust duct
- c) Jet fans system is only operated upon activation of 2 smoke detectors. This is to minimize any false alarm.

SCDF has also reviewed the requirement for jet fans system to be activated for an entire car park development by manual call points. It will not be imposed as a mandatory requirement as this design may not be practical for a very large car park. However, the jet fans system shall remain operable at the Fire Command Centre (FCC) via an override switch as stipulated in

### CURRENT CONSTRUCTION REGULATIONS

Clause 3.3.1 of the FSR 3: 2008 guidelines i.e. “A fireman cut off and activation (override) switch shall be provided at the Fire Command Centre.”

Source: Singapore Civil Defence Force

## Off-Road Diesel Engine Emissions

NEA has implemented a new regulation to control the air emissions generated by off-road diesel engines.

With effect from 1 July 2012, all off-road diesel engines imported for use in Singapore must comply with ISO 8178 test procedure to meet emission standards of EU Stage II, US Tier II or Japan Tier I. Off-road diesel engines are any equipment or machinery that is equipped with diesel engines as the main or auxiliary primer mover and not registered with the Land Transport Authority (LTA) for use on public roads. The examples of off-road diesel engines are cranes, excavators, forklifts and power generators. However, diesel engines used in ships, railways, locomotives and aircraft do not fall under this regulation.

In addition, it does not apply to the following off-road diesel engines:

- (a) Owned by the Government for the use of the Singapore Armed Forces, the Singapore Police Force or the Singapore Civil Defence; or
- (b) Used by or for the purpose of any visiting force lawfully present in Singapore.

All newly-imported off-road diesel engines, either new or used, intended for use in Singapore must comply with the stipulated emission standards. This regulation includes engine power above 560kW. The engines or off-road diesel equipment can be sent to an overseas or Singapore accredited laboratory for an emission test according to the ISO 8178 standards.

For new off-road diesel engines, NEA accepts common emissions test reports for each make and model. Prior to the approval of an import off-road diesel engine, a test report from the manufacturer of the off-road diesel engine must be submitted to NEA for evaluation to ensure conformity of the stipulated emission standards.

For used off-road diesel engines, NEA requires emissions test to be conducted on each and every unit before it can be allowed for use in Singapore.

For more information, please refer to NEA's website.

### CURRENT CONSTRUCTION REGULATIONS

#### Implementation of New Singapore Standards

SCDF has issued two circulars on 25 January 2013 regarding the implementation of two new standards:

**SS 575 : 2012** - Code of Practice for fire hydrant, rising mains and hosereel systems (Formerly CP 29)

**SS 578 : 2012** - Code of Practice for use and maintenance of portable fire extinguishers (Formerly CP 55)

SS 575 : 2012, formerly known as CP 29, specifies the design, installation, testing and upkeep of fire hydrant, wet and dry rising mains and hosereel systems while SS 578 : 2012, formerly known as CP 55, specifies the design, installation, inspection and maintenance of portable fire extinguishers within building premises.

The above new standards were officially launched by SPRING Singapore<sup>1</sup> on 2 November 2012 for all building plan approvals that are submitted to SCDF with effect from 1 May 2013.

For more information regarding the above standards, please refer to SCDF's circulars published on CORENET's (CONstruction and Real Estate NETwork) website at <http://www.corenet.gov.sg/einfo/>

In addition to the above, SPRING Singapore has also launched:

**SS 576 : 2012** - Code of Practice for earthworks in the vicinity of electricity cables; and

**SS EN 3 - 7 : 2012** - Portable fire extinguishers - Characteristics, performance requirements and test methods

For more information about Singapore Standards, please refer to SPRING Singapore's website at <http://www.spring.gov.sg/Building-Trust/Std/Pages/Standards-overview.aspx>

<sup>1</sup> SPRING Singapore, an acronym for Standards, Productivity, and Innovation for Growth (Singapore) is an agency under the Ministry of Trade and Industry of Singapore (MTI).

## **Regulatory Requirements and Implementation Timeline of Prescribed Green Mark Standard for Existing Buildings and Periodic Energy Audit of Building Cooling System**

BCA has implemented new Code on Environmental Sustainability Measures for Existing Buildings (1<sup>st</sup> Edition) and Periodic Energy Audit of Building Cooling System on 1 July 2013.

### Code on Environmental Sustainability Measures (Prescribed Green Mark Standard) For Existing Buildings

Under Part IIIB of the Building Control Act 2012 and Building Control Regulations 2013, building owners are required to submit to BCA a design for Green Mark Score for the building before installation or replacement of chillers. Also, an as-built Green Mark Score for the building is required to be submitted after the installation of chillers as they are required to meet the minimum environmental sustainability standard as and when they install or replace their water-cooled / air-cooled chiller(s) to another water-cooled / air-cooled chiller(s) or to unitary system(s) for their existing buildings.

In addition, building owners are required to engage a Professional Engineer registered with the Professional Engineers Board in the branch of mechanical engineering to ensure that the overall building design achieves the BCA Green Mark Standard for existing buildings at the Certified level. The chiller upgrading and other energy improvement works must be completed within 3 years from the date BCA approved the designs of the retrofits.

The above requirements will be applicable to any hotel, retail building or office building with a gross floor area (GFA) of at least 15,000m<sup>2</sup>. This will also be applicable to any mixed-use development that consists of hotel, retail or office building with a combination GFA of at least 15,000m<sup>2</sup>.

The regulatory requirement came into effect on 2 January 2014 and approval must first be obtained from

### CURRENT CONSTRUCTION REGULATIONS

BCA (for buildings that fall within the specified category) before building owners install or replace any of their existing chiller(s).

#### Code on Periodic Energy Audit of Building Cooling System

With effect from 1 January 2014, building owners will need to engage a Mechanical Engineer (PE(Mech)) or an Energy Auditor registered with BCA to carry out an energy audit on the building cooling system in accordance with the Code on Periodic Energy Audit of Building Cooling System before making the necessary documentary submission to the Commissioner of Building Control.

This requirement is applicable to new buildings whose application for planning permission is submitted on or after 1 December 2010. Building owners may be issued a Notice under Part IIIB of the Building Control Act 2012 to carry out the energy audit at any time after obtaining the Temporary Occupation Permit (TOP) or Certificate of Statutory of Completion (CSC); and at intervals of not less than 3 years after the date of the last notice served.

This requirement is also applicable to existing buildings which have undergone a major energy-use change on and after 2 January 2014 and are required to meet the prescribed Green Mark standard for existing buildings. Building owners may be issued a Notice to carry out the energy audit 3 years after the date of the approved as-built score; and at intervals of not less than 3 years after the date of the last notice served.

For more information, please refer to BCA's website. (<http://www.bca.gov.sg/>)

## **Green and Gracious Builder Scheme (GGBS)**

The Green and Gracious Builder Scheme (GGBS) was introduced by BCA in February 2009 to raise the environmental consciousness and professionalism of builders.

A Green and Gracious Builder Guide has also been published by BCA to guide both the certified builders and those aspiring to be certified to adopt gracious construction practice.

With reference made to the Specific Registration Requirements for Construction Workhead (CW) published by BCA in November 2013; there are two stages of change to be carried out to encourage builders to be certified under GGBS.

With effect from 1 January 2015, all contractors registered under CW01 (General Building) and CW02 (Civil Engineering) with Grade A1 and A2 must be certified under GGBS. On the other hand, those with Grade B1 and B2 must be certified under GGBS by 1 January 2016.

Construction firms must be certified under the GGBS in order to be registered under BCA.

As at 1 December 2015, a total of 262 construction firms have been certified under the scheme to promote environmental protection and mitigate inconveniences to the public caused by construction works.

BCA has launched the 3<sup>rd</sup> Green Building Masterplan on 1 September 2014 to guide Singapore's green building journey over the next five to ten years. Please refer to page 187 for details.

For more information, please refer to BCA's website. (<http://www.bca.gov.sg/>)

### CURRENT CONSTRUCTION REGULATIONS

#### Installation of Vertical Platform Lifts and Stairlifts

On 18 February 2014, BCA issued a circular to inform the industry that all previous type of approvals granted by the Commissioner of Building Control for the installation of vertical platform lifts and stairlifts will be invalid with effect from 1 July 2014 as these approvals have lapsed. From 1 July 2014, any installation of vertical platform lifts and stairlifts which are primarily designed for persons with impaired mobility will require a separate approval of plans from the Commissioner of Building Control. This, however, will not affect existing vertical platform lifts and stairlifts which were previously installed and are currently in operation unless it is undergoing major alterations or replacement works.

The design, installation and operation of the vertical platform lifts and stairlifts which are primarily designed for persons with impaired mobility shall comply with the European Standards EN 81-41:2010 and EN 81-40:2008 or American National Standard ASME 18.1-2011 or other relevant standards which are acceptable to the Commissioner of Building Control. The same shall apply to existing vertical platform lifts and stairlifts that undergo major alterations or replacement works.

The installation and commissioning of vertical platform lifts and stairlifts shall be supervised by an appropriate professional engineer and on completion, the professional engineer shall submit to the Commissioner of Building Control his certificate of supervision as required under the Building Control Regulations.

For more information, please refer to BCA's website. (<http://www.bca.gov.sg/>)

### 3<sup>rd</sup> Green Building Masterplan

On 1 September 2014, BCA has launched the 3<sup>rd</sup> Green Building Masterplan. The 3 key initiatives of the Masterplan include:

- To introduce a further \$50 million Green Mark Incentive Scheme for Existing Buildings and Premises (GMIS-EBP) to encourage small and medium enterprise (SME) building owners, occupants and tenants, or building owners with at least 30% of its tenants who are SMEs to undertake and adopt energy efficiency improvements and measures within their buildings and premises. The scheme will co-fund up to half of the retrofitting cost for energy improvements subject to a maximum of \$3 million for building owners and \$20,000 for occupants and tenants. The scheme is valid for a period of 5 years from 2014 to 2018.
- To set up a \$52 million fund for Green Building Innovation Cluster (GBIC) to stimulate the development and testing of new green building solutions specially tailored to the tropics and sub-tropics. This will aid both local as well as regional experts and the industry to share knowledge and work together on solutions to improve energy efficiency. Subsequently, this will enable the solutions to be adopted easily and quickly when the building owners build or retrofit existing buildings.
- To introduce the new BCA Green Mark Pearl Award and BCA Green Mark Pearl Prestige Award. The new award will be given to developers, building owners and landlords who have a substantial number of tenants who are Green Mark certified under the Green Mark occupant-centric scheme which is Green Mark Gold<sup>PLUS</sup> or higher. The objective is to encourage developers, building owners and landlords together with their tenants to work together in greening their buildings / premises and adding value to their businesses. Through this award, the green tenanted GFA is expected to increase to at least 50% to 70% for each building that receives this award.

### CURRENT CONSTRUCTION REGULATIONS

The new Masterplan will require the public sector to serve as exemplary adopters of green building practices. It is mandatory for all existing public sector buildings with an area of 5,000 square metres to achieve Green Mark certification, and all office spaces to be leased from buildings with Green Mark ratings. Government events and functions will also have to be held in Green mark certified venues.

The initiatives under the Masterplan would induce green growth, attract investors and profile Singapore's services and expertise on green building solutions for the tropics on an international stage.

For more information, please refer to BCA's website. ([http://www.bca.gov.sg/GreenMark/others/3rd\\_Green\\_Building\\_Masterplan.pdf](http://www.bca.gov.sg/GreenMark/others/3rd_Green_Building_Masterplan.pdf))

## **Requirements for Installation of Private Water Meters for New Developments**

With effect from 1 January 2015, all new non-domestic developments with estimated average monthly total water consumption of at least 5,000m<sup>3</sup> are required to install private water meters to measure and monitor the amount of water used at various water usage areas within the development to justify the breakdown of water usage. This requirement is part of the mandatory submission of the Water Efficiency Management Plan (WEMP) introduced by Public Utilities Board (PUB).

All Professional Engineers and Licensed Water Service Plumbers are to take note that private water meters are required to be installed for the following:

- All new non-domestic developments (with exception of developments with temporary water supply) with estimated monthly water consumption of 3,000m<sup>3</sup> or more.
- All new developments with temporary water supply with estimated monthly water consumption of 5,000m<sup>3</sup> or more.

Professional Engineers and Licensed Water Service Plumbers are required to declare that the above requirements have been complied with and locations of the private water meters shall be indicated in the water schematic drawings to be submitted with the Notification of Water Service Work Forms.

For more information, please refer to PUB's website. (<http://www.pub.gov.sg>)

### CURRENT CONSTRUCTION REGULATIONS

#### Singapore Fire Safety Engineering Guidelines 2015

Prior to the launch of the Singapore Fire Safety Engineering Guidelines (SFEG), Fire Safety Engineers (FSEs) had to refer to several reference documents when embarking on Performance-Based (PB) fire safety engineering designs. Some of these reference documents include the Society of Fire Protection Engineers (SFPE) Engineering Guide to Performance-Based Fire Protection, BS7974: Application of Fire Safety Engineering Principles to the Design of Buildings, ISO 13387: Application of the Fire Performance Concepts to Design Objectives and the International Fire Engineering Guidelines. However, these reference documents generally serve only as a guide. Hence, FSEs would still need to consult the Singapore Civil Defence Force (SCDF) frequently on design details that are specific to the respective project.

To better facilitate the work of the FSEs, on 1 April 2015, SCDF launched the SFEG, jointly developed with the Institution of Engineers (IES), Association of Consulting Engineers (ACES), Institution of Fire Engineers (IFE), SFPE and FSEs.

The SFEG comprises 2 main components, namely:

- **Part 1:** PB regulatory framework, fire engineering design concepts, submission documentation requirements and the roles and responsibilities of the FSEs.
- **Part 2:** Common alternative solutions from prescribed requirements and the general design approaches to address them.

The guidelines can be downloaded from the following link: [http://www.scdf.gov.sg/content/scdf\\_internet/en/building-professionals/publications\\_and\\_circulars.html](http://www.scdf.gov.sg/content/scdf_internet/en/building-professionals/publications_and_circulars.html)

FSEs may reference the SFEG in their PB submissions to SCDF.

For more information, please refer to SCDF's website. (<http://www.scdf.gov.sg>)

## **Amendment to the Fire Code 2013 – Appendix (20) Fire Safety Requirements for Persons with Disabilities (PWDs) FSR 7:2011**

On 2 July 2015, the Singapore Civil Defence Force (SCDF) issued a circular to inform the industry regarding the amendment to the fire safety requirements for Persons with Disabilities (PWDs) due to feedback received from Qualified Persons (QPs) on the difficulty in incorporating the requirements for PWDs in buildings when addition and alteration (A&A) works are carried out only to tenancy spaces and not the common areas (e.g. common corridor, smoke-stop lobby, fire-fighting lobby or exit staircase, etc.).

The extent of PWDs requirements that are applicable to the following types of A&A works after consultation with professional institutions namely SIA, IES, ACES, IFE, SISV and REDAS shall be as follows:

- (i) Where the A&A works affect the common corridor that is under the jurisdiction of MCST or passageway/corridor created under a single ownership in a non-strata title building, the provision of visual alarm system shall be incorporated to the affected floor(s). Other PWDs requirements such as PWDs Holding Point, PWDs Evacuation lift, Distress/Communication means, etc. need not be incorporated.
- (ii) Where A&A works affect smoke-stop lobby, fire-fighting lobby or exit staircase, the provision of visual alarm system, PWDs Holding Point and Distress/Communication means shall be incorporated to the affected floor(s).
- (iii) Where new lifts are installed, all the PWDs requirements i.e. stipulated in Appendix (20) shall be incorporated to all the floor(s) served by the new lifts.

### CURRENT CONSTRUCTION REGULATIONS

SCDF had also reviewed the type of buildings that are currently exempted from PWDs requirements which include:

- (i) Purpose Groups I and II buildings (residential) and health care occupancies as defined in the Fire Code.
- (ii) Industrial buildings that are exempted from barrier-free accessibility compliance under the Building and Construction Authority's (BCA) Code on Accessibility in the Built Environment. In SCDF's context, industrial buildings would therefore include Purpose Group VI (Factory) and Purpose Group VIII (Storage) as defined in the Fire Code.

It shall be noted that the provision of visual alarm system shall still be applicable to the industrial buildings and health care occupancies even though these buildings are exempted from PWDs requirements. The visual alarm system complements the audible fire alarm system to cater to able-bodied occupants who are hearing impaired. Visual alarm system is not applicable to Purpose Groups I & II buildings (residential) that are also exempted from PWDs requirements.

This amendment took effect from 2 July 2015 onwards. For more information, please refer to SCDF's website. (<http://www.scdf.gov.sg>)

## Environmental Health Measures for Swimming Pools and Cooling Towers

On 25 January 2016, the National Environment Agency (NEA) issued a circular to provide details on certain environmental health measures that shall be complied by the Qualified Persons (QPs) in the submission of Building Plan on Environmental Health to the Central Building Plan Department (CBPD) of NEA for their proposed development that involves the installation of swimming pool(s) and cooling tower(s) as part of the building plan clearance process.

- 1) Besides complying with the Code of Practice on Environmental Health (COPEH), Section 7, which stipulates the design criteria for swimming pool systems, the QPs shall also comply with the additional requirements listed below relating to installation of swimming pools and balancing tanks of swimming pools which address concerns over any possible contamination of water that will affect the water quality in the swimming pool and put the swimmers at risk of contracting diseases.

Below is the additional requirements extracted from the circular:

- a) Any waste, sanitary, sewerage pipes, or such other pipes conveying fluids that may cause contamination to the water in the balancing tanks and swimming pools shall not be located above and/or within the balancing tanks of swimming pools and swimming pools.
- b) For the purpose of maintenance and inspection, easy and safe access shall be provided to the balancing tank.
- c) The openings of the overflow pipes or air vents installed on the balancing tanks, where required, shall be fitted with mosquito proof nettings with aperture size of not more than 0.65mm and the material shall be durable and able to resist corrosion.
- d) The QPs shall declare in their application to CBPD that the additional requirements stipulated above

are met.

- 2) The guidelines for the location of cooling tower are provided under Clause 5 of the Code of Practice for the Control of Legionella Bacteria in Cooling Towers to prevent possibility of people being exposed to aerosols which may lead to incidents of public nuisance and threat to human health. The additional requirements to the guidelines are briefly stated below:
  - a) Cooling tower shall have a minimum 5 metres setback measured from the nearest edge or structure of the cooling towers, including the base/basin/sump, packing, exhaust, and outlet point of the exhaust hood, if there are any being installed.
  - b) To provide more than the minimum 5 metres setback if necessary, whereby the cooling towers are operating in a nearby property or in areas where there are plans to build healthcare facilities or fresh air intakes to avoid possible future problems with the cooling tower operations. A review of the proposed site should be carried out to ensure a minimum distance of 5 metres setback to cooling towers is achieved.

For more information, please refer to NEA's website at <http://www.nea.gov.sg>.

## **Fire Safety Requirements for Solar Photo-voltaic (PV) Installations on Roof**

On 31 December 2015, the Singapore Civil Defence Force (SCDF) issued the Fire Safety Requirements (FSR) for solar photo-voltaic (PV) installations on roof (FSR 13: 2015). The said FSR shall be read in conjunction with the Code of Practice for Fire Precautions in Buildings, namely the Fire Code. If there are any similar requirements in the prevailing Fire Code, the FSR for solar PV installations on roof shall take precedence.

The following requirements listed in the said FSR must be considered prior solar PV installations on roof.

- Means of Access
- Fire Resistance of PV Modules
- Design and Installation Criteria
- Emergency Disconnection
- Submission of Fire Safety Plan

The FSR for solar PV installations on roof shall take effect from 1 July 2016.

For more information, please refer to SCDF's website at <http://www.scdf.gov.sg>.

### **New Measures to Tighten Lift Maintenance and Enhance Lift Safety**

The Building and Construction Authority (BCA) issued a media release on 16 June 2016 to introduce a series of new measures to enhance lift reliability and safety. The new measures include a tighter maintenance regime with stricter enforcement by BCA accompanied with a more robust Permit-to-Operate (PTO) system took effect on July 2016.

The new requirement of tighter maintenance regime that has been imposed on top of the current regulatory regime shall be outcome-based and audit checks on lifts will be carried out by BCA to ensure that lift contractors achieve the maintenance outcomes. For any non-compliance detected, penalties will be imposed on the lift contractor(s).

The new PTO system will replace the current scheme which requires all lift owners to engage an Authorised Examiner (AE) to conduct a full commissioning inspection and tests that complies with the Singapore Standard 550 (SS 550). In addition to the current checks and certifications done by AEs, the new PTO system requires every lift to have a permit issued by BCA before it can be operated. The permit has to be renewed annually, with certification done by an independent AE.

For more information, please refer to BCA's website at <http://www.bca.gov.sg>.

## **Amendments to the Fire Code 2013 – Fire Safety Requirements for Coldroom**

The Singapore Civil Defence Force (SCDF) issued a circular on 8 September 2016 with regard to the amendments to the Fire Code 2013 – Fire Safety Requirements For Coldroom.

The amendments are to address concerns from the Singapore Manufacturing Federation (SMF) of meeting both Agri-Food & Veterinary Authority of Singapore (AVA)'s food safety requirements and SCDF's fire safety requirements for coldroom with compartment walls protection. Due to the dampness caused by condensation of ambient air on the cold surfaces, the gaps formed between the compartment walls and coldroom panels tend to attract mould formation. These gaps are also ideal for insects and rodents to hide and these outcomes are infringing AVA's food safety requirements for food storing and handling.

A work group led by SCDF comprises representatives from SMF, SIA, IES, ACES, IFE, JTC, SCDF and reputable professionals was formed to review the relevant clauses in the Fire Code 2013. The proposed amendments to the Fire Code put forth by the work group were endorsed by the Fire Code Review Committee and SCDF management.

For more details, please refer to <https://www.corenet.gov.sg/> for the amendments to the Fire Code 2013.

### **Advisory Note on Best Practices for Installing Solar Panels on Building Rooftops**

The Building and Construction Authority (BCA), Energy Market Authority (EMA) and Urban Redevelopment Authority (URA) had jointly issued a circular on 24 January 2017 to advise the building industry on best practices for installing solar panels on building rooftops. The solar panels should be installed in a manner that maximises energy harvest and minimises glare to neighbouring buildings.

A tilt angle of 10 to 15 degrees of the panel to the horizontal plane is recommended as it optimises the performance of solar panels by maximising energy harvesting. Panels installed at less than 10 degrees tilt angle could cause dirt to be accumulated on the panels when the rain trapped by the panel frame evaporates. This will deter the performance of the solar panels. Panels installed beyond 20 degrees tilt angle will reduce the absorption of overhead equatorial sunshine and may cause glare to the neighbouring buildings.

For more information, please refer to the Handbook for Solar Photovoltaic (PV) Systems published by BCA and EMA.

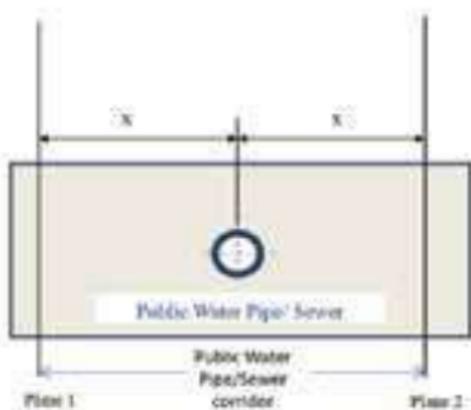
([http://www.bca.gov.sg/publications/others/handbook\\_for\\_solar\\_pv\\_systems.pdf](http://www.bca.gov.sg/publications/others/handbook_for_solar_pv_systems.pdf))

## New Public Utilities Regulations and Sewerage and Drainage Regulations

The Public Utilities Board (PUB) had issued a circular on 31 January 2017 to introduce two new regulations:

- a) The Public Utilities (Protection of Water Pipes Infrastructure) Regulations
- b) The Sewerage and Drainage (Protection of Public Sewerage System) Regulations

With effect from 30 June 2017, it would be mandatory to obtain PUB's approval prior to carrying out any 'specified activities' within the 'specified protection corridors' of the water pipes or public sewers. These new regulations provide clear protection requirements for PUB utilities and streamline the approval process for the construction industry. They clearly defined what constitutes a 'specified activity' and a 'protected' utilities corridor. Any such specified activity within the corridor can only be carried out after a Qualified Person (QP) or registered Professional Engineer (PE) obtains PUB's clearances or inform PUB of the detailed plans in cases where the water pipe is less than 300mm diameter.



Public Water Pipe/Sewer Diameter	Distance X on either side from the centreline
< 900 mm	1.0 metres
> 900 mm	2.0 metres

For more information, please refer to PBU's website. (<https://www.pub.gov.sg/compliance/industry/circulars>)

### **BCA Advisory: Ensure Proper Securing of All Lift Fittings & Fixtures**

The Building and Construction Authority (BCA) has issued an announcement on 16 June 2017 to advise Lift Owners and Lift Service Contractors with regard to proper securing of all lift fittings and fixtures within lift cars to ensure the safety of lift passengers and surrounding persons.

The lift fittings and fixtures shall include, but not limited to, ceiling panels, false ceiling fixtures, ventilation, lightings, emergency manhole covers, handrails, lift enclosure panels, decorative materials (e.g. mirrors, notice boards, etc.), button panels, maintenance switch access panels, kick plates, car and landing sills and indicator panels.

The fittings and fixtures must be properly secured using appropriate mechanical fasteners, such as screws, bolts and rivets. Non-mechanical methods (example: adhesive tapes) are not acceptable. Regular checks and inspections of the lift fittings and fixtures are strongly advised to ensure that they are securely fastened and/or properly installed as the connections fastening may deteriorate due to wear and tear over time. Proper installation will reduce the chances of causing injury to lift passengers and surrounding persons.

BCA will ensure that lifts and escalators are properly maintained for safe operation and use by performing audits and taking appropriate action against Lift Owners and Lift Service Contractors for not meeting relevant duties under the Building Maintenance and Strata Management (Lift, Escalator and Building Maintenance) Regulations 2016.

For more information, please refer to BCA's website. (<http://www.bca.gov.sg/>)







# ARCADIS 5

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About Us In Singapore

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Professional Services

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Arcadis Contract Advisory Services

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Arcadis Singapore

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Arcadis Asia Leadership Team

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Arcadis Asia Sectors

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Arcadis Asia Services

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Directory of Offices

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Acknowledgements

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## MISSION STATEMENT

To create exceptional and sustainable outcomes for our Clients in natural and built asset environments

## OUR PASSION

To Improve the quality of life and be recognized as the best

## OUR CORE VALUES

### Integrity

We perform business in an honest and responsible way, working to the highest professional standards

### Client Focus

We are entrepreneurial and agile, passionate about creating value for our Clients and achieving high performance

### Collaboration

We believe in diversity, the power of global teamwork and that by working as one we can deliver exceptional outcomes

### Sustainability

We own the responsibility to sustain our world and society in a balanced way with health, safety and well-being of our people central to all we do

## QUALITY POLICY STATEMENT

To provide our Clients with a service of excellence – through our expertise and experience

To play a positive and creative role in realising our Clients' needs

To manage and control each and every process with the highest integrity, impartiality and independency

To provide ongoing professional development and coaching to ensure growth and development of our people

## ABOUT US IN SINGAPORE

### ARCADIS CSdR COMMITMENT

In the bid to conserve our diminishing global energy reserves and reduce carbon emissions, Arcadis is committed to the continual research into the impact of the construction industry on our environment.

With this commitment, Arcadis aims to contribute to a more environmental friendly approach to buildings and will continually promote the mindset of more sustainable development to our Clients.

Corporate Sustainable-Developmental Responsibility (CSdR), created by the National University of Singapore and the Climate Change Organization (CCO), represents a streamlined and structured process of helping companies adopt sustainable practices and operation. CSdR is based on six categories indicators: social sustainability, social-environmental sustainability, social-economic sustainability, organizational structure of company, profile of CSdR standards within corporate organizations and implementation of CSdR.

Arcadis is also adopting CSdR to be a responsible employer and create value for our stakeholders, thereby maintaining sustainable business practices, without compromising on social values and environmental protection.

Arcadis continually strives to commit our effort and time towards engaging the under-privileged in our society. Thus, we organize and participate actively in outreach and fund-raising activities for the community as a socially responsible corporate organization.

### BUSINESS EXCELLENCE

In the quest for excellence and continual improvement, Arcadis continues to enhance core aspects of its business and engages all efforts to delight our Clients and business partners. These aspects can be found from the framework of the Business Excellence model, commonly used in Singapore Quality Class (SQC).

The model spells out how and what organizations

need to consider and perform in order to evaluate their performance against the “best-in-class” from various industries. These aspects are categorised under the themes of Leadership, Customer, Strategy, People, Processes, Knowledge and Results within the organization, orchestrated through the Balance Score Card.

These aspects are then verified and assessed by Assessors appointed from varied organizations which have attained Singapore Quality Award/SQC status, to ascertain that the organizations meet the very stringent set of requirements based on the standard of excellence.

Organizations with this distinction are recognised for the successful deployment of their systems and processes in order to excel in its operations.

Arcadis Singapore is proud to be certified the SQC Certification and the People Developer Certification. In 2013, we were accorded the SQC Star Certification; a recognition due to enhancement and improvement done. As a guiding framework, Arcadis uses the Balanced Score Card system in ensuring that our business processes are aligned to the company's objectives, passion and mission which encapsulates Quality, Environmental, Health and Safety aspects.

We pride ourselves in providing business excellence to our Clients and business partners.

As a continual improvement journey, we share with our Clients and business partners on various subjects amongst others such as:

- Update on Latest Developments in the Security of Payment Act
- Introduction to Design and Build Contracts and Managing Risks in Design and Build Contracts
- Changing the Project Management Paradigm to Reduce Project Failure
- Asset Enhancement and Management of Retail Developments in Singapore and Considerations for Assessment of Time

- Construction Cost Handbook
- Executive Summaries
- Green Building Products and Technologies (GBPTs) Handbook
- Quarterly Cost Publication

## **ENVIRONMENTAL, HEALTH AND SAFETY**

By committing to the Environmental, Health and Safety policies, our efforts include the emphasis on the importance of a healthy and safe work environment for our staff. Therefore, we continue to ensure that these issues are addressed with the highest priority as it pertains to the morale and productivity of our staff and conservation of our environment for future generations.

We look into the various green practices and movement in the office; such as Paper Conservation, Energy Consumption, Waste Management, Water Conservation, purchasing of Green Office products and striving in other areas within the entire organization. Such initiative is similarly extended to our business associates and partners as part of our role of a responsible environmental corporate citizen. We have created our very own Hazard Analysis and Risk Control (HARC) in which the process is a systematic and qualitative approach. In recognition of our constant involvement in sustainable construction and strategies, we have attained the Eco-Office certification from the Singapore Environment Council since 2010 and was awarded the Certified BCA Green Mark Award for Office Interior in 2015.

As a testimony to our achievements, we were the first Quantity Surveying consultant in the construction industry to be awarded the BizSAFE STAR (Enterprise Level) and BizSAFE Partner in 2008 (which is accredited by the Workplace, Health and Safety Council); an accolade recognizing organizations which supports and motivates other companies to join BizSAFE programme in the pursuit of safety in the workplace. The award recognizes organizations which commit to its initiatives and drive towards a safe environment for their staff to work and live in.

### **HPB SINGAPORE HEALTH AWARD**

The Singapore HEALTH (Helping Employees Achieve Life-Time Health) Award is presented by the Health Promotion Board to give national recognition to organizations with commendable Workplace Health Promotion (WHP) programmes. We have been receiving the Bronze award since 2002 and were awarded the Singapore Health Award Silver category in 2010. In 2015, we receive the Gold category Award. With our continuous effort on this, we were awarded Certificate of Recognition in 2017. This represents our commitment and drive to ensure that our WHP programmes stay current and progressive. Healthy bodies will equate healthy minds which boost productivity and value at all levels in our organization.

### **SUSTAINABILITY**

Sustainable development is crucial to the future growth of Singapore as a smart and resilient city. Enhancement of construction productivity as well as greening of the existing building stock has been identified as the key thrusts of sustainable development in the construction sector. The push for productivity has resulted in measures to reduce the reliance on foreign labour and focus on innovative methods of construction to increase the level of productivity. This has a consequent impact on sustainability as such innovative methods of construction tend to be environmental friendly practices which may result in lower wastage and lower embodied carbon footprint.

We own the responsibility to sustain our world and society in a balanced way with health, safety and well-being of people and stakeholders central to all we do. Arcadis is committed to improving quality of life for all generations by maximizing social, economic and environmental value. And this is part of future proofing for the existence of the next generation.

Sustainability and responsibility reside at the heart of what we do. Our people are committed to create sustainable and exceptional outcomes for our clients in natural and built asset environments and we will do so through the delivery of social, environmental and economic value.

In addition, we operate our business in a sustainable and socially responsible way, based on our global Sustainability policy. Our people uphold these principles in their everyday work and are required to abide to our integrity code. Sustainability is also one of our core values. Equally important is the attitude of our people as reflected in our passion: to improve quality of life and be recognized as the best.

### **Greening of Existing Buildings**

In line with the mandate of the 3<sup>rd</sup> Green Masterplan, our office is equipped with the necessary skills and knowledge to collaborate with Consultants to propose sustainable yet cost effective solutions for retrofitting of existing buildings. The main objective is to ensure an optimal balance between economic cost versus future economic and physical obsolescence.

### **Sustainable Masterplan Cost Studies**

Leveraging on our extensive cost database and our knowledge on sustainable development, we have incorporated the synergism into developing the master plans of sustainable development whereby cost models are focused on key performance indices of sustainable development.

### **Environmental Specialist Cost Studies**

We work with strategic partners to deliver environmental specialist cost studies which involve detailed analysis on specific performance mandates such as noise control and the mitigation measures that are cost effective.

### **Green Costing**

Green Costing involves costing on specialist green products, technologies and systems, either in trades or elements. Depending on the green building rating system, cost adjustments have to be made to the base cost. With our extensive database of such cost movements, we are in an ideal position to allow premium green cost for feasibility studies and concept stages.

### **Life Cycle Costing**

Life Cycle Costing (LCC) refers to the cost of an asset or its parts throughout its life cycle, while fulfilling the performance requirement. LCC is an effective tool that aids our Clients in their decision making with regard to investment and it helps them establish priorities between competing proposals.

### **Green Building Products and Technologies**

The Green Building Products and Technologies (GBPTs) Handbook was first launched in 2008 by L&S to serve as an educational toolkit for the industry. The handbook is modelled after the Green Mark scheme and has sought to incorporate the most commonly used GBPTs in Green Mark projects.

### **BUILDING INFORMATION MODEL (BIM) CAPABILITY AND MANAGEMENT**

We have a BIM team of which they are involved, together with the BIM Manager, to have an effective BIM Execution and BIM deployment plan in projects. We currently have 43 certified BIM personnel who have undergone the Building and Construction Authority Academy (BCAA) BIM Management course. The team is instrumental in many projects such as Changi General Hospital, CapitaGreen (Early Contractor Involvement Process) and the Tanjong Pagar Centre project by GuocoLand. We spare no effort in training and ensuring the team is kept up to date with the latest in BIM technology and BIM process. In 2012, we were the first QS team to participate in the 48 hours BCA BIM competition which we came in as 2<sup>nd</sup> Runner Up. In the BIM competition 2013, we came in as 1<sup>st</sup> and 2<sup>nd</sup> Runners Up.

### **HUMAN CAPITAL STRATEGY**

We recognize that human capital is our vital asset and inculcate that our people are our investments leading to our excellence through delivering good services and in turn Deliver Success for our firm.

We select only capable, qualified and enthusiastic individuals to be part of our team. To further groom our staff and maximize staff potential, numerous coaching,

mentoring and various training programmes have been implemented through our learning and development programmes.

## **LEARNING AND DEVELOPMENT**

We invest heavily in our people. Through our blended learning programmes, we ensure our people are continually learning, growing and developing into one of our leaders of tomorrow.

Our emphasis on research, training and professional development are a key differentiating factor for us in this dynamic economic landscape. Our people are constantly updated on the latest development in the industry as we advocate an organizational learning environment through organizing a variety of in-house workshops, external vendors' workshops as well as sending staff for professional bodies' seminars. In addition, we also conduct bi-monthly industry seminars to create awareness on the latest industry developments as part of our corporate social responsibility.

## **QUALITY ASSURANCE**

By adherence to Quality Assurance and Quality Control principles, we aim to produce an efficient and economic System of Best Practice, to the benefit of Arcadis and its Clients, and aim to produce the right service, first time, on time, every time.

Our Quality Management System provides for a cycle of corrective and preventive action, to create positive opportunity for continuous improvement.

Directly linked into our Management System are the Performance Development and Training Programmes, geared to assess effectiveness, identify training needs and delivery of training to meet those needs.

### **Our Quality Control and Monitoring**

For effective control, monitoring and communication, regular review meetings between all personnel in the project team are convened. The frequency varies with the size and complexity of the individual projects, the particular phase of work and the difficulties encountered.

## Our Quality Audits

To ensure compliance with the documented procedures, internal quality audits are carried out periodically to ensure compliance with the procedures set out in the Practice Manual and Quality Framework Manual.

Audits are carried out by an independent trained personnel in accordance with the procedures set out in the Internal Quality Audit Procedure.

In addition, a third party certification body also conducts audit to verify the quality management system within the organization is effective and constantly maintained.

As part of our continual efforts, we constantly update our audit procedures to take into account latest changes in regulations and legislations, especially latest judgements and standard forms. Thus, ensuring that our staff are properly equipped with the correct and relevant information to carry out their tasks and that the Clients' interests are always protected.

## ISO 9001 Certification

Arcadis is an ISO 9001 certified firm with British Standards International (BSI)

The award of the ISO 9001 Quality Certificate is a tangible echo and testimony of the management commitment of the firm to provide all Clients with a service which has been scrutinised by an independent third party certification body.

## People Promise



Our approach to making Arcadis Asia “a great place to work” starts with our commitment to our people and our culture. From identifying the best talent and ensuring everyone has a comprehensive onboarding experience, to investing in our emerging talent and honing the skills of our leaders – we are looking for colleagues who bring more than just skills and qualifications, we want people who share our values and passion to improve quality of life.

Arcadis Asia brings together industry-leading expertise in Quantity Surveying, Project Management, Business Advisory, Contract Solutions and Design Engineering – but the truth is, we are stronger together and it is our combined expertise that differentiates us from our competition and allows us to work on some of the biggest, most-impactful project around the world.

To fulfil our growth ambitions we need to attract and retain the very best people within the industry and ensure they are challenged, engaged and able to realize their full potential as an Arcadian. We will do this through our People Promise.



**The Arcadis Asia People Promise is:**

*“At Arcadis everybody feels valued and included. Our agility, innovation, sustainability focus and collaboration are highly regarded. We are encouraged to realize our potential, connect with others and bring the best of ourselves and Arcadis to our clients and society. We live our passion to improve quality of life”*

Our People Promise is the commitment that Arcadis Asia makes through our leaders with the support of the HR teams to deliver on our aspiration of making Arcadis a great place to work.

## ***Our People, Our Investment, Our Excellence***



## PROFESSIONAL SERVICES

**Arcadis Singapore** offers an unparalleled range of compatible and integrated cost and project management services which alongside their particular fields of specialisms are designed to provide a seamless service to the construction industry and property market.

At the very essence in the success of any project is the selection of an appropriate procurement strategy in terms of the Client's requirements, project characteristics, time and cost certainty, quality targets and distribution of risk. Arcadis is well placed and has the relevant experience to advise on various procurement options from the traditional and straightforward to bespoke hybrid methods - in response to the Client's priorities. These include:

- Measurement contracts
- Lump sum contracts
- Cost reimbursement contracts
- Design and build contracts
- Develop and construct contracts
- Turnkey contracts
- Construction management contracts
- Management contracts
- Term contracts
- Guaranteed maximum price contracts

**Arcadis Singapore** provides a total integrated cost and project management service in the following areas to meet and add value to each individual Client's specific needs:

- Quantity Surveying
- Mechanical and Electrical Engineering Quantity Surveying
- Civil Engineering Quantity Surveying
- Project & Programme Management
- Services of Employer's Agent or Representative (for Design and Build projects)
- Contract Advisory Services

## PROFESSIONAL SERVICES

- Investment Appraisals
- Value Management
- Buildability Appraisals
- Due Diligence Reports
- Project Cost and Contract Audits
- Capital Allowances Taxation Assistance
- Fire Insurance Valuations (or Reinstatement Cost Assessments)
- Advice on Development Brief
- Sustainable Economics and Strategies

The types of construction projects undertaken cover both new building and refurbishment work on residential, commercial, institutional, industrial and infrastructure type developments, such as:

- Airports and Airport Buildings
- Arts and Cultural Buildings
- Business Park Developments
- Civic Buildings
- Civil Engineering and Infrastructure Works
- Educational Buildings
- Health and Hospital Buildings
- Historic and Gazetted Buildings
- Hotels
- Internet Data Centres
- Industrial/Warehouse Developments
- Leisure Projects
- Office Buildings and Interior Fit-out Works
- Parks and Recreational Projects
- Petro-chemical Projects
- Power Generation Projects
- Public Buildings
- Residential Developments
- Retail Developments
- Sports Centres
- Transportation
- Water and Waste Projects

## ARCADIS CONTRACT ADVISORY SERVICES

**Arcadis Contract Advisory (ACA)** - is a Specialist Unit with Arcadis Singapore. ACA works closely with and supports Arcadis with their work in both traditional quantity surveying and specialist integrated management services such as cost & project management, cost engineering, loan monitoring, insurance valuation & loss adjuster assessment, sustainable construction, construction supervision & investment appraisal. ACA works in close collaboration with and supports Construction Lawyers involved in claims and disputes avoidance and resolution.

**Our TEAM** - Professionally qualified and legally trained individuals with a wealth of experience in contract administration and construction disputes and resolution form the backbone of our team. Being part of Arcadis, our Team can draw on the knowledge and expertise of the various divisions of Arcadis including the Cost, Project Management, and Mechanical and Electrical QS services. The Team is thus able to deal with complex and technical matters and so provide relevant and essential support.

**Our CLIENTS** - Our services are provided to and for developers, building owners, construction professionals, insurance companies, financial institutions, contractors, sub-contractors, lawyers, evaluators, mediators, adjudicators and arbitrators handling construction claims and disputes within Singapore, the region and the international arena.

### ARCADIS CONTRACT ADVISORY SERVICES

#### SERVICES PROFILE

##### *Front End Contract Advisory Work*

- Project procurement strategy
- Incorporation of Conditions of Contract
- Interpretation and selection of appropriate forms of:
  - Contract and Sub-Contract Agreements
  - Indemnities and warranties
  - Performance bond

##### *Claims Assessment, Legal and Litigation Support*

- Contractual validity of claims
- Evaluation of claims including preparation of documents for claim, discovery process, trial, mediation, adjudication and arbitration
- Project monitoring
- Audit and recording
- Extensions of time
- Defects and liabilities
- Loss and expense
- Acceleration cost
- Prolongation cost
- Valuation and measurement methods
- Determination and termination

### ***Expert Advisory Work***

- Contractual validity of claims and entitlements and on time and cost disputes
- Defective work, quantum of claims, negligence claims and disputes on quantum or value

### ***Dispute Management - Avoidance and Resolution***

- Facilitate negotiation
- Support and advise on cost-effective resolution
- Neutral evaluation
- Expert determination
- Adjudication and arbitration
- Other forms of resolution

### ***Evaluator, Mediator, Adjudicator and Arbitrators***

### ***Research and Development***

#### ***Publications***

- The Singapore Standard Form of Building Contract - An Annotation
- Design-Build Contract Administration Guide
- PSSCOC Contract Administration Forms
- Contract Administration Guide to the Singapore Standard Form of Building Contract
- Arcadis Insights: an information sheet on topical legal and technical issues (formerly known as "...@Arcadis' Executive Summaries for the Practitioner")
- Construction Procurement Contract Administration and Law

### ***Conference Papers***

- Refurbishment Procurement Procedures

### **ARCADIS CONTRACT ADVISORY SERVICES**

- Contract Arrangements: An Overview
- To Design-Build or Not To?
- Design-Build: Evolution or Revolution?
- Construction Insolvency: Some Practice Issues
- Contract Procurement - Which Way Forward?
- Bankruptcy and Liquidation Issues under SIA and PSSCOC Standard Forms - Contract Administration Issues for the Practitioner
- Design-Build: Fact, Fiction or Wishful Thinking?
- Procurement Management: Philosophy and Approaches
- Construction Insurance - Contract Provisions and Insurance Programmes
- Contract Administration - Some Practice Pointers under SIA and PSSCOC Standard Forms
- Design-Build Practice Issues and Custom-made Procurement Options
- Making Design-Build Better!
- Indemnities, Performance Bonds and Insurances - How effective are they?
- Instructions, Certificates, Notices and Conditions Precedent under SIA and PSSCOC Forms
- Public-Private Partnership (PPP) - Introduction and Overview
- Building and Construction Industry Security of Payment Act (SOP) - Introduction and Overview
- New Applications in Construction Procurement
- Contract Administration under FIDIC Standard Form
- Contract Administration under PSSCOC Standard Form
- REDAS Design and Build Conditions of Contract - Second Edition

## ARCADIS SINGAPORE

**Arcadis Singapore** also provides specialist services in the areas of cost research, feasibility studies, early cost appraisals and development studies, value management, capital allowances taxation, reinstatement cost assessments, review and drafting of standard office procedures and management processes for corporate organizations and also mechanical and electrical engineering quantity surveying services.

### SERVICES PROFILE

#### 1) Cost Research

##### ***Cost Analyses and Research***

- Analysis of tender prices
- Collation of cost data
- Tender price indices
- Cost trends

##### ***Land Tenders, Feasibility Studies, Early Cost Appraisals and Development Studies***

- Estimated construction cost advice
- Assessment on project viability
- Residual land cost studies

### ARCADIS SINGAPORE

#### ***Value Management / Risk Management***

- Value Management / Value Engineering studies and workshops
- Risk Management / Risk Analysis studies and workshops

#### ***Capital Allowances Taxation***

- Assessment of viability of various design features, materials and specifications to achieve tax-efficient solutions and maximise capital allowances at the minimum cost
- Valuation and identification of items qualifying as plant and equipment, and their related costs

#### ***Reinstatement Cost Assessments***

- Assessment of reinstatement costs for insurance purposes

#### ***Project Excellence***

- Providing a systematic dashboard approach to Project Auditing

## **Research and Development**

### **Publications**

- Spon's Asia-Pacific Construction Costs Handbook
- Arcadis Construction Cost Handbook
- Arcadis Insights: an information sheet on topical legal and technical issues (formerly known as "...@Arcadis' Executive Summaries for the Practitioner")
- Arcadis Quarterly Cost Publication

### **Research Studies**

- Cost Impact of Regulatory Differences between Singapore, Malaysia, Hong Kong and Sydney
- Economic Study on Large Floor Plates
- A Study on Comparison of Construction Costs between Singapore, Malaysia, Hong Kong and Sydney
- A Study of Market Rates for The Procurement of Services for Housing & Development Board Projects
- Cost Competitiveness Study on Steel with Singapore Structural Steel Society (SSSS)  
- *"Cost Competitiveness Study on Composite Steel: It's a Steal?"*
- Cost Impact on Buildability - Demystified

As Lead Consultant:

- Review of the BCA Tender Price Index

### **Conference Papers**

- Construction Prospects: Singapore
- Silver Linings: Opportunities in Adversity - The European and Asian Experience
- Construction Prospects in the New Millennium: Regional Overview and Outlook
- Value Management in Construction
- Benefits and Attributes in Value Management
- Project Management in a Knowledge-Based Economy
- Property Outlook in the Asian Market and in Singapore
- BCA - Arcadis Breakfast Talk: Costing of Precast Projects
- Regional Market Outlook 2003

## ARCADIS SINGAPORE

- Regional Construction Industry - Rising Prospects
- Singapore and the Region - Where are we Heading?
- Pricing/Procurement Strategies in Construction Projects
  - In times of Economic Crisis
- Construction Cost Trends and Outlook
  - In times of Economic Crisis
- Singapore and Regional Construction Cost Trends
  - 2010
  - 2013
  - 2016

### ***Published Articles***

- Assessing Reinstatement Cost of Buildings
- Building on Recovery
- CEMS Building
  - Drafting of the CEMS Document
  - The CEMS; An Introduction, 19 April 2002, Building and Construction Authority
  - CEMS in Construction, Building and Construction Authority
  - CEMS; Adapting your IT Systems for the CEMS, 19 April 2002, Building and Construction Authority
  - CEMS; Effects on Quantity Surveying, National University of Singapore, 12 August 2002
  - CEMS; Effects on Contractors, Singapore Contractors Association Ltd, 23 August 2002
  - CEMS; An Overview to Housing & Development Board, 18 November 2002
  - The Ethos of Electronic Measurement
  - CEMS; Adding Value to Construction through Value Management & Risk Management, Singapore Institute of Surveyors and Valuers
  - CEMS; Window to the New Ethos of QS; Institute of Surveyors Malaysia 2004
- IT in Construction
  - Do's and Don'ts of E-Tendering (Baucon Asia)
  - IcFox; Practical Solutions for the Industry (Baucon Asia)

- Construction IT; Chartered and Unchartered Waters
- QS Services in the New Epoch
- The Necessities of Construction IT Protocols; SISV
- The Trends of IT in Construction in the New Construction Era (SP) 9 April 2002
- Do's and Don'ts of E-Collaboration; an Abstract
- E-Tendering; A QS perspective; ICE 2004
- Life Cycle Costing (LCC)
  - Rhetoric and Real; Life Cycle Costing (FMA), February 2003
  - LCC Research on Life Science Buildings (Arcadis, IcFox and NUS)
- Sustainable Construction
- Green Buildings
- Reinstatement Cost - A Considered Approach
- Viability of Adoption of Steel as a Substitute for Concrete and its Impact on Sustainability
- The Carbon Index
- Final Payment to Contractors - A QS Practitioner's Viewpoint
- Licensing of Builders - It's Implication on Contracts Administration
- Tall Buildings - Main Cost Drivers
- The Strategic Value of Knowledge Management
- Construction Cost Updates
- Building Control Act
- Appointment of Instrumentation Specialist Builder
- Novation or Switch - Which is a Better Option?
- Design for Safety and Health
- Code of Practice on Buildability
- Design for Safety Recognition Scheme
- Adjudication Under the Building and Construction Industry Security of Payment Act - Some Thought Provoking Issues
- The Power of Early Contractor Involvement
- What is Lean Management?

## ARCADIS SINGAPORE

- Green Buildings and the Triple Bottom Line
- BIM Maturity Indices for Pre-Qualification for Consultants and Contractors
- Security of Payment Act - Bane or Boon?
- The Haze in Singapore, 2013: The Impact on the Construction Industry of Singapore
- Update on Building and Construction Industry Security of Payment Act
- Cost Competitiveness Study on Steel with Singapore Structural Steel Society (SSSS) - *“Cost Competitiveness Study on Composite Steel: It’s a Steal?”*
- Further Updates on the Building and Construction Industry Security of Payment Act
- REDAS DESIGN & BUILD Conditions of Sub-Contract, 1<sup>st</sup> Ed.
- Conditions Precedent - Uphold it (Dec 2014)
- Third Green Building Masterplan and Green Mark Incentive for Existing Buildings and Premises (GMIS-EBP)
- A New MODE of Working
- Duty to Warn
- Effect of Fraud in Architect’s Certificates
- Building Information Modelling (BIM)
- Design for Manufacturing & Assembly-Prefabricated Pre-finished Volumetric Construction (DFMA-PPVC)

### 2) Building Services

#### ***Mechanical and Electrical Quantity Surveying Services***

- Pre-contract cost advice
- Preparation of design briefs and requirements
- Post-contract services
- Cost audits
- Capital allowances taxation assistance
- Dispute resolution
- Value engineering studies
- Term contract management
- Life cycle costing

## ***Research Studies***

As Lead Consultant:

- Construction Electronic Measurement Standards (CEMS) (CP 97)
- Life Cycle Costing on Life Sciences Buildings (in collaboration with National University of Singapore)
- Singapore Standard Code of Practice for Information Exchange and Documentation at Handing-Over/Taking-Over of Completed Building Projects

## ***Research and Development Conference Papers***

- CEMS: An Introduction and Overview
- CEMS in Construction
- Adapting your IT Systems for CEMS
- CEMS: Effects on Quantity Surveying
- CEMS: Effects on Contractors
- The Ethos of Electronic Measurement
- CEMS: Adding Value to Construction through Value Management and Risk Management
- Do's and Don'ts of E-Tendering
- Construction IT: Chartered and Unchartered Waters
- The Necessities of Construction IT Protocols
- The Trends of IT in Construction in the New Construction Era
- Do's and Don'ts of E-Collaboration
- Rhetoric and Real: Life Cycle Costing
- CEMS: Drafting of the CEMS M&E Document

## ***Published Articles***

- Modular Wiring in Asia Pacific
- To Breathe or Not to Breathe
- Wired or Wireless?
- Why Intelligent Buildings?
- M&E Services: Managing Costs and Procurement
- Thermal Storage
- Renewable Energy
- Sustainable Lighting - Light Emitting Diodes (LED)
- Sustainable Energy - Biomass

### ARCADIS SINGAPORE

- Cost Model - Data Centre
- Regenerative Lift
- Heat Recovery System - Heat Pump
- The Benefits of a Passive Approach to Daylight Solutions in cutting Carbon Emissions
- Piping Trend in Singapore

#### 3) Others

- L&S Asia History Book: Quantifying Asia

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## ARCADIS ASIA SECTORS

### AUTOMOTIVE

At the present time we are witnessing a massive shift in the automotive sector. Electric vehicles are rapidly establishing themselves as a credible alternative as their range and performance meets (and exceeds) customer expectation. We are seeing more and more brands developing their own models across the region. In addition, the race for autonomous vehicles is leading to the development of new technologies at a pace that is unprecedented in the sector. We are helping our clients to restructure their manufacturing bases to meet shifting global demand, to remodel production lines for the new models demanded by customers, and to invest in the new supply chain technology.

Automotive retail continues to be fiercely competitive, with digital technology entering this space creating a more immersive buying experience. The race to roll out new retail formats around the globe requires lean and efficient delivery models and global standardization, supply chains and logistics.

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### AVIATION

The recent successful launches of new airframe technologies has caused airports to rethink how they can service larger passenger planes, and, with the prospect of new routes being enabled by longer range and new airframe formats, we expect to see further expansion and development of airports around the globe.

Domestic air travel and cargo hubs are also among popular areas of investment in aviation sector. Investment in domestic air travel is essential, as passengers demand an experience comparable with the best international airports. New cargo hubs are planned to meet 'same day' delivery expectations from on line retailers and logistics firms. We expect to see continued investment and demand for high quality design and engineering solutions in the aviation sector for many years to come.

## ARCADIS ASIA SECTORS

### CHEMICALS & PHARMACEUTICALS

The chemical and pharmaceutical industry faces a diverse range of challenges across globe. Growing and ageing populations have created rising demands for medication and more effective cures for diseases. Asia is no exception, despite Asia having a relatively younger population compared the other regions. It is also important to take note that approximately two thirds of total global demand growth for chemicals is expected to be generated in Asia.

In order to stay ahead of the competition, we work with our clients across Asia to improve their supply chain and secure their pipelines. The chemicals and pharmaceuticals industry will continue to be 'on the move' to Asia with rapid development in the future to fulfill demand coming from Asia and beyond.

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### COMMERCIAL DEVELOPERS

Commercial developers are a significant proportion of our market in Asia, especially in those countries where the economy is driven by investment in property. In the last 10 years China, for example, has been fuelled by demand for properties as a result of rapid urbanization, and this is also now the case in countries such as Vietnam and the Philippines.

All building types, including commercial offices, residential, leisure, hospitality and retail, are confronted with ever increasing challenges in terms of efficiency of land use, planning compliance, product positioning, cost, quality, impact on communities, sustainability and also market competitiveness. The commercial developer sector will continue to play a key role in all economies across Asia.

## FINANCIAL INSTITUTIONS

Driving better investment and asset performance and improving sustainable returns in current challenging markets is the key focus of our sector specialists.

Through utilizing unique market insight, such as our global asset performance benchmarks, our deep technical knowledge, and an unrivalled global track record in working with financial institutions, we are able to define solutions to meet client needs and to enhance their business outcomes.

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## OIL AND GAS

Rising production costs and unpredictable prices put oil & gas clients under more pressure than ever. Growing complexities of shifting environmental legislation combined with an increased need for asset decommissioning, oil & gas has become a complex and rapidly evolving sector. We partner with global oil & gas clients to maximize returns on our clients' investments, through better management of project risks and costs, and improvement of opex performance. We work across the asset lifecycle from concept through to decommissioning. We bring together upstream & downstream expertise and understanding from a broad base of capabilities including cost & risk management, environmental management, project management and maintenance strategy.

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## RAIL

Rapid large scale urbanization, tight budgets and environmental sensitivity require innovative approaches to deliver advanced infrastructure. With our expertise in rail, and our transformational thinking, clients rely on us to improve performance and connect communities across countries and regions.

In Asia, we have been involved in providing engineering design, cost management, contract administration, risk management, business advisory and mobility oriented design for numerous metro and high speed rail projects in Hong Kong, Mainland China, Taiwan, Singapore and Malaysia.

## **ARCADIS ASIA SECTORS**

### **PORTS AND WATERWAYS**

Ports are at the heart of globalization, facilitating the spread of trade and prosperity. The rapid growth of Asia has seen a substantial investment in port and logistics infrastructure, but also increasing competition between ports, and a focus on raising productivity and service quality. At the same time, it is increasingly necessary to respond to public concerns about environmental and safety issues.

Delivering sustainable growth is a great challenge and requires know-how and expertise across a broad range of disciplines. We offer governments, port institutions, private terminal operators, investors and shipping lines all the disciplines necessary for an integrated approach and the delivery of successful outcomes, whether in the technical, operational, nautical, environmental, risk, financial or economic arena.

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### **RETAIL & CONGLOMERATES**

As the world of retails faces the fiercest competition yet due to a change in the traditional retail landscape and the rapid development of online retail industry, we work with our retail clients to gain a competitive advantage in their market expansion or re-branding. It is essential for us to tailor our services to fit client strengths and needs, to minimize spend and achieve the best solution for each individual company.

With unrivaled experience across all facets of retail development, from luxury and sports fashion to cosmetics, supermarkets and restaurant chains, we help our clients successfully navigate through complex challenges in retail development.

## ARCADIS ASIA SERVICES

### BUSINESS ADVISORY

From rapid urbanization and pressure on natural resources, to tighter regulation and market consolidation, we live in an increasingly complex world. In Arcadis you have a partner that understands your business challenges and has first-hand experience of the assets you own and operate. We bring unique insights which support you in getting better results with more certainty.

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### COST MANAGEMENT

Be it a high-rise office building, a state-of-the-art rail station or a large scale industrial development, the need to achieve value for money is central to every investment strategy.

Our people understand the need to accurately advise on costs and procurement at planning stage, ensuring a development or program is both economically and environmentally viable for many years to come.

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### ENVIRONMENT

We all deserve a clean, safe environment in which to live. Now more than ever, businesses and governments recognize the need to incorporate environmental concerns into their decision making. Arcadis is a global leader in inventive technical and financial approaches, helping some of the world's leading corporates and governments understand their impact on the natural world.



## **ARCADIS ASIA SERVICES**

### **PROJECT & PROGRAMME MANAGEMENT**

Organizing the creation of the world's largest, most complex and iconic programs of work in the built and natural environment today is no easy task. Budgets, supply chains, health and safety, timeframes and the large number of parties involved can be daunting.

At Arcadis, we work alongside our clients to create the right strategy, manage and mitigate risk, and assure the outcomes to meet our clients' business objectives and create exceptional value.

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### **WATER**

From source to tap and then back to nature, the planet's most precious resource should be cherished.

Thanks to over a centuries of experience in the water sector, Arcadis' specialist teams around the globe are uniquely positioned to provide safe and secure water technology that is built to withstand the demands of a rapidly changing world.



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