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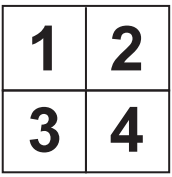
Construction Cost Handbook

SINGAPORE 2019

Arcadis Singapore Pte Ltd



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Twenty-fifth Edition 2019

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Unless otherwise stated, costs reflected in this handbook are current as at **4th Quarter 2018.**

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Published by Arcadis Singapore Pte Ltd
Printed by Drummond Printing Pte Ltd

Electronic Cost Handbook

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2. For mobile and tablet access, scan the QR code below to directly access our Annual Construction Cost Handbook webpage.

INTRODUCTION

Arcadis Singapore has been involved in the publication of construction costs handbooks for countries such as China and Hong Kong, India, Indonesia, 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 2019 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

2018

	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

Public Holidays | School Holidays

January

Week No.	1	2	3	4	5
Monday		7	14	21	28
Tuesday	1	8	15	22	29
Wednesday	2	9	16	23	30
Thursday	3	10	17	24	31
Friday	4	11	18	25	
Saturday	5	12	19	26	
Sunday	6	13	20	27	

February

Week No.	5	6	7	8	9
Monday		4	11	18	25
Tuesday		5	12	19	26
Wednesday		6	13	20	27
Thursday		7	14	21	28
Friday	1	8	15	22	
Saturday	2	9	16	23	
Sunday	3	10	17	24	

March

Week No.	9	10	11	12	13
Monday		4	11	18	25
Tuesday		5	12	19	26
Wednesday		6	13	20	27
Thursday		7	14	21	28
Friday	1	8	15	22	29
Saturday	2	9	16	23	30
Sunday	3	10	17	24	31

April

Week No.	14	15	16	17	18
Monday	1	8	15	22	29
Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	

May

Week No.	18	19	20	21	22
Monday		6	13	20	27
Tuesday		7	14	21	28
Wednesday	1	8	15	22	29
Thursday	2	9	16	23	30
Friday	3	10	17	24	31
Saturday	4	11	18	25	
Sunday	5	12	19	26	

June

Week No.	22	23	24	25	26
Monday		3	10	17	24
Tuesday		4	11	18	25
Wednesday		5	12	19	26
Thursday		6	13	20	27
Friday		7	14	21	28
Saturday	1	8	15	22	29
Sunday	2	9	16	23	30

July

Week No.	27	28	29	30	31
Monday	1	8	15	22	29
Tuesday	2	9	16	23	30
Wednesday	3	10	17	24	31
Thursday	4	11	18	25	
Friday	5	12	19	26	
Saturday	6	13	20	27	
Sunday	7	14	21	28	

August

Week No.	31	32	33	34	35
Monday		5	12	19	26
Tuesday		6	13	20	27
Wednesday		7	14	21	28
Thursday	1	8	15	22	29
Friday	2	9	16	23	30
Saturday	3	10	17	24	31
Sunday	4	11	18	25	

September

Week No.	35	36	37	38	39	40
Monday		2	9	16	23	30
Tuesday		3	10	17	24	
Wednesday		4	11	18	25	
Thursday		5	12	19	26	
Friday		6	13	20	27	
Saturday		7	14	21	28	
Sunday	1	8	15	22	29	

October

Week No.	40	41	42	43	44
Monday		7	14	21	28
Tuesday	1	8	15	22	29
Wednesday	2	9	16	23	30
Thursday	3	10	17	24	31
Friday	4	11	18	25	
Saturday	5	12	19	26	
Sunday	6	13	20	27	

November

Week No.	44	45	46	47	48
Monday		4	11	18	25
Tuesday		5	12	19	26
Wednesday		6	13	20	27
Thursday		7	14	21	28
Friday	1	8	15	22	29
Saturday	2	9	16	23	30
Sunday	3	10	17	24	

December

Week No.	48	49	50	51	52	1/20
Monday		2	9	16	23	30
Tuesday		3	10	17	24	31
Wednesday		4	11	18	25	
Thursday		5	12	19	26	
Friday		6	13	20	27	
Saturday		7	14	21	28	
Sunday	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	47	48	49	49	50	51	52	1/21
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	

2021

	January					February				
Week No.	1	2	3	4	5	6	7	8	9	
Monday		4	11	18	25	1	8	15	22	
Tuesday		5	12	19	26	2	9	16	23	
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	

	March					April				
Week No.	10	11	12	13	14	14	15	16	17	18
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	

	May						June				
Week No.	18	19	20	21	22	23	23	24	25	26	27
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	
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	

	July						August					
Week No.	27	28	29	30	31		31	32	33	34	35	36
Monday		5	12	19	26			2	9	16	23	30
Tuesday		6	13	20	27			3	10	17	24	31
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	

	September					October				
Week No.	36	37	38	39	40	40	41	42	43	44
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

	November					December				
Week No.	45	46	47	48	49	49	50	51	52	1/22
Monday	1	8	15	22	29		6	13	20	27
Tuesday	2	9	16	23	30		7	14	21	28
Wednesday	3	10	17	24		1	8	15	22	29
Thursday	4	11	18	25		2	9	16	23	30
Friday	5	12	19	26		3	10	17	24	31
Saturday	6	13	20	27		4	11	18	25	
Sunday	7	14	21	28		5	12	19	26	

CONSTRUCTION TRENDS 1

CONSTRUCTION OUTLOOK[1]

Construction Market Review in 2018

Following three consecutive years of decline, total preliminary construction demand[2] in 2018 rose to $30.5 billion. Total public sector construction demand increased by 16% year-on-year to $18.4 billion in 2018, supported by higher construction demand for public housing developments, institutional building projects as well as infrastructure works. Similarly, total private sector construction demand expanded by 35% to $12.1 billion in 2018, underpinned by more residential and industrial building projects on the back of redevelopment of various en-bloc sales sites and continued positive growth in the manufacturing sector.

On the other hand, the construction sector's GDP continued to contract by 3.4%[3] in 2018 as a result of lower construction demand in the preceding few years.

Construction Demand Outlook in 2019

Looking ahead, total construction demand is projected to reach between $27 billion and $32 billion in 2019, based on the feedback received in BCA's latest Development Plans Survey (DPS) conducted in Oct/Nov 2018 as well as the prevailing economic outlook. Public sector construction demand is projected to remain firm at between $16.5 billion and $19.5 billion, contributing to about 60% of total demand. In addition, private sector construction demand is expected to be between $10.5 billion and $12.5 billion in 2019.

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[1] All currencies stated in this paper are in nominal Singapore dollars unless otherwise stated.

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

[3] Based on MTI's press release on 2 Jan 2019 on advance GDP estimates for 2018.

Residential Construction Demand

Public Housing

Public sector residential construction demand is expected to moderate from $3.6 billion in 2018 to between $2.5 billion and $2.9 billion in 2019 following the stabilising of public housing demand. Upcoming development of Build-to-Order (BTO) units at Punggol and Tengah new town is likely to dominate the new public housing construction demand in 2019. Furthermore, upgrading projects under the Home Improvement Programme (HIP) including the Enhancement for Active Seniors (EASE) and Neighbourhood Renewal Programmes will continue to be implemented at various HDB estates.

Private Housing

In view of the tapering of en-bloc sales since the second half of 2018, private sector residential construction demand is projected to moderate from the $5.2 billion recorded in 2018 to between $4.3 billion and $4.7 billion in 2019. Despite the moderation, the anticipated demand is still about 30% higher than the average yearly volume of $3.4 billion in 2015-2017, supported by imminent redevelopments of en-bloc sales sites concluded previously.

Commercial Construction Demand

Backed by the continued demand for good quality office space, total commercial building construction demand is projected to be between $1.4 billion and $2.0 billion in 2019, as compared to $1.5 billion registered in 2018.

Industrial Construction Demand

Total industrial building construction demand is projected to reach between $6.0 billion and $7.3 billion in 2019, as compared to $4.8 billion in 2018. Public sector industrial building construction demand is projected to grow from $0.8 billion in 2018 to between $3.4 billion and $4.0 billion in 2019. On the other hand, private sector industrial building construction is projected to moderate from $4.0 billion in 2018 to between $2.6 billion and $3.3 billion in 2019.

Institutional & Other Building Construction Demand

Total institutional building construction demand is projected to moderate to between $4.6 billion and $5.3 billion, from $5.8 billion recorded in 2018. Coming off from a high base in 2018 on account of the award of several large public sector healthcare and community facilities, public sector institutional building construction demand is anticipated to moderate from $4.5 billion to between $3.0 billion and $3.5 billion in 2019. On the other hand, private sector institutional building construction demand is likely to gain momentum and increase from $1.3 billion in 2018 to between $1.6 billion and $1.8 billion in 2019.

Civil Engineering Construction Demand

Civil engineering construction demand has remained strong in recent years on the back of the implementation of major infrastructure projects by the public sector. A total of $8.2 billion to $9.9 billion worth of civil engineering projects are anticipated to be awarded in 2019, with support coming from Jurong Regional Line and infrastructure works for Changi Airport Terminal 5.

Construction Outlook for 2019-2022

Over the medium-term, total construction demand is projected to reach $27 billion to $34 billion per annum in 2020-2021 and continue to move up gradually to $28 billion to $35 billion per annum in 2022-2023.

The public sector will continue to lead demand and is expected to contribute to between $16 billion and $20 billion per annum in 2020-2023, with similar proportions of demand coming from building projects and civil engineering works. Besides public housing developments, public sector construction demand over the medium term will be supported by various major infrastructure projects such as developments at Jurong Lake District, Changi Airport Terminal 5 and new MRT lines such as the Cross Island Line.

Conclusion

Backed by expansion of construction orders from both public and private sectors, total construction demand turned around with a year-on-year increase of 23% to $30.5 billion in 2018. Despite external headwinds resulting from global trade tensions and geopolitical risks, total construction demand is expected to remain resilient with a stable stream of major public infrastructure projects and spin-off benefits from continued growths in major economic sectors. Total construction demand is anticipated to stay firm at between $27 billion and $32 billion in 2019, with the public sector continuing to contribute to about 60% of the volume. Over the medium-term, the outlook for construction demand is projected to be on a slight uptrend in view of the rich pipeline of public sector projects.

Contributed by:
Economic Research Department, Strategic Planning Office
Building and Construction Authority
24 January 2019

Table 1: Private Sector Contracts Awarded ($billion)

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
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	1.7	2.5
2018#	5.2	1.4	4.0
2019##	4.3 - 4.7	1.3 - 1.8	2.6 - 3.3

Table 2: Public Sector Contracts Awarded ($billion)

YEAR	RESIDENTIAL	COMMERCIAL	INDUSTRIAL
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	3.2	0.1	1.7
2018#	3.6	0.1	0.8
2019##	2.5 - 2.9	0.1 - 0.1	3.4 - 4.0

Note: # preliminary figure, ## forecast

INSTITUTIONAL	TOTAL BLDG	CIVIL ENG*	TOTAL
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	7.9	1.1	9.0
1.3	11.8	0.3	12.1
1.6 - 1.8	9.8 - 11.6	0.7 - 0.9	10.5 - 12.5

INSTITUTIONAL	TOTAL BLDG	CIVIL ENG*	TOTAL
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
2.5	7.6	8.3	15.8
4.5	9.0	9.4	18.4
3.0 - 3.5	9.0 - 10.5	7.5 - 9.0	16.5 - 19.5

Source : BCA as at 14 January 2019; * 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

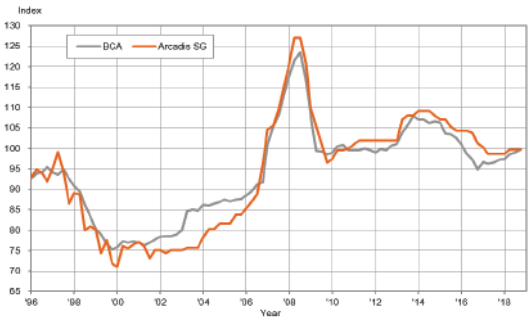
Based on Arcadis Singapore's data, tender prices for 2018 have increased approximately 1% year-on-year (i.e. 4th Quarter 2018 versus 4th Quarter 2017).

According to preliminary figures published by BCA on 14 January 2019, total construction demand in 2018 was $30.5 billion, an increase of approximately 23% as compared to 2017. Public sector construction demand increased from $15.8 billion in 2017 to $18.4 billion in 2018. Similarly, private sector construction demand also increased from $9.0 billion in 2017 to $12.1 billion in 2018.

Based on BCA's forecast, total construction demand (excluding reclamation works) for 2019 is projected to reach between $27 billion and $32 billion. Public sector construction demand is projected to maintain at a sustainable level between $16.5 billion and $19.5 billion, contributing to approximately 60% of the total construction demand. Likewise, private sector construction demand is expected to be between $10.5 billion and $12.5 billion.

Looking ahead, with the slow global economy growth and the comparable level of construction demand as 2018's, tender prices in the first half of 2019 are likely to remain stable and competitive as contractors are eager to fill up their order books. For the second half of 2019, key construction material prices are expected to rise whilst labour costs remain high, tender prices are expected to increase moderately taking into consideration that contractors' order books are being filled up and may become more selective in tendering for projects.

Nonetheless, the price movement (if any) for the whole year of 2019 is anticipated to be in the range of 0% to +2%, the actual level depending on the prevailing market sentiment and any adverse ramifications of the prevailing economic instability.



Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
BCA*	101.3	100.0	99.7	99.8	104.6	106.8	104.0	98.0	96.7	98.6(p)
Arcadis SG^	96.6	100.0	102.0	102.0	108.1	108.1	104.3	101.2	98.7	99.7

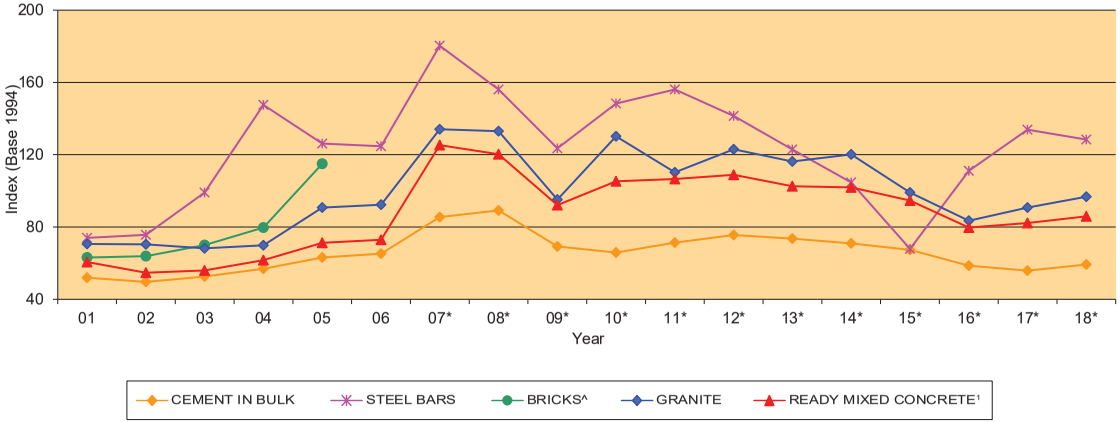
Source: * Building and Construction Authority;
p - denotes preliminary data
^ From 2009 onwards, Arcadis Singapore TPI based on 4th Quarter Index

MATERIAL PRICE INDICES

YEAR	CEMENT IN BULK			STEEL BARS			BRICKS^			GRANITE			READY MIXED CONCRETE[1]		
	$/TONNE	INDEX (BASE 1994)	INFLATION	$/TONNE	INDEX (BASE 1994)	INFLATION	$/'000 BRICKS	INDEX (BASE 1994)	INFLATION	$/TONNE	INDEX (BASE 1994)	INFLATION	$/m³	INDEX (BASE 1994)	INFLATION
01	70.00	51.9	-	432.81	74.0	-	147.00	63.1	-	12.69	70.6	-	61.40	60.6	-
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[2]	125.3[2]	71.9%
08*	120.40	89.2	4.3%	913.00	156.1	-13.4%	-	-	-	23.90	133.0	-0.8%	121.90[2]	120.3[2]	-4.0%
09*	93.40	69.2	-22.4%	722.50^^	123.5^^	-20.9%	-	-	-	17.10	95.2	-28.4%	93.30[3]	92.1[3]	-23.4%
10*	89.00	65.9	-4.8%	867.50	148.3	20.1%	-	-	-	23.40	130.2	36.8%	106.70[4]	105.3[4]	14.3%
11*	96.20	71.3	8.2%	913.40	156.1	5.3%	-	-	-	19.80	110.2	-15.4%	108.00[4]	106.6[4]	1.2%
12*	102.10	75.6	6.0%	827.50	141.4	-9.4%	-	-	-	22.10	123.0	11.6%	110.40[4]	108.9[4]	2.2%
13*	99.30	73.6	-2.6%	718.80	122.9	-13.1%	-	-	-	20.90	116.3	-5.4%	104.00[4]	102.6[4]	-5.8%
14*	95.70	70.9	-3.7%	612.50	104.7	-14.8%	-	-	-	21.60	120.2	3.4%	103.30[4]	101.9[4]	-0.7%
15*	90.80	67.3	-5.1%	397.10^^^	67.9^^^	-35.1%	-	-	-	17.80	99.1	-17.6%	95.90[4]	94.6[4]	-7.2%
16*	79.00	58.6	-13.0%	649.60^^^	111.1^^^	63.6%	-	-	-	15.00	83.5	-15.7%	80.80[4]	79.7[4]	-15.7%
17*	75.40	55.9	-4.6%	783.00^^^	133.9^^^	20.5%	-	-	-	16.30	90.7	8.6%	83.30[4]	82.2[4]	3.1%
18*	79.80	59.2	5.9%	751.00^^^	128.4^^^	-4.1%	-	-	-	17.40	96.8	6.7%	87.10[4]	85.9[4]	4.5%

Source: Building and Construction Authority as at 15 February 2019

Note: ^From 1st Quarter 2006, statistics on bricks have been discontinued. *Market prices from 2007 to 2018 are based on prices as at the month of December. ^^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. ^^^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. [1]Prior to 2007, the market prices of ready mixed concrete (RMC) were for Grade 30. [2]The market prices of RMC were for Grade 35. [3]The market prices of RMC were based on non-fixed price contract for Grade 35 Pump. [4]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

PREAMBLES

The construction costs for the respective categories given on the following pages are average costing at 4th Quarter 2018. They are based on interpolation of competitive tenders received.

Based on Arcadis Singapore's data, tender prices for 2018 have increased approximately 1% year-on-year (i.e. 4th Quarter 2018 versus 4th Quarter 2017).

Looking ahead, with the slow global economy growth and the comparable level of construction demand as 2018's, tender prices in the first half of 2019 are likely to remain stable and competitive as contractors are eager to fill up their order books. For the second half of 2019, key construction material prices are expected to rise whilst labour costs remain high, tender prices are expected to increase moderately taking into consideration that contractors' order books are being filled up and may become more selective in tendering for projects.

Price movement (if any) for the whole year of 2019 is anticipated to be in the range of 0% to +2%, the actual level depending on the prevailing market sentiment 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$/m²	HIGH S$/m²
RESIDENTIAL		
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 Condominum	2,050	2,800
Luxury Condominium	2,800	4,200
OFFICE		
Average Standard Offices	2,350	2,650
Prestige Offices	2,650	2,900
COMMERCIAL		
Shopping Centres, Average Quality	2,650	2,800
Shopping Centres, High Quality	2,800	3,100
CAR PARKS		
Multi-Storey Car Parks	880	1,280
Basement Car Parks	1,280	1,730

The above costs are at 4th Quarter 2018 levels.
For latest costs information, please refer to our 'Arcadis Singapore Quarterly Construction Cost Review'.

TYPES	OVERALL COST	
	LOW S$/m²	HIGH S$/m²
INDUSTRIAL		
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
HOTEL (Including Furniture and Fittings)		
3-Star Hotels	2,950	3,250
4-Star Hotels	3,150	3,750
5-Star Hotels	3,800	4,300
HEALTH		
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$/m² CFA				
	SINGAPORE♣	KUALA LUMPUR	BANGKOK ✪	HONG KONG £	MACAU ৳
DOMESTIC					
Apartments, high rise, average standard	1,305 - 1,485	345 - 580►	703 - 871	3,060 - 3,570	2,279 - 2,788
Apartments, high rise, high end	2,030 - 3,045	710 - 1,120	978 - 1,207	4,020 - 4,690	3,183 - 4,864
Terraced houses, average standard	1,705 - 1,920	220 - 345▲	458 - 565	4,130 - 4,860	3,884 - 4,635
Detached houses, high end	2,175 - 2,900	740 - 980	794 - 962	6,140 up	4,737 - 6,163
OFFICE / COMMERCIAL					
Medium/high rise offices, average standard	1,705 -1,920#	575 - 745▼	642 - 794	2,990 - 3,500	2,623 - 3,387
High rise offices, prestige quality	1,920 -2,100#	865 - 1,255▼	871 - 1,176	3,630 - 4,260	3,387 - 3,705
Out-of-town shopping centre, average standard	1,920 - 2,030	550 - 715	626 - 810	2,970 - 3,540	2,470 - 3,705
Retail malls, high end	2,030 - 2,245	680 - 1,000	840 - 886	3,950 - 4,720	3,884 - 4,686
HOTELS					
Budget hotels - 3-star, mid market	2,140 - 2,355	1,020 - 1,395	1,146 - 1,268	3,840 - 4,160	3,451 - 3,909
Business hotels - 4/5-star	2,755 - 3,115	1,720 - 2,175	1,466 - 1,680	4,020 - 4,720	4,686 - 5,602
Luxury hotels - 5-star	2,755 - 3,115	1,940 - 2,435	1,711 - 1,986	4,720 - 5,460	5,602 - 6,621

INDUSTRIAL					
Industrial units, shell only (Conventional single storey framed units)	725 - 930	320 - 430	489 - 611	N/A	N/A
Owner operated factories, low rise, light weight industry	N/A	430 - 520	N/A	2,330 - 2,950	N/A
OTHERS					
Underground/basement car parks (<3 levels)	930 - 1,255	310 - 530	550 - 733	3,200 - 3,840	2,050 - 3,005
Multi storey car parks, above ground (<4 levels)	640 - 930^	220 - 345	183 - 299	1,920 - 2,280	1,133 - 1,490
Schools (primary and secondary)	N/A	250 - 305 ◄	N/A	2,520 - 2,710	2,266 - 2,623
Students' residences	1,560 - 1,705	295 - 360 ♦	N/A	2,930 - 3,310	1,795 - 2,088
Sports clubs, multi purpose sports/leisure centres (dry sports)	1,955 - 2,100	595 - 730	N/A	3,820 - 4,450	N/A
General hospitals - public sector	2,755 - 2,900	855 - 1,155	N/A	4,950 - 5,580	N/A
Exchange Rate Used : US$1 =	S$ 1.38	RM 4.18	BAHT 32.73	HK$ 7.82	MOP 8.07

The above costs are at **4th Quarter 2018** levels, inclusive of preliminaries but exclusive of contingencies.

(Cont'd)

♣ 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.

ŒŒ Rates exclude VAT.

Ъ 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 area with screeded floor, painted wall and ceiling
Schools (primary and secondary) are of public authority standard, no air-conditioning and complete with basic external works.

► 6 - 12 units per floor, 46m² - 83m² per unit, exclude air-conditioning, kitchen cabinets and home appliances.

▲ Terraced houses exclude air-conditioning, kitchen cabinets and home appliances.

▼ Offices exclude tenant fitout.

◄ Schools (primary and secondary) are of standard government provisions.

♦ Student hostels to university standard.

CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	US$/m² CFA			
	SHANGHAI +	BEIJING +	GUANGZHOU/ SHENZHEN +	CHONGQING/ CHENGDU +
DOMESTIC				
Apartments, high rise, average standard	668 - 740	613 - 673	534 - 590	552 - 661
Apartments, high rise, high end	1,554 - 1,697	1,484 - 1,690	874 - 958	907 - 1,149
Terraced houses, average standard	446 - 477	447 - 522	405 - 446	445 - 541
Detached houses, high end	666 - 740	673 - 749	553 - 609	591 - 682
OFFICE / COMMERCIAL				
Medium/high rise offices, average standard	868 - 1,156	857 - 1,154	777 - 860	882 - 1,025
High rise offices, prestige quality	1,158 - 1,445	1,154 - 1,895	1,132 - 1,361	1,122 - 1,520
Out-of-town shopping centre, average standard	N/A	653 - 873	749 - 822	706 - 912
Retail malls, high end	1,228 - 1,585	1,181 - 1,626	1,088 - 1,521	1,067 - 1,505
HOTELS				
Budget hotels - 3-star, mid market	952 - 1,169	966 - 1,191	985 - 1,084	958 - 1,189
Business hotels - 4/5-star	1,556 - 2,120	1,615 - 2,132	1,592 - 2,273	1,747 - 2,188
Luxury hotels - 5-star	2,117 - 2,538	2,057 - 2,646	2,165 - 2,386	2,159 - 2,592

INDUSTRIAL				
Industrial units, shell only (Conventional single storey framed units)	280 - 342	270 - 329	497 - 547	426 - 542
Owner operated factories, low rise, light weight industry	432 - 540	522 - 598	N/A	N/A
OTHERS				
Underground/basement car parks (<3 levels)	742 - 1,033	746 - 820	513 - 820	413 - 589
Multi storey car parks, above ground (<4 levels)	382 - 532	449 - 454	367 - 404	324 - 405
Schools (primary and secondary)	528 - 676	520 - 671	407 - 448	438 - 487
Students' residences	377 - 527	368 - 520	264 - 297	N/A
Sports clubs, multi purpose sports/leisure centres (dry sports)	955 - 1,172	890 - 897	754 - 832	N/A
General hospitals - public sector	1,418 - 1,839	1,170 - 1,465	N/A	N/A
Exchange Rate Used : US$1 =	RMB 6.94	RMB 6.94	RMB 6.94	RMB 6.94

The above costs are at **4th Quarter 2018** levels, inclusive of preliminaries but exclusive of contingencies.

(Cont'd)

+ 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 air-conditioning and complete with basic external works.

CONSTRUCTION COSTS FOR SELECTED ASIAN CITIES (Cont'd)

BUILDING TYPE	US$/m² CFA			
	MANILA Ω	INDIA ₲	JAKARTA $	HO CHI MINH &
DOMESTIC				
Apartments, high rise, average standard	937 - 1,135	576 - 660	722 - 817	645 - 800
Apartments, high rise, high end	1,265 - 2,107	869 - 1,047	996 - 1,124	820 - 940
Terraced houses, average standard	762 - 917	398 - 419	383 - 498	435 - 510
Detached houses, high end	1,631 - 2,724	525 - 550	1,042 - 1,165	495 - 605
OFFICE / COMMERCIAL				
Medium/high rise offices, average standard	933 - 1,076	435 - 471	712 - 789	755 - 875
High rise offices, prestige quality	1,264 - 1,390	544 - 576	1,050 - 1,174	870 - 1,185
Out-of-town shopping centre, average standard	762 - 935	424 - 461	611 - 675	N/A
Retail malls, high end	1,093 - 1,508	592 - 639	675 - 730	705 - 920
HOTELS				
Budget hotels - 3-star, mid market	1,195 - 1,312	817 - 905	1,237 - 1,461	1,400 - 1,710
Business hotels - 4/5-star	1,347 - 1,607	1,272 - 1,508	1,691 - 1,827	N/A
Luxury hotels - 5-star	1,851 - 2,524	1,607 - 1,759	1,801 - 2,030	1,765 - 2,120

INDUSTRIAL				
Industrial units, shell only (Conventional single storey framed units)	485 - 538	340 - 398	327 - 356	310 - 390
Owner operated factories, low rise, light weight industry	685 - 789	361 - 424	355 - 392	350 - 460
OTHERS				
Underground/basement car parks (<3 levels)	494 - 610	288 - 309	505 - 619	640 - 765
Multi storey car parks, above ground (<4 levels)	475 - 661	230 - 252	327 - 356	410 - 450
Schools (primary and secondary)	701 - 952	285 - 324	N/A	540 - 590
Students' residences	742 - 937	309 - 340	N/A	540 - 695
Sports clubs, multi purpose sports/leisure centres (dry sports)	1,186 - 1,699	602 - 628	1,095 - 1,640	800 - 855
General hospitals - public sector	1,287 - 1,523	660 - 723	N/A	N/A
Exchange Rate Used : US$1 =	PHP 52.88	INR 71.9	IDR 15,180	VND 22,600

The above costs are at **4th Quarter 2018** levels, inclusive of preliminaries but exclusive of contingencies.

Ω Rates include 12% VAT.

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

$ Rates are nett of VAT.

& Rates are nett of VAT.

CONSTRUCTION COST SPECIFICATION

BUILDING TYPE	OUTLINE SPECIFICATION
DOMESTIC	
Apartments, high rise, average standard	Apartment units with fit-out, including air-conditioning (a/c), kitchen cabinets and home appliances, but **excluding** 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 **excluding** decorative light fittings and loose furniture
Terraced houses, average standard	Houses with fit-out, including a/c, kitchen cabinets and home appliances, but **excluding** 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 **excluding** decorative light fittings, loose furniture, garden and parking
OFFICE / COMMERCIAL	
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 **excluding** shop fit-out
Retail malls, high end	
HOTELS	
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) **excluded**
Business hotels - 4/5-star	
Luxury hotels - 5-star	
INDUSTRIAL	
Industrial units, shell only (Conventional single storey framed units)	RC structure with steel roof and M&E to main distribution, but **excluding** 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 **excluding** a/c and heating

(Cont'd)

CONSTRUCTION COST SPECIFICATION (Cont'd)

BUILDING TYPE	OUTLINE SPECIFICATION
OTHERS	
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 **excluding** 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$/m2 CFA. Fluctuation in exchange rates may lead to changes in construction costs expressed in U.S. dollars.

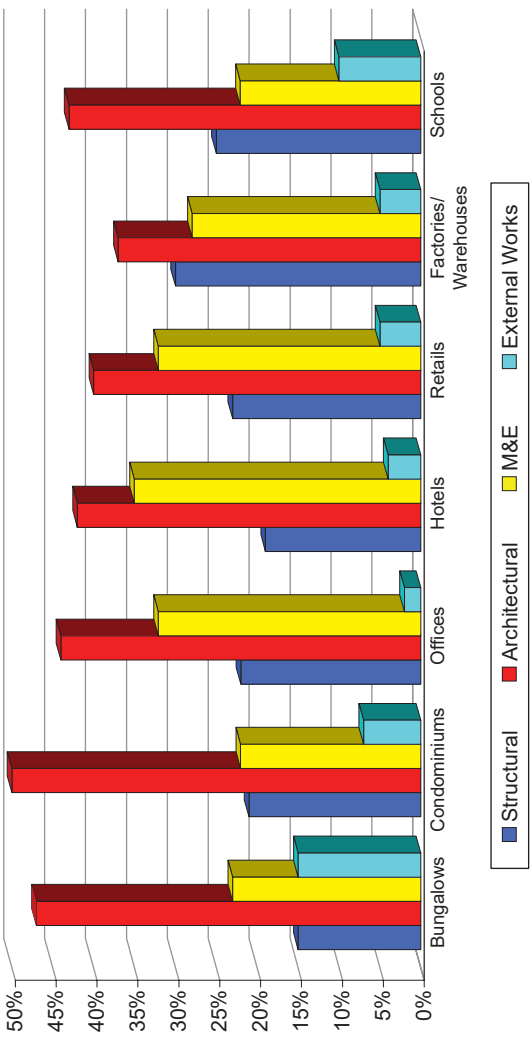
COST BREAKDOWN FOR DIFFERENT BUILDING TYPES

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.


50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Bungalows
Condominiums
Offices
Hotels
Retails
Factories/ Warehouses
Schools
Structural
Architectural
M&E
External Works

MAJOR RATES FOR SELECTED ASIAN CITIES

DESCRIPTION	UNIT	SINGAPORE ♣	KUALA LUMPUR	BANGKOK ◎	HONG KONG	MACAU
		S$	RM	BAHT	HK$	MOP
1. Excavating basement ≤ 2.00m deep	m^3	20	15 - 25	120 - 140	200	150
2. Excavating for footings ≤ 1.50m deep	m^3	20	15 - 25	140 - 180	180	180
3. Remove excavated materials off site	m^3	15 - 20	20 - 30	120 - 150	300 δ	150
4. Hardcore bed blinded with fine materials	m^3	50	72 - 95	650 - 750	950	1,200
5. Mass concrete grade 15	m^3	175 - 185♣♣	240 - 315	2,300 - 2,500	1,100	1,350
6. Reinforced concrete grade 30	m^3	115 - 120	260 - 320	2,600 - 2,800	1,200	1,250
7. Mild steel rod reinforcement	kg	1.25 - 1.35	3.4 - 3.8	26 - 29	9.7	9
8. High tensile rod reinforcement	kg	1.25 - 1.35	3.4 - 3.8	26 - 28	9.7	9
9. Sawn formwork to soffits of suspended slabs	m^2	40	38 - 45	420 - 480	410	280
10. Sawn formwork to columns and walls	m^2	40	38 - 45	420 - 480	410	280
11. 112.5mm thick brick walls	m^2	35 - 40	42 - 50	650 - 750	400	450
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m^2	43	65 - 70	1,200	1,000	N/A

13. Aluminium casement windows, single glazed	m^2	290	380- 600	7,000	3,800	4,000
14. Structural steelwork - beams, stanchions and the like	kg	4 - 4.5	7.5 - 9.5	60 - 75	36	35
15. Steelwork - angles, channels, flats and the like	kg	4 - 4.5	7.5 - 9.5	60 - 75	42	40
16. 25mm cement and sand (1:3) paving	m^2	21	17 - 25	200 - 240	160	120
17. 20mm cement and sand (1:4) plaster to walls	m^2	22	18 - 25	220 - 260	165	150
18. Ceramic tiles bedded to floor screed (measured separately)	m^2	74	50 - 70	1,200	400	450
19. 12mm fibrous plasterboard ceiling lining	m^2	30	35 - 45	750 - 850	600	650
20. Two coats of emulsion paint to plastered surfaces	m^2	3.5 - 4	3.5 - 5	120 - 160	90	200
Average expected preliminaries	%	12 - 15	6 - 15	12 - 18	10 - 15	10

The above costs are at **4th Quarter 2018** levels and are based on lump sum fixed price contract rates exclusive of preliminaries and contingencies.

(Cont'd)

♣ Rates are nett of GST.

♣♣ Rates for lean conrete blinding.

ð Rate including dumping charges.

ϖ Rates are nett of VAT.

MAJOR RATES FOR SELECTED ASIAN CITIES (Cont'd)

DESCRIPTION	UNIT	SHANGHAI	BEIJING	GUANGZHOU/ SHENZHEN	CHONGQING/ CHENGDU
		RMB	RMB	RMB	RMB
1. Excavating basement ≤ 2.00m deep	m^3	30	30	30	30
2. Excavating for footings ≤ 1.50m deep	m^3	30	33	30	26
3. Remove excavated materials off site	m^3	135	60	105	95
4. Hardcore bed blinded with fine materials	m^3	190	180	190	170
5. Mass concrete grade 15	m^3	540	530	540	420
6. Reinforced concrete grade 30	m^3	570	550	580	550
7. Mild steel rod reinforcement	kg	5.8	5.6	6	5.3
8. High tensile rod reinforcement	kg	5.8	5.6	6	5.3
9. Sawn formwork to soffits of suspended slabs	m^2	90	90	90	65
10. Sawn formwork to columns and walls	m^2	90	85	85	60
11. 112.5mm thick brick walls	m^2	90 @	80	80	80
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m^2	N/A	N/A	N/A	N/A

13. Aluminium casement windows, single glazed	m^2	700	815*	700	650*
14. Structural steelwork - beams, stanchions and the like	kg	11	11	12.5	11
15. Steelwork - angles, channels, flats and the like	kg	9.5	9.5	11.5	11.1
16. 25mm cement and sand (1:3) paving	m^2	35	32	35	25
17. 20mm cement and sand (1:4) plaster to walls	m^2	35	32	30	35
18. Ceramic tiles bedded to floor screed (measured separately)	m^2	160	145	155	130
19. 12mm fibrous plasterboard ceiling lining	m^2	150	162	190	150
20. Two coats of emulsion paint to plastered surfaces	m^2	40	32	35	35
Average expected preliminaries	%	5 - 10	7 - 10	5 - 12	6 - 12

The above costs are at **4th Quarter 2018** levels and are based on lump sum fixed price contract rates exclusive of preliminaries and contingencies.

(Cont'd)

@ Rate for 120mm thick concrete block walls.

* Rate for double glazed window.

MAJOR RATES FOR SELECTED ASIAN CITIES (Cont'd)

DESCRIPTION	UNIT	MANILA	INDIA ©	JAKARTA #	HO CHI MINH #
		PHP	INR	IDR	VND
1. Excavating basement ≤ 2.00m deep	m^3	270	199	40,000	92,400
2. Excavating for footings ≤ 1.50m deep	m^3	500	225	75,000	92,400
3. Remove excavated materials off site	m^3	350	N/A	35,000	84,700
4. Hardcore bed blinded with fine materials	m^3	1,800	4,620	650,000	280,900
5. Mass concrete grade 15	m^3	3,400	6,248	950,000	1,696,400
6. Reinforced concrete grade 30	m^3	4,800	7,822	1,135,000	1,865,650
7. Mild steel rod reinforcement	kg	54	70	12,500	19,764
8. High tensile rod reinforcement	kg	55	72	12,500	19,908
9. Sawn formwork to soffits of suspended slabs	m^2	1,000	708	200,000	215,000
10. Sawn formwork to columns and walls	m^2	950	761	195,000	245,000
11. 112.5mm thick brick walls	m^2	N/A	1,155	250,000	312,780
12. "Kliplok Colorbond" 0.64mm profiled steel sheeting	m^2	1,400	1,785	300,000	401,110 - 597,600

13. Aluminium casement windows, single glazed	m^2	11,500 Ω	6,300	1,650,000	6,315,000
14. Structural steelwork - beams, stanchions and the like	kg	160	126	27,000	52,650
15. Steelwork - angles, channels, flats and the like	kg	160	126	27,000	52,650
16. 25mm cement and sand (1:3) paving	m^2	650	498	90,000	94,000
17. 20mm cement and sand (1:4) plaster to walls	m^2	700	409	100,000	144,000
18. Ceramic tiles bedded to floor screed (measured separately)	m^2	1,800	1,785	200,000	674,180
19. 12mm fibrous plasterboard ceiling lining	m^2	1,400	1,417	215,000¤	234,000
20. Two coats of emulsion paint to plastered surfaces	m^2	500	252	30,000	88,900
Average expected preliminaries	%	12 - 18	9 - 13	8 - 10	8 - 12

The above costs are at **4th Quarter 2018** 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.

₲ All rates above are Supply and Fix, based on projects in Bangalore and are nett of GST. Mumbai costs are generally 8% higher.

Rates are nett of VAT.

¤ Rate for 9mm gypsum board.

M&E COSTS FOR SINGAPORE

TYPES	ACMV S$/m²	ELECTRICAL S$/m²
RESIDENTIAL		
Detached Houses	109 - 155	161 - 214
Average Standard Condominium	90 - 111	97 - 144
Luxury Condominium	102 - 170	167 - 213
OFFICE		
Average Standard Offices	153 - 197	158 - 201
Prestige Offices	185 - 249	182 - 258
INDUSTRIAL		
Flatted Factories	57 - 117	72 - 136
Warehouses	34 - 65	55 - 87
HOTEL		
3-Star Hotels	215 - 245	277 - 336
5-Star Hotels	232 - 278	316 - 356
OTHERS		
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 4th Quarter 2018 levels.

HYDRAULIC	FIRE	LIFTS	BAS
S$/m²	S$/m²	S$/m²	S$/m²
132 - 189	0 - 24	-	-
72 - 108	25 - 35	41 - 49	-
95 - 146	30 - 43	55 - 100	-
26 - 46	33 - 52	63 - 103	10 - 25
36 - 55	38 - 56	80 - 162	15 - 28
18 - 36	37 - 51	41 - 85	5 - 15
18 - 27	23 - 51	41 - 104	0 - 10
122 - 157	28 - 53	49 - 69	25 - 36
131 - 172	33 - 55	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

BUILDING TYPE	SINGAPORE ♣	KUALA LUMPUR	BANGKOK ♥	HONG KONG	MACAU
	S$/m² CFA	RM/m² CFA	BAHT/m²CFA	HK$/m² CFA	MOP/m² CFA
MECHANICAL SERVICES					
Offices	153 - 249	320 - 490	4,400 - 4,800	1,900 - 2,700	N/A
Industrial *	34 - 117	85 - 190	1,550 - 1,600	160 - 260	N/A
Hotels	129 - 278	300 - 590	4,600 - 5,100	2,100 - 2,650	2,640 - 3,050
Shopping Centres	147 - 246	300 - 475	4,600 - 4,800	2,200 - 2,750	2,400 - 3,000
Apartment	90 - 170	120 - 210	4,300 - 4,500	850 - 2,000up	900 - 1,200
ELECTRICAL SERVICES					
Offices	158 - 258	290 - 460	3,400 - 3,800	1,750 - 2,450	N/A
Industrial **	55 - 136	145 - 190	1,950 - 2,200	620 - 860	N/A
Hotels	181 - 356	295 - 550	3,800 - 4,500	1,900 - 2,600	2,640 - 3,150
Shopping Centres	160 - 304	295 - 460	2,800 - 3,200	1,800 - 2,450	2,640 - 3,000
Apartment	97 - 213	105 - 210	2,800 - 3,350	1,100 - 2,100up	1,020 - 1,320
HYDRAULIC SERVICES					
Offices	26 - 55	35 - 65	780 - 900	700 - 900	N/A
Industrial	18 - 36	40 - 50	750 - 790	500 - 700	N/A
Hotels	91 - 172	175 - 270	1,400 - 1,650	2,000 - 3,000	1,830 - 2,240

Shopping Centres	46 - 80	30 - 35	790 - 950	700 - 900	610 - 810
Apartment	72 - 146	50 - 100	1,200 - 1,400	1,400 - 2,200	1,520 - 2,030
FIRE SERVICES					
Offices	33 - 56	60 - 80	780 - 850	550 - 700	N/A
Industrial	23 - 51	45 - 65	730 - 750	400 - 500	N/A
Hotels	28 - 57	65 - 90	780 - 890	600 - 850	910 - 1,120
Shopping Centres	37 - 56	55 - 80	780 - 820	550 - 700	610 - 810
Apartment	25 - 43	15 - 30	720 - 850	100 - 600	250 - 300
LIFTS / ESCALATORS					
Offices	63 - 162	125- 350	1,100 - 1,350	700 - 1,200	N/A
Industrial	41 - 104	55- 180	N/A	550 - 750	N/A
Hotels	49 - 108	100- 285	1,100 - 1,400	550 - 850	610 - 810
Shopping Centres	56 - 90	95- 120	250 - 450	850 - 1,000	460 - 710
Apartment	41 - 100	65- 110	500 - 580	450 - 850	460 - 610

The above costs are at **4th Quarter 2018** levels, exclusive of contingencies.

(Cont'd)

* Generally without A/C.
** Excludes special power supply.
♣ Rates are nett of GST and excluding BAS.
Φ Based upon nett enclosed area and nett of VAT.

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

BUILDING TYPE	SHANGHAI	BEIJING	GUANGZHOU/ SHENZHEN	CHONGQING/ CHENGDU
	RMB/m² CFA	RMB/m² CFA	RMB/m² CFA	RMB/m² CFA
MECHANICAL SERVICES				
Offices	790 -1,005	775 - 1,071	775 - 1,070	730 - 990
Industrial *	176 - 295	170 - 280	155 - 285	140 - 230
Hotels	1,010 -1,316	950 - 1,224	1,080 - 1,350	930 - 1,280
Shopping Centres	1,070 -1,125	806 - 970	715 - 910	890 - 1,010
Apartment	320 - 423	143 - 459	152 - 410	150 - 300
ELECTRICAL SERVICES				
Offices	620 - 700	470 - 717	540 - 795	450 - 660
Industrial **	311 - 440	326 - 459	320 - 459	260 - 360
Hotels	677 - 864	719 - 962	715 - 1,020	580 - 830
Shopping Centres	540 - 677	490 - 690	500 - 690	510 - 660
Apartment	262 - 383	258 - 406	285 - 500	230 - 340
HYDRAULIC SERVICES				
Offices	112 - 166	97 - 143	128 - 184	85 - 120
Industrial	89 - 131	97 - 143	89 - 124	85 - 120
Hotels	375 - 498	377 - 490	390 - 500	330 - 450

Shopping Centres	140 - 188	143 - 204	114 - 168	100 - 150
Apartment	171 - 231	173 - 234	150 - 280	100 - 180
FIRE SERVICES				
Offices	232 - 325	184 - 270	230 - 350	240 - 290
Industrial	160 - 268	153 - 230	143 - 272	130 - 230
Hotels	294 - 397	224 - 383	285 - 425	250 - 350
Shopping Centres	263 - 391	224 - 383	248 - 383	250 - 370
Apartment	56 - 105	71 - 138	72 - 152	60 - 110
LIFTS / ESCALATORS				
Offices	288 - 567	294 - 577	295 - 517	300 - 550
Industrial	139 - 402	145 - 400	150 - 440	150 - 350
Hotels	226 - 510	232 - 520	250 - 480	250 - 430
Shopping Centres	335 - 510	327 - 520	325 - 470	290 - 440
Apartment	170 - 300	175 - 289	130 - 500	140 - 240

The above costs are at **4th Quarter 2018** levels, exclusive of contingencies.

(Cont'd)

* Generally without A/C.
** Excludes special power supply.

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

BUILDING TYPE	MANILA Ω	INDIA ₲	JAKARTA #	HO CHI MINH
	PHP/m² CFA	INR/m² CFA	IDR/m² CFA	VND/m² CFA
MECHANICAL SERVICES				
Offices	4,000 - 5,930	4,800 - 6,805	1,028,000 - 1,183,000	2,036,000 -2,902,000
Industrial *	800 - 1,500	2,210 - 3,925	466,000 - 744,000	N/A
Hotels	3,500 - 9,670	5,880 - 6,420	1,022,000 - 1,210,000	N/A
Shopping Centres	2,890 - 6,840	4,585 - 6,005	905,000 - 1,087,000	N/A
Apartment	1,360 - 4,430	2,620 - 3,245	915,000 - 1,001,000	1,537,000 - 2,106,000
ELECTRICAL SERVICES				
Offices	3,700 - 7,000	4,250 - 5,840	830,000 - 1,060,000	2,275,000 -2,723,000
Industrial **	2,000 - 3,500	2,500 - 4,150	589,000 - 833,000	N/A
Hotels	4,700 - 12,000	4,710 - 6,425	835,000 - 937,000	N/A
Shopping Centres	3,600 - 6,000	4,050 - 5,420	723,000 - 910,000	N/A
Apartment	3,600 - 6,800	2,040 - 2,805	878,000 - 1,049,000	2,006,000- 2,534,000
HYDRAULIC SERVICES				
Offices	1,230 - 2,200	740 - 1,130	209,000 - 294,000	332,000 - 621,000
Industrial	800 - 1,300	510 - 890	139,000 - 214,000	N/A
Hotels	2,250 - 6,820	3,868 - 5,825	835,000 - 1,054,000	N/A

Shopping Centres	1,220 - 1,600	1,100 - 1,990	198,000 - 305,000	N/A
Apartment	2,250 - 3,600	1,745 - 2,410	889,000 - 1,124,000	647,000 - 752,000
FIRE SERVICES				
Offices	950 - 1,560	1,185 - 1,545	284,000 - 375,000	704,000 - 1,167,000
Industrial	800 - 2,000	540 - 745	150,000 - 214,000	N/A
Hotels	1,100 - 2,030	1,375 - 1,760	284,000 - 332,000	N/A
Shopping Centres	1,090 - 1,730	1,130 - 1,310	278,000 - 326,000	N/A
Apartment	900 - 1,300	630 - 750	294,000 - 343,000	483,000- 606,000
LIFTS / ESCALATORS				
Offices	1,600 - 4,620	985 - 1,250	444,000 - 1,065,000	670,000 - 1,279,000
Industrial	0 - 400	640 - 825	N/A	N/A
Hotels	1,800 - 3,400	1,430 - 2,085	434,000 - 707,000	N/A
Shopping Centres	1,600 - 2,680	1,675 - 2,145	326,000 - 878,000	1,364,000 - 1,931,000
Apartment	850 - 3,440	890 - 1,150	434,000 - 798,000	761,000 - 1,101,000

The above costs are at **4th Quarter 2018** levels, exclusive of contingencies.

(Cont'd)

* Generally without A/C.

** Excludes special power supply.

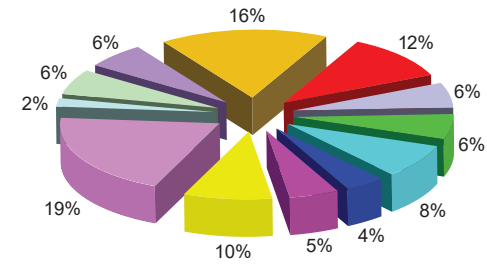
Ω Transformer, included in Electrical Services.

₲ Rates are based on projects in Bangalore and are nett of GST. 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.

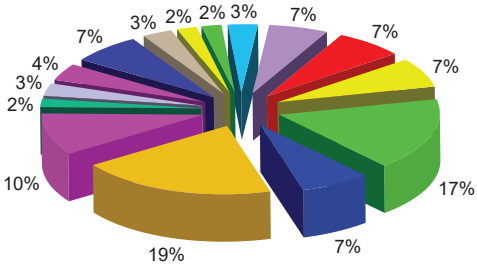
OFFICE M&E COST COMPONENTS

ACMV Installation Cost Breakdown for Office Building



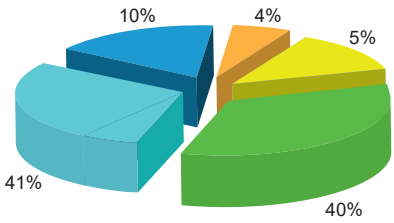
- Chillers plant
- Chilled water AHU / FCU system
- Cooling towers
- AC ductworks, diffusers and accessories
- Chilled water pumps
- Split type air-conditioning units
- Chilled water pipeworks
- Mechanical ventilation fan system
- Condenser water pumps
- MV ductworks, diffusers and accessories
- Condenser water pipeworks
- Electrical and automatic control works

Electrical Installation Cost Breakdown for Office Building



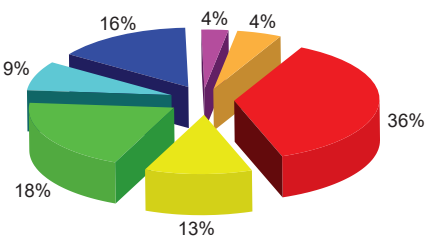
- Sub-station, HV & LV switchgear
- Telephone distribution system
- Power transformer
- Underfloor trunking system
- LV mains & sub-mains distribution system
- Public address system
- Standby generator
- MATV/SCV system
- Final sub-circuit for lighting & power points
- CCTV/Guard Patrol System
- Luminaries
- Intercom/Card access system
- Earthing system
- External lighting
- 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

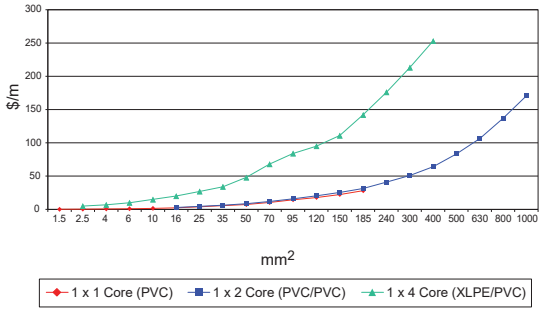
Fire Protection Installation Cost Breakdown for Office Building



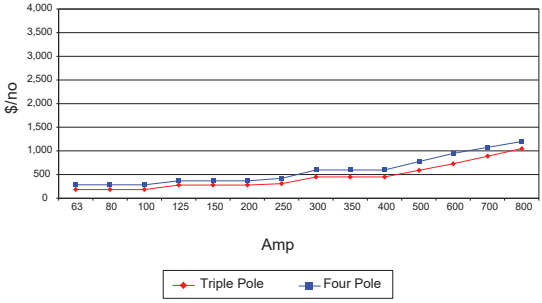
- Sprinkler System
- Automatic fire alarm & detection system
- Hose reel System
- Portable fire extinguisher
- Wet riser System
- External fire hydrants
- Dry riser System

M&E COST CHARTS

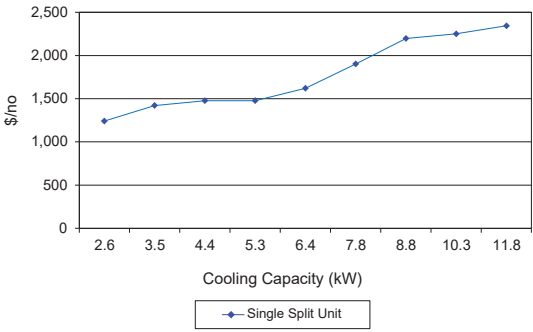
Single Core PVC Cables



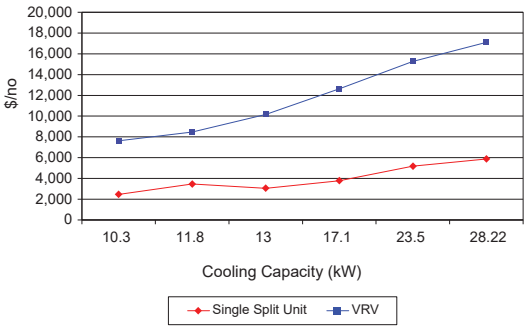
22kA MCCB



Wall Mounted Direct Expansion Fan Coil Unit

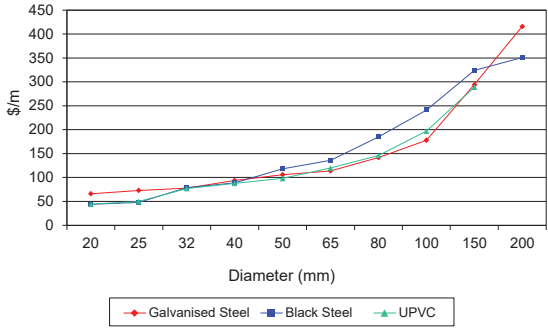


Condensing Unit

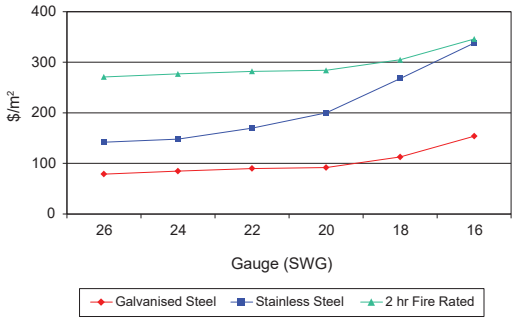


M&E COST CHARTS

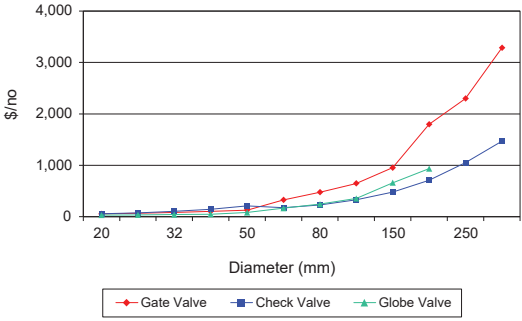
Pipework



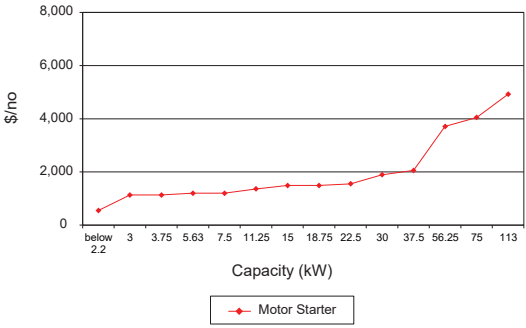
Ductwork



Valve



Motor Starter



UTILITY COSTS FOR SELECTED ASIAN CITIES COSTS ARE AT 4TH QUARTER 2018

CITIES	EXCHANGE RATE USED US$1=	ELECTRICITY (US$/kWh)		WATER (US$/m³)		FUEL (US$/LITRE)		
		DOMESTIC	COMMERCIAL/ INDUSTRIAL	DOMESTIC	COMMERCIAL/ INDUSTRIAL	DIESEL	LEADED	UNLEADED
Singapore*	S$1.38	0.17^	0.17^	1.99^^-2.67^^^	1.99^^^^	1.34^^^^^	N/A	1.94^^^^^^
Bangalore	INR71.90	0.069-0.100	0.087-0.128	0.556-0.695	1.39	1.001	N/A	1.072
Bangkok	BAHT32.73	0.072-0.136**	0.096-0.098	0.259-0.441	0.290-0.483	0.895	N/A	0.881*
Beijing	RMB6.94	0.071-0.113	0.219-0.221 (peak) 0.124-0.126 (normal)	0.721-1.296	1.296-1.368	1.10	N/A	1.22•••
Chongqing	RMB6.94	0.08	0.11	0.61	0.85	1.22	N/A	1.28*
Guangzhou	RMB6.94	0.085-0.128	0.089-0.124	0.285-0.571	0.50	0.97	N/A	1.12¤
Ho Chi Minh+	VND22,600	0.11	0.1/0.06	0.24	0.75/0.43	0.82	N/A	0.92
Hong Kong	HK$7.82	0.11SS	0.13	0.83SS1	0.59	1.83	N/A	2.21
Jakarta	IDR15,180	0.097*	0.097**	0.069-0.491*	0.450-0.965**	0.481	N/A	0.543
Kuala Lumpur	RM4.18	0.052-0.137	0.091-0.122	0.136-0.478	0.495-0.545	0.522	N/A	0.526
Macau	MOP8.07	0.17oo	0.17oo	0.56-0.90o	0.75ooo	1.7	N/A	1.45
Manila	PHP52.88	0.21'	0.19'	0.29-0.74'	1.37'	0.972	N/A	1.146
New Delhi	INR71.9	0.069-0.111	0.070-0.111	0.35-1.05	1.390-2.44	0.992	N/A	1.141
Shanghai	RMB6.94	0.089 (peak) 0.044 (normal)	0.157 (peak) 0.075 (normal)	0.497-0.840	0.68	1.16	N/A	1.220

Singapore	*	All rates are nett of GST
	^	Electricity tariff is based on low tension power supply
	^^	Domestic water tariff effective from 1 July 2018. Rate includes water conservation tax, water-borne fee, sanitary appliance fee and is an average for ≤40m³
	^^^	Domestic water tariff effective from 1 July 2018. Rate includes water conservation tax, water-borne fee, sanitary appliance fee and is an average for >40m³
	^^^^	Non-domestic water tariff effective from 1 July 2018. Rate includes water conservation tax, water-borne fee and sanitary appliance fee
	^^^^^	As at 2 November 2018
	^^^^^^	98 Unleaded petrol as at 2 November 2018
Bangkok	*	Unleaded gasohol 95
	**	For normal tariff with consumption not exceeding 150kWh per month
Beijing	***	Unleaded gasoline 97#
		Electricity: (Dom/month): 1-240 kWh = US$0.071; 241-400 kWh = US$0.078; 400 kWh above= US$0.113 Electricity:Comm/Ind: Central Districts: Peak = US$0.221, Normal = US$0.126; Other Districts: Peak = US$0.219, Normal = US$0.124 Water: (Dom/year): 1-180m3 = US$0.721; 181-260m3 = US$1.008; 261m3 above = US$1.296 Comm/Ind: Central Districts: US$1.368; Other Districts= US$1.296
Chongqing	*	Unleaded 93# = US$0.93/litre; Unleaded 97# = US$0.98/litre
Guangzhou	¤	Unleaded gasoline 97#
Ho Chin Minh	+	All rates are VAT inclusive
Hong Kong	SS	Electricity: (Dom): 0-400 kWh = US$0.11; 400-1,000kWh = US$0.12; 1,000 - 1,800kWh = US$0.14; 1,800 - 2,600kWh = US$0.18; 2,600 - 3,400 kWh = US$0.21; 3,400 - 4,200 kWh = US$0.23; Above 4,200 kWh = US$0.23(Based on tariff scheme of CLP Holding Limited and is charged on bi-monthly consumption)
	SS1	Water: (Dom): 0-12m3 = F.O.C; 12 - 43m3 = US$0.54; 43 - 62m3 = US$0.83; Above 62m3 = US$1.17
Jakarta	*	Domestic group in Indonesia will cover residence, religion building, non-profit organization building and government hospital
	**	Commercial group in Indonesia will cover luxury residence, apartment, offices, hotel, commercial building, and factories
Kuala Lumpur		Unleaded petrol Ron 95 Electricity (Commercial/Industrial): Tariff A & Tariff D (low voltage)
Macau	o	Water: Consumption charge : US$0.56/m3 for 28m3 or below, US$0.64/m3 for 29m3 to 60m3, US$0.75/m3 for 61m3 to 79m3 and US$0.90/m3 for 80m3 or above; Other charges (Depending on meter size 15mm - 200mm) : Meter rental = US$0.34 - 57.64/month;
	oo	Electricity tariff are composition of demand charges, consumption charges, fuel clause adjustment and government tax
	ooo	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.
Manila	'	Electricity - (Dom) : 190 kWh - 2099kWh; (Comm/Ind): 185,404kWh; Water - (Dom): 24m3 - 101m3; (Comm/Ind) 3,750m3
Shanghai	^	Electricity: (Dom): 0-3,120 kWh = US$0.089 (peak) / US$0.044 (normal); 3,120-4,800kWh = US$0.098 (peak) / US$0.049 (normal); Above 4,800kWh = US$0.141 (peak) / US$0.070 (normal); (Charged on yearly consumption)
	^^	Charges on consumption less than 1,000kWh per month for summer period only. Refer to www.shdrc.gov.cn for detailed charges for different tiers and charges for non-summer period
	^^^	Water: (Dom): 0-220m3 = US$0.497/m3; 220 - 300m3 = US$0.696/m3; Above 300m3 = US$0.840/m3
	^^^^	Unleaded 95

CONTRACT PROCUREMENT 3

COMMON STANDARD FORMS OF CONTRACT IN SINGAPORE - CURRENT AS OF 2019

- SIA Building Contract 2016 With Quantities published by the Singapore Institute of Architects, 1st Edition, July 2017
- SIA Building Contract 2016 Without Quantities published by the Singapore Institute of Architects, 1st Edition (EA), July 2017
- SIA Building Contract 2016 Design and Build With Employer's Design published by the Singapore Institute of Architects, 1st Edition (EA), July 2017
- Articles and Conditions of Contract for Minor Works 2012 published by the Singapore Institute of Architects, 1st Edition, December 2012
- SIA Sub-Contract 2016 for use in conjunction with the Main Contract, 1st Edition (EA), July 2017
- REDAS Design and Build Conditions of Main Contract published by the Real Estate Developers' Association of Singapore, 3rd Edition July 2013
- REDAS Design and Build Conditions of Sub-Contract published by the Real Estate Developers' Association of Singapore, 1st Edition July 2013
- Public Sector Standard Conditions of Contract for Construction Works published by the Building and Construction Authority, 7th Edition, July 2014
- Public Sector Standard Conditions of Contract for Design and Build published by the Building and Construction Authority, 6th 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, 5th Edition December 2008

STANDARD FORMS (PRIVATE SECTOR) - MAIN FEATURES

SIA Building Contract 2016

(1) Contractor's rates include all other works necessary to complete the Works, whether or not specifically mentioned in the Contract Documents [Article 8]

(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) Contractor to submit setting out and levelling proposal [Clause 8]

(6) Provision is made for staged possession of the site and phased completion of the Works [Clauses 10 and 25]

(7) No provision for Employer to take out insurances [Clauses 19 and 20]

(8) 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)]

(9) Architect to determine extension of time within 28 days from cessation of delay event and receipt of sufficient information [Clause 23(5)]

(10) Architect to apportion "equitably" extension of time for concurrent delay events [Clause 23(6)]

(11) Following failure of Contractor to remedy any defects within 84 days from Schedule of Defects (or such other period as stated in Appendix), Architect must direct the Contractor, within 14 days from the expiry of 84 days from the issue of the Schedule of Defects, that a defect need not be remedied with a corresponding reduction in the contract sum based on the estimated cost incurred by the Employer to employ other Contractors to remedy the defects [Clause 27(3)]

(12) Architect to issue Maintenance Certificate within 14 days after all defects are either remedied, or dealt with under Clause 27(3) [Clause 27(5)]

(13) Contractor is responsible for Designated/Nominated Sub-Contractors in respect of design, delays, etc. [Clause 28(3)]

(14) Duo track of payment processes - contractual payment scheme [Clause 31]; and separate clause on statutory payment and adjudication [Clause 40]

(15) Architect issues Interim Certificates on the dates or at the milestones for issuing interim payment named in Appendix [Clause 31(1)]

(16) Contractor to submit final account claim after completion has achieved and last statutory instrument obtained or before end of Maintenance Period, whichever is later [Clause 31(9)]

(17) Architect issues Final Certificate within 84 days from receipt of final account claim or issue of maintenance certificate whichever is the later [Clause 31(10)]

(18) Architect has no power to certify compensation to Contractor for breaches of contract by Employer [Clause 31(12)]

(19) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 38]

(20) 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 39]

(21) Optional clauses permit fluctuations on specified materials [Clause 41] and insurance excesses [Clause 42]

SIA Sub-Contract 2016

(1) Contractor issues directions and instructions to the Sub-Contractor [Clause 2.1]

(2) Contractor orders variations on sub-contract works [Clause 4.1]

(3) Application for extension of time is made to the Contractor, not the Architect [Clause 9.2]

(4) Time period for notification of any event, direction or instruction entitling the Sub-Contractor to an extension of time is 21 days [Clause 9.2]

(5) Extension of time is assessed and granted by the Contractor [Clause 9.2]

(6) The following certificates are issued by the Contractor:

- Sub-Contract Completion Certificate [Clause 8.1]
- Sub-Contract Maintenance Certificate [Clause 11.2]
- Sub-Contract Termination Certificate [Clause 12.2]

(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 10]

(8) Duo track of payment processes - contractual payment scheme [Clause 13]; and separate clause on statutory payment and adjudication [Clause 17]

(9) Sub-Contractor entitled to interim payment based on the amount certified in the Architect's Interim Certificate under the Main Contract Conditions [Clause 13:2]

(10) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 15]

(11) 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 16]

SIA Building Contract – Design and Build With Employer's Design {only main features which differ from the "Build" form are highlighted below}

(1) Merging procurement practice of Early Contractor Involvement ("ECI") [ECI Preamble]

(2) Parties to perform contract in good faith [Article 12]

(3) Architect empowered to issue Architect's Instructions to vary Design Concept, Employer's Architectural Design Requirements ("EADR"), Employer's Project Objectives ("PO"), Project Objective Priorities ("POP") [Clause 1(4)]

(4) Period for Design Contractor's confirmation of verbal direction(s) / instruction(s) is within 14 days from receipt of said request [Clause 1(1)]

(5) Employer is responsible for his design contained in the EADR before the Design Contractor shall have been selected. The Design Contractor shall be responsible for implementing the EADR and continuing the design. [Clause 2(1)]

(6) Design Contractor shall warrant that the Design Contractor's works proposal ("DCWP") and the Works shall meet the Employer's requirements and shall be fit for the purpose with respect to the EADR. [Clause 2(1)]

(7) Design Contractor to procure professional indemnity insurance for his design works [Clause 2(1)]

(8) Architect to provide design and specification as defined in EADR. Employer shall not be obliged to furnish the complete or all obligations, requirements by technical agencies over the works [Clause 3(1)]

(9) Contractor to design, integrate design, supervise, make applications to obtain statutory permits and/or approvals and complete the Works [Clause 3(2)]

(10) Architect to issue the following certificates in relation to completion [Clauses 3(7) and 22] :

- Completion of Design Works Certificate [on completion of Building Works and obtainment of the last statutory instrument of any authority governing the Building Works]
- Completion of Building Works Certificate
- Completion of the Works Certificate [on or after the completion of the Design Works and the Building Works]

(11) Design Contractor shall carry out any variation of the Works required for compliance with legal requirements without adjustment of the contract sum or extension of time [Clause 7(2)]

(12) Provisions on respective dates for commencement of design works and commencement of building works [Clause 10]

(13) Architect to determine extension of time as soon as reasonable after cessation of delay event and it is possible to decide the length of period of extension [Clause 23(5)]

(14) Provisions on nominated and designated sub-contractors classified as optional clause [Clause 40]

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) Contractor to provide a performance bond (either as cash deposit or on-demand bond from a bank) within 28 days from letter of acceptance or such other longer period as stated in Appendix [Clause 4.5]

(3) Provision for Named Sub-Contractors; Contractor is entitled to rights of objection [Clauses 2.4 and 2.5]

(4) 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]

(5) Contractor to engage qualified design professionals for the design and submission of the Works [Clause 4.3]

(6) 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]

(7) Provision is made for completion of the Works in whole or in phases/sections [Clause 10]

(8) Contractor must satisfy extensive criteria before handing over [Clause 11]

(9) 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]

(10) 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]

(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) ("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]

(12) Employer's Representative issues Interim Payment Certificate within 14 days of receipt of payment claim [Clause 22.2]

(13) 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]

(14) 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]

(15) Claims for additional payment are regulated by a claims procedure [Clause 29]

(16) Employer may at his convenience at any time to terminate the Contract without cause [Clause 30.1]

(17) Contractor entitled to suspend work pursuant to provisions of SOP Act [Clause 31.1]

(18) Contractor entitled to serve Notice of Termination following failure of payment of adjudicated amount by Employer [Clause 31.2]

(19) 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]

(20) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 33]

(21) Additional optional clause permit fluctuations on specified materials used for permanent works only [Clause 34]

(22) 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

REDAS Design and Build Conditions of Sub-Contract

(1) Sub-Contract Sum inclusive of all ancillary and other necessary works and expenditure, whether or not specifically mentioned in the Sub-Contract Documents [Clause 2.3]

(2) Sub-Contract shall be construed consistently with the requirements of the Main Contract Documents [Clause 3]

(3) Sub-Contractor to engage suitably qualified design professionals and/or site supervisors to carry out Sub-Contract Works [Clause 6.4]

(4) Contractor issues instructions to the Sub-Contractor [Clause 7.1]

(5) Sub-Contractor to provide a performance bond (either as cash deposit or on-demand bond within 14 days from sub-contract letter of acceptance. Sub-Contractor may obtain bond from financial institution (and not bank) unlike the Main Contract Conditions [Clause 8]

(6) Sub-Contract Works and design shall be fit for their intended purpose in accordance with the Employer's Requirements; Sub-Contractor also responsible for the sufficiency and correctness of the Contractor's and Employer's designs, specifications and calculations in the Employer's Requirements insofar as they apply to the Sub-Contract Works [Clause 9.1]

(7) Sub-Contractor entitled to a grant of extension of time for delay arising from events set out in clause 16.1 of the Main Contract, or from any act, default and breach of the Sub-Contract by the Contractor [Clause 12.1]

(8) Application for extension of time is made to the Contractor, not the Employer's Representative [Clause 12.2]

(9) Time period for notification of any event, direction or instruction entitling the Sub-Contractor to an extension of time is 21 days [Clause 12.2.1]

(10) Time period for notification of Sub-Contractor's in principle entitlement to his extension of time claim is 35 days of request to do so. [Clause 12.2.3]

(11) Provision for recovery of general damages for delay in completion only - amount is set off and deducted from monies due to the Sub-Contractor after condition precedents are satisfied [Clauses 12.3 & 12.4]

(12) Where the Contractor's employment is terminated for any reason whatsoever, and should the Employer so requires, the Sub-Contractor agrees that Sub-Contract shall be novated to Employer or any party nominated by the Employer [Clause 13.2]

(13) Sub-Contract Maintenance Period shall commence upon the date of handing over as set out in the Sub-Contract Handing Over Certificate and shall continue until the issue of the Sub-Contract Maintenance Certificate by the Contractor [Clause 14.1]

(14) Contractor orders variations on Sub-Contract works [Clause 17.1]

(15) 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) ("the SOP Act") on the Contractor on the 24th day of each month following the month in which the Sub-Contract is made (or otherwise by such time or on such day as stated in Appendix 1) [Clause 18.1]

(16) Contractor responds to payment claim within 21 days of receipt of Sub-Contractor's payment claim [Clause 18.6]

(17) Sub-Contractor to serve his Final Payment Claim on the Contractor within 14 days after the occurrence of the events specified in Clause 24.3.1 of the Main Contract Conditions whichever is the later [Clause 18.7]

(18) Contractor to provide payment response by issuing Final Payment Certificate within 14 days of receipt of the Final Payment Claim [Clause 18.7]

(19) Sub-Contractor is entitled to serve notice of termination following failure of adjudicated amount by Contractor [Clause 22.5]

(20) Parties may refer dispute to mediation; provision for mediation does not affect or prejudice right to refer dispute to arbitration [Clause 25.1]

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]

(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) Cumulative amount of liquidated damages is capped at $50 million or contract sum whichever is lower [Clause 16 and Appendix]

(9) Superintending Officer may require the Contractor to submit quotation for any proposed variation before issuing an instruction [Clause 19.3]

(10) Contractor may submit alternative proposals for variations to the Works which are likely to offer significant benefits. Actual cost savings shared by Employer and Contractor in equal proportions [Clause 19.4]

(11) 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]

(12) 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]

(13) 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]

(14) 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) ("the SOP Act") on the Employer at monthly intervals (on the day of each month specified by the Superintending Officer following the month in which the Contract is made [Clause 32.1]

(15) Superintending Officer issues Payment Certificate to the Contractor within 14 days of receipt of Payment Claim [Clause 32.2(1)]

(16) Payment Certificate issued by Superintending Officer shall be deemed the Payment Response from the Employer under the SOP Act if the Employer does not provide any response within 14 days from the Payment Claim [Clause 32.2(2)]

(17) 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)]

(18) Contractor has 90 days from the Date of Substantial Completion to submit Final Payment Claim which shall constitute a Payment Claim under the SOP Act [Clause 32.4]

(19) 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)]

(20) 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 SOP Act [Clause 32.5(2)]

(21) Mechanism for fluctuation of materials prices applicable to specified materials in Appendix [Clause 33]

(22) Any dispute or difference which involves a Payment Claim or Payment Response to which the SOP Act applies, Contractor entitles to make an adjudication application [Clause 35.5(1)]

(23) 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]

(24) Advance payment to Contractor for projects adopting Prefabricated Prefinished Volumetric Construction (PPVC); Advance payment will only be made after receipt of advance payment guarantee (issued by bank or Monetary Authority of Singapore approved insurance company) [Option Module D]

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, Qualified Persons, Resident Engineer and any others as required by statute; such persons cannot be replaced without prior consent of the Superintending Officer. Where Accredited Checker or Registered Inspector is required, they shall be engaged by the Employer [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 the Employer's Consultant and Contractor carries out work as shown/described in documents. 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 guaranteed price forms the price cap – with the risk of final cost exceeding this cap falling on the contractor. If the work is completed for less than the GMP, the contract may provide for some financial incentives, usually by way of a mutually agreed cost savings sharing scheme.

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 Contacts

A management contract is one in which the Management Contractor is appointed by the Employer to manage the planning and construction of a project and in which the construction work is executed by Works Contractors selected and contracted with the Management Contractor as the job proceeds.

The Management Contractor prepares the programme, decides on the contents of each work package to be let out, 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 where by 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 fixed-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

EXCHANGE RATES

Approximate current rates at 23 January 2019

COUNTRY	PER UNIT	S$
Australia	dollar	0.97
China	rmb	0.20
Europe	eur	1.545
Hong Kong	100 HKd	17.32
India	100 rupees	1.9094
Indonesia	100 Rp	0.00959
Japan	100 yen	1.24
Korea	won	0.0012057
Malaysia	ringgit	0.329
Philippines	100 peso	2.5727
Taiwan	NT dollar	0.043995
Thailand	100 baht	4.2837
United Kingdom	pound	1.76
USA	dollar	1.36
Vietnam	dong	0.000059

Source: The Hongkong and Shanghai Banking Corporation Limited

PRIME RATES

Indicative prime rates as at 4th Quarter 2018

COUNTRY	RATE (% pa)
China**	4.75
Hong Kong	5.13
India	9.45
Indonesia	6.75
Macau	5.38
Malaysia^^^	4.60
Philippines	4.35
Singapore	5.33
Thailand#	7.00
United Kingdom	0.75
United States of America	5.25
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

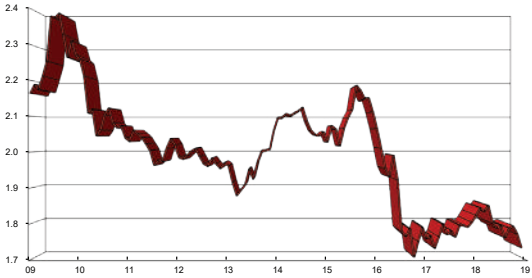
Thailand# = Minimum Loan Rate % per annum (Average based on local bank)

Vietnam## = Minimum and in VND per year

CURRENCY FLUCTUATIONS

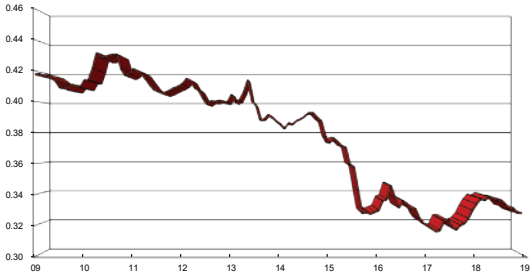
Sterling Pound

S$ per 1 STGP



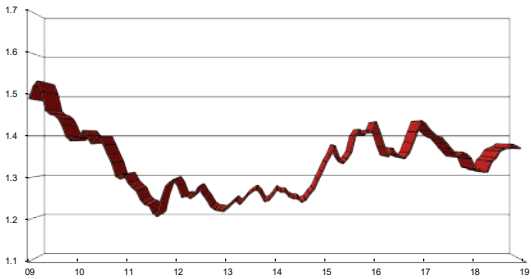
Ringgit Malaysia

S$ per 1 RM



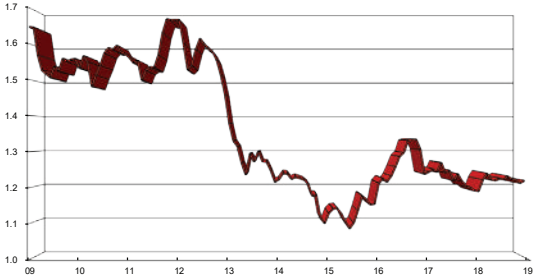
US Dollar

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^2	=	1 ha	9 ft^2	=	1 yd^2
100 ha	=	1 km^2	4,840 yd^2	=	1 acre
			640 acre	=	1 $mile^2$
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^2	=	0.093 m^2	1 m^2	=	10.764 ft^2
1 yd^2	=	0.836 m^2	1 m^2	=	1.196 yd^2
1 acre	=	0.405 ha	1 ha	=	2.471 acres
1 $mile^2$	=	2.590 km^2	1 km^2	=	0.386 $mile^2$
(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	=	1.341 hp
ºC = (ºF-32) x 5/9			ºF = (ºC x 9/5) + 32		

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 New York	 1 1	 -15 -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
www.boa.gov.sg
www.bca.gov.sg
www.cpf.gov.sg
www.hdb.gov.sg
www.iras.gov.sg
www.sla.gov.sg
www.ipos.gov.sg
www.iesingapore.gov.sg
www.mlaw.gov.sg
www.lta.gov.sg
www.mci.gov.sg
www.mccy.gov.sg
www.mindef.gov.sg
www.moe.gov.sg
www.mof.gov.sg
www.mfa.gov.sg
www.moh.gov.sg
www.mha.gov.sg
www.mlaw.gov.sg
www.mom.gov.sg
www.mnd.gov.sg
www.msf.gov.sg
www.mewr.gov.sg
www.mti.gov.sg
www.mot.gov.sg
www.mas.gov.sg
www.nparks.gov.sg
www.peb.gov.sg
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 Pte Ltd

www.scdf.gov.sg
www.singstat.gov.sg
www.edb.gov.sg
www.gov.sg
www.sla.gov.sg
www.mnd.gov.sg/stb/
www.ura.gov.sg

www.redas.com
www.sgbc.sg
www.planning.org.sg
www.sia.org.sg
www.aces.org.sg
www.ies.org.sg
www.sprojm.org.sg
www.sisv.org.sg
apfm.org.sg/
www.sibl.com.sg
www.lawsociety.org.sg
www.spgroup.com.sg

www.arcadis.com
www.arcadis.com
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 ISO45001/ 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 ISO45001/ OHSAS18001 GGBS	
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		
C1	$300,000	$3.0m	$3.0m	1RP/P + 1T of which -1RP/P/T with BCCPE	BizSAFE Level 3/ ISO45001/ OHSAS18001	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		
C3	$25,000	$100,000	$100,000	1RP/P/T with BCCPE		

Source: Building and Construction Authority as at June 2018.

Note:

1) Please refer to Page 104 for the tendering limits

2) m stands for million, min stands for minimum

Financial

3) Both minimum paid-up capital and minimum 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 ISO 45001 / OHSAS 1800 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 2 July 2018.

CONSTRUCTION WORKHEADS (CW01 & 02)	A1	A2	B1	B2	C1	C2	C3
Tendering limit ($million) 1 Jul 17 to 30 Jun 18	Unlimited	85.0	40.0	13.0	4.0	1.3	0.65
Tendering limit ($million) 1 Jul 18 to 30 Jun 19	Unlimited	85.0	40.0	13.0	4.0	1.3	0.65
SPECIALIST WORKHEADS (CR, ME, MW & SY)	**Single Grade**	**L6**	**L5**	**L4**	**L3**	**L2**	**L1**
Tendering limit ($million) 1 Jul 17 to 30 Jun 18	Unlimited	Unlimited	13.0	6.5	4.0	1.3	0.65
Tendering limit ($million) 1 Jul 18 to 30 Jun 19	Unlimited	Unlimited	13.0	6.5	4.0	1.3	0.65

Source: Building and Construction Authority as at 2 July 2018

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 2019 to 31 December 2019, the MYAF is 1.029.

The example below illustrates the adjusted MYE:

		FROM 1 JANUARY 2019 - 31 DECEMBER 2019	
NOMINAL PROJECT VALUE	MYE ALLOCATION (NO TPI ADJUSTMENT)	MYAF	MYE ALLOCATION (WITH TPI ADJUSTMENT)
$15 Million	103	1.029	103 x 1.029 = 106

Source: Building and Construction Authority as at 4 January 2019

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^2 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^2 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*		
CATEGORY OF BUILDING WORK/DEVELOPMENT	2,000m² ≤ GFA < 5,000m²	5,000m² ≤ GFA < 25,000m²	GFA ≥ 25,000m²
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 ≥ 2,000m²
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^2 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 2015December 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 than 6 storeys

YEAR	FROM 1 MAY 2017*	
CATEGORY OF BUILDING WORK/DEVELOPMENT	5,000m² ≤ GFA < 25,000m²	GFA ≥ 25,000m²
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*	
CATEGORY OF BUILDING WORK/DEVELOPMENT	5,000m² ≤ GFA < 25,000m²	GFA ≥ 25,000m²
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) <u>Higher Minimum Prefabrication Level for Industrial Sites Sold under IGLS Programme</u>

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 5,000m2 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	5,000m² ≤ GFA < 25,000m²	GFA ≥ 25,000m²
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) disciplined 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 (Seventh Edition – December 2018)*

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.

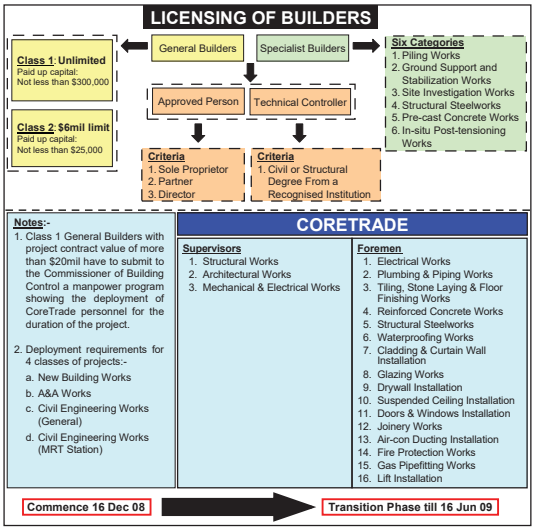
CURRENT CONSTRUCTION REGULATIONS

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.
(Deployment of CoreTrade Supervisors is applicable to projects whose permits to carry out structural works are submitted to BCA from 1 April 2013 onwards.)				
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	
(Deployment of CoreTrade Supervisors is applicable to projects whose permits to carry out structural works are submitted to BCA from 1 April 2013 onwards.)				
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

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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 implemented from 1 January 2017 onwards, **BCA has phased out the project-level CoreTrade deployment requirement for Tradesmen**, and focused on building up key construction personnel at the Foremen and Supervisory levels. All new and on-going CoreTrade projects will not be required to comply with the deployment requirements for the 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 on 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 130 for details.

Maintenance of Barrier-Free Provisions
Please refer to Page 157 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:

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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 **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. 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 prohibited, except for a detached, semi-detached, terrace or linked house used solely as a **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.
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: (a) clearances, permits or approvals under the Fire Safety Act relating to fire safety from the Commissioner of Civil Defence (b) clearances, permits or approvals under the Sewerage and Drainage Act relating to sewerage and drainage from the Public Utilities Board (c) clearances, permits or approvals under the Environmental Protection and Management Act from the Director-General of Environmental Protection (d) clearances, permits or approvals under the Street Works Act and Parking Places Act from the Land Transport Authority of Singapore (e) clearances, permits or approvals under the Parks and Trees Act from the Commissioner of Parks and Recreation.
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 www.bca.gov.sg 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) is not the specialist in that alternative solution, the application for approval of the plans of those building works shall be accompanied by details of the alternative solution, together with the certificate of a specialist in the alternative solution 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 approved building plans (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 www.bca.gov.sg 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 www.bca.gov.sg 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 2nd 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:

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

Source: Building and Construction Authority as at 9 September 2018

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

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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, **GM Version 3.0, May 2010** 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, **GM Version 4.0, August 2010** 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 to 30 November 2017 (for Residential Buildings)	BCA Green Mark Certification Standards for New Building, **GM Version 4.1, October 2012** 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 **(GM NRB : 2015)**, August 2016
From 1 December 2017 onwards (for Residential Buildings)	BCA Green Mark for Residential Buildings : 2016 **(GM RB : 2016)**, August 2017

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)
Green Mark Gross Floor Area (GM-GFA) Incentive Scheme Incentives in the form of additional GFA can be granted by URA if the development attains Green Mark Gold^{PLUS} or Platinum Rating	Based on the submission date of BCA GM-GFA application. 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. 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.
Government Land Sales (GLS) Programme Any new development located on land sold under the GLS programme and are required to attain higher Green Mark Rating Mark Platinum Rating	Based on the GLS tender closing date. 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. 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.
Public Sector Taking the Lead on Environmental Sustainability (PSTLES)	Based on the date of tender notices for the consultancy or design and build contract. 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. 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.

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)
Green Mark Gross Floor Area (GM-GFA) Incentive Scheme Incentives in the form of additional GFA can be granted by URA if the development attains Green Mark Gold^{PLUS} or Platinum Rating	Based on the submission date of BCA GM-GFA application. 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. 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.
Government Land Sales (GLS) Programme Any new development located on land sold under the GLS programme and are required to attain higher Green Mark Rating	Based on the GLS tender closing date. 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. 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.
Public Sector Taking the Lead on Environmental Sustainability (PSTLES)	Based on the date of tender notices for the consultancy or design and build contract. 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. 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.

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 came into effect from 29 April 2014 and shall lasts 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^{PLUS} and above. The quantum of GM GFA allowed under the Scheme is up to 1% for Green Mark Gold^{PLUS} and up to 2% for Green Mark Platinum, subject to a cap of 2,500m^2 for Gold^{PLUS} and 5,000m^2 for Platinum.

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

- Residential – non-landed, mixed commercial & 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

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- Existing private developments which undergo "substantial energy efficiency (EE) enhancements" to achieve higher GM rating (i.e. GM Platinum and GM Gold^{PLUS}) under the 'New Building' category. This is applicable to existing buildings of 10 years old and above from the date of the TOP[1]. 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)

[1] *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.

On 9 May 2018, iGrant was further extended and enhanced to include Integrated Digital Delivery (IDD), where digital technologies are adopted to integrate work processes and connect stakeholders working on the same project throughout the construction and building life-cycle.

The enhanced iGrant is effective from 1 July 2018 till 31 October 2020 or till the $5 million is exhausted, whichever comes first.

Source: Building and Construction Authority

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

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

The requirements on environmental sustainability for 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

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buildings as well as hawker centres, healthcare facilities, laboratory buildings and schools. The effective date for this scheme is 1 December 2016 onwards.

- BCA Green Mark for Super Low Energy Buildings (GM SLE) is an additional recognition to GM NRB: 2015 and GM ENRB: 2017 - Applicable for new and existing non-residential buildings including commercial, industrial and institutional buildings as well as schools. The effective date for this scheme is 5 September 2018 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) - Applicable to existing commercial, industrial and institutional buildings under operation. The effective date for this scheme is 13 September 2017 onwards.

- 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 - HPB Green Mark for Healthier Workplaces (GM HW: 2018) - Applicable for new office fit-outs and existing offices in operation. The effective date for this scheme is 1 October 2018 onwards and will replace the currrent BCA Green Mark for office interior (Version 1.1) starting from 1 April 2019.

- 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 20 April 2018 onwards.

- BCA Green Mark for Supermarket (Version 1.0) - Applicable for supermarket. The effective date for this scheme is 11 October 2012 onwards.

- BCA-IMDA 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-IMDA 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 20 December 2017 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.

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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^{PLUS}, Gold and Certified.

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^{PLUS}	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 EXISTING NON-RESIDENTIAL BUILDINGS
Green Mark Platinum	70 and above
Green Mark Gold^{PLUS}	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^{PLUS}	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^{PLUS}	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 OCTOBER 2018 GM 2018 HEALTHIER WORKPLACES
Green Mark Platinum	70 and above
Green Mark Gold^{PLUS}	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 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^{PLUS}	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-REQUISTES
Green Mark Platinum	100 and above	At least one building (GFA >5,000m^2) at Phase 1 to achieve Green Mark Platinum
Green Mark Gold^{PLUS}	90 to <100	At least one building (GFA >5,000m^2) at Phase 1 to achieve Green Mark Gold^{PLUS}
Green Mark Gold	75 to <90	At least one building (GFA >5,000m^2) at Phase 1 to achieve Green Mark Gold
Green Mark Certified	60 to <75	Nil

GREEN MARK RATING	GREEN MARK POINTS WITH EFFECT FROM 20 APRIL 2018 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^{PLUS}	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^{PLUS}	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 20 DECEMBER 2017 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^{PLUS}	85 to <95	60 to <70
Green Mark Gold	75 to <85	50 to <60
Green Mark Certified	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)

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.

A new sub-category called BCA Green Mark Platinum^{STAR} Champion was introduced in 2016 in recognition of the efforts of those who have achieved 50 or more building projects with Green Mark Platinum rating.

There are 2 categories for the award:

a) BCA Green Mark Champion

b) BCA Green Mark Platinum Champion

- BCA Green Mark Platinum^{STAR} 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	
		BCA GREEN MARK PLATINUM CHAMPION	BCA GREEN MARK PLATINUM^{STAR} CHAMPION
Green Mark Gold and above	At least 10	At least 50	-
Green Mark Gold^{PLUS} and above	At least 6	At least 30	-
Green Mark Platinum	At least 3	At least 15	At least 50

Source: Building and Construction Authority

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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^{PLUS} 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[1]
Outside Good Class Bungalow Areas (GCBAs)	$\frac{40\% \text{ of Site Area}}{Y}$ Where Y = Typical footprint for the relevant conventional landed housing form[2]
Within GCBAs	$\frac{35\% \text{ of Site Area}}{Y}$ Where Y = Typical footprint for a Good Class Bungalow[2]
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	$(B \times Y) + (SD \times Y) + (T \times Y) \leq 40\%$ of Site Area Where, B = Number of detached housing units SD = Number of semi-detached housing units T = Number of terrace housing units Y = Typical footprint for the relevant conventional landed housing form[2]

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[3].

[1] The number of units will be rounded down to the nearest round figure.

[2] The typical footprint of the various conventional landed housing forms is 100m^2 for terrace and semi-detached housing, 200m^2 for detached housing and 500m^2 for Good Class Bungalows.

[3] 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

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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 revision 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 mider 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
GFA exemption apply to: • Bay windows • Planter boxes	With effect from 1 January 2009: GFA exemption rescinded for: • Bay windows in all developments • Planter boxes within a residential unit GFA exemption continue to apply to: • Planter boxes provided within non-residential developments • Planter boxes provided within the communal areas of residential developments With effect from 12 June 2014: GFA exemption rescinded for: • Private planter boxes provided within non-residential developments GFA exemption apply to: • Communal planter boxes not exceeding 1 metre width provided within residential and non-residential developments.
GFA exemption apply to: • Private Enclosed Spaces (PES) and Private Roof Terraces (RTs)	With effect from 12 January 2013: GFA exemption rescinded for: • PES and Private RTs in non-landed strata-titled residential developments GFA exemption continue to apply to: • Communal RTs that are open to sky in non-landed strata-titled residential developments

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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[1] 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

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component of mixed-use projects[1] 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 **80%** 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) **90 points** for GFA ≥ 25,000m^2 b) **87 points** for GFA ≥ 5,000m^2 but less than 25,000m^2 c) **82 points** for GFA ≥ 2,000m^2 but less than 5,000m^2
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[2]. 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[2].

[1]Applicable to all new building projects with GFA of 2,000m^2 or more.

[2]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

Bonus GFA Scheme for Indoor Recreation Spaces in Private Non-Landed Residential Developments

On 17 October 2018, URA has introduced a new Bonus GFA scheme to encourage the greater provision of communal indoor recreation spaces in private non-landed residential developments. It seeks to promote more activities and bonding among residents through the provision of covered communal spaces.

Private non-landed residential developments and the residential component of mixed-use developments can apply for the communal indoor recreation spaces to be counted as bonus GFA, provided such spaces exceed 0.6% of the total GFA of the development or 10 sqm (whichever is higher)[1]. The bonus GFA is capped at 1% of total GFA (or the GFA of the residential component for mixed-use developments). See Figure 1 below.

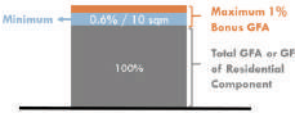

Figure 1: Bonus GFA scheme for indoor recreation spaces

The examples of communal indoor recreation spaces are gyms, function rooms, libraries, game rooms, reading rooms or other appropriate communal indoor recreation spaces subject to URA's evaluation. These spaces are to be retained as common property of the development and kept accessible to residents of the development. They are only to be used for non-commercial purposes.

This new scheme will apply to all development applications for new erection, amendments to approved developments or additions and alterations of existing private non-landed residential developments or mixed-use developments with a residential component effective from 17 October 2018.

The overall cap of 10% for additional GFA allowed beyond MP allowable GPR for each development site shall apply. All additional GFA granted will not form the future development potential of the site.

[1] If the proposed communal indoor recreation spaces do not exceed 0.6% of the total GFA of the development or $10m^2$ (whichever is higher), these spaces will be counted under the main building GFA instead of bonus GFA.

Source: Urban and Redevelopment Authority

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Revision to the Balcony Incentive Scheme (BIS) for Private Non-Landed Residential Developments

The above new guidelines took effect from 17 January 2019 and are summarised as follows:

Reduction of Bonus GFA Cap for Private Outdoor Spaces

a. Bonus GFA cap for these spaces will be reduced from 10% to 7%

b. Developers can still achieve up to 10% bonus GFA beyond the Master Plan allowable Gross Plot Ratio by qualifying for other incentive schemes, such as the Green Mark Bonus GFA Scheme and the new Indoor Recreation Space Bonus GFA Scheme

OTHER INCENTIVE SCHEMES	Bonus GFA
• Private Outdoor Spaces (i.e. balcony/ PES/Roof Terraces)	7%
• Green Mark Bonus GFA (Gold^{PLUS}/ Platinum)	1% to 2%
• Communal Indoor Recreation Space	1%
Total	**9% to 10%**

c. Additional GFA granted will not form the future development potential of the site

Revision on Size and Width Requirements for Balconies

a. The total balcony area(s) for each unit will be capped at 15% of the net internal area

b. Each balcony is to have a minimum width of 1.5 metres as measured from the external building wall

Screens for Balconies

a. Developers are required to inform homebuyers of the allowable balcony screens at the point of purchase

For more information, please refer to the Urban Redevelopment Authority's circular no.: URA/PB/2018/07-DCG dated 17 October 2018.

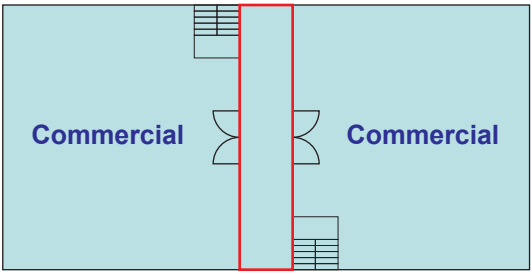
Revised Gross Floor Area (GFA) Apportionment Rules for Common Areas in Mixed-Use Developments

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: Urban Redevelopment Authority

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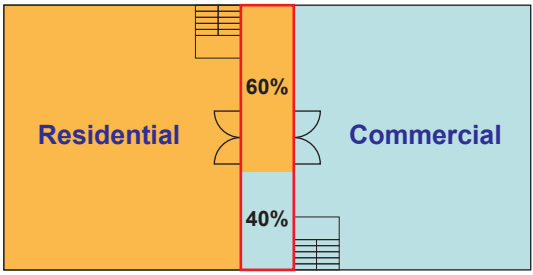
b) Non-Attributable Space

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: Urban Redevelopment 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 URA's website. (https://www.ura.gov.sg)

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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.)

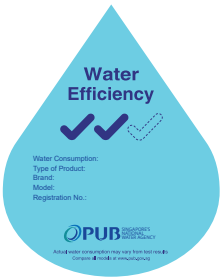


Figure 1: An example of 2-tick showerhead (voluntary WELS).

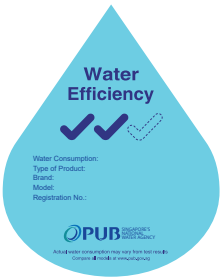


Figure 2: An example of 2 tick taps and mixers, dual-flush low capacity flushing cisterns, urinal flush valves, waterless urinals.

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. With effect from 1 October 2018, dishwashers intended for household use shall be affixed with the water efficiency label. (See Annex A for the current ratings for clothes washing machines and dishwashers.)

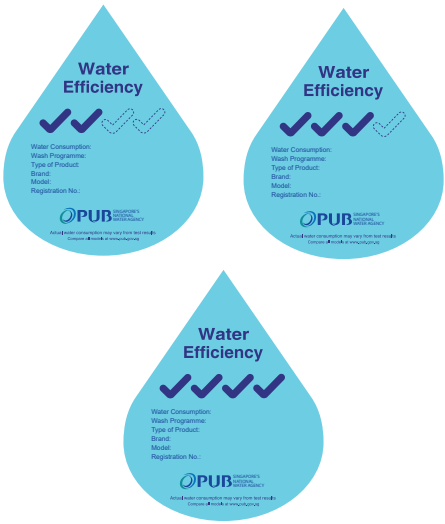
CURRENT CONSTRUCTION REGULATIONS

Annex A

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

Current WELS rating from May 2018				
	✓ 1-tick	✓✓ 2-tick	✓✓✓ 3-tick	✓✓✓✓ 4-tick
Clothes Washing Machines for household use (Per Washload)		>9 to 12 litres/kg	>6 to 9 litres/kg	6 litres/kg or less
Dishwashers for household use (Per Place Setting)	>1.2 to 1.5 litres	>0.9 to 1.2 litres	>0.6 to 0.9 litres	0.6 litres or less

With effect from 1 October 2018, dishwashers intended for household use shall be affixed with the water efficiency label. A 1-tick water efficiency rating for dishwashers with wash volume of more than 1.2 to 1.5 litres, 2-tick for more than 0.9 to 1.2 litres, 3-tick for more than 0.6 to 0.9 litres and 4-tick for 0.6 litres or less.



Water Efficiency Label for Clothes Washing Machines and Dishwashers (Mandatory WELS)

Source : Public Utilities Board as at 4 May 2018

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.

With effect from 1 April 2018, all water fittings, appliances, apparatuses and products covered under WELS, shall be certified by an Accredited Certification Body for WELS in accordance with SACCT 19 for ISO/IEC Type 1a certification scheme (based on Type Testing).

Prior to certification by an Accredited CB, the water fitting, appliance, apparatus and product to be labelled under the WELS shall be tested for compliance with PUB's stipulated standards and requirements under Regulation 5 of the Public Utilities (Water Supply) Regulations.

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.

CURRENT CONSTRUCTION REGULATIONS

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 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.

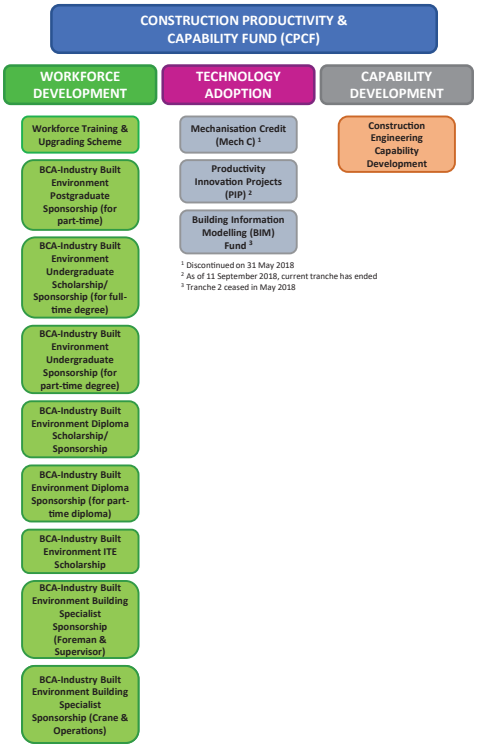
4. For Housing Development Board (HDB) developments, the estimated capital costs are in the range from $750 to $1,100 for 3-room to 5-room apartments respectively when residents opt for the gas continuous flow heaters. Generally, the payback period is in the range of 0.75 to about 2 years.

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 as at 17 December 2018

CURRENT CONSTRUCTION REGULATIONS

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:

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.
- The MechC Scheme has discontinued on 31 May 2018.

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.

- The MechC Referral Programme has discontinued on 31 May 2018.

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.

CURRENT CONSTRUCTION REGULATIONS

- As of 11 September 2018, current tranche of PIP Scheme has ended.

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 2nd Construction Productivity Roadmap, on 10 March 2015, the Government has announced that a fresh funding of $450 million has been set aside for the 2nd 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)

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.

In both the Budget 2018 and 2019 Speech, the Government announced the FWL rates will remain unchanged for all sectors.

The table below illustrates an overview on the changes of FWL for WPHs in the construction sector from July 2014 to July 2020:

CONSTRUCTION SECTOR		1 JULY 2014 $/MONTH	1 JULY 2015 $/MONTH	1 JULY 2016 $/MONTH	1 JULY 2017 $/MONTH	1 JULY 2018 $/MONTH	1 JULY 2019 $/MONTH	1 JULY 2020 $/MONTH
Basic Tier [1]	**Higher Skilled** [3a] ***(Skilled Workers)***	300	300	300	300	300	300	300
	Basic Skilled [3b] ***(Unskilled Workers)***	550	550	650	700	700	700	700
MYE-Waiver [2]	**Higher Skilled** [3a] ***(Skilled Workers)***	700	600	600	600	600	600	600
	Basic Skilled [3b] ***(Unskilled Workers)***	950	950	950	950	950	950	950

CURRENT CONSTRUCTION REGULATIONS

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] and [3b] - From July 2011 onwards, the MYE levy rates for the construction sector refer to **Higher Skilled** (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. (http://www.mom.gov.sg)

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 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.

For more information, please refer to NEA's website. (www.nea.gov.sg)

CURRENT CONSTRUCTION REGULATIONS

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:

- 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 toll-free 24 hour call centre (local) at 1800-2255-782
- 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 (and doing a search under "Eurocodes")
- Https://www.bca.gov.sg/academy/courses_tests.aspx?txtCourseTestCode=eurocode

Source: Building and Construction Authority

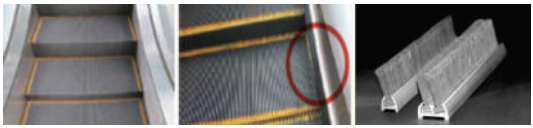
Installation of Deflector Devices on Escalator Skirting to Prevent Escalator Accidents

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

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.

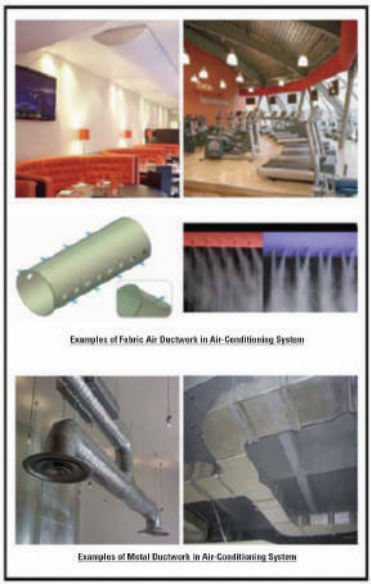
3. **Lightweight/Easy to Transport:** The weight of a fabric ductwork system can be significantly less than a comparable metal ductwork system. It also means lighter roof loads, ease of handling, and reduced need for power lifting equipment. Smaller and lighter packages reduce transportation costs and 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.



Examples of Fabric Air Ductwork in Air-Conditioning System

Examples of Metal Ductwork in Air-Conditioning System

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 Eunos 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[1] and condominium[2] developments outside the Central Area (CA) will be based on the following formula:

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

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[1] and condominium[2] developments within Kovan and Joo Chiat / Jalan Eunos GPR 1.4 Estates will be based on

the following formula:

$$\text{Maximum number of DUs per development} \leq \frac{\text{Master Plan Allowable GPR}^3 \text{ x Site Area}}{\text{100 sqm}}$$

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.

Revised Guidelines on Maximum Allowable Number of Dwelling Units for Non-Landed Residential Developments Outside the Central Area

As part of enhancing liveable space and addressing capacity concerns to reduce strain on local infrastructure, on 17 October 2018, URA has revised the existing guidelines on the maximum allowable number of Dwelling Units (DUs) for non-landed residential developments outside the Central Area (CA).

Under the revised guidelines, the maximum allowable number of DUs for all new flats and condominium development outside the CA will be derived by dividing the maximum allowable Gross Floor Area by 85 sqm up from 70 sqm based on the following formula:

$$\text{Maximum Number of DUs per development} \leq \frac{\text{Master Plan Allowable GPR}^3 \times \text{Site Area}}{\text{85 sqm}}$$

In addition, URA and LTA have also identified nine areas where the cumulative effect of new developments could pose a severe strain on local infrastructure. These areas are **Marine Parade, Joo Chiat-Mountbatten, Telok Kurau-Jalan Eunos, Balestier, Stevens-Chancery, Pasir Panjang, Kovan-How Sun, Shelford and Loyang.** For these areas, the maximum number of DUs for all new flats[1] and condominium[2] developments will be based on the following formula:

CURRENT CONSTRUCTION REGULATIONS

$$\text{Maximum Number of DUs per development} \leq \frac{\text{Master Plan Allowable GPR}^3 \times \text{Site Area}}{\text{100 sqm}}$$

The GFA of any proposed strata landed units will be excluded from the calculation in the above formulae.

The formulae for calculating the maximum allowance number of DUs are intended to derive an upper bound figure. The actual number of DUs that can be supported in any development will be assessed based on the site context, existing site conditions, and the impact on the local infrastructure. URA will also assess the overall layout, design and unit size of the development proposals, and may add other requirements where necessary to protect the quality of the living environment.

The guidelines will also apply to the residential component of mixed-use developments (e.g. Residential with Commercial at 1st storey or Commercial & Residential developments) and took effect on 17 January 2019.

The revised guidelines apply to relevant development applications submitted to URA on or after 17 January 2019. If the proposed development needs to undergo a Pre-Application Feasibility Study (PAFS)[4], applicants must first obtain LTA's clearance before submitting the application. Only formal development applications (excluding Outline Applications) which have already been granted Provisional Permission or which will result in a Provisional Permission that are submitted before 17 January 2019 will not be subject to the revised guidelines.

Source: Urban Redevelopment Authority

[1]Not applicable to Housing & Development Board (HDB) flats

[2]Including Executive Condominium

[3]Excludes bonus Gross Floor Area (GFA)

[4]The PAFS (URA/PB/2017/07-DCG) will estimate the supportable number of DUs, taking into consideration the car-lite measures and/or feasible transport improvement plans to be implemented by the developers

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

CURRENT CONSTRUCTION REGULATIONS

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

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.

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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[1] 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

[1] 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 (1st Edition) and Periodic Energy Audit of Building Cooling System on 1 July 2013. BCA has published 2nd edition on 1 July 2016.

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^2. 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^2.

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

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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.

To complement the scheme, BCA has produced this 2nd version of Green and Gracious Builder Guide to share with the industry, best practices of builders in addressing environmental concerns and mitigating possible inconveniences to the public caused by construction work.

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 30 September 2018, a total of 464 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 3rd 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 189 for details.

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

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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/)

3rd Green Building Masterplan

On 1 September 2014, BCA has launched the 3rd 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^{PLUS} 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.

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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)

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^3 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^3 or more.

- All new developments with temporary water supply with estimated monthly water consumption of 5,000m^3 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)

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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

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.

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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.

With effect from 15 January 2019, the Building Maintenance and Strata Management Regulations will allow the specialist professional engineer in the area of lift and escalator SPE(L&E) to certify lifts and escalators for the purpose of applying for Permits to Operate (”PTOs”) and AEs must not certify for any lift or escalator under the BMSM Regulations.

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)

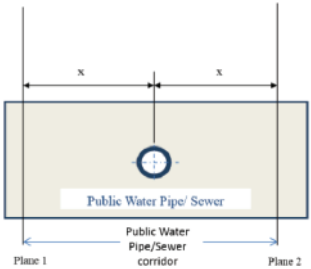
New Public Utilities Regulations and Sewerage and Drainage Regulations

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	10 metres
≥ 900mm	20 metres
Water Tunnels and DTSS	40 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/)

Changes to LTA's Car Parking Standards and Gazetting of Designated Car-Lite Precincts

On 9 November 2018, LTA has introduced a new Range-based Parking Provision Standards (RPPS) to replace the existing Car Parking Standards (CPS) and Range-based Car Parking Standards (RCPS). This revision will provide developers and building owners greater flexibility in managing their parking provision, particularly in areas well connected to the public transport system, and also free up more land for community spaces and greenery.

The RPPS will specify the range (i.e. a lower bound and an upper bound) of car parking provisions that private developments are allowed to provide, which will vary according to location zones and land uses. This will grant developers and building owners flexibility to determine the desire level of car parking provision within the stipulated range, without the need to seek LTA's approval.

LTA has also introduced mandatory motorcycle parking provision requirements in all non-residential developments to ensure new developments provide motorcycle parking lots. 5% of the total car and motorcycle parking lot provision requirement for developments will be allocated to motorcycles.

In addition, to enhance liveability and support the vision of a car-lite Singapore, five new growth areas namely Marina South, Kampong Bugis, Woodlands North, Bayshore and Jurong Lake District will be gazetted for developments as car-lite precincts. These precincts, classified as "Zone 4" in the RPPS, will be planned with strong public transport connectivity and alternative travel options. Parking provision for development applications within these five precincts will be determined by LTA on a case-by-case basis.

The following tabulation summaries the changes to the car parking standards:

PARKING ZONE	UPPER BOUND	LOWER BOUND
1 (CBD and Marina Bay, except car-lite precincts)	• 20% reduction from CPS: Office, Retail, F&B, Hotel, Non-residential white sites, Private condominiums and apartments • Same as CPS: All other uses	• 50% reduction from CPS: Office, Retail, F&B, Hotel, Non-residential white sites, Private condominiums and apartments • 20% reduction from CPS: All other uses
2 (Within 400m of a Rapid Transit System station, except car-lite precincts)	• 20% reduction from CPS: Office • Same as CPS: All other uses	• 50% reduction from CPS: Office, Retail, F&B, Hotel • 20% reduction from CPS: All other uses
3 (All other areas outside of Zones 1 and 2, except car-lite precincts)	• Same as CPS: All uses	• 20% reduction from CPS: All uses
4 (Car-lite precincts)	• Parking provision to be advised by LTA on a case-by-case basis	

Source: Land Transport Authority

The changes will apply to new development, redevelopment, selected additions and alternations (A&A) and change of use[1] application received on or after 1 February 2019 and will not be applied retrospectively.

Conversion of Surplus Car Parking Spaces to Other Uses

To align with the changes in parking provision policy, URA has reviewed the guidelines and treatment for surplus parking spaces.

Currently, URA allows surplus car parking spaces in existing Commercial, Mixed-use and Hotel developments within the Central Area to be permanently converted to additional GFA for other uses. Under RPPS, surplus carparks between the upper and lower bound parking requirement (see portion labelled ‘B’ in Figure 1) can also be considered for conversion.

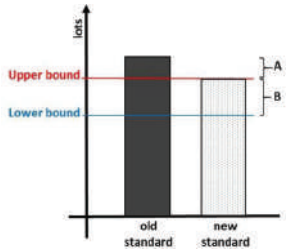


Figure 1: Diagram showing how surplus car parks arise in an existing development

Source: Urban Redevelopment Authority

This policy is extended to the following existing developments with convenient access to public transport:

a) Residential developments within the Central Area;

b) Commercial, Mixed-use, Hotel and Business Park developments within 400m of an MRT or LRT station

Computing Surplus Car Parking and Motorcycle Parking Lots as GFA

Currently, surplus parking spaces in new commercial, mixed-use and hotel developments are computed as GFA[2] to discourage the overprovision of parking spaces in these developments. Under RPPS, car park and motorcycle[3] park spaces provided over and above the upper bound will be computed as GFA. The policy to count surplus parking spaces as GFA will be extended to new developments:

a) Residential developments within the Central Area;

b) Business Parks within 400 meters of MRT and LRT stations.

The following table summarises the list of developments that the two policies above apply to. The new changes that took effect 1 Feb 2019 are highlighted in bold:

	CONVERT SURPLUS CAR PARKING SPACES INTO OTHER USES WITHIN EXISTING DEVELOPMENTS	COMPUTE SURPLUS CAR AND MOTORCYCLE PARKING SPACES AS GFA IN NEW DEVELOPMENTS
Central Area	Commercial, Mixed-use, Hotel and **Residential**	Commercial, Mixed-use, Hotel and **Residential**
Within 400m of MRT, LRT Stations	**Commercial, Mixed-use, Hotel and Business Parks**	Commercial, Mixed-use, Hotel and **Business Parks**
All Other areas	Not Applicable	Commercial, Mixed-use and Hotel

Source: Urban Redevelopment Authority

[1] The new standards will apply to A&A applications involving increase in GFA or change in existing or approved carpark layout or provision, and change of use applications involving more than 160m^2 of GFA.

[2] Each surplus car park lot is computed as 35m^2, which is assumed to be the average area of each car park lot, inclusive of circulation space. Each surplus motorcycle lot is computed as 12m^2.

[3] The new RPPS introduces mandatory requirements for motorcycle parking provision in all non-residential developments.

New Bicycle Parking Standards and Associated Gross Floor Area (GFA) Exemption

On 7 May 2018, LTA and URA have introduced new bicycle parking standards for all new developments and buildings undergoing redevelopment or reconstruction[1]. For developments located in Zone 1 and Zone 2, LTA may exercise flexibility to grant a reduction in the bicycle parking provision requirement, taking into consideration the development's location and type. The aim is to promote cycling as a mode of transport and support the car-lite vision for Singapore. This mandatory requirement came into effect on 8 May 2018.

Incentives for Bicycle Parking-Related Facilities

a) GFA Exemption

Bicycle parking spaces provided according to LTA's new bicycle parking provision standards will be exempted from GFA computation. The GFA exemption will also apply to surplus provision of bicycle parking spaces over and above LTA's minimum requirements if assessed by LTA and URA to be reasonable, given the context of the development.

In addition, provision of the End-of-Trip facilities such as showers, lockers and drying stations can also qualify for GFA exemption. This is to encourage developers to provide End-of-Trip facilities to better meet the needs of cyclists.

b) Travel Smart Grant (Developer)

On 29 September 2017, LTA has extended the Travel Smart Grant to developers to co-fund the cost of providing End-of-Trip facilities. LTA will co-fund up to 80% of the construction costs of End-of-Trip facilities for each successful Travel Smart Grant (Developer) application, up to a maximum of $80,000 per development. A total sum of $3 million has been allocated as a Travel Smart Grant (Developer) for developers and building owners. This grant will be available until 31 May 2019.

[1] This includes any A&A works that affect the first or carpark floors

Source: LTA and URA joint circular no: URA/PB/2018/03-DCG dated 7 May 2018

ARCADIS 5

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.

ABOUT US IN SINGAPORE

Arcadis is the leading **global Design & Consultancy for natural and built assets.** Applying our deep market sector insights and collective consultancy, engineering, project management services we work in partnership with our clients to deliver sustainable outcomes throughout the lifecycle of natural and built assets **that help to improve the quality of life.** Through the work that we do, we are helping our clients to address the toughest challenges, delivering value for them and the cities that we live in.

At Arcadis Singapore we have over 300 dedicated professionals armed with a vast background across a variety of specialist skills acquired from more than 80 years of experience. We combine our global connections with local market knowledge and practical experience to offer our clients the unique benefits of international expertise and local delivery. We understand that clients operating in natural and built environments today, have to tackle a growing number of complex issues. Arcadis Singapore has a range of expertise and solutions ranging from quantity surveying, project & programme management, environmental and design & engineering.

Globally, Arcadis employs more than 27,000 consultants in over 70 countries generating over €3.3 billion in revenues. Within the Asia region, we have access to over 4000 people across 50 offices. Arcadis is proud to have contributed to Asia's built asset and natural environments delivering some of the most iconic projects in Asia such as Gardens by the Bay in Singapore, Television Cultural Centre in Beijing, Hong Kong International Airport and International Finance Centre in Seoul.

ARCADIS CORPORATE SOCIAL RESPONSIBILITY COMMITMENT

In the bid to conserve our diminishing global energy reserve and reduce carbon emissions, Arcadis is committed to minimise the impact of the construction industry on our environment through internal environmental policies. 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.

Arcadis continually strives to commit our effort and time towards engaging the underprivileged in our society. We organise and participate actively in outreach and fundraising activities for the community and have supported various causes such as Hair for Hope, Shine Children and Youth Services, and Beyond Social Services. In 2018, we attained the SHARE Gold Award for our outstanding contributions towards the community chest.

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. We share with our Clients and business partners various hot topics impacting the industry through events and publications such as:

- Construction Cost Handbook
- International Construction Cost
- Quarterly Construction Cost Review
- Arcadis Insights Paper
- Arcadis Professional Development Seminars

ENVIRONMENTAL, HEALTH AND SAFETY

Environmental, Health and Safety are pillars in the core vision of Arcadis and thus keen interest is laid in providing a healthy and safe working environment for our staff, with a considerate approach in managing our environmental footprint and by reducing resource consumption and proper waste management practices.

Arcadis Singapore has been recognized as providing a safe workplace for staff by the Workplace, Health and Safety Council. For years, we have been awarded the BizSafe STAR and have been highlighted as BizSAFE partner. This will of course not stop and Arcadis continues to improve its health and safety system every year, ensuring employees have the proper tools to perform their work safely and create a shared responsibility, by showing stewardship in this effort.

Not only safety in the workplace is an effort Arcadis invests in, but focusing on the health of our employees is just as important. Whether it is through events related to physical activities or healthy lifestyles by organising shares related to nutrition, we keep on stressing the importance of taking care of your body. But physical health is just as important as mental health, so ensuring a balance between your work and personal life is maintained, is key to staff happiness and performance. Know that management is open to conversation and looking to continually improve this balance for the complete workforce of Arcadis.

In 2018, the Arcadis Singapore office was renovated, resulting in the reduction of office surface, coming from 3 floors to just 1 single floor being occupied. Not only did the renovation create a more pleasant, safe and professional working environment, we managed to reduce monthly energy consumption by 35%. This reduction is in line with Arcadis values, reducing the overall impact of our office and processes on the environment, whilst improving the quality of the work environment. The continuation of this strategy is always pursued and due to the efforts of our staff, we even managed to reduce our overall paper and water consumption accordingly.

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 continous 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 3rd 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.

DIGITAL CAPABILITIES

In order to maintain commercial advantage including remaining competitive in terms of digitalization, aligning ourselves with the Building and Construction Authority (BCA)'s implementation of Integrated Digital Delivery (IDD), Arcadis has also expanded our digital services to include the following:

1. Building Information Model (BIM) and Management;
2. Data Analytics; and
3. Drones.

Building Information Model (BIM) and Management

We have a BIM team of which they are involved, together with the BIM Manager, to have an effective BIM Execution Plan in projects. We currently have 28 certified BIM personnel who have undergone the Building and Construction Authority Academy (BCAA) BIM Management course and British Standards Institution (BSI) Level 2 Professional Training Course. The team is instrumental in many projects such as Funan, The Woodleigh, CapitaSpring, Jewel Changi Airport, JTC Bulim and Changi General Hospital. 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 2nd Runner Up. In the BIM competition 2013, we came in as 1st and 2nd Runners Up. Applying our proven BIM process and platforms simplifies how you communicate with stakeholders and helps you deliver projects faster and safer.

Data Analytics

Connect and visualize more data points across your operations to generate new and valuable insights into your projects and portfolios.

Drones

Collect data from remote sites or geographies, faster, using FAA-certified and insured small unmanned aerial systems (sUAS). The usage of drones combines improved data collection with an innovative approach towards managing and visualizing that same set of data and connects all stakeholders with one aligned version.

Digital enablement is a comprehensive and scalable approach toward data collection, management and visualization that unlocks the full potential of digital for the organization. If implemented and applied correctly, digital enables faster, safer, simpler and more informed management of the natural and built assets.

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 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.

Our 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 competitors 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

bsi. ISO 9001 Quality Management | ISO 14001 Environmental Management | OHSAS 18001 Occupational Health & Safety Management

FS 677252 EMS 677255 OHS 677256

SINGAPORE GREEN BUILDING COUNCIL FOUNDING MEMBER

bizSAFE Partner

COMMUNITY CHEST AWARDS SHARE GOLD

MiDAs Ministry for Defence Awards League

tda TOTAL DEFENCE AWARDS

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

- 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
- Procurement Management: Philosophy and Approaches
- Construction Insurance - Contract Provisions and Insurance Programmes
- Contract Administration - Some Practice Pointers under SIA and PSSCOC Standard Forms
- 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
- Managing Variation Claims - An Effective Contract Administration Approach
- Security of Payment Act - Who Makes the Best Adjudicator?
- Early Contractor's Involvement (ECI) – A Paradigm Shift in Procurement Approach

- Collaborative Contracting – Project Perspective
- A Value Approach Through Value Management
- Design for Manufacturing & Assembly – Prefabricated Pre-Finished Volumetric Construction
- Collaborative Contracting – Is the Singapore Construction Industry Ready?

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

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 fire 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 Construction Cost Review

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

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- 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
- 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
  - 2019

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 Approached
- 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

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- 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?
- 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, 1st 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
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- The Necessities of Construction IT Protocols

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- 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
- 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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From rapid urbanization and pressure on natural resources, to tighter regulation and market consolidation, we live in an increasingly complex world. We understand your business challenges and have first-hand experience of the assets you own and operate. We partner with you and bring unique insights to support you in getting better results, with more certainty from strategy, optimizing performance, enhancing resiliency or transformation of your asset- Arcadis has helped clients globally deliver success.

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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.

DESIGN & ENGINEERING

From tall buildings to the busy airports; from underground tunnels to iconic bridges, engineering feats help to improve the quality of life for us all. Our specialist engineers use their expertise and knowledge to deliver exceptional and sustainable outcomes for clients through working on some of the world's most impressive and well-known buildings and structures.

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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.

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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, time-frames and the large number of parties involved can be daunting. 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. As construction programs grow more complex, often with multi-geography delivery and faster paced schedules, the risks are getting.

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Arcadis Singapore Pte Ltd would like to acknowledge the invaluable support and advice from the following organizations:

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