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## Example 1

### Demolition and Hoarding

#### Project Parameters

Site Area:	50m x 20m = 1,000m <sup>2</sup>
Site Perimeter:	140m
Description of Site:	Corner site with 2 sides facing roads and 2 sides facing adjacent lots
CFA of Existing Building:	60% site coverage with 6 storeys high

Cost for Demolition and Hoarding per m <sup>2</sup> CFA						
Items	Backup Calculation	Qty	Unit	Rate	\$	
1. Covered Walkway (double deck)		70	m	17,000	1,190,000	
2. Hoarding		70	m	4,000	280,000	
3. Demolition of Existing Buildings *	1000m <sup>2</sup> x 60% x 6 =	3,600	m <sup>2</sup>	700	2,520,000	
Cost for demolition and hoarding					3,990,000	
Cost for demolition and hoarding per m <sup>2</sup> CFA	\$3,990,000 / 3,600m <sup>2</sup> =				\$1,108/m <sup>2</sup>	(as at 4th quarter 2014 price level)
Preliminaries	Priced separately, say 12% to 15%					

\* Up to ground floor. Removal of ground floor slab, substructure and foundation below are excluded.

# Example 2

## Bored Piles

### Project Parameters

Type of building:	Residential
Building height:	42 storeys including 2 storeys at basement
Depth of bored piles:	Average 40m deep from existing level (depth including empty bored pile at basement)
Diameter of bored piles	Mainly 2 500mm

### Norms Application

From the Table of Norm : bored piles of residential shall be 1m<sup>2</sup> cross section area of piles supporting 180 – 250m<sup>2</sup> CFA.

Consider soil quality and make necessary adjustments for the Norms. Now, say 1m<sup>2</sup> cross-section area of piles supporting 200m<sup>2</sup> CFA.

Cost for bored piles per m <sup>2</sup> CFA	
Items	Calculation
Bored pile cross section area per m <sup>2</sup> CFA	= 1/ <u>230m<sup>2</sup></u>
Volume of bored pile per m <sup>2</sup> CFA	= 1/ <u>230m<sup>2</sup></u> x 40m
Unit rate of 2 500mm dia. bored piles	\$ 10,000/m <sup>3</sup>
<b>Cost for bored pile per m<sup>2</sup> CFA</b>	= 1/ <u>230m<sup>2</sup></u> x 40m x \$10,000
	= \$1,740/m <sup>2</sup> CFA (as at 4th quarter 2014 price level)
Preliminaries	Priced separately, say 15% to 18%

# Example 3

## Driven H-piles

### Project Parameters

Type of building:	Residential
Building height:	42 storeys including 2 storeys at basement
Depth of H-piles:	Average 40m deep from existing level (depth including empty bored pile at basement)
Size of H-pile:	305 x 305 x 223kg/m; driven

### Norms Application

From the Table of Norm : 1 No. of 223kg/m H-pile could support 60 – 110m<sup>2</sup> CFA in residential category.

Consider the building configuration and number of storey, say 1 No. of pile supporting 80m<sup>2</sup> CFA.

Cost for H-piles per m <sup>2</sup> CFA	
Items	Calculation
No. of H-pile per m <sup>2</sup> CFA	= 1/ <u>80m<sup>2</sup></u>
Depth of H-pile per m <sup>2</sup> CFA	= 1/ <u>80m<sup>2</sup></u> x 40m
Unit rate of driven H-pile 305 x 305 x 223kg/m	= \$18/kg x 223kg/m
	= \$4,014/m
<b>Cost for H-pile per m<sup>2</sup> CFA</b>	= 1/ <u>80m<sup>2</sup></u> x 40m x \$4,014/m
	= \$2,007/m <sup>2</sup> CFA (as at 4th quarter 2014 price level)
Preliminaries	Priced separately, say 15% to 18%

# Example 4

## Raft Foundation

### Project Parameters

Type of building:	Residential
Building height:	42 storeys including 2 storeys at basement

### Norms Application

From the Table of Norm : the thickness of raft is around 0.1m per supporting floor and reinforcement ratio is 150 – 350kg/m<sup>3</sup> concrete.

Considering the building configuration and building height, say the thickness of raft = 4.2m and reinforcement ratio is 250kg/m<sup>3</sup> concrete. The top of raft is 1m below the existing ground level.

Cost for Raft per m <sup>2</sup> CFA						
	Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA
1.	Excavation; normal soil condition (assume 1m below ground); including cart away; excluding ELS	(1+4.2)/42 levels =	0.12	m <sup>3</sup>	450	54
2.	Blinding layer; Grade 10P; 75mm thick	0.075/42 levels =	0.002	m <sup>3</sup>	1,300	3
3.	Concrete; Grade 10P	0.1m <sup>3</sup> =	0.1	m <sup>3</sup>	1,500	150
4.	Reinforcement (including starter bar)	0.1m <sup>3</sup> x 250kg/m <sup>3</sup> =	25	kg	11	275
5.	Formwork	Girth of raft x 4.2/ total CFA, say 0.05m <sup>2</sup> =	0.05	m <sup>2</sup>	450	23
6.	Miscellaneous (such as expansion joint, etc.)	Say 3%				15
Cost for Raft per m <sup>2</sup> CFA						520 (as at 3rd quarter 2013 price level)
Preliminaries		Priced separately, say 10% to 15%				

# Example 5

## Basement Enclosure (Sheet Piles)

### Project Parameters

Basement Footprint:	2,000 m <sup>2</sup> (50 x 40m)	B1	3.5 m
Basement CFA:	4,000 m <sup>2</sup>	B2	3.5 m
Basement Perimeter:	180 m		
Excavation Depth:	8.5 m (3.5 + 3.5 + 1.5m average for substructure)	Footprint = 2,000 m <sup>2</sup>	40 m
		50 m	

Cost for Steel Piles per Basement Area					
Items	Backup Calculation	Qty	Unit	Rate	\$
1. Driven steel sheet piles (say adopting FSPIII; 17m deep)	180 x 17m x 150kg/m <sup>2</sup> =	459,000	kg	18	8,262,000
2. Strutting	180 x 8.5 x 600kg/m <sup>2</sup> =	918,000	kg	18	16,524,000
3. Excavation (including cart away/backfill)	2,000 x 8.5 =	17,000	m <sup>3</sup>	450	7,650,000
4. Screen walls; 500mm thick	180 x 7 =	1,260	m <sup>2</sup>	3,300	4,158,000
5. Miradrain and waterproofing membrane; to screen wall	180 x 7 =	1,260	m <sup>2</sup>	450	567,000
6. Lean concrete; 75mm thick; including mesh reinforcement, miradrain and waterproofing membrane; to soffits of basement slab and sides of pile caps	Footprint area x 1.3	2,600	m <sup>2</sup>	450	1,170,000
7. Wearing slab - lean concrete; min. 100mm thick; including miradrain	Footprint area	2,000	m <sup>2</sup>	500	1,000,000
8. Miscellaneous (such as dewatering, etc.)	Say 3%				1,179,930
Cost for sheet piles					40,510,930
Cost for sheet piles per basement area	\$40,510,930 / 4,000m <sup>2</sup> =				\$10,128 / m <sup>2</sup> (as at 4th quarter 2014 price level)
Preliminaries	Priced separately, say 15% to 18%				

# Example 6

## Basement Enclosure (Diaphragm Wall)

### Project Parameters

Basement Footprint:	2,000 m <sup>2</sup> (50 x 40m)	B1	5 m
Basement CFA:	8,000 m <sup>2</sup>	B2	3.5 m
Basement Perimeter:	180 m	B3	3.5 m
		B4	3.5 m
Excavation Depth:	17.5 m (3.5 + 3.5 + 3.5 + 5 + 2m average for substructure)	Footprint = 2,000 m <sup>2</sup>	40 m
			50 m

Cost for Diaphragm Wall per Basement Area						
	Items	Backup Calculation	Qty	Unit	Rate	\$
1.	Diaphragm wall; 1m thick; say 40m deep	180 x 1 x 40 =	7 200	m <sup>3</sup>	9,000	64,800,000
2.	Strutting	180 x 17.5 x 450kg/m <sup>2</sup> =	1,417,500	Kg	18	25,515,000
3.	Excavation (including cart away/backfill)	2,000 x 17.5 =	35 000	m <sup>3</sup>	450	15,750,000
4.	Cavity walls; 150mm thick	180 x 15.5 =	2 790	m <sup>2</sup>	350	976,500
5.	Miradrain and waterproofing membrane; to screen wall	180 x 15.5 =	2 790	m <sup>2</sup>	450	1,255,500
6.	Lean concrete; 75mm thick; including mesh reinforcement, miradrain and waterproofing membrane; to soffits of basement slab	Footprint area x 1.3	2 600	m <sup>2</sup>	450	1,170,000
7.	Wearing slab; lean concrete; min. 100mm thick; including miradrain	Footprint area	2 000	m <sup>2</sup>	500	1,000,000
8.	Miscellaneous (such as dewatering, etc.)	Say 3%				3,314,010
Cost for diaphragm wall						113,781,010
Cost for diaphragm wall per basement area		113,781,010 / 8,000 =				\$ 14,223 / m <sup>2</sup> (as at 4th quarter 2014 price level)
Preliminaries		Priced separately, say 15% to 18%				

# Example 7

## Frame and Slab (Concrete Frame)

### Project Parameters

Type of Building: High Rise Residential  
 Building Height: 35 Storeys

Cost for Frame and Slab per m <sup>2</sup> CFA						
Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA	
1. Concrete; Grade 45	0.55m <sup>3</sup> /m <sup>2</sup> CFA	0.55	m <sup>3</sup>	1,500	825	
2. Reinforcement	0.55m <sup>3</sup> x 250kg/m <sup>3</sup> =	138	kg	11	1,518	
3. Formwork		2.7	m <sup>2</sup>	450	1,215	
4. Miscellaneous (such as expansion joints, formwork to opening, etc.)	Say 5%		sum		178	
5. Transfer plate*	1/35	0.0286	m <sup>2</sup>	17,400	498	
Cost for Frame and Slab per m <sup>2</sup> CFA					4,234	
						(as at 4th quarter 2014 price level)
Preliminaries	Priced separately, say 15% to 18%					

### Remarks

\* Rate Build-up for Transfer plate is as follows:-

Rate Build-up for Transfer Plate						
Items	Backup Calculation	Qty	Unit	Rate	\$	
1. Concrete; Grade 45		3.50	m <sup>3</sup>	1,500	5,250	
2. Reinforcement	3.50m <sup>3</sup> x 280kg/m <sup>3</sup> =	980	kg	11	10,780	
3. Formwork to side	Say girth 200m	1.17	m <sup>2</sup>	600	702	
4. Formwork to soffit		1	m <sup>2</sup>	600	600	
					17,332	
						(as at 4th quarter 2014 price level)
						Say 17,400

# Example 8

## Frame and Slab (Composite Frame)

### Project Parameters

Type of Building: Super High Rise Office  
 Building Height: 300m

Cost for Frame and Slab per m <sup>2</sup> CFA						
	Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA
1.	Concrete; Grade 45D		0.35	m <sup>3</sup>	1,500	525
2.	Reinforcement (250kg/m <sup>3</sup> )		88	kg	11	968
3.	Formwork		2	m <sup>2</sup>	450	900
4.	Structural steel columns and beams including connections and fire proofing coating		120	kg	32	3,840
5.	Steel Deck with mesh reinforcement		0.75	m <sup>2</sup>	600	450
6.	Steel Outrigger/ Transfer Truss	Say 15% of structural steel				576
7.	Miscellaneous (such as expansion joints, formwork to opening, etc.)	Say 5% of the costs of concrete, reinforcement and formwork				120
Cost for Frame and Slab per m <sup>2</sup> CFA						7,379
			(as at 4th quarter 2014 price level)			
Preliminaries		Priced separately, say 15% to 18%				

# Example 9

## Façade (Residential)

### Project Parameters

Type of Building: Residential; similar to Type 8  
 CFA per Floor: 650m<sup>2</sup> per floor

### Norms Application

From the Table of Norm, (i) the façade area to floor ratio is 1.20; (ii) window to floor ratio is 0.24; and (iii) external wall finishes to floor ratio is 0.96.

Cost for Façade per m <sup>2</sup> CFA						
	Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA
1.	Windows (single glazed)	Say 60% of glass area	0.14	m <sup>2</sup>	3,500	490
2.	Glazing and sliding Doors	Say 20% of glass area	0.05	m <sup>2</sup>	5,000	250
3.	Curtain wall	Say 20% of glass area	0.05	m <sup>2</sup>	6,000	300
4.	External Wall Finishes; ceramic tiles (P.C. Rate \$50/m <sup>2</sup> ) to walls and bay windows		0.96	m <sup>2</sup>	400	384
5.	External Wall Finishes; architectural fins	Say 5% of the cost of external wall finishes		sum		19
6.	External Walls; 150mm thick RC walls	Say 60% of solid areas	0.58	m <sup>2</sup>	1,045	606
7.	External Walls; architectural fins	Say 5% of the cost of external walls		sum		30
Cost for Façade per m <sup>2</sup> CFA						2,079
(as at 3rd quarter 2013 price level)						
Preliminaries		Priced separately, say 10% to 15%				

# Example 10

## Façade (Office)

### Project Parameters

Type of Building:	Office; similar to Type C
Building Height:	30 Storeys
CFA per Floor:	1,500m <sup>2</sup> per floor

### Norms Application

From the Table of Norm, (i) the façade area to floor ratio is 0.52; (ii) building girth is 172m; and (iii) façade area is 722m<sup>2</sup> for type C office.

Cost for Façade per m <sup>2</sup> CFA						
	Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA
1.	Curtain wall IGU (with Low-E glass) to typical floor		0.52	m <sup>2</sup>	6,000	3,120
2.	Curtain wall extension above roof	Building girth = 1,500m <sup>2</sup> x 0.52 x 172m/ 722m <sup>2</sup> = 186m Area of curtain wall extension above roof = 186m x 9m high (say) = 1,674m <sup>2</sup> Area per floor = 1,674m <sup>2</sup> / 30 floors/ 1,500m <sup>2</sup> = 0.04m <sup>2</sup>	0.04	m <sup>2</sup>	8,500	340
Cost for Façade per m <sup>2</sup> CFA						3,460
(as at 3rd quarter 2013 price level)						
Preliminaries		Priced separately, say 10% to 15%				

# Example 11

## Façade (Retail)

### Project Parameters

Type of Building: Retail; similar to Type V

CFA per Floor: 4,000m<sup>2</sup> per floor

### Norms Application

From the Table of Norm, the façade area to floor ratio is 0.46 for type V retail. Assume 50% of façade area is glass and 50% of façade area is solid wall with aluminium cladding.

Cost for Façade per m <sup>2</sup> CFA						
	Items	Backup Calculation	Qty	Unit	Rate	\$/m <sup>2</sup> CFA
1.	Glass wall	Say 50% of façade area	0.23	m <sup>2</sup>	7,000	1,610
2.	In-situ concrete wall; 200mm thick	Say 50% of façade area	0.23	m <sup>2</sup>	1,260	290
3.	Aluminium cladding		0.23	m <sup>2</sup>	3,500	805
Cost for Façade per m <sup>2</sup> CFA						2,705
					(as at 3rd quarter 2013 price level)	
Preliminaries		Priced separately, say 10% to 15%				

2017

## Ground investigation

- (i) Boreholes: 6 Nos. x 35m deep x \$2,500/m = \$525,000
- (ii) Trial pits (assume 1.5m x 1.5m x 1.5m deep per pit)  
= 4 Nos. x \$15,000/No. = \$60,000
- (iii) Field and laboratory tests = 20% of above items = \$117,000
- (iv) Preliminaries = 10% for Ground Investigation = \$70,200

## Demolition and Hoarding

- (i) Demolition of 6-storey existing building = 1,200m<sup>2</sup> per floor x 6 floor  
x \$800/m<sup>2</sup> = \$5,760,000
- (ii) Covered walkway = (40 + 40 + 30)m x \$18,000/m = \$1,980,000
- (iii) Hoarding = 30m x \$7,000/m = \$210,000
- (iv) Preliminaries = 10% = \$795,000

## Foundation - socket-H pile

- (i) Pre-bored socketed H-piles = 130 Nos. x 30 m deep x \$7,000/m  
= \$27,300,000
- (ii) Preliminaries = 15% = \$4,095,000

## Substructure - pile cap

### (i) Concrete:

- Cap under footprint area of residential block = 460m<sup>2</sup> x 2.5m = 1,150m<sup>3</sup>
- Small caps for the podium (number and size assumed by QS)  
area = 16 nos. x 1.5m x 1.5m = 36m<sup>2</sup>; volume = 36m<sup>2</sup> x 1.5m thick = 54m<sup>3</sup>
- Total concrete volume = 1,150m<sup>3</sup> + 54m<sup>3</sup> = 1,204m<sup>3</sup>
- Cost = 1,204m<sup>3</sup> x \$1,400/m<sup>3</sup> = **\$1,685,600**

### (ii) Formwork:

Perimeter of pile caps under footprint area of residential block = 120m

- Cap under footprint area of residential block = 120m x 2.5m = 300m<sup>2</sup>
- Small caps for the podium (number and size assumed by QS) = 16 nos. x 1.5m x 4 x 1.5m = 144m<sup>2</sup>
- Total = 300m<sup>2</sup> + 144m<sup>2</sup> = 444m<sup>2</sup>
- Cost = 444m<sup>2</sup> x \$500/m<sup>2</sup> = **\$222,000**

### (iii) Rebar (assumed 300kg/m<sup>3</sup> by QS):

- Total = 1,204m<sup>3</sup> x 300kg/m<sup>3</sup> = 361,200kg
- Cost = 361,200kg x \$10/kg = **\$3,612,000**

### (iv) Blinding Layer (say 75mm thick)

- Total = 460m<sup>2</sup> + 36m<sup>2</sup> = 496m<sup>2</sup>
- Cost = 496m<sup>2</sup> x \$100/m<sup>2</sup> = **\$49,600**

### (v) Excavation of Pile caps:

Assume space from top of pile caps to ground level is 1.5m depth

- Excavation of pile cap under footprint area of residential block  
= 460m<sup>2</sup> x (2.5m + 1.5m) = 1,840m<sup>3</sup>
- Excavation of small caps for the podium (assumed by QS)  
= 16 nos. x 1.5m x 1.5m x (1.5 + 1.5) m = 108m<sup>3</sup>
- Total excavation volume = 1,840m<sup>3</sup> + 108m<sup>3</sup> = 1,948m<sup>3</sup>
- Cost = 1,948m<sup>3</sup> x \$600/m<sup>3</sup> (unit rate including cart away / backfill)  
= **\$1,168,800**

### (vi) Steel sheet piles:

Perimeter of pile cap under footprint area of residential block = 120m  
Depth of sheet piles (assumed by QS) = 2 x excavation depth = 2 x 4m = 8m

- Total = 120 x 8m deep x 120kg/m<sup>2</sup> = 115,200kg
- Cost = 115,200kg x \$16/kg = **\$1,843,200**

### (vii) Steel waling and strutting:

Perimeter of pile cap under footprint area of residential block = 120m  
Depth of excavation = 4m; assume waling and strutting = 300kg/m<sup>2</sup> on strutting area.

- Total = 120 x 4m deep x 300kg/m<sup>2</sup> = 144,000kg
- Cost = 144,000kg x \$16/kg = **\$2,304,000**

### (viii) Preliminaries

- Allow 15% on above costs = **\$1,632,780**

## Demolition and Hoarding

B.	<u>BACK-UP CALCULATIONS</u>	Quantities	Unit	Rate (HK\$)	Amount (HK\$)
3.	<u>Demolition and Hoarding</u>				
a.	Covered walkway	40	m	17,000	680,000
b.	Hoarding	40	m	5,000	200,000
c.	Demolish existing buildings	3,195	m2	1,000	3,195,000
d.	Site clearance	1,065	m2	100	106,500
e.	Preliminaries (17%)			17%	710,855
					<u>4,892,355</u>
				say	<u>4,900,000</u>

## Bored pile foundation

4.	<u>Foundation and Substructure</u>	CFA =	12,188	m2		
4.1	<u>Foundation</u> (assumed by L&S; no information)					
a.	Tower - large diameter bored pile; 10 nos; 2.5m diameter; average 60m deep (assume 1m2 support 240m2 CFA)	2,945	m3	10,000	29,450,000	
b.	Non-Tower areas - mini pile; 219mm dia; 14 No. average 60m deep (assume 1 no. support 50m2 CFA)	840	m	4,500	3,780,00	
c.	Preliminaries (17%)			17%	<u>5,649,100</u>	
				say	<u>38,879,100</u>	
					<u>38,900,000</u>	
4.2	<u>Substructure</u>			\$/m2 total	CFA	3,192
a.	Blinding layer (75mm thick)	1,065	m2	135	143,775	
b.	Pile caps (assume 300kg/m3); average 1m thick (less basement slab)	1,065	m3	5,100	5,431,500	
c.	Basement slab and beam (assume 500mm thick; 280kg/m3)	1,065	m2	2,490	2,651,850	
d.	Preliminaries (17%)			17%	<u>1,398,611</u>	
				say	<u>9,625,736</u>	
					<u>9,700,000</u>	
				\$/m2 total	CFA	796

## Pipe pile & Basement Enclosure

5.	<u>Basement Enclosure (1 Level) (No Information)</u> (construction method assumed by L&S)	CFA for Basement =	1,065	m2		
		Total Girth =	133.4	m (basement perimeter)		
		Excavation Depth =	6.0	m (3.5m + 0.5m for wearing slab + 2m for substructure)		
a.	273mm Diameter pipe piles; 400mm c/c; average 12m	4,008	m	4,000	16,032,000	
b.	Lagging wall between pipe piles; average 6m high	255	m2	2,500	637,500	
c.	Strutting (assume 600kg/m2 on strutting area; 6m high strut)	480,240	kg	17	8,164,080	
d.	Grout curtain; assume not required				assume not require	
e.	Excavation and cart away; assume average 6m deep	6,390	m3	500	3,195,00	
f.	400mm thick reinforced screen wall (assume 300kg/m3)	534	m2	2,700	1,441,800	
g.	Waterproofing to screen walls	534	m2	450	240,300	
h.	Waterproofing to sides and soffit of basement slab and pile caps	1,385	m2	450	623,250	
i.	Wearing slab	1,065	m2	500	532,500	
j.	Dewatering (3%)			sum	930,000	
k.	Preliminaries (17%)			17%	<u>5,405,393</u>	
				say	<u>37,201,823</u>	
					<u>37,200,000</u>	
				\$/m2 total	Basement CFA	34,930

7.1	<u>External and Landscaping Works</u>	Site Area =	1,065	m2		
		Less Footprint at G/F=	(800)	m2 (assume by L&S)		
		External Area at G/F=	265	m2		
a.	General paving and landscaping area at G/F; including lighting and site drainage	265	m2	3,000	795,000	
b.	General paving and landscaping area at 1/F; including lighting and site drainage	145	m2	3,000	435,000	
c.	Outdoor swimming pool	300	m2	30,000	9,000,000	
d.	Fence walls around the site; assume not required				-	
e.	External signage; assume not required				-	
f.	Preliminaries (17%)			17%	<u>1,739,100</u>	
				say	<u>11,969,100</u>	
					<u>12,000,000</u>	

# Pipe pile & Basement

2016 Question No. 1

PROPOSED RESIDENTIAL DEVELOPMENT  
AT 45-50 ABC ROAD, HONG KONG

ANSWER

24th September 2016

**CONFIDENTIAL**

## BACKUP CALCULATIONS

### 2. Demolition and Hoarding (2 marks)

a.	Demolition of existing building (8 levels)	7,200	m <sup>2</sup>	800	5,760,000
b.	Covered walkway with gantry (boundary facing roads)	110	m	25,000	2,750,000
	(= 40+30+40)				
c.	Temporary support to adjacent old building		sum		800,000
d.	Preliminaries (15%)		15%		1,396,500
					10,706,500
			say		10,800,000

### 4. Basement Enclosure

Excavation Area	1,200	m <sup>2</sup>	- pipe pile - strutting - excavation - dewatering
Excavation Depth:			
Basement storey height	3.5	m	
Wearing slab	0.5	m	
Base Slab and Pile Caps (assume average 2m thick)	2.0	m	
	6.0	m	

Pipe pile depth: assume 2 times of excavation **12.0 m**

Basement perimeter **140 m**

#### 4.1 Excavation and Lateral Supports (3 marks)

a.	CHS 273mm pipe pile 8mm thick; assume 12m deep (assume at 400mm centre to centre)	4,200	m	2,000	8,400,000
b.	Strutting; assume 600kg/m <sup>2</sup> ; 6m deep	504,000	kg	18	9,072,000
c.	Excavation (including cut away / backfill); average 8m deep	7,200	m <sup>3</sup>	500	3,600,000
d.	Dewatering			5%	1,053,600
e.	Preliminaries (15%)		15%		3,318,840
					25,444,440
			say		25,400,000
			\$/m <sup>2</sup> total Basement CFA		\$21,167/m <sup>2</sup>

#### 4.2 Basement Screen Wall, Wearing Slab and Waterproofing (3 marks)

Basement storey height	3.5	m	- screen wall
Wearing slab	0.5	m	- waterproof to wall
Height of Basement Screen Wall:	4.0	m	- waterproof to basement slab
Add side of pile caps	2.0	m	- wearing slab
Height of Waterproofing to Screen Wall:	6.0	m	

a.	400mm Basement RC screen wall	560	m <sup>2</sup>	2,500	1,458,000
b.	Waterproofing to wall	840	m <sup>2</sup>	450	378,000
c.	Waterproofing to basement slab (allow 30% of basement slab area for sides of pile caps)	1,560	m <sup>2</sup>	450	702,000
d.	Wearing slab	1,200	m <sup>2</sup>	550	680,000
e.	Preliminaries (15%)		15%		479,400
					3,675,400
			say		3,700,000
			\$/m <sup>2</sup> total Basement CFA		\$3,083/m <sup>2</sup>

2016 Question No. 1

PROPOSED RESIDENTIAL DEVELOPMENT  
AT 45-50 ABC ROAD, HONG KONG

ANSWER

24th September 2016

**CONFIDENTIAL**

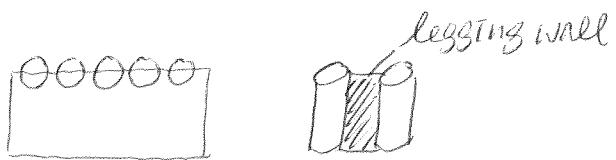
## BACKUP CALCULATIONS

### 6.1 External Paving and Landscaping Works (2 marks)

<u>Paving at G/F</u>			
Site Area	1,200	m <sup>2</sup>	
Less Ground Floor CFA	(960)	m <sup>2</sup>	
Paving at G/F	240	m <sup>2</sup>	
<u>Podium Landscaping and Pool</u>			
G/F CFA	960	m <sup>2</sup>	
Less Tower CFA	(480)	m <sup>2</sup>	
Podium Outdoor Area:	480	m <sup>2</sup>	
Less Pool Area:	(150)	m <sup>2</sup>	
Podium Garden	330	m <sup>2</sup>	

a.	Ground Floor - Paving and landscaping	240	m <sup>2</sup>	3,500	840,000
b.	Podium - Outdoor swimming pools including filtration plant	150	m <sup>2</sup>	35,000	5,250,000
c.	Podium - Garden	330	m <sup>2</sup>	5,000	1,650,000
d.	Fence wall along Site boundary facing roads	100	m	10,000	1,000,000
e.	External signage			300,000	
f.	Preliminaries (15%)		15%		1,356,000
					10,396,000
			480	M2	21,567
					10,400,000

## Pipe pile



### 5. Basement Enclosure (Steel Pipe Piles)

Level of basement	2 levels.
Basement CFA	$2.4 \text{ m}^2$
Excavation area	$1,200 \text{ m}^2 (\frac{1}{2} \text{ of CFA}) (30 \times 40 \text{ m})$
Basement Perimeter	$140 \text{ m}$ $(30+40) \times 2 \text{ m}$

### Excavation / Shoring Depth

Basement storey height	$9.0 \text{ m } (5.5 + 3.5 \text{ m})$
Wearing Slab	$0.5 \text{ m}$
Basement Slab & Pile Caps <small>(Assume 2m thick)</small>	$2.0 \text{ m}$ $11.5 \text{ m}$

Pipe pile depth, assume 2 times of excavation =  $11.5 \times 2 = 23.0 \text{ m}$   
 $280 \text{ no. } (140/0.5)$

Height of Screen Wall  $9.5 \text{ m}$

A.2 Excavation & Lateral Support	Qty	Unit	Rate (HK\$)	Amount (HK\$)
a) Steel Pipe Pile $355 \times 12.5 \times 106 \text{ kg/m} @ 500 \text{ mm c/c}$ $(0.355 \times 280 \text{ no. } - 140) \times 11.5$	$280 \times 23$	m	6440	30000
b) Steel lagging wall		$\text{m}^2$	467	2500
c) Shoring assume $600 \text{ kg/m}^2$ $140 \times 11.5 \times 600$		kg	966,000	16
d) Grout curtain; depth same as pipe piles	$140 \times 23$	$\text{m}^2$	3220	2500 ~ 3000
e) Excavation (incl. cart away / backfill)	$1200 \times 11.5$	$\text{m}^3$	13,800	600
f) Dewatering (5%)		%	5%	
g) Preliminaries (15%)		%	15%	
			Total SAY	

### B) Basement Screen Wall, Wearing Slab & waterproofing

a) 450mm Basement RC screen wall	$140 \times 9.5 \text{ m}$	$1330 \text{ m}^2$	2600
b) Waterproofing to screen wall		$1330 \text{ m}^2$	500
c) Wearing slab		$1200 \text{ m}^2$	600
d) Waterproofing to sides & soffit of Basement slab	$1200 \times 120\%$	$1440 \text{ m}^2$	500
e) Preliminaries (15%)			

allow 20% for sides  
of pile caps

Total  
SAY  
 $\$/\text{m}^2 / \text{CFA}$

# Sheet pile

## 5. Basement Enclosure (Steel Sheet Piles)

Level of basement	2 levels
Basement CFA	2400 m <sup>2</sup>
Excavation area	1200 m <sup>2</sup> ( $\frac{1}{2}$ of CFA) (30x40m)
Basement Perimeter	140m $(30+40) \times 2$ m

## Excavation / Strutting Depth

Basement storey height	9.0 m (5.5 + 3.5 m)
Wearing Slab	0.5 m
Basement Slab & Pile Cap (assume average 2m thick)	<u>2.0 m</u> 11.5 m

Steel sheet pile depth; assume 2 times of excavation = 23.0m

Height of Screen Wall 9.5m

(HK\$)

A.) Excavation & Lateral Supports	Qty	Unit Rate (HK\$)	Amt.
a) Steel Sheet pile ; 180kg/m <sup>2</sup> 140x23x190	611,800 kg	16	
b) Strutting; assume 600kg/m <sup>2</sup> 140x11.5x600	966,000 kg	16	
c) Grout curtain; depth <sup>some</sup> as sheet pile 140x23	3220 m <sup>2</sup>	2500-3000	
d) Excavation (incl. cartaway/backfill) 1200x11.5	13,800 m <sup>3</sup>	600	
e) Dewatering (5%)		50%	
f) Preliminaries (15%)		15%	
		TOTAL	
		SAY	
		\$/m <sup>2</sup> CPA	

B.) Basement Screen Wall, Wearing Slab & Waterproofing	Qty	Unit Rate	Total
a) 450mm RC screen wall 140x9.5	1330 m <sup>2</sup>	2600	
b) Waterproofing to screen wall	1330 m <sup>2</sup>	500	
c) Wearing Slab	1200 m <sup>2</sup>	600	
d) Waterproofing to sides of soffit of basement slab <sup>1200x1.2</sup> 1440 m <sup>2</sup>		500	
(allow 20% of basement area for sides of pile cap)			
e) Preliminaries (15%)		15%	
		TOTAL	
		SAY	
		\$/m <sup>2</sup> CPA	

# Sheet pile

APC 2016 Briefing  
Basement Enclosure - Sheet Piles Retaining

9th August 2016



Excavation depth =  $3.5 + 0.5\text{m}$  for wearing slab + 1.5 for substructure = 5.5m

HK\$

<i>Basement footprint</i> =	1,200 m <sup>2</sup> (30 x 40m)
<i>Basement perimeter</i> =	140 m
<i>Steel sheet piles</i> =	11 m depth (5.5m x 2)

<i>Steel sheet piles</i> =	
140 x 11 x 150kg/m <sup>2</sup> x \$13/kg =	3,003,000

<i>Strutting</i> =	
140 x 5.5 x 500kg/m <sup>2</sup> x \$13/kg =	5,005,000

<i>Excavation (including cart away / backfill)</i> =	
1,200 x 5.5 x \$500/m <sup>3</sup> =	3,300,000

<i>400mm Thick screen walls</i> =	
140 x 3.5 x \$2,500/m <sup>2</sup> =	1,225,000

<i>Waterproofing to wall</i> =	
140 x 5.5 x \$500/m <sup>2</sup> =	385,000

<i>Waterproofing to slab</i> =	
1,200 x 1.3 for pile caps x \$500/m <sup>2</sup> =	780,000

<i>Wearing slab</i>	
1,200 x \$550/m <sup>2</sup> =	660,000

<i>Dewatering (5%)</i>	717,900
------------------------	---------

Sub-total	15,075,900
-----------	------------

<i>Preliminaries (15%)</i>	2,261,385
----------------------------	-----------

Total	17,337,285
-------	------------

<i>Say</i>	17,400,000
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<i>\$/m<sup>2</sup> on basement area</i> =	14,500
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# Diaphragm wall

## 5. Basement Enclosure (Diaphragm Wall)

Level of Basement	3 levels
Basement CFA	3600 m <sup>2</sup>
Excavation Area	1200 m <sup>2</sup> (30x40m)
Basement perimeter	140m (30+40)x2 m

### Excavation/Strutting Depth

Basement storey height	12.5m (5.5 + 3.5 + 3.5m)
Wearing Slab	0.5m
Basement Slab + Pigalle Cap (assume average 2m thick)	2.0 m 1.5 m

Length of diaphragm wall	45m
Height of Concrete Block wall	13m

Qty Unit Rate(HK\$) Amount(HK\$)

### A) Excavation and Lateral Supports

a) Diaphragm wall : 1m thick	140x45x1	6,300 m <sup>3</sup>	6000
b) Strutting; assume 500kg/m <sup>2</sup>	140x15. x500	1,050,000kg	16
c) Grout curtain; not required			
d) Excavation (incl cartaway / backfill)	1200x15	18,000 m <sup>3</sup>	550
e) Dewatering (5%)		5%	
f) Preliminaries (15%)		15%	

Total

SAY  
\$/m<sup>2</sup> CFA

### B) Basement Screen Wall, Wearing Slab & Waterproofing

a) 250mm Concrete block wall along basement perimeter	140x13	1820 m <sup>2</sup>	800
b) Waterproofing to basement slab (allow 20% of basement slab area for sides of pit caps)	1200x1.2	1440 m <sup>2</sup>	500
c) Wearing Slab		1200 m <sup>2</sup>	600
d) Preliminaries (15%)		15%	

Total

SAY  
\$/m<sup>2</sup> CFA

# Diaphragm wall

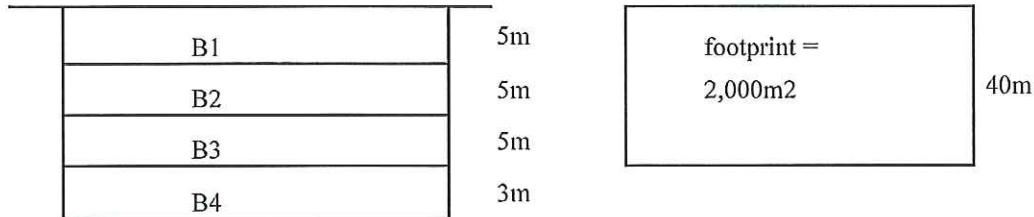
Basement  
Steel  
Sheet  
Piles

## APC 2016 Briefing

### Basement Enclosure - Diaphragm walls

9th August 2016

50m



HK\$

*Basement footprint =*

*2,000 m<sup>2</sup>*

*Basement CFA =*

*8,000 m<sup>2</sup>*

*Basement perimeter =*

*180 m*

*Excavation =*

*20 m (18 + 0.5m wearing slab + 1.5m for substructure)*

Diaphragm wall 40m deep; 1m thick =

$180 \times 40 \times \$8,000/\text{m}^3 =$  57,600,000

Strutting =

$180 \times (18+2) \times 600\text{kg}/\text{m}^2 \times \$13/\text{kg} =$  28,080,000

Excavation and cart away / backfill =

$2,000 \times 20 \times \$550/\text{m}^3 =$  22,000,000

150mm Thick block walls =

$180 \times 18 \times \$450/\text{m}^2 =$  1,458,000

Waterproofing to basement wall =

$180 \times 20 \times \$500/\text{m}^2 =$  1,800,000

Waterproofing to slab =

$2,000 \times 1.3 \text{ for pile caps} \times \$500/\text{m}^2 =$  1,300,000

Wearing slab

$2,000 \times \$550/\text{m}^2$  1,100,000

Dewatering (5%)

5,666,900

---

Sub-total 119,004,900

Preliminaries (15%)

17,850,735

---

Total 136,855,635

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Say 136,900,000

<i>\$/\text{m}^2 \text{ on basement area} =</i>	<i>17,113</i>
---	---------------

## External and landscape

### 7) External and Landscape Works

$$\text{Site Area} = a \text{ m}^2$$

$$\text{Less Total Footprint} = (b) \text{ m}^2$$

$$\text{External Area at G/F} = a - b \text{ m}^2$$

$$\text{Podium Area} = x$$

$$\text{Less Tower Footprint} = y$$

$$\text{External Area at Podium} = x - y \text{ m}^2$$

	(including lighting & drainage)	Qty	Unit Rate(HK\$)	Amount (HK\$)
a) General Paving and Landscaping works at G/F	$a - b \text{ m}^2$		3,500	
b) Paving and Landscaping at podium garden	$x - y \text{ m}^2$		3,500	
(including lighting & drainage)				
c) Swimming Pool (incl. filtration system)				35,000
d) Main entrance gate		Sum		200,000
e) External signage				1,000,000
f) Fence wall	482 m	1000		
g) Underground Drainage	$a \text{ m}^2$	2500		
h) Utility Connection	Sum			1,500,000
i) Preliminaries (15%)	15%			
			Total	
			SAY	

# Foundation & ELS

## For 40 Storey High Office Building

Cheapest for  
high-rise building

Building Footprint = 1,000 m<sup>2</sup>  
Total CFA = 40,000 m<sup>2</sup>

### Foundation Type 1 - bored piles: 40m deep from existing ground

Assume 1m<sup>2</sup> cross section supports 250m<sup>2</sup> CFA

No of 2.5m diameter bored piles required:  $\frac{\text{No. of sections needed}}{\text{Area of each bored pile}} = \frac{40,000 / 250}{\pi r^2} = 33 \text{ no.}$

Volume of bored piles:  $= 33 \times 1.25 \times 1.25 \times 3.1416 \times 40 \text{ m dp} = 6,480 \text{ m}^3$

Estimated Cost of bored piles:  $= 6,480 \text{ m}^3 \times \$7,000/\text{m}^3 \times 1.15 \text{ for preliminaries} = \$52,164,000 = \$1,304/\text{m}^2 \text{ CFA}$

### Foundation Type 2 - Socketed H piles 610mm dia. With 305 x 305 x 223kg/m; 40m deep from existing ground

Assume 1 no. supports 90m<sup>2</sup> CFA

No of socketed H piles required:  $= 40,000 / 90 = 445 \text{ no.}$

Length of piles:  $= 445 \times 40 \text{ m dp} = 17,800 \text{ m} \quad \text{Composite rate}$

Estimated Cost of socketed H piles:  $= 17,800 \text{ m} \times \$5,500/\text{m} \times 1.15 \text{ for preliminaries} = \$112,590,000 = \$2,815/\text{m}^2 \text{ CFA}$

### Foundation Type 3 - Driven H piles 305 x 305 x 223kg/m; 35m deep from existing ground

Assume 1 no. supports 80m<sup>2</sup> CFA

No of driven H piles required:  $= 40,000 / 80 = 500 \text{ no.}$

Length of piles:  $= 500 \times 35 \text{ m dp} = 17,500 \text{ m}$

Estimated Cost of driven H piles:  $= 17,500 \text{ m} \times 223 \text{ kg/m} \times \$15/\text{kg} \times 1.15 \text{ for preliminaries} = \$67,320,000 = \$1,683/\text{m}^2 \text{ CFA}$

### Foundation Type 4 - Raft Foundation 3.5m thick

Formwork  $= 1,000 \times 3.5 \text{ m thick} = 3,500 \text{ m}^3 \times \$1,300/\text{m}^3$

Rebar  $= 3,500 \text{ m}^3 \times 350 \text{ kg/m}^3 \text{ including lapping} = 1,225,000 \text{ kg} \times \$10/\text{kg}$

Formwork  $= 150 \text{ m} \times 3.5 \text{ m thick} = 525 \text{ m}^2 \times \$500/\text{m}^2$

Blinding layer 100mm thick  $= 1,000 \text{ m}^2 \times \$120/\text{m}^2$

Excavation and cartaway  $= 1,000 \text{ m}^2 \times 3.6 \text{ m} = 1,000 \text{ m}^2 \times 3.6 \times \$500/\text{m}^3$

Sheet piles FSPIII  $= 150 \text{ m} \times \text{say } 7 \text{ deep} \times 150 \text{ kg/m}^2 = 157,500 \text{ kg} \times \$15/\text{kg}$

Strutting  $= \text{assume } 300 \text{ kg/m}^2 \times 150 \text{ m} \times 3.5 \text{ m} = 157,500 \text{ kg} \times \$15/\text{kg}$

Estimated Cost of raft foundation:  $= \$23,707,500 = \$593/\text{m}^2 \text{ CFA}$   
*(note: ground slab and beam may not be required)*

# Structural Frame

APC 2018 Briefing  
Structural Frame Studies

21st August 2018

For 40 Storey High Office Building

*Note: Piling and transfer plate to be studied separately*

<u>Traditional in-situ Concrete Frame</u>	<u>\$/m2 CFA</u>
- Concrete = 0.55m <sup>3</sup> /m <sup>2</sup> CFA x \$1,300/m <sup>3</sup> =	715
- Formwork = 2.8m <sup>2</sup> /m <sup>2</sup> CFA x \$500/m <sup>2</sup> =	1,400
- Rebar (300kg/m <sup>3</sup> including lapping) x 0.55m <sup>3</sup> /m <sup>2</sup> CFA x \$10/kg =	1,650
- 5% for miscellaneous =	188
	<u><b>3,953</b></u>

<u>Composite Steel and Concrete Frame</u>	<u>\$/m2 CFA</u>
- Steel beam and column = 100kg/m <sup>2</sup> x \$30/kg =	3,000
- Allow fireproofing and connections, say 15% =	450
- Metal deck = 0.8m <sup>2</sup> /m <sup>2</sup> CFA x \$1,000/m <sup>2</sup> =	800
- Concrete = 0.3m <sup>3</sup> /m <sup>2</sup> CFA x \$1,300/m <sup>3</sup> =	390
- Formwork = 1.2m <sup>2</sup> /m <sup>2</sup> CFA x \$500/m <sup>2</sup> =	600
- Rebar (350kg/m <sup>3</sup> ) x 0.3m <sup>3</sup> /m <sup>2</sup> CFA x \$10/kg =	1,050
- 5% for miscellaneous =	315
	<u><b>6,605</b></u>

# Structural Frame (2018 D1Q2)

Concrete	Assumptions based on Project S structural ratios	Unit Rate HK\$	HK\$/m2 CFA
Reinforced concrete to beams, slabs and structural walls	0.48m3/m2 CFA; grade C45	1,500/m3	720
Reinforced concrete to columns	0.07m3/m2 CFA; grade C60	1,800/m3	126
Formwork	2.5m2/m2 CFA	500/m2	1,250
Rebar	0.55m3/m2 x 240kg/m3	9/kg	1,188
Miscellaneous	5%		164
	Total		3,448

Structural steel	Assumptions	Unit Rate HK\$	HK\$/m2 CFA
Structural steel	100kg/m2 CFA	35/kg	3,500
Fireproof coating to steel	1.5m2/m2 CFA; cementitious type fire protection, mainly to steel beams	400/m2	600
Metal decking outside core	0.85m2/m2 CFA	800/m2	680
Reinforced concrete	0.36m3/m2 CFA; including core walls, column casing, topping on metal decking	1,500/m3	540
Formwork	1.25m2/m2 CFA	500/m2	625
Rebar	0.36m3/m2 x 160kg/m3	9/kg	518
Miscellaneous	5%		323
	Total		6,786

3.	<u>Structural frame and slabs</u>				
	Structural steel, 2,300m2 x 180kg/m2 =	414,000 kg	30	12,420,000	
	(assume connections deemed to have been included in the given steel ratio)				
	Fire proofing paint	20 %		2,484,000	
	(In lieu of % basis, by assuming a typical steel member size, the area of paint per kg can be estimated)				
	Allow for sundries like water tanks, staircases, expansion joints etc.	5 %		745,200	
				15,649,200	
			Say	15,650,000	
4.	<u>Roof</u>				
	Allow for proprietary type corrugated metal roof system				
	Rate inclusive of extra cost for pitched roof, projection, gutters, etc.	2,150 m2	4,000	8,600,000	
5.	<u>External wall</u>				
	Corrugated sheet wall panel system, (60+40) x 2 x 6m high	1,200 m2	3,000	3,600,000	
	Rate inclusive of allowance for windows of minimal area				
	Allow for canopy, logo, external lighting etc.	15 %		540,000	
				4,140,000	

**APC 2018 Briefing****Fitting Out of Arcade Area of Shopping Mall**

21st August 2018

Total CFA of Shopping Mall =	50,000m2
Arcade Area / Fit out area (say 30%) =	15,000m2
Floor to floor height =	5.5m

HK\$ / m2  
(on Fit Out Area)

Shopfront 800m x 4.5m high @ \$5,000/m2 / 15,000m2 OR say 0.24m2 per arcade area x \$5,000/m2 =	1,200
Doors	250
Marble floor tiles	4,500
Wall finishes - aluminium cladding / granite 1000m x 4.5m high @ \$5,000/m2 / 15,000m2 OR say 0.3m2 per fit out area x \$5,000/m2 =	1,500
Decorative suspended ceiling (including extra for openings and bulk head)	2,000
Glass balustrades at atrium: 100m @ \$15,000/m / 15,000m2	100
Finishes to spandrel underneath the glass balustrade 100m @ \$10,000/m / 15,000m2 =	67
Built in fittings such as counters, vanity counters	500
Mall decoration: sculptures, décor, signage	2,000
Metalworks and sundries	500
Fire services (2nd layer)	500
Electrical fitting out including light fittings	2,000
A/C distribution	1,500
BWIC (5%) = <i>Builder's Works</i>	200
	Sub-total
	16,817
Preliminaries (15%)	2,523
	Total Unit Cost
	19,340
	x 15,000 m2
	Total Additional Cost
	290,100,000

**APC 2018 Briefing****Fitting Out of Arcade Area of Shopping Mall**

21st August 2018

Total CFA of Shopping Mall =	50,000m2
Arcade Area / Fit out area (say 30%) =	15,000m2
Floor to floor height =	5.5m

HK\$ / m2  
(on Fit Out Area)

Shopfront 800m x 4.5m high @ \$5,000/m2 / 15,000m2 OR say 0.24m2 per arcade area x \$5,000/m2 =	1,200
Doors	250
Marble floor tiles	4,500
Wall finishes - aluminium cladding / granite 1000m x 4.5m high @ \$5,000/m2 / 15,000m2 OR say 0.3m2 per fit out area x \$5,000/m2 =	1,500
Decorative suspended ceiling (including extra for openings and bulk head)	2,000
Glass balustrades at atrium: 100m @ \$15,000/m / 15,000m2	100
Finishes to spandrel underneath the glass balustrade 100m @ \$10,000/m / 15,000m2 =	67
Built in fittings such as counters, vanity counters	500
Mall decoration: sculptures, décor, signage	2,000
Metalworks and sundries	500
Fire services (2nd layer)	500
Electrical fitting out including light fittings	2,000
A/C distribution	1,500
BWIC (5%) = <i>Builder's Works</i>	200
	Sub-total
	16,817
Preliminaries (15%)	2,523
	Total Unit Cost
	19,340
	x 15,000 m2
	Total Additional Cost
	290,100,000

**Proposed Cost saving items for Office**  
**Similar to APC 2004 - QUESTION 1 - PART C**

For Office CFA =  $55 \times 35 = 1,925\text{m}^2 \times 30 = 57,750\text{m}^2$   
 Floor to floor height = 4.5m

Cost Saving  
(HK\$/m<sup>2</sup> CFA)

**Say tenant areas is around 70% of CFA**

1.	Omit the raised floor in office tenant areas $0.7\text{m}^2 \times \$800/\text{m}^2 \times 1.15$ for skirting =	644
2.	Omit suspended ceiling in office tenant areas $0.7\text{m}^2 \times \$650/\text{m}^2 =$	455
3.	Reduce the curtain wall unit rate from (mainly omit the fins) HK\$6,500/m <sup>2</sup> to HK\$5,500/m <sup>2</sup> $0.42\text{m}^2 / \text{m}^2 \text{ CFA}$ (façade ratio) $\times \$1000 =$	420
4.	Omit the final distribution and VAV units of HVAC in the office tenant areas $0.7\text{m}^2 \times \$800/\text{m}^2 \times 1.05$ (BWIC) =	588
5.	Omit the ceiling light panel in the office tenant areas $0.7\text{m}^2 \times \$200/\text{m}^2 \times 1.05$ (BWIC) =	147
	Sub-total	2,254
6.	Preliminaries (15%)	338
	Total Proposed Cost Saving HK\$/m <sup>2</sup> CFA	2,592
	$\times 57,750 \text{ m}^2 \text{ CFA}$	
		149,688,000
	Total Proposed Cost Saving	\$149.7M

**Items for Roof Extension**

1. Catch fans and hoarding
2. Steel frame to be adopted; avoid underpinning and structure strengthening
3. Relocation or modification of existing structure / plant / curtain wall / vent shaft
4. Relocation of gondola; temporary provision
5. Extend of existing lifts, new lift pits and machine rooms
6. Transfer floor for structure / M&E
7. Hoists 
8. Works to affected areas 
9. Propping of levels below 
10. Temporary drainage
11. Wearing slab