**Appendix C to Question 1**

Tender Price Indices ("TPI")

| Year | 1st Quarter | 2nd Quarter | 3rd Quarter | 4th Quarter |
|---|---|---|---|---|
| Year 2017 | 1790 | 1800 | 1818 (provisional) | |
| Year 2016 | 1775 | 1776 | 1783 | 1783 |
| Year 2015 | 1732 | 1761 | 1777 | 1775 |
| Year 2014 | 1621 | 1648 | 1679 | 1703 |
| Year 2013 | 1516 | 1532 | 1559 | 1590 |





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**Question No. 1 – Cost Estimate**

**NOTES TO ASSESSORS**

Objective

The objective of this question is to test Candidates' ability to:

- appreciate various design requirements that could affect the construction costs and incorporate the same into the cost plan;
- make use of cost data of similar project and apply appropriate adjustments to suit the proposed new design; and
- make reasonable assumptions in terms of construction costs for areas where the design has not been fully developed.

Cost Plan for Project Greenland

(1) Ground investigation

Candidates are expected to work out the costs of the boreholes and trial pits based on the quantities advised by the SE (item 3.2(a) of the minutes of meeting) plus allowance for field and laboratory tests.

(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

(Cost build-up for ground investigation in the range of $0.7M to $1.0M would be acceptable.)

Direct application of the cost data from Project Hillside is common but must be exercised with care. The site investigation works for Project Hillside involve boreholes on hill slopes. If the cost data from Project Hillside is used, reasonable assumptions and appropriate adjustments should be made to address the absence of boreholes on hill slopes in Project Greenland. TPI adjustment should also be made.

**Question No. 1 – Cost Estimate (Cont'd)**

**NOTES TO ASSESSORS**

(2) Demolition and Hoarding

Reference should be made to SE's advice given in item 3.1 of the minutes of meeting.

(i) Demolition of 6-storey existing building = 1,200m2 per floor x 6 floor x $800/m2 = $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

(Cost build-up for demolition in the range of $7M to $10M is considered acceptable.)

(3) Foundations

Reference should be made to SE's advice given in item 3.2(b) of the minutes of meeting.

(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

(Cost build-up for the piles in the range of $28M to $35M would be acceptable.)

The foundations of Project Hillside involved a substantial amount of rock stabilization works on hill slope which are not required for Project Greenland. Therefore, direct application of the cost data from Project Hillside would NOT be appropriate because the foundations design would depend very much on individual site's conditions. If the Candidate chooses to use the cost data from Project Hillside, he should demonstrate how he would exclude the cost effect of rock stabilization works in Project Hillside. This may be demonstrated by search and enquiry within the company for the details of cost data from Project Hillside.





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**Question No. 1 – Cost Estimate (Cont'd)**

**NOTES TO ASSESSORS**

(4) Pile Caps

Cost build-up for pile caps which includes reinforced concrete, formwork, rebar, blinding, excavation and lateral support: -

(i) Concrete:

- Cap under footprint area of residential block = 460m2 x 2.5m = 1,150m3
- Small caps for the podium (number and size assumed by QS)
  area =16 nos. x 1.5m x 1.5m = 36m2; volume = 36m2 x 1.5m thick = 54m3
- Total concrete volume = 1,150m3 + 54m3 = 1,204m3
- Cost = 1,204m3 x $1,400/m3= **$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 = 300m2
- Small caps for the podium (number and size assumed by QS) =16 nos. x 1.5m x 4 x 1.5m = 144m2
- Total = 300m2 + 144m2 = 444m2
- Cost = 444m2 x $500/m2= **$222,000**

(iii) Rebar (assumed 300kg/m3 by QS):

- Total = 1,204m3 x 300kg/m3 = 361,200kg
- Cost = 361,200kg x $10/kg = **$3,612,000**

(iv) Blinding Layer (say 75mm thick)

- Total = 460m2 + 36m2 = 496m2
- Cost = 496m2 x $100/m2 = **$49,600**

**Question No. 1 – Cost Estimate (Cont'd)**

(4) Pile Caps (Cont'd)

(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 = 460m2 x (2.5m +1.5m) = 1,840m3
- Excavation of small caps for the podium (assumed by QS) =16 nos. x 1.5m x1.5m x (1.5 + 1.5) m =108m3
- Total excavation volume = 1,840m3 + 108m3 = 1,948m3
- Cost = 1,948m3 x $600/m3 (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/m2 = 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/m2 on strutting area.

- Total = 120 x 4m deep x 300kg/m2 = 144,000kg
- Cost = 144,000kg x $16/kg = **$2,304,000**

(viii) Preliminaries

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

(Cost build-up for the pile caps in the range of **$10M to $15M** would be acceptable.)

Candidates are expected to highlight that small caps have to be allowed for the podium. Candidates should write down the considerations or send queries to the Structural Engineer to confirm the pile cap design for the podium, depth of steel sheet piles and tonnage of steel strutting and shoring.





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**Question No. 1 – Cost Estimate (Cont'd)**

**NOTES TO ASSESSORS**

(5) Substructure (Ground slab and beam, tie beams, substructure columns, cable trenches, lift pits, etc.) - costs were included in the superstructure unit costs of Project Hillside.

(6) Superstructure – Residential

Before adopting the unit costs of the Project Hillside, Candidate should check the following to verify that the unit costs are appropriate for reference:

- Building height: 23 storeys for Project Greenland and 27 storeys for Project Hillside, i.e. comparable
- Area of typical floor: 460m2 for Project Greenland and 480m2 (i.e. (11,820m2 – entrance lobby 100m2 – roof plant rooms 200m2 as Project Greenland) / 24 floors) for Project Hillside, 4.4% different, i.e. comparable
- No. of flat: 160 flats (i.e. 8 x 20 floors) for Project Greenland and 192 flats (i.e. 8 x 24 floors) for Project Hillside, i.e. comparable
- Typical floor plan layout and standard: similar in both projects as advised in Project Design Meeting

It is crucial that TPI adjustment should be made with reference to the TPI given in Appendix C to bring the cost to the current price level.

Factor for adjustment of TPI = 1818 (2017Q3 TPI) / 1783 (2016Q4 TPI) = 1.0196

Adjusted unit cost of residential = $30,000/m2 CFA x 1.0196
= $30,588/m2 CFA, say $30,600/m2 CFA

Cost = 9,500m2 x $30,600/m2 = $290,700,000 = **$291M**

**Question No. 1 – Cost Estimate (Cont'd)**

**NOTES TO ASSESSORS**

(7) Superstructure - Clubhouse

CFA of Clubhouse in both projects are small and comparable, one is 350m2 and the other one is 440m2. The unit cost of the Clubhouse of Project Hillside could be adopted for the estimate of Project Greenland. TPI adjustment similar to that described for the Residential Portion is required.

Adjusted unit cost = $45,000/m2 CFA x 1.0196
= $45,882/m2 CFA, say $45,900/m2 CFA

Cost = 350m2 x $45,900/m2 = $16,065,000 = **$16M**

(8) Superstructure - Carpark

The cost per CFA of the carpark of Project Hillside could be adopted for the cost plan of Project Greenland. TPI adjustment similar to that described for the Residential Portion is required.

Adjusted unit cost = $12,000/m2 CFA x 1.0196
= $12,235/m2 CFA, say $12,300/m2 CFA

Cost = 2,250m2 x $12,300/m2 = $27,675,000 = **$28M**

(9) External and Landscaping Works

Candidates should apply the cost data from Project Hillside and make appropriate adjustment for the difference in TPI.

| | |
|---|---|
| Project Hillside: | Site area 1,500m2 – tower 480m2 = 1,020m2 |
| Project Greenland: | Site area 1,200m2 – tower 460m2 = 740m2 |

Cost = $15M x (740/1,020)m2 x 1.0196 (TPI adjustment) **= $11M**





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**NOTES TO ASSESSORS**

(10) Preliminaries

If the costs are based on the cost data from Project Hillside, they should have included preliminaries and no separate allowance should be made on top.

If the costs are built up independently, then additional allowance could be made for preliminaries.

(11) Contingencies

Even though the some of the costs are based on the cost data from Project Hillside, it would still be prudent to allow for design development and construction contingencies for this Project Greenland.

Summary of costs of above items:

a. Ground Investigation: $0.7M to $1.0M
b. Demolition and Hoarding: $7M to $10M
c. Foundations: $28M to $35M
d. Pile Caps: $10M to $15M
e. Superstructure: Residential: $291M
f. Superstructure: Clubhouse: $16M
g. Superstructure: Carpark: $28M
h. External and Landscaping works: $11M

Contingencies = Allow 10% for items with cost build-up based on Project Greenland's design and 5% for items using the unit costs of Project Hillside (that is, 10% for items a to d ($4.6M to $6.1M) and 5% for items e to h ($17.3M) = $22M to $24M

Based on the above estimated figures, the total estimated construction cost should be in the range of **HK$414M to HK$431M.**