Tall Buildings in Numbers

The Economics of High-rise (as per 2nd Quarter 2010)

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High vs Low: An Elemental Comparison

(1) GIA = gross internal area (m^2).

(2) The most important of the key cost drivers is shape, not least because it has a profound effect upon the structural solution and the cost of the façades.

(3) Tall buildings are less efficient than low-rise schemes because:

- Structural frames and core walls are larger and thicker
- More area is taken by plant and risers
- Smaller floor plates result in relatively high space-taken by lifts, stairs, circulation, etc.

(4) Typical floor area efficiencies (NIA : GIA percentage) for low-rise is between 68%–75%, whilst for high-rise is between 60%–70% only.

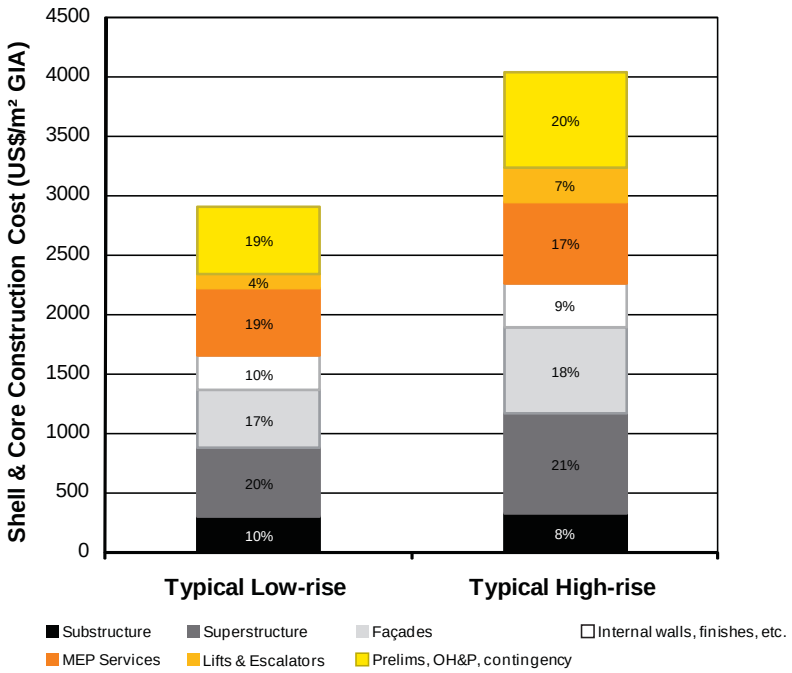
(5) Whilst the progression from low/medium-rise offices (up to 20 stories) to high-rise projects (over 35 stories) is generally marked by a significant premium, within each range there are more important cost drivers than height alone. These are shown below:

Key High-rise Cost Drivers

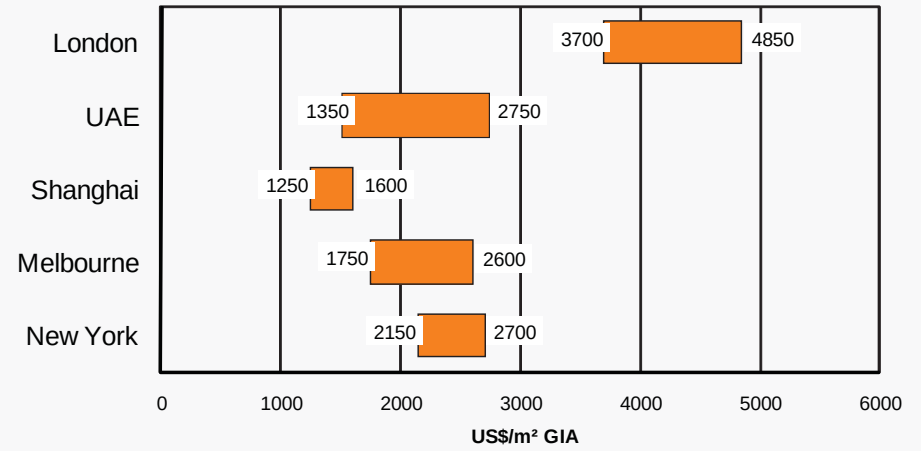
Note: Irrespective of building use/ownership

- Shape & geometry – height, iconicity, slenderness
- Size and regularity of floor plate – floor area efficiency
- Structural Solution (including core location) – construction methodology
- Façade specification – articulation, repetition, detailing
- Environmental strategy/sustainability enhancements – life cycle value
- Site constraints (including seismic considerations) – location
- Market conditions/procurement route – procurement strategy, risk transfer, market appetite
- Vertical transportation strategy – number/speed/ arrangement of elevators

Relative Elemental Costs for Low and High-rise Office Buildings (Central London)

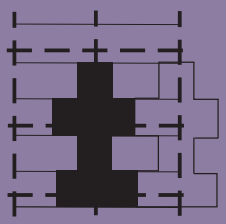


Shell and Core High-rise Construction Cost Range (US$/m² GIA)



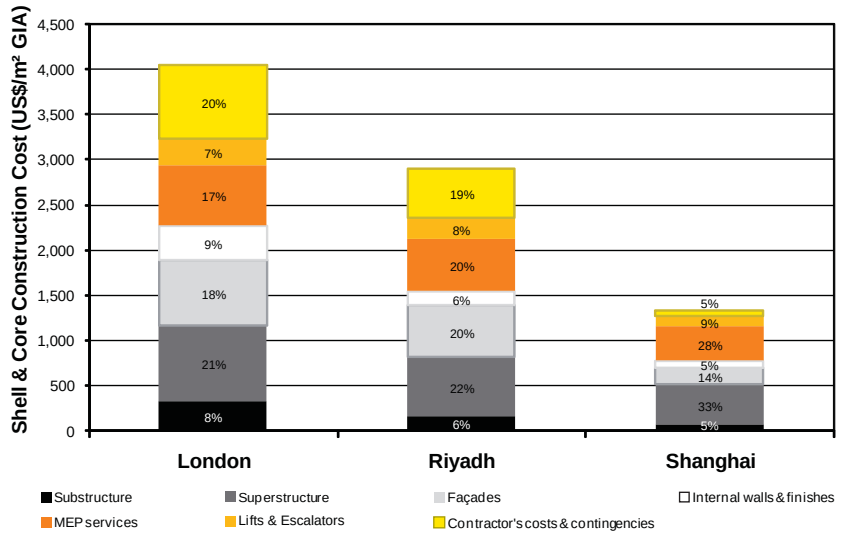
The biggest cost items in high-rise office buildings are typically superstructure, facades and MEP services.

Given that façades can constitute 20% of the total shell & core cost of a tower, doubling the wall : floor ratio would add 10% to total construction costs.

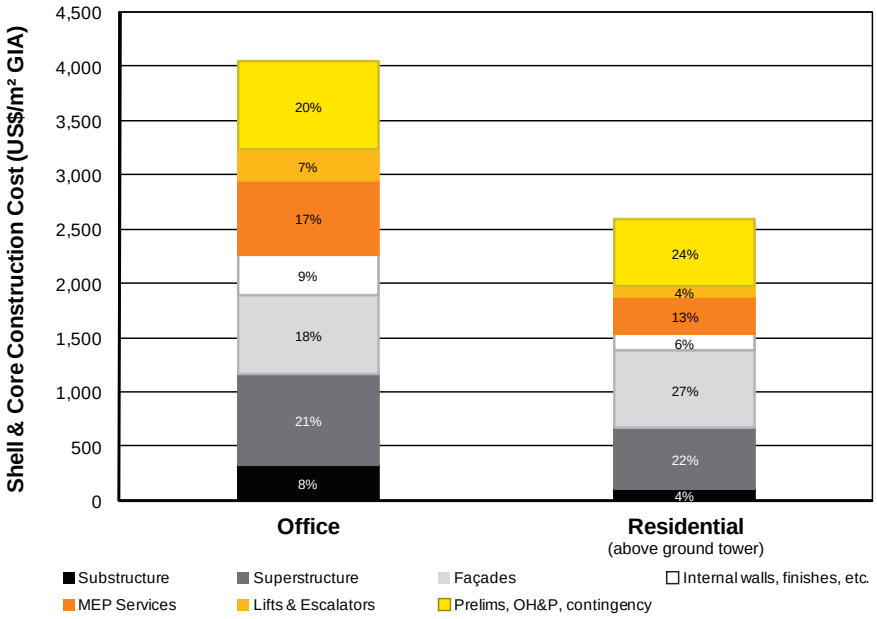


The wall : floor ratio of the tallest Asia Pacific towers ranges between 0.30 – 0.36 with an average of 0.34. While for the tallest Central London towers, this ranges between 0.32 – 0.60 with an average of 0.51.

Typical Elemental Build-up of Shell & Core Construction Costs for landmark High-rise Office Buildings in Europe, Middle East & Far East



Typical Shell and Core Construction Costs: Office vs Residential Towers (London)



Financial Ratios

(1) Two key determinants of the bottom line on the cost and value sides of the development equation, are respectively:

- Wall : Floor ratio
- Net : Gross ratio

(2) Wall : Floor ratio is one of the principle implications of shape. It represents the amount of wall area that has to be constructed for every unit of floor area, so from a cost perspective, the lower the better.

(3) Net : Gross floor area ratio is a measure of how much tenant space is provided in proportion to the total area constructed, so the higher the better.

(4) Buildings with smaller floorplates and complex urban forms are less economic than buildings with larger floorplates and regular functional forms (generally possessing higher wall : floor ratios and lower net : gross ratios).

Location, Location, Location

(1) The basic principles of cost and height apply wherever the project is located – including the key cost drivers and particularly the impact of shape (in both the vertical and horizontal planes).

(2) High-rise costs vary considerably across the globe (for a variety of reasons) and the relative build up of construction costs can also be quite different (see graph top left).

Office vs Residential

(1) Tall building uses have changed over time and continue to develop. Whilst mixed-use towers become more popular, the most common single-use variants remain the office and residential towers.

(2) The differences in cost are largely driven by differences in the following key criteria for UK schemes:

	Office	Residential
Average floor plate size	1,500 – 3,000m^2	560 – 790m^2
Wall : floor ratio	0.35 – 0.60	0.40 – 0.65
Floor : floor heights	3.65 – 4.2m	2.90 – 3.20m
Façade strategy	Ventilated double wall façade	Unitised curtain walling, 60:40 solid : glass
Superstructure material	Frame usually steel; core steel or concrete	All concrete

The construction costs of high-rise office buildings in Central London can be over double that of New York and 3 times that of Shanghai.

Shell and core construction costs for iconic high-rise office buildings are approximately 160% of the construction costs for high-rise residential.

Fundamental Financial Drivers