Design economics and cost planning
The areas of competencies expected by RICS APC Pathway

- **Economics of design** - site density, wall / floor ratio, storey heights, room sizes, letable / non-letable
- **Sources of cost data** - BCIS / in-house database / other external sources
- Inflation (tender / construction)
- **Location factors, regional variations**
- Currency fluctuations
- Estimating
- **Cost Planning**
- **Life cycle costing** - capital / running costs / replacement
- **Value Engineering**
- **Risk Management and Analysis** (contingency)
- State of the construction market
- State of the economy generally – locally and globally
- Interest rates
What are the factors affecting the cost of the building?

• Design Factors
• Site Factors
• Economic Factors
Simple Example

• Making a box of 1.5m^3
• Easiest way 1.5m x 1m x 1m = 1.5m^3
• Sides 1.5mx1m - 4 Nos, 1mx1m – 2 Nos
• Size of plywood – 2.4mx1.2m. Need 5 sheets
• Alternative 1.2m x 1.2m x 1.2m = 1.73 m^3
• or 1.2m x 1.2m x 1.0m = 1.44 m^3
• In both alternatives need only 3 sheets
Design Factors

• shape/plan shape
• grouping of buildings,
• number of stories
• story height-
• size-
• circulation space
• internal layout
• Specifications
• working conditions
Effects with the plan shape

10 x 10

4 x 25

d=11
What are the effects?

- Length of foundation
- External walls
- Eaves Gutters
- Drainage
- More paved areas
- Natural lighting, Easy to sub-divide
- Also; span of floors/roof, int. layout, service layout, ext. works.
- Irregular shapes what are the impacts??
Design Factors Cont,d

• Height- all elements with vert. comp.
• Size - increase may reduce m² rate, savings on plant rooms, kitchen bathroom
• circulation space,- affects to lettable area
• internal layout,
• specifications,- client, function, aesthetic, initial cost, future cost, Architects preference, life of the building
• working conditions (it is necessary to know what happens to the cost of different elements when part of the design is changed.)
• Work in the existing buildings- redesign of interior, refurbishment using existing interior, retention of some structures/features.

• Work in existing building is a big challenge which will have an impact on cost.
Number of stories and story height
Site Factors

- location, distance to the tip for disposal
- topography, - wind loading
- geology,- soil reuse, soil type for foundation,
- environmental,- tree preservation orders, protected species and animals, Eradication of Japanese knotweed, protection of reverbanks, flood protection
- access to site,
- existing services,
- existing site use,
- size of site,
- adjoining properties
**Economic Factors**

- amounts of works available
- availability of resources
- desirability of the project
- cost of borrowing
- micro-economics of the tendering firms - future workload, impact on tender price, profit to share holders, fixed costs, overheads
Cost Planning and Pre Contract Cost Control

• **Aim;**

• To ensure Client obtains value for money by

1. Setting a realistic cost limits which represents a fair price for the project

2. Deciding how this money is to be spend

3. Checking that the money is being spent as intended
Outline Plan of works (Oman?)

- Inception
- Feasibility
- Preliminary Design - outline proposal, schematic design
- Detailed Design
- Production Information
- Bill of Quantities
- Tender Action
- Project Planning
- Operation on site -> Completion
The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projects into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.
# RIBA work stages

## ORDER OF COST ESTIMATING AND ELEMENTAL COST PLANNING

<table>
<thead>
<tr>
<th>RIBA Work Stages</th>
<th>RICS formal cost estimating and elemental cost planning stages</th>
<th>OGC Gateways (Applicable to building projects)</th>
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<tr>
<td><strong>Preparation</strong></td>
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<td>1. Business Justification</td>
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<td>A Appraisal</td>
<td>Order of cost estimate</td>
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<tr>
<td>B Design Brief</td>
<td></td>
<td>2. Delivery Strategy</td>
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<tr>
<td>C Concept</td>
<td></td>
<td>3A Design Brief and Concept Approval</td>
</tr>
<tr>
<td>D Design Development</td>
<td>Formal Cost Plan 1</td>
<td>(See note below)</td>
</tr>
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<td>E Technical Design</td>
<td>Formal Cost Plan 2</td>
<td>3B Detailed Design Approval</td>
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<tr>
<td>F Production Information</td>
<td>Post tender estimate</td>
<td>(See note below)</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td></td>
<td>3C Investment Decision</td>
</tr>
<tr>
<td>G Tender Documentation</td>
<td>Pre-tender estimate</td>
<td>(See note below)</td>
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<tr>
<td>H Tender Action</td>
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<td>J Mobilisation</td>
<td></td>
<td>4. Readiness for Service</td>
</tr>
<tr>
<td><strong>Construction</strong></td>
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<tr>
<td>K Construction to Practical Completion</td>
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<td>5. Operations Review and Benefits Realisation</td>
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<tr>
<td>L Post Practical Completion</td>
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<td></td>
</tr>
<tr>
<td><strong>Use</strong></td>
<td></td>
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</tbody>
</table>
RICS NRM-Definitions

There are lot of definitions you need to remember which can be questions in APC.
Ex. Base cost estimate, inflation, cost limit, cost checks, EUQ, EUR, PC sum,
Essentials of cost control system

• Set Targets (prepare cost estimate /cost plan)
• Monitor Progress (measure and compare)
• Report Findings
• Agree Adjustments (cost plan or design)
Details /data used for cost planning

**Historical data**

- Price Books
- Bills of Quantities for past projects
- Final Accounts for past projects
- Building cost information service (BCIS)
- Trade Journals
Historical Data

• Can historical data simply be transferred? Most unlikely;

• Need adjustments for

  1. Time
  2. Location
  3. Building Type etc.
Methods of cost planning

- Floor Area Method
- **Elemental Method**
- Unit rates and element unit rates
- Updating unit rates and other costs to current estimate base date
- **Comparative**
- Elemental approximate quantities
Elemental Cost Planning

When preparing an elemental cost plan, the cost of the building is split up into the different “elements”
Elements

An Element is a part of a building which performs a specific function

- **Sub structure** - Piling, earth works, foundation etc.
- **Superstructure** - Frame, upper floors, Roof, Stair, External walls, Doors and windows, Internal walls and partitions
- **Internal Finishes** - walls, floors, ceilings
- **Fittings and furnishings**
Elements Cont’d

- **Services** - Sanitary Appliances, disposal installations, Water Installations, Space heating and AC, Ventilation system, Electrical installation, Gas/Fuel installation, Lifts, Fire Fighting, Telephones, medical gas

- **External Works** - site preparation, Roads and paths, landscaping, Drainage, External services
Comparative Cost Planning

• A process for comparing the cost of alternatives which perform the same function

Ex. Steel and Concrete frames
Different roof structures and finishes
3.6 Detailed Information

Detailed information includes key project information such as gross floor area (GFA), number of keys (rentable rooms) as well as a cost per square meter as compared to the GFA and a cost per key.

The **Salalah Development** detailed information is as follows:

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>MOVENPICK HOTEL</th>
<th>CLUB MED HOTEL</th>
<th>18 HOLE GOLF COURSE</th>
<th>GOLF COURSE CLUB HOUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low Level (OMR)</td>
<td>High Level (OMR)</td>
<td>Low Level (OMR)</td>
<td>High Level (OMR)</td>
</tr>
<tr>
<td>GFA (m²)</td>
<td>59,526</td>
<td>59,526</td>
<td>68,671</td>
<td>68,671</td>
</tr>
<tr>
<td>Cost / m²</td>
<td>1,238</td>
<td>1,441</td>
<td>957</td>
<td>1,111</td>
</tr>
<tr>
<td>Nr. Keys / Holes</td>
<td>400</td>
<td>400</td>
<td>395</td>
<td>395</td>
</tr>
<tr>
<td>Cost / Key / Hole</td>
<td>184,236</td>
<td>214,513</td>
<td>166,298</td>
<td>193,107</td>
</tr>
</tbody>
</table>

*Table 2: Salalah Development Detailed Information*
Not included in Cost Plan

- Land Cost
- Advertisement Cost
- Finance Cost
- Legal Fees
- Employer's operational cost
- Feasibility study cost
- Cost of future authority requirement changes
- Inflation/Price Fluctuation/Market Conditions
Value for Money

Value for money will have different meanings for different clients. (see paper 1116 section 2)

It does not necessarily mean the cheapest option

Some factors considered could be

- The building design should be economical.
- Standard of amenity, finish and equipment
- Least initial cost, consistent with good design.
- Balance between initial and future costs
- Minimum disruption resulting from maintenance
Life Cycle Costing

Typically, only one ninth of the volume of an iceberg is above water, the remainder is underwater and cannot be seen  (Wikipedia)

In buildings, future user costs are many times the initial cost of the building. Whole life costing considers both initial and future costs,
Definitions

Life cycle costing is sometimes called whole life costing. In this course, we differentiate between the two:

Life cycle costing relates to the cost of the building (or component) throughout its life.

Whole life costing includes other costs such as the cost of the site, financing costs etc i.e. the cost of the whole development.
Whole life cost

- Non-construction costs
  - Site costs
  - Finance costs
  - Rental costs

- Life cycle cost
  - Construction cost
  - Maintenance costs
  - Operation costs
  - Occupancy costs
  - End of life costs

- Income
  - Income from sale of land or building or salvaged material
  - Income from third party during occupation, e.g. rent
  - Loss of income, e.g. due to disruption

- Externalities
  - Costs associated with asset which are not necessarily reflected in the transaction costs between provider and consumer
Life cycle cost

- Construction cost
  - Construction works costs
  - Other construction-related costs

- Maintenance costs
  - Major replacement costs of systems and components
  - Scheduled refurbishment and adaptation
  - Redecoration
  - Minor replacement, repairs and maintenance costs
  - Unscheduled replacement, repairs and maintenance costs
  - Allowance for unforeseen works
  - Grounds maintenance
  - Costs or income from disposal of replaced components and parts
  - Inspections carried out as part of maintenance contract

- Operation costs
  - Cleaning costs
  - Fuel costs
  - Water and drainage charges
  - Administrative costs
  - Property insurance
  - Rates and local charges

- Occupancy costs
  - Internal moves
  - ICT and IT services
  - Switchboard/telephones
  - Catering and hospitality

- End of life costs
  - Disposal inspections
  - Demolition including landfill and recycling or disposal costs
  - Reinstatement to meet contractual requirements
How do we choose between alternatives

e.g. how do we decide whether to :

a) Spend more in construction and thus reduce maintenance costs

or

b) Build more cheaply and have higher maintenance costs
Life cycle costing provides a

- Comparison of alternative designs
- Comparison of alternative CASH FLOW streams as illustrated in the following graphs:
Life cycle costs – what is included?

- Construction costs
- Maintenance costs
  - Replacement, refurbishment, repairs, maintenance, adaptation, inspections etc
- Operation costs
  - Cleaning, fuel/energy costs, insurance etc
- Occupancy costs
  - Internal moves, IT services, switchboard etc
- End of life costs
  - Disposal inspections, demolition, reinstatement costs
Stages of Life cycle costing

• **Life cycle cost analysis**; collection and analysis of historic data connected with actual costs

• **Life cycle cost management**; collecting data on other buildings, planning and controlling occupancy costs

• **Life cycle cost planning**; using cost analysis to predict future costs
Net Present Value

Life cycle costing

- We must adjust all payments to a common base which we call the present value.

- We do this by using a combined adjustment for interest and inflation called the

**DISCOUNT RATE**

Discount rate = cost of borrowing minus rate of inflation (all expressed as percentages)
Value Engineering/Management

“A systematic approach to achieve the required project functions at least cost without detriment to quality, performance and reliability “

Value Engineering is part of the overall value management process which should be carried out during the pre-contract process mainly during the design stage
Value Engineering/Management

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Value Management

• Value Planning
• Value Engineering
• Value Review
Risks in Construction Industry

Risks are unavoidable in any project and to be...
• Identified
• Analyzed
• Monitored and Controlled
**Risk and Risk Allocation**

Identification and recording;

• All possible factors well in advance to decide whether to proceed with the project or not

• Categorization of identified risks in logical manner for easiness of assessing and managing them.
Analysis/Assessment


• Quantification and qualitative techniques can be used.
• Probabilities and sensitivity analysis.
• Can categories as critical, major, minor
Risk and Risk Allocation

• Identification and recording
• Analysis (Magnitude, Probability and Occurrence)
• Response (Avoid, Reduce, Accept, Transfer, sharing, retention)
• Contingency