Abstract

• The full potential of QS BIM for cost modelling should be realized
• QS practices will need to organize the historical information of tendered or completed projects into key indicators for economic evaluation of design alternatives
• Information from the public domain such as websites can sometimes be used, with caution

Key Performance Indicators for Building Structure

Abstract (cont’d)

• Make optimum use of available information to create a cost model where the Level of Detailing provided, of say 100, is insufficient
• There is a need to consider data-mining tools to develop the firm’s knowledge management (KM) base
• How this KM base is to be developed will depend on the proper identification of key indicators for economic design evaluation
Demand for KPIs for Economic Evaluation

• As property development becomes increasingly competitive and riskier, bankers and accountants are increasingly aware that project costs have to be managed even at the early design stage to meet investment objectives
• Marketers have to do their market research and analysis of what will sell and at what price before the schematic or sketch designs can be firmed up

Demand for KPIs for Economic Evaluation (cont’d)

• There has been a shift in emphasis on measurement (to produce bills of quantities) to that of a building or design economist to provide cost modeling or cost planning advice at the early stages not only to meet requirements of the design brief but also to address financing and marketing concerns.

Evaluation of Structural Systems

Design & Facade

• Comparison of Internal and External Shear Wall systems
• Comparison of Post-tensioned Flat Slab system and Conventional Beam & Slab system
• Comparison of unitized glass window system, curtain walling system and aluminum cladding system

Civil Engineering Structures in the Building Domain

• Inter-connecting elevated decks with pedestrian linkways supported by box girder structures between towers have made their appearance
• These are more like civil engineering bridge structures with a broad deck on top spanning between buildings
• This has made the task of using a suitable set of KPIs and benchmarks for cost modeling even more challenging for the QS
Bridge Design

Bridge design can be classified as:

- single closed box girder composite bridge,
- twin girder cross-beam directly supporting bridges with cantilever,
- twin girder cross-beam directly supporting bridges without cantilever,
- multi-girder composite bridge,
- cross-beam composite bridges with deck local widening near abutments,
- variable width cross-beam composite bridge,
- special girder composite bridges

Brief Cost Plan for Elevated Deck & Linkway (for illustration only, cost/m² not shown)

<table>
<thead>
<tr>
<th>No.</th>
<th>Elements</th>
<th>Amount (RM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Main Grid Space Truss &amp; Non-long Span Structure</td>
<td>200,000,000</td>
</tr>
<tr>
<td>2</td>
<td>Linkway</td>
<td>42,000,000</td>
</tr>
<tr>
<td>3</td>
<td>Support columns, pile, caps &amp; bored piling - allow</td>
<td>10,000,000</td>
</tr>
<tr>
<td>4</td>
<td>Retail areas of deck (light structure) - allow</td>
<td>4,000,000</td>
</tr>
<tr>
<td>5</td>
<td>Escalator, elevator &amp; stairs</td>
<td>3,000,000</td>
</tr>
<tr>
<td>6</td>
<td>Interfacing with existing building - allow</td>
<td>3,000,000</td>
</tr>
<tr>
<td>7</td>
<td>Dismantle, underpinning, trial pits - allow</td>
<td>10,000,000</td>
</tr>
<tr>
<td>8</td>
<td>M&amp;E installations - allow</td>
<td>10,000,000</td>
</tr>
<tr>
<td>9</td>
<td>Landscaping - allow</td>
<td>4,000,000</td>
</tr>
<tr>
<td>10</td>
<td>General Preliminaries - 15%, say</td>
<td>6,000,000</td>
</tr>
<tr>
<td>11</td>
<td>Contingencies - 10%, say</td>
<td>3,000,000</td>
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<tr>
<td>12</td>
<td>Total</td>
<td>362,000,000</td>
</tr>
</tbody>
</table>

Relationship between Span and Cost

- It can be generalized that the larger the spans, the heavier the steel tonnage required
- Therefore, the weight of structural steel members (in terms of kg. per m² of deck area) increases if the span increases
- The average kg. per m² of deck area ranges from 0.25 – 0.33 kg. per m², depending on the box girder type, whether there are supporting cross-beams or propped cantilevers or not
Price Grouping of Bridge Structures

(refer to main paper)

Project Information Management Systems and Knowledge Management

- Newforma
- Aconex
- Apex
- Cost XL

The above are for Buildings, what about civil engineering applications?

Conclusion

- With the advent of BIM, the QS role has shifted upfront whereby the implications of early stage design choices has to be costed out and made known
- It is clear that key indicators for cost planning need to be further developed for better knowledge management in both building and civil engineering construction projects
- The development of key cost planning indicators for civil engineering projects may still be at its infancy but over time it is hoped that a “standardized” format for cost analysis of civil engineering structures such as bridges, etc. would be available