Onsite v Offsite Economics

A presentation by
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To
Buildoffsite Residential Hub
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Content of Presentation

- Why CombiCycle Comparator is cost neutral for off-site construction
- Traditional v off-site cost comparison
- Lessons from Europe re cost-efficiency
- Lessons from USA re cost-efficiency
- Construction costs in context - the development budget
- Who gets the benefit?
- Helps and hindrances to off-site cost-efficiency
## CombiCycle Comparator - Results Screen

### Comparing Traditional vs Modular Solutions

<table>
<thead>
<tr>
<th>GIA: 300 M² - Location: Wales</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost Centre</strong></td>
</tr>
<tr>
<td><strong>Capital</strong></td>
</tr>
<tr>
<td><strong>Life-cycle replacement</strong></td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
</tr>
<tr>
<td><strong>Energy (in occupation)</strong></td>
</tr>
<tr>
<td><strong>Whole Life Total</strong></td>
</tr>
<tr>
<td><strong>Whole life sustainability factors (show/hide)</strong></td>
</tr>
<tr>
<td><strong>Sustainability rating</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Replacement sustainability</strong></td>
</tr>
<tr>
<td><strong>Time on Site</strong></td>
</tr>
<tr>
<td><strong>Time on Site (weeks)</strong></td>
</tr>
</tbody>
</table>

*Includes saving in Preliminaries

**Includes waste materials adjustment - CO₂ (embodied Initial) Tonnes

*buildoffsite*
### CombiCycle Comparator - Results Screen
Comparing Traditional v Volumetric Solutions

<table>
<thead>
<tr>
<th>Quality</th>
<th>Default 30 Years</th>
<th>Average 30 Years</th>
<th>Default volumetric_16.12.15</th>
<th>* Default volumetric_16.12.15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>£ 494,668</td>
<td>£ 487,558</td>
<td>* £ 487,558</td>
<td></td>
</tr>
<tr>
<td>Life-cycle replacement</td>
<td>£ 176,052</td>
<td>£ 177,785</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>£ 277,564</td>
<td>£ 279,584</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning</td>
<td>£ 28,229</td>
<td>£ 29,615</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy (in occupation)</td>
<td>£ 569,483</td>
<td>£ 569,509</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste Disposal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demolition</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole Life Total</td>
<td>£ 1,546,066</td>
<td>£ 1,544,051</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whole life sustainability factors (show/hide)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainability rating</td>
<td>5.7</td>
<td>5.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial sustainability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainability Rating</td>
<td>B</td>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replacement sustainability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time on Site</td>
<td>23.9</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time on Site (weeks)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Includes saving in Preliminaries
Benchmarking the Efficiency of the EU Construction Industries - ECDG/BWA 2006
Reasons for Differences Between Countries in Terms of Resource Usage Efficiency

- Extensive industrialisation of the process
- Total or partial delegation of detailed design to the contractor
- A well-paid, well-trained, industrious workforce
- Limited scale of sub-contracting
- Well developed lean construction management
- Total project insurance facilitating integration of design and construction
Typical cost breakdown: UK Traditional Residential Construction

- **Components**: 19%
- **Raw materials**: 17%
- **Labour onsite**: 40%
- **Labour offsite**: 0%
- **Waste of raw materials**: 2%
- **Waste of components**: 1%
- **Materials transport**: 1%
- **Time-related prelims**: 10%
- **Fixed prelims**: 2%
- **Overheads**: 3%
- **Profit**: 5%
- **Production facilities**: 0%
- **Unallocated**: 0%
Typical cost breakdown: UK Cost-neutral Off-site Residential Construction

- **Production facilities**: 3%
- **Fixed prelims**: 2%
- **Time-related prelims**: 5%
- **Materials transport**: 2%
- **Waste of components**: -1%
- **Waste of raw materials**: 1%
- **Overheads**: 3%
- **Unallocated**: 8%
- **Profit**: 5%
- **Components**: 17%
- **Labour onsite**: 20%
- **Labour offsite**: 18%
- **Raw materials**: 16%
Quality comparison

- The quality control in the factory is superior to that prevailing on most construction sites.
- To make a fair comparison between the two processes the allowance in Preliminaries for Quality Control should be increased by upwards of 200% for the traditional solution.
UC Berkeley (USA) Research into Offsite Construction - Anecdotal Analysis

Off-Site Construction Cost Savings
(sample California project)

Cost Per Square Foot

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Off-Site</th>
<th>On-Site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soft</td>
<td>150</td>
<td>200</td>
</tr>
<tr>
<td>Materials</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Labor</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>General &amp; Sub-Contractor Profit &amp; OH</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Podium/Site</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>General Contractor Install</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

Graph showing cost savings in off-site and on-site construction.
UC Berkeley Results in a UK context
UK v USA Capital costs/m2 GIA
Low-rise Block of Flats
Low-rise Block of Flats - Construction Cost Analysis

- Superstructure and services: 63%
- Substructure: 11%
- Site preparation: 6%
- Design: 7%
- External works: 9%
- Fittings/Furnishings: 4%

Total 100%
Effect of Saving on Residual Land Value/Profit

Traditional build

- Construction 33%
- Land and profit 52%
- Sales 2%
- Abnormal site costs 4%
- Design fees 3%
- Finance 3%

Offsite build - 20% saving

- Construction 26%
- Land and profit 60%
- Sales 3%
- Abnormal site costs 4%
- Design fees 2%
- Finance 2%
Effect of Saving Passed on to Purchaser
Reasons for Cost Savings – Off-site v Trad

- **Materials**
  - Less waste
  - Bulk purchasing

- **Off-site labour**
  - Cheaper
  - Larger pool of labour (safety, comfort, local, women)
  - Greater efficiency - repetitive processes

- **On-site labour**
  - Less weather-dependent
  - More focused activities
  - Less sub-contracting

- **Time-related preliminaries**
  - Substantially reduced

- **Overheads and profit**
  - Tier One/Two contractors
High-rise Volumetric - 40 Storeys by Vision Modular Systems
Supplier’s View of Benefits of High-rise Volumetric

Vision Modular Systems delivers the following benefits:

- Major reduction in on site programme
- Guaranteed consistent high quality of finish
- Safer method of construction
- Certainty of programme and cost.
Why Off-site Can Be More Expensive

- Design and construction
  - Fitting off-site to buildings designed for trad - i.e. late involvement
  - Lack of understanding of the process
  - Unwieldy and/or poorly designed off-site enabling works
  - Inappropriateness of solution - redundant performance

- Site constraints
  - Difficulty of access to site
  - Lack of space on site for unloading/ direct craneage

- Commercial considerations
  - Under-capacity
  - Early amortisation of initial investment
  - Tier One/Two contractor overheads
  - Construction industry recession
Conclusions

- Off-site should be cheaper at low-rise - all other things being equal
- Jury is out on costs of volumetric high-rise
- Traditional construction costs are too expensive in UK
- Any type of boom will send traditional costs soaring
- The effects of reducing costs through off-site are limited to maybe 60-70% of total building costs....
  ... and to less than 1/3 of the selling price
- The benefits of any savings do not always fall to the end user
- Speed of construction, quality and cost certainty would seem to be the main benefits of off-site construction.
- Off-site suppliers can improve the economics of their offering
- They can argue a good case for refusing to drop to the low margins of Traditional construction