Pipe modules for a hospital extension:
Ormskirk District General Hospital

Project details:
The Maternity and Paediatrics facility at Ormskirk District General Hospital is a ProCure 21 initiative for Southport and Ormskirk NHS Trust, totalling £11m, with the M&E portion at £5m. The five-storey, steel-framed extension, linking into the main hospital street, consists of six templates (layouts), each of about 1,000m² and contains 120 beds throughout. The hospital, located on the outskirts of the town centre, remained operational throughout the construction period.

Project team:

Client:
Southport & Ormskirk NHS Trust

Architect, planning and PQS:
Mersey Design Group

Principle supply chain partner:
Costain

M&E contractor:
Bailey

IMMPREST team:
Loughborough University

The modules consist of banks of three or more pipes fitted to Unistrut frames with tees and branches pre-cut, that were built and lagged in Bailey’s off-site production facility. The units were delivered on wheeled trolleys and lifted into position on site where the joints were crimped.

The traditional benchmark assumed site installation of single lengths of Mannesmann mappress pipework, cutting-in and crimping tees and branches piecemeal and in situ, using time-served tradesman. Only bracket-work would be pre-fabricated, either on-site or by a supplier using unskilled labour.

Project drivers and constraints:

Drivers
Health and safety and site tidiness initiative (Costain)
Minimise construction costs
Completion date certainty
Predictable quality

Constraints
Limited previous offsite experience within the team
Limited choice of supply chain (and limited capacity of supplier)
Restricted site and delivery space
Limited availability of skilled site labour
IMMPREST evaluation
Loughborough University’s IMMPREST\(^1\) toolkit was used by the project team to determine the actual cost and value of the Bailey pipework modules using a typical floor level\(^2\) as the base for evaluation. This level was half way through the build and represented the mid-point in learning for the team. The values were multiplied \((x6)\) to give the total cost saving figure below.

**COST ISSUES**

Total cost saving for the work package  £46,740  = 13.8%

**A Manufacture, construction and installation costs**

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Traditional cost per level</th>
<th>Offsite cost per level</th>
<th>Cost saving per level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>£55,146</td>
<td>£47,737</td>
<td>£7,409</td>
</tr>
<tr>
<td>Cost saving per level</td>
<td></td>
<td></td>
<td>= 13.4%</td>
</tr>
</tbody>
</table>

This comparison is made from the viewpoint of the M&E subcontractor and excludes any attempt to formally assess the benefit for the main contractor and building client. Of this cost saving, just under half was on materials: some £3,800 per floor level (£22,800 in all), and primarily saved on the lagging subcontract. Except for an increase in transport costs (of £1,200 per level, or £7,200 in all), the majority of the remaining items analysed were savings. These related to labour (£4,550 per level, or £27,300 in all), split roughly equally due to the general labour reduction, reduced rectification and re-work, and improvements in work flow.

**B Site process costs**

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Traditional costs per level</th>
<th>Offsite costs per level</th>
<th>Cost saving per level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td>£1,189</td>
<td>£808</td>
<td>£381</td>
</tr>
<tr>
<td>Cost saving per level</td>
<td></td>
<td></td>
<td>= 32.0%</td>
</tr>
</tbody>
</table>

This concerns the preliminary costs and logistics, and these were relatively small for this element. Nevertheless, as in the previous case study with Bailey where these savings were also around 30 per cent, proportionately there was a significant saving achieved using the offsite option.

\(^1\)www.IMMPREST.com

\(^2\)Block 12, Level 3 (Neo- and post-natal wards)
The principal quantifiable savings were made through the reduced provision of site welfare, accommodation and storage facilities, with an additional smaller saving due to the use of trolleys. Overhead costs were not extracted from the overall off-site cost, and professional costs were deemed to be equivalent.

C Life cycle costs

These items were not costed out. However it was stated that maintenance, salvage and residual costs would be the same for either method of construction.

OTHER BENEFITS

<table>
<thead>
<tr>
<th>Time Category</th>
<th>Traditional (weeks)</th>
<th>Offsite (weeks)</th>
<th>Difference (weeks)</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Off-site and pre-construction activities</td>
<td>17</td>
<td>22</td>
<td>+ 5</td>
<td>-29%</td>
</tr>
<tr>
<td>On-site activities</td>
<td>140</td>
<td>106</td>
<td>-34</td>
<td>24%</td>
</tr>
<tr>
<td>Overall project</td>
<td>157</td>
<td>128</td>
<td>29</td>
<td>19%</td>
</tr>
</tbody>
</table>

The extra five weeks invested in the factory had substantial benefits, cutting 34 weeks from the time on site and saving 29 weeks in total – about five weeks per 1,000m$^2$.

Quality

Early quality problems with material specification and layout were overcome quickly by introducing an extra quality check in the factory by the site supervisor. Despite these setbacks the modules were nevertheless considered ‘moderately better’ for the level of quality, ‘significantly better’ for meeting customer requirements and contained ‘significantly lower’ numbers of defects. However, on this project - the largest and one of the first of Bailey’s projects to use ‘offsite’ at the time - information management and flow was ‘significantly worse’ than an equivalent ‘traditional’ project.

Health and safety

Half of the many criteria assessed were rated ‘significantly better’, with the remaining criteria deemed similar, thus achieving a moderate health and safety benefit overall. Particular benefits were a reduction in the numbers of people on site, in the ratio of operations performed onsite versus offsite, and in the contribution to improved housekeeping.

Sustainability

Several sustainability issues listed by IMMPREST, such as ecological impact, energy consumption and transport, were deemed to be moderately improved by the use of modules. In terms of ‘people principles’, the stated ‘significantly lower’ employee satisfaction of site installation personnel was offset somewhat by easier and more frequent application of the bonus payment scheme.
Site benefits
The pipe modules offered major benefits in addressing the limited storage and access available, with modules being delivered just-in-time and with a reduction in the number of deliveries and personnel. Also, the use of modular pipework raises the need to start installation before the other trades, therefore the areas tend to be clear and there is less chances of being delayed. However, it highlights the need to plan the interfaces between trades. Phil Boyham, Bailey’s project manager comments that, “The use of prefab required a high level of co-ordination with dry-liners, as once modules were installed this stopped them building full height walls. However with just a few co-ordination meetings we quickly found solutions to the problem which entailed Bailey leaving some modules down whilst walls were built”

BROADER ISSUES
As the project progressed level by level and the designers became more competent at modularising the pipework, a greater proportion was prefabricated. Had the numbers of modules achieved per floor level at the end of the project been installed throughout, greater benefits, of up to 40 per cent, could potentially have been achieved.

Lead architect Tony Crawford advised that the project was not designed with modularisation (of pipework) in mind, but that the decision to use pipework modules was made by Costain and Bailey late on in the project. This is often the case and rarely allows the full benefits of pre-assembly and standardisation to be realised.

These, along with the early quality issues raised previously, present a common picture of the requirement for better planning. This was echoed by Phil Boyham who emphasised the need for sufficient pre-commencement time. Despite these issues, the pre-assembly of much of the pipework in this project contributed to substantial cost savings and early completion. Investing more time up-front in design and production readiness, would yield even greater benefits.

LEARNING FOR THE FUTURE – feedback from the project team
The following comments were made by Bailey’s project team:
- Generally how well the installation went in.
- The amount of intangible benefits to both Bailey & Costain.
- Initial difficulties in getting the Foreman to ‘buy in’ to the use of prefab.
- A desire by all involved to use prefab systems for future projects wherever possible.
- IMMPREST reveals the detail needed to make better comparisons, but that project cost data needs to be more accessible if the benefits of using IMMPREST are to be readily achieved.

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