Findings from a Post Occupancy Evaluation of adaptive restoration and performance enhancement of a 19th century 'Category B' listed tenement block in Edinburgh

Donald Shearer
setting the scene

• need for climatic response
• legislative approach to reduction in energy use and CO₂ output
• relevance of existing stock
• relevance of specific typologies
conflicting interests

THE GREAT DEBATE ON THE FUTURE OF ARCHITECTURE

CONSERVATION VS SUSTAINABILITY

WILL THESE TWO MIGHTY LOBBIES EVER BE UNITED? - JOIN THE DEBATE
our scenario

- a 19th century masonry tenement - adaptive rehabilitation
- within a UNESCO world heritage site
our scenario

• design of low energy supported housing accommodation
• incorporation of thermally efficient envelope, MVHR, GSHP & sunspaces
• impact of design aspirations?
• what were suspected problems?
• how were these investigated?
• monitoring of physical parameters
• comparative analysis of predicted vs actual energy consumption
• assessment of user satisfaction
findings

thermal comfort - prevailing conditions

<table>
<thead>
<tr>
<th>Room</th>
<th>Comfort Temp (°C)</th>
<th>Mean Temp (°C)</th>
<th>Δ T(^1) (°C)</th>
<th>Absolute Max (°C)</th>
<th>Δ T(^2) (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living Rm</td>
<td>21.00</td>
<td>22.62</td>
<td>+1.62</td>
<td>28.00</td>
<td>+7.00</td>
</tr>
<tr>
<td>Kitchen</td>
<td>18.00</td>
<td>22.87</td>
<td>+1.87</td>
<td>29.10</td>
<td>+11.10</td>
</tr>
<tr>
<td>Hall</td>
<td>18.00</td>
<td>23.45</td>
<td>+5.45</td>
<td>31.20</td>
<td>+13.20</td>
</tr>
<tr>
<td>Sun Space</td>
<td></td>
<td>21.24</td>
<td></td>
<td>40.90</td>
<td></td>
</tr>
<tr>
<td>Bedroom 1</td>
<td>18.00</td>
<td>22.58</td>
<td>+4.58</td>
<td>27.20</td>
<td>+9.20</td>
</tr>
<tr>
<td>Bedroom 2</td>
<td>18.00</td>
<td>21.41</td>
<td>+3.41</td>
<td>26.20</td>
<td>+8.20</td>
</tr>
</tbody>
</table>

mean and absolute thermal conditions over monitored period
(comfort standards as BS 5449:1990)
findings

thermal comfort vs user behaviour
findings

thermal comfort vs user behaviour
findings

thermal comfort problems

floor surface temperature $T^a$

floor surface temperature $T^a$ + 60 mins
findings

thermal comfort and passive gain

sunspace with under-floor heating system
findings

internal air quality

Dwelling 2, Twin Bed Conditions - 17.03.11 to 12.04.11

- Temperature & Vapour Pressure
- CO₂ Concentration
- Pettenkoffer’s max’ - 1000ppm
- Date
findings

positive reporting

- actual energy consumption (space and water heating) 2.1 times greater than SAP predictions
- space and water heating requirements of 92kWh/m$^2$ identified
- ground source heat pump found to provided significant CO$_2$ savings compared to conventional heating systems
• relevance of investigated typology national housing stock
• confirmation of usefulness of short-term, highly focussed POE studies
• identification of gap in the understanding of the relationship between thermal performance and internal environment quality
• need for designers and specifiers to understand the growing level of complexity in the application of sustainable technologies and approaches to building design
Donald Shearer
Mackintosh Environmental Architecture Research Unit
Glasgow School of Art
Renfrew Street
Glasgow
G3 6RQ

d.shearer@gsa.ac.uk