Energy Efficiency Through Design Detail

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Introduction

Background

What is a Thermal Bridge?

Thermal Bridging & the Building Regulations

Case Study

(dac architecture, 2007, Bluehill House.)
What is a thermal bridge?

A break in the insulation layer within a building element. The rate of heat loss at this point is significantly greater than through the well insulated area around it. It will normally occur when a structural element passes through an insulation layer, or because the insulation performance deteriorates where two building elements meet.
Types of thermal bridge?

Repeating – when a material regularly cuts through the insulation within an element

Non-Repeating – occur at junctions of the building element, wall meeting floor or roof; and around openings.

Random non repeating thermal bridges

(dac architecture, 2008, McElvanna House.)
Why worry about thermal bridging?

‘for typical dwellings built to meet the 2006 Building Regulations, heat losses from thermal bridging at junctions, corners and around openings can account for around 30% of the total fabric heat loss’.

(Energy Saving Trust, Enhanced Construction Details: Introduction and use. 2008, p.4)

Condensation and mould growth are other problems which can arise.

(Kearney, 2010, Fabric Performance.)
Building Regulations – Addressing the problem

Technical Booklet L1A (England & Wales) 2010 states that there should be no ‘reasonably avoidable thermal bridges’.

(Department for communities and local government, Accredited Construction Details, 2007)

(Energy Saving Trust, Enhanced Construction Details, 2008)
Case Study

Location: Tassagh, County Armagh, Northern Ireland.
Main Heating System: Heating Oil
Secondary Heating System: Solid Fuel Room Heater
Mechanical Ventilation with Heat Recovery System
80% Low Energy Light Fittings
No additional renewable technologies used in the dwelling

(dac architecture, 2009, Rookwood House.)
Ground Floor Plan

(dac architecture, 2009, Rookwood House.)
First Floor Plan

(dac architecture, 2009, Rookwood House.)
Dwelling Specific Detailing

Wall insulation type, depth and position.

Floor insulation type, depth and position.

Masonry selection for internal leaf

(dac architecture, 2009, Rookwood House.)
Comparative Detail.

Detail in Case Study.

(dac architecture, 2009, Rookwood House.)
<table>
<thead>
<tr>
<th>Junction Detail</th>
<th>$\Psi$-value (W/m-K)</th>
<th>IP 1/06 (W/m-K)</th>
<th>$\Psi$-value source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other lintels</td>
<td>0.01</td>
<td>0.30</td>
<td>Trisco Model</td>
</tr>
<tr>
<td>Sill</td>
<td>0.03</td>
<td>0.04</td>
<td>Trisco Model</td>
</tr>
<tr>
<td>Jamb</td>
<td>0.03</td>
<td>0.05</td>
<td>Trisco Model</td>
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<tr>
<td>Ground Floor</td>
<td>0.03</td>
<td>0.16</td>
<td>Trisco Model</td>
</tr>
<tr>
<td>Intermediate floor within a dwelling</td>
<td>0.04</td>
<td>0.07</td>
<td>Trisco Model</td>
</tr>
<tr>
<td>Eaves: insulation at ceiling level</td>
<td>0.01</td>
<td>0.06</td>
<td>Trisco Model</td>
</tr>
<tr>
<td>Eaves: insulation at rafter level</td>
<td>0.04</td>
<td>0.04</td>
<td>IP 1/06</td>
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<tr>
<td>Gable: insulation at ceiling level</td>
<td>0.08</td>
<td>0.24</td>
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<tr>
<td>Corner: normal</td>
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</tr>
<tr>
<td>Corner: inverted</td>
<td>-0.08</td>
<td>-0.09</td>
<td>Trisco Model</td>
</tr>
</tbody>
</table>
Effect of detail standards on primary energy consumption

Primary Energy Consumption (kWh/yr/m²)  SAP Rating

y = 0.15  y = 0.08  y = 0.04  ψ = 0.017

104  94  88  85

77  79  80  81

B
Conclusions....

Reduce thermal bridging where possible.

All members of the design & construction teams to work in a more integrated manner.

Can thermal bridging be reduced in the existing building stock?