

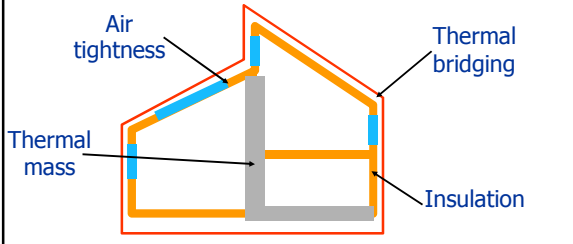
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Achieving Thermal Comfort using Timber Frame

Robin Lancashire
Timber Frame Consultant
TRADA Technology



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Air tightness

Thermal bridging

Thermal mass

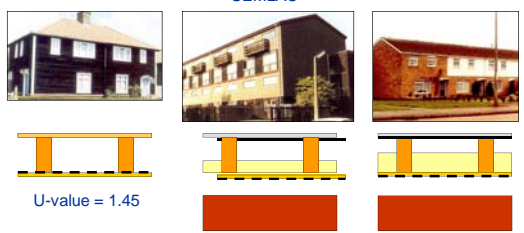
Insulation




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INSULATION

London County Council TRADA SEMLAC Frameform



U-value = 1.45 U-value = 0.85 U-value = 0.60



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Stud = 140mm 190mm 240mm

Inside

- Dry lining
- Vapour control
- Stud + insulation
- Sheathing
- Breather membrane
- Cavity
- Cladding

Outside

U-value = 0.30 0.24 0.18



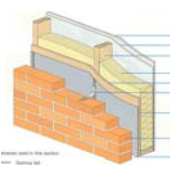

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Make walls thicker - but...

- Reduced floor area
- More materials used
- Manual handling during build

So...

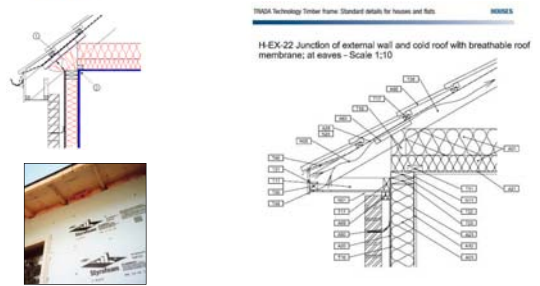

- Add reflective membranes
- Use a more efficient insulation

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TRADA Technology Timber frame. Standard Details for Houses and Flats. H-EX-22

H-EX-22 Junction of external wall and cold roof with breathable roof membrane; at eaves - Scale 1:10

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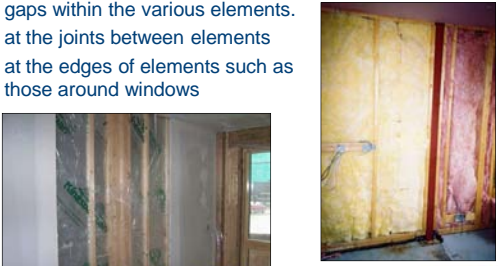
- Assume 15% timber fraction in external walls. Reduced insulation area and more thermal bridging can occur



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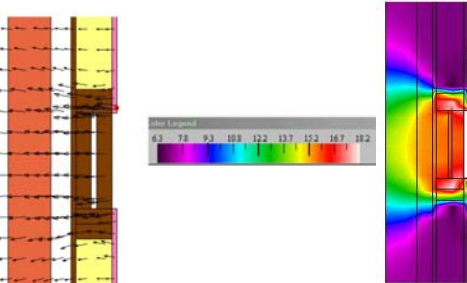
INtouch WITH TIMBER 2010 THERMAL BRIDGING

- gaps within the various elements.
- at the joints between elements
- at the edges of elements such as those around windows



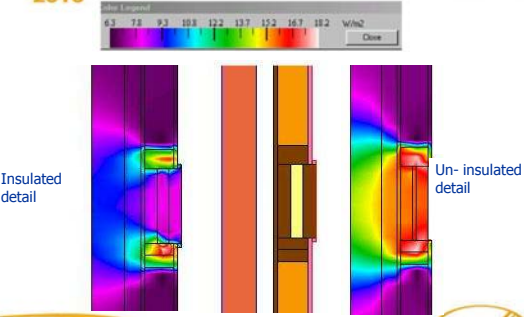
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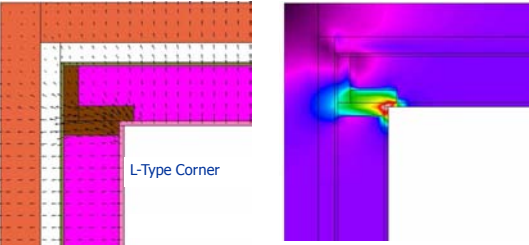


Insulated detail

Un-insulated detail

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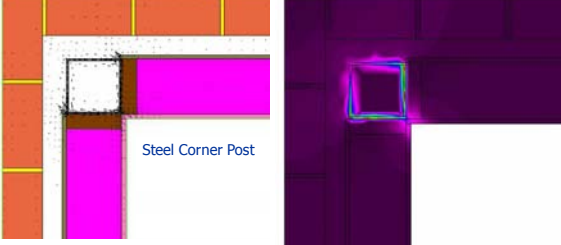
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L-Type Corner

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Steel Corner Post


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THERMAL BRIDGING- The effects

- In practice, timber fractions can be much higher than 15%
- Thermal bridging bypasses thermal insulation, leading to increased heat flow through the thermal envelope.
- Increased space heating requirements.
- In winter, low internal surface temperatures around the thermal bridge.
- Risk of local surface condensation.



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THERMAL BRIDGING- Minimising

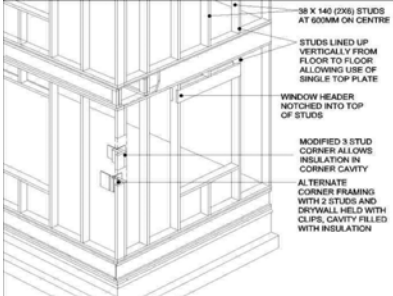
- 15% timber fraction - 'over engineering' can lead to higher timber fractions
- Effective placement of insulation
- I-beams - reduced cross sectional area
- Double stud wall - 'breaks' thermal bridge
- Warm wall - maintains continuity of insulation
- Insulated drylining - maintains continuity of insulation



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THERMAL BRIDGING - Advanced framing




90 X 140 (200) STUDS AT 600MM ON CENTRE

STUDS LINED UP VERTICALLY FROM FLOOR TO FLOOR ALLOWING USE OF SINGLE TOP PLATE


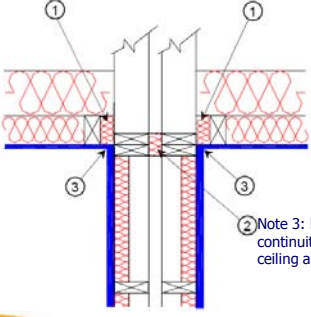
WINDOW HEADER NOTCHED INTO TOP OF STUDS

MODIFIED 3 STUD CORNER ALLOWS INSULATION IN CORNER CAVITY


ALTERNATE CORNER FRAMING WITH 2 STUDS AND DRYWALL HELD WITH CLIPS, CAVITY FILLED WITH INSULATION



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Note 3: Ensure air barrier continuity between the ceiling and the wall linings

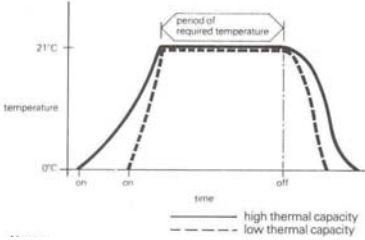


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Thermal mass



- Timber frame is efficient without thermal mass



21°C

0°C


temperature

time


period of required temperature

— high thermal capacity

- - - low thermal capacity




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Air tightness

Infiltration / Exfiltration

- Air moving through the thermal envelope into the dwelling has to be heated in order to maintain internal temperatures
- Any movement of this air to the outside will result in heat loss
- Air leakage from the inside of the building to the outside (exfiltration) will transport the water vapour it contains. This can be up to 30 times higher than vapour diffusion



INtouch WITH TIMBER 2010 - Why bother?

- 4 very good reasons
 - Protects the building envelope
 - Promotes energy efficiency
 - Better ventilation control
 - Reduces outdoor noise, odours and dust
- But remember: Airtightness is cumulative
 - Good workmanship in the construction of the entire building envelope is essential to its proper performance
 - Properly installed air barriers are not a cure-all for poor construction practices

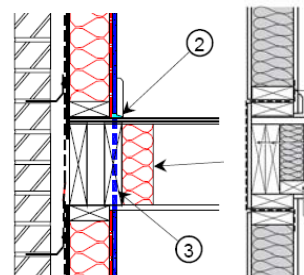


INtouch WITH TIMBER 2010 Testing

- Average Swedish leakage rate is about 2.4 ac/h at 50Pa
- Canadian R2000 leakage rate is consistently below 1 ac/h at 50Pa
- Average UK leakage rates historically between 12-14 ac/h at 50Pa
- UK building regulations now require testing





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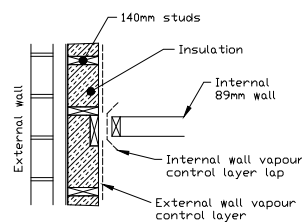


Breather membrane and vcl not shown for clarity. Upper external wall breather membrane would lap with lower wall breather membrane. Air barrier to lap with vcl



- Air barrier
- Floor deck
- Header joists
- Insulation when specified for acoustics performance
- Nogging to support ceiling lining



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- 140mm studs
- Insulation
- Internal 89mm wall
- Internal wall vapour control layer lap
- External wall vapour control layer

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Air Tightness Detailing Around Services




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Air leakage vs. Ventilation

- Airtightness cannot be considered in isolation from ventilation
- Ventilation is essential for a healthy indoor environment

But;

- Ventilation is a source of heat loss, So;
- It is necessary to control the flow of air through the dwelling



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CONSTRUCTION QUALITY - The bad.....



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CONSTRUCTION QUALITY - and the good



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