

Thermal Bridging & Fabric Performance Analysis

387wm - Larch & Lime House, Future Works

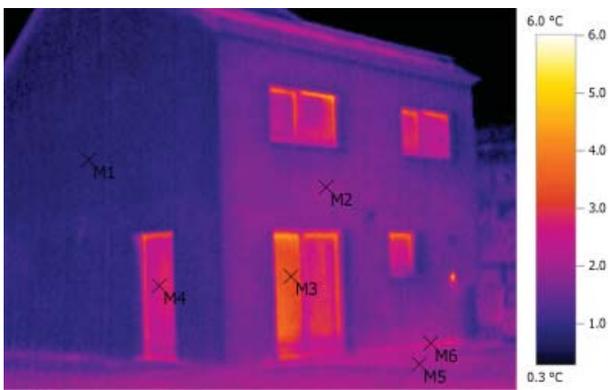
Introduction

In February 2011, Bere:architects carried out a thermal imaging survey of the Larch and Lime House in Ebbw Vale. The report (see extract below) highlighted a small but significant increase in heat loss around the plinth of the buildings, and prompted further analysis.

The following pages outline the results of a subsequent thermal bridging analysis, using Therm v5.2. Five key details were selected for the calculation, including plinth connections, door thresholds and window sill and head details.

Outcome of study

The external Psi value calculated for the Plinth (Detail D01) was found to be positive, showing a correlation with the findings of the thermal imaging analysis. The thermal bridge was not significant enough to affect the Passivhaus certification process, but this is nevertheless an important outcome of the research project. Creating a thermal bridge free equivalent for this detail will clearly have structural and cost implications, however this is clearly an area which will merit further consideration. Discussions



Picture data:	Date:	14/02/2011	Emissivity:	0.95
	Measuring Time:	10:25:08	Refl. temp. [°C]:	20.0
	File:	IV_00049.BMT		

Picture markings:

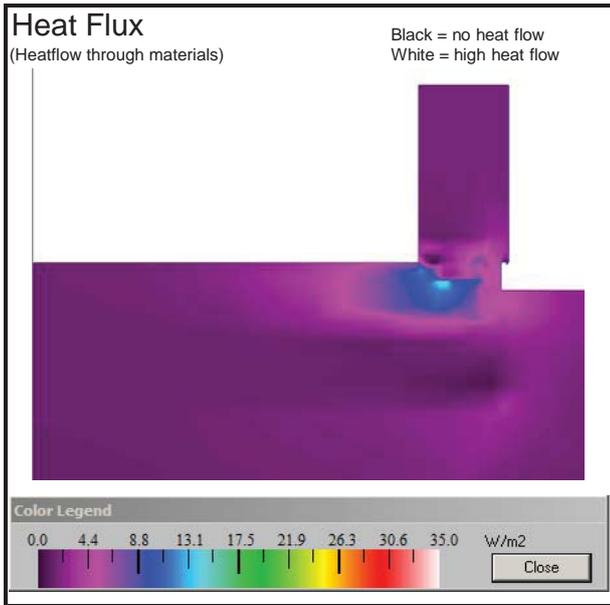
Measurement Objects	Temp. [°C]	Emiss.	Refl. temp. [°C]	Remarks
Measure point 1	0.7	0.95	20.0	-
Measure point 2	1.9	0.95	20.0	-
Measure point 3	3.2	0.95	20.0	-
Measure point 4	2.6	0.95	20.0	-
Measure point 5	2.1	0.95	20.0	-
Measure point 6	2.8	0.95	20.0	-

Remarks:

LIME HOUSE SOUTH ELEVATION

It's interesting to note that the west elevation has a surface temperature of 0.7 degrees and the south elevation is 1.9 degrees, showing how even on an overcast day, orientation affects surface temperature. Another interesting point is that the external ground temperature is warmer than the walls of the house. Curiously there is increased heat loss (2.8 degrees) around the plinth of the building and this suggests further investigation into the cold bridging at this junction may be worthwhile.

376fw - Larch & Lime House, Future Works



Software: Therm 5.2	Date: 17/02/2011
Job Name: 376fw Future Works	Job No: 376
Tab name: Ground Bearing Junction	Completed by: NN
Descrip: Plinth Detail 376.B1.G20.D01	Checked by:

Data col	Row	Name	Ufactor nam	Length mm	U factor	L2D W/Km
S	16	Wall	External	1000	0.0857	
T	17	Floor Casset	External	1000	0.076	
U	16	L2D	External			0.4454

U - value calculation for data row **Wall**

Check surface resistances correct **y**

Check total length correct **y**

Modelling U Value (W/m2K) 0.086

U - value calculation for data row **Floor Cassette**

Check surface resistance correct (zero under) **y**

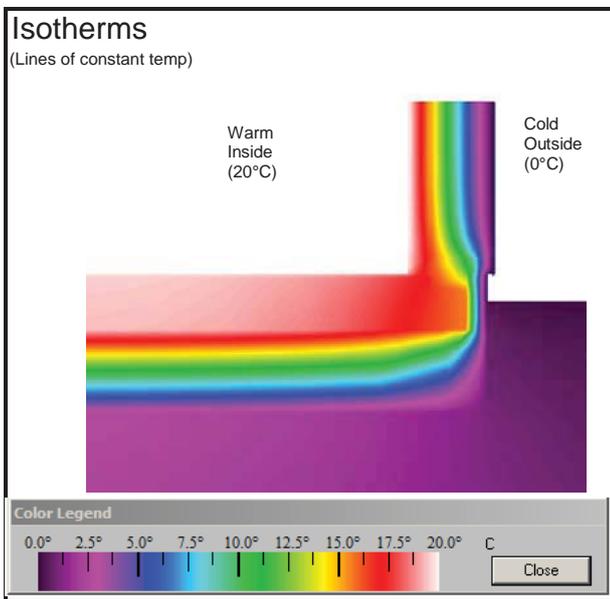
Check total length correct **y**

Floor Cassette Modelling U Value (W/m2K) 0.076

GROUND BEARING Ground Floor Calculation using ISO 13770, check values below

areas m2	51.57 m2	perim m	28.74 m
wall thick	0 m	ground k	2.0 W/m2K
dg	26.40	B'	3.58872651

FLOOR Modelling U Value (W/m2K) 0.072



Psi calculation

	length mm	U-value/L2D W/m2K	heat flow W/mK	psi value W/mK
L2D				0.445
Wall	Length time U value: 1000	0.0857		0.086
Floor	Length time U value: 3242	0.0716		0.232
				0.127

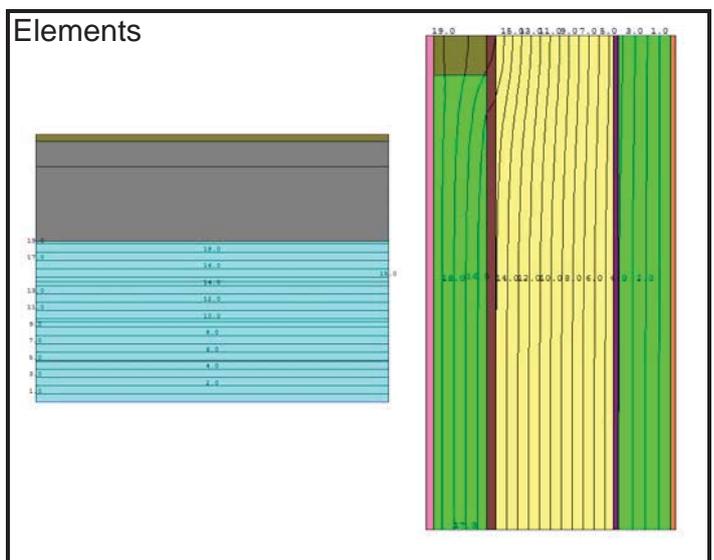
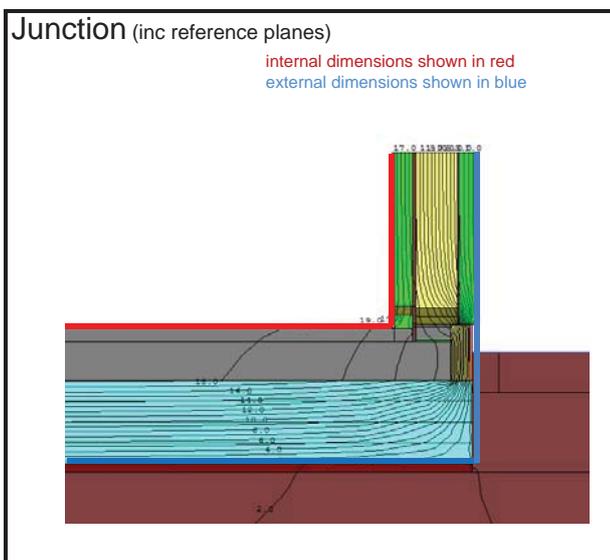
psi Internal 0.13 W/mK

Psi calculation

	length mm	U-value/L2D W/m2K	heat flow W/mK	psi value W/mK
L2D				0.445
Wall	Length time U value: 1800	0.0857		0.154
Floor	Length time U value: 3719	0.0716		0.266
				0.025

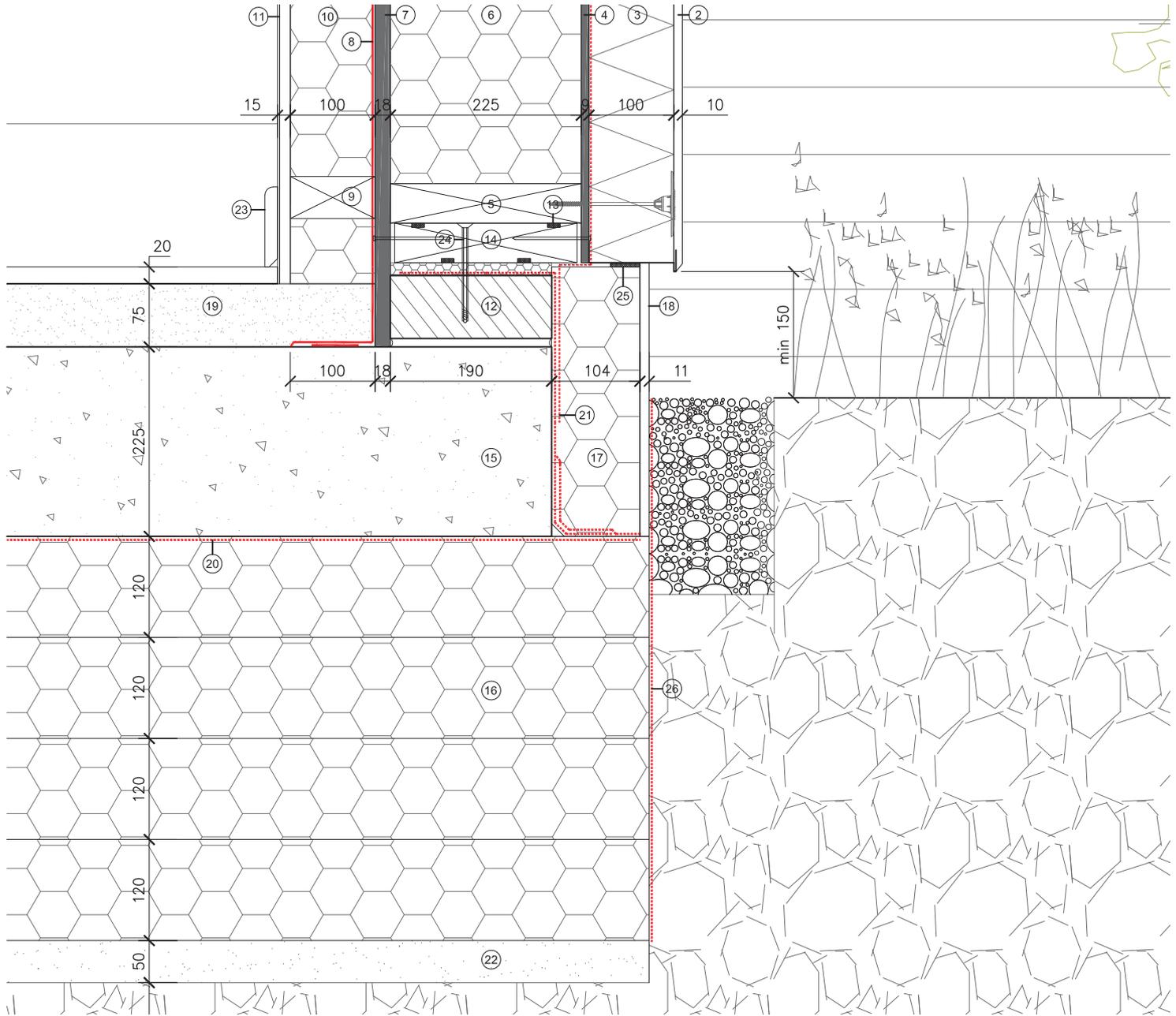
psi External 0.02 W/mK

Error in calculation: From therm report - worst cell %

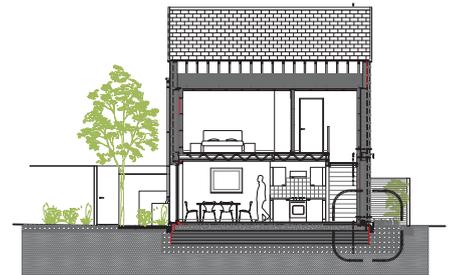


(see following page for reference drawing)

387wm - Larch & Lime House, Future Works



- | | | |
|---|--|--|
| <p>① NBS
NBT decorative finish TBC</p> <p>② NBS
NBT base coat (MC 55W) with reinforcement mesh. In accordance with manufacturer's details.</p> <p>③ NBS
NBT Diffutherm insulation board fixed to studs of timber frame with thermally broken EJOT fasteners (Ref number for fixings through 100mm thk insulation VHT-R x 130 SBH-T65/25)</p> <p>④ NBS K11.445
9.2 mm thk panelvent boards with breather membrane to outer face.</p> <p>⑤ NBS G20
225mm x 50mm s/w timber studs, untreated</p> <p>⑥ NBS P10
225 mm Knauf FrameTherm insulation ($\lambda = 0.035$ W/mK) boards between s/w studs</p> <p>⑦ NBS K11.615
low VOC 18 mm OSB panel</p> <p>⑧ NBS P10.315
Pro clima intello plus air-tightness membrane.</p> <p>⑨ NBS G20
100 x 50 mm horizontal s/w timber battens</p> <p>⑩ NBS P10
100mm Steico Flex wood fibre insulation between horizontal s/w studs.</p> <p>⑪ NBS K10
12.5 mm Plasterboard screwed to timber battens and skim finished</p> | <p>⑫ Thermalite block bedded onto 10mm mortar bedding to S.Eng design and specification</p> <p>⑬ Comcriband strips to be routed into soleplate.</p> <p>⑭ NBS G20
225x50mm continuous timber soleplate fixed to thermalite block with Tapcon screws. Fixing centres to S.Eng design and specification. Prefabricated timber panel OSB boards to oversail for fixing into 225x50mm timber soleplate. Fixings to S.Eng design and specification.</p> <p>⑮ 225mm reinforced GGBS Concrete slab to S.Eng design and specification.</p> <p>⑯ NBS P10
4x120mm Floormate 500 A in layers with staggered joints to S.Eng design and specification.</p> <p>⑰ NBS P10
NBT perimeter board ($\lambda = 0.035$ W/mK)</p> <p>⑱ NBT 2-coat render system (fully meshed HM 50 onto Plinth Board)</p> <p>⑲ 75mm screed to S.Eng design and specification with 20mm zone for floor finishes TBC by UWHA.</p> <p>⑳ 250 micron continuous DPM installed to basic Radon protection requirements.</p> <p>㉑ NBS J
RIW sheetseal 226 tanking membrane, reinforced at junction in accordance with manufacturer's details</p> <p>㉒ 50mm sand surface dressing to S.Eng design and specification</p> <p>㉓ NBS K11
Low VOC MDF skirting, primed and painted</p> | <p>㉔ NBS
Fixings to ground floor slab and blockwork kicker to S. Eng design and specification</p> <p>㉕ NBS
IIIbruck comcriband strip</p> <p>㉖ NBS
Bitumen membrane</p> |
|---|--|--|



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- 1 Use figured dimensions only
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- 6 All work and materials to be in accordance with current applicable statutory legislation and to comply with all relevant codes of practice and British and European standards

Rev	Description	Date	By	Chk
A	For costing	23.03.10	cs	dg

Project: Future Works Housing
2 bed house

Subject: Plinth Detail

Scale: 1:5 @ A3

Date: 18.05.10

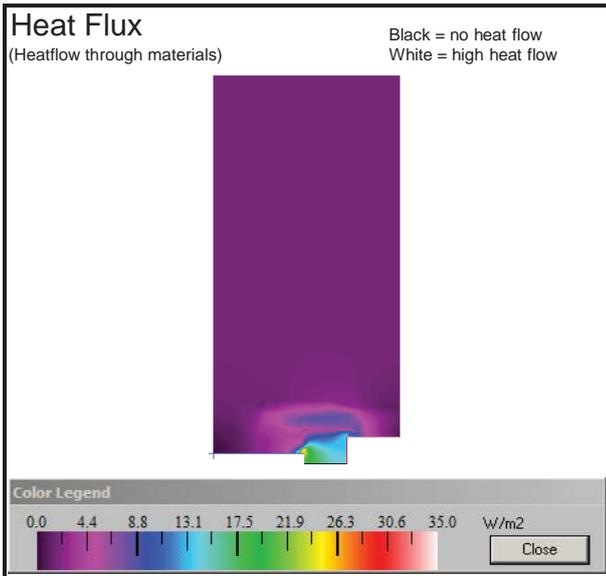
bere:architects
73 Poets Road, London, N5 2SH
T +44 (0) 20 7359 4503 F +44 (0) 20 7424 5572 bere@bere.co.uk

Project | Drawing | Rev

0376.B1.G20.D01 A

G20 General Arrangement

376fw - Larch & Lime House, Future Works



Software: Therm 5.2	Date: 14/03/2011
Job Name: 376fw Future Works	Job No: 376
Tab name: Window Installation	Completed by: NN
Descr: Head Detail 376.B1.G20.D04	Checked by:

Data column	Row	Name	Ufactor nam	Length mm	U factor	L2D W/Km
S	16	Wall	External	1000	0.0853	
T	16	Wall+Frame	Internal			0.1643

U - value calculation for data row **Wall**

Check surface resistances correct y

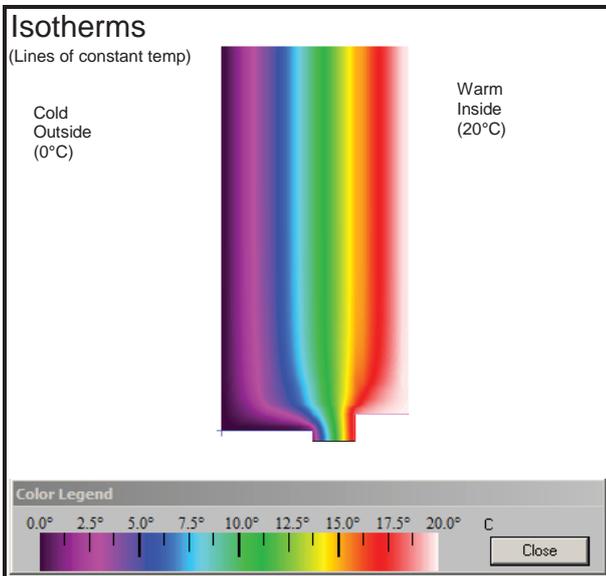
Check total length correct y

Modelling U Value (W/m2K) 0.085

Data for window frame

	dimension mm	U-value W/m2K	conductivity W/mK
Frame width w	90		
thickness t	110		
Uf		0.80	
Homogenous frame?		y	
External Surface resistance		0.04	
Internal Surface resistance		0.13	

Draw frame as a rectangle 110 mm thick, 90 mm wide and with a conductivity of **Frame Conductivity 0.101852 W/mK**

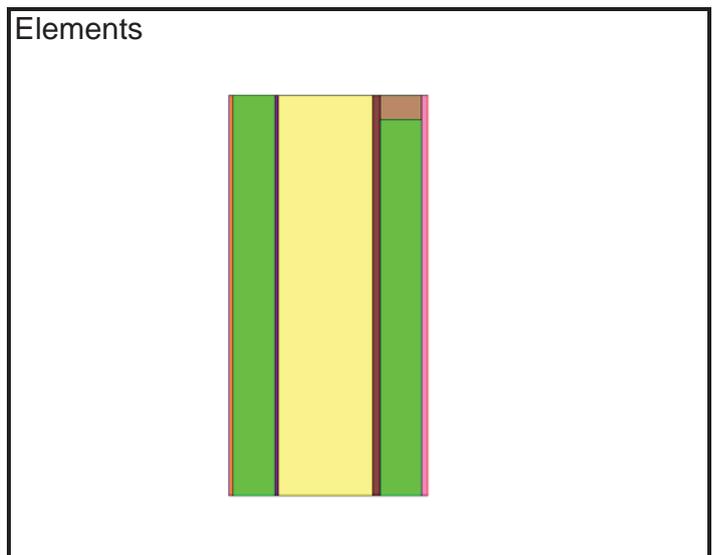
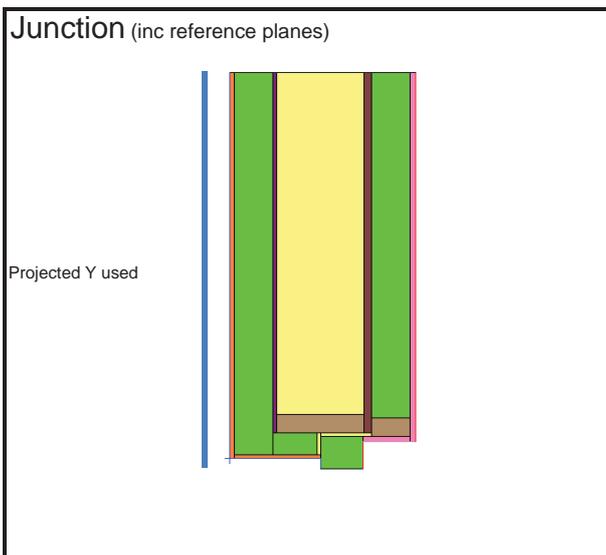
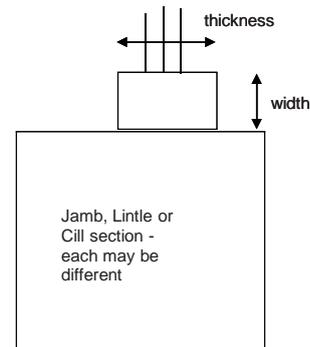


Psi Window Installation according to Passivhaus

	dimension mm	U-value W/m2K	heat flow W/mK
Wall and Frame			0.164
Wall	1000	0.085	0.085
Simplified Frame	90	0.800	0.072
			0.007

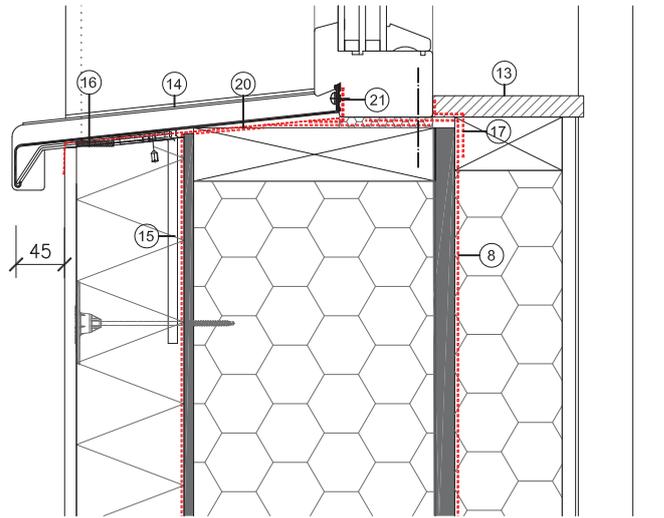
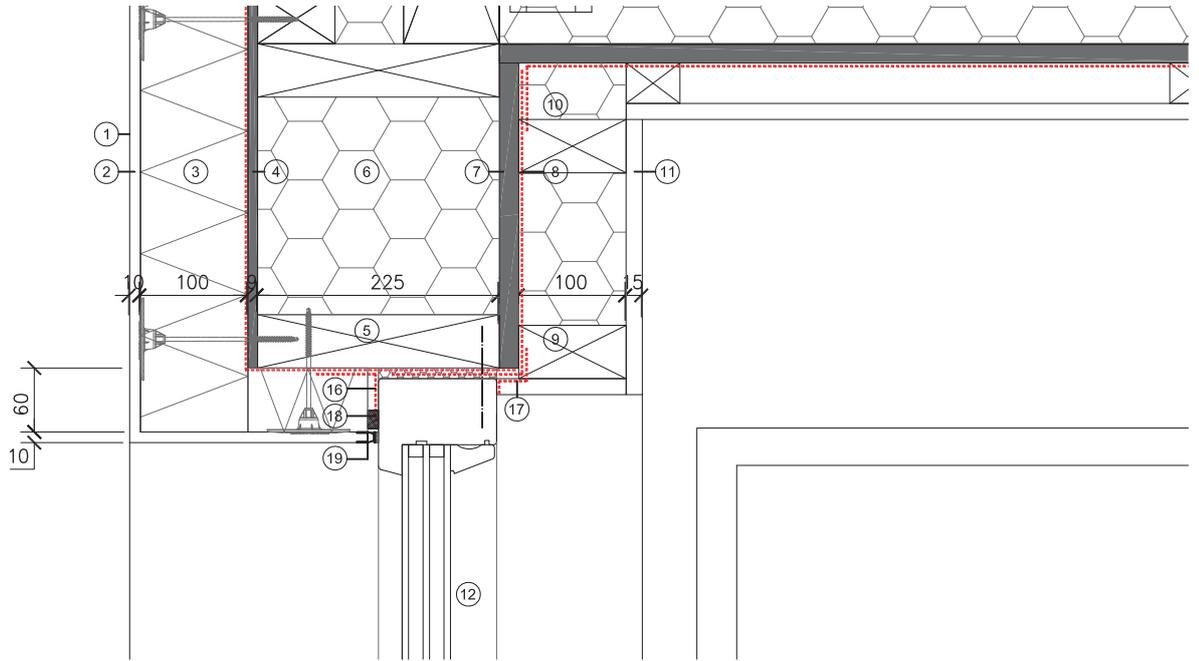
Installation Psi 0.01 W/mK

Error in calculation: From therm report - worst cell %

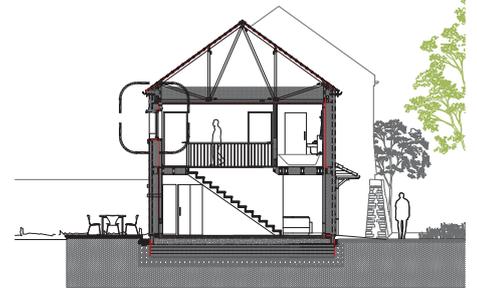


(see following page for reference drawing)

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- ① NBS
NBT decorative finish TBC
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NBT base coat (MC 55W) with reinforcement mesh. In accordance with manufacturer's details.
- ③ NBS
NBT Diffutherm insulation board fixed to studs of timber frame with thermally broken EJOT fasteners (Ref number for fixings through 100mm thk insulation VHT-R x 130 SBH-T65/25)
- ④ NBS K11.445
9.2 mm thk panelvent boards with breather membrane to outer face.
- ⑤ NBS G20
225mm x 50mm s/w timber studs, untreated
- ⑥ NBS P10
225 mm Knauf FrameTherm insulation ($\lambda = 0.035$ W/mK) boards between s/w studs
- ⑦ NBS K11.615
low VOC 18 mm OSB panel
- ⑧ NBS P10.315
Pro clima intello plus air-tightness membrane.
- ⑨ NBS G20
100 x 50 mm horizontal s/w timber battens
- ⑩ NBS P10
100mm Steico Flex wood fibre insulation between horizontal s/w studs.
- ⑪ NBS K10
12.5 mm Plasterboard screwed to timber battens and skim finished
- ⑫ NBS L10.225
Triple glazed window
- ⑬ NBS L10
Low VOC MDF window cill. Primed and painted
- ⑭ NBS L10.225
Aluminium Window cill manufactured by Gutmann. Refer to drawing 372.B1.G20.D26 for further details of window cill.
- ⑮ NBS L10.225
Aluminium Window cill support manufactured by Gutmann. Cills to be supported at 600mm centres or located centrally if width of window is less than 1200mm wide. Refer to drawing 372.B1.G20.D26 for further details of window cill.
- ⑯ NBS L10.815
llbrook window weatherproofing tape to outside of window in accordance with manufacturers installation instructions.
- ⑰ NBS L10.815
llbrook window airtightness tape to inside of window in accordance with manufacturers installation instructions.
- ⑱ NBS
llbruck compriband tape
- ⑲ NBS
APU rail around window for render system in accordance with manufacturer's recommendations
- ⑳ NBS J40.120
DPM layer underneath window cill.
- ㉑ Cill fixed to window frame using stainless steel screw and rubber seal (both supplied by Gutmann)



DOTTED RED LINES INDICATE POSITION OF MEMBRANES. SEE KEY AND NOTES FOR DETAILS.

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Rev	Description	Date	By	Chk
A	For costing	23.03.10	cs	dg

Project: Future Works Housing
2 bed house

Subject: window head and cill

Scale: 1:5 @ A3

Date: 18.05.10

bere:architects

73 Poets Road, London, N5 2SH
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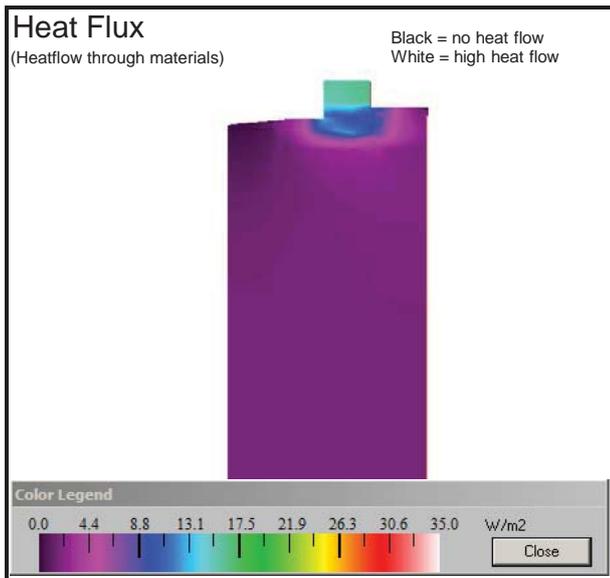
Project Drawing

Rev

G20 General Arrangement

0376.B1.G20.D04 A

376fw - Larch & Lime House, Future Works



Software: Therm 5.2	Date: 14/03/2011
Job Name: 376fw Future Works	Job No: 376
Tab name: Window Installation	Completed by: NN
Descrip: Sill Detail 376.B1.G20.D04	Checked by:

Data column	Row	Name	Ufactor name	Length mm	U factor	L2D W/Km
S	16	Wall	External	1000	0.0853	
T	16	Wall+Frame	Internal			0.1883

U - value calculation for data row **Wall**

Check surface resistances correct y

Check total length correct y

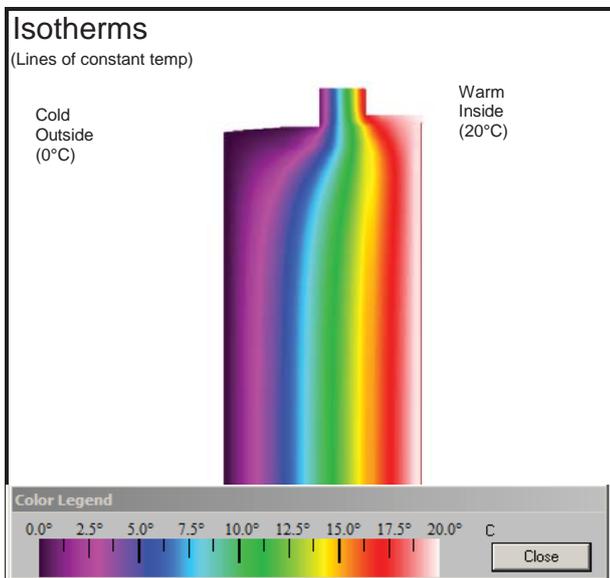
Modelling U Value (W/m²K) 0.085

Data for window frame

Frame	width w	thickness t	Uf	Homogenous frame?	External Surface resistance	Internal Surface resistance
	88	110	0.80	y	0.04	0.13

Draw frame as a rectangle 110 mm thick, 88 mm wide and with a conductivity of

Frame Conductivity 0.101852 W/mK

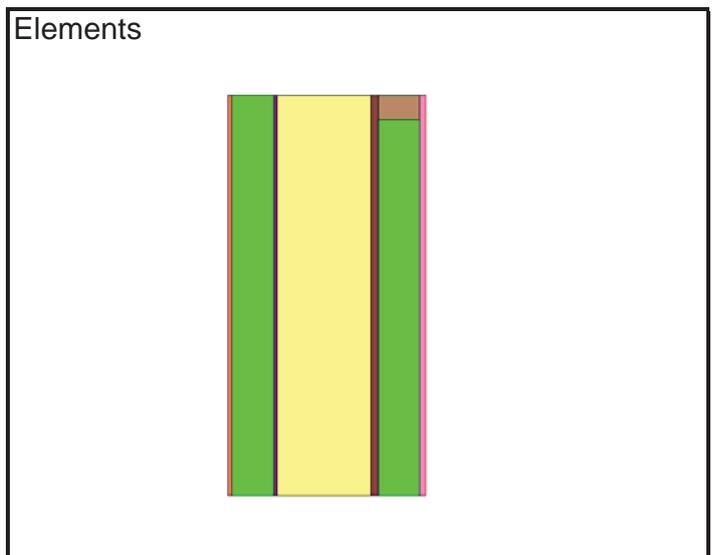
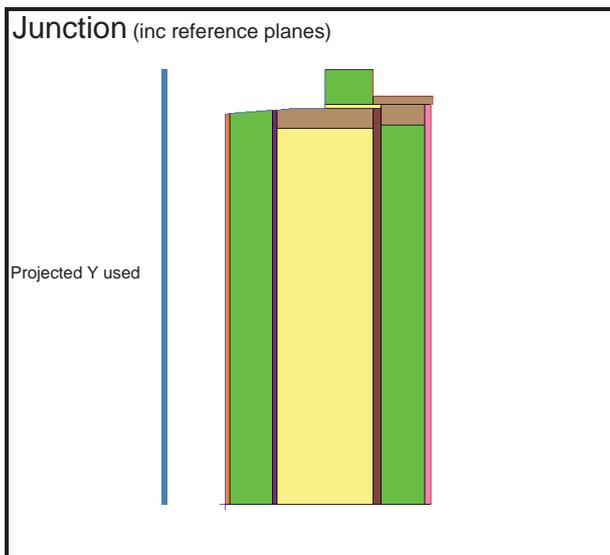
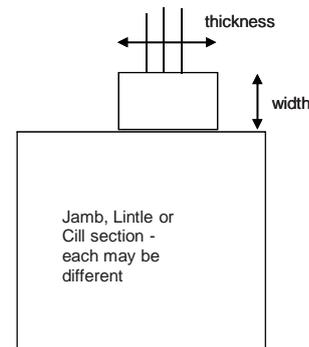


Psi Window Installation according to Passivhaus

Wall and Frame	dimension mm	U-value W/m ² K	heat flow W/mK
Wall	1000	0.085	0.188
Simplified Frame	88	0.800	0.085
			0.070
			0.033

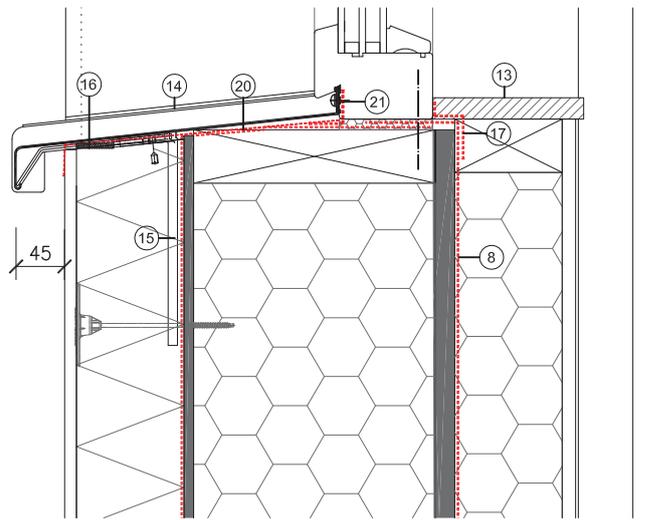
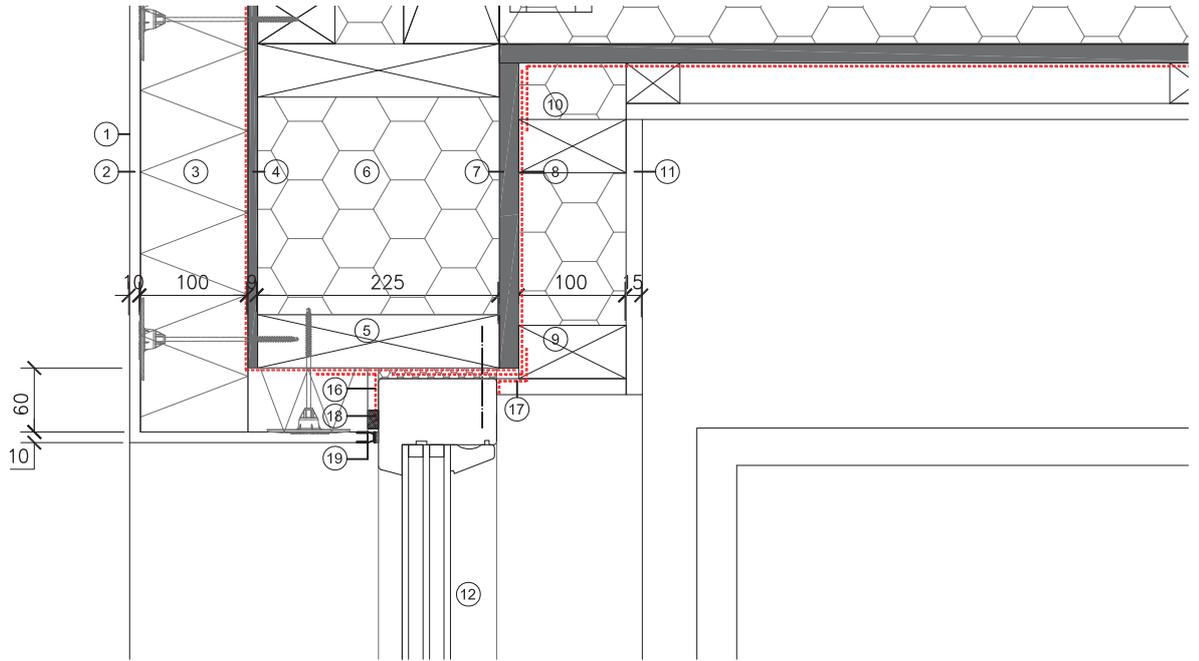
Installation Psi 0.03 W/mK

Error in calculation: From therm report - worst cell %

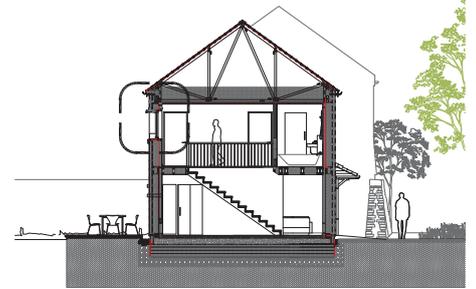


(see following page for reference drawing)

387wm - Larch & Lime House, Future Works



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- ⑤ NBS G20
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- ⑥ NBS P10
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- ⑦ NBS K11.615
low VOC 18 mm OSB panel
- ⑧ NBS P10.315
Pro clima intello plus air-tightness membrane.
- ⑨ NBS G20
100 x 50 mm horizontal s/w timber battens
- ⑩ NBS P10
100mm Steico Flex wood fibre insulation between horizontal s/w studs.
- ⑪ NBS K10
12.5 mm Plasterboard screwed to timber battens and skim finished
- ⑫ NBS L10.225
Triple glazed window
- ⑬ NBS L10
Low VOC MDF window cill. Primed and painted
- ⑭ NBS L10.225
Aluminium Window cill manufactured by Gutmann. Refer to drawing 372.B1.G20.D26 for further details of window cill.
- ⑮ NBS L10.225
Aluminium Window cill support manufactured by Gutmann. Cills to be supported at 600mm centres or located centrally if width of window is less than 1200mm wide. Refer to drawing 372.B1.G20.D26 for further details of window cill.
- ⑯ NBS L10.815
llbrook window weatherproofing tape to outside of window in accordance with manufacturers installation instructions.
- ⑰ NBS L10.815
llbrook window airtightness tape to inside of window in accordance with manufacturers installation instructions.
- ⑱ NBS
llbruck compriband tape
- ⑲ NBS
APU rail around window for render system in accordance with manufacturer's recommendations
- ⑳ NBS J40.120
DPM layer underneath window cill.
- ㉑ Cill fixed to window frame using stainless steel screw and rubber seal (both supplied by Gutmann)



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A	For costing	23.03.10	cs	dg

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2 bed house

Subject: window head and cill

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Date: 18.05.10

bere:architects

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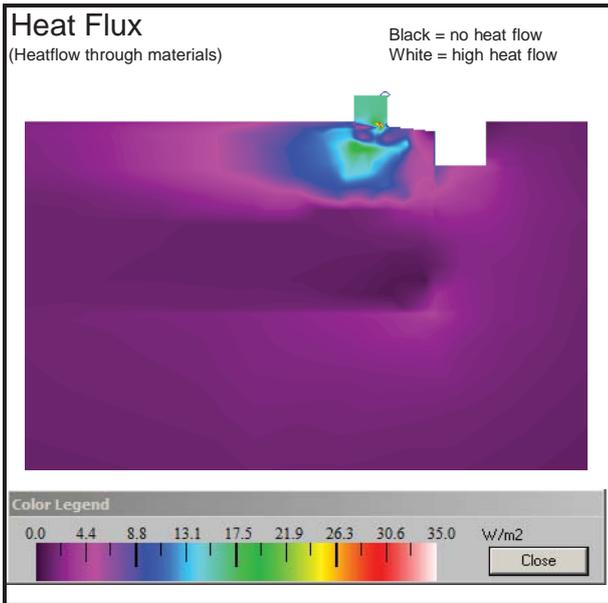
Project Drawing

Rev

G20 General Arrangement

0376.B1.G20.D04 A

376fw - Larch & Lime House, Future Works



Software: Therm 5.2	Date: 17/02/2011
Job Name: 376fw Future Works	Job No: 376
Tab name: Ground Bearing Junction	Completed by: NN
Descrip: Plinth Detail 376.B1.G20.D06	Checked by:

Data colum	Row	Name	Ufactor nam	Length mm	U factor	L2D W/Km
S	17	Wall	External	128	0.7999	
T	17	Floor Casset	External	1000	0.076	
U	16	L2D	External			0.5330

U - value calculation for data row **Wall**

Check surface resistances correct y

Check total length correct y

Modelling U Value (W/m2K) 0.800

U - value calculation for data row **Floor Cassette**

Check surface resistance correct (zero under) y

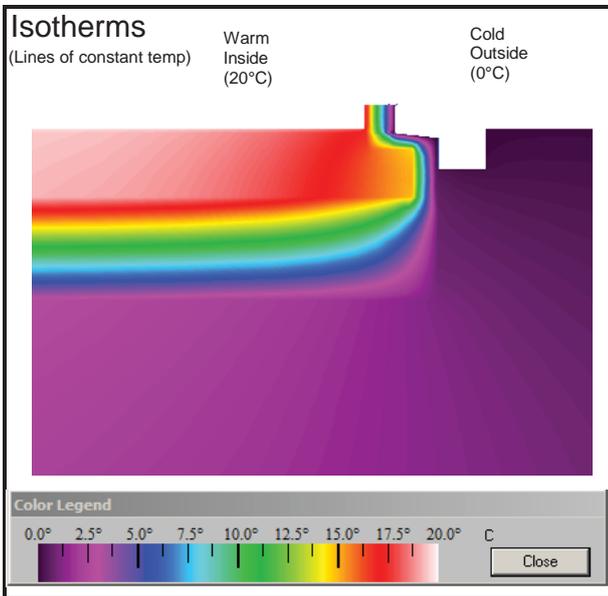
Check total length correct y

Floor Cassette Modelling U Value (W/m2K) 0.076

GROUND BEARING Ground Floor Calculation using ISO 13770, check values below

areas m2	51.57 m2	perim m	28.74 m
wall thick	0 m	ground k	2.0 W/m2K
dg	26.40	B'	3.58872651

FLOOR Modelling U Value (W/m2K) 0.072



Psi calculation

	length mm	U-value/L2D heat flow W/m2K	psi value W/mK
L2D			0.533
Wall	Length time U value: 108	0.7999	0.086
Floor	Length time U value: 3680	0.0716	0.264
			0.183

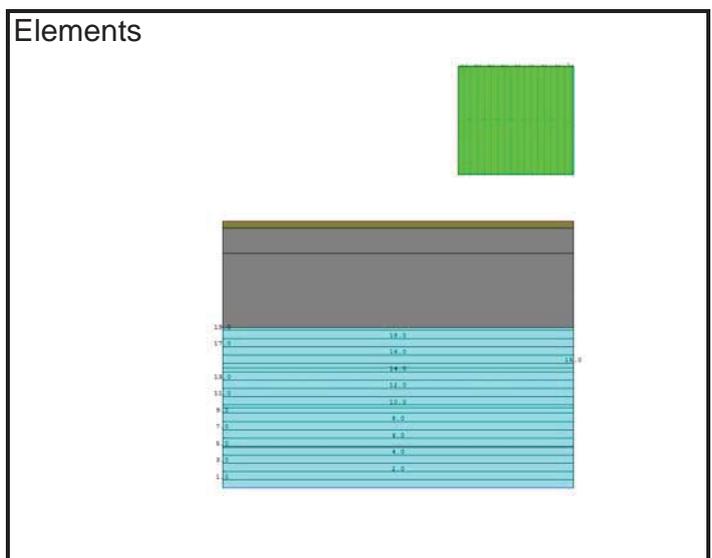
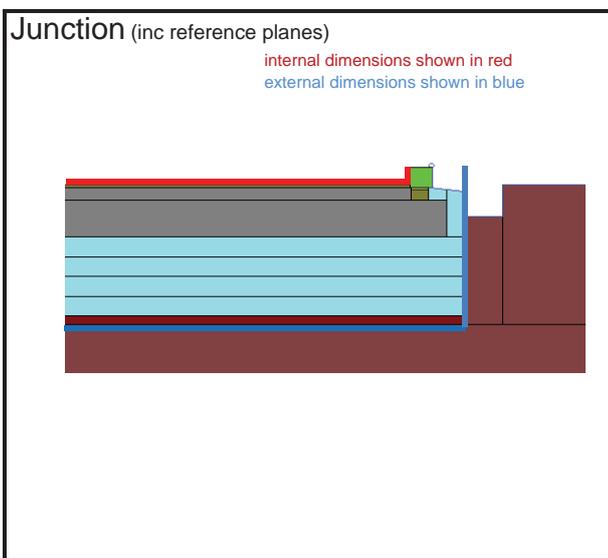
psi Internal 0.18 W/mK

Psi calculation

	length mm	U-value/L2D heat flow W/m2K	psi value W/mK
L2D			0.533
Wall	Length time U value: 958	0.7999	0.766
Floor	Length time U value: 4000	0.0716	0.286
			0.520

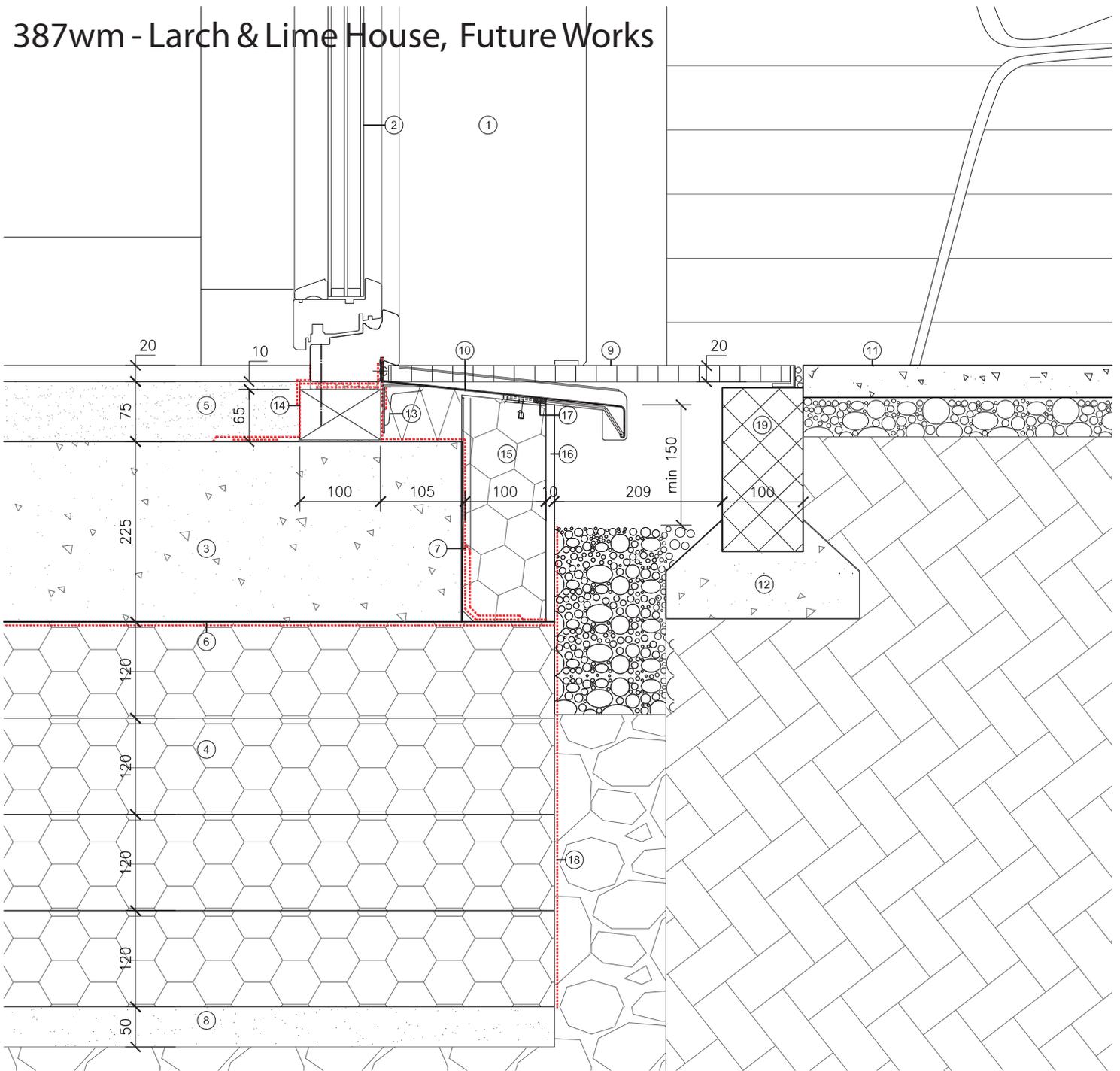
psi External -0.52 W/mK

Error in calculation: From therm report - worst cell %



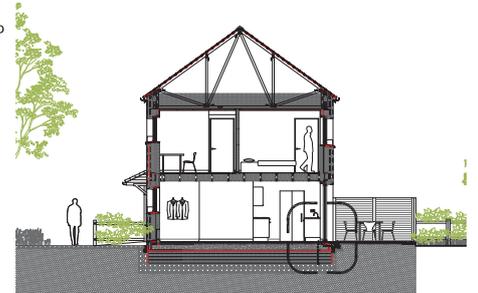
(see following page for reference drawing)

387wm - Larch & Lime House, Future Works



- ① NBS
NBT decorative finish TBC. On top of NBT base coat (MC 55W) with reinforcement mesh. In accordance with manufacturer's details.
- ② NBS L10.225
Triple glazed opening window to be supplied by Bayer
- ③ 225mm reinforced GGBS Concrete slab to S.Eng design and specification .
- ④ NBS P10
480mm Floormate 500 A in 4 layers with staggered joints to S.Eng design and specification.
- ⑤ 75mm screed to S.Eng design and specification with 20mm zone for floor finishes TBC by UWHA.
- ⑥ 250 micron continuous DPM installed to basic Radon protection requirements.
- ⑦ NBS J
RIW sheetseal 226 tanking membrane, reinforced at junction in accordance with manufacturer's details
- ⑧ 50mm sand surface dressing to S.Eng design and specification
- ⑨ Galvanised steel grating

- ⑩ NBS L10.225
Gutmann window cill
- ⑪ Paving stone TBC
- ⑫ Concrete haunching
- ⑬ Aluminium angle to S. Eng design and specification, screwed to timber window support.
- ⑭ NBS P10.315
Pro clima intello plus air-tightness membrane fixed to concrete slab with Pro Klima Orcon F adhesive
- ⑮ NBS P10
NBT perimeter board ($\lambda = 0.035 \text{ W/mK}$)
NBT 2-coat render system (fully meshed HM 50 onto Plinth Board)
- ⑯ NBS
Illbruck compriband strip
- ⑰ NBS
Bitumen membrane
- ⑱ Blockwork TBC



DOTTED RED LINES INDICATE POSITION OF MEMBRANES. SEE KEY AND NOTES FOR DETAILS.

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- 6 All work and materials to be in accordance with current applicable statutory legislation and to comply with all relevant codes of practice and British and European standards

Rev	Description	Date	By	Chk
A	For costing	23.03.10	cs	dg

Project: Future Works Housing
2 bed house

Subject: threshold detail rear patio

Scale: 1:5 @ A3

Date: 18.05.10

bere:architects

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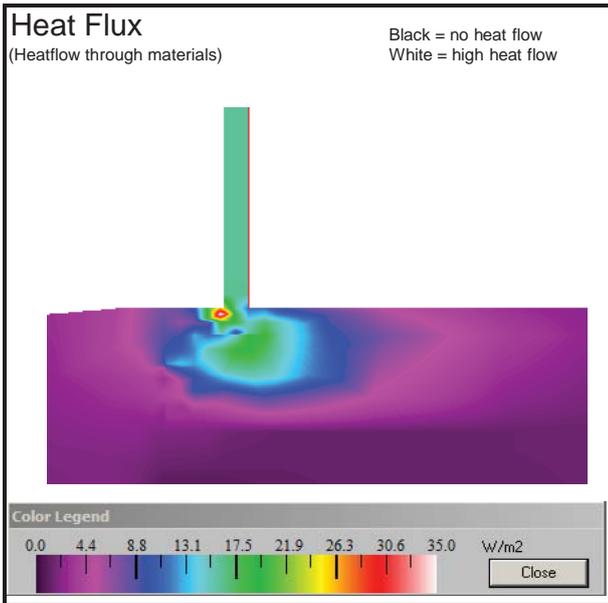
Project Drawing

Rev

G20 General Arrangement

0376.B1.G20.D06 A

376fw - Larch & Lime House, Future Works



Software: Therm 5.2	Date: 09/03/2011
Job Name: 376fw Future Works	Job No: 376
Tab name: Ground Bearing Junction	Completed by: NN
Descr: Plinth Detail 376.B1.G20.D11	Checked by:

Data colum	Row	Name	Ufactor nam	Length mm	U factor	L2D W/Km
S	17	Wall	External	1000	0.7999	
T	17	Floor Casset	External	1000	0.076	
U	16	L2D	External			1.3037

U - value calculation for data row **Wall**

Check surface resistances correct y

Check total length correct y

Modelling U Value (W/m2K) 0.800

U - value calculation for data row **Floor Cassette**

Check surface resistance correct (zero under) y

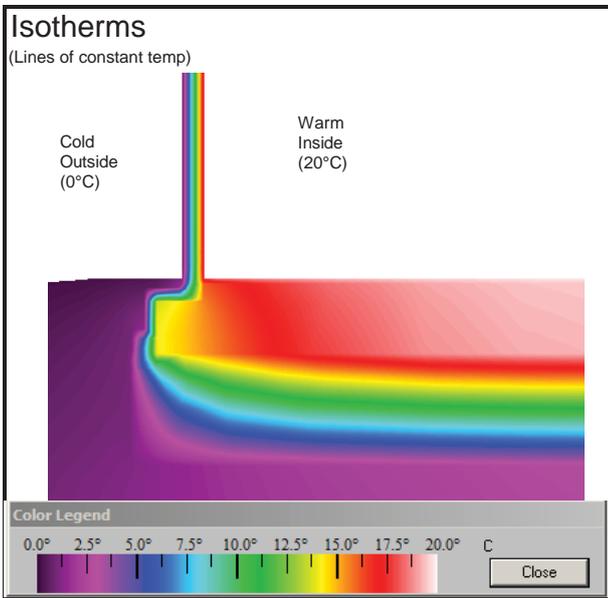
Check total length correct y

Floor Cassette Modelling U Value (W/m2K) 0.076

GROUND BEARING Ground Floor Calculation using ISO 13770, check values below

areas m2	51.57 m2	perim m	28.74 m
wall thick	0 m	ground k	2.0 W/m2K
dg	26.40	B'	3.58872651

FLOOR Modelling U Value (W/m2K) 0.072



Psi calculation

	length mm	U-value/L2D heat flow W/m2K	psi value W/mK
L2D			1.304
Wall	Length time U value: 1000	0.7999	0.800
Floor	Length time U value: 3700	0.0716	0.265
			0.239

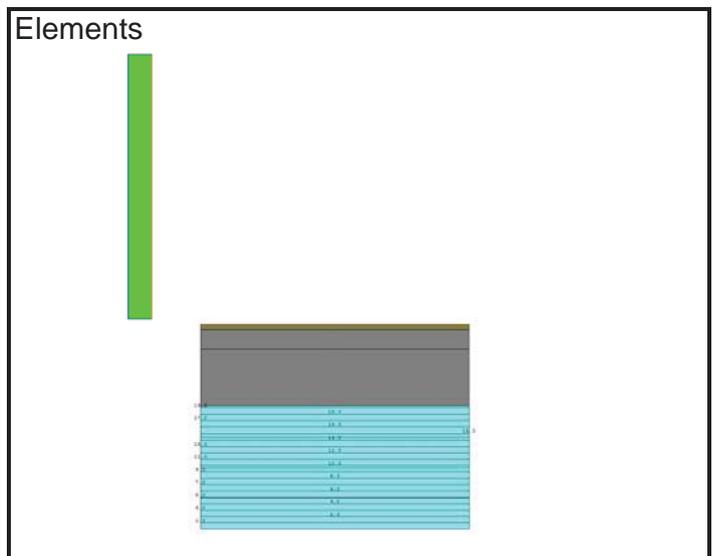
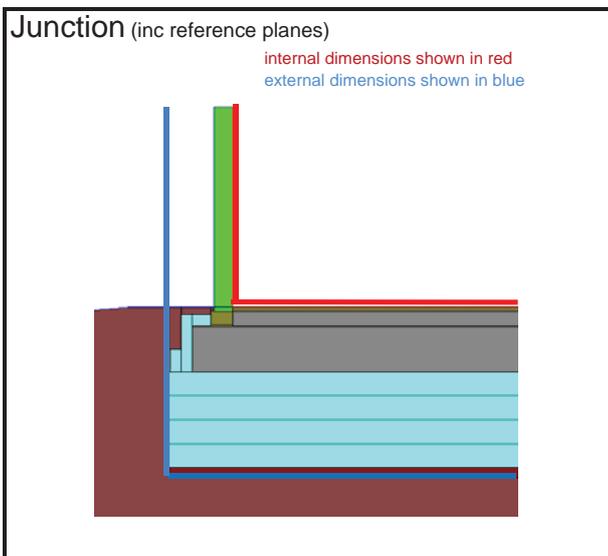
psi Internal 0.24 W/mK

Psi calculation

	length mm	U-value/L2D heat flow W/m2K	psi value W/mK
L2D			1.304
Wall	Length time U value: 1850	0.7999	1.480
Floor	Length time U value: 4000	0.0716	0.286
			0.463

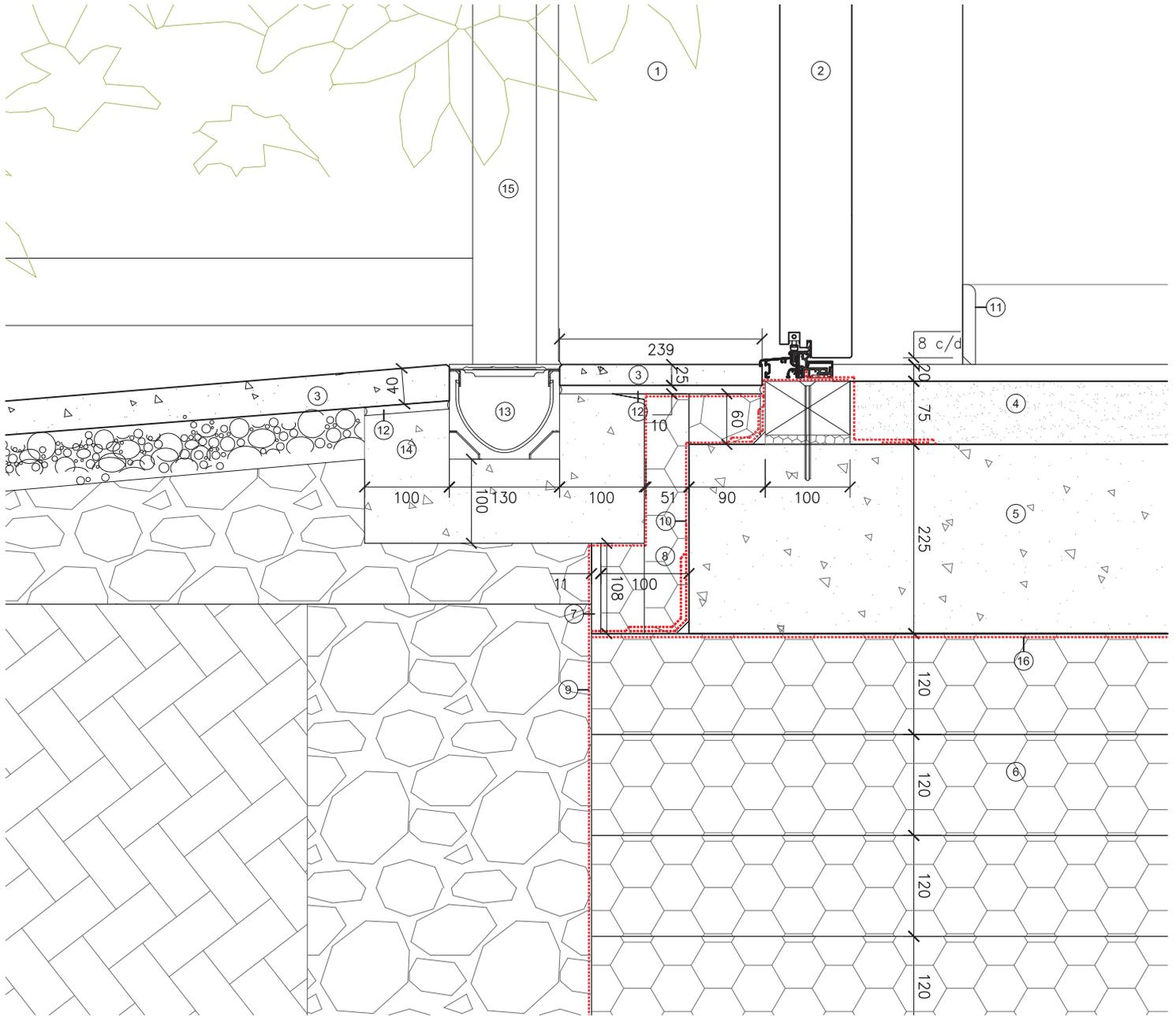
psi External -0.46 W/mK

Error in calculation: From therm report - worst cell %



(see following page for reference drawing)

387wm - Larch & Lime House, Future Works



- | | |
|--|---|
| <ul style="list-style-type: none"> ① NBS
NBT decorative finish TBC ② Insulated front door to be supplied by Bayer ③ Paving stone TBC ④ 75mm screed to S.Eng design and specification with 20mm zone for floor finishes TBC by UWHA. ⑤ 225mm reinforced GGBS Concrete slab to S.Eng design and specification . ⑥ NBS P10
4x120mm Floormate 500 A in layers with staggered joints to S.Eng design and specification. ⑦ NBT 2-coat render system (fully meshed HM 50 onto Plinth Board) ⑧ NBS P10
NBT perimeter board ($\lambda = 0.035 \text{ W/mK}$) | <ul style="list-style-type: none"> ⑨ NBS
Bitumen membrane ⑩ NBS J
RIW sheetseal 226 tanking membrane, reinforced at junction in accordance with manufactures details ⑪ NBS K11
Low VOC MDF skirting, primed and painted ⑫ 10mm mortar ⑬ Aco Rain Drain Plus to be embedded in concrete ⑭ Concrete bed for Aco Rain Drain Plus ⑮ Down pipe from entrance canopy connected to Aco drain ⑯ 250 micron continuous DPM installed to basic Radon protection requirements. |
|--|---|



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Rev	Description	Date	By	Chk
A	For costing	23.03.10	cs	dg

Project: Future Works Housing
2 bed house

Subject: Front Door Threshold Detail

Scale: 1:5 @ A3

Date: 18.05.10

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Project | Drawing | Rev

0376.B1.G20.D11 A

G20 General Arrangement

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