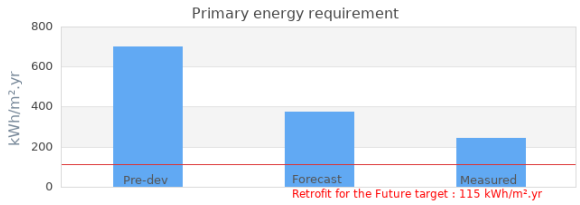
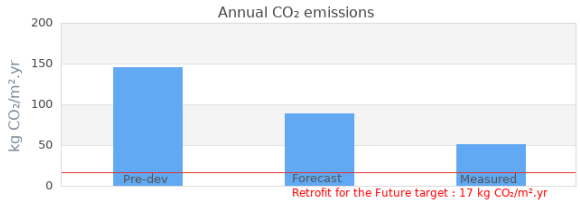
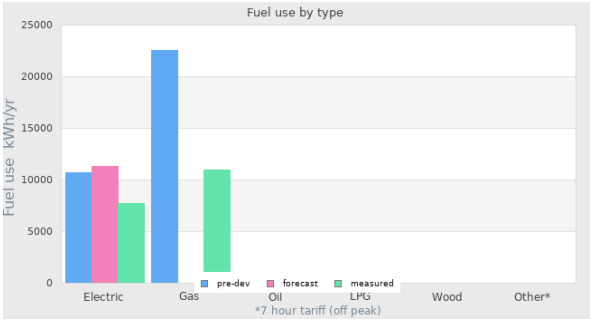
https://www.lowenergybuildings.org.uk/

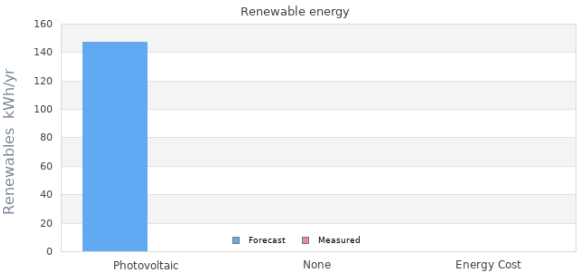
**Project name** Bringing Wates homes into the Future

**Project summary** Wates property structural and low energy refurbishment based on an optimised structural insulated render consisting of a steel cage filled with insulation (Structherm). The void created allows for plumbing and ventilation ducting to provide heat recovery air heating and vent control throughout the house from a heat exchange unit located in the roof space. Other features include air source heat pump supplemented by solar and PV cells, triple glazed windows and doors with reveal detail to improve sealing and solar gain, weather compensating energy controls and a broadband based monitoring system to enable point of use metering information. A porch to reduce energy loss from front door and veranda at the rear for washing to reduce energy...




## Project Description

| | |
|---|---|
| Projected build start date | 05 Jul 2010 |
| Projected date of occupation | 25 Sep 2010 |
| Project stage | Under construction |
| Project location | Birmingham, West Midlands, England |
| Energy target | Retrofit for the Future |
| Build type | Refurbishment |
| Building sector | Public Residential |

| | |
|---|---|
| Property type | End Terrace |
| Existing external wall construction | Concrete frame |
| Existing external wall additional information | none |
| Existing party wall construction | blockwork |
| Floor area | 75 m² |
| Floor area calculation method | PHPP |

## Project team

| | |
|---|---|
| Organisation | G F Tomlinson Group Limited |
| Project lead | G F Tomlinson Group Ltd - Les Needham |
| Client | Birmingham City Council - Steve Walker |
| Architect | Pick Everard, Derby - Jerry Tseng |
| Mechanical & electrical consultant(s) | SPI Ltd, Burntwood, Staffs (part of NPower) - Paul Dillon |
| Energy consultant(s) | Hadley Brook Enerprises Ltd, Coventry - Dermott McLaughlin |
| Structural engineer | Structherm Building Systems Ltd, Holmfirth - Julian Taylor |
| Quantity surveyor | G F Tomlinson Birmingham Ltd - Karen Ford |
| Other consultant | Loughborough University - Paul Rowley, Bowater, Worcester Bosch |
| Contractor | G F Tomlinson Birmingham Ltd - Pat Daly |

## Design strategies

| | |
|---|---|
| Planned occupancy | Existing family home. Design enables uninterrupted occupancy. Energy performance improvements is in the main achieved externally |
| Space heating strategy | Heat recovery unit located within the roof space with distribution ducting within the external insulated void with supply and exhaust to each room. This will enable well sealed, controllable heating and ventilation to all spaces. Further more it omits the need for a wet pipework distribution system and the inadequacy and space loss of radiators. |
| Water heating strategy | Roof or porch mounted Solar thermal panels, appropriate to building orientation. Lower mounting improves maintenance access. Point of use heating and energy display will also improve user appreciation and practice. |

| | |
|---|---|
| Fuel strategy | Due to the long term nature of the proposals it is envisaged that electricity is the likely fuel most likely being generated from available primary fuel sources. Renewable fuel sources being developed Hydrogen fuel cells, pv, wind, wave and nuclear power all produce electricity. |
| Renewable energy generation strategy | Integration of solar thermal and PV within the roof construction where appropriate. The recent trade in tariffs now make these potentially viable contributors to renewable energy to the house holder. |
| Passive solar strategy | See notes regarding renewable energy from solar sources. This project does not seek to add elements such as trombe wall techniques to the design as they a re less fail safe. High insulation was considered to be of the greater benefit for the widest range of property |
| Space cooling strategy | None envisaged due to slower thermal response and higher insulation standards |
| Daylighting strategy | Replacement high performance window and special reveal design creates sealable stepped junctions with splayed design to retain views and light. |
| Ventilation strategy | Airtightness by sealed external skin and controlled ventilation and air distribution by heat recovery unit |
| Airtightness strategy | Interlocking external insulation enhanced by seals,  membranes and external rendered finish. |
| Strategy for minimising thermal bridges | Fully thermally broken components for windows, doors and reveals, minimising fixings to thermally broken external insulation subframe. |
| Modelling strategy | None at present, it is considered that the prototype ( if granted) will enable detailed examination of the minutia for maximum performance |
| Insulation strategy | High performance external insulation on proprietary top hat subframe supported from existing building shell.  No foundation required. There is almost no limit to amount of insulation usable to achieve required standards. The solution also retains the thermal mass characteristics of existing concrete wall panels. |

| | |
|---|---|
| Other relevant retrofit strategies | Conscious that the devil is in the detail, the team has sought ways throughout to ensure stepped sealing details for air tightness and longevity in the finished construction Over and above primary building performance, It is also felt that a crucial element in design is the availability of point of use information for the user to encourage an understanding of the significance and cost of individual actions. |
| Other information (constraints or opportunities influencing project design or outcomes) | The project seeks to utilise presently tested and developed products so that development time is reduced. This will to enable an early execution of the solution. The innovation is in design approach to integrate the known products into a coherent whole. The solutions have also been scrutinised by G F Tomlinson (the builder partner) to ensure viable building costs and practice. Project partners include: Birmingham City Council, G F Tomlinson Building, Pick Everard architects, Pick Everard BREEAM assessors, N Power, Hanson Structherm, Worcester Bosch, Bowater window systems, Loughborough University CREST |

## Energy use

Fuel use by type (kWh/yr)

| Fuel | previous | forecast | measured |
|---|---|---|---|
| **Electric** | 10669 | 11310 | 4049 |
| **Gas** | 22565 | | 7004 |
| **Oil** | | | |
| **LPG** | | | |
| **Wood** | | | |
| **7 hour tariff (off eak)** | | | |

Primary energy requirement & CO2 emissions

| | previous | forecast | measured |
|---|---|---|---|
| **Annual CO2 emissions** (kg CO2/m².yr) | 146 | 89 | 51 |
| **Primary energy requirement** (kWh/m².yr) | 702 | 377 | 242 |

Renewable energy (kWh/yr)

| Renewables technology | forecast | measured |
|---|---|---|
| **Photovoltaic** | 147 | |
| **none** | | |

| Renewables technology | forecast | measured |
|---|---|---|
| **Energy consumed by generation** | | |

Airtightness ( m³/m².hr @ 50 Pascals )

| | **Date of test** | **Test result** |
|---|---|---|
| Pre-development airtightness | - | 11.9 |
| Final airtightness | - | 11.1 |

Annual space heat demand ( kWh/m².yr )

| | Pre-development | forecast | measured |
|---|---|---|---|
| **Space heat demand** | - | 67 | - |

| | |
|---|---|
| Whole house energy calculation method | SAP Extension for Whole House |
| Other energy calculation method | SAP extention worksheet |
| Predicted heating load | 67 W/m² (demand) |
| Other energy target(s) | Whole House Primary Energy Demand 130kWh/m2/yr Primary areas of additional energy reduction; 1. Water Heating 2. Lighting 3. Appliances |

## Building services

| | |
|---|---|
| Occupancy | NULL |
| Space heating | NULL |
| Hot water | NULL |
| Ventilation | NULL |
| Controls | NULL |
| Cooking | NULL |
| Lighting | NULL |
| Appliances | NULL |
| Renewables | NULL |
| Strategy for minimising thermal bridges | NULL |

## Building construction

| | |
|---|---|
| Storeys | |
| Volume | |
| Thermal fabric area | |
| Roof description | NULL |
| Roof U-value | 0.00W/m² K |
| Walls description | NULL |
| Walls U-value | 0.00W/m² K |

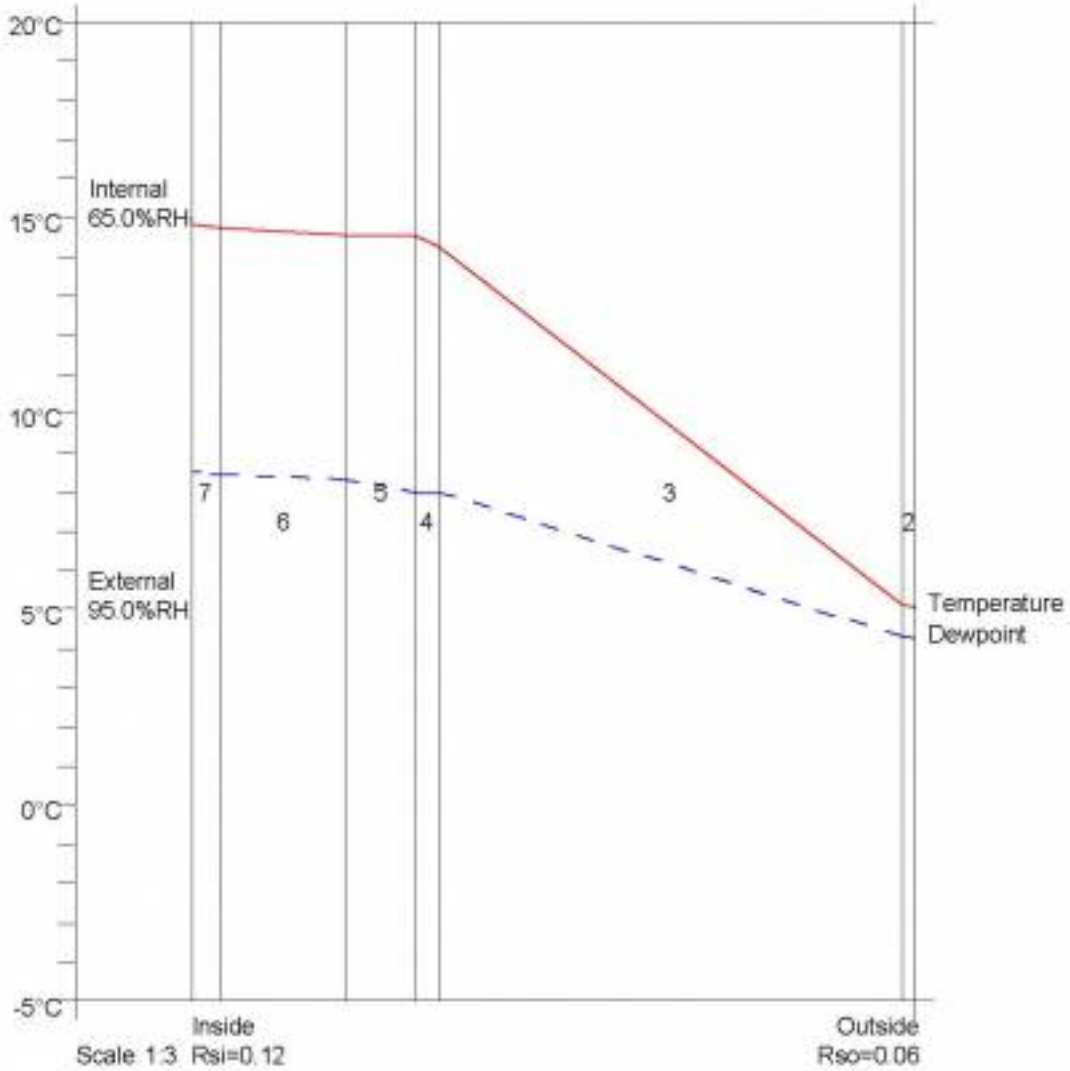
| | |
|---|---|
| Party walls description | NULL |
| Party walls U-value | 0.00W/m² K |
| Floor description | NULL |
| Floor U-value | 0.00W/m² K |
| Glazed doors description | NULL |
| Glazed doors U-value | 0.00W/m² K |
| Opaque doors description | NULL |
| Opaque doors U-value | 0.00W/m² K |
| Windows description | NULL |
| Windows U-value | 0.00W/m² K |
| Windows energy transmittance (G-value) | |
| Windows light transmittance | |
| Rooflights description | NULL |
| Rooflights light transmittance | |
| Rooflights U-value | 0.00W/m² K |

## Project images

**Condensation Risk Analysis (no account taken of thermal bridges)**

Internal / External Conditions : 15.0°C @ 65.0%RH / 5.0°C @ 95.0%RH Buildup period 60 days

| | Interface Temp. °C | Dewpoint Temp. °C | Vapour Pressure (kPa) | Saturated V.P. (kPa) | Winter Buildup (g/m²) | Annual Buildup (g/m²) | Conden-sation |
|---|---|---|---|---|---|---|---|
| 1 Outside surface resistance | 5.1 | 4.3 | 0.83 | 0.88 | - | - | No |
| 2 Render (BS5250) | 5.1 | 4.3 | 0.83 | 0.88 | - | - | No |
| 3 Expanded polystyrene (BS5250) | 14.3 | 8.0 | 1.07 | 1.63 | - | - | No |
| 4 Cavity >=25mm, wall (CIBS) | 14.5 | 8.0 | 1.07 | 1.65 | - | - | No |
| 5 Concrete, dense | 14.6 | 8.3 | 1.10 | 1.66 | - | - | No |
| 6 Concrete, light weight | 14.7 | 8.4 | 1.10 | 1.68 | - | - | No |
| 7 Gyproc Wallboard | 14.9 | 8.5 | 1.11 | 1.69 | - | - | No |
| 8 Inside surface resistance | | | | | | | |






JPA Designer Version 4.02a1
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X:\Shared Work Folder\JOBSFILE\6900- 6999\6954\Calculations\U-Values\6954 U-Values.JDP

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U-Value calculations are not an exact science and are based on assumptions made about the existing construction and their predicted thermal conductivity.

# CONDENSATION RISK ANALYSIS

**Users Ref:** GFT06

**Issued on:** 30.November.2009
**Prop Type Ref:**

**Property:**

**DER:** 15.52
**TER:** 32.41

**SAP Rating:** 80 C **SAP Energy Cost:** £245.31 **CO2 Emissions:** 1.32 t/year
**EI Rating:** 87 B **Energy used:** 102 kWh/m2/year **Enel:** 4 **ZC:** 0.00

Surveyor: B249-0000, Dermot McLaughlin, Tel: 02476 792 621, Fax: 02476 236 024
Address: The Techno Centre, Puma Way, Coventry, CV1 2TT
Client:

Software Version: EES SAP 2005.018.01, June 2009 (Design System), BRE SAP Worksheet 9.81
SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build
Calculation method: BS EN ISO 6946, BS EN ISO 13370, BS 5250

## Roof Plane 1 -

### Environmental conditions:

| | | |
|---|---|---|
| External conditions: | Temperature: 5 °C | Relative Humidity: 95 % |
| Internal conditions: | Temperature: 15 °C | Relative Humidity: 65 % |

### Table of layers:

| Layer | Width mm | Thermal conduct. W/m.K | Thermal resistance m2.K/W | Cumulative thermal resistance m2.K/W | Vapour resistivity GN.s/kg.m | Vapour resistance GN.s/kg | Cumulative vapour resistance GN.s/kg |
|---|---|---|---|---|---|---|---|
| External surface | - | 0.000 | 0.040 | 0.040 | 0.000 | 0.000 | 0.00 |
| 1. Render - Gypsum and Sand | 6.0 | 0.800 | 0.008 | 0.048 | 0.000 | 0.000 | 0.00 |
| 2. Standard cavity | 25.0 | 0.000 | 0.180 | 0.228 | 0.000 | 0.000 | 0.00 |
| 3. Expanded polystyrene | 200.0 | 0.030 | 6.667 | 6.894 | 300.0 | 60.00 | 60.00 |
| 4. Concrete, dense | 30.0 | 1.667 | 0.018 | 6.912 | 200.0 | 6.00 | 66.00 |
| 5. Concrete, no fines | 54.0 | 0.400 | 0.135 | 7.047 | 60.0 | 3.24 | 69.24 |
| 6. 12.5mm Gyproc Wallboard | 12.5 | 0.190 | 0.066 | 7.113 | 60.0 | 0.75 | 69.99 |
| 7. Plaster, standard | 3.0 | 0.400 | 0.008 | 7.120 | 60.0 | 0.18 | 70.17 |
| Internal surface | - | 0.000 | 0.130 | 7.120 | 0.000 | 0.000 | 70.17 |
| External surface | - | 0.000 | 0.040 | 0.040 | 0.000 | 0.000 | 0.00 |
| 1. ROCKWOOL ROLL | 150.0 | 0.040 | 3.750 | 3.790 | 5.9 | 0.89 | 0.89 |
| 2. 12.5mm Gyproc Wallboard | 15.0 | 0.190 | 0.079 | 3.869 | 60.0 | 0.90 | 1.79 |
| 3. ROCKWOOL ROLL | 150.0 | 0.040 | 3.750 | 7.619 | 5.9 | 0.89 | 2.67 |
| Internal surface | - | 0.000 | 0.100 | 7.619 | 0.000 | 0.000 | 2.67 |


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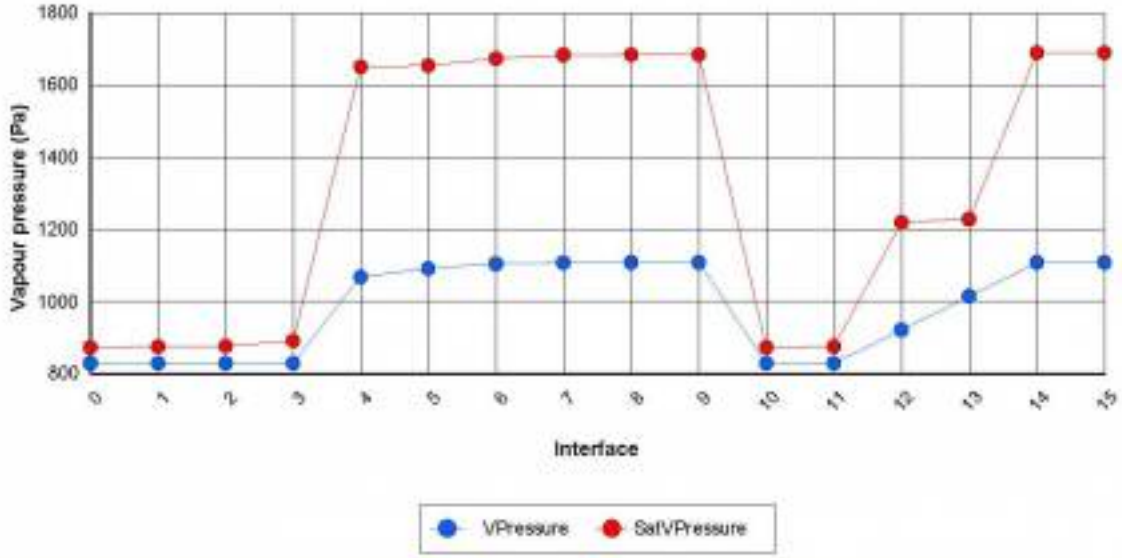
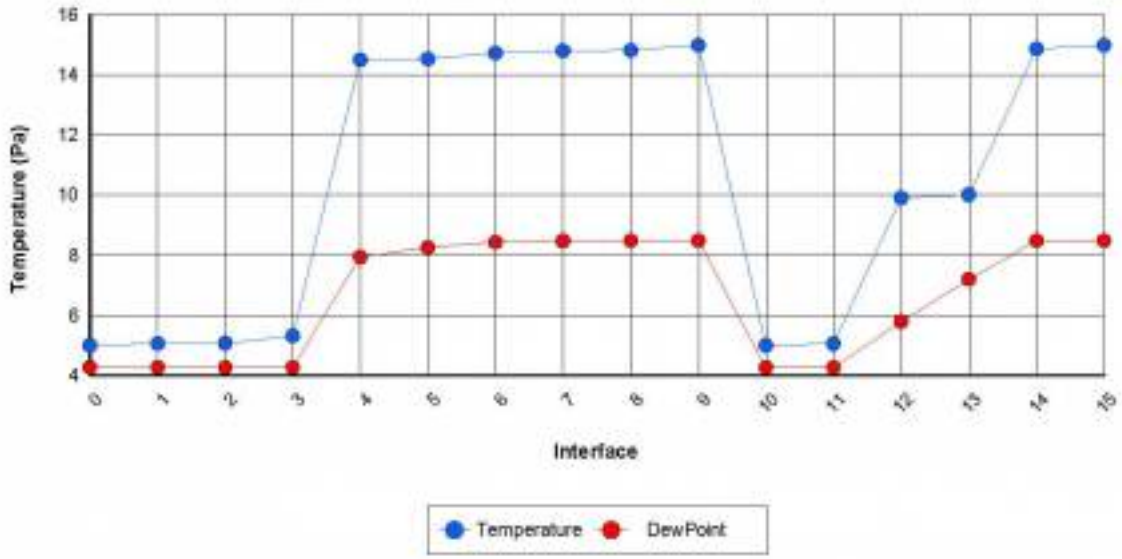
**Vapour pressure table:**

| Interface - between layers | Interface temp. °C | Vapour pressure Pa | Satur. vapour pressure Pa | Dew point °C | Cond. rate g/m2.h | Cond. rate 60 days g/m2.h | Cond. risk Y/N |
|---|---|---|---|---|---|---|---|
| External surface | 5.00 | 828.3 | 871.9 | 4.27 | 0.00 | 0.00 | No |
| 1. External surface / ROCKWOOL ROLL | 5.05 | 828.3 | 875.0 | 4.27 | 0.00 | 0.00 | No |
| 2. ROCKWOOL ROLL / 12.5mm Gyproc Wallboard | 9.91 | 920.9 | 1 219.9 | 5.79 | 0.00 | 0.00 | No |
| 3. 12.5mm Gyproc Wallboard / ROCKWOOL ROLL | 10.01 | 1 015.2 | 1 228.3 | 7.20 | 0.00 | 0.00 | No |
| 4. ROCKWOOL ROLL / Internal surface | 14.87 | 1 107.9 | 1 690.2 | 8.48 | 0.00 | 0.00 | No |
| Internal surface | 15.00 | 1 107.9 | 1 690.2 | 8.48 | 0.00 | 0.00 | No |




**Interface temperature / Dew point graphical representation:**





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# CONDENSATION RISK ANALYSIS

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**Issued on:** 30.November.2009
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**SAP Rating:** 80 C **SAP Energy Cost:** £245.31 **CO2 Emissions:** 1.32 t/year
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Surveyor: B249-0000, Dermot McLaughlin, Tel: 02476 792 621, Fax: 02476 236 024
Address: The Techno Centre, Puma Way, Coventry, CV1 2TT
Client:

Software Version: EES SAP 2005.018.01, June 2009 (Design System), BRE SAP Worksheet 9.81
SAP version: 9.81 Regs Region: England and Wales (Part L1A 2006), Calculation Type: New Build
Calculation method: BS EN ISO 6946, BS EN ISO 13370, BS 5250

## Wall Main -

### Environmental conditions:

| | | |
|---|---|---|
| External conditions: | Temperature: 5 °C | Relative Humidity: 95 % |
| Internal conditions: | Temperature: 15 °C | Relative Humidity: 65 % |

### Table of layers:

| Layer | Width mm | Thermal conduct. W/m.K | Thermal resistance m2.K/W | Cumulative thermal resistance m2.K/W | Vapour resistivity GN.s/kg.m | Vapour resistance GN.s/kg | Cumulative vapour resistance GN.s/kg |
|---|---|---|---|---|---|---|---|
| External surface | - | 0.000 | 0.040 | 0.040 | 0.000 | 0.000 | 0.00 |
| 1. Render - Gypsum and Sand | 6.0 | 0.800 | 0.008 | 0.048 | 0.000 | 0.000 | 0.00 |
| 2. Standard cavity | 25.0 | 0.000 | 0.180 | 0.228 | 0.000 | 0.000 | 0.00 |
| 3. Expanded polystyrene | 200.0 | 0.030 | 6.667 | 6.894 | 300.0 | 60.00 | 60.00 |
| 4. Concrete, dense | 30.0 | 1.667 | 0.018 | 6.912 | 200.0 | 6.00 | 66.00 |
| 5. Concrete, no fines | 54.0 | 0.400 | 0.135 | 7.047 | 60.0 | 3.24 | 69.24 |
| 6. 12.5mm Gyproc Wallboard | 12.5 | 0.190 | 0.066 | 7.113 | 60.0 | 0.75 | 69.99 |
| 7. Plaster, standard | 3.0 | 0.400 | 0.008 | 7.120 | 60.0 | 0.18 | 70.17 |
| Internal surface | - | 0.000 | 0.130 | 7.120 | 0.000 | 0.000 | 70.17 |
| External surface | - | 0.000 | 0.040 | 0.040 | 0.000 | 0.000 | 0.00 |
| 1. ROCKWOOL ROLL | 150.0 | 0.040 | 3.750 | 3.790 | 5.9 | 0.89 | 0.89 |
| 2. 12.5mm Gyproc Wallboard | 15.0 | 0.190 | 0.079 | 3.869 | 60.0 | 0.90 | 1.79 |
| 3. ROCKWOOL ROLL | 150.0 | 0.040 | 3.750 | 7.619 | 5.9 | 0.89 | 2.67 |
| Internal surface | - | 0.000 | 0.100 | 7.619 | 0.000 | 0.000 | 2.67 |


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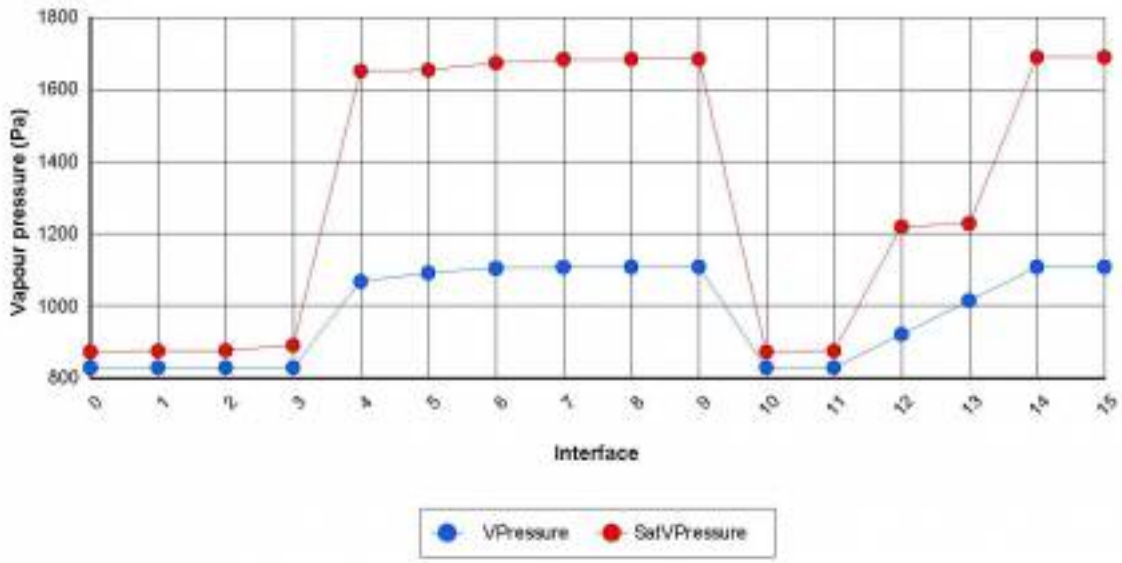
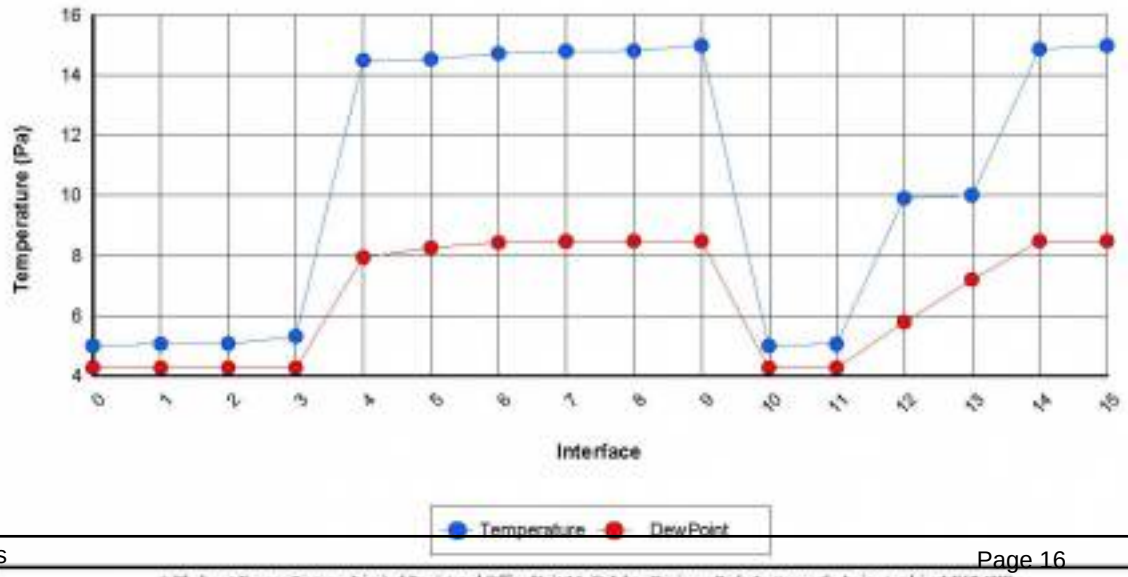
**Vapour pressure table:**

| Interface - between layers | Interface temp. °C | Vapour pressure Pa | Satur. vapour pressure Pa | Dew point °C | Cond. rate g/m2.h | Cond. rate 60 days g/m2.h | Cond. risk Y/N |
|---|---|---|---|---|---|---|---|
| External surface | 5.00 | 828.3 | 871.9 | 4.27 | 0.00 | 0.00 | No |
| 1. External surface / Render - Gypsum and Sand | 5.06 | 828.3 | 875.2 | 4.27 | 0.00 | 0.00 | No |
| 2. Render - Gypsum and Sand / Standard cavity | 5.07 | 828.3 | 875.9 | 4.27 | 0.01 | 20.66 | No |
| 3. Standard cavity / Expanded polystyrene | 5.31 | 828.3 | 891.1 | 4.27 | 0.01 | 20.66 | No |
| 4. Expanded polystyrene / Concrete, dense | 14.51 | 1 067.3 | 1 651.2 | 7.93 | 0.00 | 0.00 | No |
| 5. Concrete, dense / Concrete, no fines | 14.53 | 1 091.2 | 1 653.9 | 8.26 | 0.00 | 0.00 | No |
| 6. Concrete, no fines / 12.5mm Gyproc Wallboard | 14.72 | 1 104.2 | 1 673.9 | 8.43 | 0.00 | 0.00 | No |
| 7. 12.5mm Gyproc Wallboard / Plaster, standard | 14.81 | 1 107.1 | 1 683.7 | 8.47 | 0.00 | 0.00 | No |
| 8. Plaster, standard / Internal surface | 14.82 | 1 107.9 | 1 684.8 | 8.48 | 0.00 | 0.00 | No |
| Internal surface | 15.00 | 1 107.9 | 1 684.8 | 8.48 | 0.00 | 0.00 | No |




**Interface temperature / Dew point graphical representation:**





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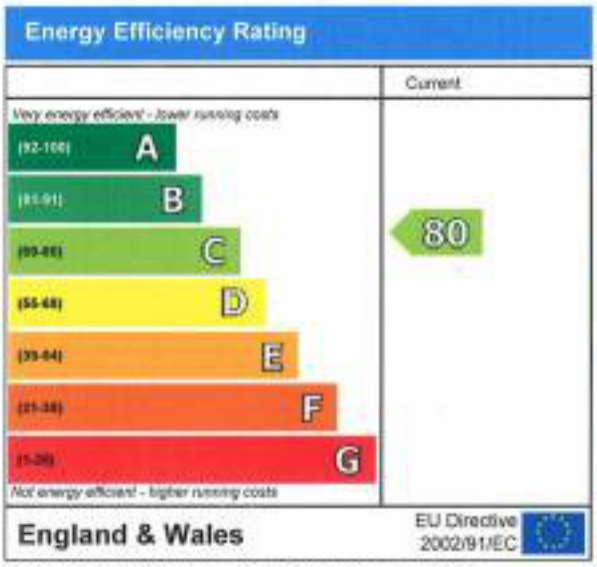
# Predicted Energy Assessment

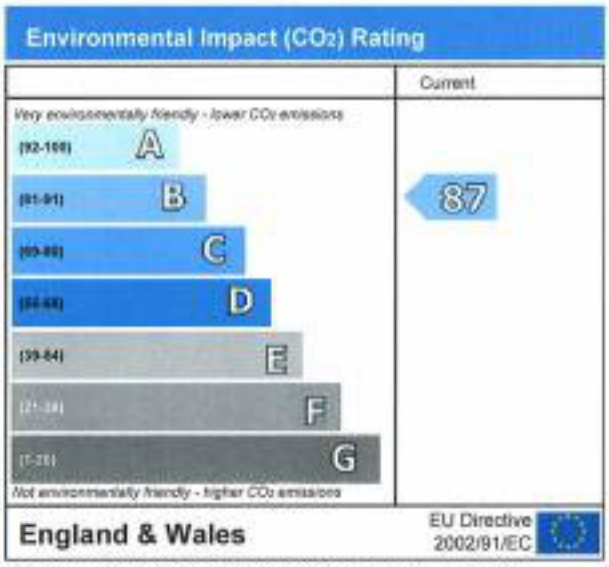
| | |
|---|---|
| Dwelling type: | End-terrace house |
| Date of assessment: | 06 November 2009 |
| Produced by: | Hadley Brook Enterprises Limit |
| Total floor area: | 87 m² |

This document is a Predicted Energy Assessment required to be included in a Home Information Pack for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, the Pack should be updated to include information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2005 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide ($CO_2$) emissions.




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.




The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide ($CO_2$) emissions. The higher the rating the less impact it has on the environment.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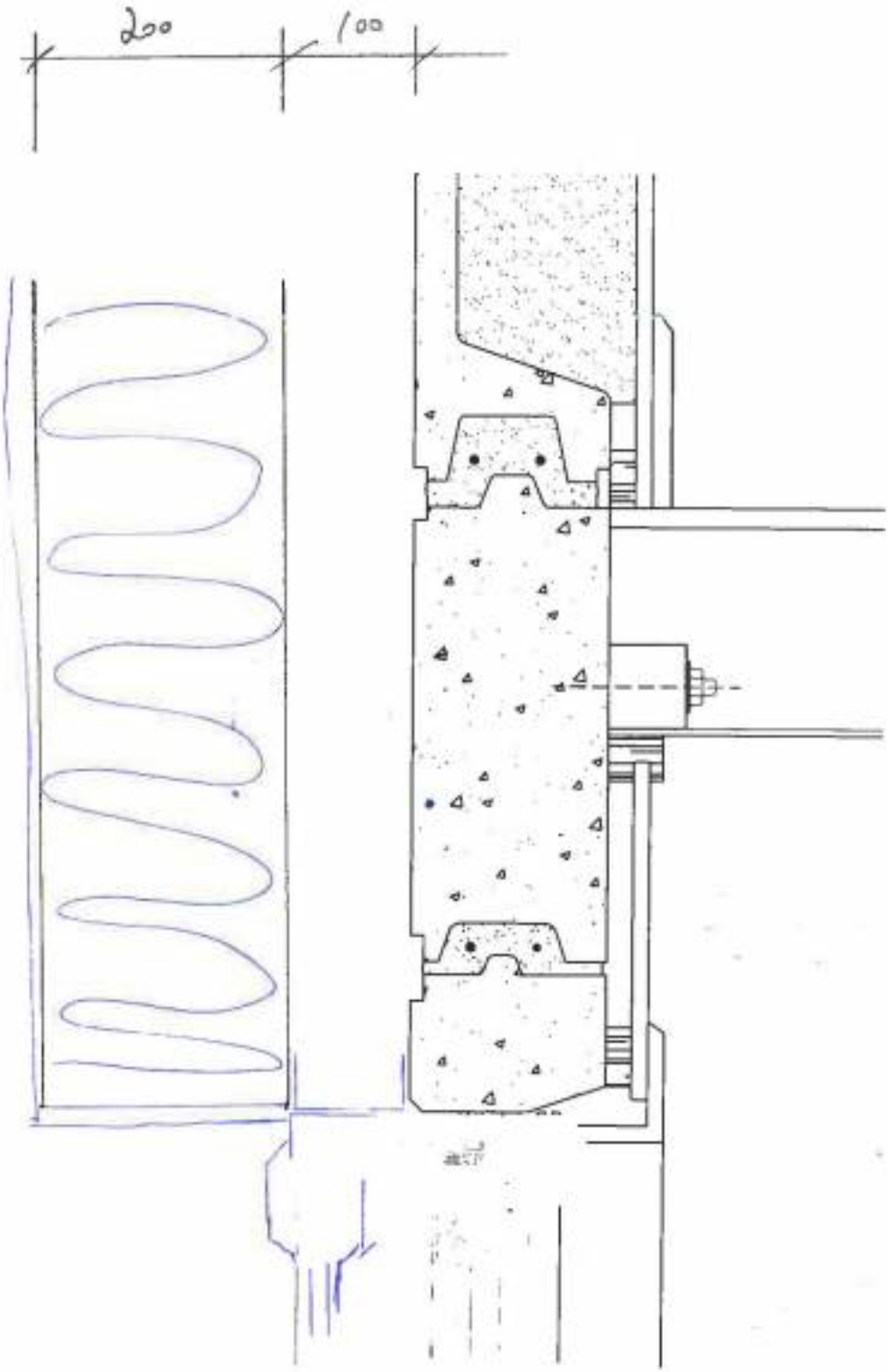


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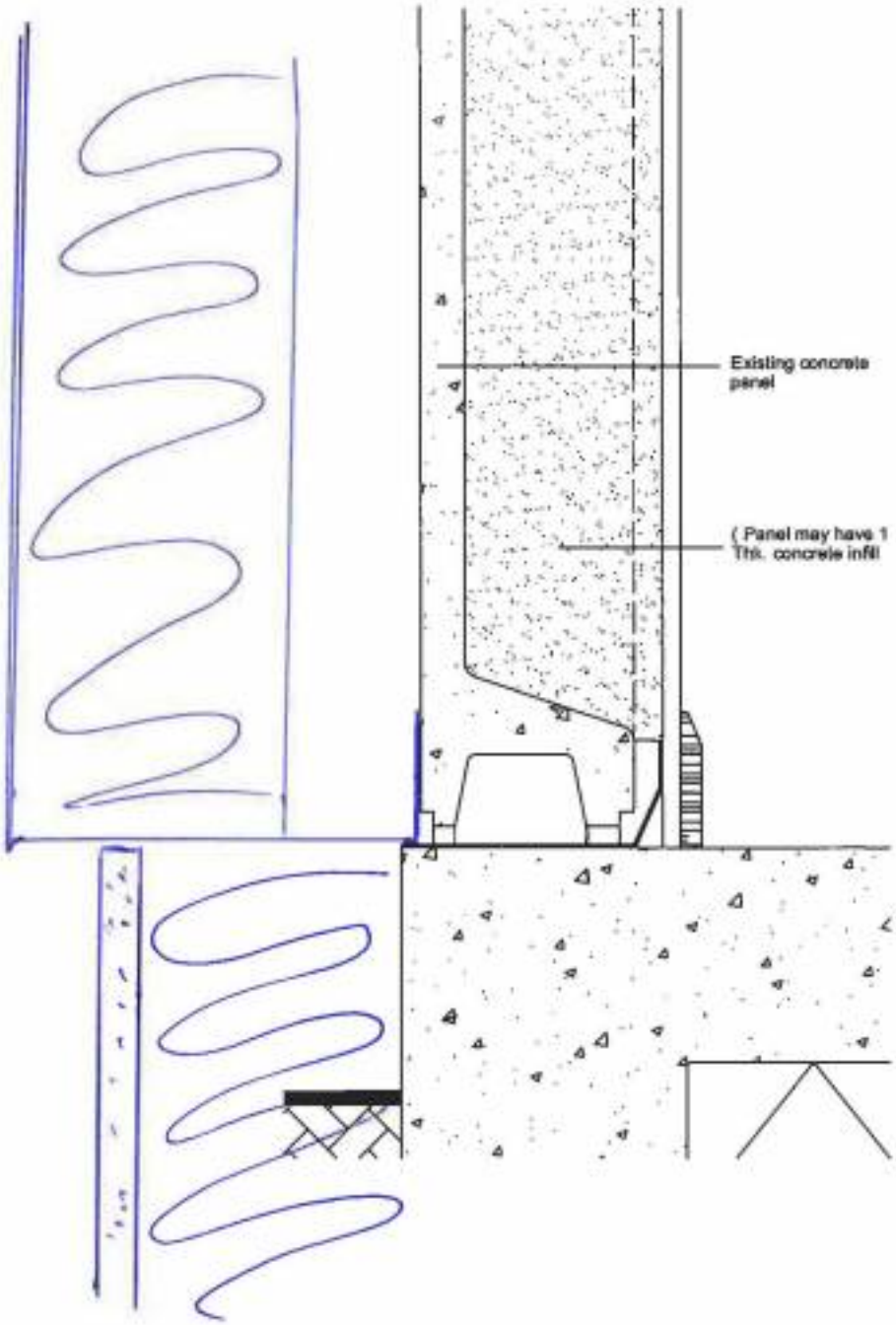
6954 - SK1

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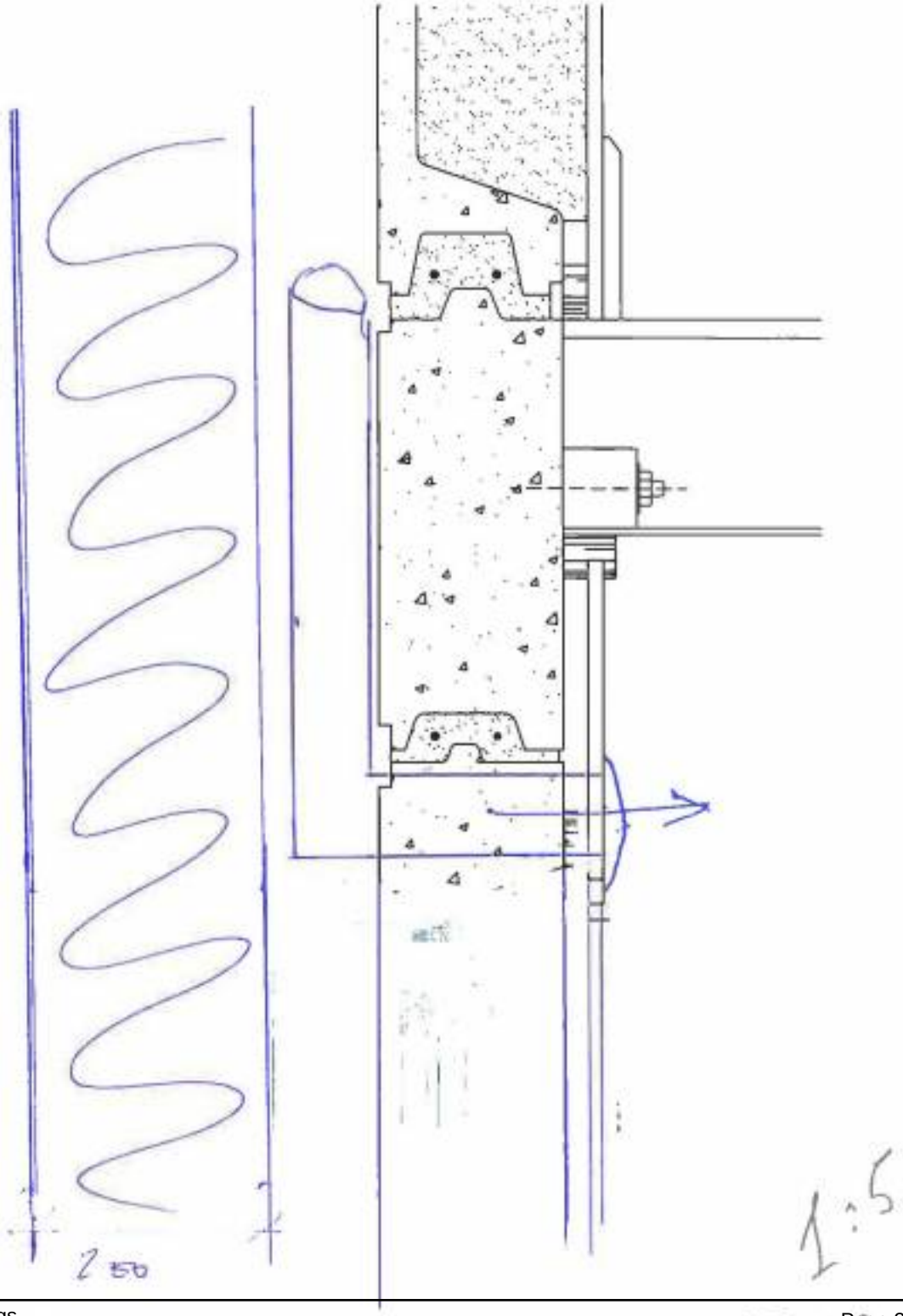
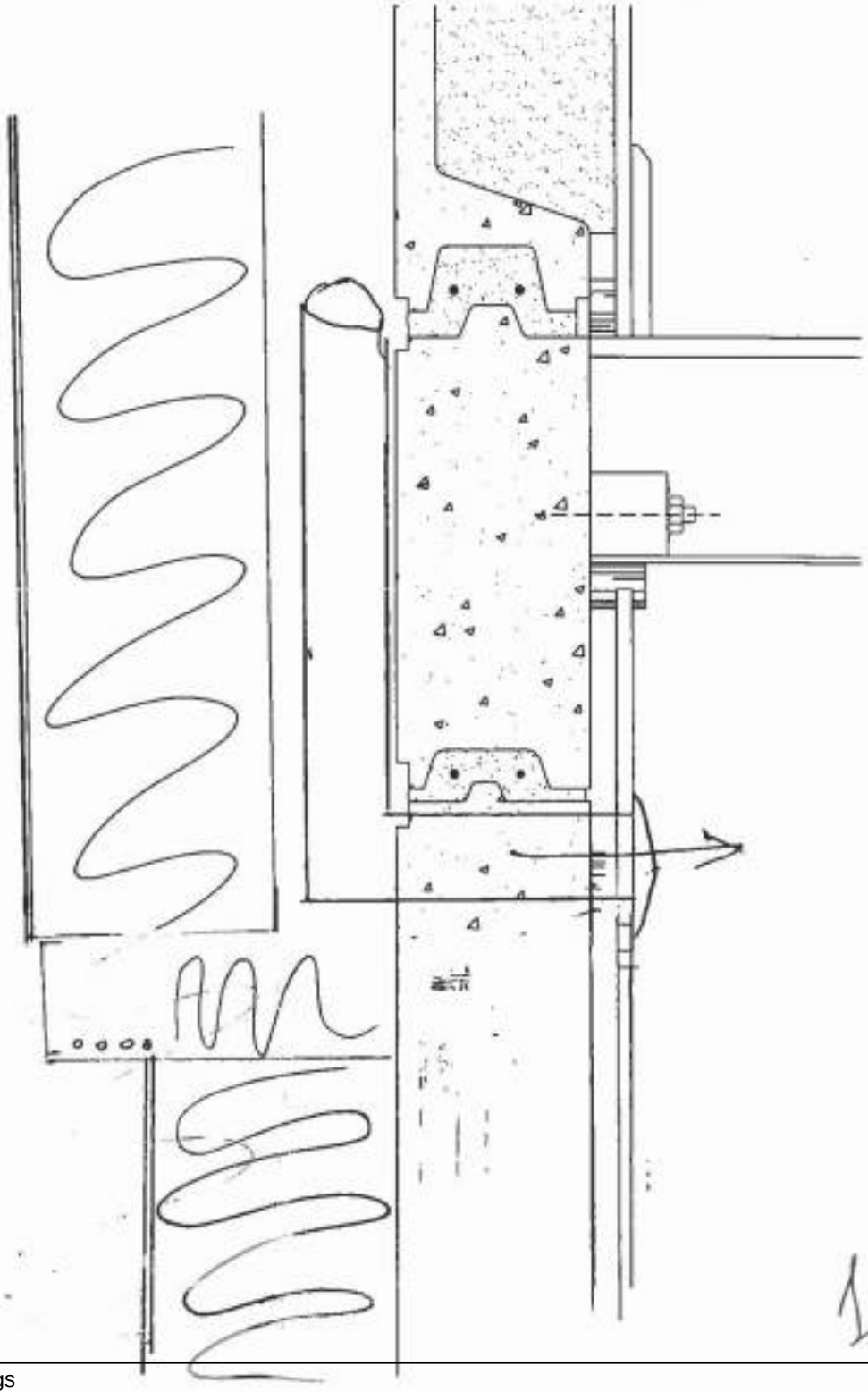
BASE DETAIL

6954-542




FIRST FLOOR DETAIL - OPTION 2
6954-SK3



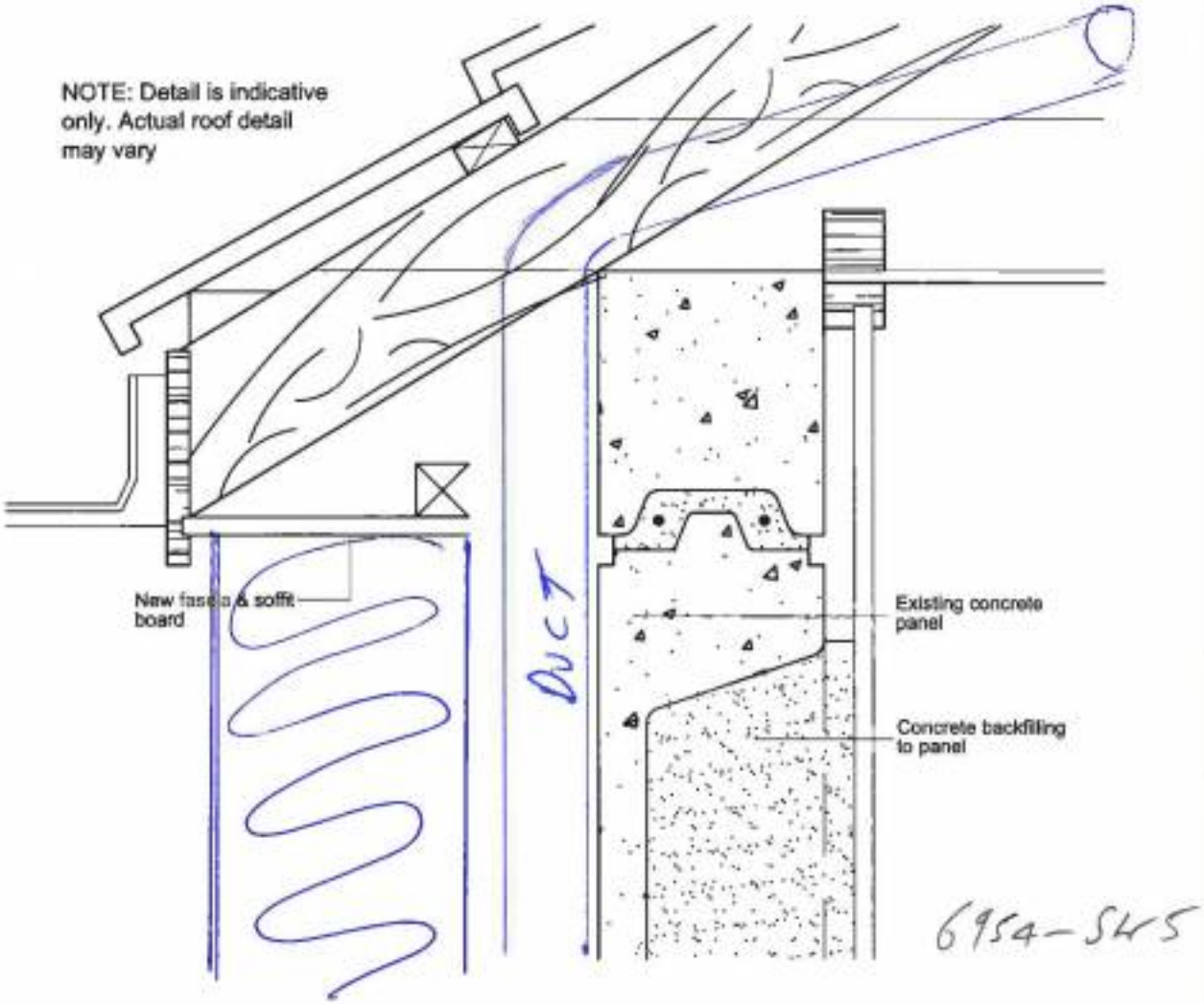

FIRST FLOOR DETAIL _ OPTION 2.

Standard Details

# Structherm | Cladding Solutions

Thermal Performance, Structural Continuity

Structherm BUILDING SYSTEMS




| FOR STRUCTHERM LTD OFFICE USE | |
|---|---|
| Date | 01.12.06 |
| Drn | R.C.Dowling |
| Checked: | |
| Scale: | N.T.S. |

| | | |
|---|---|---|
| DETAIL REF: | Wates-02 | Rev A |
| House Type: | Wates Properties | |
| TITLE: | Details at Eaves | |

Bent Ley Road
Meltham, Holmfirth
Huddersfield
HD9 4AP

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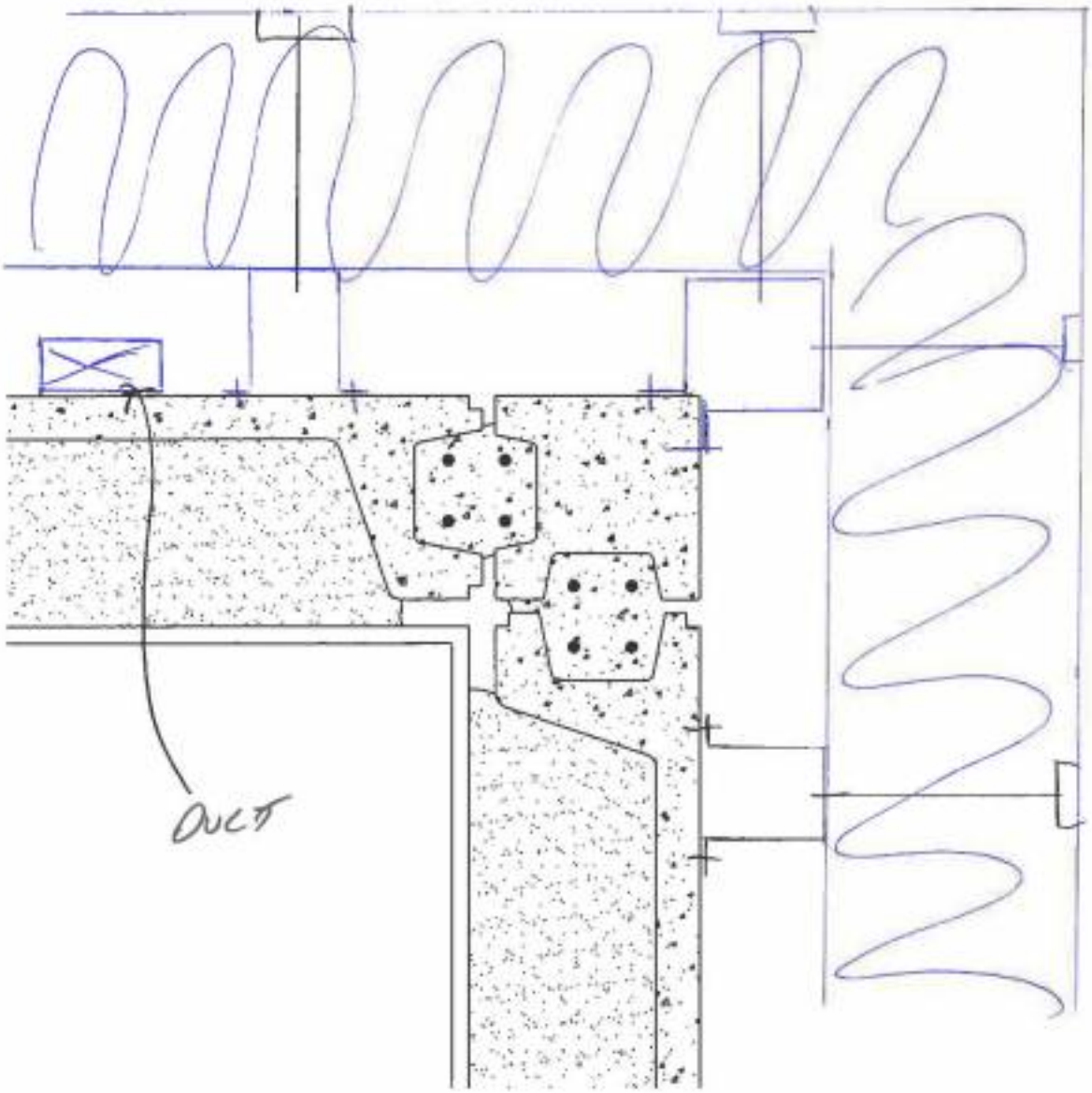



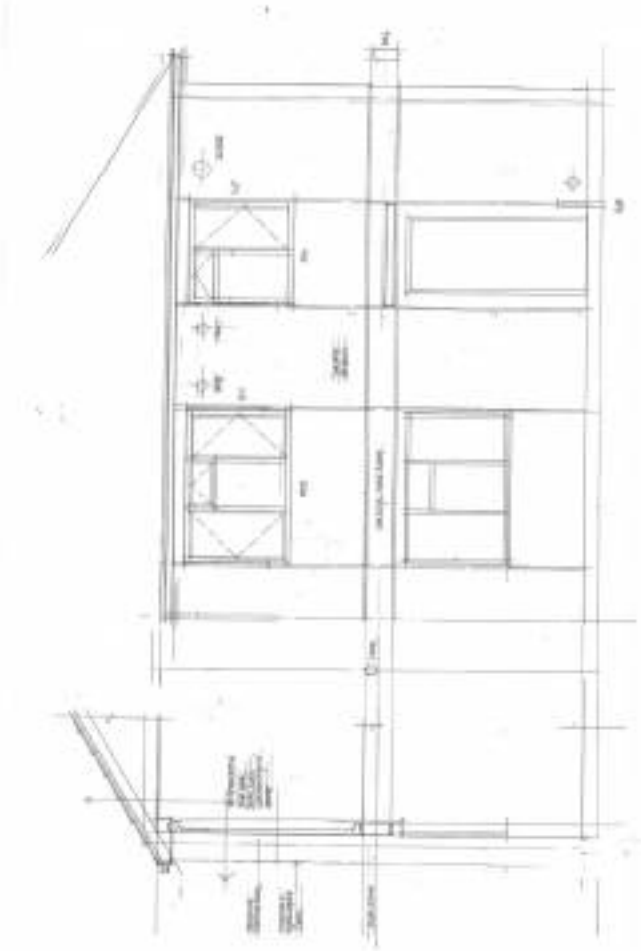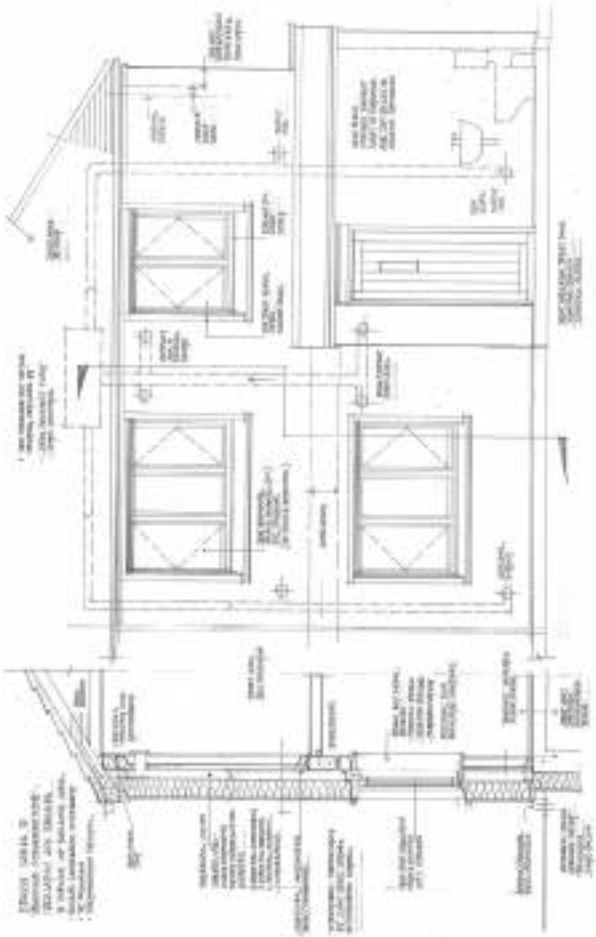
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