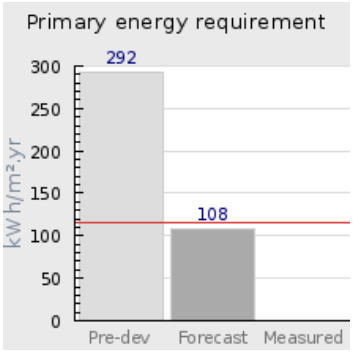
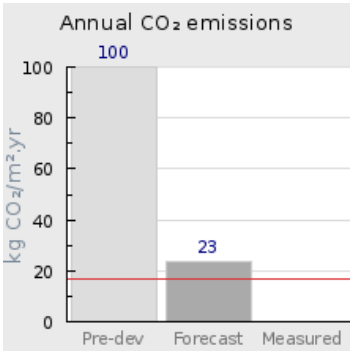
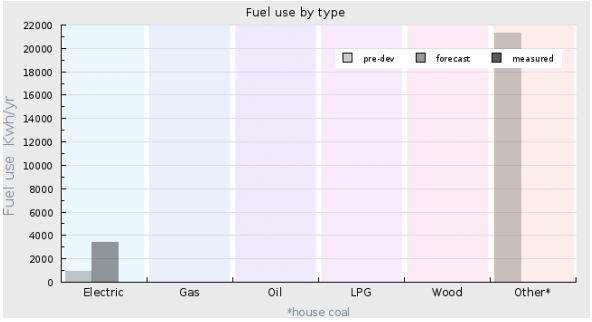
http://retrofitforthefuture.org

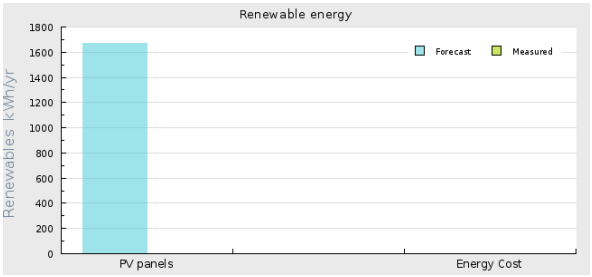
Project name 3 Mayfair Place, Tuxford for A1 Housing Association.

Project summary The existing pre-cast concrete panel construction and orientation led us to a solar strategy, which utilises the inherent thermal mass of the internal walls. The fabric solution was detailed to ensure there is no de-bonding of the concrete's ability to absorb and radiate heat contributing to internal temperature regulation and a comfortable environment for the tenant. Combining an air source heat pump, low temperature distribution system, whole house mechanical ventilation (MVHR) and photovoltaic electricity generation into a coherent renewable strategy complements the solar/ thermal mass approach. Thermaskirt heating distribution was selected due to its innovative delivery of heat low down in the room avoiding inefficient convection.









Project Description

Projected build start date	01 Mar 2010

Projected date of occupation	30 Apr 2010
Project stage	Under construction
Project location	Tuxford, Nottinghamshire, England
Energy target	Retrofit for the Future
Build type	Refurbishment
Building sector	Public Residential
Property type	Mid Terrace
Existing external wall construction	Other
Existing external wall additional information	Precast concrete panel, render and tile finish. 70mm insulation
Existing party wall construction	Uninsulated precast concrete panel
Floor area	87.18 m²
Floor area calculation method	PHPP

Project team

Organisation	Connaught Partnership Limited
Project lead	
Client	
Architect	
Mechanical & electrical consultant(s)	
Energy consultant(s)	
Structural engineer	
Quantity surveyor	
Other consultant	
Contractor	

Design strategies

Planned occupancy	There are currently 4 occupants, 3 Adults and a child. The property is occupied for most of the day and one of the occupants works night shift.
Space heating strategy	Space heating from air source heat pump with Thermaskirt heating distribution. Controls from weather compensator and time and temperature zone control.
Water heating strategy	Water heating from air source heatpump feeding 210l thermal store with 50mm insulation and electric immersion back up.
Fuel strategy	Mains electricity and electricity generated from PV.
Renewable energy generation strategy	2 kWp photovoltaic panel array orientated South.
Passive solar strategy	House is orientated due South.

Space cooling strategy	Natural ventilation for most of the cooling season. MVHR unit has an automatic summer bypass valve to prevent exit air from the dwelling heating fresh incoming air during hot periods. This function is desirable during summer nights when outside air temperature is cooler than inside air temperature, therefore providing a cooling function.
Daylighting strategy	Existing kitchen achieves an average daylight factor of at least 2%. The living room, dining room and study achieve average daylight factor of at least 1.5%.
Ventilation strategy	MVHR and openable windows for summer ventilation.
Airtightness strategy	Through extensive experience in Air testing we initially identified the key areas that contribute to poor air permeability tests results Our approach relies on communicating the details required to those on site who will implement them. The concrete floor is sealed to the wall to the entire perimeter. Plasterboard ceiling taped to wall, all joints in plasterboard taped. Penetrations in plasterboard to be mastic sealed. Plaster finish to walls to cover sealed floor/wall and ceiling wall/junctions. Reveals where thermal laminate board is to be installed to receive continuous strip of sealant, window board fixed on layer of compressible regupol to create air tight seal. Timloc insulated, air sealed loft hatch. External doors to Air Permeability standard in BS 6375: 1-2004 All windows and doors to receive continuous mastic seal to frame. All penetrations in denoted in elements above to be mastic sealed.

Strategy for minimising thermal bridges	Careful detailing and consideration in section, plan and 3 dimensions ensures we achieve an excellent Y-value. A continuous thermal envelope is implemented and aided by the use of the external insulation system. External wall insulation extends below ground level to minimise the lateral thermal transmission. At roof level the external wall insulation extends into the eaves and wraps the head of the pre-cast concrete panel to maintain continuity with the roof insulation. Windows and doors are thermally broken and reveals and heads provide a secondary thermal barrier in the form of thermal laminate board. The existing concrete floor insulated with Specetherm is the only separated element in the otherwise continuous thermal envelope.
Modelling strategy	The method of assessment used to develop the performance figures is SAP 2005 and the TSB extension sheet. The design process has used Dynamic Simulation Modelling (DSM), which is a more flexible design tool and allows for on going design improvements and management of building use. The DSM modelling has also allowed a comprehensive comparative analysis, reflecting the profile assigned within SAP and also the actual expected usage profile and temperature set points agreed with the tenant. This analysis should provide a close approximation of the actual energy use monitored by EST following the implementation of the improvements.
Insulation strategy	External walls to receive NBT Pavatex Diffutherm a 95% recycled product achieving a u-value of 0.18 W/mÂ²K Roof to receive 300mm Thermafleece a natural, sustainable product achieving a u-value of 0.13W/mÂ²K. Ground floor solid slab topped with 10mm Spacetherm, unrivalled in its thermal conductivity. Its application combined with Fermacell protection board ensures a good thermal resistance with minimal disruption.

Other relevant retrofit strategies	The design approach has been to benchmark, improve the fabric using appropriate materials and measures, reduce the energy load and provide heat and energy from appropriate technologies. Other considerations have included specific issues with house construction, setting, type, applicability/repeatability, planning & building regulation requirements and aesthetics. Briefing from the tenant and house provider has been integrated in this process.
Other information (constraints or opportunities influencing project design or outcomes)	The existing pre-cast concrete panel construction and orientation led us to a solar strategy which utilises the inherent thermal mass of the internal walls. The fabric solution was detailed to ensure there is no de-bonding of the concrete's ability to absorb and radiate heat contributing to internal temperature regulation and a comfortable environment for the tenant. Careful consideration was given to summer and winter solar azimuths that helped us determine reveal depths ant the use of external shading devices. The already existing external render allowed us to utilise a higher performing external insulated render system with minimal visual impact. The orientation provided a platform for solar technologies in the form of PV.

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric	968.27	3395.04	-
Gas	-	-	-
Oil		-	-
LPG	-	-	-
Wood	-	-	-
house coal	21283.04	-	-

Primary energy need & CO2 emissions

	previous	forecast	measured
Annual CO2 emissions (kg CO2/m².yr)	100	23.8	-
Primary energy requirement (kWh/m².yr)	292	108.3	-

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
PV panels	1667.19995117188	-

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

Airtightness (m³/m².hr @ 50 Pascals)

	Date of test	**Test result**
Pre-development airtightness	-	-
Final airtightness	-	-

Annual space heat demand (kWh/m².yr)

	Pre-development	forecast	measured
Space heat demand	-	38	-

Whole house energy calculation method	SAP Extension for Whole House
Other energy calculation method	
Predicted annual heating load	-
Other energy target(s)	

Building services

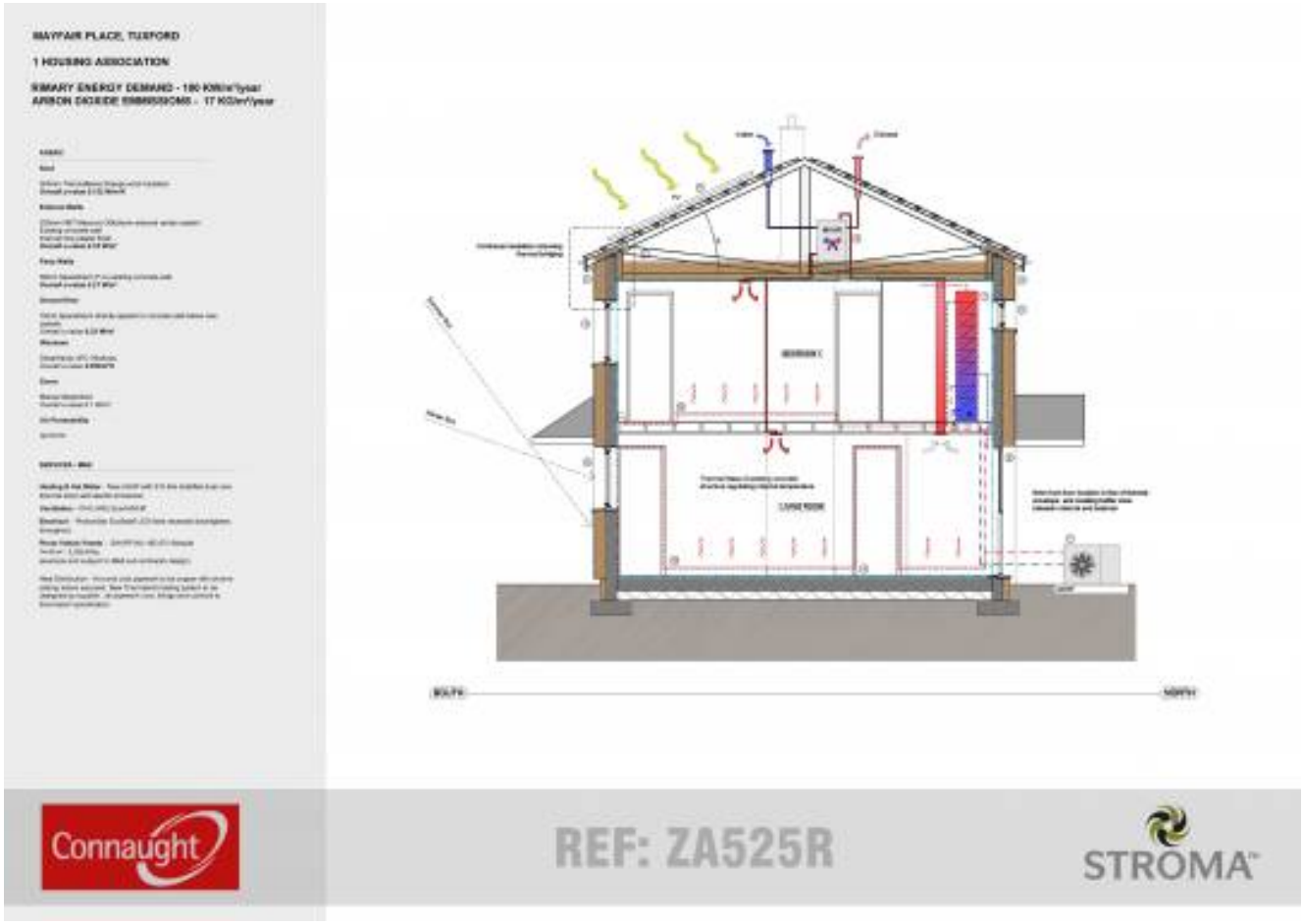
Occupancy	
Space heating	
Hot water	
Ventilation	
Controls	
Cooking	
Lighting	
Appliances	
Renewables	
Strategy for minimising thermal bridges	

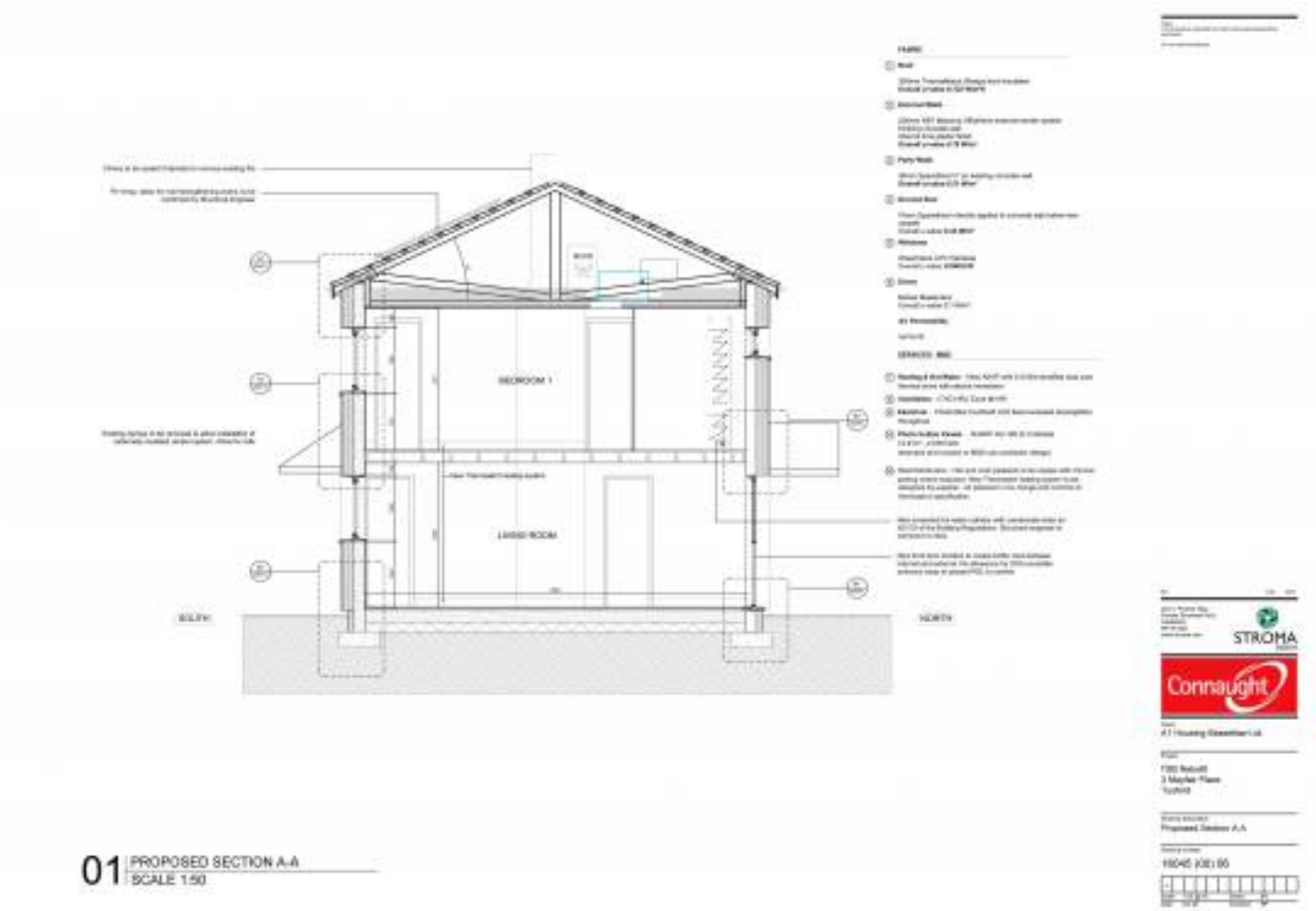
Building construction

Storeys	
Volume	
Thermal fabric area	
Roof description	
Roof U-value	
Walls description	
Walls U-value	
Party walls description	
Party walls U-value	
Floor description	

Floor U-value
Glazed doors description
Glazed doors U-value
Opaque doors description
Opaque doors U-value
Windows description
Windows U-value
Windows energy transmittance (G-value)
Windows light transmittance
Rooflights description
Rooflights light transmittance
Rooflights U-value

Project images





01 PROPOSED SECTION A-A
SCALE 1:50

A1 HOUSING
3 Mayfair Place
Floor Area - 87.24m²

			CO_2 EMISSIONS			PRIMARY ENERGY		
			($kgCO_2$/ yr)		($kgCO_2$/m².yr)	(kWh/yr)		(kWh/m².yr)
Software	Profile	Location	Heating/DHW	Lights	Total CO_2 ($kgCO2/m^2.yr$)	Heating/DHW	Lights	Total PE (kWh/ m².yr)
SAP	SAP	Nottingham	1779	58	17	11772	348.8	110
IES	SAP	Nottingham	867	194	5.59	5755.96	1290.24	55.35
IES	Actual	Sheffield	893	194	6.4	5923.96	1290.24	59.78

SOUTH ELEVATION

NORTH ELEVATION

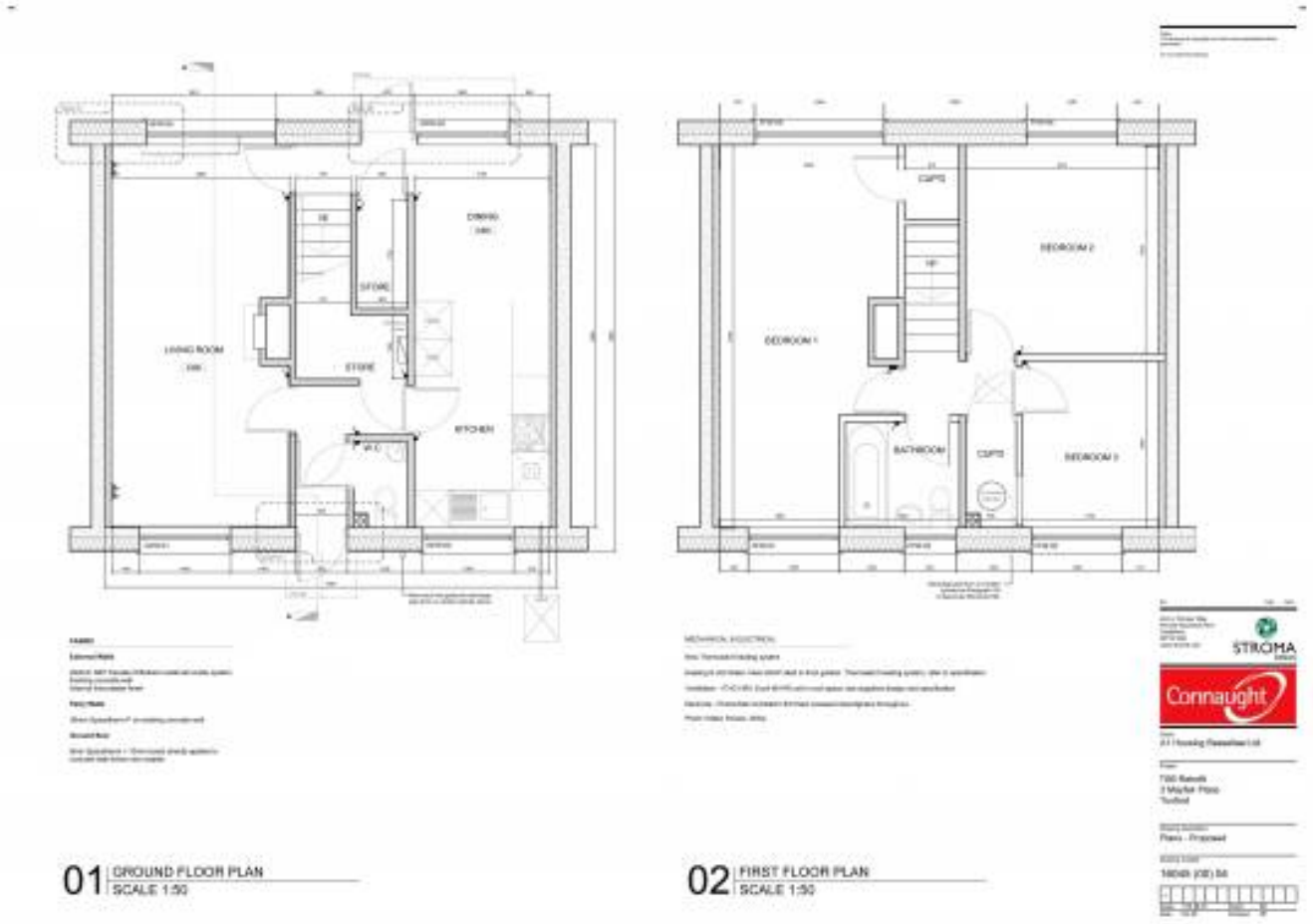
REF	LOCATION	STRUCT OPENING WIDTH	STRUCT OPENING HEIGHT	NOTES
GF01	LOUNGE	1400	1050	
GF02	KITCHEN	1400	1050	
GF03	DINING	1400	1050	
GF04	LOUNGE	2000	1050	
FF01	BEDROOM 1	1400	1050	
FF02	BATHROOM	600	1400	OBSCURE GLAZING
FF03	BEDROOM 2	1400	1050	
FF04	BEDROOM 3	1400	1050	
FF05	BEDROOM 4	2000	1050	

REF	LOCATION	STRUCT OPENING WIDTH	STRUCT OPENING HEIGHT	TYPE	LINTEL	FC
EF01	FRONT DOOR	954	1981			
EF02	KITCHEN	954	1981			

01 GROUND FLOOR PLAN
SCALE 1:50

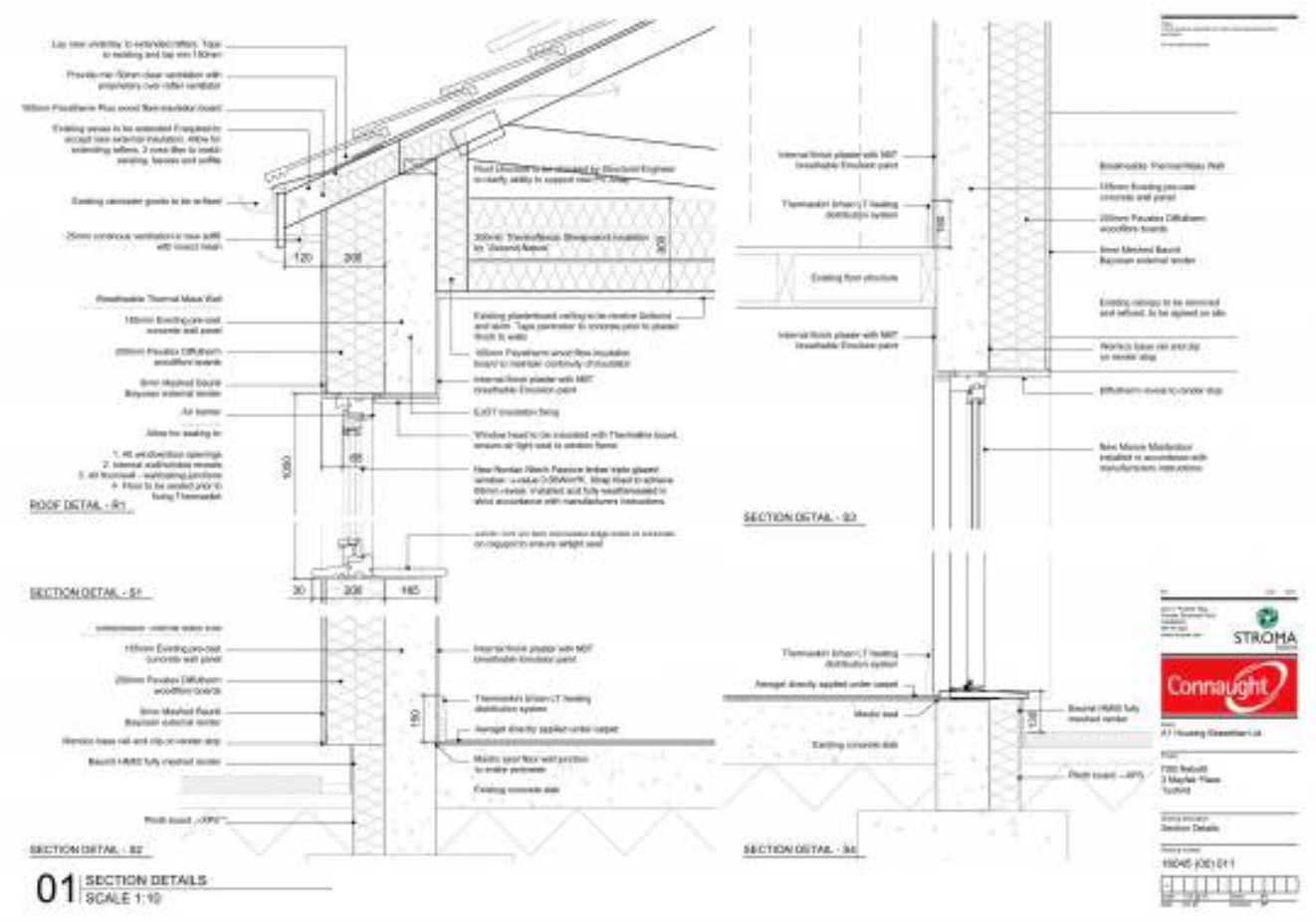
STROMA

Connaught

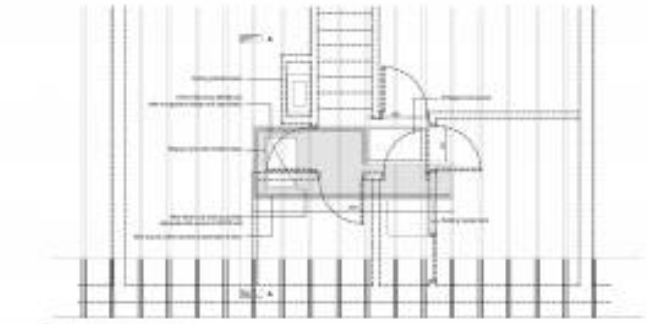


01 GROUND FLOOR PLAN
SCALE 1:50

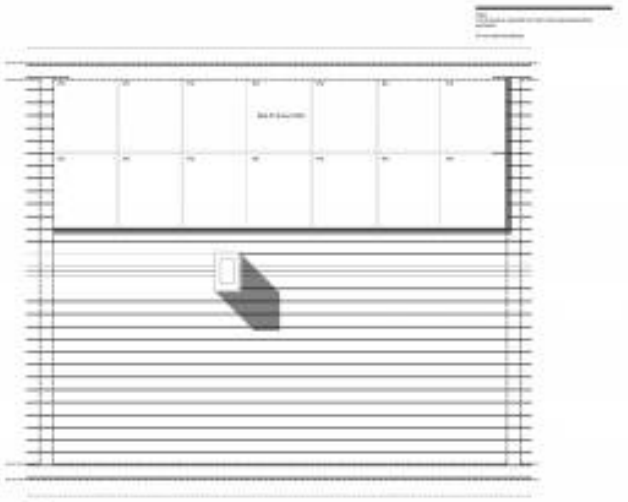
02 FIRST FLOOR PLAN
SCALE 1:50



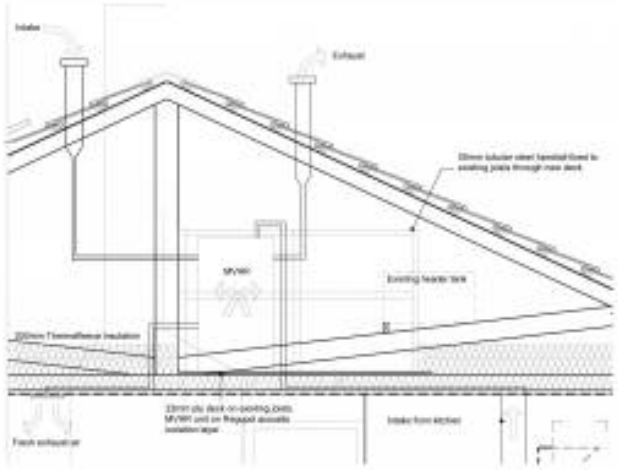
01 SECTION DETAILS
SCALE 1:10



01 ROOF SPACE PLAN
SCALE 1:50



02 ROOF PLAN
SCALE 1:50

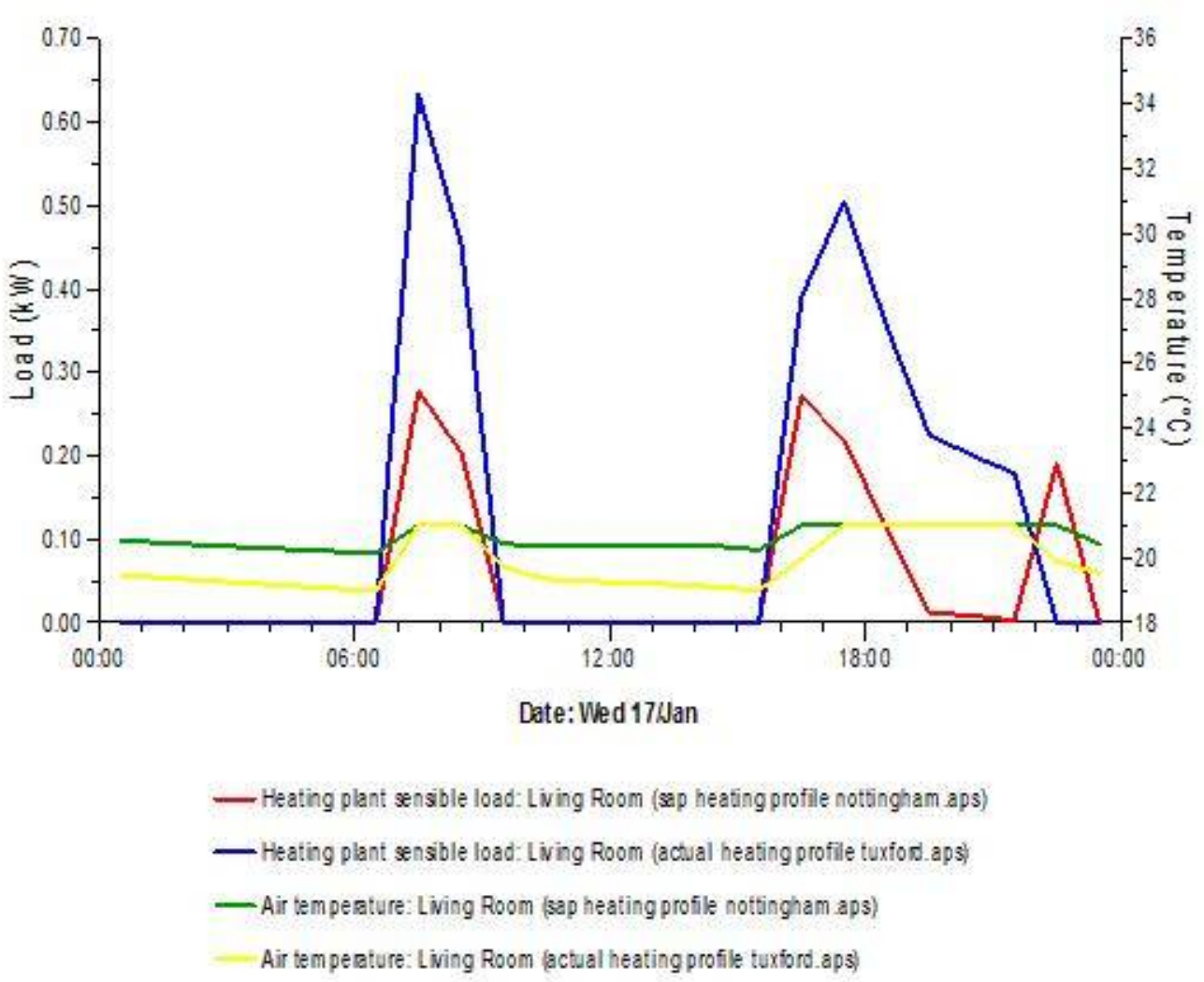


03 ROOF SPACE SECTION A-A
SCALE 1:20

01 LOCATION PLAN
SCALE 1:1250

02 THE HOUSE
3 MAYFAIR PLACE, TUXFORD

03 SITE PLAN
SCALE 1:200


0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Load (kW)
36
34
32
30
28
26
24
22
20
18
Temperature (°C)
00:00
06:00
12:00
18:00
00:00
Date: Wed 17/Jan
Heating plant sensible load: Living Room (sap heating profile nottingham.aps)
Heating plant sensible load: Living Room (actual heating profile tuxford.aps)
Air temperature: Living Room (sap heating profile nottingham.aps)
Air temperature: Living Room (actual heating profile tuxford.aps)