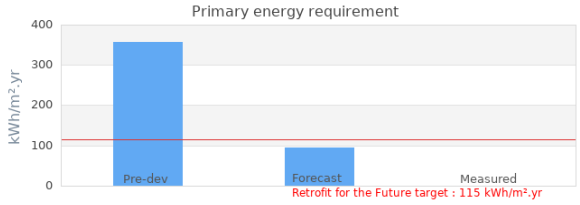
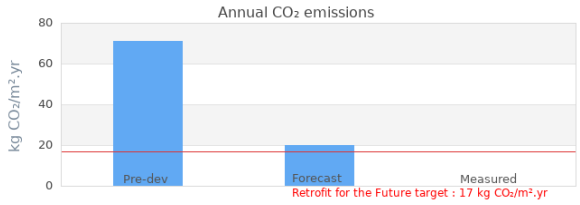
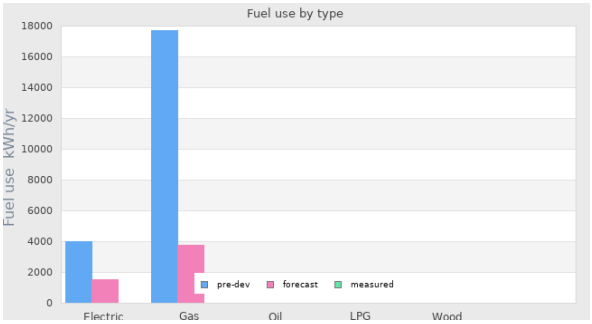
https://www.lowenergybuildings.org.uk/

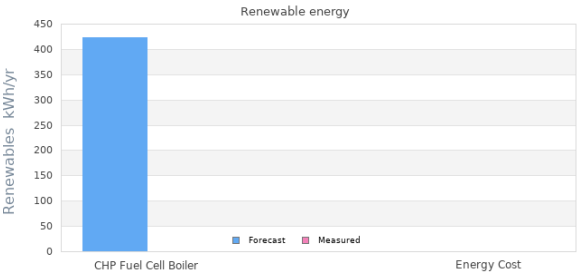
Project name The Natural Refurbishment of 1960 Laing Easiform System; Housing Study of the application of natural Hemp Insulation and Fuel Cell Technolgy

Project summary The Easiform system was in production until early 1970's providing 90 000 units.
Proposals are the for natural refurbishment of the Easiform house type. It proposes a combination of natural Hemp insulation, a Fuel Cell CHP boiler and Stainless Steel Vacum Insulated Panels (VIPs) applied to a semi. Hemp Fibre is used as an external render system (u-value 0.16W/m2K) on walls together with low u-value doors and windows achieving an airtightness of 1m3/h.mm2, while maintaining the breathability of the wall. Feasiblity and SAP confirm an annual CO2 emissions total of 17kg/m2. A CHP gas boiler incorporating 1kW fuel cell will generate electricity. The SS VIPs panels provide gnd flr insulation using a thin panel.









Project Description

Projected build start date	01 Apr 2010
Projected date of occupation	31 Jan 2011
Project stage	Under construction
Project location	Cymbran, Torfaen, Wales
Energy target	Retrofit for the Future
Build type	Refurbishment

Building sector	Public Residential
Property type	Semi-Detached
Existing external wall construction	Other
Existing external wall additional information	75mm clinker conc-50mm cavity-75mm clinker concrete
Existing party wall construction	200mm clinker concrete
Floor area	85.2 m²
Floor area calculation method	PHPP

Project team

Organisation	Melin Homes
Project lead	Wael Nabih, Willdig Lammie Partnership Ltd.
Client	Melin Homes Housing Association
Architect	Wael Nabih, Willdig Lammie Partnership Ltd.
Mechanical & electrical consultant(s)	Andrew Geens, CEREA University of Glamorgan
Energy consultant(s)	Martin Brocklesby, BRE Wales
Structural engineer	N/A
Quantity surveyor	Andrew Cowling, Property Design and Maintenance, Peterborough
Other consultant	Sue Duehurst Hemcrete
Contractor	Proj. Management Contracting; Hemcrete, CERES, Superline Ltd, Melin Homes supply chain

Design strategies

Planned occupancy	Family of three. Two adults and one teenager. Adults alternate working at night.
Space heating strategy	The Micro CHP plant is a totally new design by Ceres Power. The boiler used refluxed gas to power a hydrogen fuel cell and produced both heat and electricity in a 50/50 proportion and with a total output of 1KW. This is supplemented within the same unit by a standard boiler for when the fuel cell output is not high enough. The boiler is designed to be a drop in replacement for an existing condensing boiler unit. All excess electricity produced by the unit is exported to the grid. All excess heat will be stored in the hot water tank. The fuel cell part of the unit has an efficiency of 85% (heat and power) and the standard boiler has an efficiency of 90%. It has been slightly problematical to model this unit in SAP.

Water heating strategy	Solar Hot Water To minimise the demand for hot water 4.5m2 evacuated tube solar panels have been used. The unit used for SAP modelling is the Thermomax HP100 although other similarly performing units would be acceptable so long as the heat loss coefficient (a1) was less than 1 W/m2K and the zero loss collector efficiency (no) was 0.74 or better.
Fuel strategy	Mains Gas, Mains electricity with supplementary electricity from the Fuel Cell CHP boiler.
Renewable energy generation strategy	N/A
Passive solar strategy	Front elevation is within 30 degrees of south.
Space cooling strategy	Natural Ventilation via windows. Cross ventilation can be achieved using through ventilation between the ground floor living and dining areas.
Daylighting strategy	There are no changes being made to the areas or location of glazing units. All windows will be replaced with same size units but with better U-Values.
Ventilation strategy	This bid does not propose the introduction of new forms of ventilation. Windows are to be used for ventilation.
Airtightness strategy	Sap proposes an airtightness of 1m2/h.m2. This is to be ahieved via via parging where appropriate, and providing a rebating doors and windows. We consider that the external render system and the new windows and doors will greatly enhance the air-tightness inside the house.
Strategy for minimising thermal bridges	Thermally broken doors and windows incorporated. Door and windows will be located half on the external wall and half of the frame in within the thickness of the external render system. Continuous insulation will be maintained. In addition the cavity will be filled with blown insulation. All jambs will inlcude insulation boards on all sides of the reveal. The roof insulation will be continued to connect with the external render insulation. VIPs are are used for ground floor insulation. In order to avoid bridging, we will make sure that insulation is placed in the cavity below floor level. Full details of the proposals are provided our submission.

Modelling strategy	Modelling was undertaken only using SAP. Although PHPP was planned, because of time limitations and changes to house type, PHPP was not undertaken.
Insulation strategy	Wall: Application of external insulation to solid brick walls to achieve a U-value of 0.16W/m2k. Floor: Application of VIPs panel to give 0.23 w/m2K. Roof: Addition of 280mm mineral wool to give 0.12w/m2k. Windows: Nordan thermally broken tripple glazing to give 0.8w/m2k Door: Nordan thermally broken frame to give 1.2w/m2k All window and doors reveals are to have insulation slabs applied to them.
Other relevant retrofit strategies	We are planning to carry out retrofit works, minimising disruption to tenants who will continue to occupy the proporty. We consider that all our proposals can be delivered with minimal disruption to tenants. In demonstrating this, we consider that there would be little tenant resistance in a roll out programme.
Other information (constraints or opportunities influencing project design or outcomes)	Initial planning consultation has been undertaken. An artist image of post retrofit proposals has been produced and attached to this submission. We note that there has been some concern made by neighbours prior to seeing our proposals. However, we are confident that the proposals will be accepted as there is minimal change in form. Planners have accepted our proposals. Some of the technologies proposed are not available as a market product. These are namely the SS VIPs panels proposed as gnd. fl. insul. and the CHP Fuel Cell boiler. Proto-types are being provided specifically for this bid. Currently their cost is high, but we have provided the cost at which they will be supplied to the market in about a year from now.

Energy use

Fuel use by type (kWh/yr)

Fuel	previous	forecast	measured
Electric	4000	1500	
Gas	17711	3765	
Oil	0		
LPG			
Wood			

Fuel	previous	forecast	measured

Primary energy requirement & CO2 emissions

	previous	forecast	measured
Annual CO2 emissions (kg CO2/m².yr)	71	20	-
Primary energy requirement (kWh/m².yr)	356	95	-

Renewable energy (kWh/yr)

Renewables technology	forecast	measured
CHP Fuel Cell Boiler	423	
-		
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	-	42	-

Whole house energy calculation method	SAP Extension for Whole House
Other energy calculation method	
Predicted heating load	2.75 W/m² (demand)
Other energy target(s)	1KW electricity will be generated by the CHP boiler used by the household.

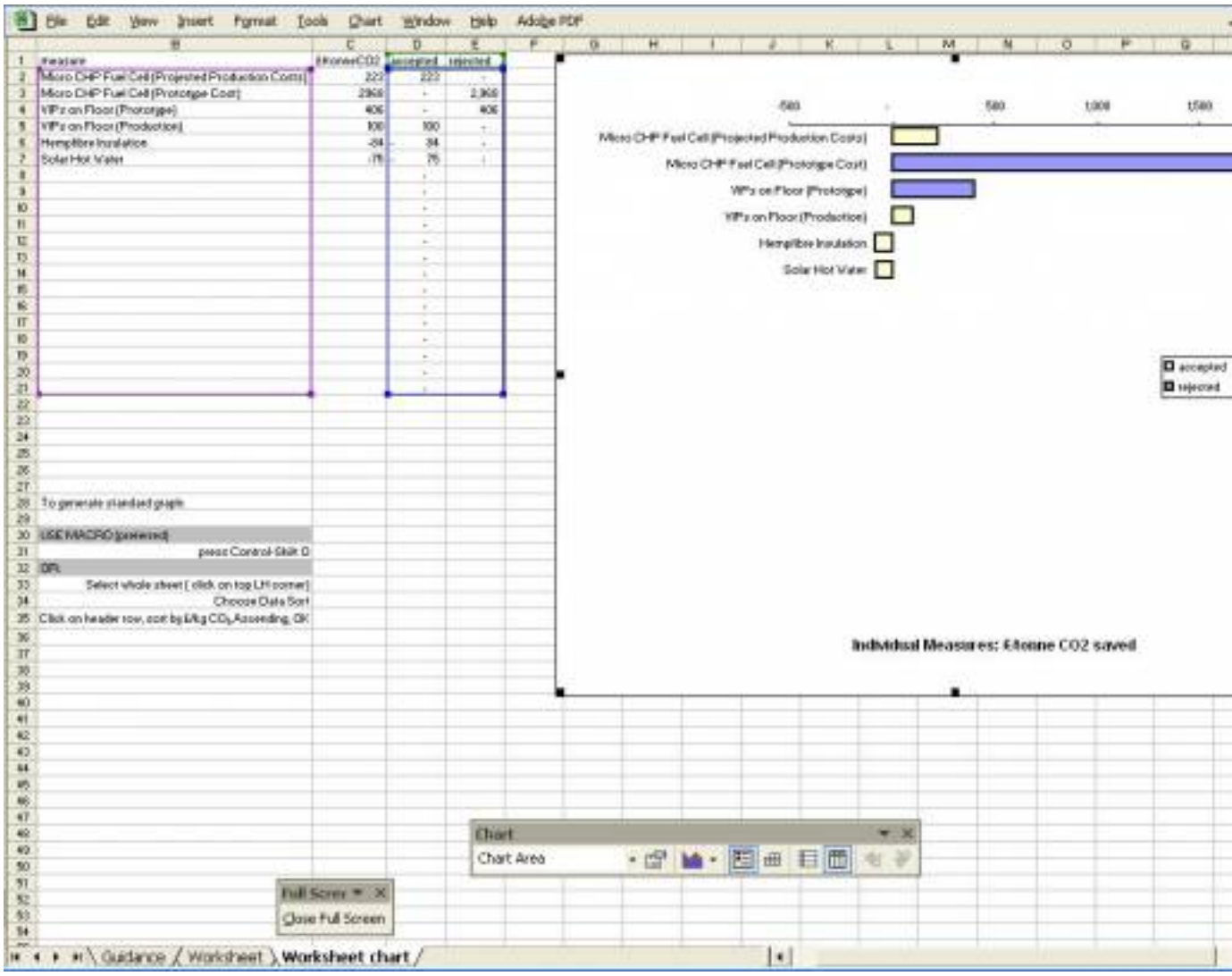
Building services

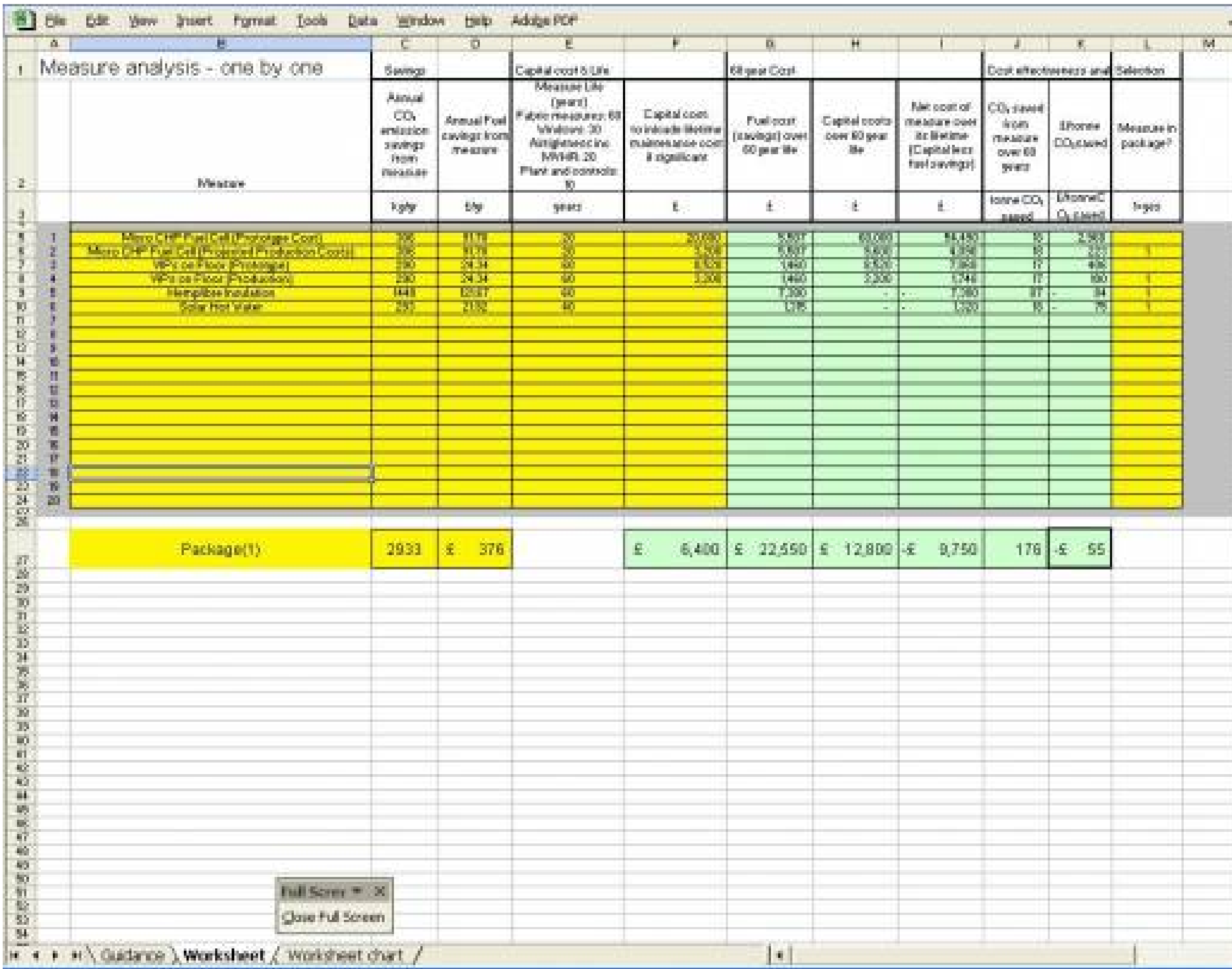
Occupancy	NULL
Space heating	NULL
Hot water	NULL
Ventilation	NULL
Controls	NULL
Cooking	NULL
Lighting	NULL
Appliances	NULL
Renewables	NULL
Strategy for minimising thermal bridges	NULL

Building construction

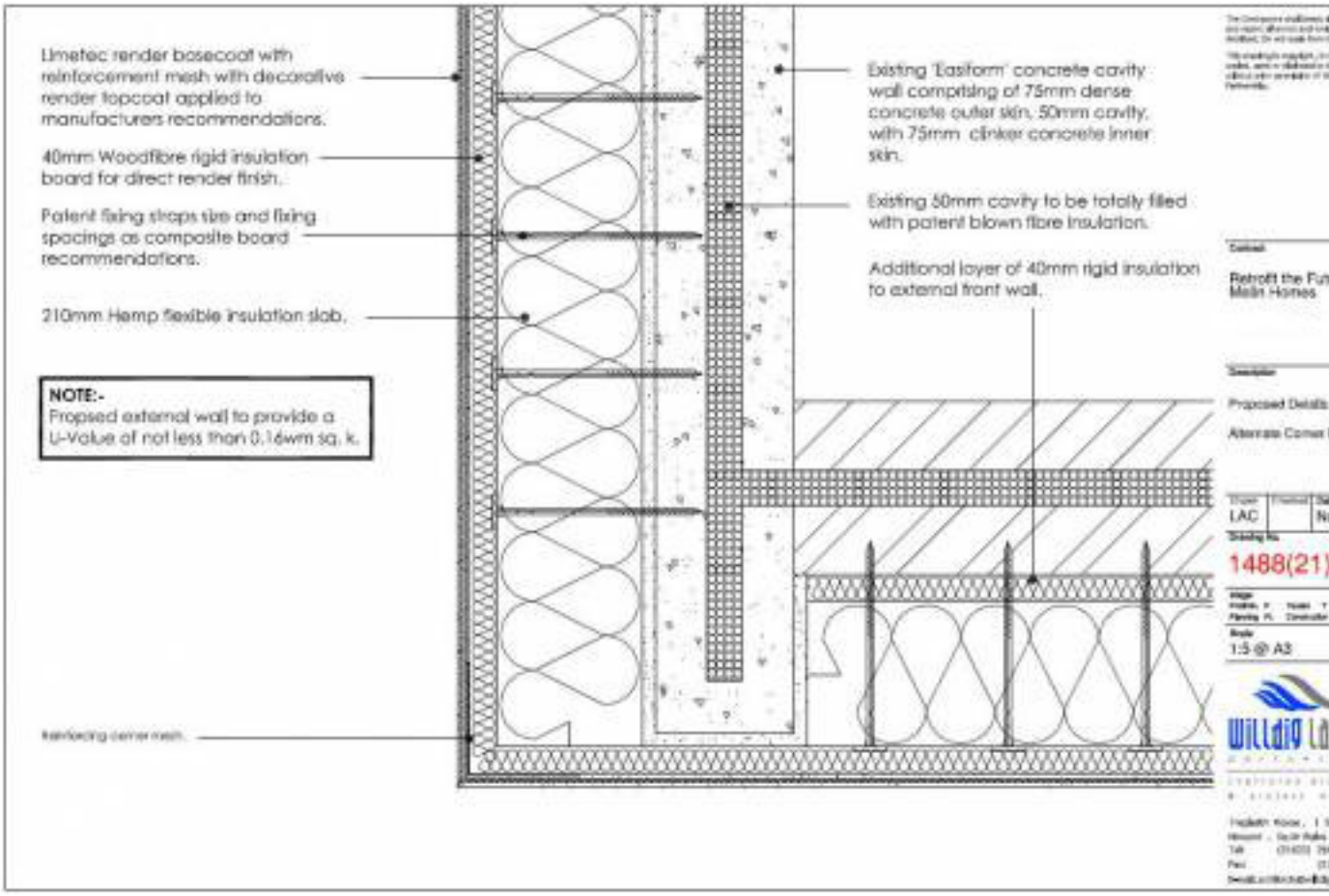
Storeys	
Volume	
Thermal fabric area	
Roof description	NULL
Roof U-value	0.00W/m² K
Walls description	NULL
Walls U-value	0.00W/m² K
Party walls description	NULL
Party walls U-value	0.00W/m² K
Floor description	NULL
Floor U-value	0.00W/m² K
Glazed doors description	NULL
Glazed doors U-value	0.00W/m² K
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

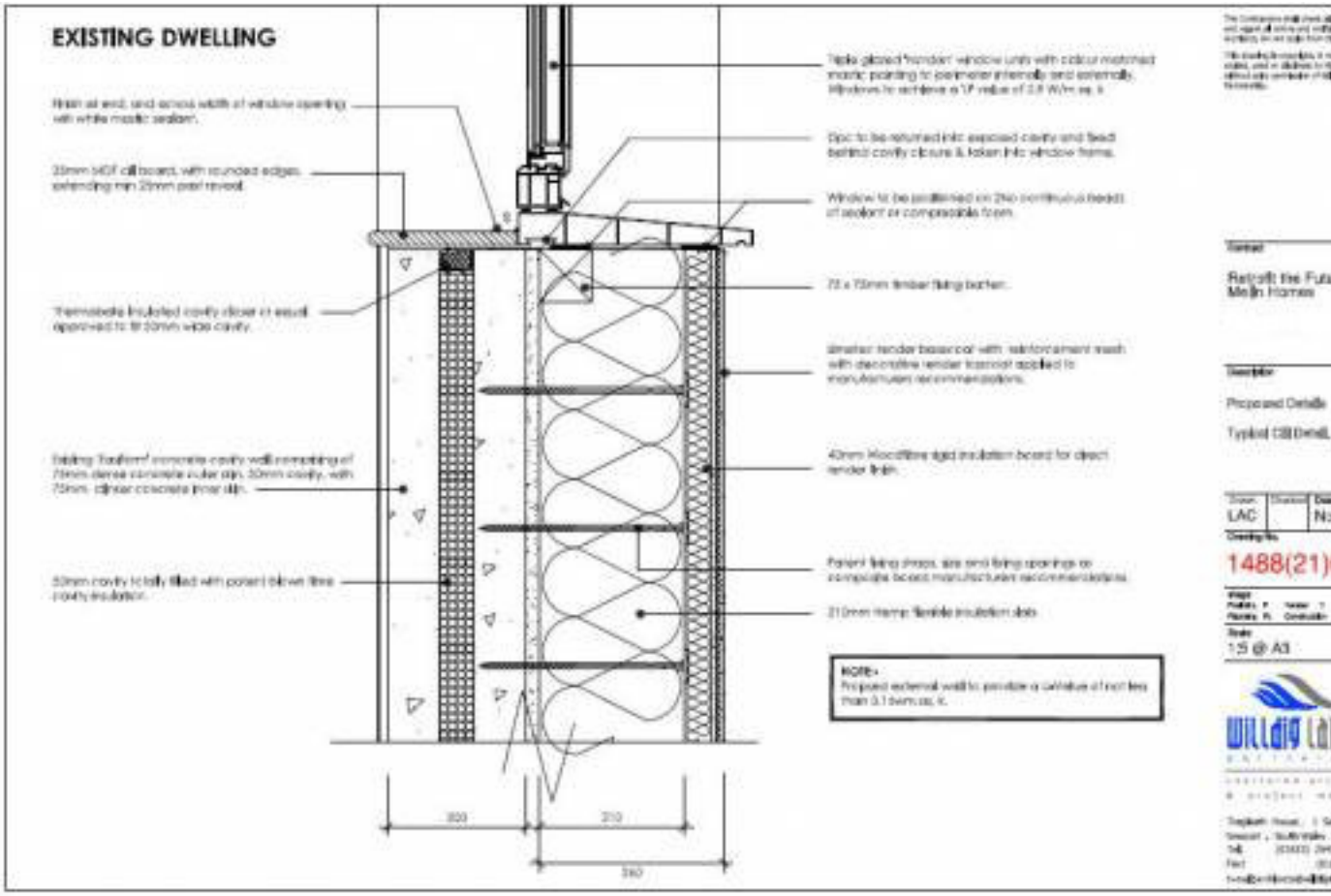
Project images




File Edit View Insert Format Tools Data Window Help Adobe PDF
Measure analysis - one by one
Savings
Capital cost & Life
60 year Cost
Selection
Measure
Annual Fuel savings from measure
Measure in package?
Package(1)
2933
£ 376
£ 6,400
£ 22,550
£ 12,800
-£ 9,750
176
-£ 55
Close Full Screen
Guidance
Worksheet
Worksheet chart


Cross Section A-A
Cross Section B-B
Side Elevation
Front Elevation
Rear Elevation
Ground Floor Plan
First Floor Plan


Limetec render basecoat with reinforcement mesh with decorative render topcoat applied to manufacturers recommendations.
40mm Woodfibre rigid insulation board for direct render finish.
Patent fixing straps size and fixing spacings as composite board recommendations.
210mm Hemp flexible insulation slab.
NOTE:-
Propsed external wall to provide a U-Value of not less than 0.16wm sq. k.
Existing 'Easiform' concrete cavity wall compising of 75mm dense concrete outer skin, 50mm cavity, with 75mm clinker concrete inner skin.
Existing 50mm cavity to be totally filled with patent blown fibre insulation.
Additional layer of 40mm rigid insulation to external front wall.
LAC
1488(21)
1:5 @ A3


EXISTING DWELLING
Triple glazed 'Hordern' window units with colour matched mastic pointing to perimeter externally and internally.
Dpc to be returned into exposed cavity and lead behind cavity closure & taken into window frame.
Window to be positioned on 2No continuous beads of sealant or compressible foam.
Finish at end and across width of window opening with white mastic sealant.
Thermabeta insulated cavity closer or equal approved to fit 50mm wide cavity.
40mm Kingspan rigid insulation board for direct render finish.
50mm cavity to fully filled with polarit blown fibre cavity insulation.
NOTE:-
Proposed external wall to provide a U-value of not less than 0.13 W/m2.K.
820
210
340
LAC
1488(21)
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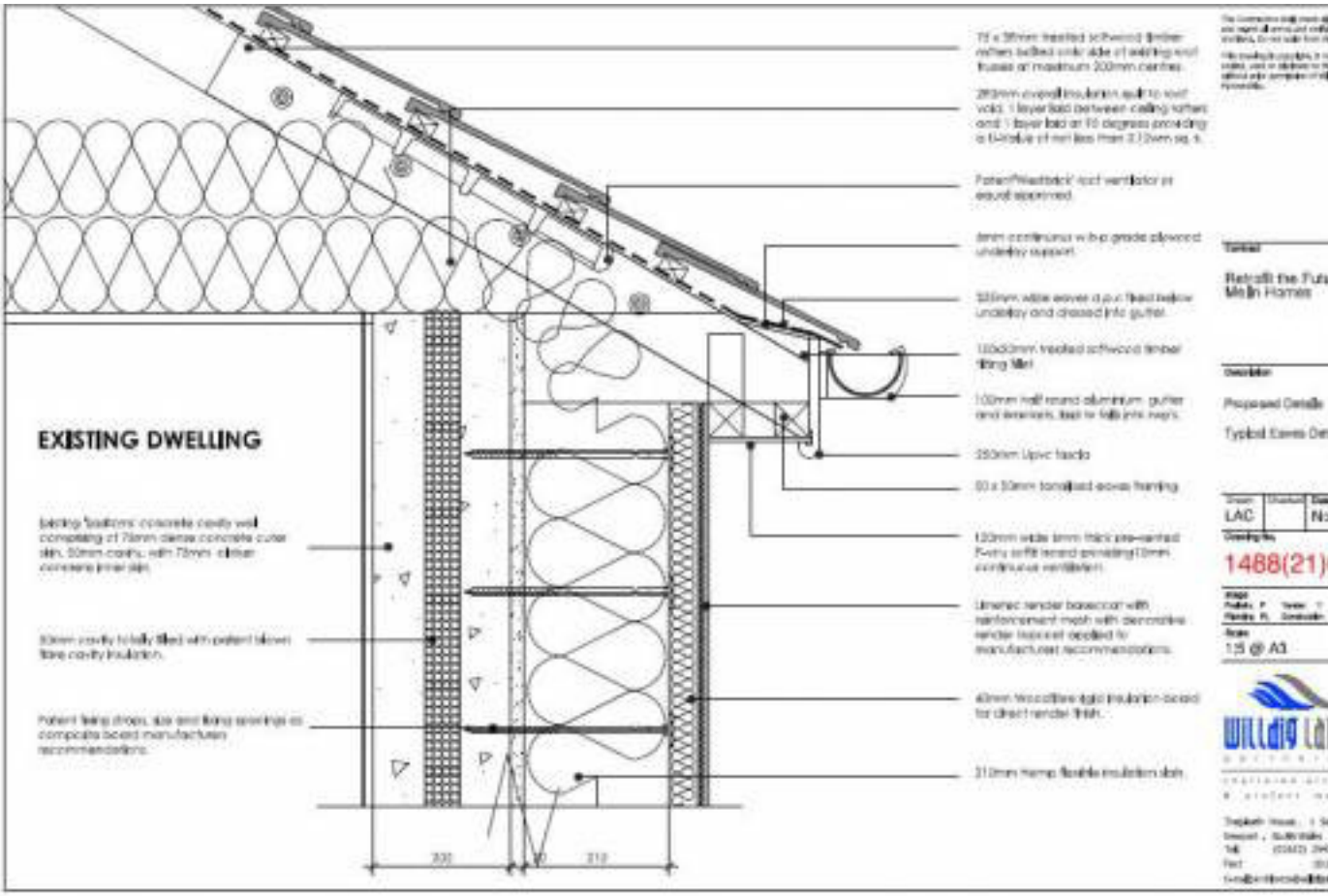
EXISTING DWELLING
LAC
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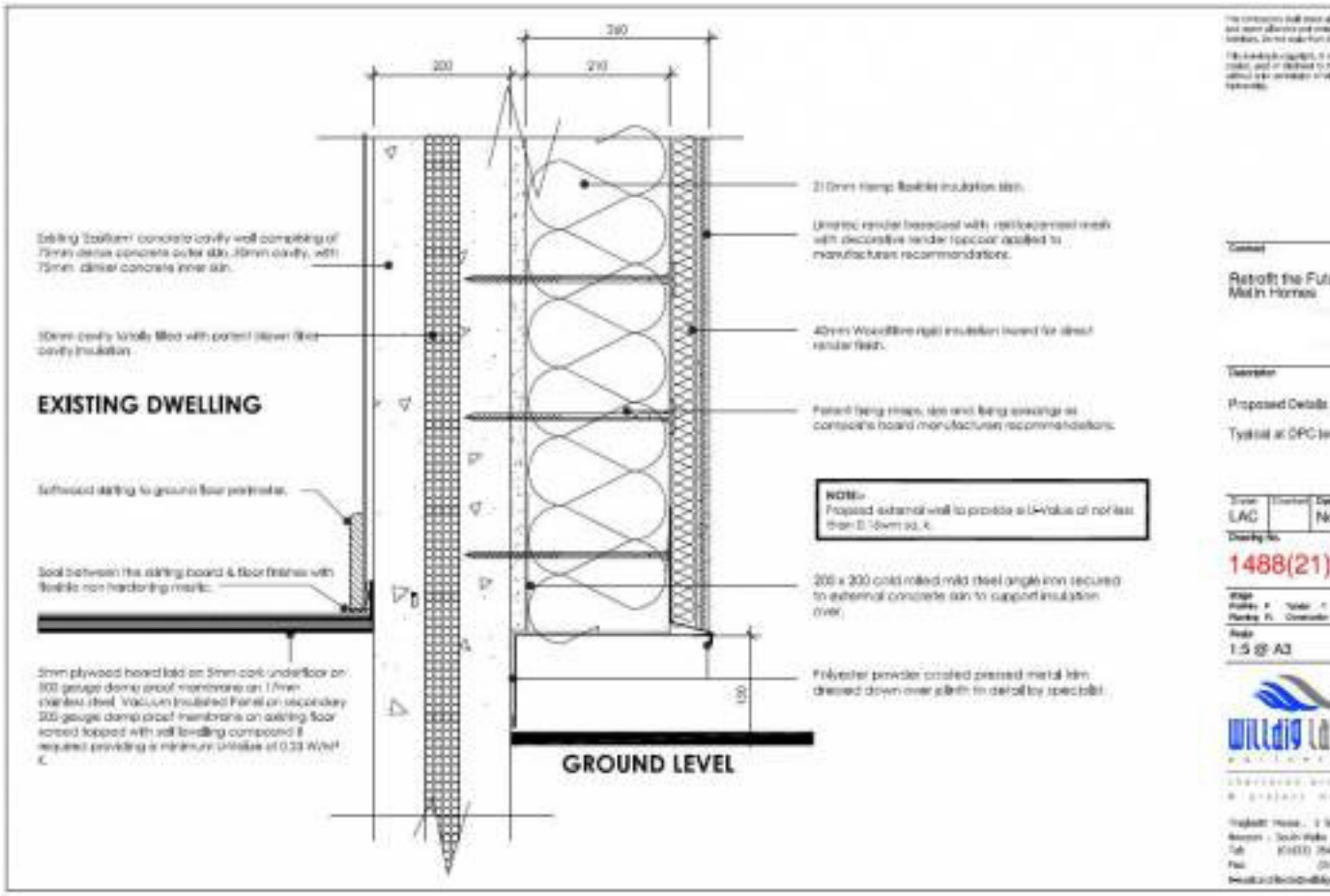
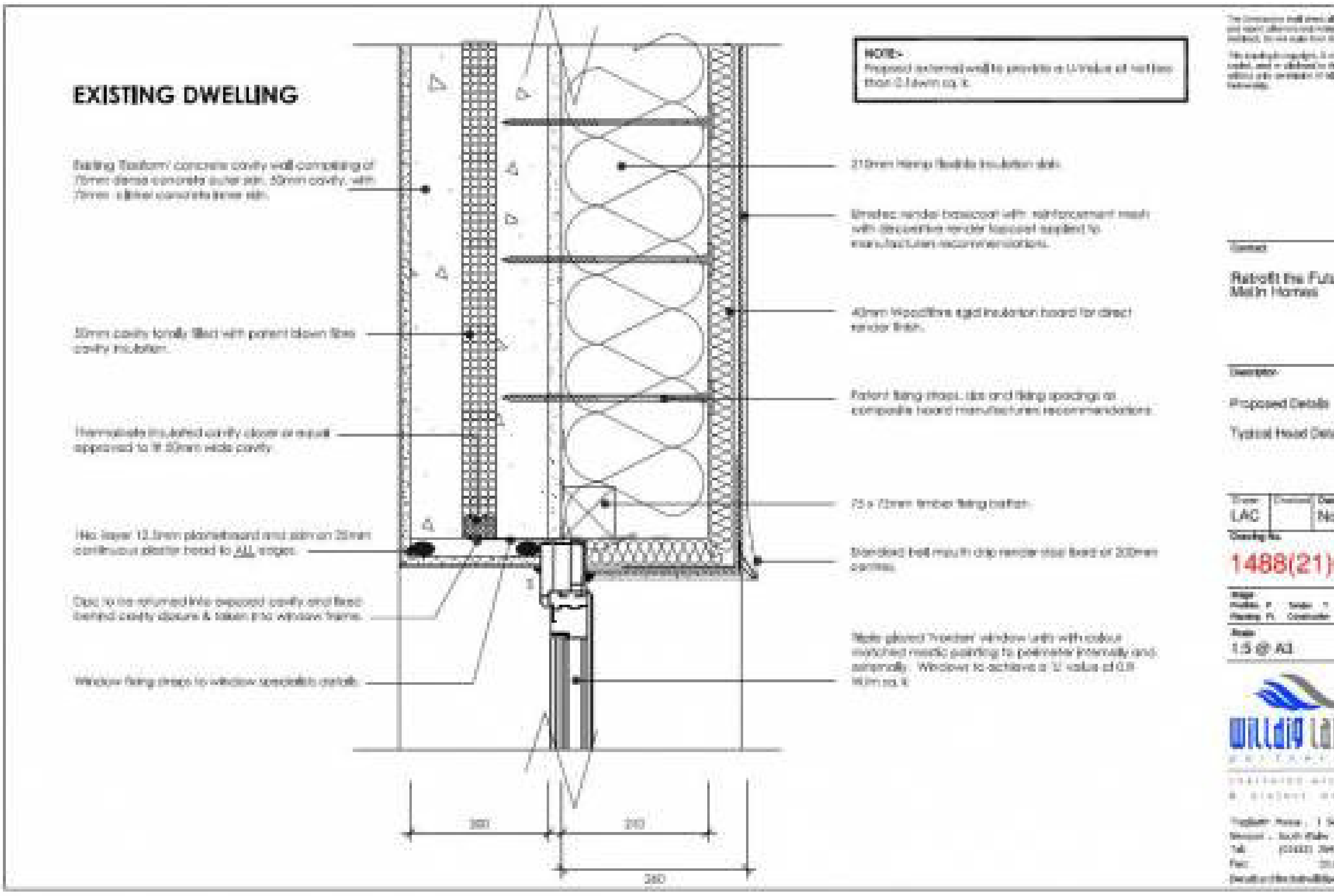

290
200
210
EXISTING DWELLING
NOTE:-
GROUND LEVEL
150
1488(21)
1:5 @ A3


EXISTING DWELLING
Proposed Details
LAC
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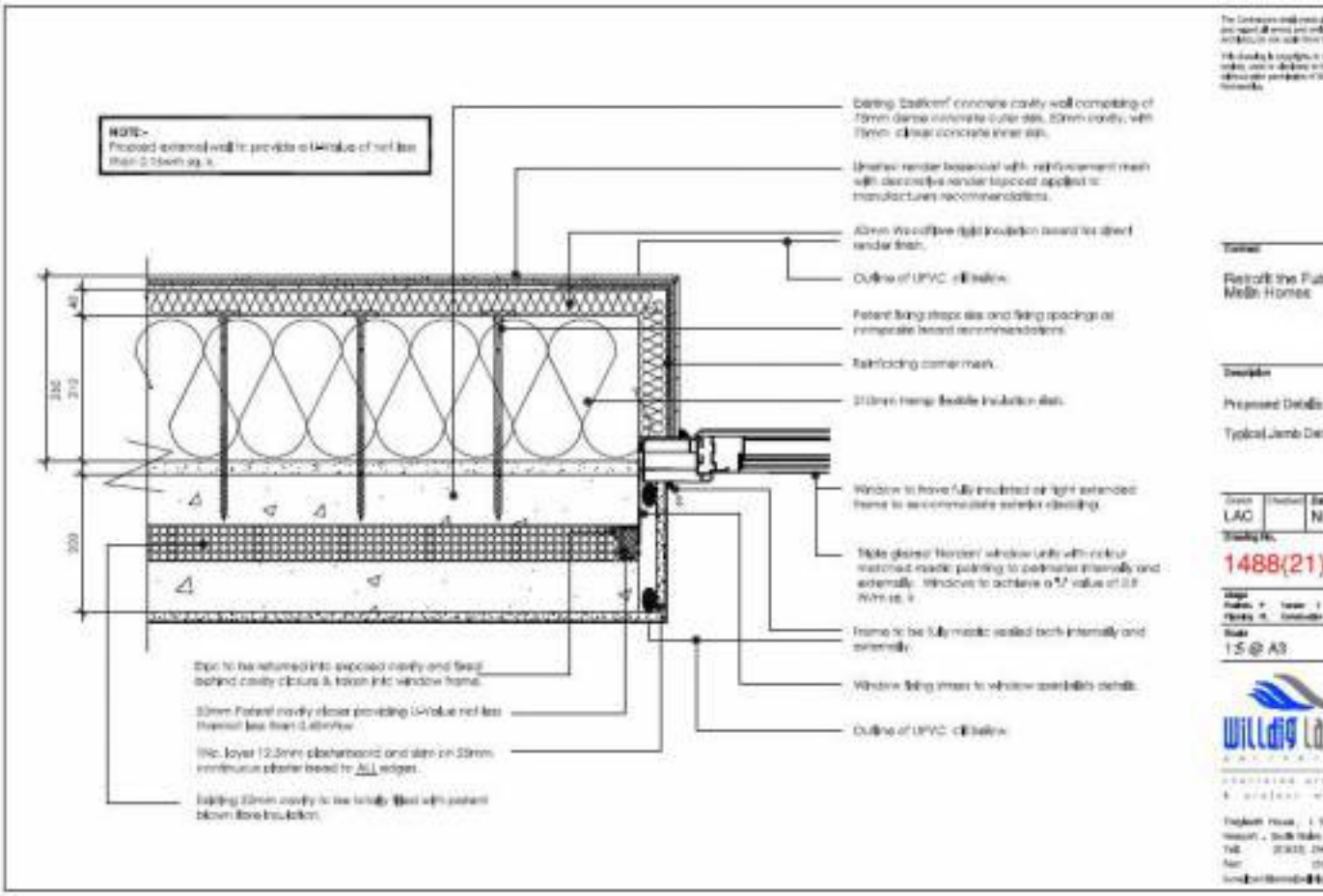
NOTE:-
Outline of UPVC cill below.
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LAC
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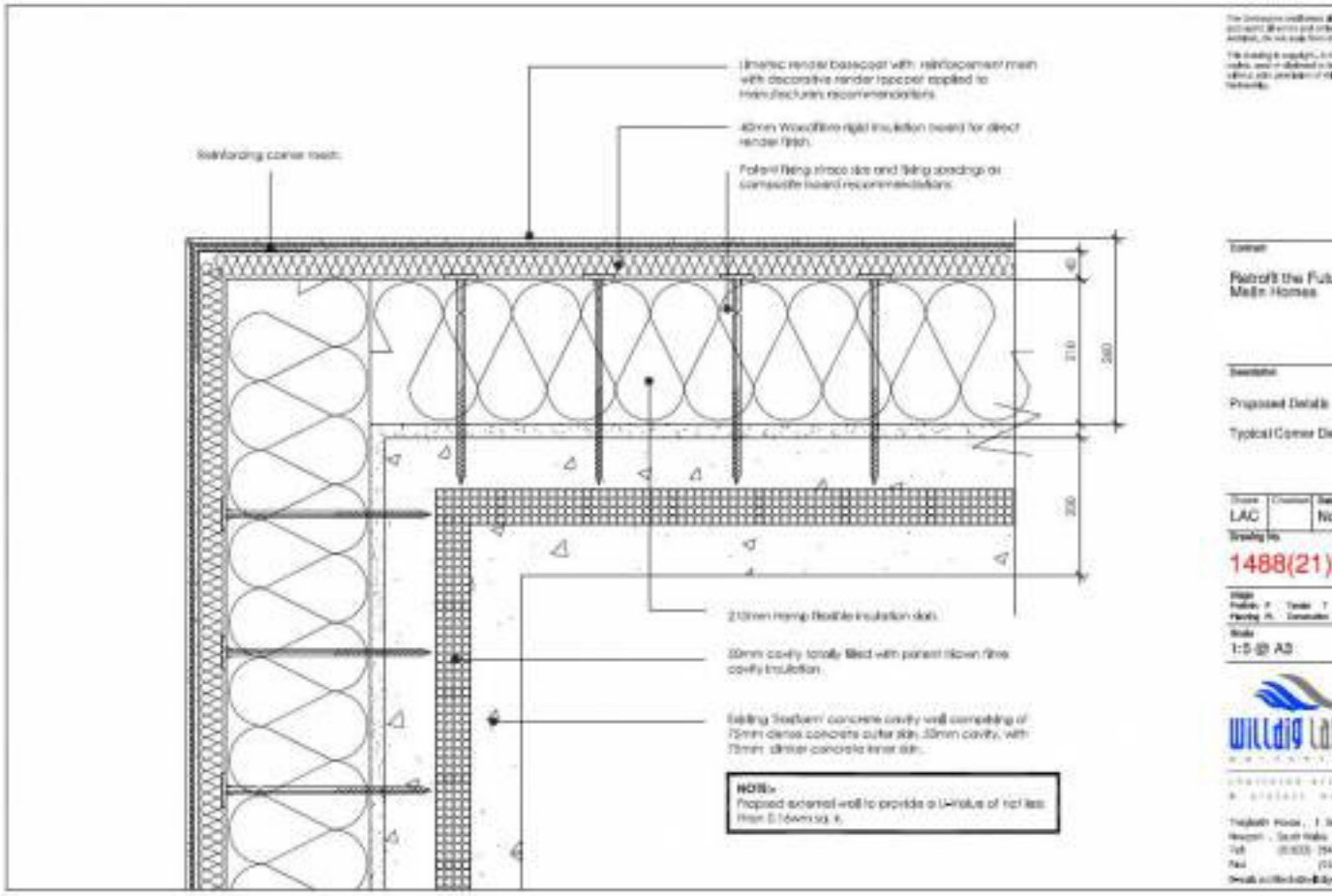
Reinforcing corner mesh
Retrofit the Fu
Mid-n Homes
Proposed Details
Typical Corner De
LAC
1488(21)
1:5 @ A3


Side Elevation
Front Elevation
Rear Elevation
Ground Floor Plan
First Floor Plan