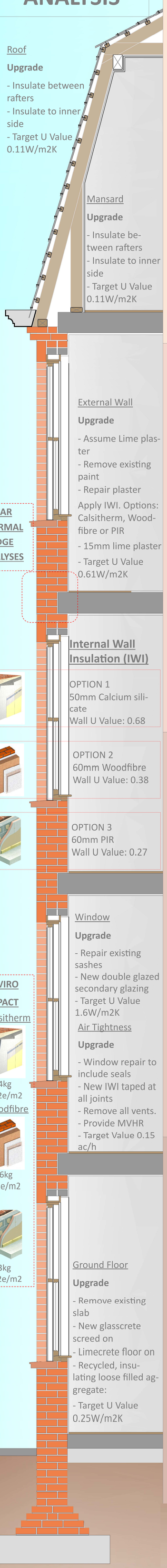
MULTI UNIT RESIDENTIAL RETROFIT RESEARCH CASE STUDY

DUBLIN TECHNOLOGICAL UNIVERSITY DUBLIN
OLLSCOIL TEICNEOLAÍOCHTA BHAILE ÁTHA CLIATH

FAÇADE ANALYSIS



OVERVIEW & ISSUES

SURVEY & STRATEGY

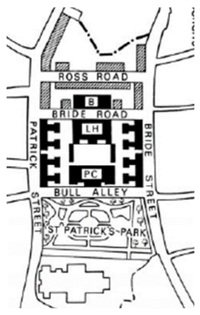
TESTING & ANALYSES

OPTIMAL SOLUTION

SITE

URBAN BLOCK

- 8 T-Shaped Blocks
- Five stories each
- Blocks A-D completed in 1901
- Blocks E—H completed in 1904
- Recreational buildings—Iveagh Baths & The Iveagh Play centre
- Distance between blocks 10 to 11.4m



BLOCK

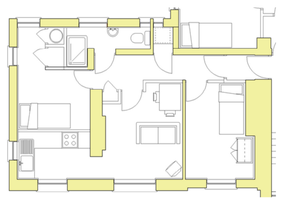
BLOCK D

- 3 Commercial units(Ground)
- 29 Apartments units
- 35m2 to 49m2
- 20no. 1 bed; 9 no. 2 bed
- 2 entry points
- Stair access only
- No central service risers
- No Basement

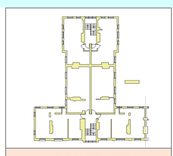
- Orientation determined by site plan
- 2no. Single orientated apartments
- Vehicle hierarchy on site
- Little communal space
- No services strategy hierarchy for site or block
- Minimal plant space under roof

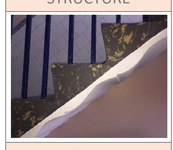
APARTMENT

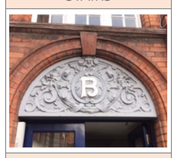
- Less than current minimum design standards
- Modern living in old building
- Air quality
- Noise
- Services predominantly electric



- Façade—damage to brick-work
- Walls—significant detailing
- Windows - partially original
- Roof—slate mansard features
- Uninsulated ground floor slab

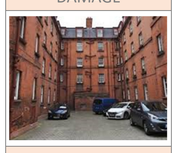

STRUCTURE


STAIRS



DETAIL


DAMAGE

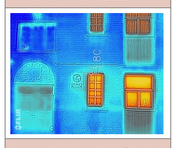

COURTYARD

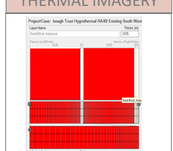

ROOFTOP PV


EAHP

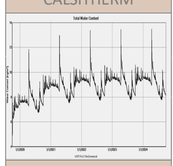

ENCLOSURE

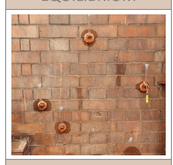

ROOF VISIBILITY

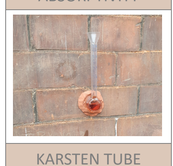

THERMAL IMAGERY

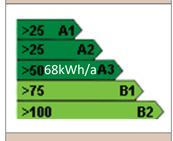

WUFI - BASE


CALSITHERM

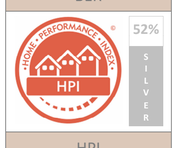

EQUILIBRIUM


ABSORPTIVITY

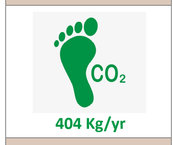

KARSTEN TUBE



BER



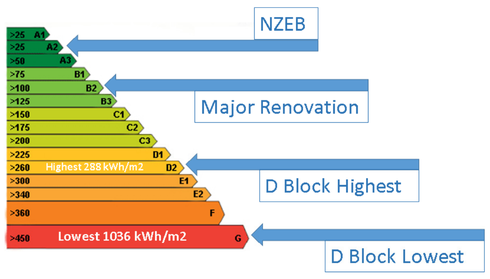
HPI



CO2 REDUCTION


INTERNAL

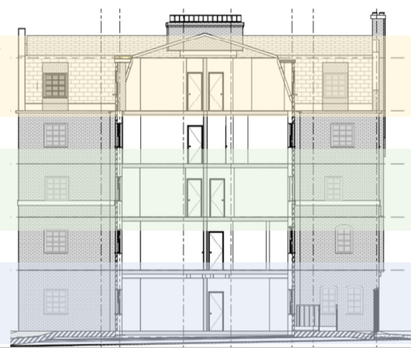
ENERGY SURVEY



D Block Delivered Energy: 213,912 kWh/yr

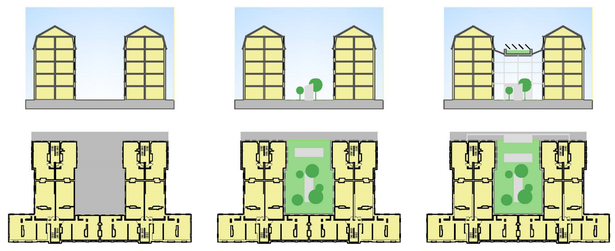
Average BER: 491 kWh/yr **G**

Elemental U Values W/m^2 K



Top Floor		
Mansard	1.95	
Roof	2.3	
Windows	4.8	
Mid Floor		
Walls	1.6	
Windows	4.8	
Ground Floor		
Walls	1.6	
Floor	0.8	
Windows	4.8	

SITE OPTIONS



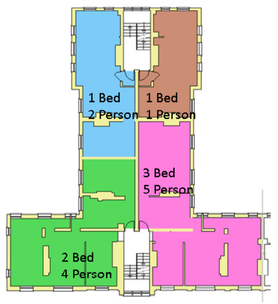
Existing.
Car Hierarchy
No Communal Space

Communal Space
Shared Facilities
Pedestrian
Green

Screen Space
New entry points
New eco system
Space for PV

BLOCK OPTIONS

- Create better mix of apartment sizes
- More flexibility to cater for families & single dwellers in the one block
- Maintain structural layout
- More scope to create central risers
- Space for lift and to improve accessibility



SERVICES & RENEWABLES OPTIONS

SERVICES STRATEGY
Individually serviced apartments. No central plant available.

Option 1

Exhaust air heat pump(EAHP)

Option 2

Combi gas boiler and MVHR

Photovoltaics to inner roof.
45 south and 28 east facing panels at 230Wp per panel. Total for block 13,222 kWh/yr. 456 kWh/yr per apartment

APARTMENT STRATEGY

- Conservation approach.
  Minimal effect, repair & refurbish.
- Fabric first
  Walls, floors, windows, roof, air tightness.
- Individually serviced units.
  Minimal systems
- Renewables
  Roof top PV

3 Apartments

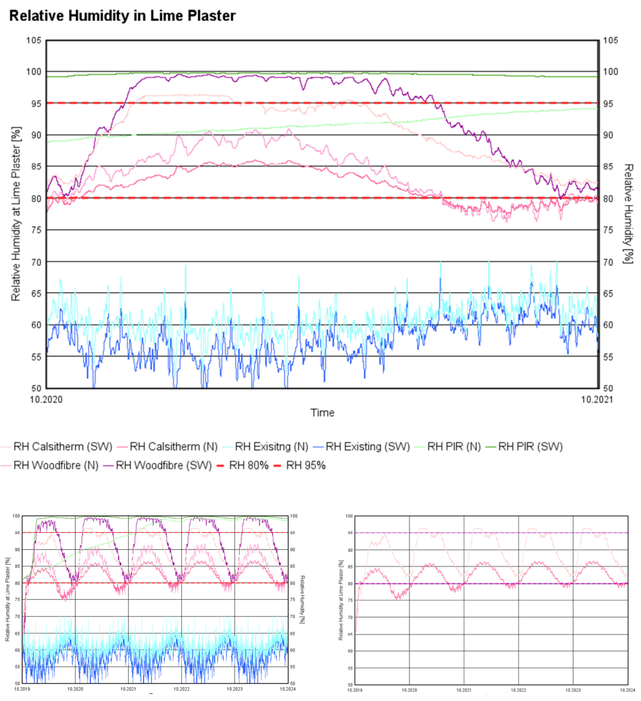
Test strategy and options on a cross section of representative apartments—ground, mid floor and rooftop.

ENERGY RESULTS

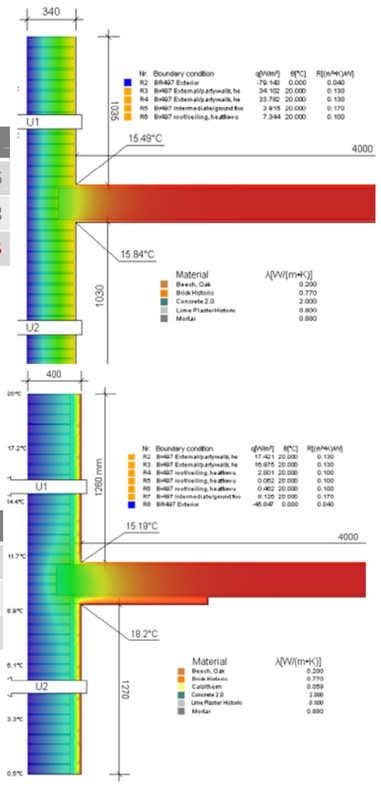
Step	Description	Step	Description
1	Window upgrade	5	Ventilation
2	Wall Upgrade	6	Heating
3	Floor	7	Hot Water
4	Roof	8	Renewables

	2 AD	12 D	27D	Average
Existing BER Rating	513	312	843	556 G
OPTION 1				
After fabric upgrade (Steps 1 to 4)	273	210	274	252 D1
Add MVHR (Step 5)	208	172	213	198 C2
Install Combi Boiler (Step 6 to 7)	140	110	135	128 C1
Add PV (Step 8)	123	91	120	111 B2
OPTION 2				
After fabric upgrade (Steps 1 to 4)	273	210	274	252 D1
Add EAHP (Step 5 to 7)	75	82	96	84 B1
Add PV (Step 8)	38	34	43	38 A2

HYGROTHERMAL



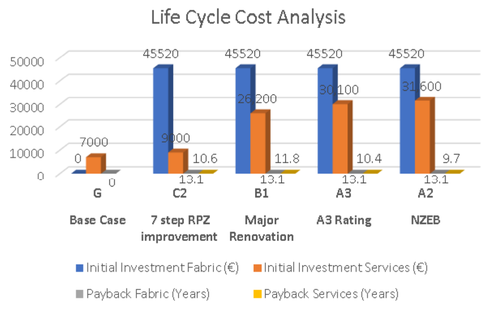
LINEAR THERMAL BRIDGE



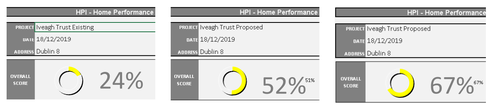
Existing Wall	
Psi Value	0.576
Heat Flow Q	79.1428
Frsi	0.65

Wall + Calsitherm	
Psi Value	0.576
Heat Flow Q	45.848
Frsi	0.76

COST OPTIMALITY



HOME PERFORMANCE INDEX



EXISTING BASE CASE	APARTMENT UPGRADE FOCUSSED	BLOCK & SITE UPGRADE FOCUSSED
Not Certified	SILVER	SILVER

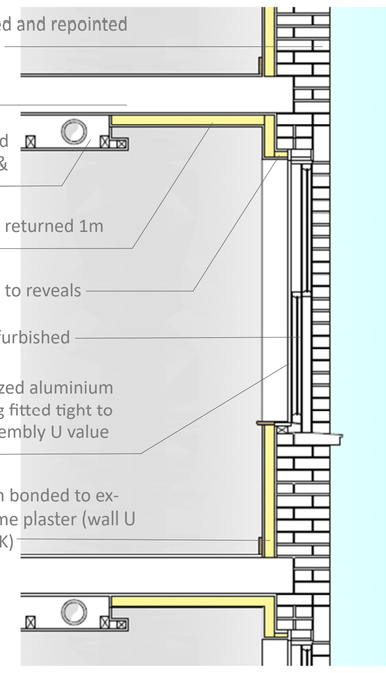
OPTIMAL MATRIX

Case	U Value (Wall) W/m2K	Moisture Risk	Linear Thermal Bridge	Frsi	Carbon Kg CO2e /m2
Existing	1.64	LOW	0.576	0.65	0
PIR	0.27	HIGH	0.06	0.7	4.63
✓ Calsitherm	0.68	MEDIUM	0.572	0.76	26.4
Woodfibre	0.38	HIGH			-9.56

	Site	Block	Unit	Primary Energy	Capital Cost
✓ EAHP	No infrastructure required	No riser required	Single system Heat, vent & DHW	3,926 kWh	€26,200
Gas Combi +MVHR	Infrastructure required	New risers required	Separate system Heat & vent	12,019 kWh	€16,513

	2 AD	12 D	27D	Average
Existing	513	312	843	556 G
✓ Optimal	57	58	73	63 A3

OPTIMAL SOLUTION



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