Impact of different building standards on indoor air quality in homes

Future Urban Ventilation Network

Understanding AQ for health in different environments – link to monitoring and health

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Aims and objectives

This pilot study aims to monitor the indoor air quality of houses built under current Building Regulations with homes built under Future Homes Standard to compare the benefits and potential unintended risks.

Objectives:

1. To monitor air quality in homes built to different building regulations.
2. To understand the relative difference in indoor air quality between homes built to Part L 2013 and those built to the Future Homes Standard due to be implemented in 2025.
3. To identify air quality implications of new building regulations.

PROJECT 80
HOMES FOR THE FUTURE

The Future Homes Standard

Average home will produce 75-80% lower CO2 emissions than one built to current energy efficiency requirements.

Use 'low carbon' forms of heating.

Tougher fabric energy efficiency standards.

	Indicative FHS spec	2013 notional dwelling	
Floor U-value ($W/m^2.K$)	0.11	0.13	15%
External wall U-value ($W/m^2.K$)	0.15	0.18	17%
Roof U-value ($W/m^2.K$)	0.11	0.13	15%
Window U-value ($W/m^2.K$)	0.8	1.4	43%
Door U-value ($W/m^2.K$)	1.0	1.2	17%
Air permeability at 50 Pa	5.0 $m^3/(h.m^2)$	5.0 m3/(h.m2)	-
Heating appliance	Low-carbon heating	Gas boiler	-
Heat Emitter type	Low temperature heating	High temp	-
Ventilation System type	Natural (with extract fans)	Natural (with extract fans)	-
PV	None	None	-
Wastewater heat recovery	No	No	-

Centre for Future Homes

- Improving Indoor Air Quality and reducing overheating
  - Indoor air quality improvement and overheating prevention in new homes
  - Impact of different building standards in indoor air quality in homes (UKRI)
- Future Homes Standard
  - Project 80 (Midland Heart)
  - Lambley Lane (Keepmoat)
- Sustainable low-carbon refurbishment
  - Ecrofit (ERDF project)
- Occupant engagement through technology for reducing environmental emissions
  - Digital Home User Guide (Ecrofit and Covatic)
  - I am zero (Covatic)

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Healthy Homes

Real world Research

Robust solutions

Scalable

Cost effective

Human behaviour and wellbeing

Living Lab

Poor Air Quality

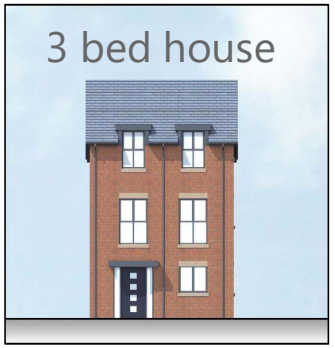
Increased thermal insulation and air tightness are causing unintended consequences (low thermal comfort and IAQ, as well as overheating).

Unintended Consequences

Overheating

ECO Drive

PROJECT 80
HOMES FOR THE FUTURE



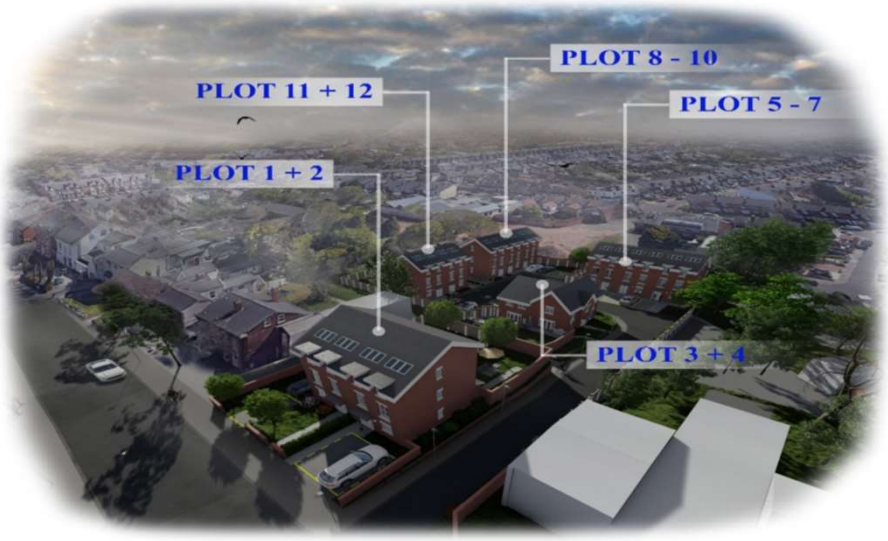
Key Partners

PROJECT 80
HOMES FOR THE FUTURE

Plot 1-4 :
Spec A
Plots 5-12 :
Spec B

	Current (P5)	Gov't FHS	Plot 1-2	Plot 3-4	Plot 5-12
Floor U-value	0.13	✓ 0.11	0.11	0.11	0.11
External wall U-value	0.18	↑ 0.15	0.13	0.13	0.13
Roof U-value	0.14	↑ 0.11	0.1	0.1	0.1
Window U-value	1.4	↓ 0.8	1.2	1.2	1.2
Door U-value	1.4	↓ 1.0	1.2	1.2	1.2
Air permeability	5.12	✓ 5.0	1.5	1.5	5.0
Heating	Gas boiler	✓ ASHP	ASHP	Panel Heaters Hot Water HP	ASHP
Heat Emitter type	Radiators	Low temp	Low temp	Panel Heaters	Low temp
Ventilation	Natural	✓ Natural	MVHR	MVHR	Natural
PV	None	↓ None	Yes	Yes	Yes
WWHR	No	↓ No	Yes	Yes	Yes
y value	0.05	↑ 0.05	0.028	0.0274	0.028
Kg CO_2/annum	1626.71		~352.14	~268.98	~313.52
SAP running cost	£486		~£385	~£241	~£214

Grosvenor Road – Project 80 (FHS)
Birmingham

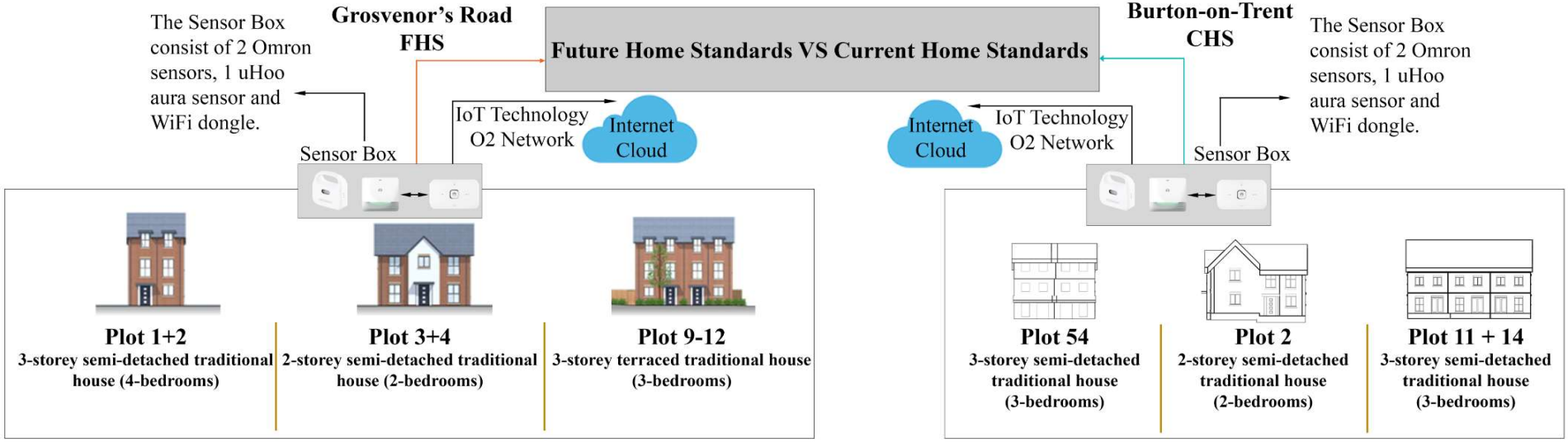


Five Lands – Stapenhill (CHS)
Burton-on-Trent

Future Homes Specification Comparison

Element	Current Building Regs		Plots 1-4 TYPE A		Plots 5-12 TYPE B	
Wall	102.5 Brickwork, 125mm Cavity with Knauf Blown 34 Insulation, 100mm Celcon Solar Blockwork	0.18 W/m²K	102.5 Brickwork, 150mm Cavity with 150mm Xtroliner full fill rigid joints to be taped to manufactures tape 100mm Besblock star Performer	0.13 W/m²K	102.5 Brickwork, 150mm Cavity with 150mm Xtroliner full fill rigid joints to be taped to manufactures tape 100mm Celcon Solar	0.13 W/m²K
Lintel	Standard catnic, Kingstone or similar		Thermally Broken Hytherm or similar		Thermally Broken Hytherm or similar	
Cavity Closer	Kingspan Thermabate or Similar		Kingspan Kooltherm		Kingspan Kooltherm	
Floor	75mm Screed, 150mm Celotex XR4000, 150mm Block and Beam	0.11 W/m²K	150mm Xtratherm Thin-RXT/UF	0.11 W/m²K	150mm Xtratherm Thin-RXT/UF	0.11 W/m²K
Windows	1.4-1.6 W/m²K U Value Double Glazed Units	1.4 W/m²K	1.2W/m²K U Value Double Glazed Units	1.2 W/m²K	1.2W/m²K U Value Double Glazed Units	1.2 W/m²K
Roof	450mm Rock Wool	0.11 W/m²K	Warm Roof 180mm Xtratherm Thin RXT/PR to be installed between roof timbers 50mm of Xtraththerm Thin RXT/PR under rafters joints to be taped with manufactures recommended tape	0.1 W/m²K	Warm Roof 180mm Xtratherm Thin RXT/PR to be installed between roof timbers 50mm of Xtratherm Thin RXT/PR under rafters to be taped with manufactures recommended tape	0.1 W/m²K
Air Tightness	5 – Air Permeability (No Special Measures)		1.5 – Air Permeability 10mm Airtight polymer spray specific reveal and junction details, floating ceiling, additional hold points and early air test required after this procedure. Airtight tape to be used for cable/pipe penetration.		5 – Air Permeability 10mm Airtight polymer spray specific to reveal and junction detail, floating, ceiling, additional hold points.	
Heating	Gas Combi Boiler		Plots 1 and 2 Air Source heat pump and PV's Plots 3 and 4 Edel Cylinder and Electric Panel Heating / PV		Air Source heat pump / possible electric rads / PV's	
Ventilation	Natural		Full Mechanical Ventilation Heat Recovery (MVHR) – Balanced Heat recovery - Minimum efficiency 70.2%		Complying with systems/section 3 continuous mechanical extract ventilation	
Additional	None		Wastewater heat recovery, min 63% recovery efficiency supplying up to 19 degrees of heat hung joists to be used		Wastewater heat recovery, min 63% recovery efficiency supplying up to 19 degrees of heat.	

Grosvenor Road vs Burton-on-Trent



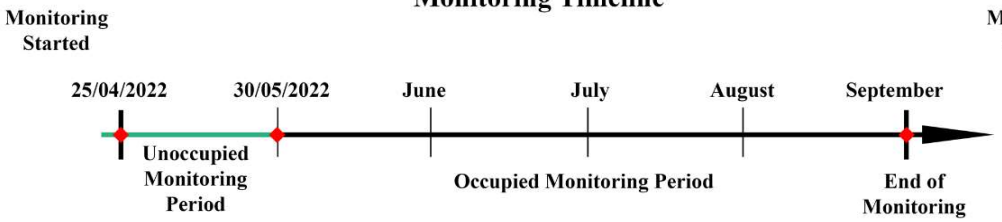
Monitoring

- **Eight homes are monitored on Grosvenor Road.**
- **There are three house types in Grosvenor Road (Plot 1 and 2, Plot 3 and 4, and, Plot 9 to 12 as one house type, respectively)**
- **Unoccupied properties were monitored between 25/04/2022 and 30/05/2022.**
- **The homes were occupied on 30/05/2022, and monitoring continues until the end of September.**

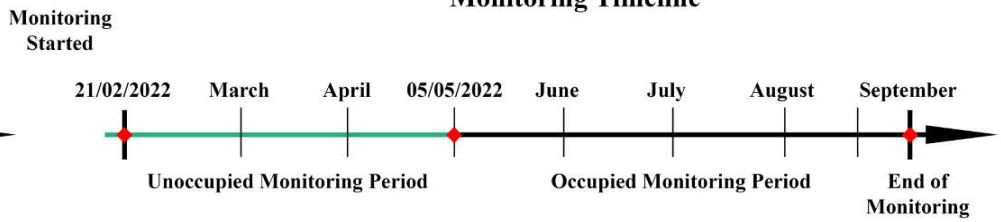
Monitoring

- **Four homes are monitored on Five Lands in Burton-on-Trent.**
- **There are three house types in Burton (Plot 54 Plot 2, and, Plot 11 and 14 as one house type, respectively)**
- **Unoccupied properties were monitored between 21/02/2022 to 05/05/2022.**
- **The homes were occupied on 05/05/2022, and monitoring continues until the end of September.**

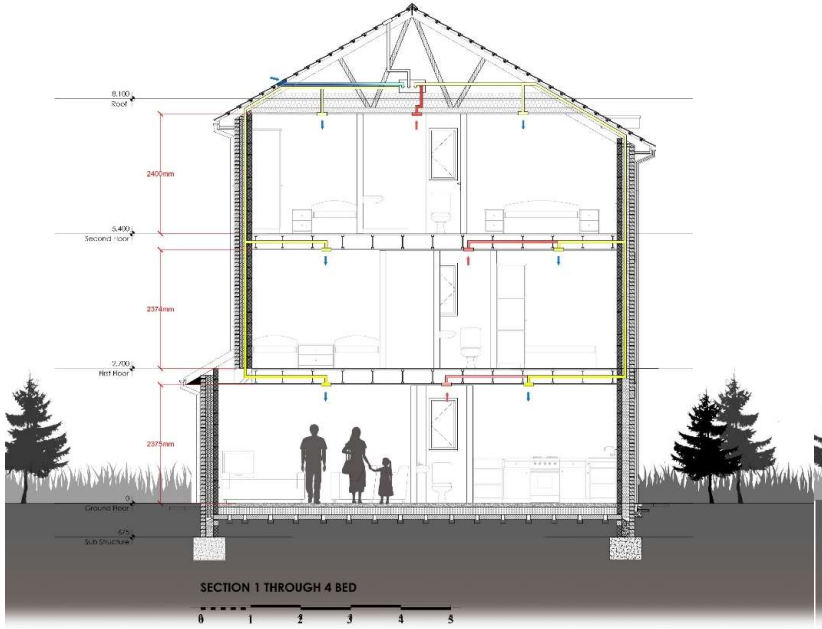
Monitoring Timeline



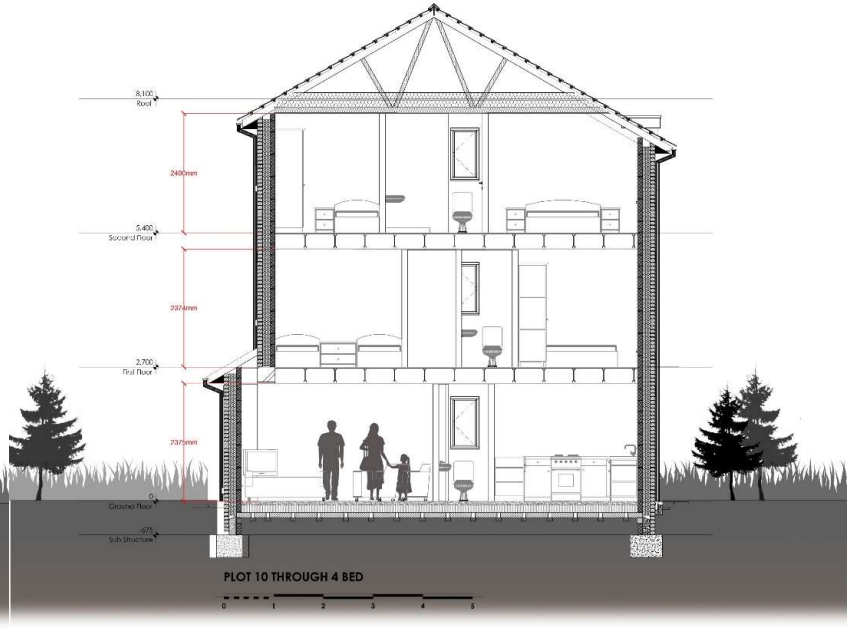
Monitoring Timeline



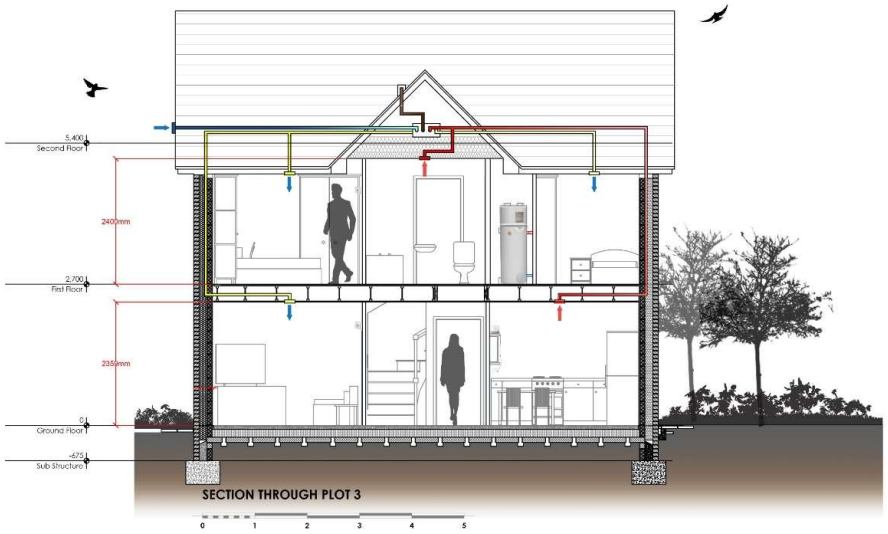
Section Plot 1
Birmingham



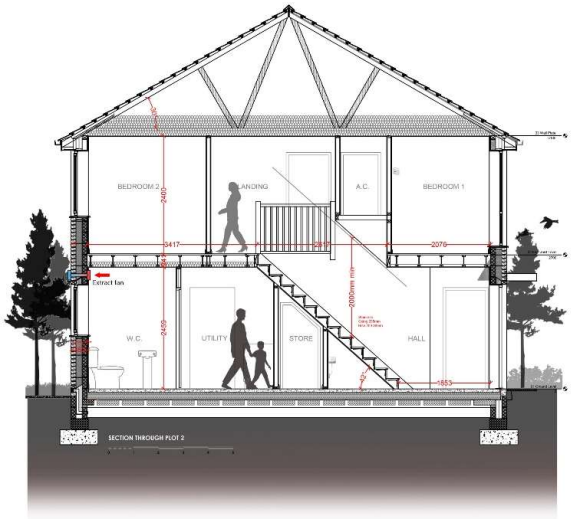
Section Plot 10
Birmingham

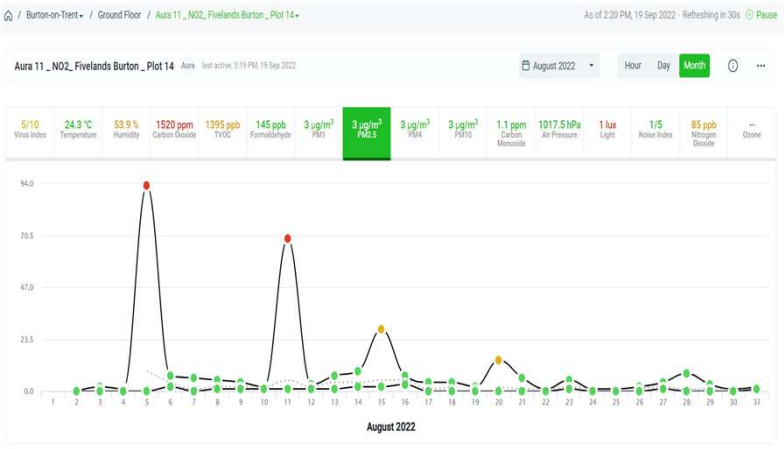


Section Plot 3
Birmingham



Section Plot 14
Burton-on-Trent





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MANY THANKS

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