Measured indoor temperature in two unoccupied dwellings and weather data during the hottest UK summer on record, 2022

Dataset descriptor

2022

(Version 1.0)

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Version	Amendment	Page	Editor	Date
1.0	First release	N/A	ME	24/11/2022

1 Introduction

This document provides details of the measurement of indoor dry bulb temperatures and surrounding weather conducted in the Loughborough Matched Pair test houses during summer 2022.

Detailed descriptions of the test house floorplans, site plans, geometry, construction, windows, window coverings are available elsewhere (Roberts et al. 2019).

1.1 Document Aim

The aim of this guidance document is to provide the necessary information to allow other researchers to understand and use the dataset for their own research purposes. It accompanies further information in Roberts et al. 2018, 2019, 2022a, 2022b.

2 Measurement of summertime indoor temperatures

The Loughborough Matched Pair test houses were used for all measurements of indoor temperature (Figure 1). Monitoring of the indoor temperatures took place simultaneously in both houses over 4 months, or 122 days, from 1 June to 30 September (inclusive).

Details of test house location, description, geometry, site plan, construction, and airtightness has been provided previously (see Roberts et al. 2018, 2019, 2022a, 2022b).

The two test houses were unoccupied during the monitoring: no windows or external doors were opened; no internal heat gains were generated; heating was turned off; curtains, blinds, and internal doors were always open.

Figure 1: The Loughborough Matched Pair. The West house is on the left of the photograph, the East house on the right.

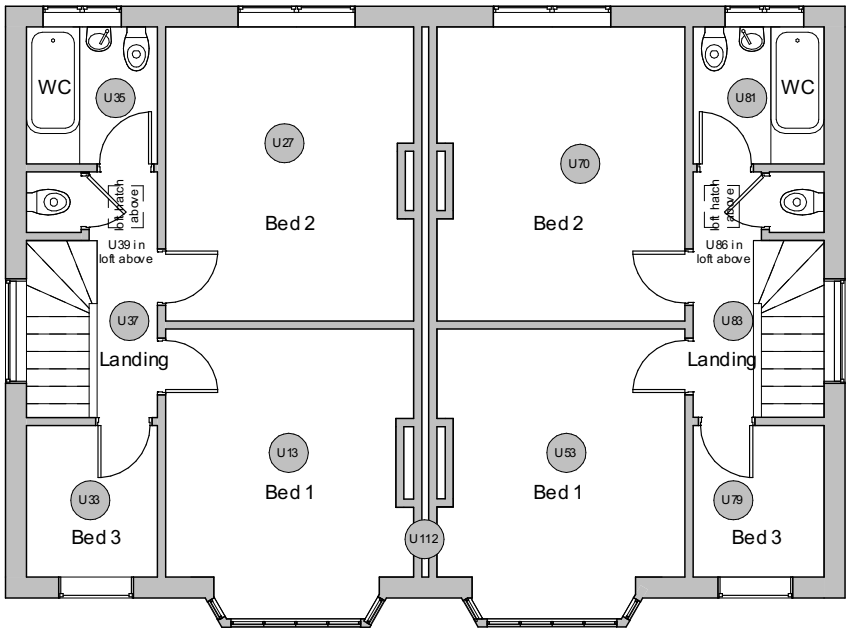
2.1 Sensors, locations, and monitoring periods

2.1.1 Measurement of indoor dry bulb temperatures

Measurement of dry bulb temperature was conducted in all rooms, beneath the floors of both dining rooms and kitchens, and in the centre of both loft (attic) spaces using U-type thermistors calibrated in a water bath against a calibrated thermometer. To measure dry bulb temperature, the thermistors were hung on a tripod and shielded from solar radiation.

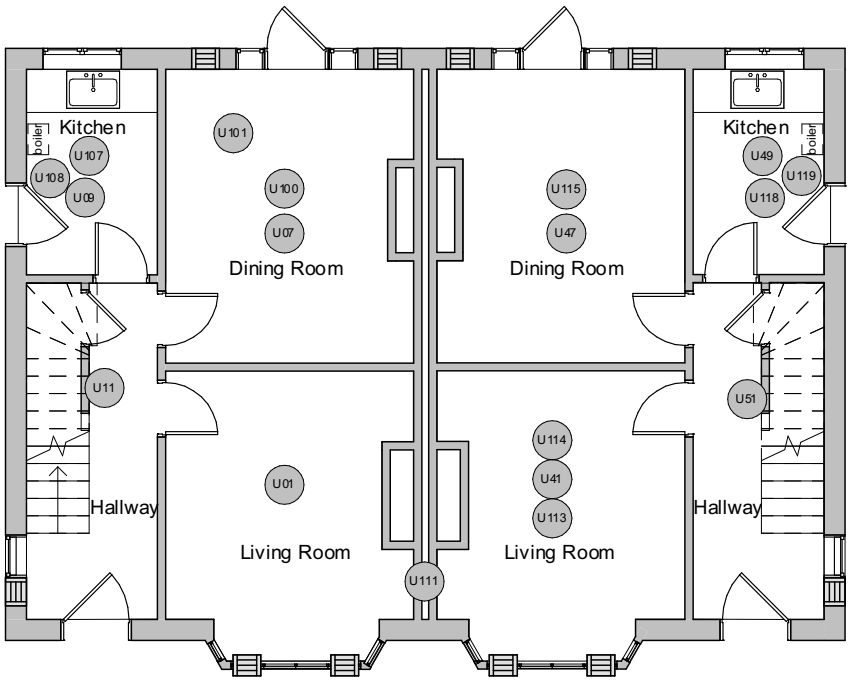
Table 1: Summary of indoor equipment used and uncertainty

Data type	Variable	Device	Measurement interval (mins)	Uncertainty (±)
Indoor temperature	Dry bulb	U-type thermistor connected via wire to DT85 DataTaker	10	0.3°C



First Floor

West House East House



Ground Floor

Figure 2: Floorplan with sensor locations. Refer to Table 2 for information on sensor height from floor.

Table 2: Description of sensor locations and data periods. Dates are inclusive. Sensor codes correspond to Figure 2.

Room	Sensor Type	Location in room	Height from floor (m)	West House			East House		
				Sensor code	Data period (dd/mm/2022)		Sensor code	Data period (dd/mm/2022)	
					From	To		From	To
Living room	U	Centre	1.1	U01	01/06	30/09	U41	01/06	30/09
	U	Centre	0.1	-	01/06	30/09	U113	01/06	30/09
	U	Centre	2.2	-	01/06	30/09	U114	01/06	30/09
	U	Party wall cavity	0.5	U111	01/06	30/09	-	01/06	30/09
Dining room	U	Centre	1.1	U07	01/06	30/09	U47	01/06	30/09
	U	Centre, sub-floor	-0.2	U100	01/06	30/09	U115	01/06	30/09
	U	NW corner	1.1	U101	01/06	30/09	-	01/06	30/09
Kitchen	U	Centre	1.1	U09	01/06	30/09	U49	01/06	30/09
	U	Centre, sub-floor	-0.1	U107	01/06	30/09	U118	01/06	30/09
	U	Perimeter sub-floor	-0.1	U108	01/06	30/09	U119	01/06	30/09
Hall	U	Centre	1.1	U11	01/06	30/09	U51	01/06	30/09
Front bedroom	U	Centre	1.1	U13	01/06	30/09	U53	01/06	30/09
	U	Party wall cavity	0.5	U112	01/06	30/09	-	01/06	30/09
Rear bedroom	U	Centre	1.1	U27	01/06	30/09	U70	01/06	30/09
Single bedroom	U	Centre	1.1	U33	01/06	30/09	U79	01/06	30/09
Bathroom	U	Centre	1.1	U35	01/06	30/09	U81	01/06	30/09
Landing	U	Centre	1.1	U37	01/06	30/09	U83	01/06	30/09
Loft	U	Centre	1.1	U39	01/06	30/09	U86	01/06	30/09

2.1.2 Measurement of weather conditions

Weather data were measured in the gardens of the test houses (Table 3 and Table 4).

Table 3: Weather stations

Station name	Station code	Location	Data from	Data to	Variables measured
Test house	TH	Ground-mounted on a 10m high pole in the north-facing garden to the rear of the test house.	01/06/2022 [a]	30/09/2022	Dry bulb temperature; wind speed; wind direction; global horizontal irradiance.

Table 4: Weather data collection devices, measurement intervals, and uncertainty

Data type	Device	Units	Measurement interval	Height from ground (m)	Uncertainty (±)
Dry bulb temperature	U-type thermistor [a]	°C	20 seconds	1.1	0.3°C
Wind speed	Ultrasonic anemometer	m/s	20 seconds	10	2%
Wind direction	Ultrasonic anemometer	°	20 seconds	10	3°
Global horizontal solar irradiance	Pyranometer	W/m^2	20 seconds	10	5%

3 Format of data release

File formats for data release are provided (Table 5). The files are listed in the README included with the dataset.

Table 5: Guide to file format for data release

Data type	Code	Example
West house	West	"West_..."
East house	East	"East_..."
Dry bulb temperature	AT	"West_AT_..."
Measurement at 10-minute intervals	10minute	"…_..._10minute…"
Measurement at 20-second intervals	20second	"…_..._20second…"

4 Acknowledgements

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The contributions of the following technical staff in the School of Architecture, Building and Civil Engineering at Loughborough University are acknowledged: Mark Harrod, Neil Parkes and Dean Sanham.

Use of the test houses would not be possible without the ongoing maintenance and 24-hour security provided by Loughborough University.

5 References

Roberts, B.M., Allinson, D. and Lomas, K.J., 2018. A matched pair of test houses with synthetic occupants to investigate summertime overheating. Journal of Sustainable Design and Applied Research, 6(1), 29-38. https://doi.org/10.21427/D70N8S

Roberts, B.M., Allinson, D. and Lomas, K. 2019. Prediction of overheating in synthetically occupied UK homes: dataset for validating dynamic thermal models of buildings. Loughborough University Research Repository (Figshare). https://doi.org/10.17028/rd.lboro.8094575.

Roberts, B.M., Abel, B., Allinson, D., Crowley, J., Salehi, B., Rashid, T. and Lomas, K. J. (2022). A dataset from synthetically occupied test houses for validating model predictions of overheating. CIBSE Technical Symposium, April 2022, UK. https://hdl.handle.net/2134/19412207

Roberts, Ben M; Allinson, David; Abel, Ben; Lomas, Kevin (2022): Measured indoor temperature, weather, infiltration, and ventilation in synthetically occupied test houses: summer 2021, UK. Loughborough University. Dataset. https://doi.org/10.17028/rd.lboro.19308299