Small Scale Forensic Thermal Imaging Study

Executive Summary

Detailed thermographic surveys and pressure tests were performed on newly completed dwellings on 4 Taylor Wimpey sites, encompassing 3 different external wall types; partial-fill masonry (PF), full-fill masonry (FF) and timber frame (TF).

Pressure tests were conducted in accordance with the ATTMA TS1 (2016 Edition) protocol. Thermographic surveys were conducted by an ITC Level 2 qualified thermographer using a FLIR B620 IR thermal imaging camera.

Thermal images in site reports should be considered for qualitative purposes only, as surveys are irreconcilable under normal environmental conditions.

An approach of capturing thermal images both externally and internally, and under natural conditions and under depressurisation, was adopted to avoid misinterpretation of individual thermal images.

Comparisons between images were then made to distinguish whether thermal anomalies observed on surfaces were due primarily to thermal conduction through the building fabric or due to air movement beneath those surfaces.

All the houses examined had both air barrier and insulation layer complete (apart from one timber frame property without loft insulation). There was no discernible difference in the quality of build or quality of finish between any of the properties surveyed.

Placement of Insulation:

- There was no clear-cut evidence of missing wall insulation on clear sections of wall in any of the 3 construction types investigated; any suggestions of misplacement only arose around specific details/junctions:
    - The loft insulation in the cold roof properties regularly failed to meet with the wall insulation at the eaves junctions in all 3 construction types.
    - Placement of loft insulation was often impaired by services and additional timber in the loft.
- Possible inconsistencies in insulation at electricity and gas meter boxes were only observable from inside the properties.
- Insulation in dormer cheeks may not be fitted satisfactorily, allowing air to move within the wall and compromise thermal performance.

Thermal Bridging:

- Additional heat loss was observed at all ground floor perimeters, and around intermediate floor perimeters in TF and PF dwellings.
- External thermal imaging did not reveal many thermal bridges seen from inside properties, as the cavities (whether filled or unfilled) in the external walls appeared to disperse any point anomalies.

Air Leakage:

Site/Plot	Insulation	Depressurisation		Pressurisation		Mean	
		$m^3/(h.m^2)$@50Pa	ach^{-1} @50Pa	$m^3/(h.m^2)$@50Pa	ach^{-1} @50Pa	$m^3/(h.m^2)$@50Pa	ach^{-1} @50Pa
Pipers Green / 288	Full-fill	4.65	4.22	4.98	4.51	4.81	4.37
Kingsbrook Place / 9	Full-fill	4.53	4.11	4.65	4.22	4.59	4.17
Newton Farm / 268	Timber frame	2.82	2.92	3.11	3.22	2.96	3.07
Newton Farm / 267	Timber frame	3.41	3.37	3.91	3.86	3.66	3.61
Hele Park / 294	Partial-fill	6.48	7.50	6.48	7.50	6.48	7.50
Hele Park / 297	Partial-fill	6.86	5.71	7.39	6.15	7.13	5.93

- There was a clear distinction in the levels of airtightness of the 3 construction types investigated, with PF dwellings less airtight than TF and FF.
- In some of the PF dwellings it was possible to see cold air entering the void behind the plasterboard dry-lining directly from the cavity; this was not observed in the fully-filled dwellings on either site. It seems likely that the additional airflow resistance of fully filling the cavities is playing a part.
- Dwellings were generally more airtight under depressurisation than under pressurisation, this was most apparent in TF houses.
- In all masonry dwellings airflow into, from and through the dry lining void was commonly observed. This was facilitated by continuous ribbons of plasterboard adhesive not being fully achieved at wall perimeters and around openings.
- Airflow directly into/from the external wall cavity was more obvious in PF masonry walls than in FF external walls; again, possibly due to increased flow resistance in FF cavities.
- Service penetrations through the external walls, floors and ceilings were often sealed where visible but not sealed where the air barrier was penetrated, examples include; external soil pipes in TF dwellings and outside lights/taps.
- Air infiltration around ground floor windows/doors was observed even under natural conditions.
- Air leakage at windows/doors/patio doors was highly variable across all construction types; trickle ventilators generally performed poorly and were not sealed to window frames; air leakage at the jambs into the dry lining void was particularly severe in PF dwellings.

Design Issues:

- Boiler placement in the integral garage (TF) and attached garage (PF) appears to supply significant amounts of heat to non-inhabited spaces.
- Eaves details above and between lintels appears to create problems with full continuity of insulation on the external wall.
- Installing loft rolls from inside the loft to meet up with the wall insulation is often unsuccessful in the cold roof constructions observed, creating discontinuities in the thermal envelope.

Attached Site Reports:

- Hele Park, 18th December 2017
- Kingsbrook Place, 15th November 2017
- Newton Farm, 13th November 2017
- Pipers Green, 8th November 2017