Why thermography is the 'weapon of choice' for increasing the quality and efficiency of the retrofit and conservation of traditional buildings

By Jerry Przylucki

When we think about maintaining and protecting our traditionally constructed buildings, from stately homes through to charming little cottages, it might not seem entirely intuitive to consider the use of modern technology like thermography which is a way of visualising the infrared part of the electromagnetic spectrum. When I say modern I mean fairly modern as it has been around since the 1920s! The first applications in the building conservation field, in the 1970s, were at the most significant and vulnerable sites as the type of the infrared equipment used would have been prohibitively expensive for anything less important.

Most people would therefore be familiar with the use of infrared scanning in conservation of some high profile heritage sites like Egyptian Pyramids or high value paintings and such, where the nondestructive property of the technique was of paramount importance. It still seems an obscure knowledge though, that in the Conservation Principles section of The Burra Charter, published in its current form by Australia ICOMOS in 2013 and considered by many to be one of the best set of guidelines for the care of culturally significant places, Article 4.1 reads:

'Conservation should make use of ALL the knowledge, skills and disciplines which can contribute to the study and care of the place.' Experts in the field agree with professor John Edwards, the lead author of the *Guide to the Conservation of Historic Buildings* (BS7913: 2013), that a condition survey incorporating the analysis of the air and moisture movement patterns in relation to the current or proposed use of any building is a prerequisite for the correct identification and specification of any required works.

So it's not only the famous buildings that should benefit from the use of this ground breaking technology. 50 years on it should be all buildings and it shouldn't really be an option anymore but a logical compulsion.

There is no denying that the technological progress truly is exponential. This is more evident now than ever before and the adoption rates will only keep increasing as the costs continue to decline. It is already perfectly possible to have a basic thermal camera attached to one's phone and it actually costs less than the phone itself! Soon it will be attached to an autonomous drone, no doubt.

Without getting too technical, lets just emphasise that the advantage of using thermal imaging boils down to this basic principle: the heat flowing through any material will always be obstructed or altered by the presence of anomalies within that material.

Thanks to the complex inner workings of a modern thermal imaging device we can see these abnormal patterns almost instantly and non-invasively and analyse them in great detail with the help of dedicated software.

It is easy enough these days to find out the technicalities of how and why a thermal camera works the way it does or even hire one to experiment with. It's actually great fun and a bit of a mesmerizing experience in its own right.

What's unfortunately not so easy, is taking account of all the many factors and parameters while recording these images (as well as other auxiliary data) to ensure the correct interpretation down the line. The obvious keywords here are training and experience as it is extremely easy to jump to conclusions and miss important facts in the interpretation phase.

Nevertheless, as professor Peter Swallow has already pointed out with regards to thermography in building conservation applications nearly 10 years ago, '...to secure the simultaneous wellbeing of the building, occupants and contents requires a proper understanding of the interplay of relative humidity, air temperatures, both internally and externally, and the temperatures on the surface and within the materials. Only by measuring and monitoring these data can environmental strategies be devised and suitable corrective measures applied.'

The thermal imaging allows us to see this interplay continuously unfold so we can better understand it, better explain it and make better-informed decisions when prioritising the allocation of the ever-limited resources.

Because the associated cost is already a fraction of what it used to be, even as recently as 10 years ago, there is now a huge potential for the widespread adoption of this marvellous technology.

How wide? Well, it is estimated that seventy million dwellings in 28 countries in Europe alone were constructed prior to 1960. That's 1/3 of the entire built environment in this part of the world. Still, only about 8% enjoy statutory protection!

If 65 million traditional buildings need exactly the same approach to maintenance as the protected lot, and if the retrofit measures for improving their energy efficiency are no longer an option but necessity in the face of the global warming, thermography is the natural way forward.

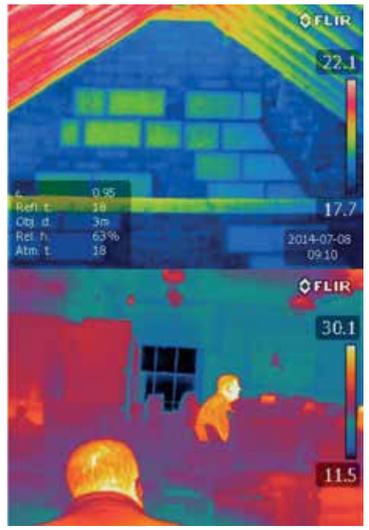
If we think of thermography as a sixth sense, there really is no excuse for switching it off. In the context of our built environment and the sustainability of our way of life to do so would be like trying to appreciate the aesthetics of these buildings with our eyes shut. Thermography now truly needs to play the key role in driving the efficiency and bringing the costs of these efforts down as the sheer volume of what needs to be addressed already seems almost insurmountable. For any meaningful gains to the society the process will soon need to be standardized, streamlined and at least partially automated. Thermography is the tool that lends itself to all three. Because of the visual and immediate nature of the thermal survey it offers a relatively inexpensive and non-invasive way of helping clients and other stakeholders to understand the significance of problems that might otherwise be difficult to conceptualise. Among many others these can include problems with:

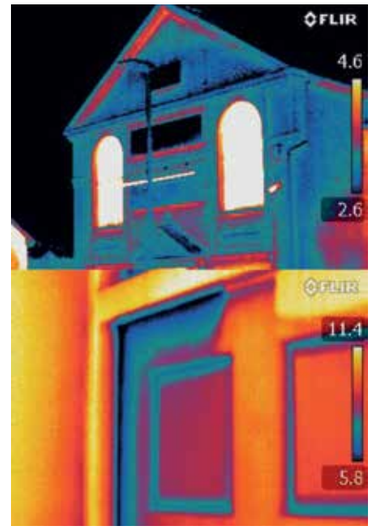
- continuity and condition of insulation
- cold bridging
- structural defects
- hidden structures/services/past alterations
- air leakage/infiltration
- electrical, plumbing, heating, cooling and ventilation systems
- damp and decay
- moisture and air circulation
- cleaning interventions
- plaster/finishes delamination
- insect infestation
- blockages in flues and rain water goods
- quality of workmanship and materials
- demonstrating the improvements of a retrofit programme
- substantiating insurance claims
- communicating the objectives to the workforce on the ground where language barriers might exist and/or competence levels need improving

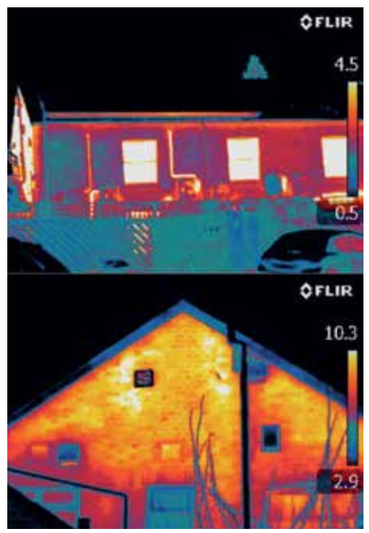
This is precisely why here at Tiffins we have been investing in both IR training and thermal imaging equipment for nearly a decade now. Strong believers in the 'fabric first' approach to building conservation we find thermal imaging to be an invaluable tool for corroborating and sharing our understanding of buildings.

After all, that's what we have been doing for over 320 years now – working with buildings and trying to understand how they work, evolve and eventually fail. Without much fuss, we have always taken the holistic and proactive approach to monitoring the ever-changing environment and we provide a 'one stop shop' for the most thought through and economically viable solutions in historic buildings maintenance while ensuring the best possible outcomes for all of our well-informed patrons.

We love to share our knowledge and are always happy to answer any technical questions and discuss various case studies so get in touch if we can be of any assistance.







Sample thermograms from the converted Grade II listed church in Harpenden

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