GBG Australia

Some of our work undertaken using Thermographic Imaging:

Identification of defective walls behind plasterboard, Manly Vale, New South Wales.

Peter Allsopp Engineers (2011)

QA investigation of concrete walls at a major water retention project, Wonthaggi, Victoria.

Thiess Degrémont (2011)

Assessment of conditions of sandstone walls of Newcastle Town Hall prior to restoration work, Newcastle, New South Wales.

City of Newcastle (2001)

In Conjunction with GBG USA:

Assessment of conditions of walls prior to restoration work, Melwood Park Manor, Washington DC.

Robert Silman Associates (2009)

Assessment of condition of Whyalla Steelworks precipitator chimney, Whyalla, South Australia.

Bierrum International (2010)

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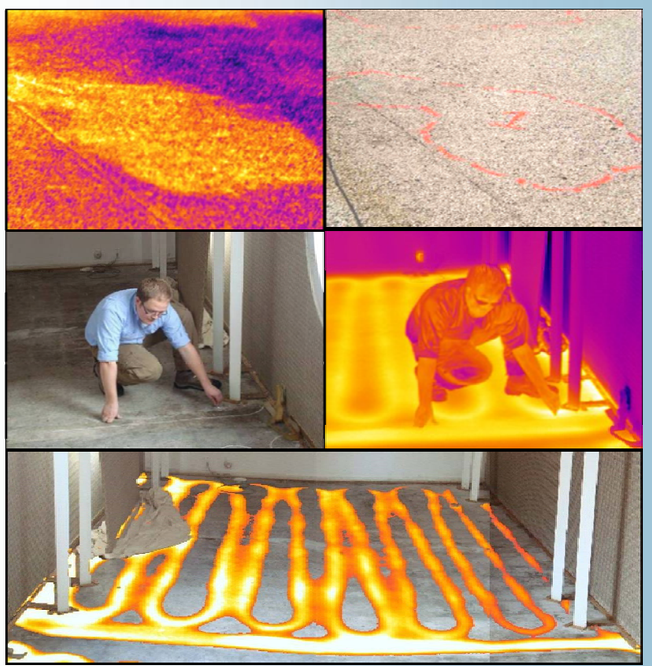
Applications for

THERMOGRAPHIC IMAGING

- **Surface Delaminating**
- **Void Location**
- **Heat Flow Mapping**
- **Surface and Hidden Moisture Detection**
- **Historical Structure Assessment**
- **Quality Assurance**



GBG Australia

Non-Destructive Techniques

THERMOGRAPHIC IMAGING

GBG Australia

GBG Australia specialise in applying Non-Destructive investigation techniques for assessment of existing structures. We offer our clients innovative methods of revealing subsurface information over large areas whilst minimising both costs and disturbances to the site.

Company Expertise

GBG Australia is a subsidiary of the GBG Group, a multi-national company specialised in the application of geophysics and advanced applied physics for precision investigations of geotechnical, environmental and structural applications in the UK and Europe since 1982. GBG has had a presence in Australia since 1993 originally through a joint venture with CMPS&F and GHD before becoming a stand alone company in 2003, operating in three main areas of business: geotechnical and environmental investigations; non destructive investigation of structures and contracting of equipment and staff for data collection, processing and interpretation of data.

GBG Australia is an independent provider of non-destructive and shallow geophysical investigation services with applications ranging from the location of a single pre-stressing strand in a concrete slab to mine scale exploration geophysics. With clients ranging from local to Federal Government, developers and engineering companies to private individuals, we can provide tailored solutions to your particular subsurface investigation requirements.

Applications for

THERMOGRAPHIC IMAGING

Thermographic Imaging is a Non-Destructive Testing (NDT) technique used by the GBG Group for engineering applications. It is quick and relatively inexpensive method compared to more conventional NDT techniques and is well suited for investigation of both small and large scale structures. As processing of the data is minimal, results of investigation can be provided quickly. In many cases anomalies (such as voids or certain services) can be marked in situ.

GBG Australia employs advanced thermographic techniques in applications such as the mapping of heat flow in solid material, delineation of surfaces, detection of moisture (both surface and hidden) and looking for voids. The purpose of this mapping range from investigation of problems associated with workmanship to the need to better understand the structure of a building prior to renovation/remediation.

Objects either radiate or absorb heat depending on the their condition and the conditions of the environment. Thermal cameras detect these variations in temperature, providing both a digitised recording and a visual display contrasting areas of significant heat differences.

Advances in technology and greater awareness of the benefits of thermographic imaging as an NDT technique has led to its growing use in the inspection and investigation of buildings.

Thermographic imaging is a means of investigating the arrangement and condition of both construction material and types of structure, without intrusion or damage to the existing material. This sheet summarises some of the applications of thermographic imaging.

A PIPE LEADING FROM AN AIRCONDITIONER UNIT SHOWING A CLEAR THERMAL DIFFERENCE.

QUALITY ASSURANCE IN CONCRETE WALLS

GBG was tasked to survey the concrete walls behind a High Density Polyethylene (HDPE) cover of a large water retention structure as an exercise in quality assurance.

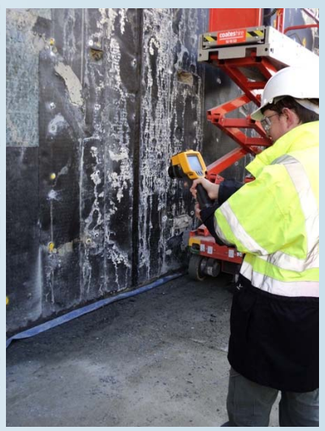
Designed to hold large volumes of salt water, a large water retention structure was constructed with concrete walls with thicknesses up to one meter and up to five layers of reinforcement. The outer walls were covered in HDPE to prevent leakage from the structure. *It was discovered certain walls contained honeycombed concrete that was a result of poor concrete compaction, reinforcement density and concrete compositions, there was concern that honeycombed concrete existed behind the HDPE layer.* As part of a quality assurance exercise by the structural engineers, GBG was tasked with imaging walls to ensure proper bonding of HDPE cover with the concrete wall as visual inspection was impossible.

Methodology

During the survey a series of thermographic images were taken on each wall in a 1m x 1m grid. Any anomalies located were marked on site. Sufficient heating/cooling was required to ensure good thermal differential, therefore scans were performed during early morning and early evening to ensure the thermal difference between the concrete and anomalies was at its greatest. High frequency radar was also undertaken in selected sections to determine the accuracy of the thermal imaging results.

Results

The data was interpreted using SmartViewer 3.1, a specialised image editing software and located anomaly were shown on schematic CAD drawings. Some anomalies were discovered and these were marked up on site as well as highlighted in the drawings. These results were used by the structural engineers to coordinate remedial work which consisted of injecting grout directly into the defect behind the HDPE layer.



A THERMOGRAPHIC IMAGE BEING TAKEN

DETECTION OF EMBEDDED TIMBER FRAME IN 18TH CENTURY PLANTATION HOUSE

GBG investigated an early 18th century plantation house with multiple phases of redevelopment and repair work to map the extent of timber framing within one of the walls and determine the quality of the wall.

Work was carried out as part of the redevelopment plan to identify any voiding between the brick wythes. It was decide to employ thermal imaging and GPR techniques to assess the quality of the wall and map the timber frame.

FRONT DOOR - HOTTER (LIGHTER) RESPONSES HIGHLIGHTING THE POSITION OF THE INTERIOR DOOR LINTEL, AND ALSO TIMBER INSERTS BELOW

Methodology

Horizontal and vertical GPR surveys were performed over the interior and exterior surface of the walls using 900 MHz antenna provide the highest possible resolution whilst still penetrating the full thickness of the wall.

A long wave thermographic camera was used to assess the thermal variations over the walls during heating and cooling cycles which helps in identification of elevated moisture levels, debonding masonry and voids.

COOLER RESPONSE HIGHLIGHTING PATCH REPAIR AROUND WINDOWS.

THERMAL IMAGING FROM INTERIOR

Results

Timber encased in brickwork is readily identifiable in GPR data as the waves travel much faster through the wood than through masonry. Excessive voiding was evident from the exterior walls that would have separated from the interior walls. The voiding was probably due to deterioration of timber and change in roof loading due to redevelopment history of the building.

The thermal imaging recorded some stucco patch work on the walls that appear cooler as a striking contrast in the typically hotter background which means that the repair stucco is thicker than the original stucco. Increased moisture levels in some areas of the walls appear cooler than the surroundings and are shown as dark patches. Some internal timber inserts were identified behind the plastered finishes.

DELINEATION OF DEFECTS IN OF PRECIPITATOR CHIMNEY

GBG was entrusted to carry out assessment of a precipitatory chimney surface to identify any breaches in the interior brick lining and map any voids in the reinforced concrete.

The structure composed is composed of a mild steel inner liner covered with refractory bricks and coated with a reinforced concrete windshield exterior. There is concern that over time breaches in the interior brick lining have occurred threatening the stability of the concrete windshield.

Methodology

Thermal imaging is an appropriate technique to assess the condition of the brick lining and concrete windshield. The hot gases through holes & cracks in the brick cause localised heating in the concrete windshield which can easily be detected through with a thermographic camera Comprehensive mapping of the chimney was achieved by scanning the full height of the structure from different perspectives.

Results

Imaging was done when the chimney was in use to provide the best possible results. It was found the chimney produced an overall cool thermal response with clusters of hotter thermal responses. Hotter responses are related to potential breaches in the brick lining, the hot spots were relatively minor in size and were localised. Due to this it is believed that systematic failure of the entire structure was unlikely. The cooler overall response however suggests more widespread failure of the reinforced concrete windshield as the result of delamination and spalling.

THERMAL IMAGE OF CHIMNEY