Building Diagnostics
& Property Science

USING INFRARED THERMOGRAPHY FOR STRUCTURAL INSPECTIONS

www.bldgdiagnostics.com

The infrared inspection of buildings for heat loss was one of the first commercial uses for infrared thermography. Another important use of IR is with the structural inspection of the walls of one type of building: CMU or concrete masonry unit. (See figures 1 and 2).

Figure 1
Typical CMU wall section

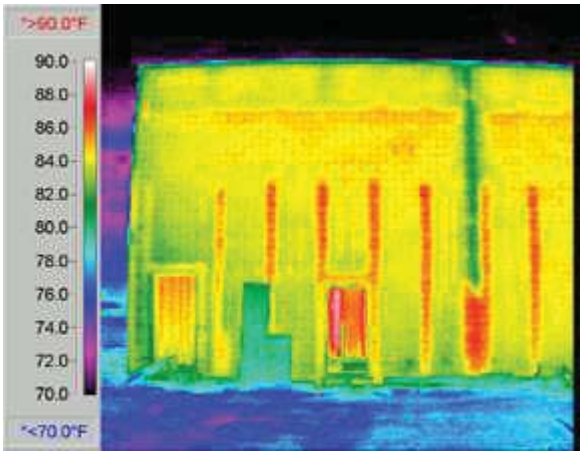

Figure 2 Thermograph of CMU wall section showing multiple deficiencies. (Pilasters are warmer.)

Building Diagnostics & Property Science Corporation has provided IR non-destructive structural inspections on numerous commercial and institutional projects throughout the Southeast United States.

Our experience is that (with respect to the placement of grouted cells) there is no correlation between the number of problems found in the walls and whether or not a testing company was hired to watch the construction. We find many problems with the construction of CMU walls, but judge these defects are almost never caused by fraud. Instead, poor supervision on the job is the cause for the poor quality. Even with IBC mandated Special Inspections, proper inspections by qualified personnel are often lacking.

Some buildings are effectively grouted, but it takes good inspection and quality workmanship. One method used in the past was to require the installation of inspections ports or holes, cut in the block faces. These are installed at every lift height and at all grouted vertical pilaster locations. (See figure 3.) This is a very costly, time-consuming and sloppy method. That is why infrared documentation can be so valuable. It is fast, inexpensive and accurate.

Figure 3 CMU wall section with inspection ports are time consuming and expensive.

No matter what the perception, there are many problems especially with school buildings. Almost all schools are built using CMU walls. Interior walls can be painted, making a durable, yet inexpensive finish. Exterior walls are painted on the inside and made to receive brick faces or stucco finishes on the outside. Unlike other building owners (who can hire anybody they want to build the building), schools are built with public money and mandated to accept the lowest bid.

5217 5th Avenue South ◦ Birmingham, Alabama ◦ 35212 ◦ Phone: (205) 439-7780◦ Fax: (205) 591-7184

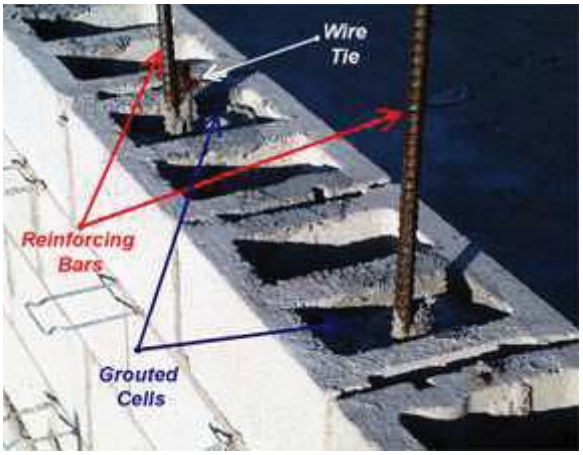

Figure 4
Typical 12" CMU wall construction

Grouted cells, being higher in mass, warm more slowly than the lower mass of insulated or empty cells. This works great, except that you have to follow the Sun around the building. Also, some walls do not receive direct sunlight at any time during a particular day (or season) while others are blocked from sun entirely by the building itself or by an adjacent building or other object(s).

So we went on the outside and watched the surface temperatures change when the Sun hit the wall. Because the solar radiation is *so* powerful, often the image becomes 'washed out', especially on reflective surfaces, like painted walls. Also, for the same reasons as stated in the previous paragraph, some of the walls never receive direct sunlight. Finding pilasters in the middle of the night had worked. Because the lack of heat is uniform, it is the equalizer. Timing turns out to be everything. Areas of higher mass heat up and cool down at a different rate from those of lower mass. (See figure 5.)

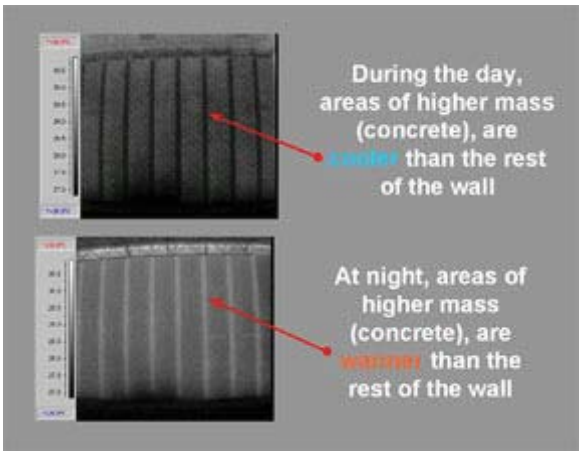

Figure 5
Thermographs showing daytime and nighttime tempera-

The walls absorb solar heat during daylight hours and radiate that energy back into the atmosphere at night. This is why, as with infrared roof moisture surveys, clear nights are preferred so as to see the higher mass [water] in the roof's substrate. Each wall has a thermal 'life' of its own, so we sometimes have to wait for a wall to reach it's peak delta-T between the different masses; grouted and non-grouted cells. Figure 6, shows a time vs. temperature plot of a South-facing CMU wall, over a 24-hour period.

THE FINISHED PRODUCT-THE REPORT

The report should include the following:

- A thermographic report printed on high-quality paper, containing:
  - Letter explaining the survey, and giving an account of the conditions and any notations.
  - An individual thermographic report of each problem area, with thermographs and matched photographs. Also, the exact location of the problem, referenced by wall section and description of any anomalies found. The thermograph and/or photograph should have arrows pointing to problems.
- An original building drawing (supplied by the owner) marked with arrows, indicating the position of the camera, the direction of the shot and the corresponding thermographic report number.
- A CD with the PowerPoint presentation of the entire report, the digital image files of all infrared images, and the digital image files of all photographic images.

Today, infrared thermography is the best tool for the surveying of a masonry wall to find deficiencies in the structural components and/or the thermal envelope. It is fast, inexpensive, accurate and it will save money on the job in many ways. Using the methods described above, CMU walls can be effectively and efficiently surveyed.

For more information about this or any of our other services please contact:

Josh Bhate
Telephone: (205) 439-7780
Fax: (205) 591-7184
E-Mail: jbhate@bldgdiagnostics.com