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BUILDING ENVELOPE NEWS

An information service for building owners and managers, architects and engineers concerned with comfort, structural integrity, energy savings and building preservation.

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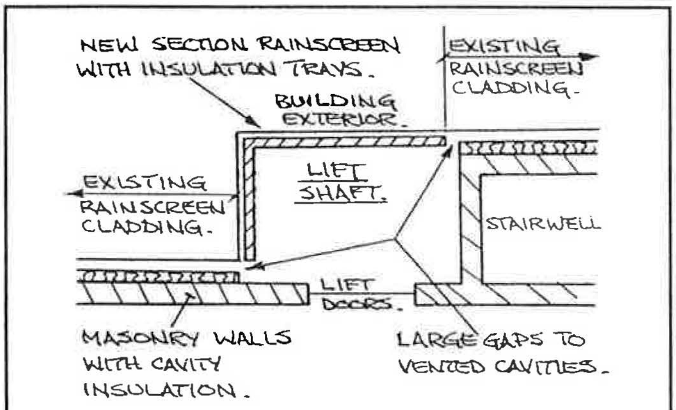
THE SOLUTION TO LIFT SHAFT AIR LEAKAGE

Since moving into a recently refurbished office block in West London, the tenant had suffered from severe air ingress problems around the service lift doors. As the doors opened onto the office spaces at each of the 12 floor levels the problem resulted in numerous complaints from nearby staff.

The level of leakage was such that staff positioned close to the lift suffered extreme discomfort during periods of windy weather and at times the draughts were so severe that papers were being blown from desks. Complaints to the building owner resulted in some remedial works being undertaken but as these failed to solve the problem Building Sciences was commissioned to carry out a full investigation.

An internal and external survey of the lift shaft identified two significant areas of leakage. These defects were so substantial that a proposed pressurisation leakage rate test of the shaft could not be undertaken as the available fan equipment was of insufficient capacity to deal with the huge level of leakage.



Lift Shaft extension results in significant air leakage paths.

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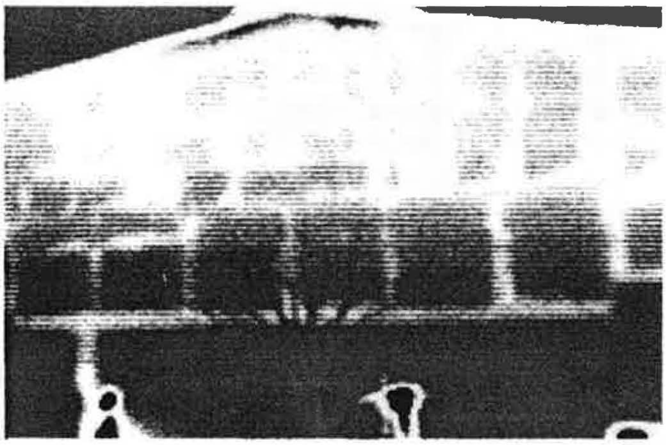
ENVELOPE THERMAL PERFORMANCE - THE ILLUSION AND THE REALITY



Gable wall thermogram shows significant areas of missing insulation and air leakage at verge detail.

The thermal performance of the envelope is a key factor in the heating and cooling cost of any building. However the significant degree to which the actual as built performance often varies from the calculated levels is not widely recognised. The reason for this is simple. The vast majority of performance related data is obtained from laboratory rather than field testing. As most laboratory tests are carried out under closely controlled conditions on idealised specimens the results frequently do not reflect the reality of the as built envelope "system".

Generally laboratory conditions do not, and really cannot adequately reflect field conditions which can be impacted by such issues as:

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BUILDING ENVELOPES - THE PANAMA INTERNATIONAL WAY

Building Sciences Technical Director, Stuart Borland, recently presented a paper at the 22nd General Assembly of PANAMA International which was held in Dublin. PANAMA is an international association of manufacturers and related suppliers of polyurethane foam cored composite cladding panels for use in industrial and commercial buildings.

Mr Borland's paper dealt with the comparative thermal performance of composite and site assembled built-up cladding systems covering issues such as the effects of air movement and condensation, and a review of the relative merits of site installation requirements of the two systems.

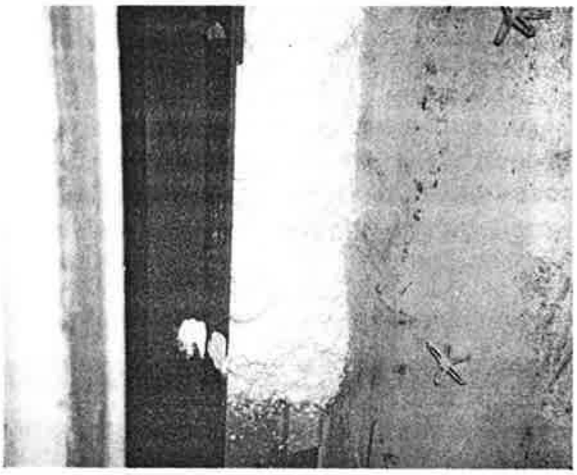
The conference was well attended with delegates from throughout Europe and the USA, and was deemed to be informative and a great success by all who attended. Copies of Mr Borland's paper are available to those interested by contacting Marion Jones of Building Sciences Ltd.□

THE SOLUTION TO LIFT SHAFT AIR LEAKAGE (from page 1)

The existing building envelope comprised a "rainscreen cladding" system which included an outer "rainscreen" skin, a ventilated cavity, mineral fibre insulation and an inner masonry wall. The lift had been added to the building after the main refurbishment exercise and whilst the same external rainscreen skin was utilised, insulated steel liner trays formed the inner skin.

In the existing construction the masonry wall acted as the primary air barrier whilst the liner trays formed the barrier around the lift shaft. The air barrier element of the main building envelope had not however been joined to the lift shaft liner trays and this left two very large vertical gaps of approximately 100mm and 220mm wide respectively between the ventilated cavity of the old construction and the lift shaft over the full building height. In addition to the discontinuity in the air barrier this deficiency also resulted in significant gaps in the thermal insulation around the envelope.

Large vertical gap covered with plywood panels. Gaps around steelwork sections filled with fibre prior to foaming.



Completed section of sprayed foam.

Building Sciences produced a report highlighting the defects and put forward a series of remedial work proposals. They were subsequently engaged by the tenant to carry out their remedial work proposals which primarily involved the installation of full building height plywood panel sections across the larger of the two openings which was then oversprayed with a polyurethane foam layer to form a continuous air barrier link between the new and existing construction and to provide continuity of the insulating layer. For the smaller of the two gaps a foam layer was sprayed across the surface of the existing mineral fibre insert to provide air barrier continuity.

Prior to commencing the site works the local Fire Authority was contacted to obtain approval of the sealing process which included treating the foam surfaces with an appropriate fire retardant product.

The site works took 4 days to complete and to date there have been no further complaints of draughts even though the building has been subjected to periods of high winds and low temperatures since these remedial works were completed.□

ENVELOPE THERMAL PERFORMANCE - THE ILLUSION AND THE REALITY (from page 1)

* "Substandard" workmanship. This is often an unfair label as this includes that common mistake of blaming the tradesman for quality defects where component system design and construction requirements may make acceptable quality assurance impossible.
* Defective or misplaced insulation.
* Use of improper materials.
* The deterioration of component performance due to aging, moisture effects etc.

In addition to the matter of the "actual" as built thermal performance of the components compared to the theoretical there is also the important issue of the continuity of envelope insulation and the avoidance of cold bridges.

If we are to address the actual thermal performance of our buildings then we must avoid relying solely on laboratory results and have the facilities to establish quantitative information from field testing of as built envelopes.

It should also be recognised that field testing is not only a means of comparing performance against specification criteria, but is also a means of focusing attention onto defects which may require improvements in component design and/or construction methods.

So if such field testing is important, how can this be carried out in a meaningful and cost effective manner? Two of the options available are the Heat Flux Technique and Calorimetric Hotbox Method. Both systems are readily installed, are non intrusive and provide reliable and accurate in-situ information which describes the true level of performance for the tested area of construction.

Often in situ U-values have been found to be 100% worse than theoretical levels which can have a dramatic effect on building performance.

Doug Lawson of Building Sciences advises that such field testing technology now forms an important element in their range of envelope performance testing services.□

GOOD AIR TIGHTNESS - THE COMING ATTRACTIONS

It is well known that uncontrolled air leakage results in a wide range of performance problems but the true magnitude of the energy impact of excessive leakage is only recently becoming recognised.

With ongoing improvements in insulation performance levels so air change rates have become a much more significant element in space conditioning energy usage.

Alongside this are the results of many fan pressurisation tests which confirm that many buildings are excessively leaky. Based on tests of twelve large office buildings the average leakage rate was around $22m^3/hr/m^2$ at a differential pressure of 50Pa. This compares to a target specification of $5m^3/hr/m^2$.

If many of our buildings are excessively leaky and certainly very much leakier than many in the construction industry believed, what is the real impact. Well significant! As an example Building Sciences modelled a "typical" $5{,}000m^2$ factory unit and from the following information using the AIDA Programme can be seen that by building tighter energy usage can be reduced by a massive 59%. In the same case study it was estimated that such a reduction could cut the capital cost of the space conditioning system by up to 25%.

<u>Leakage Rate $22m^3/hr/m^2$</u>		
Estimate Air Change	=	0.5 ACH
Estimated Total Heat Loss Fabric and Air Change	=	170 KW
Ventilation Loss	=	59% of total
<u>Leakage Rate $5.0m^3/hr/m^2$</u>		
Estimated Air Change	=	0.06 ACH
Estimated Total Heat Loss Fabric and Air Change	=	70 KW
Ventilation Loss	=	19% of total

Note: At wind speed of 8m/sec the above air change rates could double.

Fan testing typically provides leakage rates per m^2 of envelope whereas the sizing of conditioning systems is based upon natural charge rates. Flow modelling programmes such as AIDA together with the results from extensive fan testing means that the construction industry can now:

* Achieve predicted envelope air tightness levels.
* From pertinent building and location data including air tightness levels, predict realistic natural air change rates.
* More accurately forecast energy usage.
* Where appropriate downsize space conditioning systems.□