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**MALONE ASSOCIATES LTD**  
BUILDING TECHNICAL EXCELLENCE




**Chartered Building Consultancy**

## Cavity Wall Defects

### Cutting through the current mass hysteria

Presented By: Joe Malone BSC(Hons) MCIQB C. Build.E MCABE



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**A little about us.**

- Malone Associates Ltd are a Chartered building consultancy & Chartered Building Engineers with a strong specialism in building pathology, particularly damp and disrepair and we do a great deal of expert witness work in this area.
- We have been teaching damp investigation and remediation since 2006 and I have been a visiting guest lecturer at Coventry University for the last 7 years teaching the principles of damp investigation to building surveying undergraduates as part of their building pathology module.
- I keep and maintain the academic blog [buildingdefectanalysis.co.uk](http://buildingdefectanalysis.co.uk)
- I have had technical papers published by SAWA, the CIOB's Construction, Research and Innovation Journal and in the ICWCI Site Recorder.

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### Purpose


- To counteract the tide of misinformation being disseminated by action groups such as CIVALLI and the new cavity wall insulation removal industry.
- To provide guidance as to identifying when a CWI has not been installed correctly
- To provide guidance on how to report CWI defects appropriately
- To highlight the diagnostic tools required to investigate cavity wall defects
- To highlight how cavity wall defects can occasionally cause dampness in properties
- To outline the investigative process through a number of case studies

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### So why the current mass hysteria around CWI?

**Cavity wall insulation 'a scandal', Arfon MP claims**



Wales MP Arfon, Iwan Rhys Iwan, says he has written to the Welsh Government to demand an investigation into the quality of the work done on the island of Anglesey. He says that the work done on the island of Anglesey is a scandal and that the Welsh Government should be held responsible for the quality of the work done on the island of Anglesey.

**'Our house is ruined ... we are in a living hell'**

Mr and Mrs Jones, from Penarth, have been distressed to learn that their house is in a living hell, and that their children have to live with an unhygienic and unhealthy environment. The house has become an unhygienic and unhealthy environment due to the quality of the work done on the island of Anglesey.

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### Why the current mass hysteria?

**The great cavity wall calamity: 1.5 million homes are blighted by damp after cowboy builders cash in on a Government insulation drive**

February 22, 2017


**Mail on Sunday "The Great Cavity Wall Calamity" 21/01/2017**

[www.dailymail.co.uk/news/article-1151101-1.5-million-homes-blighted-damp-cowboy-builders.html](http://www.dailymail.co.uk/news/article-1151101-1.5-million-homes-blighted-damp-cowboy-builders.html)

**Read More -**

CIVALLI post links to both the Daily Mail article but in their post claim that up to 5m homes are affected!

Please read [Should we demoise all CWI?](#)




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### So who are CIVALLI and why were they formed?

- The Cavity Wall Insulation Victims Alliance
- An action group set up by three housewives after considering that their damp problems were caused by cavity wall insulation
- They claim that there are several reasons why a CWI installation can go wrong...
  - The building was never suitable for an installation in the first place. This should be detected at the point of a pre-assessment (or suitability survey) but is often missed
  - The building is elevated and in a position or location where it is exposed to severe weather conditions
  - The outside of the building is showing evidence of distress for example cracks in the walls that could be an entrance point for water
- They gained some prominence after gaining a slot on BBC Wales X-Ray, where they found a Chartered Surveyor to support their claim that internal dampness was caused by the wet CWI.
- He completely ignored the fact that the building was next to a rail track and was suffering from massive subsidence cracks that had allowed rainwater ingress into the wall cavity but mentioned that there was "rubble in the cavity." Wouldn't the property have been damp anyway?
- It is interesting that they ignored that last of their 3 reasons for CWI failure during this broadcast.

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Are CIVALLI's claims on the high incidence of CWI problems correct? 

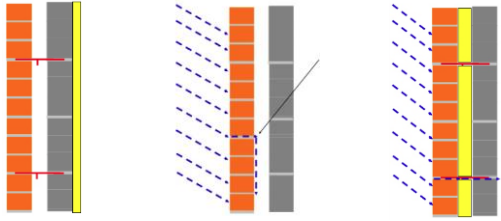
- It is worth noting that CIVALLI have consistently refused to post or publish any evidence that supports the alleged high incidence of CWI defects.
- Their refusal is on the back of the claim that they have to protect identities but how does publishing technical evidence compromise identities?
- They're refusal to post evidence contradicts their statement that their 'victims' can't afford to have technical investigation work completed.
- In 2016 we were approached by CIVALLI as BBC Midlands had picked up the BBC Wales X-Ray programme and wanted to run a story on BBC Midlands.
- The problem was that CIVALLI didn't know of a single case of failure in the whole of the Midlands and asked us if we knew of any 'victims'.
- I tell this story because it is very important that you contextualise this issue.
- We are of the opinion that cavity wall insulation can cause problems but only in rare cases.
- Rather like the damp proofing industry, which sprung up to treat an incredibly rare problem, so we see the same happening for cavity wall insulation.
- The companies that installed this CWI are now looking to also profit from its removal.

The Purpose of a Wall Cavity  

1. To improve thermal efficiency (airgap)
2. To provide a moisture break (airgap)
3. To provide a thermal break (Reduce direct cold bridging)
4. Enables the use of low cost non-rigid insulation bats or cavity fill
5. Weep holes allow the cavity to drain
6. Weep holes allow an airstream through the cavity to remove evaporated moisture

- Early cavities were extremely narrow and purely designed to prevent the passage of moisture to the inner leaf.
- Cavity walls gained widespread use from the 1920's
- Generally around 35% of heat loss is through the uninsulated cavity wall

The cavity is primarily to prevent moisture transfer To the inner leaf!  





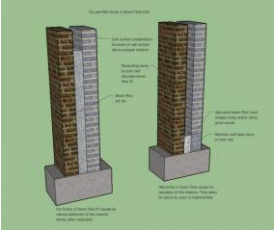
Moisture break      Penetration can drain      Problems caused by full fill!

Partial Fill. The ideal Solution?  



The fundamental principle in a cavity wall is that there shall be no bridge of solid material capable of carrying water across the minimum 50 mm cavity space. Therefore, the construction of two separate walls, with a clean cavity, is of prime importance.

The Problem with Retrofit Cavity Wall Insulation  





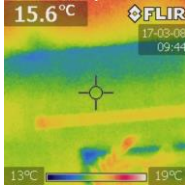

Dry & Wet Slump in Blown Fibre CWI

Remember that blown fibre CWI is not inherently waterproof!

Please read [The problem with CWI](#)

The comments sections the bottom of all CWI blogs are interesting and worth reading.

The Problem with Retrofit Cavity Wall Insulation  

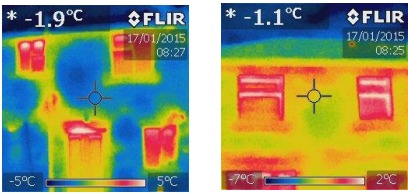
Dry slump to the head of the wall seen with thermal imaging

**The Problem with Retrofit Cavity Wall Insulation**



Confirmed as dry slump after borescope inspection to the head of the external wall

**Incomplete Cavity Fill with Blown Fibre**



Incomplete filling of the cavity during installation is the number one installation problem! However, would walls subject to dry slump or insufficient fill be any more prone to cold surface condensation? Wall surface temperatures in this property were 5°C below dew point temperature despite an internal ambient temp of 23.8°C and a low humidity of only 50.5%

**Dry Slump with Blown Fibre**

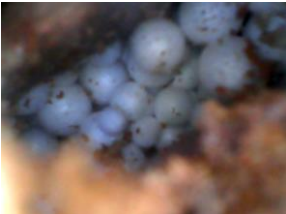


Another property with dry slump and/or poor fill. This is 280mm cavity walled construction and recently subject to a blown fibre CWI installation when we inspected.

**What about blown Polystyrene bead CWI?**


- Bonded or unbonded polystyrene beads are inherently waterproof and present less of a problem in terms of dry slump wet slump, or poor filling of the cavity.
- The beads flow better during installation and are more tightly compacted together, providing better thermal resistance than blown fibre
- However, they can still act as a moisture bridge in rare circumstances of penetrating damp and so are capable of transferring moisture to the inner leaf
- Note that its far more difficult to find a CWI installer that uses polystyrene beads!

**What about blown Polystyrene bead CWI?**



- We recently inspected a cavity walled property in Staffordshire with significant penetrating damp. The property had polystyrene beads installed to the wall cavity.
- The cavity was inspected with an electronic borescope due to a significant problem with penetrating damp on the inner face of the lounge wall. This revealed the cavity was fully filled with polystyrene beads. Even visually these appeared to be wet.

**What about blown Polystyrene bead CWI?**



Saturated masonry and lack of sarking into gutter or eaves flashing

### What about blown Polystyrene bead CWI?



- The shallow pitched roof was poorly constructed at eaves level. The sarking membrane was not draped into the gutter at eaves level
- In fact the sarking was rotten and was draping into the cavity.
- Rainwater was collecting in the sarking trough created to the head of the cavity and draining into the cavity below.
- The inner leaf of masonry would have saturated with or without the polystyrene bead installation.
- Should we remove the polystyrene beads?

### If saturation occurs in the cavity, what insulation can be recovered and what can't?



- **Wet polystyrene beads can be retained as the material itself does not absorb moisture.**
- **However, they may slow the drying time.**
- **Wet blown fibre is not recoverable, once you see evidence of wet slump, it must be removed.**
- **Closed cell insulation boards such as phenolic or PUR are not recoverable and must be removed once wet.**
- **Similarly we would advise that saturated Rockwool bats are removed as they won't dry in a closed cavity**

### Retrofit CWI... Does it cause condensation damp?



- We are consistently told that retrofit CWI has contributed to condensation damp but is this possible?
- The single biggest tool in combating cold surface condensation is to raise internal wall temperatures.
- Retrofit CWI may be the difference between walls being above or below dew point temperature
- Retrofit CWI does not in itself generate humidity
- If it has proven to transfer moisture across the cavity, causing internal wall saturation then additional moisture can evaporate from the building fabric and secondary condensation damp can occur... This is incredibly rare!
- If cold spots exist on walls due to incomplete CWI fill and condensation forms on these cold spots can the CWI be blamed for causing the condensation?
- No, in all likelihood, the whole wall would have been at the same temperature as those individual cold spots causing condensation to occur across the whole wall.
- The partial fill situation only proves that CWI has been effective in combating cold surface condensation where it has filled the cavity.
- The solution is to fully fill the cavity to eliminate voids.
- What is secondary condensation damp?

### Proving that CWI is the problem



- We have a number of tools at our disposal to assess CWI installations and to prove whether in fact they are causing moisture bridging of the wall cavity.
  1. Thermal imaging
  2. Borescope (Portascope and electronic)
  3. Moisture testing at depth (Deep wall probes and calcium carbide)
  4. ERH (Equilibrium Relative Humidity) sleeves and Hygrometer
  5. Visual inspection of the wall cavity

### Proving that CWI is the problem



- The definitive tool for proving that retrofit CWI has caused internal dampness is calcium carbide testing!
- You must prove that moisture is present at depth in the masonry!
- Once you record high readings for moisture at depth, you must then provide visual proof as to what is bridging the cavity.
- In our experience it is rarely the CWI and more likely attributed to...
- Cavities bridged by mortar, bricks or other debris
- Poorly installed wall ties
- Water ingress to the head of the cavity due to defects at eaves level
- We have opened up or inspected hundreds of wall cavities and only ever encountered two cases of wet blown fibre insulation over the last 10 years!

### Cavities in timber and steel framed buildings



- Timber framed or on-traditional steel framed buildings often cause a degree of panic where CWI is installed and some take the view that cavities should always be clear of CWI in these properties
- For timber framed buildings this makes perfect sense to allow better air circulation to ventilate the timbers
- For steel framed buildings the evidence is less clear cut and CWI removal may be detrimental to the steel frame. Why is this?
- We recently examined a Trusteel building after a Chartered Surveyor had advised the buyer to walk away as CWI was installed that would in his opinion cause corrosion of the steel frame but what is the logic behind such a conclusion?

### Cavities in steel framed buildings



- We were commissioned to inspect the structural integrity of the steel frame and for the interim advised the client to cancel their £1500 order to have the CWI removed.
- If CWI is installed can we inspect by Borescope?



Opening up the cavity showed the base of the steel stanchion to be sound in the North corner of the building

### Other considerations (Steel Frame)



- The Blown fibre CWI proved to be dry.
- We had also carried out an ERH test to assess moisture in the cavity, which showed a 6.4% difference between humidity in the cavity and ambient humidity.



When assessing ERH we want to see readings within 10% of one another

### Other considerations (steel frame)



- We checked the surface temperature of the steel frame and recorded it at 12.9°C, 2.6°C above dew point temperature.
- What effect does the dry CWI have on the temperature of the steel frame?
- It raises the temperature!
- Without the CWI would the steel frame be at more or less risk of cold surface condensation occurring on the frame?
- So with more risk of cold surface condensation would you agree that there is more risk of corrosion?



Surface temperature of steel frame above dew point with blown fibre CWI installed!

### Retrofit CWI and Wall Ties



- Going back to the BBC Wales X-Ray programme, the resident involved, was reported as making the following statement...

She had CWI installed in 2003. Her house is now full of cracks because the wall ties in the cavities have rusted away.

Heather said: "We've had water come through the walls. The render falls off, the plaster falls off. We have to keep re-rendering, re-plastering."

A report carried out by a member of Ciga's staff said the structural problems at the house were not caused by CWI and blamed other factors – including vibrations from the nearby railway. They suggested that Network Rail could pay some of the costs.

### Retrofit CWI and Wall Ties



- So there is now a suggestion that retrofit CWI is now responsible for cavity wall tie failure
- Should we be concerned at the potential for chemical reaction between the insulant and any embedded steel?
- Phenolic insulation is known to cause corrosion of steel, and a number of law suits are pending in the states particularly with regard to corrosion of steel roof decks.
- Both blown fibre and polystyrene beads are inert when in contact with embedded steel
- There is not a shred of evidence to support a causal link between retrofit CWI and wall tie failure; the issues of wall tie failure are well known and understood.
- The diagnostic process for wall tie failure remains unchanged and if we identify that ferrous wall ties have failed then why should we now be looking to blame CWI for this problem?
- You should maintain current knowledge and practice of investigating steel corrosion in masonry walls

### Corrosion of Metal



- Corrosion of ferrous building products is an age old problem, which was well known and understood before the current trend for blaming all ills on CWI.
- Cavity wall ties
- Steel lintels
- Steel reinforcement to concrete corrodes (Carbonation)
- Where we find corrosion to wall ties the corrosion is concentrated in the mortar joint and not the air gap to the cavity, why is this?
- Like concrete, mortar gradually loses alkalinity at which point embedded steel corrodes



**Wall Tie Placement**

Approx. 6 brick courses

Horizontal cracking

X — NORMAL SPACING OF WALL TIES

**Visual Signs of Wall Tie Failure**

**Investigation and Replacement of Wall Ties**

1. The presence or absence of retrofit CWI does not change the investigative process.
2. Endoscopic Survey
3. Use of metal detector
4. Stitch drilling
5. Removal of wall ties
6. Remedial wall ties

**A call to investigate failed CWI**

- We were called to investigate penetrating damp to the rear of a mock Georgian townhouse
- Retrofit blown fibre CWI was installed
- The cause of the dampness was obviously defective rainwater goods but how was this moisture crossing the wall cavity?
- The client believed it was the CWI insulation

**A call to investigate failed CWI**

- Calcium Carbide testing proved that moisture was present at depth to the inner leaf of masonry
- However, moisture was concentrated around the window reveals
- Borescope inspection showed the CWI to be loosely filled and poorly installed but it was dry and clearly not responsible for the penetrating damp
- We suspected the cavity closer and advised the client to have them exposed at the window reveals.

We consistently find that penetrating damp has a far simpler technical explanation than failed CWI!

**Another call to investigate failed CWI**

- We were called to investigate penetrating damp to the utility room at the rear of this Midlands property
- Retrofit blown fibre CWI was installed
- The cause of the dampness was obviously the defective overflow pipes but how was this moisture crossing the wall cavity?
- Water was pooling at the wall base causing more severe saturation at the lower levels and high ground levels helped splash from the overflow to bridge the DPC
- The client believed it was the CWI insulation when in fact it transpired that none was installed

**Another call to investigate failed CWI**



- Again we checked for moisture at depth to the inner leaf of masonry, which returned a high reading of over 2%
- We actually took the wrong calcium carbide meter with us, this is the one we usually use for floor testing





**Another call to investigate failed CWI**






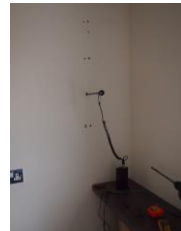
- The wall base was visibly saturated
- Electronic borescope inspection showed the base of the wall cavity to be blocked with debris.
- Yet another case where a far simpler technical explanation could be found!

**Yet another call to investigate failed CWI**




- This Leeds bungalow was suffering from a number of damp related problems and we were called to carry out a full damp investigation
- The building was primarily affected by severe cold surface condensation and mould colonisation
- We knew this because we consistently found that there was no significant moisture present at depth to most walls, despite the internal decorative spoiling
- In fact the cavity in this case was unsuitable for CWI because it was less than 50mm in width
- Walls were measured at 270mm including external render and internal plasterwork

**Yet another call to investigate failed CWI**

- In fact borescope inspection proved that no CWI was installed, despite the owners assumption that it was
- A condensation risk assessment returned the following results...




Internal relative humidity was recorded at 83.3%, Ambient temperature (T<sub>a</sub>) was recorded at 14.4°C and dew point temperature (T<sub>d</sub>) was recorded at 11.9°C

Wall temperatures were taken throughout the property and the following readings were observed:

|               |         |
|---------------|---------|
| Kitchen       | = 7°C   |
| Hall          | = 8°C   |
| Subroom       | = 7°C   |
| Rear bedroom  | = 6.7°C |
| Lounge        | = 8.8°C |
| Front bedroom | = 6.7°C |
| Bathroom      | = 6.7°C |

Did this property have an active condensation damp problem on the day of inspection?

**Yet another call to investigate failed CWI**

- We recorded high readings for moisture at depth using both deep wall probes and calcium carbide only to the rear elevation of the property.
- In particular the rear bedroom wall was saturated in the corner with a TMC of 10.4%


**Yet another call to investigate failed CWI**






- The garden wall directly abutted the building without the benefit of a vertical DPC
- There were high ground levels caused by decking and bridging of the DPC by the external render
- But how was moisture transferring across the cavity since no CWI was installed.
- The building owner opened up the wall himself and in his words, "raked out a tonne of debris."
- Yet another case where a simple technical explanation was proven to be the cause!

**Do not be diverted from the damp investigation process!**




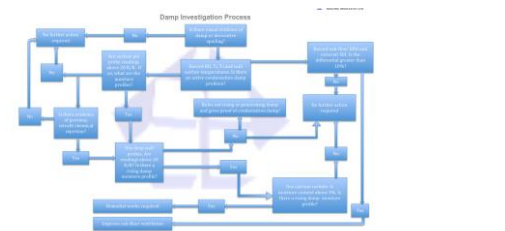
- What these case studies show and what we consistently find is that internal damp is very rarely caused by failed CWI
- A poor CWI installation does not equate to a conclusion that it is causing damp. Correlation is not causation!
- The answer is often to simply have poorly installed blown fibre topped up.
- Recognise that the number one damp problem is condensation damp and so long as the CWI is dry then it will significantly help to combat this problem!
- If specifying from scratch always recommend polystyrene beads and not blown fibre!
- If investigating alleged CWI failure then the process to follow is as follows
- Carry out your usual external inspection noting any defects and further noting whether there are regular holes indicating that CWI has been installed.
- Carry out a condensation risk assessment.
- Check walls for dampness at surface in pin mode. (Are readings >20% relative?)
- Check walls for moisture at depth using deep wall probes (Are readings >20% relative?)
- If so, test for moisture at depth using calcium carbide. Generally we consider any figure less than 1% to be of little consequence.
- This would rule out any moisture crossing the cavity and therefore rule out any alleged CWI problems.

**So what if you find moisture at depth in the masonry?**




- This does not in itself mean that CWI is to blame
- Ensure you have fully investigated the external defects and understand the initial cause of moisture
- You can carry out an ERH test to assess levels of interstitial humidity and condensation.
- Ensure you take a benchmark reading for ambient humidity!
- Inspect the cavity using a Portascope or electronic borescope
- Remember if CWI is installed then you'll see very little and the wall may need opening up for inspection.
- If you open up the wall, the chances are that you'll find perfectly dry blown fibre CWI
- Remember that if you open up a wall containing polystyrene beads then you may lose a lot of material.
- If blown fibre is installed, feel the bottom of the cavity, is there any wet slumped material?

**The Damp Investigation Process Should be consistent!**

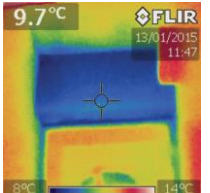



The flowchart illustrates a systematic approach to damp investigation, starting with 'Visual Inspection' and 'External Inspection', leading to 'Internal Inspection', 'Damp Investigation Process', and finally 'Damp Investigation Report'.

**Condensation Risk Assessment**




- Condensation damp is still by far the number one issue affecting older solid walled properties. Cavity wall insulated properties are statistically far less prone to this problem. Why is this?
- An active condensation damp issue is easily revealed with a basic condensation risk assessment to check relative humidity (RH), ambient temperature ( $T_a$ ), dew point temperature ( $T_d$ ) and wall surface surface temperatures.
- If you find wall surface temperatures below dew point temperature then you have proven that an active case of condensation damp exists on the day of inspection.

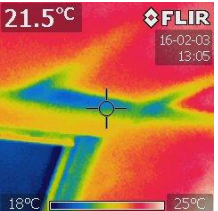


Thermal imaging can be a great tool for highlighting direct thermal bridging or cold spots

**Dealing with Condensation**




- Condensation damp is very rarely attributable to 'occupancy' issues and there is no way of directly proving an occupancy issue.
- You should first ask yourself:
  1. Is the building fabric dry and well insulated?
  2. Is there an effective and fully controllable heating system installed?
  3. Is there an effective means of mechanical extraction installed?
- It is only by exclusion of these three factors that you can reasonably and positively assert that occupancy issues are to blame. Please read [this](#)
- Occupants cause humidity but buildings cause condensation!



Here an old building with 'rooms in roof space' has been thermally upgraded. Thermal imaging revealed insulation voids and subsequent cold spots. If mould forms on these cold spots is this because the insulation was installed or because the installation is incomplete? Why is this situation any different to a CWI installation in a wall?

**Proving that Dampness is caused by Condensation**



- If you do not get a positive result for active condensation damp, this does not mean that the property is unaffected. The risk assessment is only good for that day.
- Are we in the condensation season? (October to May)
- Ultimately, proving condensation damp requires the same diagnostic trigger points and process, as for all forms of damp.
- We need to test for moisture at depth... Why??
- Because condensation damp will only ever wet the plasterwork and not the underlying masonry!
- So if we record high electronic pin readings (>20%) at the wall surface but low readings for moisture at depth ( $\leq 20\%$  using deep wall probes or  $<1\%$  using calcium carbide) then the wall surface dampness is caused by condensation.
- BRE 245 states that walls should not be considered as requiring remedial action unless a figure of 5% or more is attained from carbide testing. In our opinion this figure is too high and we generally work to a 3% maximum figure because we consistently note that this figure is high enough to cause decorative spoiling.
- When testing for condensation we use a 1% figure because dry walls are usually 0% TMC and figures above 1% TMC can contribute towards a secondary condensation damp problem.
- What is secondary condensation damp?



Secondary Condensation Damp



- Wet building fabric provides a number of other issues besides the obvious one of decorative spoiling.
- Wet building fabric can contribute to internal humidity levels due to moisture evaporating from the fabric.
- Wet fabric has a much reduced thermal value and therefore takes much more heat to increase its temperature above dew point
- This means that it will be at significantly increased risk for what we call secondary cold surface condensation



Thank you for your time. We'll now have a short Q&A session but if you have any other questions relating to this presentation after the Q&A, please feel free to email or call me at:

[joe@maloneassociatesltd.co.uk](mailto:joe@maloneassociatesltd.co.uk) or call 0800 0437732

Please visit:

[www.maloneassociatesltd.co.uk](http://www.maloneassociatesltd.co.uk)

[www.buildingdefectanalysis.co.uk](http://www.buildingdefectanalysis.co.uk)

- Finally, we can not create damp experts within the space of a 45 minute presentation but if you do have any unusually complex cases or require expert advice then please give us a call. We are also one of the leading UK experts in EWI system failures and floor screed system failures.

