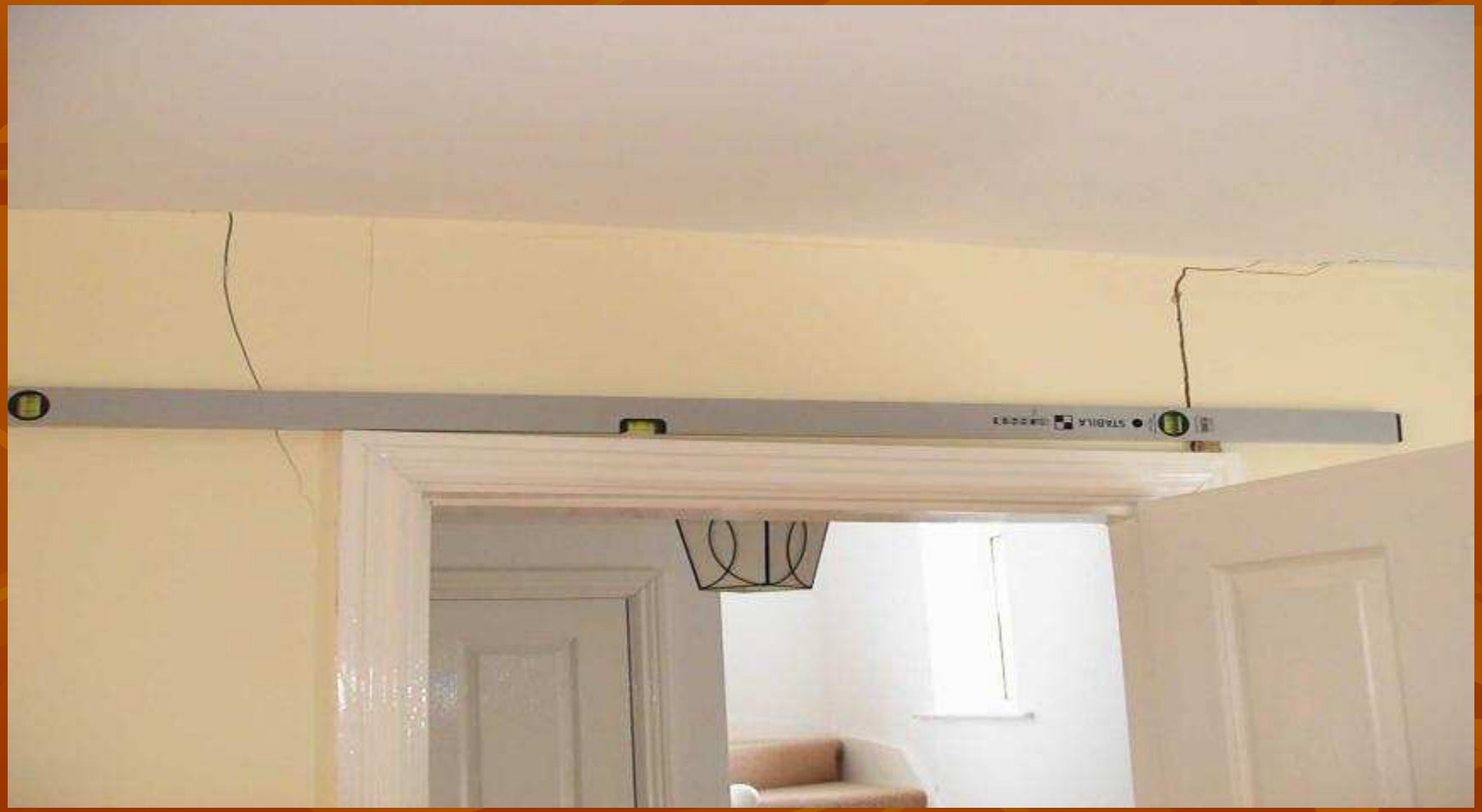
Pyrites the Building Control Experience

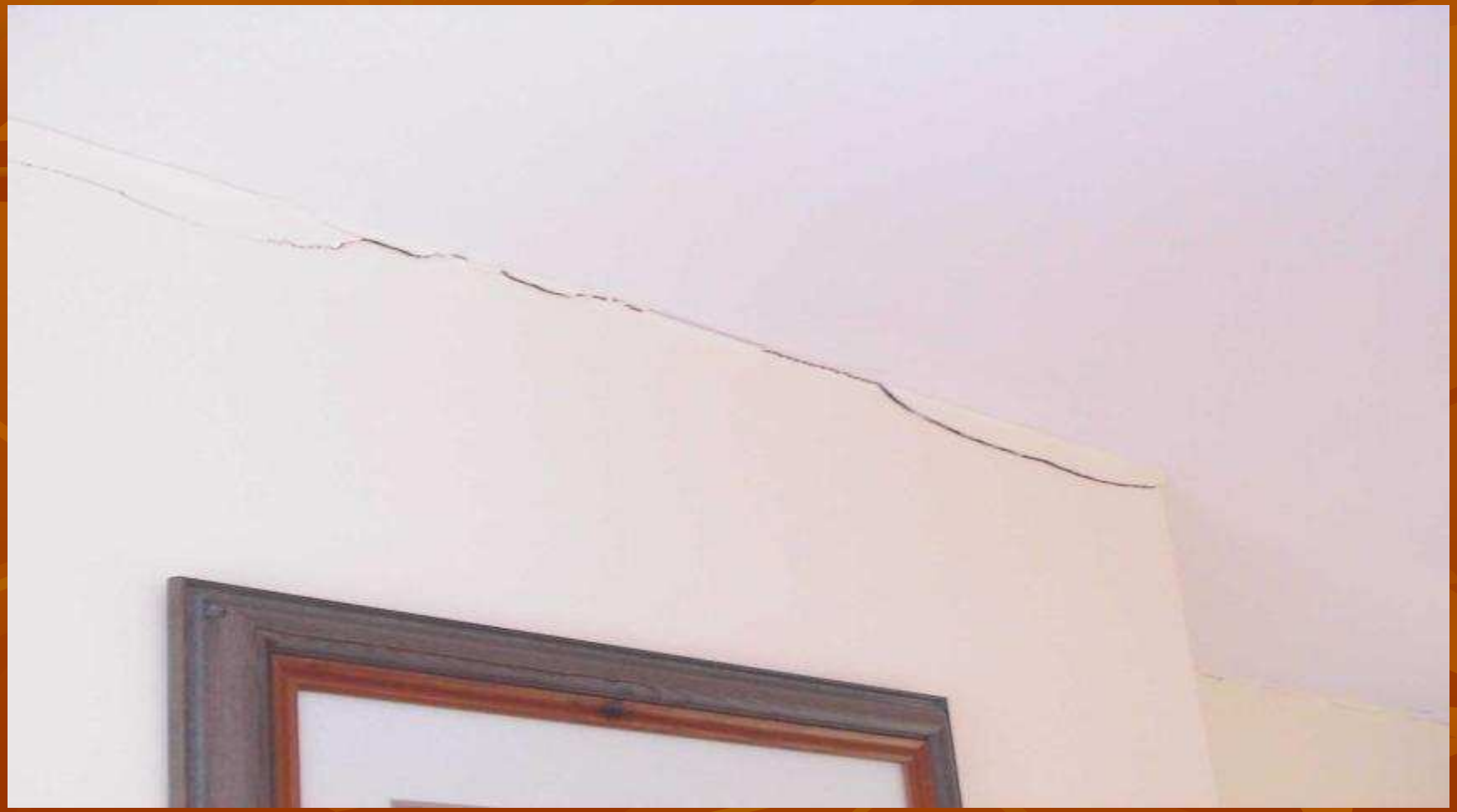
IBCI Conference 2008

Structural Cracks on internal walls

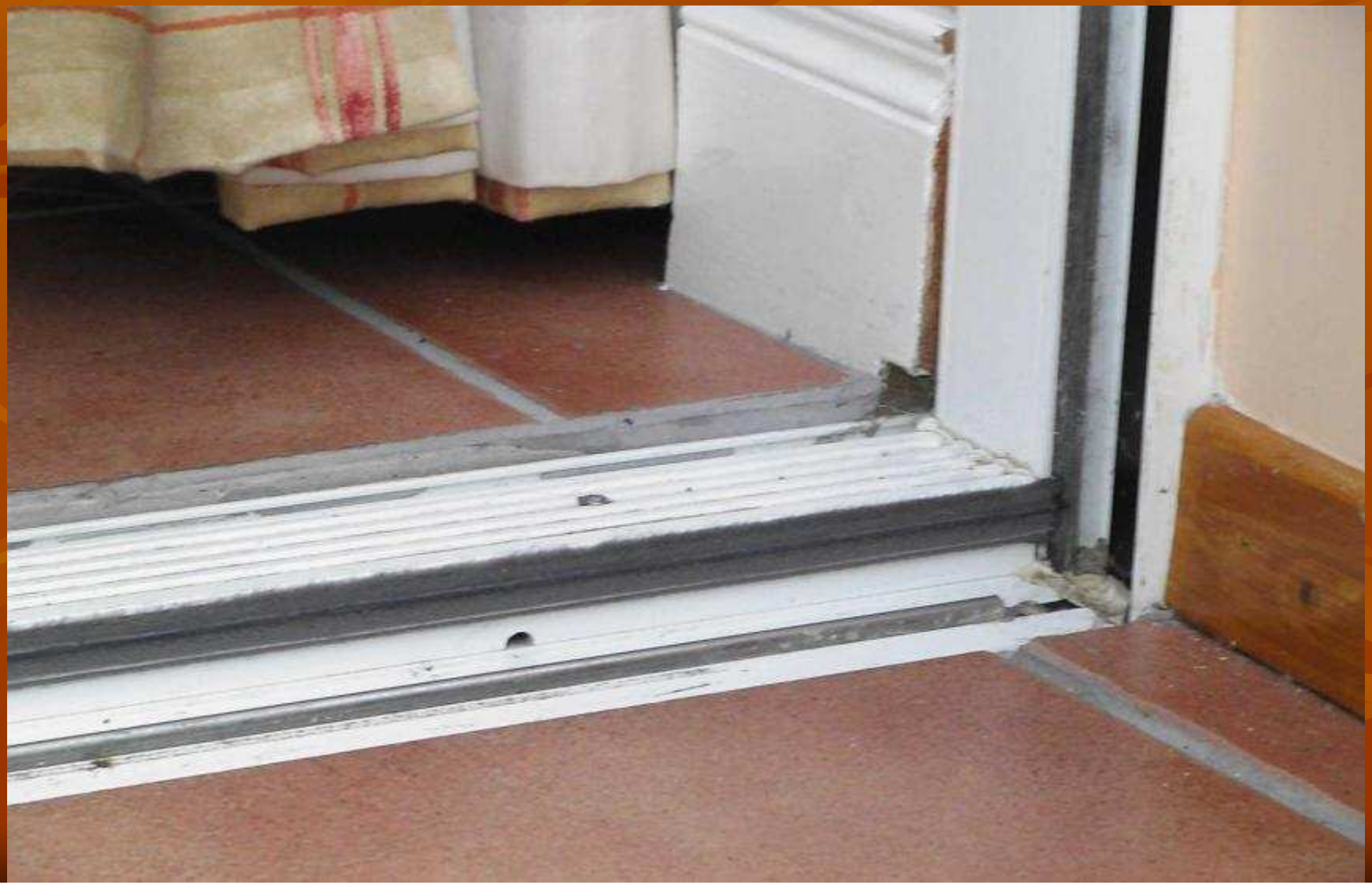


Bulging Internal Wall

Horizontal cracking at ceiling level



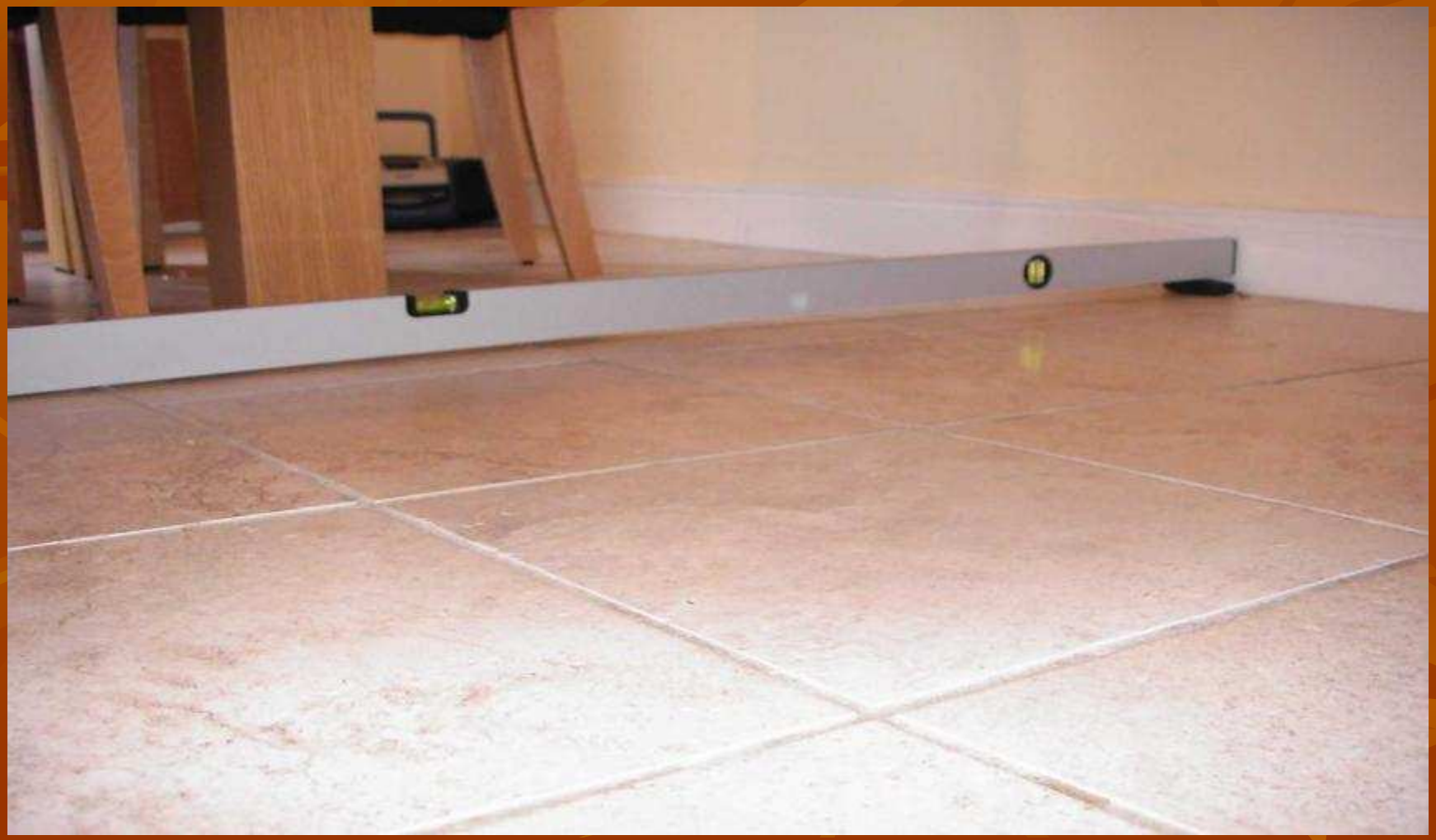
Pyrites Causing floor to rise



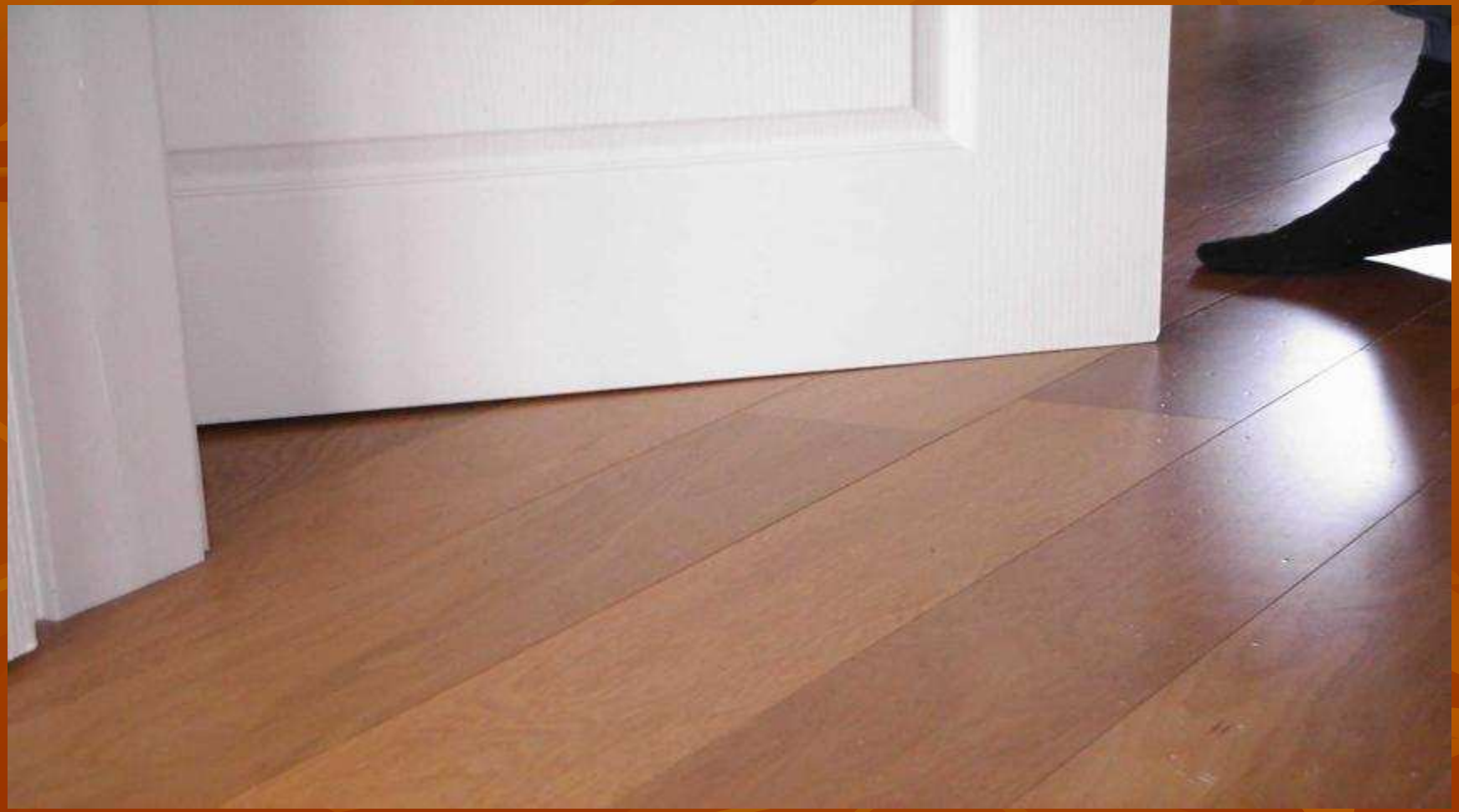
Pyrites in Rock

Pyrites in Shale Slate Rock

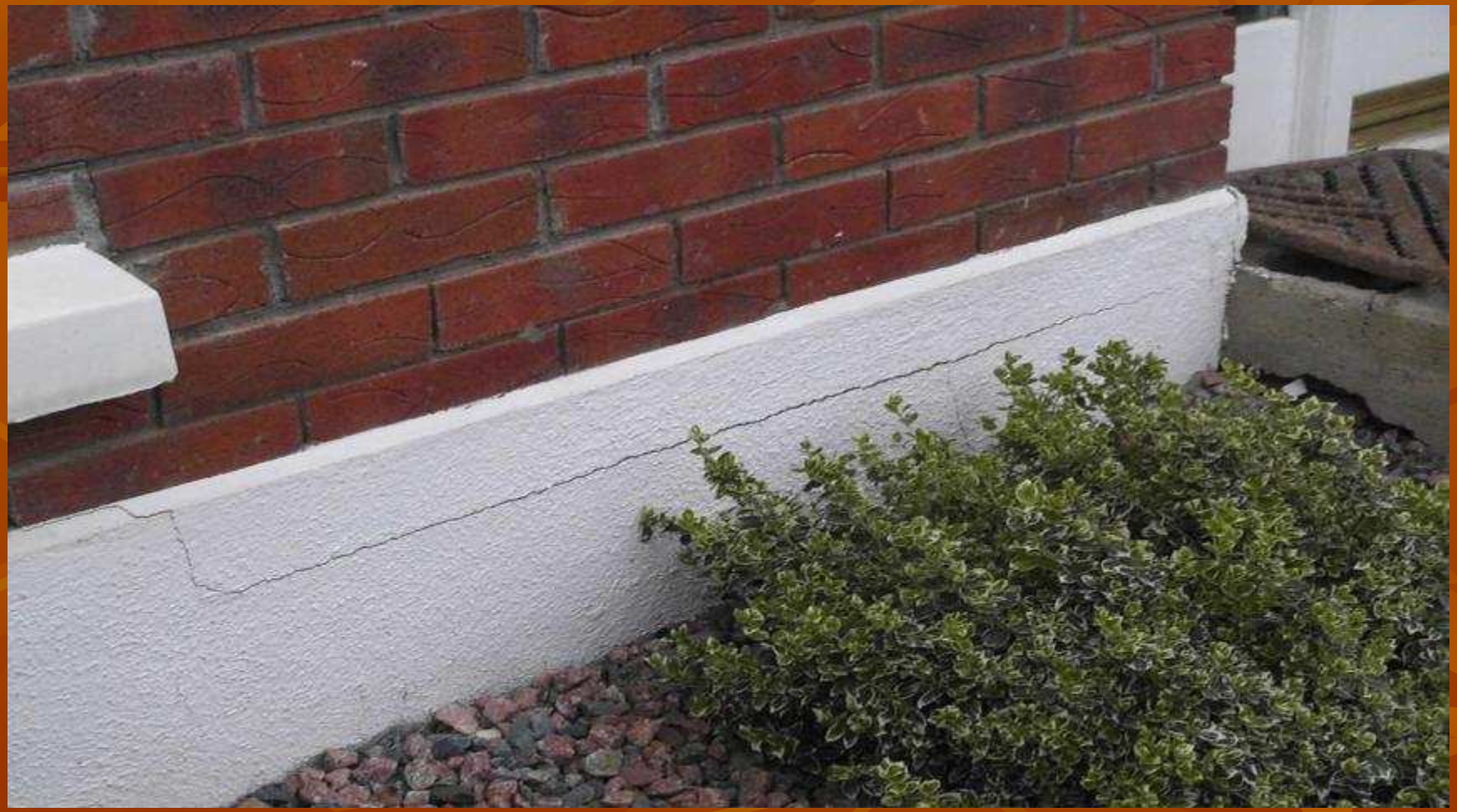
Bulging Floor caused by expanding pyrites



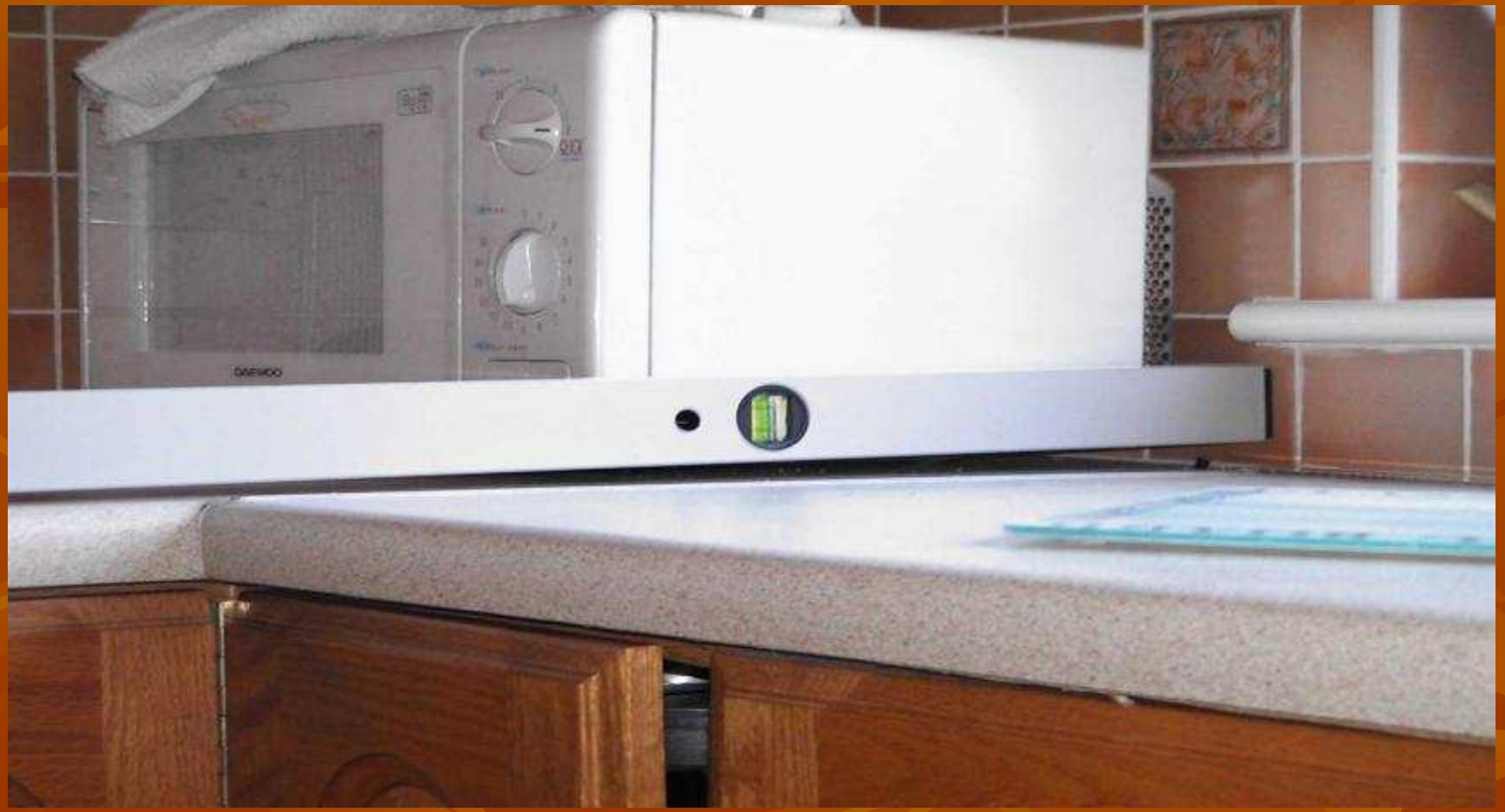
Internal door jamming



Structural Cracking



Kitchen Work Top Raised



Current Position

- Structural faults occurring in buildings in Dublin area
- Builders, Designers, Structural Engineers, Insurers dealing with pyrite faults on one to one basis
- NSAI have amended S.R.21:2004 specification for hardcore aggregates for unbound & hydraulically bound materials for use in civil engineering work and road construction.
- The amendment that came into effect on 7/12/07 deals principally with the provision of a guidance specification outlining properties required for granular sub-base materials used under concrete floors and footpaths. Materials supplied based on this guidance may also need an evaluation of rock mineralogy in order to ascertain it’s suitability for the proposed end - use
- Class Legal Action developer and quarry owners in progress

Structural Damage to Building

- Concrete ground floor raising and showing spider web cracking
- Structural walls below DPC level bulging out
- External and internal wall showing cracks from floor to roof
- Internal doors jammed open or shut position
- Internal load bearing and partition walls resting on concrete over pyrite material can result in major cracks to the structural internally and externally

Pyrites – Limestone – Chemical Reaction

- Pyrites Two types
- (a) Copper Pyrites – $CuFeS_2$
- (b) Iron Pyrites – FeS_2
- Iron Pyrites-Sulphur oxidises to form Sulphuric Acid H_2SO_4. the acid reacts with the calcium carbonates (e.g. limestone).
- This chemical reaction produces sulphate and can form gypsum whose crystallization will cause the stone to burst and the hardcore to swell

Building Regulations - Pyrites

- Hardcore filling controlled by
- TGD. C Section 3.1.4 (b) Should be suitable material clean & free from matter liable to cause damage to Concrete.
- TGD. D Section 0.1 (a) Materials should be of a suitable nature and quality in relation to the purposes and condition of their use.

Pyrites Problems – Geology Background

- Problems caused by swelling rocks first reported in USA around 1930.
- In 1997 Montreal Association of Engineering Geology held a scientific conference on the subject.
- Later a Canadian TV programme exposed the scope of the problem.
- Since then more than 1,000 cases have been recorded in Canada.
- Cases in Canada occur in buildings from 8 – 20 years old
- In the Dublin Region it was first noticed in buildings 3-4 years old
- What was Forbart have a record of pyrite damage to a detached one off house in Clare in 1996

Remedial Works Canada

- Due to slow rate of swelling Canadian Government & Municipal Authority provide grants to cover some elements.
- Elements covered are removal and replace of floor slab, hardcore and possibly repairs to the walls and elements of the structure damaged by the lifting floors.
- A maximum grant of $18,000 per single dwelling is allowed.

Fingal Co.Co. Building Control Experience

- Came to notice of Building Control authority in July 2007.
- Problem identified by developer in early 2007.
- Source seemed to emanate from a single quarry source.
- Quarry in business about 5 years.
- About 500,000 tonnes of material taken from quarry.
- Pyrites problem known to be on 4 sites in Fingal area.
- Pyrites problem in buildings as early as 3 years old.

Building Control Action

- Action in relation to buildings completed and occupied with pyrites in hardcore under floors
- Action in relation to buildings under construction and buildings completed but not occupied.
- Action to prevent pyrites to future construction

Action in relation to units containing pyrites

- Building Control Authority received no complaints from property owners.
- Developer repaired pyrite faults on one to one basis with occupied dwellings.
- Pyrites was removed from unoccupied dwellings prior to sale.
- Some dwelling owners taking legal action against builder/ developer.
- Developer taking class action against quarry owners

Action to prevent pyrites future damage to buildings

- Source quarry, CIF, Insurance underwriters & DoEHLG were notified of pyrites problem and asked to warn specifies, designers & builders of this hazard.
- Property owners, designers and builders on Commencement Notices submitted since Jan 2007 are notified of the pyrites hazard, warned to only use hardcore materials analysed & certified not to contain chemicals or metals that may render the material unsuitable for the purpose intended.

Building Control Lessons Learned from Experience

- Much goodwill & positive response from public and elected representatives following warning letters in relation to pyrites hazard.
- Building Control proactive preventative policy much more satisfactory than legal enforcement action.
- Proactive letters currently sent out to designers & builders listed on commencement notices to carry out test at the appropriate time on dwellings prior to occupation in relation to;-

1. Air tightness to achieve best energy ratings and air-bound sound TGD Part E compliance.
2. Air-bound and impact sound test in all multi developments to achieve full compliance with TGD Part E

Future Pyrites Risk

- That pyrites hardcore in current buildings little beyond what has shown up to date – This can be managed by the building and insurance industry
- That the problem is much greater than currently known – Independent inspection evaluation process needs to be put in place. Followed by long-term insurance compensation supported by the property insurance industry

Future Local Authority Building Control Support

1. Building Control can best serve the industry by controlling the pyrites at the quarry source.
2. Quarrying activity should be matched by a corresponding testing of materials to satisfy compliance with the amended NSAI S.R.21 Clause 3.4.2 Total sulphur < 1% by mass of aggregate & Annex E which advises that a detailed mineralogical examination be carried out by a suitable experienced petrographer.
3. Control can be managed by checking that hardcore delivered to sites is properly certified

END of Presentation

- Thanks for your attention
- Best wishes
- Joe Boyle