Verulam

Readers' letters, comments and queries

HAVE YOUR SAY

Send letters to…
All contributions to Verulam should be submitted via email to: **tse@istructe.org**

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Restoring Notre-Dame

PETER SPARKES

It was great to see Professor Jacques Heyman writing in *The Structural Engineer*, in his Viewpoint article (July 2019) on the fire at Notre-Dame cathedral. As usual, an excellent engineering appraisal coupled with invaluable information on the history of the building and other cathedrals affected by fire.

I agree with his point that repairing Notre-Dame's damaged crossing is an opportunity for innovation. Figure 4 in the article gives a clue – the current hole in the roof is letting in a good amount of natural light. Why not construct a transparent structure in the roof area that continues this, allowing light in during the day? The new structure could also incorporate artificial light at night, to shine both inside and out, and show off the great cathedral at night as desired – declaring that it is restored and revitalised.

This new structure could be a fleche or dome, or other. As necessary, a lower ceiling, also predominantly transparent, could hang from the main structure, to blend with the adjacent ribbed vaults. With good design, new materials would not offend the existing structure. Once upon a time, the gothic form itself was new.

There will be those who think this is a great idea, and those who think the opposite! Those who travel through many European cities will be enthralled by the old architecture. Actually, much of it is postwar fakes, to 'restore' terrible war damage – but nevertheless widely appreciated.

Rising cost of PI cover

STEVE COCKAYNE

As a single practitioner, I am suffering the effects of other engineers' professional indemnity (PI) claims with my premium doubling each year for the same cover. My list of risks stays the same, so these increases are fast pricing me out of business. Premium costs can now be around 10% of my modest turnover.

My current broker has been informed by his governing body that insurers in our sector are losing huge sums over architects' and engineers' claims, to an unsustainable degree. Hence, many insurers no longer offer PI cover. Others are now quoting ridiculous sums and also only offer cover for 'aggregate' claims, not 'each and every claim'.

> "AFFORDABLE PROFESSIONAL INDEMNITY COVER IS PARAMOUNT TO OUR BEING ABLE TO PRACTISE

What efforts is the Institution making to mitigate this approach with insurers/underwriters? Who can I speak to regarding getting reasonable insurance?

I have read Business Practice Note No. 10: *Risk and professional indemnity insurance*. It needs updating as the cover range is mentioned (£250 000 to £20M), but not the high premiums being levied. When this article was published in October 2017, my premium for £2M of PI cover was around £2000; my premium for the same cover this year is £8500. Where is the logic for that increase apart from it being a reaction to the claims other engineers are having made against them? I don't see anything in *The Structural Engineer* regarding claims. It seems to be a taboo subject.

I suspect the Grenfell Tower tragedy is one reason, but I'm searching for others. Grenfell was obviously not a structural failure, but we are all tarred with the same brush as far as insurance goes. The Grenfell structure actually held up magnificently for an old building in such a severe fire. Why, then, should engineers be punished financially for such good work?

In my PI application documents, I am now specifically asked how many storeys my building work takes place in and whether I work in sectors of basements or swimming pools. High-rise structures and basements, of which there are very many on site at present (and possibly failing in some way, leading to claims), must be the trigger.

One niche I do work in, and have done for over 10 years, is crane stability checks. Insurers now regard this as 'high risk'. My specific job is to make the risk of crane instability 'low'. I make this very clear and explain how this is achieved, yet insurers seem to think I am involved with every shackle and lifting block. I am not: the crane companies do that and they have huge cover. Essentially, a crane base is a foundation and one with no 12-year residual risk!

Some questions for us all regarding claims:

- Is it over-reliance on computer calculations and analysis without reality checks?
- Is it poor checking?
- Is it poor supervision on site?
- Is it a 'hands off' approach to uneconomical or unbuildable structural designs, which cannot be changed, but still are built?

I just don't know, but I would welcome any views on this, as affordable PI cover is paramount to our being able to practise. Nevertheless, I think we should all look at ourselves and make every effort to stop claims happening, not least as it's costing me a fortune!

This is a heartfelt plea from Steve. Let's not look upon this as an individual case of hardship, but follow Steve's suggestion that we should all look at ourselves.

For the last few months, the Verulam pages have been filled with discussion on settlement, subsidence, domestic stability issues, site construction not being as intended, etc.

Anecdotal feedback suggests there are far too many errors, all costing a great deal of money. Let's all contribute to constructive efforts to try and whittle incidences down. *The Structural Engineer* will no doubt play its part by considering what to publish to help all of us improve.

Subsidence and insurance reports

PAUL CLIFFORD

I write as someone who has worked in the loss adjusting industry for 27 years, gaining dual qualification as a chartered loss adjuster.

The insurance policy is a consumer contract between an insurer and policyholder and so is subject to consumer contract law. Under such laws, where a term such as 'subsidence' is not clearly defined in the contract, interpretation is to fall as per the weaker party's reasonable understanding. The Financial Ombudsman has ruled that the lay person makes no distinction between settlement and subsidence and so they are interchangeable terms in relation to operation of the insurance contract. Thus, our technical definitions become irrelevant.

Recent letters demonstrate a lack of basic background reading by those preparing reports that will be used to substantiate insurance claims. It is not unreasonable to expect that we, as engineers, should at least read a sample policy, maybe our own house polices, to gain a better understanding. The time involved is recordable as CPD after all.

Landmark case law defines that what is insured 'is not the bricks and mortar, but the financial interest in the property', i.e. the remedy following a claim must put an insured back to the financial position they were in before the loss. Thus, increased excesses and premiums following a claim can be said to breach the requirement. However, this response is partly due to our own failings as a profession in handling insurance claims. In my experience, it is frequently the case that engineers preparing reports are acting outside their competency.

As a case study, a few years ago I was asked to take over a case from a loss adjuster that had run for several years with no resolution in sight, the claim being the second for damage in the same part of the house. In the previous claim, the gable was underpinned, but damage returned. The insured's engineer had undertaken more investigations and monitored cracks for a couple of years, but evidently was no closer to defining the cause and so the appropriate remedy.

My site visit revealed that what was not recorded was the presence of two large willow trees within 2m of the gable of a house built on shrinkable clay. Thus, the remedy that was soon enacted was to remove the trees and repair cracks, which is what should have happened at the time of the first loss. Instead, insurers funded unnecessary underpinning, two sets of repairs and two sets of fees. The insured suffered many unnecessary years of living in a damaged house.

> "THE LAY PERSON MAKES NO DISTINCTION BETWEEN SETTLEMENT AND SUBSIDENCE

There are some in our profession who prepare reports without any detailed comprehension of possible causes of damage to a building. They proceed on the basis that any crack must be subsidence related. Others stray into fields that are alien to engineers, with one recently claiming detailed knowledge of root spread and influence of a tree that they could only define as a 'conifer'.

In conclusion, there is a need for us to ensure that we take on cases only where we are satisfied we are competent. Most of us have inadequate training in the inspection and reporting required for existing buildings.

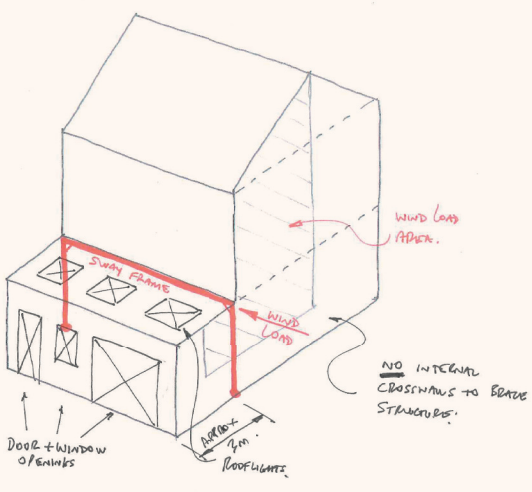
This is a cautionary tale and raises some important points. It is, indeed, true that pinpointing the cause of visible building 'stress' can be difficult.

Engineering in the domestic sector

ANDY GREENWOOD

I would like to reply to the letters on 'Lateral stability in domestic situations' (Verulam, September 2019), responding to my previous letter on 'Engineering in the domestic sector' (August 2019).

Sway frames are not specified 'by default', but only as a 'last resort'. Like any good engineer, we are well aware of the options available to us and would always explore these first. I am sure we are well aware that large piers and returns can sometimes be justified to provide sway resistance.



Perhaps I should have anticipated some of the responses by explaining that the house in question (new build) had *no* cross walls on the ground floor, could not have piers in lieu of columns, and the rear extension wall and roof were peppered with holes (see sketch).

I agree with Keith Rawlings that these frames should not automatically be installed, and it should not be a 'kneejerk' reaction. Nowhere in my letter did I suggest this. A study of my enclosed sketch will show that none of the options suggested by Don Stevenson and Keith Rawlings are available to assist with lateral stability; as such, the 'last resort' is the sway frame.

In this instance, I have not been able to justify anything but the sway frame, and despite requests to my client for calculations from the previous engineers, who managed to obtain Building Regulations approval without the frame, nothing credible has been forthcoming. Let's also remember that the awarding of Building Regulations approval is not a guarantee of structural competence and does not remove responsibility from the structural engineer.

Despite over 40 years working for contractor and developer clients, I am always keen to learn from the experiences of others, and in part this was the purpose of my original letter. In this instance, nothing new has been forthcoming, and for the house design enclosed I have been unable to justify anything other than the sway frame.

I don't know the thought processes of those 'other engineers', but in this instance, I don't think I would own up to being one of them.

I would like to thank all the respondents for their kind input.

DAVID WADSWORTH

We have a small consultancy working mainly in the domestic sector. In any one year, we probably have 150 projects where a substantial part – more than two-thirds – of an external wall is removed or opened out and we detail sway frames.

For single-storey or lightly loaded frames, we would design a portal like Andy Greenwood's sway frame. However, for more heavily loaded frames in two- or three-storey buildings, we ditched the goalpost-type frame a decade or so ago and these days use a full frame, with columns pinned at the top and a moment connection at the bottom where it connects to a ground beam.

The reason for this is that designing the column top connection for full portal loads, dead and live plus sway, produces a heavy connection, sometimes with stiffeners and haunch. This is often difficult to accommodate in the internal finishes.

We pin the top beam-to-column connection and apply the wind or notional lateral loads at the top of the frame. The column acts as a cantilever with a base moment connection, but this can be buried below floor level. We are happy that this avoids the need for new pad foundations under the columns because the ground beam acts as a spreader and distributes the loads back into the existing foundations.

Of course, we have found it impossible to predict by calculation the forces and deflections of the ground beam on existing foundations (details of which are often assumed at the design stage). All we can say is that these frames work and settlements are always acceptable if not non-existent. There is a small increase in steel weight offset against foundation costs and intrusive connections.

One benefit of Verulam is that members can share their experience and good ideas. Thanks are due to David.

JOHN BENDER

Following letters from Simon Smith, Don Stevenson and Keith Rawlings (September 2019) regarding the use, or not, of lateral frames, I felt I had to comment. I've been prompted by two site visits, both involving single-storey rear extensions 3m out from the house.

In both cases, I had extended existing external walls by bonding in the new wall to the existing, with the distance from the centre buttress wall to the extension rear return about 6m – which is well within the 'deemed to satisfy' condition of the Building Regulations paragraph 2C17, or 12m.

I had noted that the new wall was to be bonded to the existing wall and even noted that use of a wall starter was not permitted, as I needed a continuous wall below the padstone.

The builder ignored my note and not only used a wall starter, but even had a 50mm mortar joint between the rough-cut blocks of the removed rear wall and the new wall. The building inspector had apparently agreed as long as I wrote to confirm, which to my mind suggested the inspector knew the construction was inadequate but wanted to avoid involvement and left me to face the builder's wrath.

Keith Rawlings is right when he says the structure should be considered on its merits, but there comes a point where accepting the lack of knowledge some builders show for structures means that the design has to be foolproof. Providing a frame and detailing the junction between the stanchions and the walls would help eliminate the lack of tie and also provide a lateral restraint to the side wall. This stanchion can be set on the inner leaf line, with the walls built into the web with some form of frame tie shot-fired to the steel. This also hides the difference in cavity width between existing and new walls.

I would normally design this as a box with a base beam under the stanchions to redistribute the loads back along the existing foundations, rather than installing two concrete pad foundations. The additional steel cost is less than the cost of underpinning the existing walls. I would also detail a moment connection at the stanchion top beam connection (which is queried most of the time by the builders as they want to sit the top beam on the top of the stanchion).

I would take exception to the comment made by Simon Smith to change the law so that the structural calculations are signed off by a chartered engineer. Being an Associate-Member who was elected in January 1987 and has worked in the domestic market for the past 40 years, I fail to see the logic in saying my years of experience are not as relevant as a recently appointed chartered engineer. I know many RICS members who also have a knowledge of structure and produce calculations for building control of a similar standard to those by a chartered engineer.

> "I FAIL TO SEE THE LOGIC IN SAYING MY YEARS OF EXPERIENCE ARE NOT AS RELEVANT AS A RECENTLY APPOINTED CHARTERED ENGINEER

I agree that the calculations and architect's drawings should contain the name and address of the designers, but just because someone decides not to be a member of an institution, does not mean they are not qualified and not competent.

John highlights a couple of generic problems which occur not just on domestic projects, but also on larger-scale ones. The first is the frequency of reports that contractors have not followed 'design intent'. The second is that such errors will not be picked up if site inspections are not made. And that puts parties in danger.

Verulam has sympathy with John's view of the skills of (non-chartered) designers. There is no doubt that many such engineers have vast experience which will automatically eclipse the skills of those recently chartered. On the other hand, we have many reports of outright incompetence: such as John's own description of his (probably) experienced builder.

In John's case, having Associate-Membership is a highly respectable degree of competence. The debate is how best to protect the public overall and that might be by requiring some level of qualification.

GRAHAM FLETCHER

I fully support Simon Smith's suggestion (September 2019) that the Institution should lobby parliament to effect a change to the law in the UK which currently allows the submission of calculations and drawings by unqualified agents acting on behalf of applicants. This arrangement is often undertaken on the basis of a minimal fee and without the benefit of any professional indemnity (PI) insurance.

I have regularly checked the structural aspects of such applications on behalf of local authority building control departments and am appalled (and indeed depressed) by the general standard of these submissions (many of which carry no reference to the author of the accompanying design calculations).

It is not uncommon for significant coordination issues to be present between calculations and drawings and for practical construction matters to be completely ignored. There is a heavy reliance on the use of software to generate member designs without any appreciation of how sections interact in terms of their loadings, bearings and connection arrangements. Stability and serviceability factors are usually completely ignored.

Often submissions are made with structural elements identified by ill-defined line lengths on the architectural plans without any necessary reference to bolting and/or welding requirements, bearing arrangements, etc.

The drawings submitted at Building Regulations stage are supposed to represent construction issue documents. Sadly, this concept appears absent in most cases and reliance is placed on the competency of the builder and building inspector to resolve matters which should have been properly addressed at submission stage.

This situation has arisen because there is a prevailing attitude that Building Regulations applications are an unfortunate and often last-minute evil and, as a result, minimal expense is afforded to prepare a competent submission.

I have observed this situation over a period of approx. 25 years of checking such commissions. If anything, the advent of relatively cheap computer software has accentuated the problem.

As Simon alluded, this is a matter that the Institution should be able to address. It should be mandatory that a competent chartered engineer has prepared, or at least checked, proposals before Building Regulations submission and that the latter member should also have pre-registered their PI verification certificate with the relevant local authority.

This process would also surely serve to enhance the standing of chartered engineers in the view of the general public.

Graham has strongly expressed views. Perhaps one comment is the emphasis on 'chartered'. John Bender's letter makes the case for the experience and competence of Associate-Members. Nevertheless, more views are welcome and no doubt the Institution will listen.

Assessing existing masonry

MATT LINSTER

As a graduate member of the Institution, currently working towards chartership, I thought I would invite members to express their views on the assessment of masonry in existing domestic/residential structures.

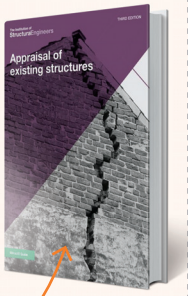
Whenever new openings or additional loads are added to existing masonry walls and piers in structures, it is the engineer's responsibility to assess the capacity of the remaining masonry and confirm its adequacy. This includes local bearing, vertical and lateral capacity.

I am quite concerned about the number of calculations and actual constructions I have encountered where there has been disregard for the existing masonry. Such examples include inadequate bearing beneath steelwork; inadequate lateral resistance to remaining wall panels; overloaded piers and walls; 'assumed' compressive strength of masonry and the interaction of early constructed cavity walls. On the latter, I would like to invite fellow members to offer their views.

I have read many texts on the typical compressive strengths of masonry and how varied the strength can be given a variety of factors. One example I came across was checks on a brick wall where the engineer had assumed a compressive strength of 30N/mm^2, which was almost at unity on vertical capacity; a second example was of a remaining pier which had three new steel beams bearing onto it with no checks. I ran some numbers and found the pier significantly overloaded above 10N/mm^2 (not to mention the effect on the footing).

Generally, the strength of a brick may be as low as 5–10N/mm^2 and, unless laboratory testing is done to obtain the strength, accounting for the interaction between the existing masonry units and mortar, then shouldn't engineers be wary of using such compressive strengths without sound evidence? Remember, the strength of masonry is not assessed on visual inspection alone!

Appraisal of existing structures (3rd ed.) is available from the Institution bookshop



My final point is regarding early cavity walls, in particular early twist ties. I would normally assume the inner leaf to act independently when assessing the capacity of the wall, given knowledge of such ties corroding and their frequency within the cavity.

I invite members to share their thoughts and experiences and ask the Institution for any recommendations on this for all engineers to seek further advice.

A difficult task we face is to justify the capacity of older structures. Many letters to Verulam show there are significant complications in what might be thought simple domestic structures. It is easily possible to destabilise them by making alterations. So, Matt is correct in cautioning about making assumptions. Assumptions might be required, but a degree of conservatism/realism is appropriate.

Matt's last point is an issue that has not been discussed for some time. When cavity walls were first introduced, the two leaves were interconnected by galvanised ties. These were found to corrode to an extent that the two leaves became disconnected: single leaves may bulge. Thus, caution is required in calculations when making assumptions about how the two leaves may work to stabilise each other or how wind load may be shared between the two leaves.

Inspection and maintenance

DAVID BRETT

I was fascinated to read the excellent Technical Guidance Note in September on workmanship and quality inspections by the structural engineer during construction. Inspection during construction is vital, as most problems with structures are usually experienced during construction, demolition, alteration, or caused by lack of maintenance or the knowledge that it was required.

When those responsible for maintenance are actually rewarded for saving money by reducing the scope of work, it's an accident waiting to happen. For aircraft, regular maintenance is mandatory, which is why it's rare for engine or air frame failure to be the cause of accidents. Health and safety has become mandatory in most cases, but the maintenance of building structures is usually optional and up to the building owner.

Inspection is also often difficult in reinforced concrete structures, as the reinforcement is covered by concrete, so sophisticated methods of inspection are required, such as 'pulsed eddy current' or 'backscatter computed tomography'.

Inspection of structures is a specialised area of our profession, which not many of our members have had the opportunity to study or practise. I only got into it by working in the oil industry on offshore structures, which tend to corrode rapidly but only have an operational life of around 25 years – far less than most other structures.

Much has been achieved in recent years through the CROSS initiative, but we also need to make our members aware of the need to inspect and maintain structures at regular intervals. For offshore structures, the 'class societies', such as the American Bureau of Shipping, Bureau Veritas and Lloyd's Register, insist on periodic surveys every two-and-a-half and five years. We can all learn from other industries and adopt their best practice procedures to make our structures safer.

David is absolutely right. All structures degrade and lose capacity over time. No one knows what will be found unless they look, and the objective of inspection is to catch degradation and reduce it before it progresses too far.

Stress relief

PETER SPARKES

I am responding to your invitation for ideas on desktop toys that demonstrate true structural engineering principles ('Newton's balls', Verulam, August 2019). This first photo shows my little chef standing proud, fully post-tensioned. The second shows the poor chap in a destressed state (or on the cooking sherry), caused by my fingers pressing under his base to relax the tension in his tendons, inside his body.

Verulam is disappointed that no one else has so far risen to the challenge. All manner of structural and physical effects can be demonstrated with desktop ingredients. Surely there is a market opportunity for someone?