

Comments by John Woodside of J Woodside Consulting Pty Ltd

CV

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John was educated in Melbourne, attended Melbourne University completing his degree in civil engineering in 1965. After post-graduate study, he worked in Melbourne from 1967 for 4 years with Milton Johnson and Partners before working in London for 4 years with Taylor Woodrow.

He returned to Australia in 1975 and worked as a consulting engineer for John Connell and Associates and then Connell Wagner (now Aurecon) in Adelaide, from 1976 to 2000 principally involved in high-rise buildings.

He commenced his own practice in 2001 as a sole practitioner and is the principal of J Woodside Consulting Pty Ltd. John has over 50 years' experience in the building industry in Australia and overseas.

He was on the concrete standard committee for AS3600 from 1986 until 1998 and is still on subcommittees associated with that standard.

He has specialised in the structural design of buildings and concrete buildings and is widely experienced and respected in that field. He has also had a very long involvement in prefabricated concrete both in the design and erection over the past 20 years or more. Some of his current projects include precast concrete for the Sydney Opera House.

John was elected an Honorary Member of the Concrete Institute of Australia (CIA) in 2005 for his services to concrete and was awarded the Lewis Kent Award in 2011 by the Institution of Structural Engineers for his outstanding contribution to structural engineering in Australia.

In 2006, he was awarded the John Connell Gold Medal by EA for his outstanding contribution to structural engineering and eminence in consulting engineering in Australia and overseas, as a Principal of Connell Wagner. He made a significant contribution to earthquake design and the concrete design in Australia.

Introduction

In my professional opinion, there is a missing element called quality in all of this discussion, and a need for excellence in both design and structural engineering, as well as building construction in Australia. When we are good, we are excellent, but when we are bad, we are horrible! By and large, the civil construction industry does not suffer these problems.

My comments largely are based on the structural engineering aspects of the design and construction of buildings and structures in Australia, but I have also commented on other issues which I think are important to be considered in this submission.

Unfortunately building regulators and building authorities around the country are not skilled or experienced in the design and construction of buildings and they will need advice from outside to arrive at the correct conclusions for this enquiry.

It is obvious that self-regulation of the building industry has not worked and the only alternative is some form of sensible regulations that works.

One only has to look at Singapore where in March 1966 the failure of a 7 story building led to a significant tightening of structural engineering requirements in that country, and Singapore probably has the highest standard of structural engineering design in the world.

Australia, on the other hand, has gone down a path where quality has been sacrificed for minimum cost over many years, and now this is the problems we are facing.

The requirements in Singapore include: -

- A mandatory inspection of all commercial buildings by the designer.
- A two-tier professional registration system for engineers.
- The structural design of every building other than residential up to 3 stories has to be checked and certified by an engineer from a second tier known as an accredited checker. The accredited checker has to be employed by the developer from an approved list of checking consultants.
- Sufficient time has to be allowed for this approved checking

Previous Reports

Previous reports have raised similar issues on quality and design, e.g. [Independent Review of the Building Professionals Act 2005](#) by Michael Lambert in 2015 with its focus on the effectiveness of the building regulation and certification system in NSW; and the 2013 Engineers Australia [EA Report on Defect Free Construction NSW](#) and the 2005 report by the Queensland Division of Engineers Australia: [Getting it Right First Time](#) noted that poor documentation was contributing an additional 10-15% to project costs in Australia. All these reports have been ignored to the best of my knowledge by the building authority in NSW as well as other building authorities around Australia.

The Shergold & Weir [Building Confidence](#) report February 2018 raised concerns about the effectiveness of compliance and enforcement systems for the building and construction Industry across Australia. And in March 2019 the BMF published its [Implementation Plan](#) for the recommendations in that report.

In February 2019 the NSW Government published the [Opal Tower Investigation Final Report](#) that raised concerns around the effectiveness of the regulatory environment in which we operate and made several recommendations to raise the standards of building design and construction. We now have other buildings such as buildings in Mascot with similar issues and this is just the tip of the iceberg, and it has to stop.

Similar issues have been subject to detailed investigation in the UK including effective scale, concluding that there are systemic issues in the construction industry that must be addressed. For details go to these reports:

- [Building a Safer Future](#) by Dame Judith Hackitt and [SCOSS Alert of July 2018](#)
- [Report of the Independent Inquiry into the Construction of Edinburgh Schools](#) and [SCOSS Alert of February 2017](#)
- [SCOSS Alert https://www.structural-safety.org/media/502426/scoss-alert-effects-of-scale.pdf](https://www.structural-safety.org/media/502426/scoss-alert-effects-of-scale.pdf)

CROSS UK

CROSS (Confidential Reporting on Structural Safety) in the UK has recently published the following comments on industry not reacting to failures, and I think the regulators need to understand the building industry will not change without regulators imposing additional requirements as costs will always dominate building construction unless these requirements are in place. The building industry, in my opinion, is not capable of self-regulating, and therefore, it needs to have sensible regulations imposed on it.



798: Industry not reacting to failures

(R) REPORT

The tragic events at the Grenfell Tower fire should have been a wake-up call for the construction industry. The Hackitt report and the harrowing evidence at the Public Inquiry has revealed serious issues across the board which we should all be striving not to repeat, says a reporter.

They are concerned that those in the construction industry have not reacted at all to this tragedy and are carrying on as if nothing has changed. Whilst the current regulatory framework has not yet changed (although the government has just released a consultation on this), Dame Judith Hackitt has said that the industry should not wait for legislative change and should act now to ensure the safety of buildings.

Following the Grenfell Tower fire, the reporter has personally experienced clients and contractors putting money before safety, and consultants giving poor advice on fire related issues. Examples include fire engineers attempting to justify poor designs rather than ensuring good design from the start, and structural engineers poorly advising on fire related aspects of the structural design. The reporter speculates that some of this may be down to a fear of telling the client that they can't do something, combined with a lack of knowledge and experience in the realm of fire design.

The reporter has also uncovered products being put into buildings without the certification or justification which demonstrates their adequate performance, and in one case with certification to a relevant fire related British Standard which shows it does not meet the required standard in the guidance in the Approved Documents. While this could be deemed satisfactory if the performance of the materials is properly assessed as a whole, the reporter is referring to products being selected purely based on cost without regard to fire performance.

If attention is not paid to the products and their likely performance in the building, then surely it is only a matter of time before some unsafe combination of material and circumstance come together.

Prior to the **government ban on combustible materials on high-rise homes**, the reporter had experienced

contractors and consultants proposing to install combustible insulation in cladding products for tall buildings, without thought or justification as to the performance of the system in fire, and the likely consequence. They will have known that this was reported to be a major contributor to the rapid fire spread at Grenfell.

Whilst the facts are not fully known until the Public Inquiry completes its work, the publicity alone should have been enough to make people review what they were doing, and in this case to realise that what they were doing didn't comply with current guidance, let alone any lessons that needed to be learnt from the Grenfell tragedy. The reporter continues to see combustible products proposed in high rise residential buildings, despite the ban.

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In the view of the reporter, this is simply not good enough, and it is time for all parties to take responsibility. Buildings are complex and bespoke, and the reporter acknowledges that the overall responsibility is not straight forward. However, the reporter believes that if each developer, architect, consultant, contractor, tradesperson and product supplier were to consider safety as their first priority, then many of the issues that they see would not occur.

Professionals are bound by their Institution's Code of Conduct, but the reporter wonders whether all professionals are really taking this seriously.

Australia

The quality of design and inspection of buildings by structural engineers in Australia are almost invariably driven by owners, builders and developers demands and minimising costs, which has led to reduced fees for structural engineering over the past 20 years or more.

Structural engineers have, therefore, have had to tailor their fees to suit a regime where the minimum cost wins. This, in turn, has meant that design and documentation processes are minimal, changes to the drawings are often not recorded or recorded poorly on shop drawings and the like, and checking of the design and the drawings is often non-existent. Often inspections of construction on and off site are not carried out, or they are carried out, those inspections are by those who are not experienced in this type of work or not connected with the original designer. All of this is a recipe for poor quality work and the problems that we are now seeing as well as the ones we cannot see.

It is also important to remember that all graduate designers, including structural engineers with a university degree, are not experienced in the design of buildings and structures. That experience only comes from working in the building industry over time. It takes some years to develop that experience and appropriate skills. It is therefore important that graduates engineers not take responsibility for those matters which are beyond their expertise or experience.

Also, in the author's opinion, Engineers Australia (EA) has abrogated its responsibility for the training of graduate engineers. All of EA training is aimed at subjects such as project management which is suitable for engineers with 5 to 10 years' experience, but graduates are not well catered for in the current training regime of EA.

Also, the current system of qualified engineers by EA is at best, reasonably satisfactory, and at worst is very limited in what it tries to achieve. It simply allows an engineer with say 5 years experience to carry out all types of design which in some cases they may not be capable designing. It is, therefore, going to be necessary to provide significantly higher levels of registration so that engineers have adequate experience and background in structural design and construction of buildings.

Local councils and relevant building authorities do not have the expertise, the time or the staff to check structural engineering designs, and they depend on independent certifiers in most cases for their advice.

In this race to the bottom, we have ignored quality, and we need to change that urgently. These are some of the things we need to do: -

- **Registration of structural engineers:** Registration of structural engineers should be in 3 tiers as follows: -
 - Graduate engineer of 0 to 4 years' experience who can carry out design and inspection of structures but cannot certify any structure. Also, graduate engineers must not be in senior roles of project management or acting as building surveyors and the like in this initial phase of their career.
 - Structural engineers, reasonably experienced, with 5-10 years' experience who can certify the design of buildings and structures up to certain heights, suggest 5 storeys and within their professional experience.
 - Structural engineers experienced, with greater than 10 years' experience who can certify all buildings and structures provided they are experienced and can design such structures within their professional experience.

- **Structural design:** Structural design and documentation and inspections must be carried out under the control of suitably qualified and experienced structural engineer or by graduate engineers or less experienced structural engineers under the control of a suitably qualified and experienced and registered structural engineer.
- **Graduate engineers, limited experience:** Graduate engineers with 0 to 4 years of experience can carry out structural design and documentation under the guidance of registered structural engineers but cannot certify any structural design. They can also inspect structural work on site under the guidance of the original designer who must be a registered structural engineer for the works involved.
- **Structural engineers, reasonably experience:** Structural engineers with 4 up to 10 years' experience, can certify the design and inspections of buildings up to say 5 story and must be registered for this type of work and of course competent in design of these structures. They can inspect and certify works up to this level.
- **Structural engineer, experienced:** Structural engineers with greater than 10 years experience, who can certify the design and inspections of all buildings and of course must be competent in the design of the structures and must be registered for this type of work.
- **Internal checking:** All design, drawings and specifications and the like are to be initially coordinated with other design members of the project and then independently checked within their own organisation. Drawings, specifications, reports and the like are to be signed as having been checked before submission for external checking. Documents which have not been checked internally and noted as such, will not be checked by the external checker.

Where organisations or individuals do not have sufficient staff for this internal checking, this checking can be carried out by another external suitably qualified and certified structural engineer independent of the owner, developer or the builder for the project.

- **External and third-party Independent checking:** Other than single-story housing, all structural engineering design for buildings and structures is to be independently checked and certified by an external and independent checking engineer who is also a registered structural engineer and who is not the original designer. This independent checking will only be carried out after the drawings, and the designs are submitted as having been internally checked.

This independent checking engineer while being paid by the owner will be an independent entity from the structural or designer, the owner and builder and developer for the building and probity reasons must have no direct ownership or similar relationship with the original designer, the builder, the owner, builder or developer. Not only that the owner must not direct the independent checking engineer in their role.

The independent checking engineer should be registered, and checking can only be carried out by a suitably qualified and experienced structural engineer who has to provide independent certification that they are satisfied with the original design complies with the intent of the NCC, the drawings are adequate for construction and building or structure as designed is suitable for the purpose it has been designed for.

For fast track or staged projects, independent checking may need to be done in stages.

- **Independent checking engineers:** This will require an approved register of registered independent checking engineers who would need additional fees to carry out this checking work. It may be that the certifying authority who nominates the independent

checking engineer from a panel of checking engineers they have established, so there is total independence.

The independent checking engineer will need to provide a suitable certificate to the appropriate building authority that they are satisfied that the structural design complies with the NCC and good practice.

If the independent checking engineer does not accept the design initially, then it is the responsibility of the original designer or structural engineer to amend their design and drawings until the independent checker is satisfied, it complies with the NCC requirements and good practice.

The independent checking engineer shall also state the critical elements need to be inspected by the original structural engineer during construction. The independent certifier needs to be qualified and also approved for certification by an appropriate certification authority. They should also be audited regularly and at least every 2nd or 3rd year.

- **Independent checking engineer:** The independent checking engineer is to be engaged by the owner who has to certify that they have employed the independent checking engineer to the appropriate building authority and advise the fees that they will be paid for this work together with a statutory statement that they have paid the agreed fees for their work.

They must also provide a statutory statement that independent checking engineer is fully independent of the owner.

It is also going to be very important to insist that the independent checking engineer is paid adequate fees for their work, otherwise, the system will end up where again the lowest price will dominate. How that is determined needs to be advised, but probably a minimum scale of fees needs to be established even though it may raise the ire of the ACCC.

- **Construction:** Physical construction cannot start either on or off-site until approval has been received from the independent checking engineer that the design complies with the NCC, and the drawings and specifications are satisfactory. The independent checking engineer must be given sufficient time to carry out their task. Construction also cannot proceed until has been approval has been received from the relevant building authority.

The owner, developer, contractor or builder must not make changes to the design or drawings for construction without formal written approval from the original structural designer and only after it has been internally checked. Construction of any revised works can only be carried out after the redesign has been completed and drawings have been updated to clearly show the revised designs which have been checked and approved independently within the original design organisation.

- **As-built drawings:** All changes to the structural drawings and specifications and the like are to be updated before the building is to be handed over for occupation. This requirement for as-built drawings is in addition to the original drawing and specifications originally submitted to the building authority for construction. The as as-built drawings and specifications must also be submitted to the appropriate building authority before the occupation of the building.

Updating of shop drawings and sketches and the like will not be acceptable for as-built drawings, and all approved changes must be to the original, or any additional design drawings prepared during construction and these must be shown as upgraded for construction.

So that records are properly kept as-built drawings and specifications in digital form should be kept for at least a minimum of 25 years by the original designer and at least 15 years by the local authority or council as a record of the construction of a building. The statutes of limitation should not apply to as-built drawings. The availability of these drawings will be vital in the event of a major earthquake to ascertain the details of the particular building if it's damaged.

- **Seismic design:** The structural engineer must supply to the design team the design requirements for seismic design, including design parameters and the like for all non-structural components in accordance with the NCC.
- **Periodic inspections:** The structural engineer responsible for the original design shall carry out regular and periodic inspections of construction including inspection of all critical elements such as footings, columns and transfer structures and the like. They must inspect the building work at least once a week during construction on site unless agreed otherwise with the building authority and the independent checking engineer. They shall prepare a written report on each inspection.

They must submit at least monthly reports in sufficient detail to show to the builder, the building authority and the independent checking engineer that they have inspected the works and that they are satisfied the works are constructed in accordance with the approved design documentation.

This inspection work must not be carried out by an independent organisation who does not understand the design or has not been involved in the original design. This inspection must include all fabrication and construction work both on-site and off-site, including interstate and overseas work. It is unacceptable for a subcontractor to confirm that the works have been constructed in accordance with the drawings or shop drawings and such confirmation is not acceptable as a replacement for a detailed inspection and report by the structural engineer responsible for the design of the project.

- **Confidential reporting:** a confidential reporting system for all structural engineering is to be set up, such as CROSS-AUS which membership should be mandatory and free. All structural engineers and designers should be required to confirm that they have a membership of such an organisation and the confidential reporting authority is to report at least twice a year on problems that have been reported to them.

These are very simple and basic requirements that would go a long way to meeting quality work and overcoming many of the issues that we are now facing. This is what we used to do 50 years ago when I first started structural engineering, but with the squeeze on fees, much of this has disappeared.

This, of course, should not inhibit innovation or new systems or minimising costs provided it doesn't compromise quality or the design.

Cost

When I first started practising structural engineering, total professional fees were round about 10 to 12% of the project cost in the structural engineering costs were about 4 to 6% of the cost of the total project. These days often professional fees are as low as 1 to 3% of the cost of the project, and the minimum professional fees in my opinion for a building of reasonable complexity are around 6 to 8% and structural engineering fees around 2 to 3% of the total cost the building.

Therefore, adding the design requirements above for structural engineering will increase their fees, but that is what is needed to get quality into the design and avoid the problems of the past. It will not come at no cost to the building industry or the end user.

There will be some additional cost principally in structural engineering costs for correct documentation and for external checking, but as structural engineering fees generally run to 1 to 3% of the cost of the project, so the increase in structural engineering fees including checking will probably add approximately 1% to the cost of the project. Therefore professional fees for structural engineering will be of the order to 3 to 4% of the cost of a project. This is a small price to pay for a much better quality product and minimising the problems of the past, which are costing huge amounts of money.

Conclusions

There is a common theme in the earlier reports and other documents noted above that the construction industry badly needs to “lift its game”, and building regulators and building authorities appear to have ignored all of these reports in the hope the problem will go away. The building industry as a whole must play its part in addressing these concerns, but without regulation, it will not play that part. It is not sufficient to come up with some weak requirements which will get watered down by various players in the industry so that we are back where we started. However, where cost is the driver, then regulations need to be in place as the building industry will not self-regulate in these circumstances.

Therefore, it is important that significant changes be adopted and subject to satisfactory discussion and are accepted by the building regulators, and building authorities and the building industry moves on in Australia. If this is just another whitewash, then we may as well not bother, and the problems of the building industry will continue until these changes are implemented. It is going to take another major failure to bring everybody back to the understanding of what the issues are. Indeed, the author has predicted that the collapse of buildings is possible due to poor design, particularly under earthquake conditions that will occur in the future.

The procrastination by the various regulators and building authorities around Australia has to stop.

It is a national disgrace that the building industry has arrived at this situation. There needs to be a national approach which is consistent around Australia and what I have proposed above, in my opinion, is the minimum requirements for structural engineering with comments on other professions involved.

These comments are based on my 50 years of experience in the building industry in Australia, and I've seen a lot of changes and a lot of issues, and I am a very experienced structural engineer still practising part-time and understanding the issues involved.

Other issues.

There are a number of other issues of the building industry has skirted around for many years, and this time these were fixed e up as well. These include the following:-

- The importation of non-compliant materials and in particular over 100,000 tons of steel reinforcement is imported into Australia, which probably does not comply with Australian standards. There has been a Senate enquiry on this, and the building authorities need to action this matter urgently.
- Metal claddings and the like which are not fire resistant which needs to be resolved urgently.
- Waterproofing is a major issue and architects don't seem to understand what is required. The RIAA needs to urgently issue details to all of their members, showing what is required for waterproofing and teaching of waterproofing to architectural students should be mandatory in their undergraduate courses and professional practice.
- Engineers and architects often assume that concrete slabs are waterproof. This is a fallacy even if the slab is post tensioned and it should be a mandatory requirement that for all habitable areas either a suitable waterproof membrane laid to falls with proper drainage is used, or a metal deck roof also laid to falls with proper drainage. Indeed, it could be argued that non-habitable areas are similar, requiring either a waterproof membrane or a metal deck roof.
- The design of non-structural components for seismic loads is poorly done and largely ignored by the building industry despite many attempts to get designers to understand their statutory requirements. It is recommended that the lead designer, usually the architect, provides a certificate to be lodged with the building authority before construction that all non-structural components have been designed for seismic loads.
- The inability of governments both State and Federal generally to provide an adequate briefing to the industry, including master planning and preliminary planning so that projects are properly briefed and can then be properly designed and costs can be properly controlled. Most governments seem to have little technical expertise by way of planning for the future and they really need to look at their technical expertise as it is sadly lacking.

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