

CROSS-AUS

Confidential Reporting on Structural Safety - Australasia

Newsletter 2 | July 2019

Editorial

Several events in recent years have raised serious concerns about safety in the construction industry resulting in calls for significant changes in how the industry operates.

The Shergold & Weir **Building Confidence report** submitted to the **Building Ministers' Forum (BMF)** in 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.

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

- **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

Previous reports have raised similar issues 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; the 2013 Engineers Australia **Report on Defect Free Construction in 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.



DIRECTOR:
Mike Fordyce

There is a common theme in these documents that the construction industry needs to "lift its game" and we as Structural Engineers must play our part in addressing these concerns. CROSS-AUS provides a conduit whereby we can contribute towards improving quality and safety performance by sharing lessons learned and disseminating advice on good practice.

The reports in this newsletter cover a range of issues including some of the concerns raised in the above documents particularly related to competency, communications, documentation, application of Australian Standards, site inspections, quality control, and the influence of parties other than engineers (AUS-8, AUS-3, AUS-7, AUS-2). Unfortunately issues around temporary works (AUS-1) and excavation hazards (AUS-6) remain all too frequent.

We encourage you to give us feedback on any of these matters or to submit a report on any safety issues or matters of concern that you may have.

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HOW TO REPORT

For more information, please visit the **How to Report** page.



If you have experienced a safety issue that you can share with CROSS-AUS, please **Submit a CROSS-AUS Report**.

If you want to submit a report by post, please send an email to administrator@cross-aus.org.au asking for instructions.

KEY

- (R)** CROSS-AUS Report
- (C)** CROSS-AUS Panel Comments
- (N)** News
- (I)** Information
- › Denotes a hyperlink

CROSS-AUS

VISIT: www.cross-aus.org.au ›

EMAIL: administrator@cross-aus.org.au ›

AUS-8: Poor quality of structural design on high-rise buildings

REPORT

The correspondent has been very concerned about the quality of structural engineering on some projects in recent years, particularly for certain high-rise buildings. According to the correspondent, there are engineers who regard the requirements of the Concrete Structures Standard (AS 3600) to be generally conservative and are the maximum requirement, rather than the minimum requirement.

The correspondent has experienced the following issues:

- When the design of post-tensioned floors is given to a specialist sub-contractor, the design may not be coordinated nor indeed checked by the structural engineer. Hopefully the changes in AS 3600-2018 in the design of diaphragms and the tying together of elements will overcome this.
- When the design of precast concrete is given to the precast manufacturer, they may have little understanding of structural design unless they employ structural engineers themselves. Again, there can be a lack of coordination between the in-situ concrete design and the precast concrete design.
- It is possible that clause 11.5 of AS 3600-2009 may be misinterpreted using the simplified method to design concrete walls that may be supporting 20 to 30 storeys. This may result in a 150mm thick wall with a single layer of mesh in the middle. However, in the view of the reporter, the clause was never intended to be used in this way when it was originally included in AS 3600-1988. This problem should be resolved by the revisions to AS 3600-2018 which have introduced stricter requirements for the design of load-bearing concrete walls.
- Lateral loads and in particular seismic loads are sometimes not well considered and in some cases are ignored. Again, changes in AS 3600-2018 together with a minimum earthquake hazard factor (Z) of 0.08 should bring this to the fore.
- Many young engineers lack site experience and although they may have good structural analysis skills, the practicalities of construction and buildability issues may not be considered.
- Checking and coordination of drawings is often lacking. While there is no such thing as a perfect set of design documents, a good set of documents goes a long way to making sure that everything works.

When changes occur during construction, structural engineers are reluctant to amend the drawings and mark-ups are done on shop drawings instead.

- Private certification may, in some cases, have contributed to the problem. There should be independent building surveyors and certifiers who are appointed by somebody other than the parties directly involved in the project.

There is much focus currently on the need for everybody to be registered, but that's not the answer in this correspondent's opinion. What is needed are quality people and quality time to do the job properly.

COMMENTS

This report raises several issues of concern, not all of which are new, and some that have been raised in other reports such as design of RC walls (AUS-3) and managing changes during construction (AUS-7). It also highlights several of the issues raised in the **Shergold & Weir** and **Opal Tower** reports around competency, co-ordination of drawings, the correct application of Australian Standards, site inspections, quality control, private certification and registration.

The issue of attitude to the Australian Standards raised in the report, and also in the accompanying AUS-3 report, is a serious one which has arisen from the changing nature of Standards and Codes over the last 50-60 years. The present Australian Standards have developed from Codes of Practice written to represent conservative good practice. Increasingly they seem to have become regarded as being accurate reproductions of theory that can be used without a detailed understanding of their background or the limitations of their use. When incorporated into design software their use becomes even more remote from their theoretical backing, and the outcomes are certified as meeting the code because the software is apparently based on the code. Ensuring that the relationship between theory, codes, and practice is properly understood is the responsibility of the profession.



[SUBMIT REPORT >](#)

[SUBMIT FEEDBACK >](#)

INFORMATION

What should be reported to CROSS-AUS?

Structural failures and collapses, or safety concerns about the design, construction or use of structures.

Near misses, or observations relating to failures or collapses (which have not been uncovered through formal investigation) are also welcomed.

Reports do not have to be about current activities so long as they are relevant.

Small scale events are important - they can be the precursors to more major failures.

No concern is too small to be reported and conversely nothing is too large.

Your report might relate to a specific experience or it could be based on a series of experiences indicating a trend which may require industry or regulatory action.

Benefits of CROSS-AUS

- Share lessons learned to prevent future failures
- Spurs the development of safety improvements
- Unique source of information
- Improved quality of design and construction
- Possible reduction in injuries and fatalities
- Lower costs to the industry

INFORMATION

CROSS-AUS Panel

We continue to expand our Panel of experts and for the most up to date list refer to the people page of our website.

[View CROSS-AUS People page >](#)

AUS-3: Safety concern about the design of thin concrete walls

R REPORT

The reporter refers to the **SCOSS Alert**> of November 2018 about the effects of scale on design.

About 4 years ago the reporter was involved with a group of structural engineers who were concerned about the design of thin concrete walls (usually precast), often only 150mm thick and reinforced centrally with a single layer of mesh. These were load-bearing walls being used in multi-storey buildings and sometimes supporting 10 or more stories.

This concern was as a result of the Steel Reinforcement Institute of Australia (SRIA) writing a **Guide to Seismic Design and Detailing of Reinforced Concrete Buildings in Australia**> and a seminar series around Australia on the topic at that time.

Also, the Christchurch earthquake of 2011 showed how poorly reinforced concrete walls performed, and that was another reason why this group were so concerned.

The group lobbied the main committee for AS3600 (Concrete Structures) and as a result a subcommittee was formed that substantially changed the design of concrete walls in the AS 3600-2018 edition.

The changes have a significant impact on the design of load-bearing concrete walls for high-rise buildings, and although this problem has been known for some time, the changes did not come into the National Construction Code (NCC) until May 2019.

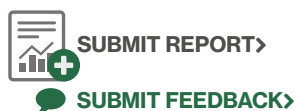
C COMMENTS

AS3600-18> was published in June 2018 and designers should have been using the revised standard from that time. Standards will generally lag behind practice and this raises the question that when an issue arises, such as this, how do we ensure that knowledge is disseminated? The SCOSS Alert referenced above is one such means.

A further issue is that designers do not always appreciate that any standard sets out minimum requirements and too often designers are not looking behind the standard to fully understand the issues and background to the design of the particular element, in this case the design of load-bearing walls.

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More generally there are risks when using superseded codes and standards and another example is given in report 624 published in **CROSS Newsletter 54**> of April 2019.



N NEWS

National Construction Code

The new edition of the National Construction Code, **NCC 2019**>, has been given legal effect as of 1 May 2019 when it was adopted by all States and the NT.

For more details visit the **ABCB website**>.

N NEWS

Changes to building law

In response to the **Shergold & Weir Building Confidence report**>, the NSW Government announced proposed changes to building laws on 19 February 2019.

[View proposed changes to building laws](#)>

N NEWS

16th East Asia Pacific Conference on Structural Engineering and Construction (EASEC16)

EASEC16 will be held at the Brisbane Convention and Exhibition Centre on 3-6 December 2019.

[Visit easec16.com.au](http://eassec16.com.au)>

N NEWS

Lacrosse Tower decision

The Lacrosse Tower Decision released by Judge Woodward on 28 February 2019 makes sobering reading for all building professionals, and reinforces the complexity of relationships, responsibilities and liabilities in contemporary building practice.

[View decision report](#)>

AUS-7: Managing changes to design

REPORT

A correspondent has written in response to the current debate about standards of construction.

Their experience is that change is the root of many problems - planned, instructed or otherwise. One example of a major issue they encountered when working with the builder was that the design engineer refused to document significant changes that arose during construction, choosing instead to document the changes via mark-ups on shop details, meaning anyone who didn't review 3000 shop details was not apprised of the changes. This made erection sequencing difficult and the builder's life impossible for planning.

The underlying cause, the correspondent believes, is inadequate fees to fully document the project in the first place, let alone allow for incorporation of changes during construction. It then becomes a blame game between client, designer and builder. This, says the correspondent, is another example of the harm that is caused by selecting the design consultant on the lowest price that is prevalent in the commercial building sector.

The correspondent notes that in the transport sector there is not the same effect, as processes and gateways are mandated and strictly complied with, and proper change management practice is instilled culturally from top to bottom. Rejection of poor documentation is also a real and serious threat and significantly more is spent on design and QA processes in this sector.

With buildings, there now appears to be a loss of control by the regulatory authority and by the designer of what actually gets built compared with the approved design documentation. In the correspondent's opinion, the majority of such change could be prevented by proper planning, refusing last minute changes and proper QA by experienced individuals at all stages of the development. Registration and competency assessments are part of the solution; however, without proper and rigorous competency assessment across the industry, just having labels misses the point.

COMMENTS

The issues raised in this report, particularly around Building Control and control of what actually gets built, are typical of the issues addressed in the recent public reports including the **Building Confidence report**> by Shergold & Weir and the **Opal Tower Investigation Final Report**>. Similar conclusions were reached in the **UK Hackitt Report on Building Regulations and Fire Safety**> following the Grenfell Tower fire. These reports should be required reading by all professionals in the building and construction industry.

Changes during construction occur on most projects and the reluctance by designers to update their drawings is not uncommon in this competitive market when designers may have exhausted their design and documentation fee by this time, and in many cases their client is not interested in any claim for additional fees. Part of the problem is that the designers of the building may not be retained to carry out inspections to confirm that what they have designed is being correctly constructed on site. Even if they are retained, it will usually be for periodic inspections that are essentially very limited in what they can achieve.

Designers are also depending more on specialist subcontractors for key elements such as prefabricated (precast) concrete, reinforcement fixing, post-tensioned floors, structural steel and the like to be manufactured, installed and certified by the specialist subcontractor that the works comply with the approved shop drawings, resulting in split responsibilities.

While in most cases subcontractors and suppliers try to do the correct thing, they may not have structural engineering expertise, and small changes that may seem simple to them and may assist manufacture, could in fact affect the original design intent. In the case of specialist subcontractors who are interstate or overseas, they may not carry out any inspections themselves or they may get a local engineer to make periodic inspections, thus involving a third party.

CROSS-AUS supports the recommendation from the Opal Tower Investigation Final Report that there should be a mandated regime of critical stage on-site inspections by a Registered Engineer who certifies that construction is as per the design. We also

agree that all changes to critical structural elements that are proposed and made during construction should be certified by an independent Registered Engineer; and that "as constructed" drawings should be mandatory and lodged with the authority responsible for approving the building.

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It is important to note that designers also have obligations under work health and safety legislation to provide adequate information to persons involved in the construction of a structure on an ongoing basis. Failure by a designer to provide current information could result in criminal prosecution.

The Shergold & Weir and other reports referenced above make it clear that the issues are a consequence of a culture within the building and construction industry that is out-of-date, being based on past practices when much simpler systems of managing design and construction were the norm. As the Dame Judith Hackitt Report states, what is needed is "an integrated systemic change not a shopping list of changes which can be picked out on a selective basis" in order to change this embedded culture.

A good starting point is a recent presentation **An Introduction to complexity and how it influences Risk**> by Black and Hurst given to Engineers Australia's Risk Engineering Society. A key point they make is that effective solutions to the risk management of systems vary according to their complexity. Accountability is a key part of risk management, but complex systems require a different approach from simple systems. Understanding this should be a key part of the education of professionals in the industry.



SUBMIT REPORT>

SUBMIT FEEDBACK>

AUS-2: Concern over the quality of steel fabrication for street furniture

R REPORT

A reporter, who is a metal worker and MIG welder, refers to **CROSS report 793**> published in CROSS-UK Newsletter 52 entitled *Street sign collapse causes fatality*.

The accompanying photograph in that report shows corrosion and internal rusting to the supporting post. In the view of the reporter, such a post should have an expiry date for replacement, or a requirement for periodic inspection.

This reporter has been concerned for many years about the variation in quality of the steel that metal workers are being made to use and believes that there are some seriously sub-standard quality steels that should not even be considered for use.

They are also seriously concerned about the tensile strength and durability of steel; particularly in connection with public utilities such as the above example of a street sign. These are serious issues in terms of public safety.

The reporter is strongly of the opinion that all substantial welded fabricated engineering projects should be regularly inspected, for not only the actual welds themselves but also for the state of the steel and x-rayed internally for rust/moisture, metal deterioration, and other defects.

C COMMENTS

Those responsible for the procurement of signs, posts, hoardings, and other forms of street furniture must be aware that they are dealing with potentially life-threatening issues and act accordingly.

Specifications must be of a high enough standard to give confidence that the components in question will give long, reliable, and safe service. The same standards must be followed through for construction, inspection, and maintenance.

Attention is drawn to the **Feedback on Report 390**> by Professor Gregory Hancock on the CROSS-AUS website where he advises that the relevant standards **AS4100 Steel Structures**> and **AS/NZS 5131 Structural Steelwork - Fabrication and Erection**> are in the process of a

major revision related to fabrication and erection issues. The revised standards were expected to be out for public review in May 2019.

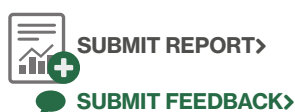
Steel should comply with Australian Standards and there are organisations such as the **Australasian Certification Authority for Reinforcing and Structural Steels (ACRS)**> who can certify the origin of the steel before manufacture.

There have been many cases of non-compliant steel used with disastrous consequences as highlighted by the Australian Steel Institute in **Steelwork Quality and Compliance**>.

Designers should be aware of the limits of simple tensile tests e.g. there have been failures of steel members where a simple tensile test has recorded values well above the minimum required for that grade of steel, but subsequent Charpy tests and chemical analysis have shown this was at the expense of ductility. The problem is that the quality of steel cannot be determined by visual inspection so reliance is placed on certificates from suppliers and diligence is required to ensure that these are accurate.

For critical items, external independent welding inspectors should be used both for the initial assessment of the welders and subsequent periodic testing of the welds. The small cost of independent welding inspection by an Australian **NATA**> registered inspection company should not deter designers and specifiers from specifying these requirements.

Designers also need to ensure that corrosion and durability are properly considered in their designs and specifications. Owners should then ensure that the design and these requirements are incorporated into contract documents provided to the builder.



N NEWS

New UK safety reporting proposals - have your say

The UK Government published a consultation seeking views on proposals for a new building safety system, which includes expanding and strengthening CROSS.

CROSS-AUS strongly encourage readers to support the proposals by responding to the three questions highlighted in Structural-Safety's article on the consultation.

[View safety reporting proposals article](#)>

N NEWS

CROSS United States (CROSS-US) launch

In association with Structural-Safety, Glenn Bell, President-elect of SEI and IStructE Board member, has launched CROSS-US, with SEI as the principal sponsor.

[View ASCE article on CROSS-US launch](#)>

[Visit www.cross-us.org](http://www.cross-us.org)>

N NEWS

Grenfell Tower Fire - The Consequences for Safety

ASCE have published an article summarising the special session at the Structures Congress 2019 in Orlando on the Grenfell Tower Fire - The Consequences for Safety.

[View article on Grenfell Tower fire](#)>

N NEWS

Iconic Global Structures: what can we learn?

The first joint international conference organised by the IStructE and SEI of ASCE will be held in Dubai, UAE from 29-30 September 2019.

[Visit conference website](#)>

AUS-1: Set-up of temporary works

R REPORT

A reporter who does inspections of temporary works was called onto site after a formwork collapse as the main builder required confirmation that it was safe to clear the collapsed portion.

The formwork contractor was setting up formwork for a slab using a proprietary system with main props supporting the ends of timber primary beams; timber secondary beams are then laid out on top of the primary beams before the deck is sheeted.

The correct procedure is to ensure that intermediate propping to the primary beams is in place before any additional loading is applied. In this event, it appears that the team doing the sheeting on top was unaware that the primary beams were not propped at mid-span.

The clear single span of the primary beam was over 4.0m (beam length was 4.9m). The workers were pushing a pallet of ply (at least 1 tonne) over the unpropped beam which snapped in two. At mid-span the bending moment would have been about 10kNm v/s 5kNm working capacity for the beam. The two workers pushing the pallet suffered serious injuries. Fortunately, no one was under that area at the time of collapse.

The reporter has since seen on other sites similar situations where a clear span of timber beams in excess of 3m occurs with the deck fully sheeted. Normally the form worker will give the all clear before the deck is loaded with construction material. In this case, the incident happened while it was still being constructed.

The reporter stresses that end users must be fully aware of any limitations when using proprietary systems as the member properties may be very different from conventional materials.

C COMMENTS

This report highlights the need for clear communication, consultation and co-operation between all parties involved in construction.

Pressure on contractors and sub-contractors for productivity can lead to short cuts being taken. Whilst the formwork sub-contractor may be tempted to put all his labour into getting the deck laid out to enable steel fixing to commence, and then redeploy that labour to install the intermediate props, the structural limitations of the system in the semi complete stage need to be recognised.

The project specification must cover the formwork standards as set out in **AS 3610**> and when a proprietary system is being used, the system supplier should have a documented installation methodology; and installers need to be inducted into that methodology and the limitations of the system during installation.

It is helpful if there is a nominated person on site (for example, the temporary works co-ordinator) who is responsible for supervising temporary works to ensure safe performance of those works.

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[SUBMIT REPORT >](#)

[SUBMIT FEEDBACK >](#)

N NEWS

The Warren Centre - Fire Safety Engineering

The Warren Centre> has recently released its report into fire safety engineering methods, which discusses the utility and benefit of the International Fire Safety Engineering Guidelines, Fire Safety Verification Methods and Practice Guides issued by the various professional bodies and is the third to be released under its Fire Safety Engineering Project.

[View Fire Safety Engineering - Methods Report >](#)

N NEWS

ABCB publications

The ABCB has published two handbooks on **Structural Robustness**> and **Structural Reliability**> that support the verification methods for buildings in the **NCC Volumes One and Two**>.

N NEWS

Pedestrian bridge collapse in Miami - investigation report

Following the collapse of a pedestrian bridge under construction in Miami on 15 March 2018, OSHA (Occupational Safety and Health Administration) published an investigation report on the collapse in June 2019.

[View investigation report >](#)

N NEWS

An Examination of Building Defects in Residential Multi-owned Properties

This recent report by Nicole Johnston (Deakin University) and Sacha Reid (Griffith University) found poor waterproofing, unsafe cladding and fire risks were the most common problems in residential multi-owned properties.

[View report >](#)

AUS-6: Lift pit excavation hazards

REPORT

The reporter took the attached photo of a worker standing close to the edge of a deep excavation.



Figure 1
Excavation hazards

The reporter notes that there are several issues/risks here:

1. Worker safety from falling into the pit which may have had water and slurry in it.
2. There was no immediate escape method visible (except perhaps via the excavator bucket?).
3. Excavation side wall collapse.
4. The stockpiles to the side are a potential risk although they were being moved at the time.

The controls for all of the above are or should be well known by builders. For example:

1. Worker fall restraint could be achieved by harness systems or a walkway with handrails etc.

2. An access ladder should be available.
3. In NSW, the excavation code of practice requires that "Shoring, benching and/or battering may not be required if written advice is received from a geotechnical engineer that all sides of the trench are safe from collapse. Any advice should state the period of time to which it applies and may be subject to a condition that specified natural occurrences may create a risk of collapse."

The reporter would be interested to hear more from a geotechnical engineer on how they look at the risk of excavation collapse.

COMMENTS

Despite much publicity about this issue, deaths from excavation collapses are all too common and may now lead to corporate manslaughter charges as has happened in the UK. In Australia, industrial manslaughter offences now exist in Queensland and the ACT.

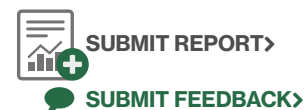
The reporter draws attention to the [NSW Excavation work code of practice](#) - and other states and territories have similar codes that are based on the [Safe Work Australia Code of Practice for Excavation Work](#).

All parties involved in construction work, including structural engineers, must address workplace health and safety issues and while any excavation is a hazard, the above codes of practice consider any excavation

over 1.5m deep to be high risk and requiring control measures to prevent collapse unless a geotechnical engineer has advised otherwise.

This is also a design matter and clause 3.2 in the above code of practice sets out the responsibilities of designers, including "Designers of structures should consider possible excavation work methods and health and safety control measures when producing any final design documents and the safety report for the structure."

As the reporter notes, it would be good to get feedback on how a geotechnical engineer would address the question of when control measures are not required. If you can provide feedback on this, or any other report, please submit feedback on the CROSS-AUS website.



PARTICIPATION

The success of the CROSS-AUS scheme depends on receiving reports, and individuals and firms are encouraged to participate by sending reports on safety issues in confidence to [CROSS-AUS](#).

FEEDBACK

If you have any comments or questions regarding this CROSS-AUS Newsletter, please [Submit Feedback](#).

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