CROSS AUS
COLLABORATIVE REPORTING FOR SAFER STRUCTURES

The Institution of Structural Engineers

CROSS Newsletter

CROSS-AUS Newsletter 6 | **December 2021**

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Share knowledge to help create a safer built environment

Editorial

Welcome to CROSS-AUS Newsletter No.6 with four new reports. Since our first CROSS-AUS Newsletter in December 2018 we have now published 27 reports on a wide range of topics. These are all freely available on our **website>**, as are all CROSS-UK and CROSS-US reports, now over 1,000 having been received in total. We hope you have explored our new-look website since it was launched earlier this year. To find a report on any particular topic, use the search function at **https://www.cross-safety.org/aus/safety-information-aus>**. We would appreciate your feedback on any aspects of the website and importantly, whether you can find what you are looking for.

Those who follow the **NSW Building Commissioner>**, will be aware of the progress being made in that State to improve the standards of design and construction and although the focus is on residential apartment buildings, the findings and recommendations are applicable to all classes of building. Water ingress continues to be one of the most common defects and **Report 959>** deals with one particular situation involving the structural engineer, i.e., the waterproofing of exposed concrete slabs.

Since the publication of the **Shergold Weir Building Confidence Report>** (BCR) in 2018, the **BCR Implementation Team>** established by the Australian Building Codes Board (ABCB) has produced several discussion papers in response to its recommendations. One of these (recommendation 18) focuses on the subject of Mandatory Inspections and **Report 960>**, the myth of Quality Assurance, emphasises that there is no substitute for the practice of regular site inspections being conducted by the original design engineer.

Report 980> highlights the importance of clear communications and good record-keeping when providing controls to limit or prevent access to unsafe work places; and **Report 1080>** raises the important question of the reliability of data provided by suppliers of specialised products.

CROSS-AUS continues to grow and widen the range of expertise within our Expert Panel with the addition of Jarvis Anderson (Technical Director, Innovis) and Mark Sturgess (Principal, Northrop). We are also pleased to welcome **Consult Australia>** who join with Engineers Australia (EA), Engineering New Zealand (ENZ), the Structural Engineering Society New Zealand (SESOC) and the Australasian Certification Authority for Reinforcing and Structural Steels (ACRS) as CROSS-AUS Supporters.

More reports are always needed on structural safety and, if you have a concern or observe a safety-related incident, please go to the **CROSS-AUS website>** where guidance is given on how to make a confidential report. In addition, please pass on this Newsletter to any colleagues who are not already subscribers and encourage them to register via our website.

Mike Fordyce
Director, CROSS-AUS Ltd

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Reporting to CROSS

Your report will make a difference. It will help us to create positive change and improve safety.

Find out more

Visit:
www.cross-safety.org/aus

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team@cross-safety.org

Waterproofing exposed concrete slabs

CROSS Safety Report Report ID: 959

This report highlights that water ingress into buildings continues to be a problem and discusses the role of the structural engineer when dealing with waterproofing of exposed concrete slabs.

It shows how this can be achieved by careful design and detailing of the reinforced concrete structure and by close collaboration of all parties involved.

Key Learning Outcomes

For construction professionals:

- A successful waterproof concrete slab can be achieved when there is close collaboration between the architect, structural engineer and hydraulic/drainage engineer in the design and by the contractor and their subcontractors during construction
- Where a concrete slab is exposed, ensure there are adequate falls and drainage outlets to remove the water as quickly and efficiently as possible

For structural design engineers:

- Pay careful attention to crack control in the design and detailing of reinforced concrete slabs
- There is good practical advice available, such as the **Concrete Institute of Australia Current Practice Note CPN28 Watertight Concrete Structures>**
- Thin reinforced concrete slabs are not waterproof without special consideration

R Full Report

Water ingress continues to be a major issue with many buildings, and although architects, or building designers, generally have responsibility for specifying waterproofing, the reporter notes that structural engineers have an important role especially when exposed concrete slabs are being used. The reporter's experience is that some structural engineers mistakenly believe that thin suspended concrete slabs exposed to the weather are watertight or waterproof without some form of additional waterproofing.

For reinforced concrete slabs, even with a large amount of reinforcement, watertightness cannot be guaranteed without very special detailing and very specific attention paid to construction. Although post-tensioned slabs can be used to provide a water-resistant (watertight but not waterproof) slab, considerable design and detailing effort is required for the slab and the joints to minimise any leaks. Experience suggests that, even with the most careful design and construction, some local water staining and minor leaking from the underside of slabs is still possible.

What should be reported to CROSS?

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.

The reporter also notes that deflections of horizontal suspended slabs exposed to rain or water can lead to ponding of water, and this, in turn, may result in additional load, possible leaks and unsightly staining on the underside of the slab.

> **For reinforced concrete slabs, watertightness cannot be guaranteed without special detailing and specific attention paid to construction**

Code Compliance

The NCC[1] covers the requirements for damp- and weather-proofing in buildings. For non-habitable areas (such as car parks and some types of industrial buildings), slabs generally do not need to be weatherproof. The reporter notes that although this may not be a problem for such buildings, there is still the possibility of leaks and staining on the underside of exposed slabs. Often the visual appearance of such staining will cause significant concern, and this should be resolved and accepted by way of confirmation in writing at the time of design by all involved, including the developer, the client and preferably the final end-users. In considering this issue, all parties should agree on the method for identifying stains (e.g., at the time of crack inspection) and for determining non-compliant stains (i.e., of a certain measurable size). If certain stains are to be considered as non-compliant with the design or construction of a concrete structure, the parties should specify in writing which party is responsible for remediation.

Where watertightness and waterproofing are required for habitable areas, and for non-habitable areas if staining and some leaking from the underside of the slab are unacceptable, other measures need to be considered e.g., an applied waterproof membrane or a separate watertight roof constructed over the slab.

There may be situations when the ingress of water can lead to long term corrosion problems so interpretation of the NCC and whether a waterproof structure is required requires careful consideration as the consequences of reinforcement corrosion can be catastrophic.

Practical advice

The reporter draws attention to the Concrete Institute of Australia Practice Note CPN 28 on *watertight concrete structures*[2] that provides a valuable resource on this topic for engineers, architects, building owners and construction managers.

[1] NCC Volume 1, Australian Building Codes Board, May 2019

[2] Concrete Institute of Australia CPN 28 –Watertight Concrete Structures, 2005

C Expert Panel Comments

As the reporter notes, water ingress continues to be a major issue with buildings. For example, the 2019 report **An Examination of Building Defects in Residential Multi-owned Properties>** by Johnston and Reid examined 212 building defect reports from New South Wales, Queensland and Victoria. These reports identified 3,227 building defects of which at least 20% were related to water ingress.

Water ingress may be the result of several factors and can involve any part of the building envelope. In many cases, it may not be considered a structural issue. However, this report deals with one situation that does involve the structural engineer, i.e. waterproofing of exposed concrete slabs.

An important question when dealing with exposed concrete slabs is to determine how watertight or waterproof the slab needs to be. Water ingress into habitable spaces is certainly a matter for health and safety; it may also result in corrosion of reinforcement and deterioration of other structural elements leading to distress and/or potential failure.

Benefits of CROSS

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

Supporters of CROSS

- Australasian Certification Authority for Reinforcing and Structural Steels (ACRS)
- Consult Australia
- Engineers Australia (EA)
- Engineering New Zealand (ENZ)
- Institution of Structural Engineers (IStructE)
- Structural Engineering Society New Zealand (SESOC)

NCC Section E Compliance

The **National Construction Code (NCC) Volume 1, Section F Health and Amenity, Part F1 Damp and weatherproofing>**, simply states:

FP1.2 Preventing rainwater from entering buildings
Surface water, resulting from a storm having an average recurrence interval of 100 years must not enter the building.
FP1.4 Weatherproofing
A roof and external wall (including openings around windows and doors) must prevent the penetration of water that could cause (a) unhealthy or dangerous conditions, or loss of amenity for occupants; and (b) undue dampness or deterioration of building elements.
It then gives exemptions for certain classes of building where these requirements do not apply and that are "based on the belief that the use and safety levels of the exempted buildings will not be significantly diminished by surface water entering them." Also, that "it is the responsibility of a building proponent to satisfy the appropriate authority that the exemption should apply".

Design and detailing

As the reporter notes, it is possible to achieve a water-tight concrete slab, but this does require careful design, detailing and construction to be successful. To achieve a fully weatherproof design that is compliant with the NCC a layered approach is suggested as follows:

1. If possible, prevent the water from reaching the concrete slab in the first instance, e.g., for some buildings it may be more cost-effective to provide a separate weathertight light steel roof over the concrete roof slab.
2. Where the concrete slab is exposed, remove the water as efficiently as possible by providing adequate falls to a correctly designed roof drainage system with outlets at its low points. This requires close collaboration between the structural engineer, architect and hydraulic/drainage engineer to ensure that the falls and drainage outlets take into consideration building movements and long-term deflections of the concrete slab.

To achieve a fully weatherproof design that is compliant with the NCC a layered approach is suggested

3. Pay close attention to crack control, particularly from restraint to shrinkage and other building movement. The risk of cracking can be reduced by:
   1. Judicious location of service cores and other stiff building elements;
   2. The location of permanent and temporary movement joints;
   3. Provision of adequate and correctly detailed reinforcement;
   4. Use of post-tensioned concrete slabs;
   5. Correct concrete mix design, possibly with shrinkage-reducing admixtures.
4. Provision of a correctly specified, detailed and installed waterproof membrane.
5. Good construction and an understanding of the waterproofing requirements by the contractor and their subcontractors.

Waterproof membranes

Where a waterproof membrane is to be applied, it should comply with **AS4654 Parts 1 and 2 - Waterproofing membranes for external above-ground use>**. However, adequate falls must still be provided and attention paid to crack control, as in steps 2 and 3 above. The membrane should be installed by a competent and experienced specialist contractor to ensure it performs as intended. As the Masters Building Association of New South Wales website points out "waterproofing tops the list of the '10 most common defects' in every State and Territory" and it has produced a series of **Waterproofing Guides>** for use throughout the building industry and by training institutions.

Construct New South Wales has recently commissioned a course

News

CROSS-AUS Presentations:

Peter Wilkinson (Fire Engineering Consultant, CROSS) gave a presentation on **Collaborative Reporting for Safer Structures** as one of the keynote speakers at the Institution of Fire Engineers, Australia Branch, National Conference on 6 October 2021.

Climate Emergency:

We must ensure our structures remain safe as we develop and implement any climate-motivated innovation or change of approach. Accordingly, CROSS-UK has launched a dedicated **Theme Page on the safety of structures during the climate emergency>** to collate information around this important and fast-moving topic. We need more reports on the subject so please help if you can by telling us of climate-related concerns and events affecting buildings and structures.

Waterproofing Design Principles> to prevent water leaks and leaching in buildings. Although the course focuses on residential apartment buildings (class 2), the principles apply to all building types.

The **Australian Institute of Waterproofing>** also provides technical advice and training and as a 2017 presentation to a Queensland Building and Construction Commission (QBCC) seminar on **Preventing Waterproofing Defects concludes>**:

Successful waterproofing systems rely on:

- Design (compatibility chain)
- Specification (compatibility & installation)
- Membrane Application
- Adherence to specifications and standards
- Maintenance (other contractors)
- Common sense

To verify the membrane installation the specification should include the following hold points:

- Slab preparation
- Priming
- Testing of membrane thickness (for liquid membranes)
- Corner and turnup preparation

Flood testing is also advisable for critical applications.

Non-habitable spaces

As noted above the NCC does allow some exemptions for certain classes of buildings involving non-habitable spaces, e.g., car parks and some industrial buildings, provided "the use and safety levels of the exempted buildings will not be significantly diminished by surface water entering them" and that "it is the responsibility of a building proponent to satisfy the appropriate authority that the exemption should apply". This requires careful consideration at the design stage as water seeping through a concrete slab will not only cause unsightly staining, it may also damage car paintwork and other stored goods. One approach is to classify the end usage such as that in the UK Concrete Centre's publication **Basements: Waterproofing>** that can be used to agree the expected level of performance with all parties and for the contractor to have a clear level of delivery expected.

Submit Report

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Information

Lessons learned from the Florida Bridge Collapse>

This online presentation by Steve Williams (Network Rail and CROSS-UK Panel member) examines the Florida Bridge collapse in 2018 and the reasoning for the subsequent **CROSS Safety Alert>**.

CROSS-AUS encourages all structural engineers to watch this presentation as it contains lessons learned and recommendations that are applicable to all forms of structure anywhere in the world.

The **Australian Building Codes Board>** (ABCB) has refreshed its entire suite of digital products as part of developing a more user-friendly online National Construction Code (NCC).

The **Australasian Certification Authority for Reinforcing and Structural Steels>** (ACRS) has recently launched a new website to enable users to search quickly and find what they are seeking. Everyone who specifies reinforcing and structural steel should become familiar with this site and the services provided by ACRS.

The myth of Quality Assurance

CROSS Safety Report Report ID: 960

This report argues that, to achieve the objective of good quality construction that satisfies the design intent, there is no substitute for the practice of regular site inspections being conducted by the original design engineer.

It questions whether there has been too much reliance on the process of quality assurance systems to the detriment of the quality of the end product.

Key Learning Outcomes

For building owners and managers:

- A Quality Assurance system for construction should focus on the end product and not be allowed to become a bureaucratic process of "ticking boxes"
- When appointing the Structural Design Engineer, include the requirement to carry out sufficient periodic site inspections to satisfy the design intent

For structural and civil design engineers:

- Consider making it a requirement of your appointment that you will specify the designated hold points for inspection and ensure that the relevant inspections are carried out by members of the design team
- Be aware of the risks of accepting a design-only commission that excludes site inspections
- Take every opportunity to appropriately inspect the works during construction and to use this as training for less-experienced engineers

R Full Report

Despite the enthusiasm of those who promoted the introduction of Quality Assurance (QA) systems in the construction industry in the 1990s, the reporter's opinion is that it has not been very successful for engineering and construction, and that too many have assumed it replaced the need for regular and periodic inspections by engineers in the field. The experience of "ticking boxes" or a checklist in the office does not necessarily provide good quality work on-site (or in the factory) without understanding the practical issues about what is achievable and what is involved in achieving a high-quality outcome.

> **The experience of "ticking boxes" or a checklist in the office does not necessarily provide good quality work on-site**

Information

The NSW Design and Building Practitioners Act (DBP) commenced on 1 July 2021 and a DBP Industry Communications Pack has been provided that includes:

- 5 things you may not know about the DBP – including the impact on remedial works and temporary structures
- New video explaining the online registration process
- New FAQs

For further information on the DBP go to the NSW Fair Trading website: **https://www.fairtrading.nsw.gov.au/housing-and-property/changes-to-class-2-buildings>**

The paper **Why we need engineers who study ethics as much as maths>** by S. Travis Waller, Kourosh Kayvani, Lucy Marshall and Robert F. Care published recently in The Conversation referring to the several recent issues of poor quality and performance in the construction industry emphasises that the erosion of professional ethics has played an important part in this state of affairs.

Worksafe Queensland has released a revised **Scaffolding Code of Practice 2021>** with increased work health and safety considerations. A key change for the engineering profession includes the requirement for engineers, rather than scaffolders, to design and sign-off scaffolds.

Australian Steel Institute (ASI) Queensland State Manager, John Gardner, recently presented the paper **"How to reduce the risk of structural steelwork failing in your projects">** at the 2021 Institute of Public Works Engineering Australasia Queensland (IPWEAQ) conference.

It is the reporter's opinion that relying on contractors and sub-contractors (who may not understand the design process) to manage the inspection of work using the method of quality control, is at best a very doubtful proposition and at worst a recipe for possible failures. As Phil Stevens said in 1992[1], *'As for the future of quality management, I would like to think that the audit fraternity will come to realise that there is an enormous gap between the pedantic view of quality management and what happened successfully in practice'.*

Site inspections

The reporter believes that there is no substitute for periodic and regular hands on-site inspections by all designers to understand the complications of their design and to receive feedback on their design. As an example, consider a complicated reinforced concrete member where congestion of reinforcement can result in difficulties in placing wet concrete and maintaining correct covers. It is only by physically looking at and examining details on-site (or in the factory) that engineers will have this direct feedback on their designs and understand the practicalities of construction.

Through their involvement with several major projects involving high-quality precast concrete, the reporter has been concerned that the original design engineers have not been prepared to inspect their work in the field. Possible future failures were avoided in two projects when the reporter observed significant design issues and took action to recommend changes.

Thus, the reporter believes it is imperative that regular and periodic inspections be carried out by design engineers (senior and junior) to understand their designs and what is practical in manufacture and construction. The sooner mandatory regular and periodic inspections are required by the designers of all projects, the better and safer will be the construction industry in Australasia.

[1]Stevens P, Quality Management Documentation and Auditing-Is it Out of Control? Concrete in Australia, Volume 18, No 4, December 1992.

C Expert Panel Comments

Quality assurance systems are required by most engineering companies, but it is the day-to-day decisions about what to audit and what to inspect that makes the difference between genuine quality assurance and half-hearted compliance. Some companies with very mature third-party audited quality assurance systems may fall well short of achieving quality outcomes because 'the culture' within the organisation rewards speed and profit above the quality of the end product. It is not enough to have a quality assurance system; it must form the cornerstone of the company's work ethic.

> **It is not enough to have a quality assurance system; it must form the cornerstone of the company's work ethic**

Historically the practice of the design engineer inspecting the work during construction provided dual benefits of ensuring that the work complies with the design intent, and providing feedback and learning for the designer. While the construction industry cannot be held accountable for providing feedback and learning to designers, it is accountable for ensuring that the work complies with the design intent, and this aspect is not always well served by Quality Assurance systems. Drawings cannot reflect the myriad of decisions that design entails.

When construction work is inspected by someone who was not involved in the design process, or (as is often the case) cannot contact someone who was involved in the design process, that inspector cannot focus on the parts of construction that are particularly important, and must not depart from the design drawings. As a result, important departures on-site can be overlooked, and equally time is wasted when unimportant departures are required to be corrected. The outcome is a reduction in the quality of the constructed work.

Risks associated with poor on-site quality assurance and control

The risks associated with an inadequate on-site quality assurance and quality control (QA/QC) system include:

- Non-compliance with the design intent.
- Not having sufficient hold points to allow for verification checking at critical stages of construction.
- Reliance on third parties who do not understand the basis of the design.
- Human factors including not allowing sufficient time for QA/QC.
- Not recording as-built construction correctly.
- A safety incident occurring that results in property damage or injury to a person(s).

These risks could be mitigated by:

- Legislation requiring designers to inspect the works and enforced by the Regulators.
- Designers specifying when, how, why, and where hold points are required and the competency requirements of the inspectors.
- Independent third-party verification and validation for all high-risk structural building work. The risk would be considered high if there were an increased likelihood and consequence of the design intent not being met, through lack of suitable QA/QC, and other factors as noted in this advice.

Thus, we would agree with the reporter that there is no substitute for the structural designer being on-site at all specified hold points and ensuring that the design intent has been met.

> **there is no substitute for the structural designer being on-site at all specified hold points and ensuring that the design intent has been met**

As the reporter notes, there are some design engineers who believe that items that are shop-drawn (e.g., precast or steel) do not need to be inspected on the basis that off-site quality control is substantially better than on-site and therefore lower risk. Whilst this may be the case with reputable off-site contractors, this does not mean that errors in design interpretation, drafting translation, or on the shop-floor, cannot occur.

It should be noted, however, that the presence of the design team on-site may lead to genuine disagreements on best practice for project decisions during construction. Project documents should ensure a clear and efficient procedure is in place to resolve these disagreements (e.g. contractual hold points, RFI process).

Quality Assurance in New Zealand

In New Zealand, site inspections are generally mandatory using the Engineering New Zealand (ENZ) **Producer Statement and Construction Monitoring system>.**

Producer Statements give authorities confidence that building work will be or has been constructed to meet the Building Code and approved consent requirements. Engineers use Producer Statement documents to:

- confirm their professional opinion that aspects of a building's design comply with the Building Code, or
- that elements of construction have been completed in accordance with the approved building consent.

There are three kinds of Producer Statements to provide verification at different stages in the design and construction process:

- PS1 – design
- PS2 – design review
- PS4 – construction review

Construction Monitoring is an independent verification provided by an engineer to a client. It confirms that construction has been completed according to the building consent. Engineers are required to recommend the most appropriate level for the work and then carry out the agreed levels of monitoring.

Legislation in Australia – Mandatory Inspections

All jurisdictions have building compliance and enforcement systems that provide for inspections of some types of building work during construction. The builder is required to notify the building surveyor or council once a prescribed stage is reached. This triggers an inspection or, at least, an opportunity for an inspection.

The 2018 **Shergold Weir Building Confidence Report>** (BCR) noted that: "There are significant differences across jurisdictions in the number of inspections required and the notification stages. In some jurisdictions, very few inspections occur and for certain types of buildings there are no inspections required at all." For commercial buildings, many jurisdictions leave it to the building surveyor to determine what inspections are appropriate.

Recommendation 18 in the BCR states: "That each jurisdiction requires on-site inspections of building work at identified notification stages." Furthermore, the BCR recommends that on-site inspections be carried out by appropriately registered inspectors. These recommendations have not been legislated across Australian Jurisdictions.

In 2020 the BCR Implementation Team established by the Australian Building Codes Board (ABCB) produced a **Discussion Paper on Mandatory Inspections>** (closed 28 February 2021) and **according to its website>**: "The Mandatory Inspections model guidance will be presented to Building Ministers for endorsement in late 2021 and is expected to be published on the ABCB website shortly thereafter."

It is important to remember that structural design engineers, as well as building owners and managers, have an ongoing obligation to ensure that structures designed by them are designed to be without risks to the health and safety of persons under work health and safety legislation across all Australian jurisdictions (as well as in New Zealand). This includes provision of information and the carrying out of, any calculations, analysis, testing or examination necessary on an ongoing basis. Recently in Australia, a number of structural design engineers have been prosecuted and convicted under work health and safety laws for failing to conduct adequate on-site inspections. Accordingly, implementing a system for conducting site inspections at appropriate intervals is of vital importance for satisfying structural design engineers' duties under legislation.

> **engineers have an ongoing obligation to ensure that structures designed by them are designed to be without risks to the health and safety of persons**

Submit Report

Submit Feedback

Use of temporary barriers to control access to hazards

CROSS Safety Report Report ID: 980

This report highlights the risks associated with the use of temporary barriers to control access to unsafe workplaces.

It discusses the issues when scaffolding is used as a barrier, and that this should only be considered for use as a short-term temporary barrier.

Key Learning Outcomes

For asset owners, contractors and managers:

- Be aware of your duty to ensure the health and safety of workplaces that are under your management or control (to any extent), including when temporary barriers are moth-balled or temporarily out-of-use, including the risk of access by unauthorised persons
- Recognise the importance of clear communications and good record-keeping with respect to any risk controls that have been put in place and ongoing review of those control measures

For structural design engineers:

- Understand the hierarchy of risk control measures and that eliminating or removing the hazard should be considered first, wherever possible, prior to considering other controls to minimise risks
- Recognise that the use of temporary barriers to control access to structural (or other) hazards is dependent on good record-keeping and is, therefore, an administrative form of control
- When carrying out any site inspection, undertake your own risk assessment and always ensure that there is safe access to the area to be inspected

R Full Report

The reporter has been involved with a number of mining sites and port facilities where temporary barricades (e.g. using scaffolding) have been used to control risk due to structural hazards such as unsafe flooring, missing handrails, etc. In many cases, these barricades have been left in position for months or years and the reporter is concerned that this is not an appropriate long-term control for structural risks. The following examples are given:

1. A scaffold barricade was placed to prevent access to a corroded walkway. However, at some point in the following 12 months, the barricade was removed. During a subsequent site visit the reporter inspected the walkway from below and decided that, due to its poor condition, it required a closer and more detailed inspection. Whilst testing the soundness of the first-floor mesh panel from a ladder the mesh gave way and collapsed. Only the fact that the reporter was holding on to the ladder saved them from serious injury.
2. In this case the owner of a moth-balled plant requested that a structural engineer inspect a number of areas of the plant that had been barricaded off as structurally unsafe prior to the moth-ball process. However, no record had been kept of why the barricades had been placed. In some areas the reporter was able to identify structural defects that may have explained the barricade; however, in other areas, there was no obvious reason why the structure was not sound. It was therefore unclear whether the barricades had been placed incorrectly, or whether the reporter had missed an important issue jeopardising the safety of the structure and personnel.

Risk control

Using the hierarchy of risk controls, many people assume that barricading would be a high-level control (equivalent to an engineered control) in that it prevents exposure to the hazard. However, barricading actually depends on an administrative control (which is at the low end of the hierarchy of risk controls) for its implementation. Usually, there would be some sort of "paper tag" system to indicate why the barricade had been put in position, and a record kept by someone somewhere that the barricade had been installed, both of which are error-prone administrative systems. For example, if the tag blows away or is damaged there is nothing to indicate the purpose of the barricade. With scaffold and other types of hard barricades, these

tend to be removed for re-use elsewhere as part of general site clean-ups. This might explain what happened in example 1 above.

However, even if the tag remains in place, the reporter's experience is that it usually does not contain significant detail about the hazard being controlled, leaving uncertainty in the future as to the nature of the hazard. This exposes personnel to hazards when trying to inspect or identify the problem and raises the risk that the issue could be missed and the barricade removed without addressing the underlying issue (as in example 2 above).

Discourage the use of temporary barriers

It is the reporter's opinion that engineers and others involved in the operation and management of industrial and similar facilities should discourage the use of temporary barricading to control access to structural (or other) hazards and should encourage more direct (and appropriate) means of controlling these issues. These could include rectification of the original issue or installation of permanent handrails or guarding. If barricading is required, it should be considered to be a short-term administrative-type control only, until more permanent means of addressing the issue are implemented. Additionally, a clear reason for installing the barricade should be recorded somewhere easily accessible to other personnel, and someone made responsible for ensuring the barricade is inspected and maintained until the hazard is addressed permanently.

C Expert Panel Comments

Owners of assets have a duty to ensure the safety of these assets and the safety of anyone who might have access to them. This report highlights the importance of clear communications and good record-keeping with respect to any controls that have been put in place.
At the sites that the reporter describes it is very likely that there had been a safety management team with JSA (Job Safety Analysis) and SWMS (Safe Work Method Statement) and other similar administrative controls in place.
However, as the reporter notes, records cannot always be relied upon, they are a low-level risk control at best, and may rely on retention of people and site history.

Always ensure a safe form of access

Ultimately, this report highlights that persons accessing a dilapidated structure have an obligation to themselves to ensure that the structure is in fact safe to access (noting that the person(s) with control and management of the site and/or the particular area also have this obligation). They should undertake preliminary inspections using a safe form of access or from a safe vantage point before entering any area that may potentially have hazards, structural or otherwise. If this is not possible, the matter should be referred back to the asset owner.

The risk of unauthorised access

Besides intentional and authorised access, there is always the risk that unauthorised persons may obtain access to structures. Therefore, removal and making safe is always preferable to precluding access and letting a structure continue to deteriorate as it will only become more expensive, dangerous, and time-consuming to rectify in the long term.

Scaffolding should only be used as a short-term temporary barrier

As the reporter notes, scaffolding should only be used as a short-term temporary barrier. The assumption made by scaffolding manufacturers and suppliers is that it is disassembled after use, inspected for damage and readied for re-deployment. This process does not allow for permanent or long-term installations as these pose risks the suppliers never considered, such as:

- Corrosion under long-term product build-up. This is especially prevalent on mine sites and port facilities.
- Internal corrosion not identified as the parts are not stripped and inspected as intended.
- Loosening of fastenings and couplings due to fatigue and corrosion.

Where scaffolding is used as a temporary short-term barrier, the following mitigating steps are suggested:

- Keep registers on-site of when the scaffolding was installed and ensure it is removed, inspected and rebuilt or replaced with permanent suitably-designed barriers.
- Keep scaffolding clear of any spillage encrustation.
- Avoid using scaffolding as a makeshift barrier in damp, corrosive areas or where there are dynamic loads present.
- Use a modified metal scaffold tag which includes the reason for the barrier, contact phone number of responsible engineer or inspector and the date of next inspection.

A risk assessment should always be undertaken to control a hazard or risk according to the hierarchy of controls. If a risk assessment determines that a control measure higher up on the hierarchy of controls (for example, a control measure that eliminates the hazard all together) other than a temporary barrier is reasonably practicable, then that control measure should be implemented.

> **A risk assessment should always be undertaken to control a hazard or risk according to the hierarchy of controls**

Submit Report

Submit Feedback

The reliability of technical data for proprietary products

CROSS Safety Report Report ID: 1080

This report highlights the importance of verifying technical data provided by the manufacturer or supplier of proprietary products.

Key Learning Outcomes

For structural design engineers:

- When using technical data provided for proprietary products it is important to check that the product has been tested to the appropriate AS/NZS standard by a NATA/IANZ registered laboratory
- When using an unfamiliar product, request the product supplier to confirm in writing how the product was tested and the relevance of the testing conditions to the actual application

R Full Report

A reporter has raised concerns about the technical data provided for some products that are used to brace non-structural elements (such as suspended building services within ceiling spaces) in Australia and New Zealand.

Test Results

When tests were performed by an independent testing laboratory on 3 random samples of each of two products, the published Ultimate Limit State (ULS) was not able to be achieved in all but one of the tests. The results obtained were 92%, 93%, and 96% of the published ULS for one product and 97%, 98%, and 109% for the other product.

Use of published data

These products are installed in buildings around Australia and New Zealand and Engineers rely on the published data being correct. The reporter is concerned that if an Engineer uses the published ULS ratings to carry out their seismic design for the bracing of non-structural services, then the Engineer may produce a design that could fail in the event of an earthquake. This failure could potentially lead to death or serious injury.

It is the reporter's opinion, that the published ULS ratings have either been based on incorrect testing or the testing has been undertaken on a product that is different from that supplied.

C Expert Panel Comments

The panel thanks the reporter for bringing this matter to their attention as there are several aspects to be considered. It is not CROSS policy to name manufacturers, so these comments are generic and apply to all safety-critical products.

It is possible that values given by product manufacturers for any component or system are not confirmed when independently tested. Structural engineers should be mindful that when safety-critical components or systems are being used it is good practice to have sight of the original test data and confirm that the testing has been carried out in accordance with the relevant Australian and/or New Zealand Standard and by NATA or IANZ registered laboratories.

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Reporting of results below expectation

Where test results fall short of expectations, as stated in the report, this should be reported by the company who carried out the tests to the manufacturer and, if necessary, to the relevant authorities so that the matter can be investigated. It may be that differences between the manufacturer's quoted test values and those of an independent laboratory could be due to reasons associated with testing procedures.

Check for current datasheets

When choosing capacities from technical data sheets it is important to check that the latest version of the technical data sheet is being used and that the values provided are for testing under the relevant conditions and to the appropriate AS/NZS Standard.

When using an unfamiliar product, or where there is some doubt as to the reliability of the published information, it can be worthwhile to make a comparison with similar products from other manufacturers. If doubt still exists, then the prudent Engineer will consider using a larger capacity reduction factor depending on their assessment of the robustness and criticality of the overall system. Alternatively, independent tests may be commissioned to verify any data considered incorrect or dubious.

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