# Seismic Anchors in the Interiors Industry - An important update

**New Zealand Building Code, April 2025**
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## The introduction of the C2 anchor spec

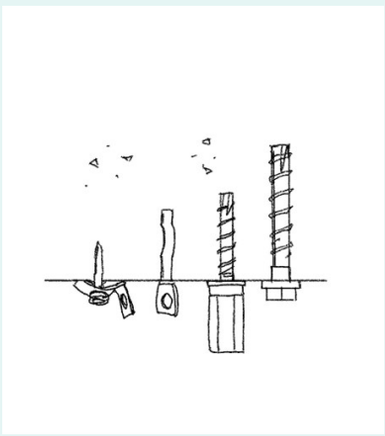
In 2017, a relatively small change to the concrete standard, NZS 3101, had a surprisingly large impact on the interiors or fitout industry. I am, of course, talking about the introduction of C1/C2 rated anchors, or seismic anchors. Specifically the changes to NZS 3101, section 17.5.5 - Strength of anchors by calculation (Amendment 3) to include the following sentence:

"Post-installed mechanical anchors and post-installed adhesive anchors shall pass the prequalification testing stipulated in ETAG 001, Annex E and be designed in accordance with EOTA TR045."

This was progressively introduced into the New Zealand Building Code, B1 - Structure in 2018, and was then sporadically adopted into industry over the following two years. Regulators have taken different approaches on different project consents, however the most simple but also most conservative position is that to comply with the concrete standard, any anchor into concrete should now be a C2 seismic anchor.

## C2 anchors are significantly more expensive

The reason for the unexpected impact of this change was that the status-quo anchors for interiors were shot fixed, knock-in or M6 screw anchors, used primarily for fixing ceiling suspension hangers and wall head tracks. These anchors couldn't possibly meet the requirements of C2 because of their smaller size; it is practically impossible to get a standard anchor to pass the C2 requirements in a screw diameter smaller than 8 mm. However, an M8 screw anchor is about five times the capacity required for interior building element loads. It is also about ten times the cost to install, when you consider the underlying cost increase of the anchor and the significantly increased time to install.



Picture : Anchor comparison - non-seismic (shot-fired and knock-in), and seismic C1 and C2 anchors for the equivalent ceiling hanger application

## Are C2 Anchors necessary for Non-Structural Elements?

C2 anchors provide a tested capacity when the concrete structure cracks and moves under earthquake loads. This is important when you are anchoring primary and secondary structure with critical load paths. That is, building elements which could fall down and hurt people if the individual anchors failed and could even cause the total structural collapse of the building.

However, is this necessary for Non Structural elements like walls and ceilings?

Well, if you dig deep into the design standard for C2 anchors (EN 1992-4), you will find that there is a lot more to it than a simple classification by seismic zone and substrate type, and you can conclude that we have oversimplified by assuming that C2 anchors are required for all Non Structural elements. But it's not a straightforward journey through EN 1992-4, and this path is not likely to be picked up by many engineering designers or received well by consenting officers. So what to do?

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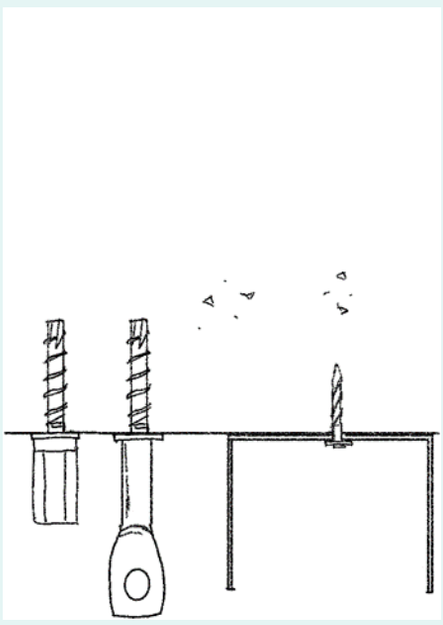
## ER95 Code of Practice - A better approach

Recently, a talented group of Non Structural Specialist engineers and academics have released an excellent Code of Practice, ER95 - Code of Practice for the Seismic Performance of Non-Structural Elements (2024). The authors include engineers from Beca and WSP, and academics from the University of Canterbury. In this Code of Practice, the design requirements for wall and ceiling anchors are addressed in a sensible and practical manner.

ER95 states the following about wall and ceiling anchors (bold is my emphasis):

- **There are no clear, New Zealand specific, recommendations** related to the specification of appropriate seismic qualifications for post-fixed anchors. **Engineers will need to satisfy themselves** of the appropriateness of selection in any application.
- Seismic fixings for some non-structural element support and restraints may not be available. In these instances, the non-structural element designer is expected to provide a design appropriate to the lower levels of validated resilience. This may be done, through redundancy in load path or by providing residual capacity in these elements.
- Due to confusion over the appropriate use of C1/C2 rated anchors, and the unavailability of C2 rated anchors for all existing floor substrates, the following risk-based approach is suggested:
  - **Low Risk Anchorage - Most distributed, suspended non-structural elements (i.e., general services, ceilings)** and floor mounted plant constitute a higher level of support redundancy, **a lower consequence of failure and a significantly lower life safety risk than that associated with primary structural elements. Category C1 (or ACI 355.2) anchors are generally considered appropriate for low-risk applications.**
  - Whilst selecting C1 anchors may be viewed as unconservative according to the reference ground acceleration thresholds given in table 5.1 of ETAG 001, this recommendation is considered appropriately aligned with its intent when adopting elastic loading and deriving loads directly from NZS 1170.5, especially as applied to lightweight and low risk applications. Category C1 is generally equivalent to ACI 355.2.

To summarise, ER95 states that an appropriate engineering methodology for wall and ceiling anchors is to use NZS1170.5 actions and elastic design (eg, ductility = 1.0) and use C1 anchor capacities. Which means that C1 or ACI 355.2 M6 screw anchors and rated shot-fired pins are acceptable design specifications for hangers and tracks.



Examples of acceptable details to ER95 for wall and ceiling anchors - two C1 rated M6 hanger screw anchors, and a C1-rated powder actuated deflection headtrack nail

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## How will ER95 be used to prove compliance with the building code?

The cited Verification Method compliance pathway for post installed anchors is as follows:

- New Zealand Building Code - Section B1 Structure
- Verification Method B1/VM1:
  - Calculation of Actions to AS/NZS 1170 (The structural loading standard)
  - Calculation of Anchor Capacity to NZS 3101 (The concrete standard)
  - Calculations to be carried out by "an engineer with relevant experience and skills", or a Chartered Professional Engineer

A verification method must be accepted by the Building Consent Authority (BCA) as evidence of compliance with the building code. However, because ER95 is not cited in a verification method, using the ER95 details will be an Alternative Solution. That means the BCA doesn't have to accept the design, and will likely require more proof before they grant consent.

The Alternative Solution compliance pathway looks like this:

- New Zealand Building Code - Section B1 Structure
- Alternative Solution to ER95:
  - Calculation of Actions to AS/NZS 1170 (The structural loading standard)
  - Calculation of Anchor Capacity to ER95, considering the following design principles:
    - Building elements are lightweight and low risk
    - There is redundancy in load path, or
    - There is residual capacity in components
    - Ductility = 1
    - Specified anchors have sufficient C1 anchor capacity
  - Calculations to be carried out by "an engineer with relevant experience and skills", or a Chartered Professional Engineer

As can be seen, the differences between the Verification Method and the Alternative Solution are limited to the replacement of the NZS 3101 method by the ER95 method. The question then becomes will this alternative solution be accepted by BCAs? The answer is that it's not guaranteed, but ER95 has been written by professionals and is endorsed by BRANZ, the BIP and AWCI. If the interiors industry supports this approach in future projects, the probability of this approach becoming industry best practice is much higher.

## How does ER95 work with the AWCI Code of Practice?

The AWCI Code of Practice for ceilings was developed before ER95 came out. In anticipation, we referenced ER95 at the start of the code of practice by its working title, the BIP NSE CoP. We were also careful to leave the content around concrete anchors open, specifically stating "Current requirements based on the European Standard are under review, including new fastener type options more suitable for the suspended ceiling industry".

What that means is that the AWCI CoP is complemented nicely by ER95, and both codes can be used concurrently. ER95 is more design focused and the AWCI CoP is more build focused. In future revisions of the AWCI CoP, we will be able to reference the requirements around C1 anchors for interiors directly.

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The AWCI CoP and ER95

## What should AWCI members do next?

For current projects that have been designed with C2 anchors, there is an immediate value engineering opportunity if you can get a minor variation to the consented design. An informed engineer will be able to redesign for C1 anchors, and you will be able to substitute for the more economic design.

For pricing of future projects, or design and build interiors projects that you are working on, RFI the anchor specifications early. Specifically, ask whether ceiling and wall anchors are to be specified to B1/VM1 - C2 anchors, or B1 Alternative Solution - C1 anchors.

And if you have questions about ER95 and C1 vs C2 anchors, feel free to get in touch with me directly. For the price of a coffee, I'm more than happy to answer any questions!

## References:

Borosnyoi-Crawley, Dorian,
Paradigm Change in the Seismic Design of Post-Installed Fasteners in New Zealand
(February 09, 2024). SESOC Journal V. 37, No. 1, April 2024, Available at SSRN: https://ssrn.com/abstract=4977518

https://bipnz.org.nz/wp-content/uploads/2024/10/ER95_Code_of_Practice_for_the_Seismic_Performance_of_Non-Structural_Elements_S_ASdX8IF.pdf

https://www.building.govt.nz/building-code-compliance/how-the-building-code-works/different-ways-to-comply/acceptable-solutions-and-verification-methods

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