engineering new zealand
te ao rangahau

Warehouse design
Module 1: Introduction

September 2025

Introduction

Engineering New Zealand has launched a project to upskill engineers in the design of warehouses across the country. This initiative stems from the findings highlighted in the 2023 Engineering New Zealand Warehouse Review, which identified several areas where current design practices can be improved to ensure safer, more robust warehouse structures.[1] The project aims to enhance compliance with the Building Act, standardise competency expectations for Chartered Professional Engineers (CPEng), and offer practical examples of good engineering practice by providing targeted training and resources.

Why this project is necessary

Legal and compliance requirements

New Zealand's Building Act mandates that all structures meet specific safety and performance criteria. Due to their large, open spaces and heavy reliance on structural integrity, warehouses pose unique challenges. The Engineering New Zealand Warehouse Review revealed that inconsistencies in design approaches have led to vulnerabilities in earthquake resilience and general structural performance. This project seeks to bridge these gaps, ensuring warehouse designs consistently meet legal requirements and contribute to public safety.

Regulatory consistency for CPEng

The CPEng credential is a benchmark of professional competence. However, Engineering New Zealand has identified a variance in the assessment of warehouse design capabilities among applicants and assessors. This project aims to establish a transparent, unbiased bar for CPEng certification by providing standardised examples of good practice. This will help assessors apply consistent criteria and guide engineers in preparing for their assessments.

Practical education for engineers

In addition to regulatory needs, there is a pressing demand for educational resources that illustrate good warehouse design from a first-principles approach. Many engineers, especially those new to the field or working in smaller practices, lack access to detailed, practical guidance. By creating a series of modules and compiling them into a comprehensive guide, this project will offer invaluable resources for both experienced engineers and graduates.

Using these modules, Engineering New Zealand will build training courses for engineers to help them upskill and reinforce their learning.

1 https://d2rjvl4n5h2b61.cloudfront.net/media/documents/Warehouse_Review_Feb2023.pdf

Project structure

The warehouse design upskilling project will be delivered in stages, with modules released from late 2025 to 2027. They will cover key warehouse design aspects, providing theoretical knowledge and practical guidance.

The modules will focus on providing sketches demonstrating design principles, with bullet point tips for good practice, what to avoid and why, as well as references to more detailed guidance.

Each module will be released in stages:

- a short document
- a webinar with Q&A
- an additional learning resource developed by Engineering New Zealand's CPD team.

Key topics covered in the modules

1. Global design principles

- Fundamental principles governing the overall stability and performance of warehouse structures.
- Considerations for load distribution, redundancy, robustness and durability.
- The importance of holistic design, considering wind, seismic and gravity loading interactions.

2. Portal or transverse frames – global view

- Overview of single-span and propped portal frames with practical sizing guidelines.
- Determination of span-to-depth ratios to ensure efficient structural performance.
- Key factors affecting the placement and effectiveness of lateral restraints.
- Compact sections vs. non-compact sections, including implications for design and performance.
- Differences between nominal vs. actual yield strength (Fy) in steel sections and its effect on design.

3. Bracing or longitudinal frames

- Good practices for bracing bays, including number, placement and function in resisting longitudinal l loads.
- Types of bracing systems, including diagonal, portal, and tension-only bracing and proprietary systems.
- Load transfer mechanisms in longitudinal end frames and their impact on global stability.

4. Joints (knee, apex, splices, and change of section depth)

- Detailing for knee joints and their role in resisting moments in portal frames.
- Considerations for apex joints and their behaviour under seismic, wind, snow and gravity loading.
- Splice connections, including when and where to use bolted vs. welded splices.
- Managing changes in section depth to ensure continuity and efficient force transfer.

5. Baseplates and foundations

- Design considerations for hold-down (HD) bolts to ensure proper anchorage.
- Selection criteria for base plates – thickness, stiffening and load transfer.
- Best practices for designing footing pads and pile foundations for warehouse structures.

6. Side walls

- Structural role of precast concrete vs. concrete block walls in warehouse stability.
- Design considerations for lightweight wall cladding (e.g., metal panels) and its connections.
- Wind and seismic load effects on side walls and their influence on global stability.

7. Mezzanine floors

- Load considerations for mezzanine floors and their interaction with primary warehouse structure.
- How mezzanine floors integrate with portal frames and bracing systems.
- Seismic detailing to prevent undesirable movements or failures.

8. Side wall collectors

- Full-height vs. part-height collectors, including when to use and key design considerations.
- Connection detailing for collectors to ensure structural integrity.
- Provisions in NZS 1170 for collector design and seismic force transfer.

9. Collectors and wind posts for end walls

- The role of collectors and wind posts in transferring lateral loads to bracing systems.
- Connection detailing for wind posts to roof plane struts to enhance overall stability.
- Load path considerations, including ensuring effective force transfer without weak links.

10. Eccentricities

- How to minimise eccentricities in warehouse design to avoid unintended load effects.
- Understanding load paths and their role in distributing forces efficiently.
- Good practices for designing for eccentricities, including detailing for tension bracing.
- Considerations for pin edge distances to prevent premature connection failures

Expected outcomes

By the conclusion of this project, Engineering New Zealand aims to achieve several key outcomes:

Enhanced structural integrity

Warehouses designed following the principles outlined in the modules will exhibit improved resilience to seismic events and other structural stresses. This will contribute to increased safety for occupants and better protection of goods and infrastructure.

Consistency in professional standards

The project will establish a clear benchmark for warehouse design competency, reducing variance in CPEng assessments. This will ensure that all engineers seeking certification demonstrate a consistent level of skill and understanding, enhancing the credibility of the CPEng credential.

Comprehensive educational resources

When compiled, the modules will form a basic guide to good warehouse design. This guide will be an invaluable resource for engineers at all stages of their careers, providing a reference for best practices and first-principles design.

Wider industry impact

The project will disseminate knowledge across the engineering community by publishing the modules through Engineering New Zealand and submitting the work to the SESOC journal. This will encourage the widespread adoption of improved design practices and elevate the overall standard of warehouse construction in New Zealand.

Conclusion

Engineering New Zealand's warehouse design upskilling project represents a significant step forward in enhancing warehouse structures' safety, consistency and quality across the country. By addressing legal, regulatory and educational needs, this initiative will improve individual engineering practices and contribute to the broader goals of public safety and professional excellence. As the modules are released and the final guide is compiled, engineers will be better equipped to design warehouses that stand the test of time.

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