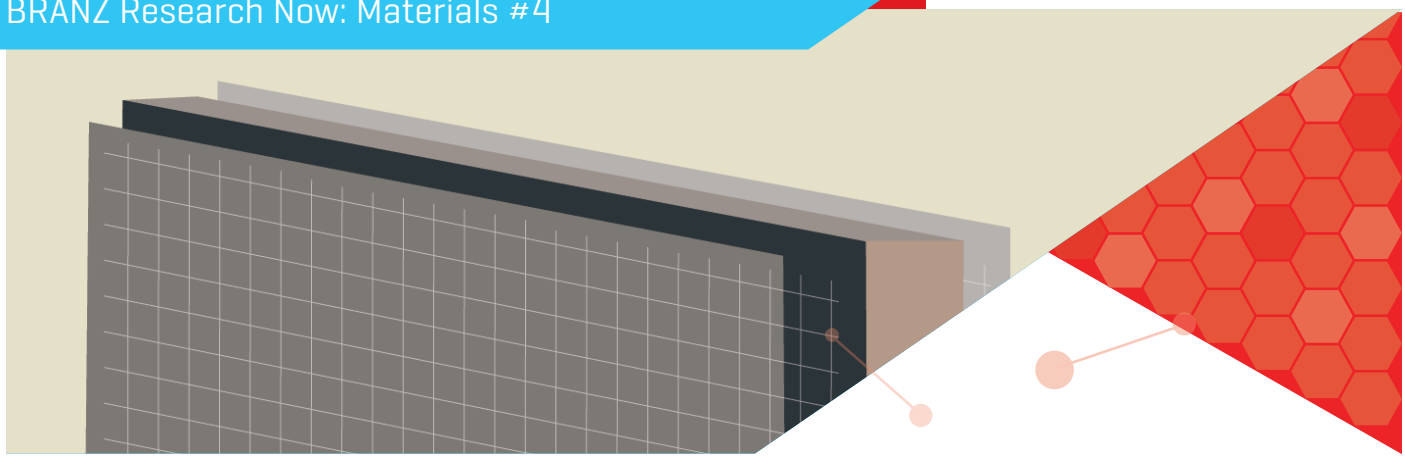


Comparing the performance of magnesium oxide and fibre-cement

Since magnesium oxide (MgO) boards may be used as an alternative to traditional sheet materials such as those made with fibre-cement (FC), it is useful to compare the performance of the two types of products.

BRANZ Study Report SR472 and Research Now Materials #3 *Performance of magnesium oxide boards in New Zealand conditions* summarise the results of a study investigating the performance of MgO boards in New Zealand.

The modulus of rupture (MOR) or bending strength is a routinely specified mechanical property used for the grading of cellulose FC sheet products. In this study, MOR was determined in accordance with clause 8.1.2.1 of AS/NZS 2908.2:2000 *Cellulose-cement products - Flat sheets*. While this is not an MgO standard, no international standards currently exist that state acceptance criteria across the full range of relevant properties. Thus, AS/NZS 2908.2:2000 was used to gather meaningful data for MgO given that FC boards are well known and extensively used in numerous applications in New Zealand.

MOR data for four different MgO boards sourced from commercial suppliers was obtained as described in BRANZ Study Report SR472. Comparative FC MOR data was obtained by averaging results from 10 different commercially available products.

The ratio of the test sample MOR to reference (control) sample MOR are shown below for:

- 24-hour soaking at ambient temperature (Figure 1)
- freeze-thaw cycling (Figure 2)
- prolonged warm water immersion (Figure 3)
- soak-dry cycling (Figure 4).

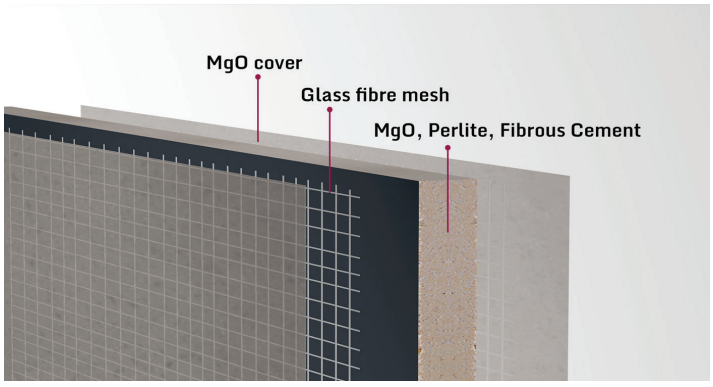
To better understand the variability of the data, both the lower confidence limit (LCL) and the average ratio result (r) are represented in the figures by the bottom and the top of the grey shading respectively.

The LCL in AS/NZS 2908.2:2000 is given by LCL = r - (0.58 × s), where s = standard deviation of r.

The total height of the grey bar therefore represents the variability in the MOR ratios and is shown here to provide additional useful information but is not required to be calculated within the scope of AS/NZS 2908.2:2000.

Results

Soaking for 24 hours under ambient conditions (Figure 1) shows that the MgO boards generally retained over 90% of their equilibrium condition strength in the wet condition while the FC retained around 70% strength. All boards easily met the minimum acceptable performance of 50% strength retention.



Typical structure of a magnesium oxide (MgO) board.

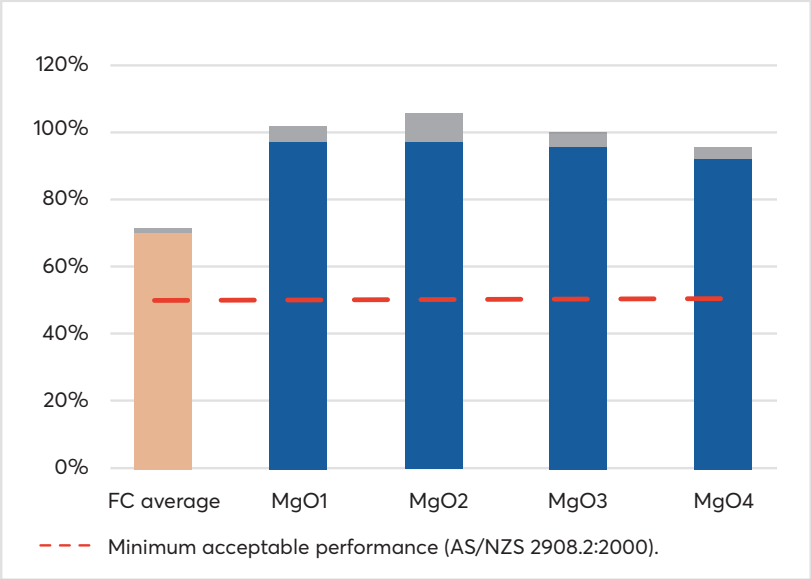


Figure 1. MOR ratios for 24-hour soaking under ambient conditions (AS/NZS 2908.2:2000) section 8.2.1.

Freeze thaw testing to assess frost resistance clearly identified differences in the composition of the MgO boards (Figure 2). Samples MgO3 and MgO4 were composed of an oxychloride cement while MgO1 and MgO2 were not. Comparable results were obtained for MgO1, MgO2 and FC with around 90% strength retention, above the minimum acceptable performance requirement of 75% strength retention. The two oxychloride cement products MgO3 and MgO4 retained 40% strength after this test and did not meet the minimum acceptable performance requirement.

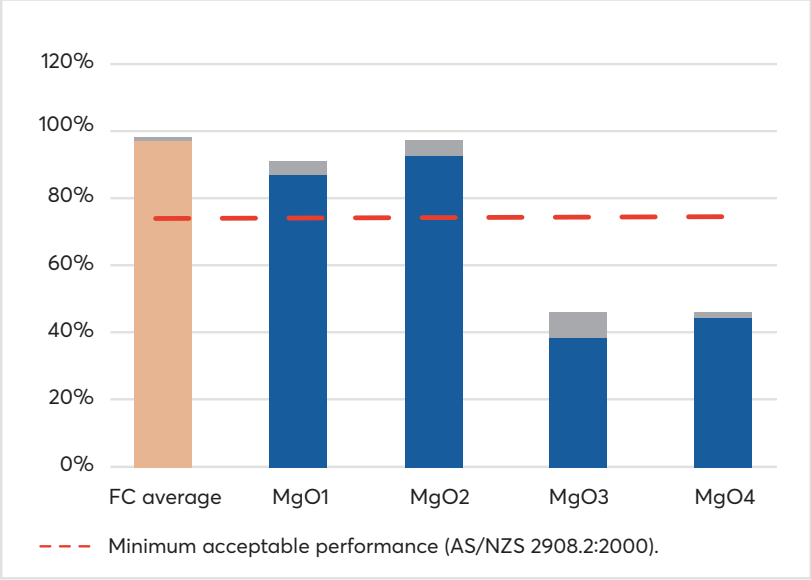


Figure 2. MOR ratios after 50 freeze thaw cycles (AS/NZS 2908.2:2000) section 8.2.3.

After warm water testing, the performance of all MgO board products was different to FC (Figure 3). All MgO ratio results were below 50% strength retention and as such did not meet acceptance criteria. The FC retained its full strength.

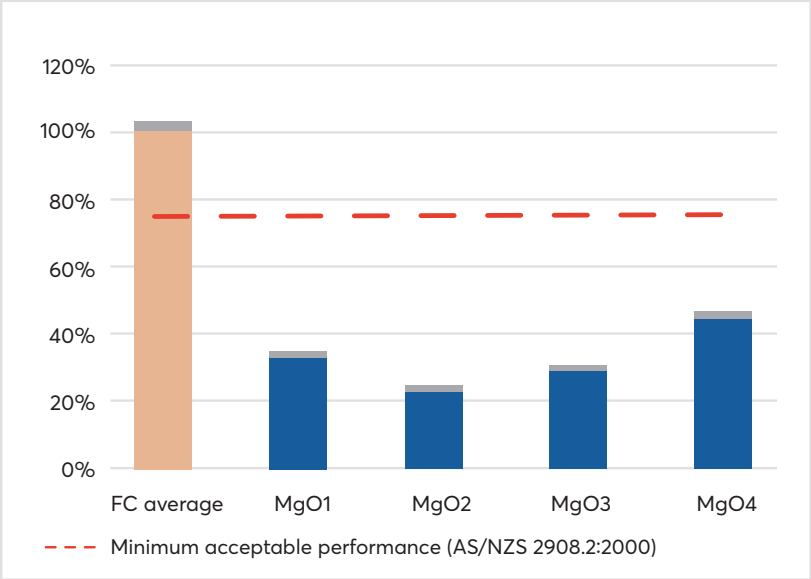


Figure 3. MOR ratios after warm water immersion for 56 days at 60°C (AS/NZS 2908.2:2000 section 8.2.4).

In a similar manner to freeze-thaw testing (Figure 2), soak-dry testing highlighted compositional/chemical differences between the MgO products (Figure 4). Comparable results were obtained for MgO1, MgO2 and FC with over 90% strength retention, complying with the minimum acceptable performance requirement of 75% strength retention. The two oxychloride cement products MgO3 and MgO4 showed around 40% strength retention and therefore did not meet acceptance criteria.

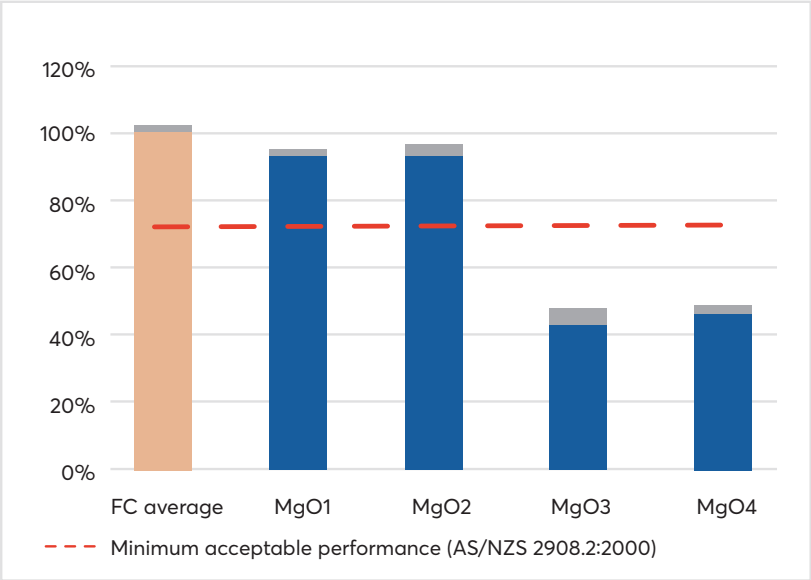


Figure 4. MOR ratios after 25 cycles of soaking (5°C water) and drying (60°C and ≤20% RH) (AS/NZS 2908.2:2000 section 8.2.5).

Findings

This performance comparison highlights the variability of MgO boards under some testing conditions. These results underscore the need to carefully consider likely in-service conditions when assessing the suitability of a particular MgO product for a given application.

Further reading

BRANZ Study Report SR472
Performance of magnesium oxide (MgO) boards in New Zealand (2022)

BRANZ Research Now: Materials #3
Performance of magnesium oxide boards in New Zealand conditions