February 2020

PRECAST CONCRETE CURING AND DURABILITY

New Zealand Concrete Structures Standard NZS 3101 clause 3.6 sets out the minimum curing requirements for concrete for various exposure classifications. These require 3 days wet curing for exposure classifications A1, A2 and B1 and 7 days wet curing for B2 exposure.

Traditionally, factory made precast concrete has not been subject to wet curing where the manufacture relies on high strength concrete and accelerated heat curing to enable daily turnaround of moulds. There are numerous examples of well made factory made precast concrete demonstrating proven durability. For example research performed by University of Canterbury measured carbonation depths of only 1 or 2 mm on decommissioned power poles in Christchurch that had been in service for over 50 years.

Note (3) to table 3.5 of NZS 3101 permits alternatives to wet curing provided a special study demonstrates that the concrete achieves the equivalent durability properties.

In 2018 the Concrete NZ Precast Sector Group commissioned the University of Canterbury to test the durability properties of typical 30 MPa and 35 MPa concretes subject to 3 days and 7 days of wet curing as required for exposure classifications A1, A2, B1 & B2 by NZS 3101. The results were then compared with typical precast concrete mixes of 40 MPa and 45 MPa using GP (ordinary Portland cement) and HE (high early strength cement) supplied by the main cement suppliers in New Zealand.

The durability performance of each of the precast mixes were tested using samples cast with no wet curing and subjected to the following curing profiles:

1. Samples remaining at 21º C following casting, as for the control specimens.
2. Samples subjected to accelerated curing at 30º C following casting
3. Samples subjected to accelerated curing at 40º C following casting
4. Samples subjected to accelerated curing at 50º C following casting

The control mix samples of 30 MPa and 35 MPa concrete subject to 3 or 7 days wet curing met the requirements for exposure classifications A1, A2, B1 & B2.

The main conclusions from the tests include:

- The precast mixes with no wet curing demonstrated equivalent, or in most cases better, durability performance than the control mixes subjected to wet curing, even without accelerated heat curing.
- Durability performance for the precast mixes improved when they were subjected to accelerated heat curing following casting.

For more information refer to "Time to Cessation of Curing of Concrete using Maturity Method or by Equivalent Durability Testing" by James Mackechnie & Allan Scott – 2019 Concrete Conference.