Gimme strength, cover and quality

All concrete is not the same. By considering four key factors, you can specify and create quality dense reinforced concrete that will pass the test of time outside.

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Lack of cover meant this steel was exposed when the slab edge was straightened. The cladding ground clearance also looks insufficient.

CORRECTLY SPECIFYING reinforced concrete exposed to the weather firstly depends on the exposure zone of the location. After that, good performance depends on:

- the strength of the concrete
- the amount of concrete cover provided to the reinforcing
- the quality of the concrete
- the placement and vibrating of the concrete.

Which exposure zone?

Exposure zones need to be considered when specifying concrete exposed to wind, rain and salt spray.

Depending on the severity of salt spray given in NZS 3604:2011 *Timber-framed buildings*, NZS 4229:2013 *Concrete masonry buildings not requiring specific engineering design* and E2/AS1, the exposure zones are:

- exposure zone B, defined as low risk
- exposure zone C, defined as medium risk
- exposure zone D, defined as high risk
- exposure zone E, which is close to breaking surf and has the highest risk.

Exposure zone E is not used in NZS 3604:2011 but is used in E2/AS1 for metal cladding selection.

Specify the right strength

To address the minimum compressive strength requirements for durability, NZS 3604:2011 paragraph 4.5.2 and NZS 4229:2013 paragraph 7.8.1 specify that the minimum 28-day strengths expressed in megapascals (MPa) for reinforced concrete and grout fill to concrete masonry are:

- 17.5 MPa in exposure zone B
- 20 MPa in exposure zone C
- 25 MPa in exposure zone D.

Geothermal hot spots require specific engineering design.

Concrete must comply with NZS 3104:2003 *Specification for concrete production,* and masonry must comply with NZS 4210:2001 *Masonry construction: Materials and workmanship.*

As a general rule, 20 or 25 MPa concrete is recommended. This gives improved performance for little additional cost, well worthwhile if the concrete is to be exposed during use in areas such as garage floors or where tiles are to be laid.

Provide enough cover

NZS 3604:2011 paragraph 4.5.1 specifies minimum cover to steel of:

- 75 mm for concrete placed directly on or against the ground
- 50 mm when placed against formwork and the concrete has the strength requirements above
- 30 mm for the top of an exposed slab protected from the weather
- 50 mm for any slab surface exposed to the weather.

An alternative approach allowed by NZS 3101:2006 *Concrete structures* is to use 17.5 MPa concrete with 75 mm cover to the steel or 50 mm cover if a damp-proof membrane is used.

For concrete masonry foundations, the minimum cover requirements are:

- 45 mm in zone B and for interior conditions (17.5 MPa)
- 50 mm in zone C (20 MPa)
- 60 mm in zone D (25 MPa).

Vibrate for good concrete

The final part of the equation for concrete exposed to the weather is ensuring the placed concrete is dense and well compacted using a poker-head vibrator.

Exposed concrete that has voids created by air pockets in the wet concrete is bony, or not very dense, and will readily allow in water and salts, which can initiate corrosion of the steel and result in spalling.

For more See page 24 for how to correctly vibrate concrete.