

NZRMCA's Handbook for Concrete Placers

Introduction

The placing, compaction, finishing and curing are all part of the essential processes to achieve satisfactory performance of concrete. Even with the smartest specifications and fancy concrete mix designs, the concrete will NOT achieve the required performance without the work of the placer and finisher.

Unfortunately for many years there has been limited training for the Placers/Finishers. In particular while there is an emphasis on how to do things correctly, there has been very little time spent on explaining WHY the various aspects of the job are needed.

This section of the website looks primarily about WHY you should do things and explains that in many cases failure to carry out the job properly means that you are breaking the legal requirements of the NZ Building Code. In any subsequent failure of a concrete component if it can be shown that faulty workmanship is a factor you can be held liable.

The Legal Stuff

All concrete production in NZ has to comply with the NZ Standard NZS 3104 Concrete Production. The bulk of concrete production is from ready mixed concrete plants but the Standard also has concrete mixes for small site mixing set ups. You may see the terms Prescribed (P), Normal (N), Special (S). Prescribed mixes are ones that have fixed cement contents and are usually only used in a small site mixing operation.

Normal concretes are the ones that you deal with each day from the ready mixed concrete supplier. Ordering procedures for the concrete are shown on [Poster 1](#). While you may not always be fully involved with this you need to know the background to the ordering process.

One of the most important factors relating to concrete is the amount of water included in the mix. Cement and water form the "glue" that sticks the sand and aggregate together. It is a chemical reaction similar to 2 part epoxy glues except in this case, it is cement and water. The more water you use, the weaker the "glue" and the lower the concrete strength.

While you must have enough water and cement paste to be able to compact the concrete, immediately you go past this point then the concrete will have reduced performance e.g. its strength goes down and the risk of getting shrinkage cracks a few days later is significantly increased.

So there is a WHY factor in not adding water to concrete on site. If the concrete does not have a satisfactory slump when it is delivered then the ready mixed concrete driver has an opportunity to add limited amounts of water to the mix to ensure that the slump that was ordered is met.

You cannot change the ordered slump figure i.e. if you ordered it at 100 mm you cannot amend it on site to 150 mm by adding water.

The mixer driver can add up to one bucket of water 10 litres for each 1 cu metre of concrete in the truck to restore the slump to the ordered value.

If you put water in the truck you take full responsibility for the concrete performing as the designer has specified.

Who will know? Well the ready mixed concrete company retains the records of the concrete mix including water used. It is possible by taking hardened concrete samples from a job to establish how much water was in the mix.

The difference in water used puts you in the gun for responsibility if things go wrong.

Do you want the responsibility for breaking out the concrete, buying the replacement concrete and placing it?

Remember to order concrete with the right slump for your job.

Think twice before adding water from the "green snake" (water hose). If you stick to the rules you will be complying with NZS 3109 Concrete Construction Section 6.

Transport and Placing

Poster 2 gives you a run down on possible options for transporting the concrete on the job. The most important issues to consider when are:

- A ready mixed concrete truck is not an "off road" vehicle. So it needs temporary roading to get to the area to be concreted
- Wheelbarrows do not carry much concrete. A 3-metre load of concrete requires 100 or so wheelbarrow loads to transport it!
- The ready mixed concrete supplier needs to know whether you are going to pump the concrete.

The key NZ Standard that controls what you need to do is NZS 3109 Concrete Construction.

The requirement for concrete transport is that the concrete does not segregate i.e. all the large aggregate at the bottom and fine material at the top. The wetter the mix the more likely it is that you will have a problem of segregation.

The Standard requires you to put the concrete as near as possible to the correct place BEFORE vibrating the concrete. You are required to do this because 'dragging' the concrete into place with a vibrator causes segregation with large aggregate in one place and fine material elsewhere. All this weakens the final concrete.

Compaction

Of all the jobs you do, this is one of the most important. When concrete is

delivered it may have up to 12% of air trapped inside as a result of the mixing process.

If you do not remove this air, then the concrete will only be half as strong as it is supposed to be!

Poster 3 and Poster 4 give you some examples of the best way to get that air out. The tamping process shown in Poster Fig 11 is really only suitable for small jobs where fixed edge formwork is used. It is very hard work and you would do the job much more easily using a vibrator.

The fancy phrases of NZS 3109 said, "expel entrapped air". Once again if there is a problem with the concrete performance, the tests that can be carried out on hardened concrete will show whether you have done your job properly.

Remember you can cause a 50% strength loss. You do not want the liability of that, so follow the example shown on the two posters.

By following the rules your work will comply with the requirements of NZS 3109 Concrete Construction Clauses 7.1.1, 7.4 and 7.6.

Finishing

The next stage after compaction is the sequence of finishing Poster 5. While bleeding (excess water coming to the surface) is common for all concrete pours it does have some special significance on concrete floors.

Remember the comment about too much water in concrete, well if you get the finishing process wrong you will be remixing water into the top of the slab. This causes the top surface to be weak and dusty. You may get what seems to be a perfectly smooth surface but after a few months of floor use; the concrete will be wearing very badly.

So follow the sequence of finishing very carefully.

In most cases there will be several hours between the initial and final finishing of a slab. So you may have to finish up doing the final trowelling at night! Poster 5 shows you some of the techniques required to meet the regulations in NZS 3109 Concrete Construction Clause 7.1.2 and 7.7.

Once again it may seem very easy to say who will know but again there are test methods that will show whether the problem resulted from improper workmanship by you.

So follow the letter of the law on these matters to avoid getting involved in any later disputes. Concrete is a one chance material, get it right first time.

Poster 5 also lists out some of the coding requirements for typical finishes you may get have specified from the New Zealand Standard 3114 Concrete Surface Finishes.

The NZRMCA Bulletin Decorative Concrete Guidelines included in the Handbook gives advice on how to go about planning for these special finishes.

Protection

There are two protection conditions that need to be considered:

- While the concrete is fresh and is setting
- When the concrete has hardened. This later stage is called curing and is discussed in the next part of the Handbook

In New Zealand, the temperature and wind conditions are critical influences on many days of the year. Essentially you need to stop the surface of the concrete drying out too quickly. This job is easier said than done because the concrete is still in a plastic state i.e. you cannot walk on it. What happens when you do nothing is shown in the NZRMCA Cracking Booklet.

There are special compounds that can be sprayed on to the surface see Figure 4 Poster 5 using a powered spray pack. An alternative is to use a fine water

misting spray, perhaps from a high-pressure water blaster, discharging into the air above the slab but not flooding the concrete surface.

Following the procedures will ensure you comply with the rules in NZS 3109 Concrete Construction Clauses 7.8.1 and 7.8.2.

Curing

This is perhaps the least understood job because after all you cannot see that it makes any difference. Right at the start we said that water and cement are the "glue". Too much water makes the "glue" weak but if there is no water the gluing action stops. This action of gaining strength takes place over days and weeks. If the concrete surface dries out, then the surface will be weaker than the interior of the concrete. The outer concrete can have several important functions:

- It protects the reinforcing steel
- It carries the direct wear from, for example, wheels on floors
- It has increased resistance to penetration of liquids and chemicals

So the purpose of curing is to ensure that the hardened surface does not dry out. This means that there will be water for the cement to continue to react with, thus improving the quality of the surface.

Poster 6 Fig 2 shows you that 5 days curing improves the surface quality 15 times the quality of leaving it just air exposed.

Poster 6 shows various methods of curing that can be done and they vary whether the concrete is a wall, column, beam or floor. Some methods suit one component and not others.

The best method to get maximum performance out of a concrete slab is to pond it but covering with anchored down polythene also provides good curing. Membrane curing compounds are convenient but they rely very much on your

skill to apply the correct coverage. You should check that the manufacturer is supplying you a curing compound that complies with NZS 3109.

All normal concrete shrinks as it dries out, so let's have a look at that next.

Shrinkage of Concrete

The effect of this is to create strains in the concrete that lead to cracks forming. The [NZRMCA Bulletin Cracking in Concrete](#) included in the Handbook gives some examples of different crack types. While many of them you can control in the concrete's plastic state, shrinkage after hardening is a complex business depending on a variety of factors that are set by either the builder or the designer.

If you are asked to provide control joints, you must receive clear instructions from either the builder or designer on where to position the joints.

The purpose of the joint is to allow the slab to shrink and relieve the strain at the joint. I.e. it does not crack away from the joints.

How often have you seen cracking nowhere near the joint? It is for this reason you must get instruction from the builder or designer because the position and spacing of joints depends on many factors you may not know about.

For Residential floors there are various rules in NZS 3604 for the builder or designer to follow. They are contained in Section 7.5 of that Standard and need to be discussed with you before the slab is placed.

On commercial projects, the jointing issues are also part of the construction process and need to be discussed before any concrete is placed.

While some joints will be formed during construction, a significant number may be formed by saw cutting after the concrete has hardened. The rule of thumb is that the joints should be cut within 24 to 36 hours of placing.

However these times can be changed due to concrete strengths and ambient

temperature conditions. The depth of saw cut needs to be one third of the depth of the slab.

On industrial and commercial floors where higher strength concretes may be used, the chemical reaction between the cement and water (glue) causes the concrete temperature to rise quite a bit resulting in expansion. If this is followed by a cold night, the concrete can crack within 12 hours. To reduce this risk, you can for example saw in the construction joints shortly after the final trowelling using a special early age cutting saw.

Another precaution is to cover the slab with polythene which is supported 25mm or so above the slab and blocked down on the slab at the edges. After 24 hours remove the polythene, wet the slab and then replace the polythene back right on the slab surface.

Summary

YOU can see for the various concrete topics discussed that you have an important role in seeing that concrete construction achieves the specification requirements set down on a piece of paper. The real job is to do it in practice out there under job site conditions.

Your job is important!

So why not get some recognition for it.

The Building Construction Industry Training Organisation has two qualifications you could consider:

- National Certificate in Concrete Construction (Placing and Finishing)
- National Certificate in Concrete Construction (Site Work)

These are primarily practical based qualifications which if you follow the rules contained in this handbook you are already close to qualifying for the National

Certificate in Concrete Construction (Placing and Finishing), the details of which are supplied in the Handbook.

The Government is looking at seeing evidence of competency within the Building Industry for trade skills.

Seriously consider getting that practical training registration.

