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BUILDING RESILIENCE

AUDITED PLANT

Quality Assured NZS 3104

CONCRETE NZ

PLANT AUDIT SCHEME

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CONCRETE PLANT AUDIT SCHEME

A STAMP OF EXCELLENCE

The Plant Audit Scheme operates to audit Concrete New Zealand (NZ) Readymix Sector Group member's ready mixed concrete plants as defined in New Zealand Standard *NZS 3104 Specification for Concrete Production*. The Scheme provides an independent and rigorous audit of the quality systems in place at a ready mixed concrete plant.

Audits are carried out by the Plant Audit Committee of five or more engineers. Members include representatives from the Concrete NZ Learned Society and Engineering New Zealand (ENZ). The committee is resourced to enable it to conduct reviews to a high and consistent standard throughout New Zealand.

Without the scheme, purchasers and specifiers would be faced with a costly and time-consuming audit of concrete quality for each construction project. The Scheme operations are carried out under a quality assurance programme certified to ISO 9001 and audited by Bureau Veritas New Zealand.

CRITERIA FOR PLANT AUDIT SCHEME

WHAT THE SCHEME REQUIRES

Compliance with NZS 3104 and the relevant parts of related documents is mandatory under the Scheme, along with an appropriately qualified employee to perform concrete testing at each plant, as well as a plant engineer who is either a chartered professional engineer or a registered engineering associate.

Records must be properly maintained, with the following original records retained on-site to provide an audit trail confirming the test records analysed are correct and complete:

- The original day sheet compiled by the batcher showing each load sampled.
- The original technician's record of tests carried out on samples referenced to the batch record.
- The original summary of results forwarded to the plant engineer, referenced to the above test and batch reports.
- An annual report from the plant engineer to the Plant Audit Committee (and at other times should they require it) on the performance of the plant, and quarterly reports on the frequency of sampling and testing of concrete.
- On-site audits of plant performance by an auditing engineer appointed by the committee, some without prior notice.

QUALITY PERFORMANCE DATA

SPECIFIC BENCHMARKS AUDITED

Plants report quality performance data to the Committee annually and are subject to a detailed annual review of data together with an on-site audit every second year.

Site audits may also be carried out without warning at any time.

Among performance criteria audited are:

- Mean concrete strengths and coefficients of variation
- Aggregate quality by testing and monitoring
- Weigh scale calibration and accuracy
- Mixer efficiency tests
- Laboratory equipment calibration
- Production and testing record keeping
- Technician training
- Plant operator performance
- Effectiveness of plant engineer's monitoring of quality controls

ON-GOING ASSESSMENT

MAINTAINING AN AUDIT CERTIFICATE

In addition to the specific benchmarks audited, the frequency of testing within each quarter year must be submitted to the Plant Audit Committee. Failure to maintain testing requirements can result in the withdrawal of an Audit Certificate.

Performance standards of all plants in the scheme are under regular review. Certificates of Audit are issued for a period not exceeding 12 months.

Where plants fail to meet the criteria, their Audit Certificate is removed. It is necessary for such plants to resubmit to an initial reassessment with at least 30 results indicating compliance with NZS 3104.

When using concrete from unaudited plants, the purchaser is responsible for the implementation of the audit process required by NZS 3104 to ensure compliance with *New Zealand Building Code*.

Members of the Concrete NZ Readymix Sector Group are free to elect to use another authority to classify their plants. Such authorities work outside the jurisdiction and ISO Certification of the Concrete NZ Plant Audit Scheme.

A full list of audited plants is available on the Scheme's website - **www.rmcplantaudit.org.nz**

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SPECIFYING CONCRETE

TYPES OF CONCRETE SPECIFICATION

There are three types of specification methods for concrete:

1. Prescribed Concrete
2. Normal Concrete
3. Special Concrete

The choice of concrete specification is the prerogative of the design consultant. The detailed production requirements of the three concretes are contained in NZS 3104. The terms used previously like Ordinary, High and Special Grades have all been dispensed with.

PRESCRIBED CONCRETE

The prescribed concrete permitted by NZS 3104 and *NZS 3109 Concrete Construction* ranges from 17.5 MPa to 25 MPa. This concrete is not tested for strength but by checking that the materials used are batched correctly.

The specifier's control over these mixes is by way of checking cement content of the hardened concrete by chemical analysis, however, the accuracy of the test is low with an accuracy of ± 15%.

Typical use of prescribed concrete would be on small remote projects outside the operating areas for ready mixed concrete plants, and where concrete strength is not required over 25 MPa.

NORMAL CONCRETE

Specifications calling for the use of normal concrete 17.5 to 50 MPa in accordance with NZS 3104 and NZS 3109 should be used where the structural designer's primary concern is the compressive strength of the concrete. The structural designer has the following to specify:

- Concrete strength at 28 days
- Maximum nominal aggregate size
- Workability
- Method of Placement
- Additional requirements for Special Concrete (see below)

Based on this information the concrete producer will design, produce and take responsibility for the concrete. The quality assurance that concrete will be produced in accordance with NZS 3104 lies in requirements for the concrete producer to have an independent audit of the plant's production capability and viability of production on a statistical basis.

This function is performed by Concrete NZ's Plant Audit Scheme.

SPECIAL CONCRETE

This concrete will have performance requirements that may be outside the strength range 17.5 to 50 MPa or have special features not necessarily measured by compressive strength such as shrinkage, tensile strength, chloride durability etc. concrete requiring specialist skills of the concrete producer. The plant must have a current audit certificate for Normal concrete. The structural designer must now specify the special features required, together with a test method or other means that the concrete supplier can

demonstrate specification compliance. The specifier also needs to get some prior assurance from concrete producer that these special mixes will perform at the time of the project, this can cover:

- Producers records in producing similar compliant concrete
- Need for test trials prior to production
- Acceptable production variation in special parameter
- Required test frequency for compression and for the special parameter initially for production and reduction in testing rate once compliance is established

PRESCRIPTIVE VS. PERFORMANCE-BASED SPECIFICATION

The required properties of concrete can be specified in several different forms:

- Prescriptive specifications stipulate the mix design and method of placement and curing
- Performance-based specifications stipulate the required properties of the concrete but does not say how they are achieved

It is usual to nominate concrete properties by calling for a nominated slump and specified strength. Specifying slump and strength is the simplest form of performance-based specification, and can be appropriate when strength is required for adequate performance in its own right.

However, this approach does not always provide a desirable outcome to the client, as strength may not be the most appropriate property to measure or assess 'fitness for purpose'. For example, concrete's chloride resistant properties may be more important than its compressive strength for marine durability, and floor flatness and levelness may be more important than compressive strength for a high rack warehouse.

Performance-based specification can also include such properties, and this is seen as its greatest potential. There are several advantages in using a performance-based specification. Some of these advantages are:

- The client can nominate specific properties of the end product that are important to them (other than strength) and thus ensure a more relevant outcome.
- Specific and project-relevant criteria can be nominated for supply to the project.
- The material supplier with expert knowledge of their product can economise and where appropriate, optimise the design using innovative techniques to meet the desired properties.

Specifiers need to be aware that any concrete defined with performance criteria other than strength, (or for concrete with strengths in excess of 50 MPa) is considered as 'Special Concrete' in NZS 3104.

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