

Canterbury Earthquakes Royal Commission



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(CCANZ)

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CCANZ BACKGROUND

- Non-profit organisation
- History dating from 1950s
- Roots in Research
- Standards Development
- Education and Training

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CCANZ Submission

Critique of

- “CTV Site Examination and Materials Tests Report”

by Hyland Fatigue + Earthquake Engineering/StructureSmith

- “CTV Building Collapse Investigation Report”

by Hyland Fatigue + Earthquake Engineering/StructureSmith

- Collectively referred to as “Hyland Reports”

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CCANZ Submission cont'd

- Hyland Reports' concrete core testing methodology not best practice
- Hyland Reports' conclusions re concrete column strength must therefore be questioned
- Robust outcomes required

Core Sampling / Testing Best Practice

- Cores internationally recognised method to:
 - o Determine in-situ concrete strength
 - o Determine concrete supply strength
- BS EN 13791:2007
 - o Assessment of in-situ compressive strength in structures and precast concrete components
- BS 6089:2010
 - o Assessment of in-situ compressive strength in structures and precast concrete components – Complementary guidance to that given in BS EN 13791

Core Sampling / Testing Best Practice cont'd

- Quality control and consistency for extracting, testing and interpreting cores is critical:
 - o Choose representative locations with no cracking
 - o Adequate number (minimum 3, more for smaller cores)
 - o Diameter (D) of cores (4 times largest aggregate size)
 - o Length (L) of cores ($L/D = 2.0$)
 - o Avoid reinforcement
- If checking concrete supply strength account for:
 - o Excess voidage
 - o Inadequate curing

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Hyland Reports - Methodology

- Testing objective not clarified
- Damage – earthquake & fire
- Core diameters and number
- Core failure mechanism and laboratory reporting
- Location – specified strength
- Schmidt Hammer



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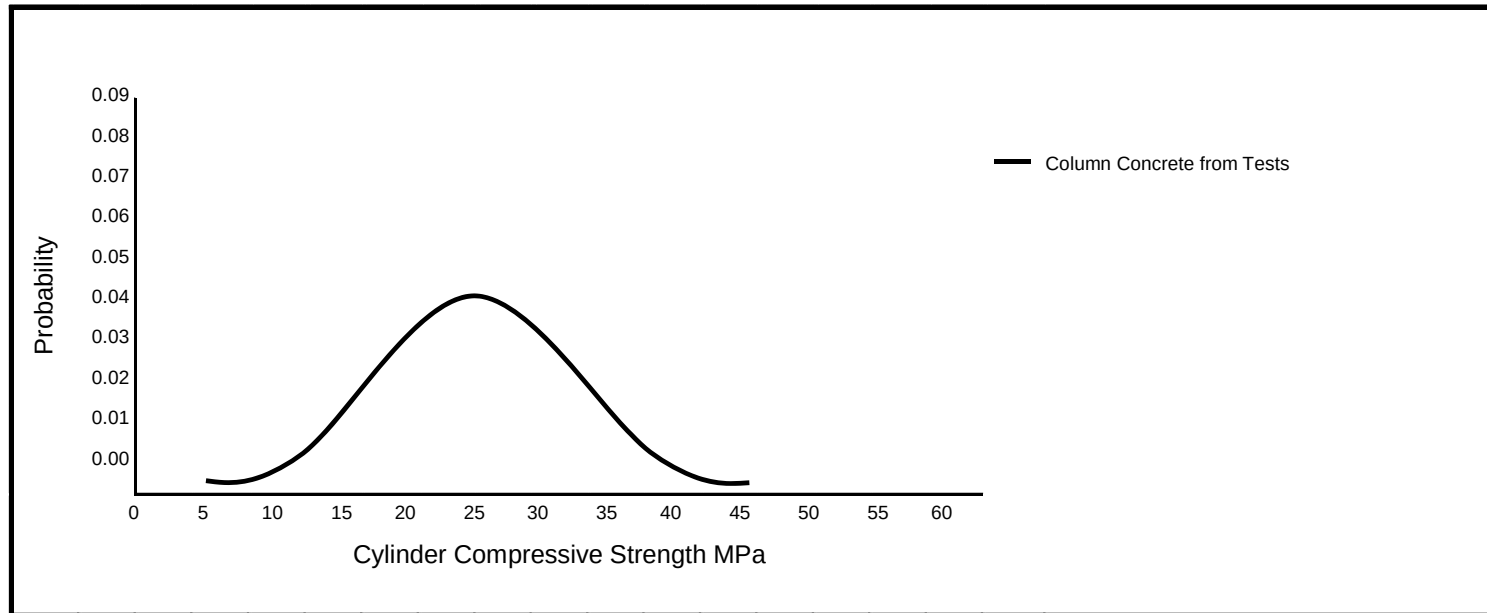
Hyland Reports - Interpretation

- Incorrect application of concrete aging
- High Grade vs. Special Grade

Specified Strength	20 MPa	25 MPa	30 MPa	35 MPa
Target mean strength (based on):				
NZS 3104 High Grade and Ageing applied in Hyland Materials Report	34.4 MPa	41.9 MPa	50.0 MPa	56.9 MPa
NZS 3104 Special Grade TMS as should have been applied	24.5 MPa	30.5 MPa	36.5 MPa	42.5 MPa

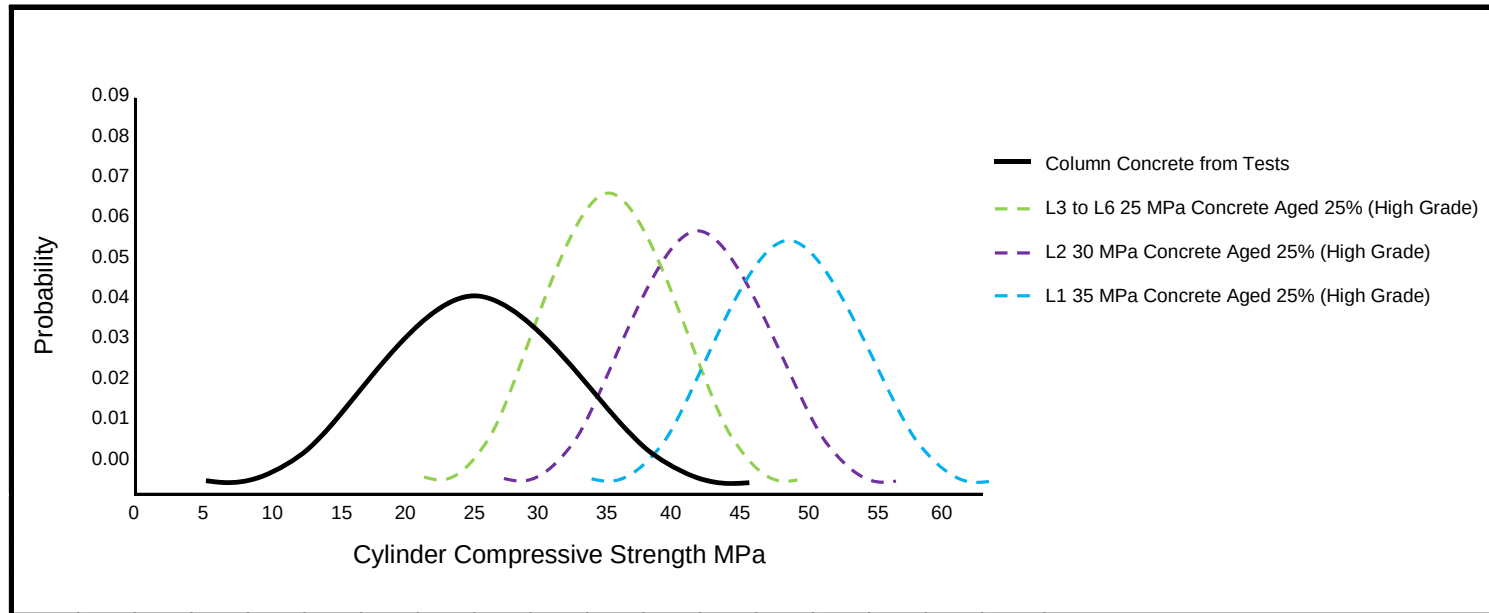
Target Concrete Strength verses Specified Strength to NZS 3104:1983

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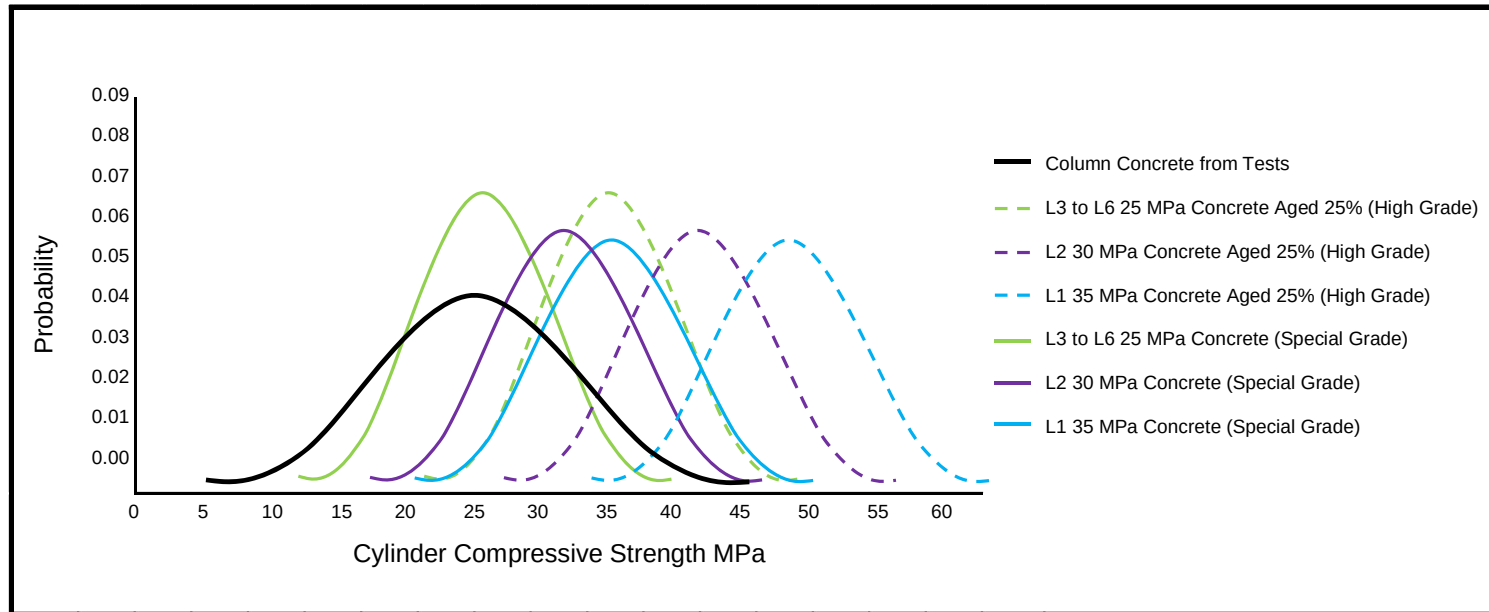
**Column Test Strength Distribution.
Special Grade Concrete versus High Grade Concrete aged 25%**

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**Column Test Strength Distribution.
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**Column Test Strength Distribution.
Special Grade Concrete versus High Grade Concrete aged 25%**

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CCANZ - Interpretation

- Core – applied correct:

- o Aspect ratio
- o Number
- o Diameter

- Schmidt Hammer

- o 9 paired results

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New Zealand Plant Audit Scheme

- Ready mixed concrete conforms to NZS 3104
- Provides an auditing system conforms to NZS 3104
- Independent of company interest
- Checks the plant's operational QA system, including:
 - o mix design performance, plant equipment and frequency of tests
 - o assesses plant records annually and visits plant biennially
- Audit certificate requires annual renewal
- Breach of protocol = removal of audit

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Summary

- Hyland Reports' concrete core testing methodology not best practice
 - o Testing objective not clarified
 - o Cores taken from distressed concrete
 - o Issues around core diameters, number and location
 - o Incorrect application of concrete aging
 - o Schmidt Hammer test – insufficient number and poor sample
- Hyland Reports' conclusions re concrete column strength must therefore be questioned