

Performance vs Compliance

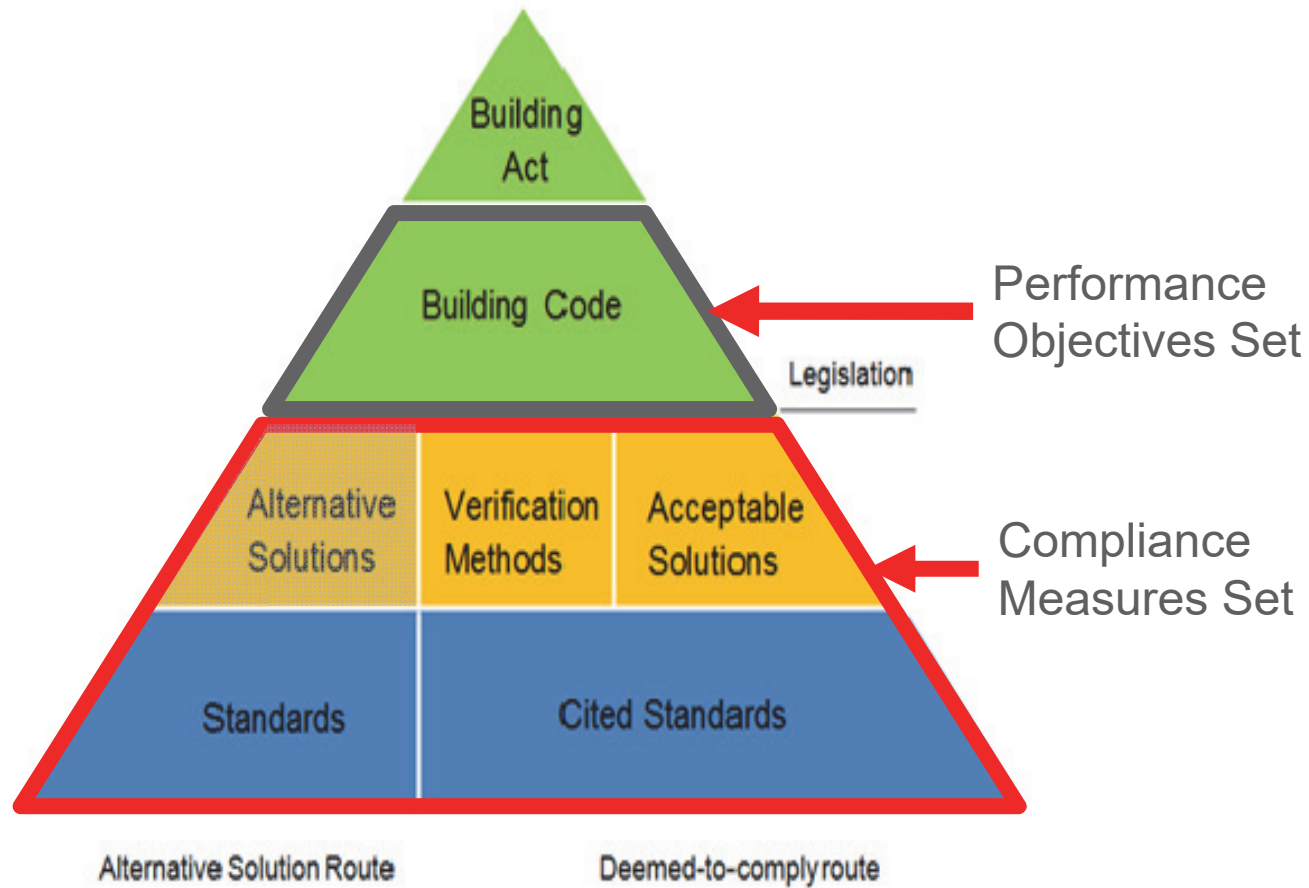
Rob Jury, Senior Technical Director, Beca, New Zealand

Andrew Stirrat, Senior Engineer, Beca, New Zealand

Outline

- Performance and compliance for earthquakes in the NZ context
- Requirements for seismic performance of buildings in NZ
- Compliance processes
- Why performance and compliance need to be kept separate
- Examples of issues that can arise when they are not

New Zealand Building Control System



New Zealand Building Code - New Building Work

- Clause B1 Structure

PERFORMANCE

B1.3.1 *Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives.*

New Zealand Building Code - New Building Work

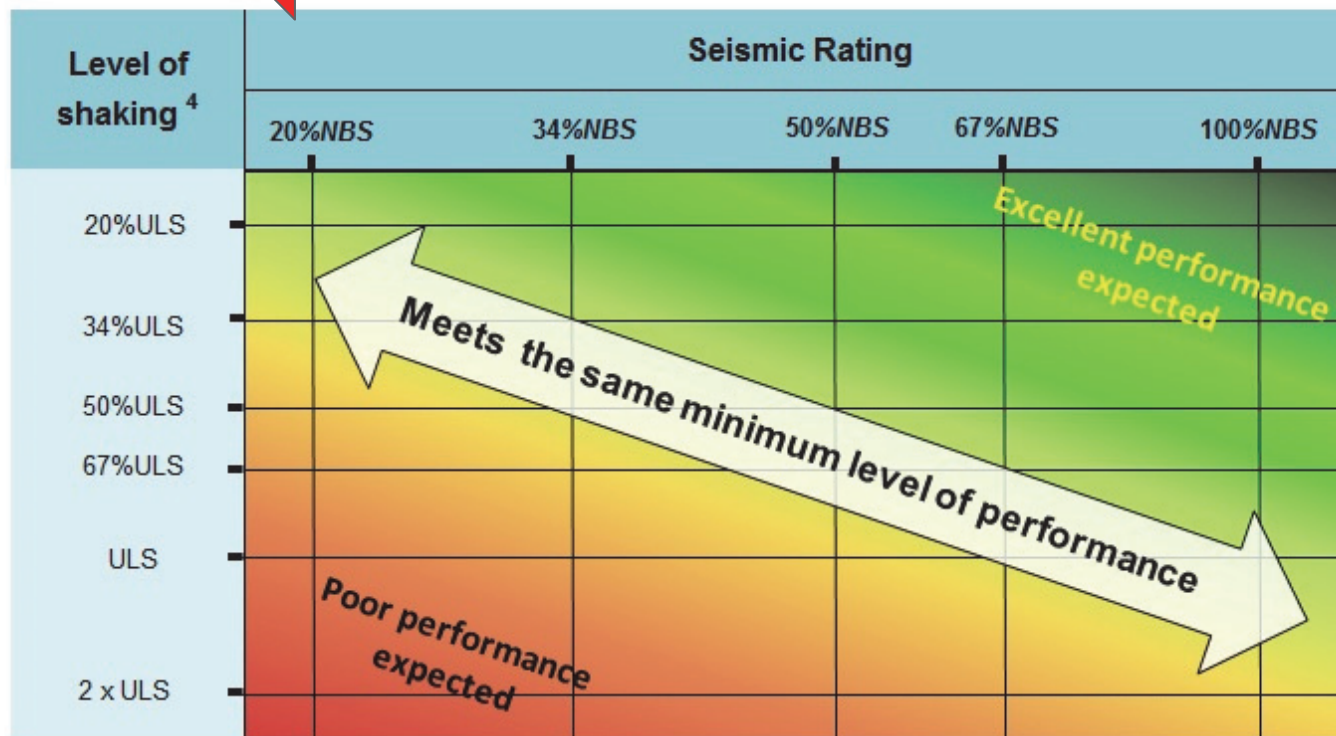
- Clause B1 Structure

B1.3.2 *Buildings, building elements and sitework shall have a low probability of causing loss of amenity through undue deformation, vibratory response, degradation, or other physical characteristics throughout their lives, or during construction or alteration when the building is in use.*

Performance Expectations for Existing Buildings

Earthquake Risk

EQ Prone



Meets the same minimum level of performance

Excellent performance expected

Poor performance expected

Reducing levels of performance expected

Reducing levels of performance expected

Performance

- Must address all performance objectives
- Must address all levels of earthquake shaking
- Must address all relevant damage states
- Must be addressed holistically and probabilistically
- Can only be verified from actual experience

Compliance

- Limit State approach
 - ULS
 - SLS1 and SLS2
- Based on prescribed seismic shaking levels
- Based on meeting acceptance criteria, primarily at a member level
- Compliance measures are primarily heuristic in nature
- Achieving compliance implies that the minimum required performance objectives will be met at all levels of shaking
- ***Compliance does not imply a given damage state **will** occur in a given level of shaking***

Issues

- Over reliance on nonlinear time history analyses
- Complete reliance on use of a MCE and the CP Limit State in preference to application of sound judgements e.g. non-redundant systems, “plug and play” devices
- Unrealistically and unjustifiably raising expectations around achievable performance based on application of essentially compliance measures
- Incorrectly stating compliance objectives as performance objectives
- Believing that performance can be predicted with certainty
- Too much reliance placed on the compliance measures to deliver the performance objectives

Concluding Comments

- Design profession must recognise the difference between tolerable/expected performance and the process of achieving compliance against defined measures at defined levels of shaking
- Discussions on performance should always be accompanied with the associated uncertainties, or, at the very least, acknowledgement that predictions of performance are very uncertain