

since they are just one part of an overall or global factor of safety which also includes consideration of member strength.

The load factor may be related to the capacity reduction factor as follows:

$$\gamma S = \phi R$$

Where γ is the load factor
 S is the load effect
 ϕ is the capacity reduction factor and
 R is the nominal strength of the member.

Using load factors and ϕ factors from ACI 318-71 (6) the following values of the overall or global factor of safety may be calculated.

	D = L	D = 2L
$\phi = 0.9$	1.72	1.67
$\phi = 0.7$	2.21	2.14

In determining overall safety the commentary to ACI 318-63 (7) suggests the following items need to be evaluated or assessed.

A. Those Factors which can Produce Overload

1. Inaccuracies in the design load assumption.
2. Variation from assumed load distribution.
3. Future changes in loads.
4. Frequency of loading and impact.
5. Inaccuracies in the analysis.

B. Factors which can Produce Understrength Members

1. Design inaccuracies in sizing and proportioning of members.
2. Lower than assumed material strength.
3. Variations in member sizes.
4. Other construction variations.

C. Factors which can Influence the Degree of Required Safety

1. The importance of members in relation to the overall stability of the structure.
2. The behaviour of a member at ultimate load.
3. The occupancy and type of structures.
4. The seriousness of failure from a safety of life or financial loss viewpoint.
5. The economics of additional safety.

Consideration of these items leads to an allocation between load factors and ϕ with some overlap as follows:

Load Factors Al-5, B1 & B4
 Capacity Reduction Factor ϕ B1-4, C1 & C2

In the end, however, load factors for strength design in most codes have been based upon the criterion of achieving approximately the same degree of overall or global safety as that achieved by working stress design.

A comparison of load factors and design load equation for various codes is set out in Table B.

ACI 318-71 (6) has been used as the

basis for load factors and design load equations in the draft code.

5. DISCUSSION ON THE DESIGN LOAD REQUIREMENT OF DZ 4203 PART 1

Design Load Combinations: Strength Method

The existing Chapter 8 "Basic Design Loads" is based upon the use of the working stress method of design (now called the alternative method). Apart from Clause 8.8 relating to stability there are no provisions for load factors and design load equations for loading combinations. Strength design of reinforced concrete is covered by NZS 3101P (8) and load factors and design load equations are included in this document.

As stated earlier it is intended that NZS 4203 cover all structural materials so that the provisions of Clause 1.3.2 will supercede the requirements of NZS 3101P (8).

The load factors and load equations have been derived from ACI 318-71 (6). A load combination probability factor of 0.75 has been applied to load combinations involving dead and live loads and wind or earthquake while for dead and snow loads and wind a factor of 0.85 has been used. For both snow and wind the design loads are based upon return periods of 50 years.

For the deterministic approach to gravity loads adopted by the code, only dead and live loads are separated. From a probabilistic viewpoint further subdivision of loads is necessary. If live loads were classified into short and long term loads a more rational treatment of the small probability of short term loads being present during earthquake attack is possible.

The present procedure of reducing the live load to either D/10 or L/3 or 2L/3 as the contribution of live load to the seismic load has no rational basis and presumably can only be justified by experience.

An important change has been made with the elimination of the load factor to be applied to E. The basic seismic coefficient (given in Fig. 3) has been increased by 25% so that E as calculated is the design earthquake load for use in strength design.

Clause 1.3.2.6 covers loading where the effects of differential settlement, creep, shrinkage and temperature may be significant insofar as the serviceability requirements of the structure are concerned. The same clause in the original draft was based upon Clause 9.3.7 of A.C.I. 318-71 but this has been drastically altered in the final version of the code.

For both reinforced concrete and for structural steel these effects do not significantly influence the ultimate strength of a section (apart from buckling loads) since deformations produced by these causes are usually much less than those at collapse.

In combining these effects with service loads to determine their affects on the serviceability of the structure realistic values for the actual dead live and other loads should be used. This may mean coefficients of 1.0 or less.