NEW ZEALAND GEOTECHNICAL SOCIETY INC

SESOC

Interim Guidance for the Design of Retaining Walls

11 August 2025

Dear Colleagues,

This interim design guidance has been prepared to assist competent structural and general practice engineers in the design of retaining walls of a routine nature. This guidance has been jointly prepared by NZGS and SESOC in response to feedback and requests for clarification from our members regarding load factors and worked example outputs in Module 6 (MBIE/NZGS, 2021).

SESOC and NZGS emphasise that, under section 175 of the Building Act 2004, only MBIE (under the authority of the Chief Executive) can issue formal guidance or clarifications to the Building Code and its supporting documents. This document does not constitute formal guidance under the Act.

Disclaimer

The material contained in this document is intended as a guideline only.

All readers should satisfy themselves as to the applicability of the recommendations made and should not act on the basis of any matter contained in this document without considering their own particular circumstances. Users of this document should ensure they are practicing within the bounds of their competence, and seek advice from an appropriately qualified and experienced geotechnical engineer as appropriate.

It is acknowledged retaining wall design is complex and the simplified approach proposed in this document may not be appropriate for more complex retaining walls. This guidance is not intended to place constraints on specialist geotechnical engineers.

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1 Background

NZGS and SESOC have received feedback and requests for clarification on how active soil pressures on retaining walls resulting from superimposed surcharge (dead and live) loading are to be determined. In particular concerns have been raised that the recommendations in Module 6 (MBIE/NZGS 2021) might not be appropriate for the case of retaining walls that have significant superimposed live surcharge loads.

A joint working group with representatives from NZGS and SESOC was established to consider these concerns and provide interim guidance which is intended to be consistent with the intent of AS/NZS 1170.0 (SANZ, 2011).

1.1 Key Outcomes from Working Group Meetings

Wall surcharge loads

Module 6 implies that active soil pressures on walls resulting from superimposed surcharge loading the loads should be factored according to Eqn 1 for the ULS static case:

$E_d = 1.5\ (1.2G + \Psi_c Q)$ Eqn 1

where:

E_d = superimposed surcharge design action effect

G = superimposed dead surcharge load

Q = superimposed live surcharge load

Ψ_c = combination factor from AS/NZS 1170.0 Table 4.1

For most imposed load categories the combination factor, Ψ_c , is in the range of 0.4 to 0.6. A consequence of this is the factored ULS superimposed live load is in the range of 0.6 to 0.9 Q i.e. for the ULS gravity case the retaining wall is typically not designed to resist 100% of the superimposed live load specified in AS/NZS 1170.0.

Concerns have been raised with NZGS and SESOC that this might lead to undesirable performance for the case when retaining walls are subject to high superimposed live loads. These concerns are consistent with comments in AS/NZS 1170.0 Cl C4.23(f) where it is stated *"The design should allow for the possibility of imposed actions occurring* [i.e. live load] *and for a surcharge being added (permanent action)".*

It can also be observed that the factored ULS superimposed dead load used for the design of the retaining wall is 1.8G. This is inconsistent with the 1.5 load factor applied to earth pressures resulting from the self-weight of the retained soil.

The work group concluded that when calculating active soil pressures on walls for the ULS static case, a uniform load factor of 1.5 applied to superimposed dead and live surcharge loading according to Eqn 2 could be considered appropriate:

$E_d = 1.5\ (G + Q)$ Eqn 2

where the variables G and Q are defined above.

The load factor of 1.5 is intended to account for the combined effect of load uncertainty (i.e. variation over time) and geotechnical uncertainty (i.e. soil mechanical properties and computation of soil pressures). The proposed approach is consistent with the requirement in AS/NZS 1170.0 Cl 4.2.3 (f) which specifies a load factor of 1.5 for soil pressures for the case when an ultimate limit state method (i.e. such as that detailed in AS 4678) is not followed.

For the ULS earthquake case when calculating active soil pressures on walls resulting from superimposed surcharge loading the loads should be factored according to Eqn 3:

$E_d = G + \Psi_E Q$ Eqn 3

where Ψ_E is the earthquake combination factor, and the variables *G* and *Q* are defined above i.e. the AS/NZS 1170.0 1.5 factor for soil pressures need not be applied. This is consistent with the approach recommended in Module 6.

Stabilising and destabilising load factors

Load factors applied to stabilising and destabilising 'self-weight' of retaining walls, and trapped soil behind the wall when applicable, remain as prescribed in AS/NZS 1170.0 and implemented in Module 6 (i.e. 0.9 and 1.2 respectively).

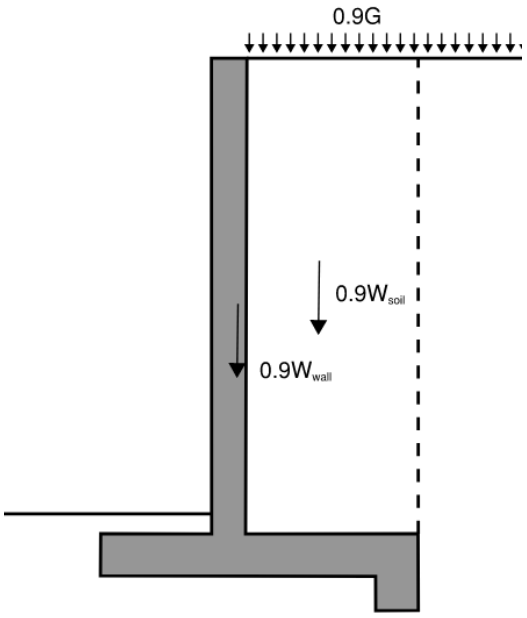


Figure 1 Example of 0.9 stabilising load factor applied to self-weight of the wall, trapped soil above the heel of the wall and dead load component of the surcharge.

1.2 Worked Example

To help communicate the intent of this advice selected portions of Worked Example 2 in Appendix C of Module 6 have been presented below with alterations made to reflect the advice contained in Section 1.1 above. Wall geometry, surcharge loads, soil parameters and seismic design parameters remain unchanged from that detailed in the Module 6 worked example.

Step 2. Wall overturning (gravity case)

Superimposed surcharge loading on the wall:

$G = 2.5\ kPa$

$Q = 5.0\ kPa$

Factors to be applied to soil pressures

$\alpha_q = 1.5$ (ULS static)

$\alpha_{qe} = 1.0$ (ULS seismic)

Combined surcharge loading on the wall:

$\omega^* = G + Q = 2.5 + 5.0 = 7.5\ kPa$ (ULS static)

$\omega_e^* = G + \Psi_E Q = 2.5 + 0.3 \times 5.0 = 4.0\ kPa$ (ULS seismic)

Active thrust, surcharge component (static):
$P_{a\omega} = \omega^* K_A H_T = 7.5 \times 0.3 \times 2.95 = 6.64\ kN/m$

Active thrust, surcharge component, horizontal (static):
$P_{ah\omega} = P_{a\omega} cos(\delta_a) = 6.64 \cos(30) = 5.75\ kN/m$

ULS static moment from horizontal active pressure:

$$M_{ah} = \left[P_{ah}\left(\frac{H_T}{3} - L_{key}\right) + P_{ah\omega}\left(\frac{H_T}{2} - L_{key}\right)\right]\alpha_q$$
$$= \left[20.35\left(\frac{2.95}{3} - 0.2\right) + 5.75\left(\frac{2.95}{2} - 0.2\right)\right] \times 1.5$$
$$= 34.9\ kNm/m$$

2 Interim Guidance

This guidance has been prepared to assist competent structural and general practice engineers in the design of retaining walls of a routine nature. It may not cover structures governed by other authorities (e.g., NZTA Bridge Manual or local councils). For the definition of a routine wall in the context of this guidance designers should refer to the limitations in Section 3 of SESOC Timber Pole Retaining Wall Design Guide (SESOC, 2025).

When using Module 6 (MBIE/NZGS, 2021) to calculate active soil pressures on walls resulting from superimposed surcharge loading for the ULS gravity case, the superimposed loads should be factored using a uniform load factor of 1.5 according to Eqn 2 above.

Structural and general practice engineers using this guidance should ensure they are practicing within the bounds of their competence, and seek advice from an appropriately qualified and experienced geotechnical engineer as appropriate.

3 Conclusion

We trust this interim design guidance provides clarity and direction.

Kind regards,

On behalf of the NZGS/SESOC Retaining Wall Working Group.

4 References

MBIE/NZGS. (2021). *Earthquake geotechnical engineering practice Module 6. Earthquake resistant retaining wall design*. Wellington, NZ: New Zealand Geotechnical Society.

SANZ. (2011). *AS/NZS 1170.0 Structural design actions, Part 0: General principles*. Wellington: Standards Australia, Standards New Zealand.

SESOC. (2025). *SESOC Design Guide: Timber Pole Retaining Walls*. Wellington, New Zealand: Structural Engineering Society New Zealand.