Best Practice Note:
Retaining walls / inground tanks

Introduction

The purpose of this practice note is to provide guidance about retaining walls and inground tanks; it provides information about how they should be designed for surcharge. For this guidance, the side of an inground tank is considered a retaining wall.

What is a surcharge?

Any vertical pressure applied to the ground surface in the vicinity of a retaining wall is a surcharge. This surcharge load will result in additional horizontal pressure on the retaining wall. It is the responsibility of the designer/structural engineer to determine the appropriate surcharge that can reasonably be ascertained from the site condition for both during the construction stage and long-term condition in which the retaining wall is to be built.

Close proximity definition

Where a retaining wall is constructed in close proximity to a building or structure, the distance from the base of the building to the wall (retained area side of the wall) shall be equal to or less than the height of the retaining wall (measured from the base of the foundation).

Design of retaining walls close to a boundary for surcharge load

If the owner of a property wishes to erect a retaining wall on or close to the boundary of their site, they must design the wall to provide adequate support to the neighbouring site, and should also provide reasonable allowance for surcharge loadings likely to occur during the life of the structure. In particular, it is highly likely that the retaining wall will incur a surcharge if there is potential for subdivision or other further development of the neighbouring site.

The designer of the retaining wall shall specify and design for the maximum surcharge loading likely to be experienced throughout the life of the structure (with reasons) and show that long-term lateral deflection of the wall will be within acceptable limits (in some cases, design for ‘at rest’ soil pressure will be considered sufficient to address this deflection requirement).

Unless there is clearly a case for designing for a greater surcharge loading, Council will normally accept design for:

- 12.0 kPa minimum surcharge loading if there is future potential for a right of way or access lot on the adjoining site
- 5.0 kPa minimum surcharge loading in all other cases (this allows for up to about 300mm of loose filling placed on top of the ground behind the wall).

In addition, the structural design may include a construction methodology to ensure that the stability of any land on the adjoining site is fully protected.

Note: the wall including the drainage metal and sub-soil drain behind the wall must not cross the boundary at any point.

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Design of tanks under driveways
If the owner of a property wishes to install a tank under a driveway or trafficable area on the site, they must design the tank to provide adequate support to the surface above. This design needs to ensure a reasonable allowance for surcharge loadings likely to occur during the life of the structure. In particular, it is highly likely that the tank will incur a surcharge from moving trucks, cars and possibly fire trucks.

The designer of the tank shall specify and design for the maximum surcharge loading likely to be experienced throughout the life of the structure (with reasons) and show that long-term deflection will be within acceptable limits.

Unless there is clearly a case for designing for a greater surcharge loading, Council will normally accept design for:

- 12.0 kPa minimum surcharge loading

In addition, the structural design may include a construction methodology to ensure that the stability of any land on the adjoining site is fully protected.

Commentary
B1.3.3 of the Building Code states that "…account shall be taken o*f all physical conditions **likely** to affect the stability of buildings, building elements and site work…"*

This implies that the retaining wall design needs to consider "likely" loads. "Likely" loads have been previously defined by MBIE as "loads known with reasonable certainty" including planned activity such as anticipated loading from a subdivision (driveway).

Past Determinations
Whilst there is no direct ruling from past determinations regarding the design to 12kPA surcharge on retaining walls, such load magnitude has been quoted and appears acceptable (albeit indirectly) in site specific cases (see determinations 2015/003 and 2015/006).

NZS 4229:2013 Concrete masonry buildings not requiring specific engineering design
There has been some confusion in the past regarding masonry retaining wall designed to NZS 4229. Details of the design are explained in Appendix A. Clause A1.2 states that specific engineering design still needs to be provided if any one of the conditions (a)-(g) exists.

In particular, A1.2(b) where the surcharge is above the limit specified in Fig. A2 which is 2.5kPA. In other words, the deem-to-comply design in Fig. A2 can be adopted without specific design if and only if, the expected surcharge does not exceed 2.5kPA. It does not mean, however, that all surcharge loads must only be 2.5kPA.

Do I need a barrier?
As specified in clause F4.3.1 of the Building Code, a barrier is required to be constructed to safeguard people from falling, where the height of the retaining wall exceeds 1.0m and the area is associated with the use of a building.

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Examples of areas associated with the use of a building in respect to retaining walls: -

- on the edge of driveways
- near pedestrian access routes to and from buildings; and
- amenity areas used in conjunction with the use of a dwelling

Retaining wall design and observation
Where retaining walls are to specific design, and generally, Engineer's observation and PS4 producer statement is required; agreement in respect to the PS4 producer statement must be reached before the building consent is granted.

A B and C type masonry retaining walls
NZS 4230:2004 Table 3.1 has 3 categories for masonry design (A, B & C). These designs are based on the maximum design compressive strength of masonry.

- A and B type masonry must be inspected by the design Engineer or their nominated representative
- C Grade masonry is generally inspected by Council officers

For timber pole retaining walls, the PS4 producer statement should include the inspection of the bored holes and the final retained height.

Drainage
It is essential that suitable drainage be installed behind retaining walls. Stormwater should discharge to an approved point of disposal via a silt trap. In order to protect the public stormwater system from silt build up, drain coil should be wrapped in a protective wrap or sock which prevents silt entering the drain. Alternatively, clean out points at either end of the drain can be installed to enable the system to be flushed out from time to time.
Note: drainage is not required for porous retaining walls where seepage does not cause a nuisance. For example, gabion structures are porous and hence are not designed for hydrostatic pressure as they are physically not able to retain water. Similarly, timber walls can be constructed as fully porous structures as long as the seepage from such retaining wall will not cause nuisance to any neighbouring property.

Planning considerations
The district plan also has rules regarding retaining walls, tanks, and associated earthworks. This may affect things like boundary setback distances, proximity to waterways, height recession planes etc. Different zones have different rules, so check your zoning requirements, and feel free to ask for advice.

References
NZS 4210:2001 Masonry Construction, Materials and Workmanship
NZS 4229:1999 Concrete Masonry Buildings Not Requiring Specific Engineering Design
NZS 4230:2004 Design of Reinforced Concrete Masonry Structures
Manukau City Council “City Managers Task Force – Retaining Walls and Excavations – Surcharge Levels for Boundary Retaining Walls (GHD) Feb 2005
Ellis Gould legal opinion Aug 2014
New Zealand Building Code
New Zealand Building Act 2004