C L P Structures

STRUCTURAL ENGINEERING CONSULTANTS

Elite Blocks - Stockbay Walls Design Guidance

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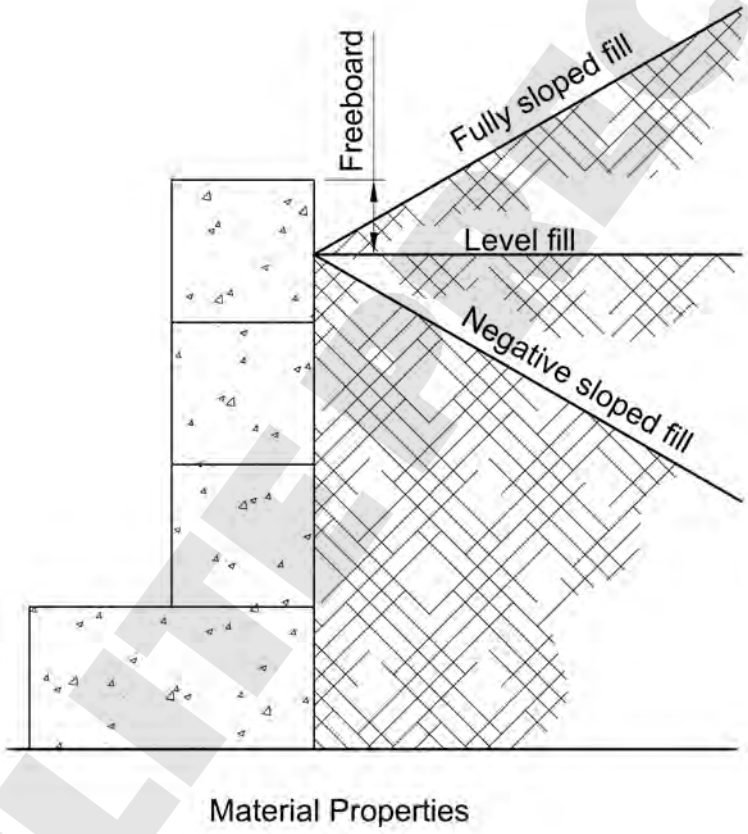
1. *General Design:-*
   A wall that has been correctly designed and maintained and is used in accordance with the recommended design guidance will not suffer any degree of failure during its design lifetime. However, certain factors such as overloading, insufficient support or excessive impacts may cause partial localised failure of the wall and therefore the following items should be duly considered when designing a stockbay wall.

2. *Position Of Bays:-*
   The walls should be positioned giving due consideration to the possibility of an extreme event occurring which leads to a partial localised collapse of the wall. If the walls can be sited away from areas where personnel may walk, site boundaries, plant and buildings then in the extreme event of the wall being overloaded this would present a lower risk of injury to personnel or damage to buildings or equipment.

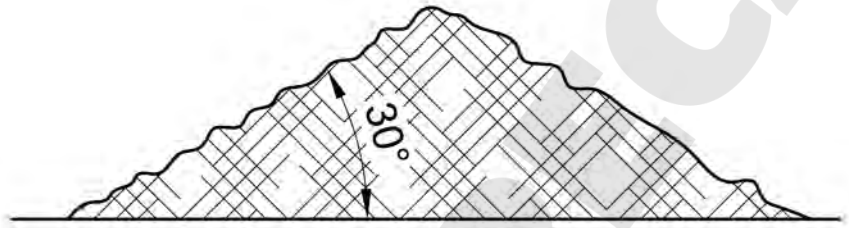
3. *Bay Size:-*
   Bay size also requires consideration. If a specific volume of material requires storage then a larger bay will require lower retaining walls as opposed to a smaller bay requiring higher walls. The lateral pressures imposed by the stored material increase with the height of the wall, as does the pressure exerted on the ground. Partial failure of a low height wall also offers less risk of injury to personnel or damage to plant.

4. *Stored Material – Height:-*
   The allowable height of the material should be considered in relation to its density, for example a lower density material can be more easily stored at a higher height due to the lower load that it exerts on the wall and the ground. A 'freeboard' height between the top of the wall and the maximum height of the stored material is also a sensible approach as it limits the likelihood of overspills occurring. The angle of the stored material is also an important design consideration, will the material be fully sloped up, level, or sloping down towards the ground.



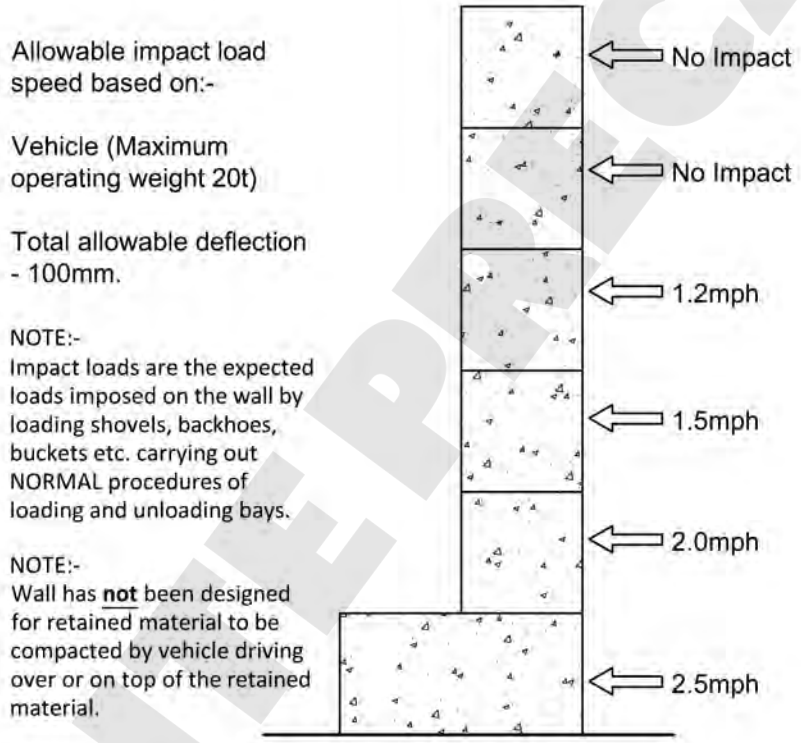
Material Properties

5. *Stored Material - Properties:-*
   The walls should be designed to retain the worst case material that is anticipated to be stored over the lifetime of the wall. The maximum possible density of the material should be used, giving due consideration to an increase in density due to water saturation or compaction. A typical density for materials such as sand or gravel would be 18kN/m3. The minimum natural angle of repose of the material should be used in the design, this is the angle at which the material will stand up on its own if heaped on a level surface. A typical angle of repose for materials such as sand and gravel would be 30 degrees.



Natural Angle of Repose
(when lightly vibrated)

6. *Vehicle Impact:-*
   The wall should be designed to withstand the expected impacts from loading vehicles, however it should be noted that this should be the expected loads form vehicles carrying out normal day to day procedures of loading and unloading bays. No wall can be expected to withstand an accidental load from a large loading shovel and therefore this should be guarded against with proper procedures and training. The maximum anticipated weight of the loading shovels that will be used during the walls lifetime should be designed for. A typical design for allowable vehicular impact is shown below.

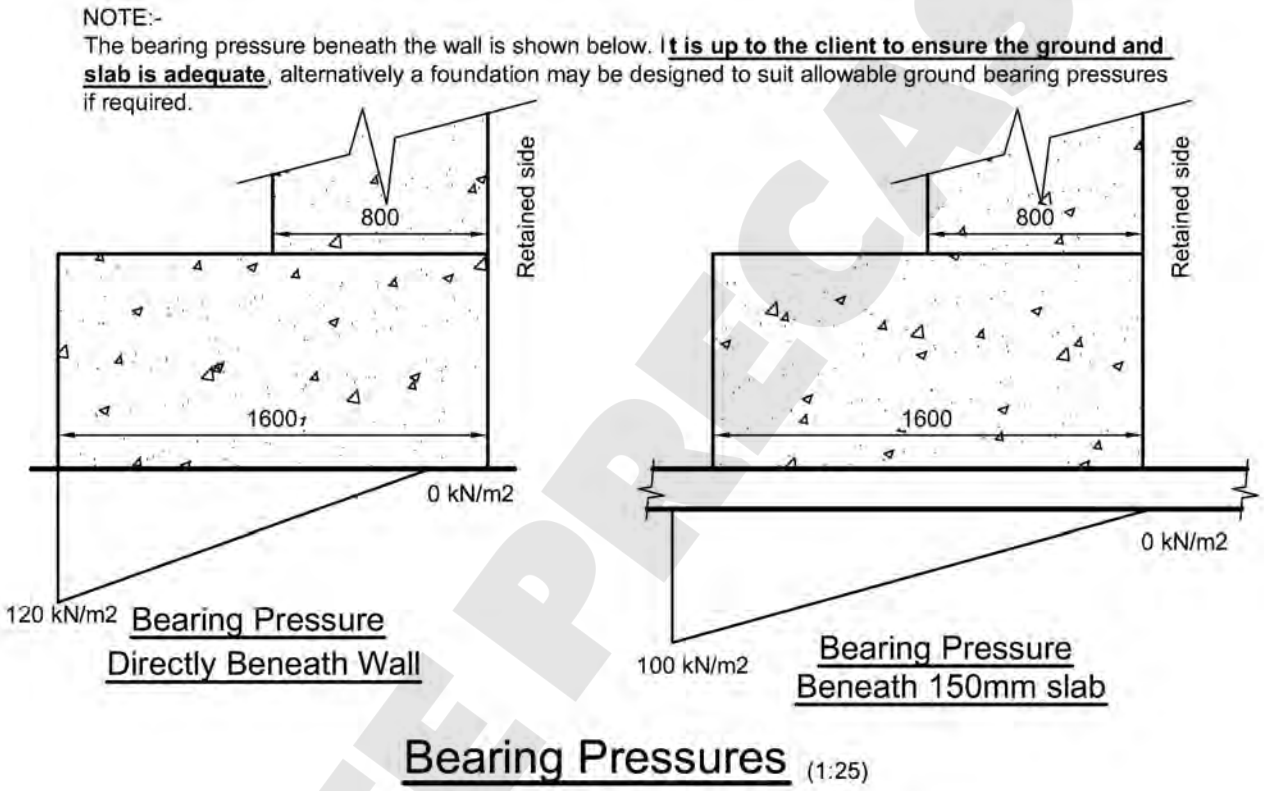


Impact Design Example

7. *Support of the Wall – Ground Conditions:-*
A well designed wall is only as good as the ground that it is supported on. If the wall is insufficiently supported due to bad ground conditions then partial or total collapse of the wall could occur. It is important that the ground is assessed by a suitably qualified person to ascertain its allowable bearing capacity. A guide as to allowable bearing pressures are shown below.

Description	Safe bearing capacity[1] kN/m²	Field description/notes
Strong igneous rocks and gneisses	10 000	Footings on unweathered rock
Strong limestones and hard sandstones	4000	
Schists and slates	3000	
Strong shales and mudstones	2000	
Hard block chalk	80–600	Beware of sink holes and hollowing as a result of water flow
Compact gravel and sandy gravel[2]	>600	Requires pneumatic tools for excavation
Medium dense gravel and sandy gravel[2]	200–600	Hand pick – resistance to shovelling
Loose gravel and sandy gravel[2]	<200	Small resistance to shovelling
Compact sand[2]	>300	Hand pick – resistance to shovelling
Medium dense sand[2]	100–300	Hand pick – resistance to shovelling
Loose sand[2]	<100	Small resistance to shovelling
Very stiff and hard clays	300–600	Requires pneumatic spade for excavation but can be indented by the thumbnail
Stiff clays	150–300	Hand pick – cannot be moulded in hand but can be indented by the thumb
Firm clays	75–150	Can be moulded with firm finger pressure
Soft clays and silts	<75	Easily moulded with firm finger pressure
Very soft clays and silts	Nil	Extrudes between fingers when squeezed
Firm organic material/medieval fill	20–40	Can be indented by thumbnail. Only suitable for small-scale buildings where settlements may not be critical
Unidentifiable made ground	25–50	Bearing values depend on the likelihood of voids and the compressibility of the made ground
Springy organic material/peats	Nil	Very compressible and open structure
Plastic organic material/peats	Nil	Can be moulded in the hand and smears the fingers

8. *Foundations/Slabs:-*
   It is recommended that the walls be constructed on a continuous concrete foundation or slab that has been designed to suit the ground conditions as noted above. Guidance as to the pressure exerted on the ground can be provided by Elite to allow clients to ensure that the walls are adequately supported. An example of the imposed bearing pressures are shown below.



9. *Wall Thickenings:-*
   Where the imposed load on the wall is very high due to a very dense material or a high wall, it may be necessary to increase the thickness of some of the blocks, this is usually done by rotating a standard block by 90 degrees or using a specially sloped ‘footblock’. The added size and weight help to increase the walls capacity for overturning and sliding , and also reduces the bearing pressure beneath the wall.

10. *Good Practice – Filling and Emptying:-*
    Overloading of the walls may result in a partial collapse and therefore should not be allowed to occur. Excessive impacts from loading shovels may also cause partial collapse and should not be allowed to occur.

11. *Good Practice – Training and Signage:-*
    Driver training is essential to ensure that the material is filled and removed in the correct manner with no excessive impacts form loading shovels, and no vehicles driving on top of the stored material. Signs and documentation should be in place clearly showing the design limitation of the wall i.e. maximum allowable height of the fill material, the type of material to be stored etc.