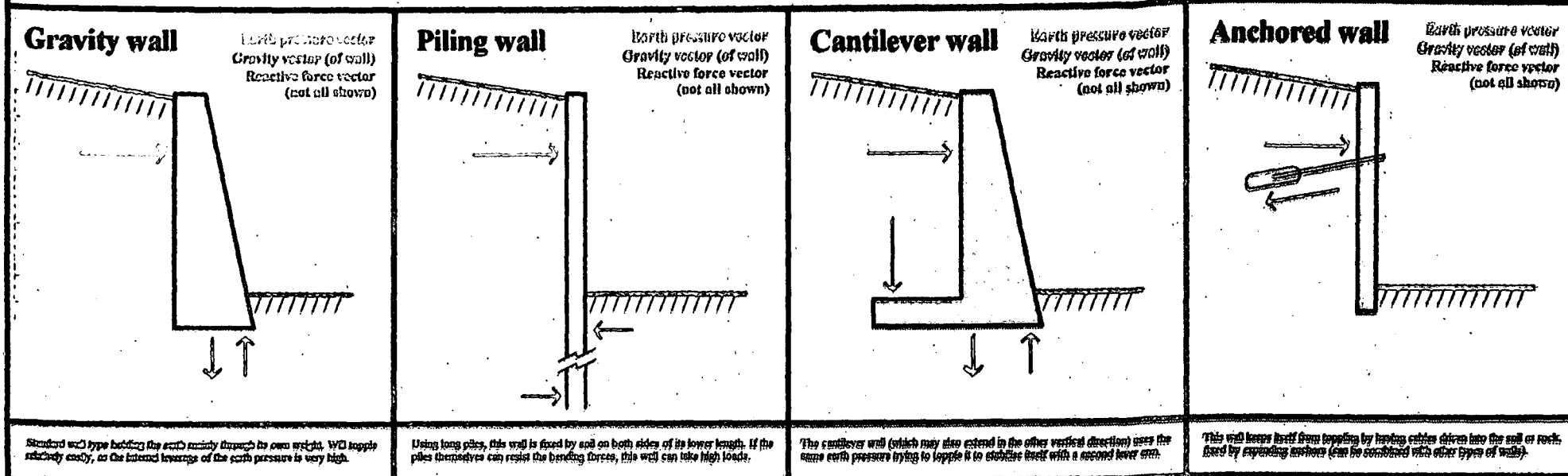


Simplified explanation of typical retaining walls



Why retaining walls collapse after rains

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We have to be extremely careful about rain as nobody has control over it. Why do we bother so much about rain? Rain provides us irrigation water, drinking water, hydro electricity and so forth. Nevertheless, when it comes to retaining walls we have to take rain very seriously. You may think that we are saying this as obstructions or delays are minimal if there is no rain when constructing a retaining wall. The problem we are going to discuss is much more serious than that as rain could have graver adverse impact effecting the stability of retaining walls.

Collapsing of retaining walls are a common phenomena after torrential rains. Therefore it is worth investigating the reasons for these collapses as it could affect human life, loss of property, infrastructure, road transport etc.

Construction of retaining walls without professional advice could lead to disasters. Quite often the contractors are requested to carry out ancillary work as part of a building construction project. This ancillary work might involve construction of retaining walls, paving of the compound, landscaping etc. All these works require professional advice. One must have sufficient intelligence to know at least what one doesn't know. Proving that 'Fools rush where angels fear to tread, without hesitation, contractors undertake to construct retaining walls and/or raise existing retaining walls to suit the landscape and gladly change the topography of the area, without professional advice.

It is pertinent to mention that every structure, which is being built, has to be designed by a competent engineer. Gravity retaining wall is no exception. It is not a matter of giving false importance for selected structures.

Although it may not be public news, very recently a

retaining-wall in a textile factory premises, collapsed injuring a few employees in the factory and the injured had to be hospitalised for treatment. The lower part of this retaining wall structure had been built sometime back by one contractor and subsequently another contractor had raised the existing retaining-wall and completed the associated civil works on the higher side of the retaining wall.

The contractor was extremely lucky not to be charged with criminal negligence. Even if the damages caused to human beings were minor, the perpetrator is criminally liable for negligence. Unfortunately the majority of our public is still ignorant of this fact.

I had the opportunity to witness the aftermath of this calamity and analyze the blunders made by the contractors. The lower part of the retaining wall had been constructed by one contractor out of rubble and whereas the contractor who completed the balance work has raised the retaining-wall and has gone to the extent of constructing concrete tie beams columns etc in the raised section, with the false impression that if he uses more steel and concrete in the upper part, the structure would be safer. The height of the original retaining wall had been 8 feet and at the request of the property owner the wall had been raised by another 8 feet by the second contractor.

This is a 100 percent increase of the structural height of the structure. In retaining walls, the lateral force acting on the wall increases to the square of the height and the bending moment increases to the cubic power. Therefore when the height is raised from 8 feet to 16 feet the active force would increase by four fold and the moments by eight fold. The contractor may have built an extremely strong structure above the eight feet level but all the forces acting at the top level would necessarily have to transfer to the bottom portion and eventually to the ground.

Once the construction of a retaining wall is completed, and if there is no immediate failure of the structure, one might get false confidence that it would be safe. But the full active forces may not act on the wall immediately due to inadequate compaction of the backfill. Also pore-water pressure would not develop immediately due to the dryness of the earth. However, all the physical conditions will change with rain. Rain promotes compaction of the backfill and at the same time it exerts pore water pressure on the wall. Therefore, the full active force would begin to act on the wall only after rain.

A retaining wall may be an ancillary structure in a project but careful consideration has to be given when constructing retaining walls. Even gravity walls have to be designed and checked for their stability. The Designs Engineer must consider the structures around the vicinity of retaining-walls, extent of their foundation and the effect on the retaining wall due to adjacent structures such as surcharge forces.

Therefore extensive site investigation is essential before designing a retaining wall and at the same time soil investigation has to be carried out to determine the ground conditions, allowable bearing pressure etc. Depending on the capacity of the project, sufficient boreholes to a suitable depth have to be carried out along the wall. Strength and engineering properties of retained soil are also fairly important parameter. At the same time, quality of backfill earth is also relevant. It must be a granular soil which facilitates drainage. Weep holes have to be placed in retaining walls at suitable intervals to facilitate drainage and filters have to be placed around the weep-holes before placing the backfill.

The Designs Engineer must have sufficient knowledge about the ground water level, hydrostatic uplift if any, flood level etc. In addition, if deleterious chemicals are present in the ground water it would affect the concrete and steel. Therefore it is desirable to

obtain a chemical analysis of the ground water. This emphasises the importance of collecting sufficient information when designing a retaining wall. Therefore even when constructing masonry walls it should not be a case of simply using a standard type drawing. The engineer must ensure that it is the right retaining-wall satisfying the ground conditions and surrounding envi-

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ronment. Therefore although it is not the best way of learning, one could learn from mistakes.

It is a known fact that sometimes professional decisions are being influenced by political interference. However, as professional engineer one must keep his head high and should not compromise professional standards. There is a strong possibility of demands being made to accelerate construction work of proposed development work of the government. However, if investigations have to be carried out before commencing construction activities, although it is time consuming, it must be done.

Therefore it is vital to make the politicians and administrators understand that scientific engineering studies have to be carried out before implementing the projects. It is not a matter of using the money allocation during the given financial year; the money should be used for the betterment of the society. The engineer must bear in mind that he has to serve the client as well as society. It is important that the engineer has to consider the society also as a client. Although he must pay attention to the immediate client, it does not mean that he could ignore his obligations to society.

In the unfortunate incident which was described above, the contractor has no doubt satisfied the client ignoring his obligation to society at large. Therefore engineers have a positive and responsible role to play in the development of this country.

This particular incident is not an isolated one but one of numerous failures that have occurred in recent times. About 6 months back there had been another failure of a retaining wall in a playground belonging to a school at Kotte. About 2 weeks back a huge retaining wall of more than 30 feet in height had collapsed in an area close to Kiriella.

These are costly mistakes and the cost could include loss of human life as well as financial aspects. Apart from this, there are public hazards, waste of public money and also could cripple the transport altogether had it happened by the side of a highway. Therefore it is of utmost importance that all retaining walls are designed by qualified engineers and stringent measures are adopted to maintain the quality of the constructions.