In this article we discuss a humble piece of infrastructure which is appearing more-and-more frequently in material damage and liability claims – the retaining wall.

Their apparent simplicity means the science and engineering behind them are often taken for granted, sometimes with unfortunate consequences. When they fail, what first appears to be a simple and obvious cause often turns out to be far more complex.

This article will take a glimpse at the many types of retaining walls in use today, how they work, why they sometimes don’t work, and what we as Loss Adjusters do to provide Insurers with the information they need to properly consider policy response for ensuing claims.
A Brief History

From stone tools to satellites, we humans have demonstrated an amazing and unique ability to solve complex problems and to utilize the resources around us to improve our way of life.

Retaining walls probably first evolved from free-standing walls, as a means to ‘keep out the enemy’. The earliest village ramparts, built to protect the inhabitants from marauding tribes, were simple earth mounds, which were later enhanced by free-standing fences or walls like those that were built around Jericho 10,000 years ago. Someone eventually figured out that defensive walls would be much stronger if they were backed up by earth, and so the earth-retaining wall evolved. The idea caught on with the Egyptians 5000 years ago adapting the retaining wall for both architectural as well as military purposes. Perhaps the most famous wall in the world, the Great Wall of China, built 2500 years ago, is essentially two parallel retaining walls with rammed earth in between.

The Romans filled their empire with retaining walls and we can find many and varied examples throughout Medieval Europe, Incan and Mayan cities, and just about anywhere else on the planet where we have endeavored to alter our environment. We are still doing it.

Some may believe we are doing a much better job than those who came before us, with our modern technology and seemingly endless resources. However, despite our advantages, many Loss Adjusters can tell you that, despite 5000 years of practice, we still get it wrong from time to time. Although modern walls are intentionally not designed to stand for thousands of years, given the rapidly changing world we live in, we generally expect them to last 50 to 100 years. When a wall fails within the first weeks or years of existence, we have a problem.

While most retaining walls throughout history have been massive stone walls relying on their enormous weight to hold back the earth, modern retaining walls have many different forms and use a number of different engineering principles to achieve the same outcome. Without a doubt, this has enabled us to build retaining walls faster and cheaper than ever before, but it also means that there are many more things that can possibly go wrong in the process.
What is a retaining wall?

A retaining wall is intended to hold back the soil behind it, in order to achieve an abrupt change in ground elevation. Consequently, the wall must withstand the uneven forces resulting from soil pressure against one side of it. Sometimes it must also deal with additional pressures resulting from vehicular or foot traffic or by water seeping through the soil.

Without the retaining wall, the earth would need to be gently sloped from the higher level to the lower level, so that it doesn’t collapse. The retaining wall eliminates the need for this slope, which often takes up valuable space, and instead allows a vertical, or almost vertical, step-down to be achieved.

Common retaining walls in Australia

In modern times, engineering has developed many different systems for the construction of retaining walls, with the optimum choice of wall type for each project depending on soil conditions, available space, access for machinery, height of wall, other imposed forces, ease of construction, required life span and cost.

The first form of retaining wall, which has much in common with ancient walls, is the gravity wall. It relies on the sheer mass of the wall structure to resist the force of the soil. The wall may be built of stone or concrete blocks or may consist of a hollow structure filled with crushed rock.

The second form of wall is a reinforced earth wall, which is a variant of the gravity wall, where the mass is provided by the soil itself, as well as the wall. The outside face of the wall usually consists of concrete blocks or panels, and these are ‘tied’ to the soil behind the wall by a series of reinforcing strands or sheets. Relying on the friction between the reinforcement and the soil, the soil acts as one big cohesive “block”.

The third form of wall is a cut-off wall, which is used to stop water flow by preventing it from entering the soil behind the wall. This can be achieved by building a wall of concrete or stone and then filling it with a waterproofing material such as bentonite or a synthetic membrane.
The third form of wall is a cantilevered wall, which relies on the strength of the wall itself to resist the soil forces. This may take the form of a steel-reinforced concrete block wall, with a large horizontal footing designed to resist sliding and overturning.

The last form of wall is an embedded wall, where the wall relies on the soil in front of it for support. An example of this is where interlocking concrete piles are bored into the ground to a significant depth. Similarly, interlocking steel sheet piles may be driven into the ground. The depth to which these concrete or steel piles extend into the ground depends on the strength of the soil, and the resulting support it provides. Such walls are often used to allow excavation of the ground to form deep basements under buildings. Once the entire wall is completed, excavation of the site can commence. Depending on the depth of the excavation, the piles may need additional support, which is often provided by anchors into the adjacent ground.

As can be seen, whilst these types of walls serve a common purpose, it is important that the adjuster when faced with the failure of such walls, holds suitable engineering experience to quickly determine the areas of investigation that are required. For this reason Charles Taylor Adjusting (CTA) utilises engineering qualified adjusters with a specialty in civil / structural engineering to investigate such wall failures.
When things go wrong

When a wall has moved, cracked or collapsed we are often called on to investigate the cause, which sometimes becomes clear upon first inspection and sometimes requires extensive investigation. Establishing the cause of the failure is usually critical for Insurers to correctly apply the wording of the policy, its conditions and exclusions.

Example 1

A recent case involved an anchored concrete pile retaining wall around a deep basement excavation on a building site. Construction of the basement was proceeding at a rapid pace, when slight movement occurred in one section of the wall, resulting in cracking of an adjacent roadway. To prevent further movement or a catastrophic collapse, the contractor acted quickly to buttress the wall. We were quickly engaged by Insurers to investigate the cause of the failure, in parallel with the Contractor’s own investigations. Working with structural experts, we found a number of factors may have contributed, including inadequate geotechnical investigations, insufficient design capacity, and poor quality control of anchor installation.

However, the primary cause of failure was determined to be defective steel used in the anchors. The steel cables had suffered from stress corrosion, which can occur when steel is placed under excessive stress for extended periods of time in a moist environment. A number of anchors had failed where the wall movement occurred. Extraction of remaining anchors that had not previously failed showed that the steel strands did not have the required tensile strength. It was imperative that the investigations were completed quickly to avoid unnecessary costs and delays in resuming normal construction activity, and to provide Insurers with the information they needed to determine policy response.
Example 2

Another recent matter involved a series of concrete block retaining walls on a residential subdivision. One section of wall had collapsed during construction, after a modest rain event, and our investigations quickly revealed a number of contributing factors. This particular type of wall relies on a mass of concrete poured behind the wall and within the voids of the concrete blocks as indicated in the diagram on the right. With the particular blocks used in this case, it also relied on the partial removal of the rear face of the blocks so that the concrete in the voids and the concrete behind the wall could form one mass, locking the blocks to the concrete.

In this case, the Contractor had failed to remove the rear face of the blocks, so there was no mechanical interlock between the concrete and the blocks. The contractor also failed to pour the concrete behind the wall to the required height and width. As a result, soil was bearing directly against the rear face of the blocks, which were not “tied” to the concrete mass and simply toppled over. Matters were made worse by the Contractor altering the original engineering design without obtaining further engineering advice. As a result, the wall type was unsuitable for the height of wall being built.

These examples highlight two recurring themes, which we frequently find in retaining wall investigations: involvement of defective design or workmanship, and the existence of multiple contributing factors.

The importance of good drainage behind retaining walls is often underestimated. Walls are often designed to withstand forces imposed on them by the weight of soil behind them but in some cases not the additional water pressures acting on the back of the wall. Since such water pressures can be highly destabilizing, the stability of many walls relies on good drainage of the retained soil to prevent the buildup of water pressure between the soil and the wall. This usually involves a vertical drainage zone of porous material immediately behind the wall, with a slotted pipe at the bottom to carry seepage water away. When this drainage zone or the pipe becomes blocked, or overwhelmed by an unexpected inflow of water, the water pressure behind the wall may build to a point where the wall is destabilised and/or damaged. Good planning, design and construction practices usually ensure this does not happen.
Example 3

This is the case of a recent sheet piling wall failure where the dewatering system used by the contractor could not effectively remove groundwater behind the wall. Since the sheet piling was not designed for any hydrostatic pressure, the buildup of water eventually caused the wall to give way and collapse into the basement excavation. Our early appointment on the matter was beneficial in collecting the relevant technical and non-technical information and site-specific evidence at the onset of the claim before engaging suitable expert engineering consultants to investigate causation. It was imperative to be able to supply the consultant with as much relevant data as possible, which not only reduced the time taken for the investigation process but also ensured that a fully informed expert opinion was obtained.

CTA’s engineering adjusters are able to provide concise scopes of work to experts and manage these experts such that the most probable root cause is established quickly and correctly.
Cause is critical

As with any insurance claim, establishing causation is critical to the proper application of the policy of insurance, whether it be a contract works policy or a liability policy. Cause can determine if the policy is triggered (defect vs damage) and if triggered to what extent the policy might respond after exclusions are applied. Cause is also important in respect to potential recovery considerations.

A contract works policy often includes exclusions and/or increased excesses for defective design or workmanship, and different policies often contain small but significant differences in wording, which could have a bearing on policy response to the matter at hand. Insurers rely heavily on Loss Adjusters to correctly identify the cause of the loss and to advise on how the policy wording may apply to the circumstances and cause in each case. It is also important to correctly identify the timing of the failure and when the causative factors arose, relative to the construction period and the period of insurance, as this is likely to have a bearing on policy response. A policy will sometimes include a condition that the works have been designed and supervised by a qualified engineer. An understanding of the process and protocols followed in engineering the works, and an ability to read and understand engineering drawings and specifications, is a distinct advantage in determining if such a policy condition has been satisfied.

Quantum

Once cause and policy response is established, we are also often called upon to determine if the claimed costs of repair, whether submitted by the Insured or by a third party claimant, are reasonable and in accordance with the policy. CTA engineering loss adjusters are well acquainted with standard construction practices and are well placed to assess the costs of removal of debris, replacement of materials, excavation, protection of adjacent structures, reconstruction of walls, professional supervision and other ancillary activities. We are also well placed to identify any improvements to the property that sometimes occur in the process of reinstatement that may constitute uninsured betterment.
Conclusion
Retaining wall failures are commonly the result of complex interactions of geotechnical conditions, soil properties, water pressure, design or construction defects, materials defects, excessive external loads, and gradual degradation. Overlay this complex web of causation, with the equally complex set of conditions, exclusions and benefits in a typical insurance policy and the vast array of costs associated with repair and reinstatement, and it is easy to recognize the value of engaging a highly experienced engineering loss adjuster to a retaining wall claim.

CTA’s specialized engineering loss adjusters, who come from backgrounds in civil, structural, geotechnical, hydraulic and mechanical engineering, are uniquely placed to manage this complexity and equip Insurers with all of the appropriate information on which to base their determinations, with timeliness and clarity.

Charles Taylor Adjusting (CTA) Expertise
CTA has qualified engineers on staff throughout all Australian offices with diverse backgrounds ranging from “big picture” Project Engineering / Construction right through to detailed design work. Our Engineering Adjusters hold Adjusting qualifications and are members of the Australian Institute of Chartered Loss Adjusters (AILCA), the Australian & New Zealand Institute of Insurance and Finance (ANZIIF), or other UK-based professional bodies of equivalent or higher standards. We ensure outcomes are concisely reported to Insurers to match their requirements in documenting the circumstances of the loss in a clear and logical manner, allowing them to reach a conclusion in respect to policy response.

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About Us
Charles Taylor Adjusting (CTA) is one of the leading loss adjusting businesses in the market. We provide loss adjusting services across aviation, marine, natural resources, property, casualty, technical and special risks along with average adjusting services for ship owners. The business primarily focuses on larger and more complex commercial losses arising from major insured incidents and claims.

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