What are These Earth Bunds?

A giant earth bund constructed by LTTE

Recently there has been much interest about earth bunds due to their use in military warfare. The LTTE built these earth bunds for defence against Sri Lankan armed forces advancing into their strongholds such as Kilinochchi, Puthukkudiyirippu,Mullativu,Pudumathalan,Wadduvakal,Vannerikulam and Akkarayankulam. These earth bunds are very cost effective as the building material could be found cheaply onsite. Once the earth is excavated and piled to make a bund, a ditch is automatically formed which transforms it into a canal filling with rain water or seepage from ground water. This gives double protection from the advancing troops by earth bund cum canal. This article briefly describes the use, construction and characters of these earthen bunds used by the Tamil Tigers

Introduction

Earthen bunds have been used for many purposes in Sri Lanka. In historical perspective, earthen bunds or dams were first used in construction of "*wewa*" (lakes) in the Dry zone to store rain water received during monsoonal times to be used during the dry season. Later, with the development of rice cultivation, many more wewa's were developed using earthen bunds around them to collect rain and runoff water. Subsequently, numerous tiny earthen dams were constructed across nearby rivers by farmers and the water was led to small artificial reservoirs and from there to the rice fields through a channel network. The largest example of such tank was the Prakramabahu Samudraya built in 12th century during the era where Sri Lanka was the most important rice exporting country in South and South-East Asia. When one of the ancient cistern type sluice *(bisokotuwa)* of Parakrama Samudaya was excavated, it was revealed that soils with high and sticky clay transported from far away places have been used to prevent leaks around these devices. There is also evidence to show that the know-how was available for the ancient kings to use soils with high and sticky clays when constructing leak proof bunds or dams. Most of these bunds were constructed in a manner where the flat top could be used as roadways.

Even though, most of the earthen bunds were used for irrigation, in water supply schemes and roadways in the past, these have been presently used as barriers in military warfare. The purpose of this article is to provide information on construction, characteristics and use of these earthen bunds and dams by LTTE in the war against Sri Lankan troops.

Composition of Soil

Soil found in the earth's crust is a natural medium resulting from rock weathering. Soil, being a freely available natural resource, is one of the cheapest building materials. Soil consist of mineral fragments of clay, silt and sand which are particles less than 2 mm in diameter, and larger particles as gravel, stones and boulders. These are the products of different minerals in the rocks which weathers into brittle parent material and subsequently formed as soil. When the finer particles of clay and silt as well as larger particles of gravel and stones are removed, the remaining are sand particles used in building construction. During high rainfall events, the soil gets eroded (washed away) where the finer particles will be carried over with water, while sand particles are deposited in the streams which are subsequently mined. In most of the Sri Lankan soils, the sand content is high as 70%. Some of the sandy regosols occurring near sea coast consist of more than 95% of sand. In addition to the mineral fraction; soils contain organic matter which are of plant and animal origin. The organic matter content normally varies from about 1% in the dry Zone soils to 3% in Wet zone soils. In special cases, organic soils as Peat found in Muthurajawela may contain about 20% organic matter. Mostly the sub soil, containing less organic matter is used in construction of earthen bunds.

Use of Earth Bunds in North and Eastern Provinces

The North and Eastern Provinces covers most of the Dry zone of Sri Lanka where the landscape is mostly flat (0-2% slope) to undulating (2-6% slope). This is different to the hill country, where the mountainous landscape provided many natural hideouts for ancient kings during previous warfare. Therefore in the Dry zone, when dense vegetation is cleared movements are visible even up to distances as 100 meters. As shown in Figure 1, when an earth dam is made for military purposes the dense vegetation in front is removed to clearly observe the advancing troops. The trees behind the earth bund will remain giving protection to Tigers from any air borne attacks or artilleries fired at them.

The Sri Lankan troops confronted earth bunds constructed by LTTE at many places during the latter part of the war. To quote some examples, the 55th division troops breached LTTE defences and gained manage over an LTTE built earth bund cum channel constructed North of Palamathalan on 28th March 2009. The 59th division troops with initial advances made by 6 SLLI and 12 SLLI infantrymen crossed the LTTE constructed earth bund cum ditch North of the Wadduvakal causeway on early morning of May 12th 2008. Some of the earthen bunds have been very tall and long. The earth bund found in Puththukudirippu has been 8 feet tall where SLAF jets were used to blast a part of it. The earth bund from Nacchcikuda to Akkarayankulum was 27 kilo meters long. There have been instances where earth bunds has been constructed around towns or areas where protection was needed. On 16 April 2009, when LTTE established Kilinochchi as their new capital, they built an earthen dam hurriedly around it for protection. Sometimes. Instead of building dams, certain dams of reservoirs were breached to release water and inundate the area making advancing difficult to Sri Lankan troops. On January 24 2009 the LTTE had blown up a dam near Mullaitivu which flooded the surrounding areas.

Construction of Earth Bunds

Most of the earth bunds have been constructed hurriedly blocking the advancing path of the troops. Heavy excavating machines as backhoes were used in these constructions. As shown in Figure 1, earth has been simply excavated and piled to make these bunds. The top soil consisting of organic matter and plant debris is normally removed and the sub-soil is used in these constructions. The piling of soil is easy if it is in moist condition (about 25% of moisture) than when it is dry. When the soil is dry the particles do not stick to each other and get rolled or blown off easily. When soil is too wet (nearly saturated with water) it also becomes difficult to work due to its viscous nature.

Once the earth is excavated and piled on the side, a ditch is automatically formed in the front. This ditch will be filled with rainwater or seeping ground water during rainy seasons. Due to lack of time and machinery, the soil in the bund is not compacted and remains loose. With one or two rainfall events the soil get naturally settled by raindrop impact and wetting and drying. Sometimes a fence is constructed at the top of the earth pile using Palmyra branches, sticks and plants to stabilize the earth pile (see the picture next to the title).

As stated earlier, the earthen dam found in Puththukudirippu has been 8 feet tall. To pile soil up to such depth, the base of the bund has to be sufficiently broad extending to about 12 feet. This shows the amount of earth work that is needed to even construct a simple earth dam of such size. These tasks were easier for LTTE as they had heavy earth moving equipment and sufficient labour.

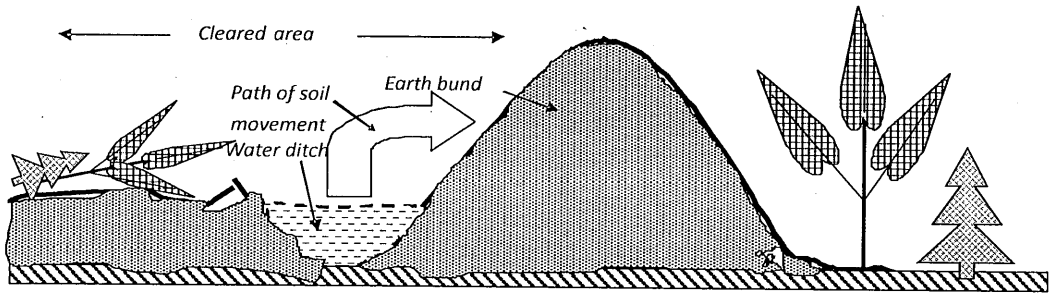

Figure 1. Construction of an earth dam where a ditch is made automatically in the front

If large stones and boulders are found in the area they are piled together before soil is filled to add strength to the bund as shown in Figure 2. As stated earlier, most of the times these earth bunds were built hurriedly without having any boulders or stones within the structure to strengthen them.

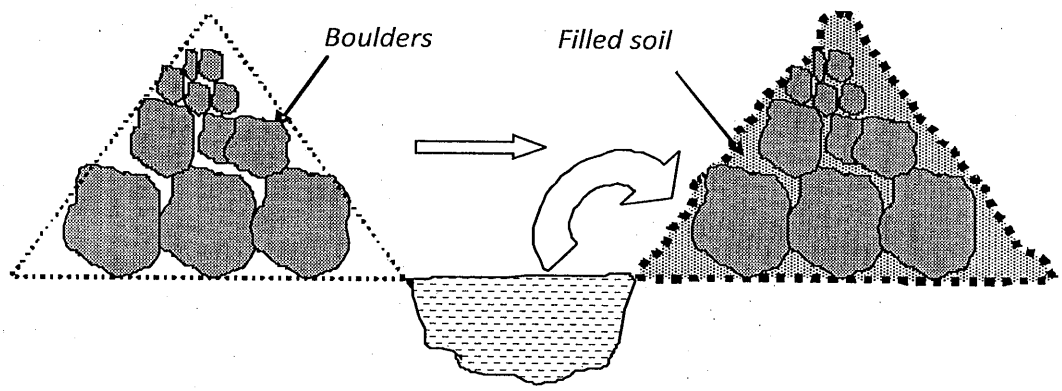

Figure 2. Boulders and stones are added to the earth bund in some instances to improve its strength

In many of these constructions landmines were placed in the ditch as well as on the earthen bund to prevent advancing of troops through the ditch and the bund. In addition, bunkers were placed at about 50 meter distance in the earth bund to observe any advancement of troops or movements in the surrounding area. The bunkers were placed near to the top of the bund to have a clear view of the open area in the front. A bunker in place in the earthen dam at Vishwamadu is shown in Figure 3.

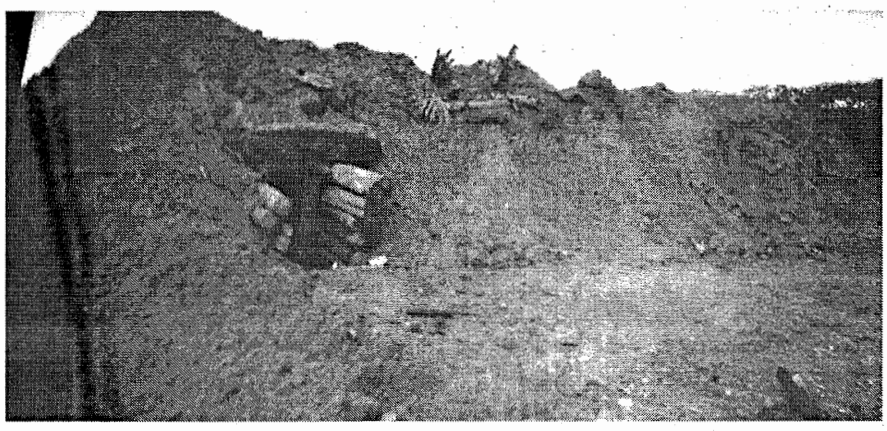

Figure 3. A Bunker constructed in the earthen bund at Vishwamadu.

Soil Types Used for Earth Bunds

The soils found in these areas mostly consist of Red Latasols formed from limestone parent material which are red in colour, deep and sandy in nature. In areas where the drainage is poor these are converted to Yellow Latatsols where only the colour is changed due to reduced conditions. Most of the earth bunds in the area were constructed using these soils. These soils have depths of about 140 cm and sand contents varying from 80% to 82% from sub soil to top soil. Therefore excavating this soil is easy and could be done down to 140 cm (12 feet) before hard materials are found, making a ditch of sufficient depth to collect water and soldiers getting to it will be easily drowned. Some of the lands close to the sea mainly consist of Sandy Regosols where the soil texture is totally sandy in nature, other than a very thin A horizon developed on the top of soil profile. These sandy Regosols extend to depths as even 150 cm, and due to sandy nature it is easily excavated. Bunds constructed by these soils are very loose and easy to penetrate than the one's made using Red Latasols. Sometimes gravel deposits are available in these areas which could be mined and added to strengthen the earthen bunds. The LTTE always used whatever soil that was available in the site (immaterial of the soil type) as it was convenient than transporting more suitable Red Latasols from distant places

Conclusive Remarks

As shown in this article, the LTTE used the most cheap and abundant building material, the earth or soils to build bunds/dams to prevent troops advancing to their strongholds. The Sri Lankan troops were brave enough to concur all these difficulties in winning the war fought during last 35 years. Once the earth mines in these bunds and ditches are cleared, these areas should be opened for the Soil Scientists, Engineers and Geologists to study them further. Some of these should be preserved without damaging for viewing for the future generations

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