

Review

Hill development by Earth architecture

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The aim of this paper is to find better knowledge for earth architecture's applications as a sustainable architecture. Earth architecture is a research devoted to the architectural uses in shaping the environment of human kind related to human ecology. Earth architecture includes vernacular and historical architecture drawn from many cultures and periods in different countries. Hills to make artificial mounts or bermed enclosures seems to have been one of the nearest styles of creating architectural that propose the ideas and concerns of builders. The paper discusses on the earth architecture based on few case studies in some countries.

Key words: Mud architecture, hill, mount, sustainable, vernacular, Earth architecture.

INTRODUCTION

Earth architecture is one of the most environmentally sound ways to build. It is a sustainable building method that substantially decreases dependence on cement, the production of which accounts for five per cent of man's output (Gernot, 2006). Though earth is usually considered a primitive building material, it is estimated that half of the typical population still lives and works in earthen buildings. Many assume that earth is a fragile material ill-suited for large structures, but the samples cited above provide ample proof of the durability of earth architecture. Earth architecture makes a lot of sense, both environmentally and financially. Earth walls are usually thick, and provide effective thermal insulation, warding off the heat during the day and conserving the warmth during the nights. Earth buildings occupy a special place in humanity's cultural consciousness and encourage a more intimate relationship between a community and the Earth. Rammed earth architecture is said to have originated in ancient Iran and China. Parts of the Great Wall of China were built using rammed mud. The oldest surviving specimens of earth architecture are found in the Middle East (ancient Mesopotamia). The Citadel of Bam

in Iran was a complete township made of earth that is at least 2000 years old that unfortunately much of it was destroyed in the Kerman earthquake of 2003, but the remnants testify to the consummate skill of the artisans who built it. Ever since mankind first congregated in villages almost 10,000 years ago, unbaked earth has been one of the principal building materials used in every continent. Over one third of the world's population still lives in earth houses today. In ancient periods, unbaked earth was widely used in Iran, Mesopotamia and Egypt, while later on, Romans and then Muslims built in earth in Europe, Africa and the Middle East – as did the peoples of the Indus civilizations, Buddhist monks and Chinese emperors (Ronald, 2009). During the middle ages, construction in unbaked earth was practiced not only in Europe, but in North America by the Indians, in Mexico by Toltec and the Aztecs, and in the Andes by the Machida. Earth architecture has some application that this paper will present hills as earth architecture.

HILLS

What is a hill?

Mounding the ground to create artificial hills or bermed

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enclosures seems to have been one of the earliest techniques of making architectural statements that subsume the ideas, concerns and ambitions of their builders (Niroumand, 2010). A hill is a landform that extends above the surrounding terrain. Hills often have a distinct summit, although in areas with scarp/dip topography a hill may refer to a particular section of flat terrain without a massive summit (Niroumand, 2006).

Earth architecture's hills in the world

The distinction between a hill and a mountain is unclear and largely subjective, but a hill is generally somewhat lower and less steep than a mountain. In contrast, hill walkers have tended to regard mountains as peaks 2,000 feet (610 m) above sea level. Artificial hills may be referred to by a variety of technical names, including mound and tumulus.

Earth architecture's hill in UK

Avebury is the position of an ancient monument consisting of a large space, several stone circles, stone avenues and barrows, surrounding the village of Avebury in UK of Wiltshire. Figures 1 and 2 are shows Avebury view in UK. It is one of the finest and largest Neolithic monuments in Europe, about 5,000 years old. Although older than the megalithic stages of Stonehenge 32 km to the south, the two monuments are broadly contemporary overall. The village name of Avebury and the earthwork have been synonymous only since the 20th century. The earliest written mention of the earthwork is from the 13th century, when it is referred to as "Waledich". In 1696, it was referred to as Wallditch. Both names are of Anglo-Saxon origin, and probably mean "ditch of the wealas"; wealas was a term used by Anglo-Saxon colonists to describe an enclave of native Britons.

The history of the site before the construction of the henge is uncertain, because little datable evidence has emerged from modern archaeological excavations. Most of the surviving structure is composed of earthworks, known as the dykes, consisting of a massive ditch and external bank henge. Although the henge is not perfectly circular, it has a diameter of about 420 m. Evidence of activity in the region before the 4th millennium BC is limited, suggesting that there was little occupation. Stray finds of flints at Avebury, dated between 7,000 and 4,000 BC, indicate that the site was visited in the late Mesolithic period by hunter-gatherers. A collection of flints found 300 m to the west of Avebury has been identified as a flint-working site occupied over several weeks. Despite minimal activity at early times, Avebury's later rise to importance follows a trend that is also seen at Stonehenge in Wiltshire and Hambledon Hill in Dorset. Another possible parallel with Stonehenge is the

presence of a posthole, similar in shape to one at Stonehenge, near Avebury's southern entrance.

A great deal of interest surrounds the morphology of the stones, which are usually described as being in one of two categories; tall and slender, or short and squat that they are shows in Figure 3. This has led to numerous theories relating to the importance of gender in Neolithic Britain with the taller stones considered "male" and the shorter ones "female". The stones were not dressed in any way and may have been chosen for their pleasing natural forms. Some claim to have identified carvings on the stones' surfaces, some carvings being more persuasive than others.

Earth architecture's hill in USA

Adena culture's most lasting artifacts were substantial earthworks. Adena sites are concentrated in a relatively small area - maybe 300 sites in the central Ohio Valley, with perhaps another 200 scattered throughout Indiana, Kentucky, West Virginia and Pennsylvania. Once Adena mounds numbered in the hundreds, but only a number of Adena earthen monuments still survive today. These mounds generally ranged in size from 20 to 300 feet (91 m) in diameter and served as burial structures, ceremonial sites, historical markers and possibly gathering places. These mounds were built using hundreds of thousands of baskets full of specially selected and graded earth. According to archaeological investigations, Adena mounds were usually built as part of burial ritual, in which the earth of the mound was piled immediately atop a burned mortuary building. These mortuary buildings were intended to keep and maintain the dead until their final burial was performed. Before the construction of the mounds, some utilitarian and grave goods would be placed on the floor of the structure, which was burned with the goods and honored dead within. The mound would then be constructed, and often a new mortuary structure would be placed atop the new mound. In the later Adena period, circular ridges of unknown function were sometimes constructed around the burial mounds. Adena mounds stood in isolation from domestic living areas that it shows in Figure 4.

Grave creek mound is probably the most famous of the Adena burial mounds, and certainly one of the most impressive. Not only is it the largest Adena mound, but it is the largest conical type of any of the mound builder structures. In 1838, road engineers measured the height of the mound at 69 feet and the diameter at the base as 295 feet. Originally a moat of about 40 feet in width and five feet in depth with one causeway encircled the mound. Construction of the mound took place in successive stages from about 250 to 150 B.C., as indicated by the multiple burials at different levels within the structure. The building of the mound and moat must have been a massive undertaking, since the total effort



Figure 1. Avebury view in UK.



Figure 2. Around of Avebury site.



Figure 3. Stones area in Avebury.



Figure 4. Adena hill in Ohio.



Figure 5. Lion hill in Belgium.



Figure 6. View of Lion hill as Earth architecture.

required the movement of over 60,000 tons of earth.

Earth architecture's hill in Belgium

The lion hill, which is the main memorial monument of the Battle of Waterloo, indicates the spot where the Prince of Orange was wounded. A total of 226 stairs leads to the top of the monument where one can enjoy a beautiful view of the entire battlefield. The hill is the ideal place to have an overview over the entire surface of the

battlefield. A total of 300.000 m³ of earth were moved to erect this (for its era) imposing monument. The earth was taken out of the fields between the "Haie Sainte" farm and the sunken lane behind which the Duke of Wellington had strategically positioned his troops. The hill is 43 m high and at the basis the circumference measures 520 m. A total of 226 stairs lead to the top of the hill. The socle on which the lion stands has been built in brick throughout the entire hill. The Lion itself weighs 28 tons, is 4.45 m high and 4.50 m long. Figures 5 and 6 shows Lion hill in Belgium.



Figure 7. Silence hill in Iran.

Earth architecture's hill in Iran

The silence or dakhmeh is a place on top of a hill where Zoroastrians brought corpses for vultures to devour as a funeral formality (Niroumand, 2010). With its Zoroastrian history, Yazd is home to many of such mu structures although they are no longer utilized for their original purpose and currently just serve as a tourist attraction. Figure 7 shows Silence hill in Iran.

Earth architecture's hill in Malaysia

Cameron Highlands is located in the state of Pahang. Currently, there are two main roads that connect major towns in west coast of Peninsula Malaysia to this popular highland resort town. Cameron Highlands is a highland region located about 121 km east of Ipoh and about 214 km north of Kuala Lumpur, in Pahang, Malaysia. At 5,000 feet (1,500 m) above sea level it is the highest area on the mainland that it shows in Figure 8.

Earth architecture's hill in Denmark

The Trelleborg Viking Fortress is located a few kilometers

west of the town of Slagelse on the West side of the island of Zealand. It is located on a peninsula at the confluence of the Tude River and the Vårby River, with the rivers covering two thirds of the fortress circumference. It has been determined that the trees used to build the Trelleborg Viking Fortress were felled between 980 and 981 AD, setting the time of construction at that period. This model of the Trelleborg Viking Fortress gives a good overview of its layout, with the living quarters inside the walls and the 15 stables between the inner and outer walls. The square behind the two houses at the back was the cemetery. Figures 9 and 10 shows Trelleborg hill in Denmark.

The fortress would probably house a skeleton crew most of the time, maintaining the fortress between the times when it was needed for military maneuvers or times of war. The diameter of the Trelleborg Viking Fortress is 180 m. The inner wall is 17 m wide and 5 m high. Trelleborg is the only Danish viking fortress with an outer wall. The fortress covers 15 acres of land. The fortress has two paths made of oak timber crossing at the middle which function as the main roads of the fortress and divide it up into 4 sections of equal size. All four entrances into the fortress were covered, and arrowheads and scorch marks on the timber found at the



Figure 8. Cameron highlands in Malaysia.



Figure 9. Trelleborg view in Denmark.



Figure 10. View of Trelleborg hill in Denmark.

gates tell of attacks on the fortress.

CONCLUSION

Taken as a whole, the some examples of earth architecture cited in this research suggest ecologically sustainable relationships between human beings and their environments. The research's brief discussion of two proposes cities explorers a number of principles of earth architecture in consonance with applications design. It is a sustainable building method that substantially decreases dependence on cement. Though earth is typically considered a primitive building material, it is estimated that half of the typical population still lives and works in earthen buildings. This paper proofed that earth architecture is a promising field of study and a continuing source of inspiration of architects, designers, ecologists, and other who are concerned with shaping to earth and earth to create a sustainable balance between human beings and the world around them.

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