

Rammed Earth Outreach Event

Eoghan Butler

Introduction

Rammed earth is an ancient construction technique. Earth is taken from the surroundings, sieved, and mixed with a small amount of water. A thick layer of the earth mixture is placed within a temporary formwork, generally made from wooden planks. The earth is compacted by ramming it with a heavy handheld tool. Once a layer cannot be compacted any further, more earth is poured on top and rammed in place (Figure 1). This technique can be used to make strong, thick walls that can last centuries.

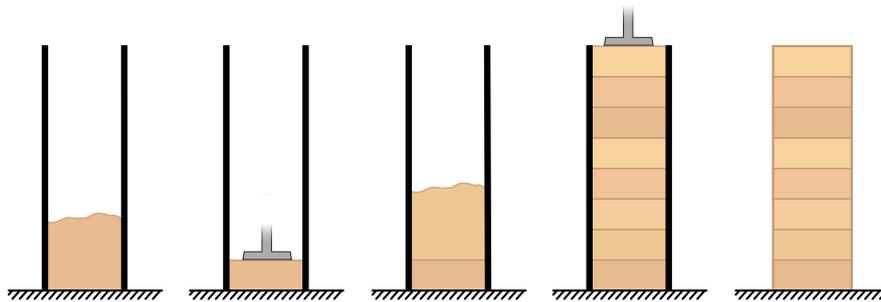


Figure 1: The construction of a rammed earth wall

Rammed earth is often considered a sustainable material as it has a low embodied carbon - meaning the processes used to make it emit very little carbon dioxide. Materials can be taken from the site or nearby and then sifted, mixed, and rammed by hand. If desired rammed earth can be ground up, mixed with a small amount of water and rammed into a new wall.

This document gives details of how to carry out a small interactive demonstration on rammed earth construction.

Equipment

- Loose earth - expect to use 3 kg of earth per litre of rammed earth made
- Water
- Mallet
- Wooden block
- Steel or plywood mould that can be disassembled
- Trowel or scoop
- Tumble mixer (optional)
- Buckets

Preparation

Significant preparation is required before the activity begins. Firstly, appropriate moulds need to be produced. The formwork must be strong and stiff. Steel cube moulds of the type used to make concrete cube samples may be used. If steel cube moulds are not available, cuboid moulds can be made from sheets of plywood and wooden batons, attached with screws. It is important that any mould used can be disassembled easily.

An adequate mass of earth must be made up. Most soil types are appropriate for use, apart from very sandy soil. Top soil should be avoided as it contains a high concentration of organic material. The soil should be sieved to remove gravel or other particles with a diameter larger than 1 cm. The strength of rammed earth depends greatly on its water content when rammed. Test the soil first by compressing a ball of earth in your hands and dropping it from chest height onto a hard, flat surface. If the soil is too dry, it will burst like a snowball. If it is too wet, it will 'splat' like a cow-pat. The perfect moisture content is achieved when the ball deforms slightly and breaks into two or three large pieces. Add water a little at a time and mix thoroughly (either with a tumble mixer or with a trowel and bucket) until this consistency is achieved. Don't worry if you go a little too wet but this may mean that the sample needs longer to dry. Do not leave too long between mixing the damp earth mixture and ramming, as the mixture may dry out and weaken the sample.

Activity

Pour a layer of the damp earth mixture into the mould to a thickness of around 5 cm. Ram the loose earth layer evenly it cannot be compacted further. In a classroom, this can be done most simply using a mallet and a wooden block.

Scratch the surface of the rammed layer with a trowel. Place another layer of loose earth into the mould and ram it on top of the previous layer. Build up successive layers until the mould is filled.

For small samples, the mould can be removed immediately and reused. The sample can be tested immediately if there are significant time constraints but leaving to dry out overnight (or a few days for larger samples) will give the sample additional strength. The sample can be tested either by placing weights on it or by standing on it.

The time required for this activity will range depending on the size of the sample. Approximately 20 minutes should be allocated to a demonstration and brief safety talk and a further 20 minutes allocated for the students to manufacture their own samples.