

Sandcastle secrets could help revive ancient building technique

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Courtesy Durham University
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The secret of a successful sandcastle could aid the revival of an ancient, eco-friendly building technique, according to engineers at Durham University in the U.K. They have carried out a study into the strength of rammed earth, which is growing in popularity as a sustainable building material.

Rammed earth was developed in ancient China around 2,000 B.C., when people used the technique to build walls around their settlements, according to archaeologists at Durham. The technique then spread throughout the world.



Part of The Alhambra palace complex in Granada, Spain, built in 1238 and now a world heritage site. (Image © Paul Jaquin/Durham University)

Parts of the Great Wall of China and the Alhambra palace at Granada in Spain were built using rammed earth. In the U.K. the technique was used to build experimental low cost housing, in Amesbury, Wiltshire, after the end of the First World War, and it is a recognised building method in parts of Australia and the U.S.

Rammed earth is a manufactured material made up of sand, gravel and clay which is moistened and then compacted between boards to build walls. Sometimes stabilisers such as cement are added but the Durham research focused on unstabilised materials.

Just as a sandcastle needs a little water to stand up, Durham engineers found that the strength of rammed earth depends much on its water content.

Small cylindrical samples of rammed earth underwent “triaxial testing” – where external pressures are applied to model behaviour of the material in a wall. The researchers found that the suction created between soil particles at very low water contents was a source of strength in unstabilised rammed earth.

They found that rammed earth walls left to dry after construction, in a suitable climate, could be expected to dry but not lose all their water. The small amount of water remaining provided considerable strength over time.

The researchers say their work could have implications for the future design of buildings using rammed earth, as the link between strength and water content becomes clearer. The team hopes their findings may also aid the conservation of ancient rammed earth buildings by creating

safeguards against too much water entering a structure, which would weaken it.

“We know that rammed earth can stand the test of time but the source of its strength has not been understood properly,” said the research project leader, Charles Augarde of Durham. “By understanding more about this we can begin to look at the implications for using rammed earth as a green material in the design of new buildings and in the conservation of ancient buildings.”

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