The secret of a successful sandcastle could aid the revival of an ancient eco-friendly building technique, according to research led by Durham University and supported by EPSRC.

Researchers at Durham University’s School of Engineering have carried out a study into the strength of rammed earth, which is growing in popularity as a sustainable building method. Rammed earth is a manufactured material made up of sand, gravel and clay which is moistened and then compacted between forms to build walls. Just as a sandcastle needs a little water to stand up, the Durham engineers have found that the strength of rammed earth was heavily dependent on its water content.

**Impact on sustainable buildings**

- By understanding more about this material we can begin to look at the implications for rammed earth both as a green material in the design of new buildings and in the conservation of ancient buildings that were constructed using this technique.
- Using rammed earth would reduce reliance on using cement in building materials, reducing the amount of CO₂ produced.
- Rammed earth materials can usually be sourced locally thereby reducing transportation costs.

**Past techniques**

Rammed earth was developed in ancient China around 2,000 years BC, when people used the technique to build walls around their settlements and the technique spread throughout the world. Parts of the Great Wall of China and the Alhambra at Granada in Spain were built using rammed earth. In the UK, the technique was used to build experimental low cost housing in Amesbury, Wiltshire, following the end of the First World War. Today television programmes such as Grand Designs have reintroduced this technique as a viable building method.

**Strength testing**

The research project leader, Dr Charles Augarde, said: “We know that rammed earth can stand the test of time but the source of its strength has not been understood properly to date.” The research, published in the journal Geotechique, showed that a major component of the strength of rammed earth was due to the small amount of water present. Small cylindrical samples of rammed earth underwent “trixial 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.

**Building a sustainable future**

Tom Morton, secretary of Earth Building UK, said: “This kind of research is very valuable as the construction industry analyses environmentally sound, traditional ways of building and adapts them for sustainable construction in the 21st century. Such low carbon technologies are most likely to succeed by marrying the expertise of research universities, such as Durham, with the commercial understanding of the wider industry.” Paul Jaquin, a researcher on the project, is now working for an engineering consultancy (Ramboll UK) on new earth building projects around the world, using this research to better engineer buildings.

For more information about EPSRC and the impact it is making visit [www.impactworld.org.uk](http://www.impactworld.org.uk)

Cement production is responsible for five per cent of total global CO₂ output; using rammed earth could dramatically reduce this figure.
USING RAMMED EARTH COULD HELP REDUCE GLOBAL CO₂ OUTPUT