Usually, when concrete shells are constructed, they require support from elaborate and expensive timber structures. In light of this requirement, large concrete domes are rarely ever built anymore. Thankfully a revolutionary technique has now been developed at the Vienna University of Technology which eliminates the need for timber structures. By making the timber structures obsolete, this new method helps to save time, resources and money!

The method calls for air cushions to be placed underneath a flat slab of concrete. After the flat slab of concrete hardens on the ground, the air cushion underneath is inflated, which in turn bends the concrete – forming the sustainable shell. It is believed that even large event halls are able to be built this way and as such we may be seeing an influx of concrete dome structures being erected in years to come.

Professor Johann Kollegger of the Vienna University of Technology describes the process similar to that of peeling and orange peel and flattening it on a flat surface – only reversed. “We do it the other way around, starting with a flat surface and then bending it to a shell,” Kollegger explains. This new method had been developed by Professor Kollegger and colleague Benjamin Kromoser and has already been successfully tested on the Aspang Grounds in Vienna.

How does it work? The Pneumatic Wedge Method

The first step of the process is to create a flat slab using standard concrete. One crucial aspect of this step is getting the geometric shape of the slab exactly right. Wedge-shaped spaces are left between several segments within the slab so that the segments fit together once the structure is bent.

Once hardened, the air cushion placed underneath is inflated. The cushion includes two plastic sheets that are welded together. Simultaneously, a steel cable is tightened around the segments of the concrete in order to ensure that the concrete is lifted up at the center and pushed together from the outside. As a means of ensuring that all of the concrete segments move in synchronicity, metal beams are connected to them.

In Kollegger and Kromoser’s experiment, the entire process of creating a concrete dome with this method took approximately 2 hours to complete with the final height of the structure reaching 2.9 m. Although it was observed that when bent, tiny cracks appeared in the concrete, this is not deemed as a problem for the stability of the shell. “We can see that in old stone arches,” Kollegger states. “If the shape is right, each stone (segment) holds the others in place and the construction is stable.” It was determined by the team that once the structure is plastered, it shares the same properties and is just as stable as a concrete shell

that is constructed in a conventional way.

It is hoped that this new construction method for concrete shell construction will soon establish itself in the market as it has already been patented. Interest is also already being shown by the Austrian Federal Railways (OEBB-Infrastruktur) who have commissioned a design project based on the method for deer Passover structure!

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