Cracking Under Pressure

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Today's society pushes the limits of concrete by creating structures that are taller and heavier than ever before. This leads to problems because concrete can only do so much. Fortunately, just as society continues to advance its structures it also continues to advance in technology, this includes concrete. The purpose of this project is to find an inexpensive solution for strengthening concrete. In this project, three innovative designs were tested: the control, compression strengthening, and a completely new design called ABS Centitubes. The control is just normal concrete poured into a mold in the shape of a tunnel. The compression strengthening is done by compressing the gravel around the tunnel so that it forms a self-supporting structure. The ABS Cenitubes were created by filling tube-shaped structures made out of ABS filament and 3D printed with a two-stage epoxy. The tubes will act as rebar, but once broken, the epoxy will react and cure providing a seal to cracks. The tunnels were tested by placing weight on top in ten-pound increments until complete failure occurs. Five tunnel molds for each design were tested. In the end, the compression strengthening only improved the average of the control by ten pounds. On the other hand, the compression strengthened tunnels produced data 2.5 times more closely related than the averages of the control. Therefore, they are more predictable and safer for commercial use. The ABS Centitubes displayed the lowest average and were extremely expensive. However, one Centitube tunnel supported almost double the weight of all of the averages. This means that ABS Centitubes, though not effective now, have the potential to be a revolutionary development and save millions of dollars and lives.