



**CALIFORNIA STATE SCIENCE FAIR  
2017 PROJECT SUMMARY**

<b>Name(s)</b> Seney M. Larson Moreno	<b>Project Number</b> <b>J1414</b>
<b>Project Title</b> <b>When It Rains, It Drains: The Best Additive for Permeable Concrete</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this study was to determine what additive would best increase the porosity of permeable concrete with the least decrease in compressive strength. Permeable concrete is an enhanced concrete formulation in which small aggregate is removed to produce a porous material that can filter water back into the ground.</p> <p><b>Methods/Materials</b> As porosity is hard to measure, a flow rate testing system (WITS) was designed and used to measure maximum water flow rate through the samples. An industrial Instron machine was used to measure the compressive strength of the samples. There were 6 additives consisting of both metals and plastic materials. Standard concrete components and easily accessible construction materials were used to make the samples, molds, and the flow rate testing system.</p> <p><b>Results</b> Additives always increased the flow rate through the samples and significantly dropped the compressive strength. Metal Mesh samples had the least drop on compressive strength measuring at 326N/cm<sup>2</sup> (473PSI), while Steel Wool #00 had the highest flow rates at 2.04cm/sec (2892in/hr).</p> <p><b>Conclusions/Discussion</b> The permeable concrete formula used resulted in extraordinary high flow rates that over compensate for realistic rain events. The recipe needs to be adjusted to increase the compressive strength of the permeable concrete. The permeable concrete samples did not have a typical "failure" fracture like the industrial standard, rather it continuously found a new load path. The inclusion of additives into permeable concrete results in drainage and increases local water reclamation, reducing runoff and pollution deposited into our oceans. Possible applications include its use in parks, pavements, patios, pavements, patios, court yards, and sidewalks. Selection of material additives would likely depend on the properties needed for the application.</p>	
<b>Summary Statement</b> While the inclusion of additives does decrease the compressive strength of permeable concrete, it greatly improves the flow rate creating an eco-friendly material with lots of applications.	
<b>Help Received</b> I received help in cutting materials used for molds from my science fair advisor. Orbital ATK allowed me to use their Instron for compressive strength testing and provided instruction on using the equipment.	