



**CALIFORNIA STATE SCIENCE FAIR  
2016 PROJECT SUMMARY**

<b>Name(s)</b> <b>Ethan P. Kerr</b>	<b>Project Number</b> <b>J1116</b>
<b>Project Title</b> <b>The Effect of Man-Made Materials on Urban Temperatures</b>	
<b>Abstract</b> <b>Objectives/Goals</b> My objective was to determine whether the average temperature in an urban environment is greater than in a natural, non-urban environment because of the man-made materials used in an urban environment. <b>Methods/Materials</b> My approach to the problem was to heat both man-made, and natural materials to mimic the heating effect of the sun, and then to test the surface temperature, and the air temperature above the materials. I built a testing apparatus made up of a 2 foot high, 10 inch diameter steel duct with a thermometer port at 14 inch high, topped with a heat lamp. I filled the bottom of the duct with 2#3 inches of the material to be tested (concrete, asphalt, brick, sod, soil with twigs and leaves). Then I turned on the heat lamp for 30 minutes. I then removed the heat lamp and took temperature readings of both the air above the material, and the surface temperature of the material every minute for 60 minutes. This process was repeated for each of the materials. The data allowed me to determine the average temperatures (air and surface), and to see the rate of cooling of the materials. <b>Results</b> I found that the average air temperature above the materials was 4.8 degrees F warmer with the man-made materials than with the natural materials. The average surface temperature of the man-made materials was 28.1 degrees F warmer than that of the natural materials. The natural materials cooled down more rapidly than did the man-made materials. <b>Conclusions/Discussion</b> Man-made materials generate more air and surface heat than natural materials, and natural materials cool at a more rapid rate than man-made materials. The science behind the results is that since the man-made materials are denser than the natural materials, they retain heat for a longer time and cool more slowly. I would like to study the effect of color and/or reflectivity on temperature. I observed, for example, that the concrete, being light in color did not reach as high a surface temperature as the darker materials, but due to its density it cooled more slowly and had the highest ending surface temperature. My experiment supports the idea that providing for natural open spaces in urban areas would be beneficial to the inhabitants, as would the use of more natural materials in urban landscaping, because that would reduce the abnormally high temperatures of urban areas known as Urban Heat Islands.	
<b>Summary Statement</b> I showed that man-made materials found in urban environments cause higher air and surface temperatures than natural materials found in non-urban environments.	
<b>Help Received</b> My dad helped me with equipment design and fabrication.	