April 6, 2018

Dear Mr. Vassiliades and the Professional Engineers in California Government,

It was an incredible honor to receive the 2018 Marilyn Jorgensen Reece Award at the 68th Annual Los Angeles Science and Engineering Fair. In 2017, when I received the award as a 6th grader, I was inspired to continue studying civil engineering. The award showed me how important infrastructure is, and I was motivated to build-on to my project from last year. Considering that the Marilyn Jorgensen Reece Award recognizes a top female engineer, I am grateful to receive this powerful award. As a feminist, I have a great appreciation for the contribution of women who came before me.

My name is Diana Michaelson, and I am a 7th grader from Charles Evans Hughes Middle School in Long Beach, California. I was inspired to compete in the Los Angeles Science and Engineering Fair after visiting the California State Science Fair as a 5th grader with my aunt. The experiments were mind-blowing, and I began working towards participating in a competitive science fair. My school did not take part in the LA County Science and Engineering Fair, so I helped start the first science team at Hughes Middle School to ever compete in the LA County Science Fair. This year will be the first year that Hughes Middle School will be represented at the California State Science Fair, and I am proud to be a part of it.

My interest in projects about civil engineering began in the 4th grade. In my 4th grade science class, my class learned about the effects of freezing and thawing on rocks. I was fascinated with the power of water expansion on rock disintegration, and performed a science fair experiment about freezing and thawing attacking rocks. During this project I learned that concrete is also greatly affected by freezing and thawing. This lead me to my 6th grade project, which studied if the size of aggregate can affect the strength of concrete in a freezing and thawing condition. My experiment this year tests how the environmental sustainability of coarse aggregates compares to the compressive strength of concrete.

My project is called Compressive Strength in Concrete vs. Environmental Sustainability. My project was designed to figure out if there is potentially a more environmentally sustainable coarse aggregate alternative that will have a similar compressive strength to traditional coarse aggregate in concrete. For my experiment I used 3 different coarse aggregates in my concrete samples: traditional ¾" large aggregate (control), recycled aggregate from a previous construction and recycled rubber mulch. I made 3 samples of each aggregate type. My hypothesis was that the control would be the strongest, but that the recycled aggregate would be very close in strength, and the rubber would be the weakest. After mixing, my samples cured in a moisture controlled environment. My tests were performed at Twining Lab in Long Beach, CA, using industry standards for testing compressive strength in concrete. At 7 days, the traditional coarse aggregate had a compressive strength of 2970 psi, the recycled aggregate was at 2720 psi, and the rubber aggregate was at 480 psi. After 28

days of curing, I tested the remaining 2 samples from each aggregate type. The traditional coarse aggregate samples had an average compressive strength of 4460 psi, the recycled aggregate was at 3925 psi, and the rubber aggregate was at 601 psi. Therefore my hypothesis that the traditional aggregate would be the strongest followed by the recycled aggregate, and that the rubber would be the weakest, was supported by my results. However, I also learned that although rubber aggregate does not give a high compressive strength to concrete, it has other potentially useful qualities.

The rubber aggregate had incredible results because it gave concrete the potentially useful qualities of being lightweight, flexible, and being about to rebound under pressure. Rubber aggregate in concrete has a great potential to benefit infrastructure, but there is so much more to learn. I realize that there is so much more to be researched about concrete and the possibilities of strengthening building materials are endless. Another aspect of concrete that interests me is how aggregate type may affect degradation rates of the concrete over time. For instance, more sustainable coarse aggregates may have the potential to replace traditional coarse aggregate in a compressive strength, but how about in a long-term test that studies the effects of aggregate on concrete disintegration over time.

Once again I would like to acknowledge the Professional Engineers in California Government for awarding me the 2018 Marilyn Jorgensen Reece Award. Allowing me to present my project to the civil engineers at Caltrans was an amazing opportunity for me to explain my research on concrete. This has been such a remarkable opportunity for

me to evolve as a scientist. The Marilyn Jorgensen Reece award allowed me to see the possibilities of studying infrastructure, and has inspired me continue learning about this field. Thank you so much for this amazing opportuning!

Sincerely,

Diana Michaelson