

Felimon Charles L. Legaspi, III

Glendale, CA

April 11, 2016

Professional Engineers in California Government

P.O. Box 712352

Los Angeles, CA 90071

Attention: Mr. John Vassiliades

Dear Professional Engineers in California Government, Mr. John Vassiliades and Cal Trans:

My name is Felimon Charles Legaspi, and everyone calls me "Charlie." I'm 11 years old and in 6th grade at Incarnation School in Glendale, California. I would like to express my deep gratitude and thank the members of the Professional Engineers in California Government (PECG), Mr. John Vassiliades, the California Dept. of Transportation (Cal Trans) and all the engineers who honored me with the "James E. Roberts Award of Excellence" at this year's Los Angeles County Science Fair. The medals, certificates of recognition, the trophy, and the \$1,000 cash award I received from your organization have made my entire science fair experience very fulfilling and rewarding. This has truly been the highlight of my young life so far!

I am very grateful for the honor and positive feedback I received from the PECG regarding my science project which made my first experience competing at the L.A. County Science Fair truly memorable. My project is about "Building Better Earthquake Resistant Structures." I wanted to find a way to lessen the destructive effects of an earthquake is by building stronger, safer and more earthquake resistant buildings.

The purpose of my experiment is to determine the effects of varied building modifications on its performance during a simulated earthquake. I used steel rods, cross-bracing, a base isolator and a combination of these improvements in this experiment. My hypothesis is that buildings can be more earthquake resistant by making certain structural changes to make it more stable during an earthquake. I believed that adding a combined system of cross bracing, base isolation and steel rods to a building can make it more earthquake resistant. With the help of my grandfather, an earthquake simulator was built with sheet metal and wood, attached to wooden rods and powered by a 7-amp, 120-volt electric drill. I overlapped four blocks of wood ten stories high to make a building, and placed them at the center of the earthquake simulator. I left the simulator vibrating and timed until the building

collapsed. Three trials were done. At the end of each trial, the building was rebuilt. For the next set of three trials each, I modified and tested the building as follows: 1) adding a cross brace made of popsicle sticks, 2) adding a base isolator made of cardboard box filled with marbles, 3) adding steel rods placed at the top corners of the building, 4) then I tested a combination of cross brace and base isolator, 5) combined cross brace and steel rods, 6) combined steel rods and base isolator, and lastly, 7) a combination of all 3 improvements – a cross brace, base isolator and steel rods. I recorded the data of each trial.

After conducting multiple tests on each building modification, the results of my experiment show that adding a combination of cross-bracing, base isolator and steel rods performed the best overall by resisting simulated earthquake conditions the longest, with an average standing time of 184 seconds. This combination resulted in an improved stability of 4,873%. Next to this combination, adding both steel rods and a base isolator performed second best, standing an average of 139 seconds. The cross-brace and steel rods combination performed third best with an average standing time of 117.67 seconds. The cross-brace and base isolator combination performed fourth best with an average standing time of 112.33 seconds. The steel rods came in fifth with an average standing time of 60.08 seconds. The base isolator came in sixth with an average standing time of 33.12 seconds. The cross bracing came in seventh with an average standing time of 6.90 seconds. Finally, the control group without any modification performed the worst with an average standing time of 3.7 seconds.

My experiment has shown how good engineering practices can help buildings become more resistant under the stress of large earthquakes. The building with all three improvements was the most stable. It was able to withstand the earthquake simulation for the longest time compared with the seven (7) other building structures. I highly recommend adding a combination of cross-brace, base isolation, and steel rods to buildings in order to make them substantially earthquake-resistant. I believe my findings should be useful to architects, engineers, building contractors and society as a whole because they can build stronger, safer buildings that can withstand earthquakes better.

I had a great time doing this experiment. In the future, I would like to become an engineer and help build earthquake resistant homes and buildings just like the structures in my project. The L.A. County Science Fair was very exciting for me. I learned a lot and had a lot of fun during the 3-day event. At the awards ceremony, I was surprised and very happy to have won the special **James E. Roberts Award of Excellence from the PECG**. I am also grateful to have won second place in my Earth/Space Sciences category. Along with a certificate, I'm blessed to have received a \$1,000 cash prize from the PECG, which I will use as part of my college fund. I feel very honored to receive these awards.

I also thank the PECG and Cal Trans for allowing me to present my project at the Cal Trans office and meet the fine engineers and staff who work tirelessly everyday to ensure a safe and effective public transportation for our state. I will always treasure the beautiful glass trophy

and Cal Trans medal I received as the “James E. Roberts” awardee. Moreover, my family and I very much appreciate being invited to attend the PECG luncheon where I received a Certificate of Recognition from Senator Isadore Hall.

I am incredibly grateful to the PECG, Mr. John Vassiliades, Cal Trans and to all the judges who interviewed me. I hope to follow in the footsteps of Mr. James E. Roberts, and the countless fine engineers he has inspired over the years. I hope to be among the PECG members when I fulfill my dream of becoming an engineer someday. **Thank you so very much for believing in me, and my project. Thank you for my certificates, medals, trophy and cash prize. Thank you so very much for this amazing experience and your incredible generosity to young students like me. I will forever be grateful and will constantly strive to be worthy of the honor you bestowed on me!**

Sincerely,

Charlie Legaspi

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