Composites: Transforming T-Beams

Louw, Danika (School: Centerville High School)

In order to continue the growth and improvement of society economically, environmentally, and sustainably, it is essential to develop advancements in materials to create new reliable sources for infrastructure. Can changing the shape of a beam to more effectively distribute the load and adding the composite material of fiberglass, which is 225% stronger than wood, make the beam more effective than commercially used pine beams? By developing a T-beam that consists of a top flange and web made of an inexpensive material like pine and by adding an environmentally friendly composite material like fiberglass to the bottom of the beam where tensile forces are experienced, the beam will be a viable alternative that is equivalent in strength while being a smaller volume than both the standard pine beam and the I-beam. To evaluate, simulate various combinations of beams. Assemble the physical beams and add fiberglass with a uniquely designed pultrusion machine. Use a hydraulic press to test the beams until they fail and record their deflections. Evaluate stress, cost, deflection, and volume to determine the most efficient solution. After testing, it was found that hybrid composite T-beams were structurally equivalent to conventional pine beams and I-beams while remaining cost effective and reducing the overall volume of the beam. This experiment can help build strong environmentally friendly beams that will not fracture under the pressure of a building, allow for space conservation, and be more cost effective to buy and manufacture due to less material being needed for construction.

Awards Won:

Third Award of $1,000

National Aeronautics and Space Administration: Honorable Mention