

For my performance estimate I got a vertical distance of 0.21 in and a horizontal distance of 0.14 in. This seems realistic based on what I observed during my tests and based on my weight and small amount of stored energy. However, the actual distance my hopper jumped varied significantly with each attempt. Sometimes it was a few inches, sometimes it was less than an inch, and sometimes it did not jump at all. For my environmental impact estimate I got 28 kg CO<sub>2</sub>eq, which seems realistic based on how small and skinny my hopper is.

My choice to make my hopper light and use as little material as possible probably contributed to both my small distance estimate and my small environmental impact. My small distance estimate because I made my springs very small to use less material, and my small environmental impact because of how few materials I used.

Weight: 61 g  $E = \frac{1}{2}kx^2$   $k = 2.49 \text{ lbs/in}$   $x = 0.45 \text{ in}$   
 $E = \frac{1}{2}(2.49)(0.45)^2 = 0.25 \text{ J}$

Vertical:  $E \sin \theta = 0.21 \text{ in} = 5.33 \text{ mm}$   
Horizontal:  $E \cos \theta = 0.14 \text{ in} = 3.56 \text{ mm}$

$\frac{\sqrt{13}}{2}$   $3$   $3^2 + 2^2 = c^2$   $9 + 4 = c^2$   $\sqrt{13} = c$   
 $\tan \theta = \frac{3}{2}$   
 $\theta = 56.31^\circ$

Max height with launch angle of  $56.31^\circ$ :  
Vertical:  $3 \sin \theta = 2.5 \text{ in}$  Horizontal:  $3 \cos \theta = 1.66 \text{ in} = 42.16 \text{ mm}$   
 $= 63.5 \text{ mm}$

Materials	Mass (g)	Embodied Carbon (kg CO <sub>2</sub> eq)
Fiberboard Sheet	49	1.9
Wooden Dowel	2	0.6
Spring Wire	1	6.8
Compression Spring	6	5.5
Rubber Tubing	1	3.3
Suction Cup	1	7.1
Wood Glue	1	3.2
<b>Total</b>	<b>61</b>	<b>28.4</b>