

Cross Over Bike: Boomerrang
Version 1

A cross over bike is to be designed for the mass consumer market. The expected sales volume is 100,000 per year. Affordability, excellent performance/cost ratio and light weight are most important to be successful in this market. Below is an initial design for manufacturing. The table lists the design requirements and the FEM testing results for a load case of $f1 = 50$ lbs, $f2 = 75$ lbs and $f3 = 75$ lbs.

Requirement	Required	FEM Result:
Manufacturing Cost	$\leq 5.2\$/\text{part}$	\$4.05
Performance: d1	≤ 0.060 mm	0.0692 mm
d2	≤ 0.009 mm	0.0064 mm
First Natural Frequency (Restrained)	≥ 295 Hz	219 Hz
First Natural Frequency (Unrestrained)	≥ 505 Hz	544 Hz
Mass	≤ 0.27 lb	0.27 lb

Figures 1 and 2 below show our initial design and final design for this model. This design concept was prompted by an effort to reduce the cost of manufacturing through the lack of a hole in the material, besides those holes required in the design requirements. The initial sketch for Boomerrang consisted mainly of a center circle from which arms extended and looped around required holes (see Figure 1). The final design (Figure 2) was reached through gradual modification of adding material to areas experiencing high stresses. There was a trade off between mass and performance. We feel that we optimized the design to minimize the displacement while constraining mass; additional modifications made increased the displacements.

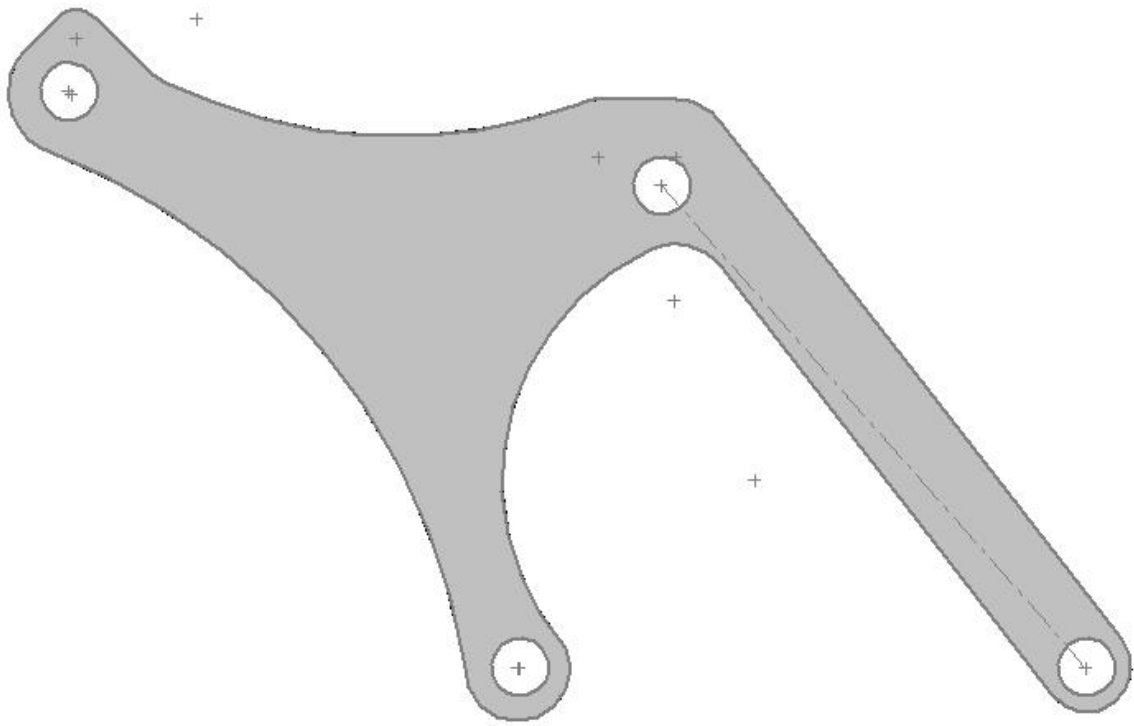


Figure 1. Initial Solidworks sketch for the Boomerrang model.

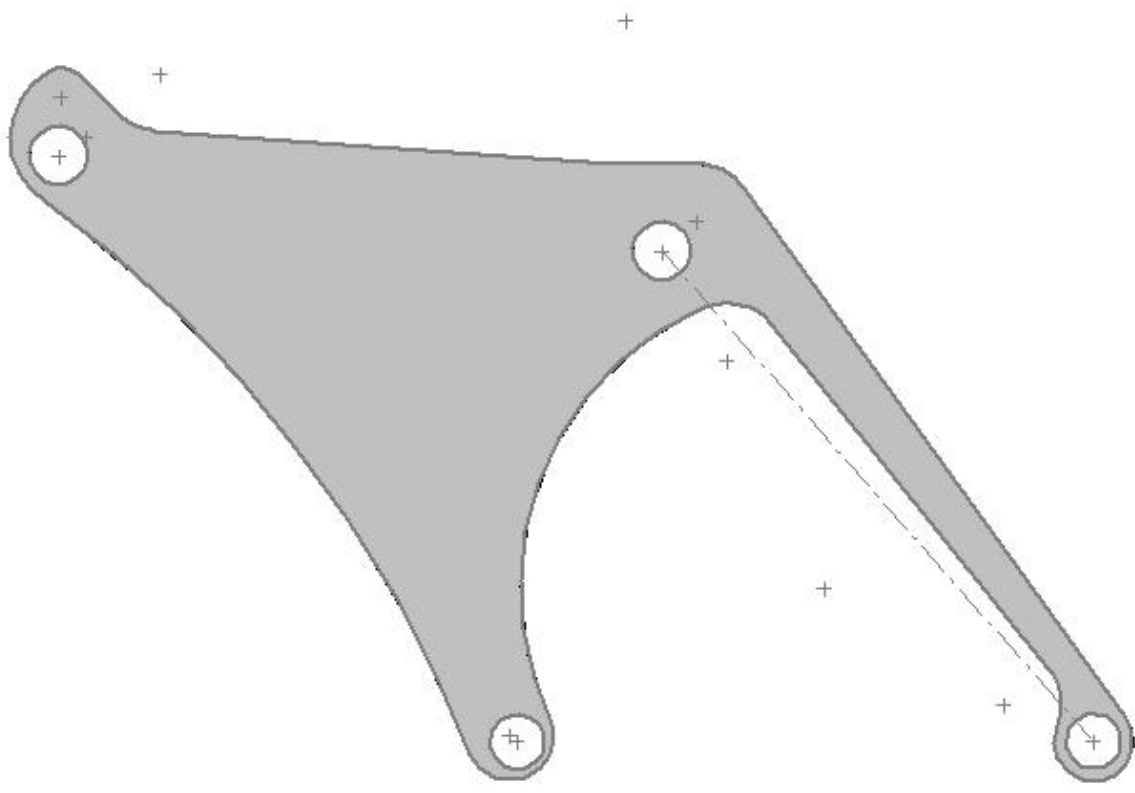


Figure 2. Final Solidworks sketch for the Boomerrang model.