

Final Design Document for BMX Bicycle Frame

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Presented with a set of requirements for the construction of a frame for the production of BMX stunt bikes, the group pursued several designs in order to meet the specific set of requirements listed below. As directed, the designers placed greatest emphasis on minimizing mass, while still attempting to reduce displacements that the bicyclist may encounter during the usage of the product. Solid Works and COSMOS software allowed for the simulation of the heavy loads placed at the seat and handlebars thus modeling the weight of a rider and the additional forces exerted during the use.

Several attempts were made in order to meet all the requirements presented. Various iterations included the addition of complex truss structures both within and without individual members, the introduction of small holes throughout the piece, and the resizing of various members. However, almost any attempt to optimize the displacement at the seat resulted in an increased mass. Therefore, only one extra member remained in the final version. Extra weight was also removed by replacing straight lines with slightly curved arcs in low stress areas.

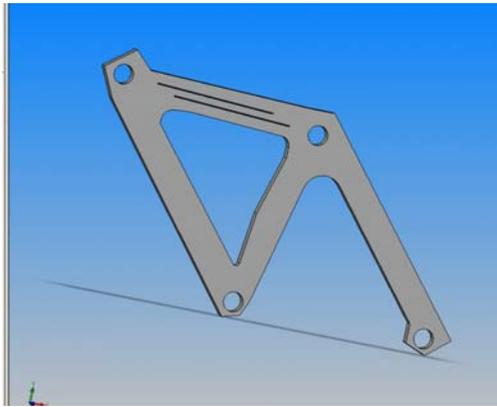


Figure 1: BMX Version 1

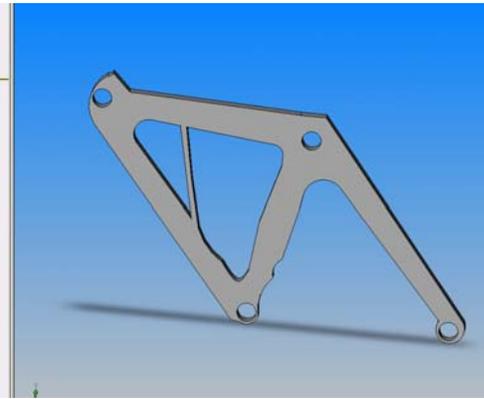


Figure 2: BMX Version 2

The final configuration thus allowed for an acceptable mass with a minimized displacement at the seat: 10% above the required value. The natural frequency also fell below requirements, but not by more than 10%. Nonetheless, most measurements showed an improvement from the initial version.

	Required	Version 1	Version 2	Improvement	Variation (2) from Requirement
Mass (lbs)	.23	.265	.234	11%	+ 1.7%
Displacement 1 (mm)	.060	.062	.066	-6.4%	+ 10%
Displacement 2 (mm)	.009	.006	.006	--	- 33%
Natural Frequency (Hz)	590	478.54	534.55	11.7%	- 9.3%
Cost (\$)	8.60	5.89	5.82	--	--

Table 1. Comparison of BMX Versions 1 and 2 of Structure

	Required	Expected	Actual	Error
Mass (lbs)	.23	.234		
Displacement 1 (mm)	.060	.066		
Displacement 2 (mm)	.009	.006		
Natural Frequency (Hz)	590	434.55		
Cost (\$)	8.60			

Table 2. Comparison of Expected and Actual Values for Version 2