



Team 07 -The Bikers

Engineering 339/340 – Senior Design – The Electric-Assisted Bicycle Rack



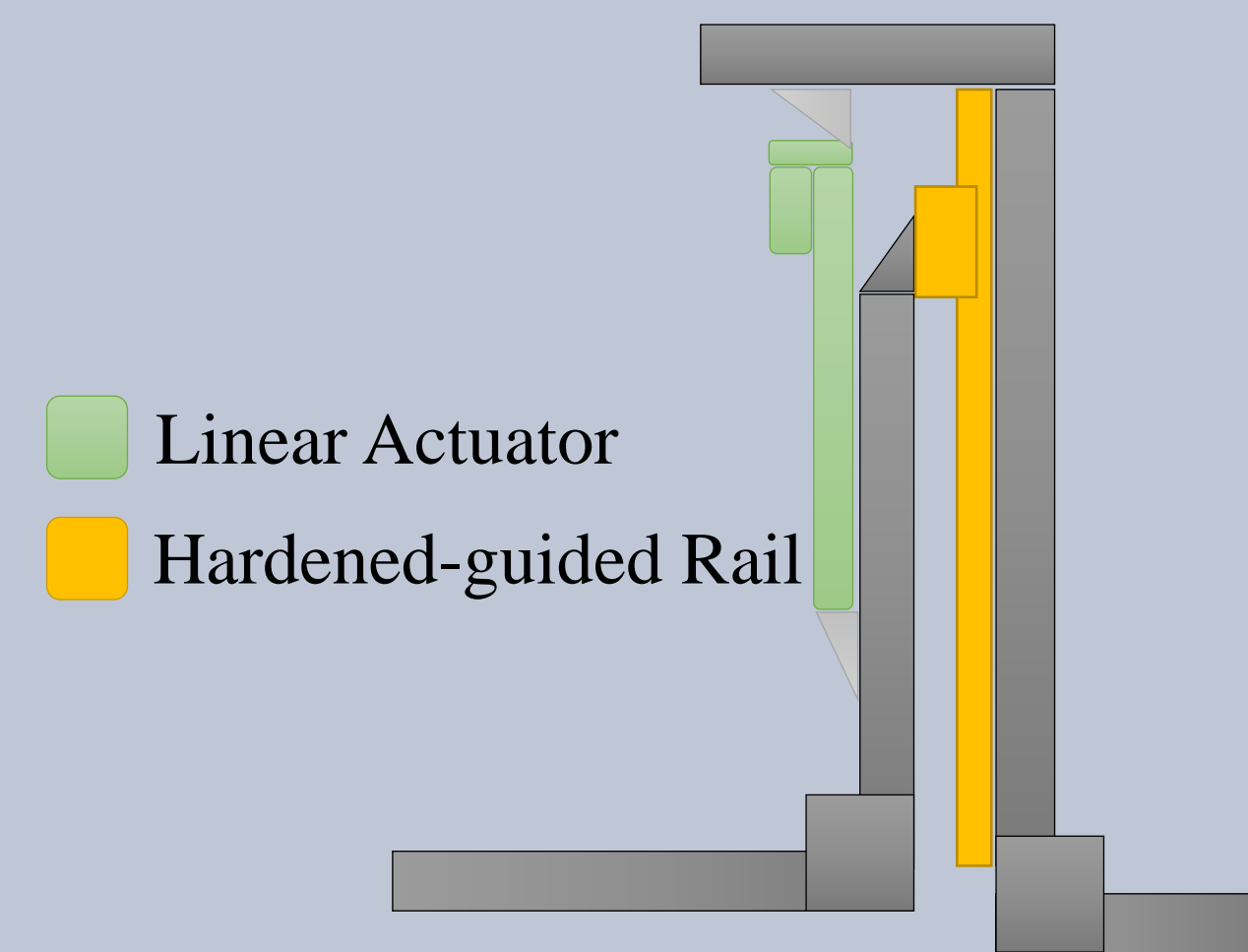
Introduction

The Bikers designed an electric-assisted bicycle rack. This rack alleviates the need for upper body strength during the loading and unloading of e-bicycles from a platform hitch mounting bicycle rack. This rack is used in combination with a 2” hitch receiver and 4-pin trailer power connection



Mechanical Engineers:

- Jonathan Jansma**
Manufacturer
- Adam Brunsting**
CAD Designer
- John Stehouwer**
Communication
- Young Rak Choi**
Researcher



Approach

Team formation:

Early in their design, the team was faced with challenges. With two students returning from a gap year and the others seeking a welcoming group, the team had to find a relevant issue in the engineering field that they could design a solution harmoniously together. The Bikers united around the bicycle, making bicycle adventures accessible to their loved ones. Through their team formation adversity, cultural and talent diversity, and unification on two rolling wheels, the Bikers found their own way to play to each member’s strengths resulting in a successful product.

Project Goals:

- Primary: Lift mechanism to raise/lower rack side
- Secondary: Pivot mechanism to reduce needed storage space

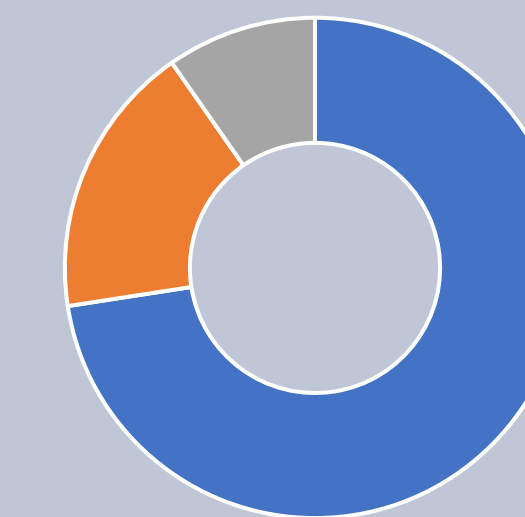


Guidelines

- Transparency:**
Clear, simple, and visible mechanisms
- Responsibility:**
Care for everyone’s quality of life (Psalm 71:9)
- Sustainability**
Recyclable and reusable materials

Financial Analysis

Total Cost Required per Rack (\$)



■ Direct material ■ Direct labor ■ Overhead

Key Highlights

- Direct material cost is a fixed cost
- Focus on direct labor to reduce the product cost

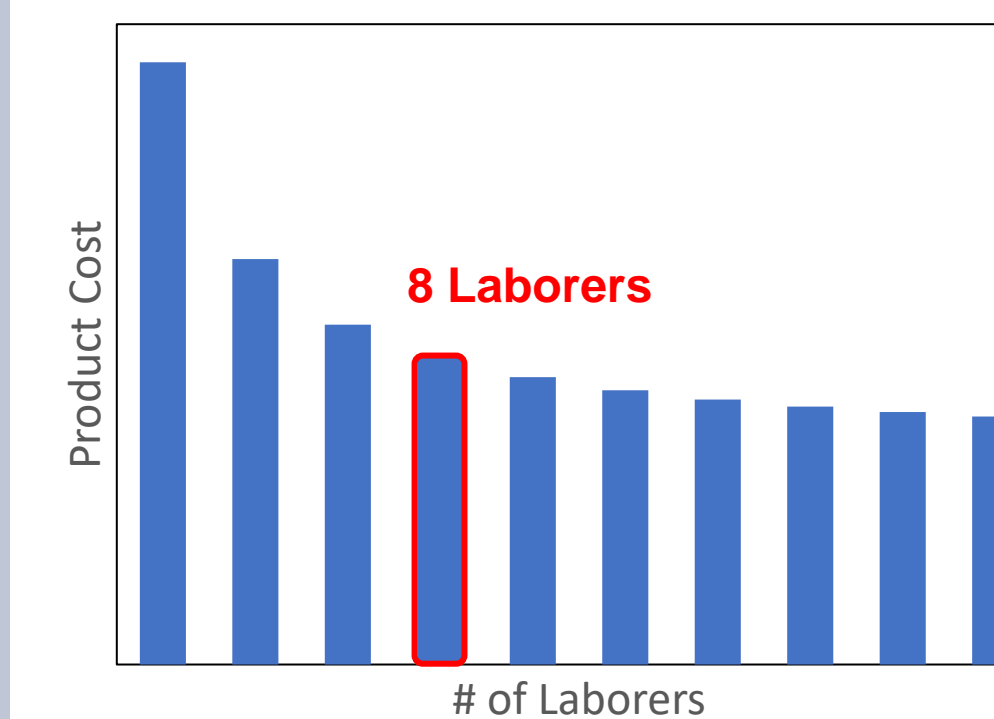
BASE CALCULATION ASSUMPTIONS

- Engineering Salary
60,000 \$/yr
- 1 Shift per day
- # Of labor
2 Person

BASE CASE COST CALCULATION

TYPE	COSTS (\$)
Direct Material	736.07
Direct Labor	180.00
Overhead	98.32
Total COST	\$1014.39 per rack

Impact of Increase Labors



If the Bikers’ rack went into large scale manufacturing, we propose 8 laborers to reduce product cost. Salary positions do not impact the production rate and only have a linear effect on product cost. In contrast, hourly positions increase the production rate and exponentially decrease product cost yet undergo the law of diminishing returns.

Prototype Fabrication Process

The project was inspired by the Bikers’ customer, John Stehouwer’s aunt and uncle, who represent a customer market of aging individuals that are buying into e-bicycles (electric-assisted bicycles). These customers are looking for a way to transport their e-bikes. To create their prototype, the Bikers fabricated a brand-new design in the Calvin metal shop.

Welding:

The Bikers’ prototype is welded using 2” and 1” square steel tubing with ¼” plate steel for the pivot mechanisms. Jonathan Jansma, as the manufacturing lead, piloted the welding process.

Drilling:

Drilled holes for the pivot mechanism and attachment of the lifting mechanism components were completed by John and Adam.

Wiring:

The lift mechanism runs off a 12V DC connection running less than 3 amps. John Stehouwer, with a past work experience as an electrician, piloted wiring the linear actuator, power switch, and momentary rocker switch.

Acknowledgements

During the design of their product, the Bikers learned the practical experience of an engineering design project. Through meetings with their various professional advisors, the Bikers analyzed design dimensions, manufacturability, and feasibility tradeoffs. By the end of their senior year, the Bikers were able to transform a complex problem into a simple solution.

Special thanks to:

- Jeff Deheer**
Industrial consultant
- Chris Hartemink**
Engineering 340 professor/advisor
- Chuck Holwerda**
Electronics Shop Technician
- Chris Sorensen**
Machine and wood shop supervisor