

# MobileRack: Modular Bike Rack

Nick Bozonelos (ME), Liam Audette (ME), Jackson Calawa (ME), Eugene Kuraishi (ME), & Matthew Keeth (ME)

Advisor: Lucas Meza | Capstone Sponsor: Cascade Bicycle Club | Special thanks to: UW ME Machine Shop Staff  
University of Washington Department of Mechanical Engineering

## Objective Statement

Design and manufacture a mobile bike rack to transport 8 - 12 bikes from the storage area to the loading dock. The bike rack will improve load and unload times during warehouse operations and bike assembly, and will be collapsible for storage.

## Background

In 2022, the Washington State Legislature selected Cascade to run a statewide school-based bicycle education program:

- Teaches students in grades 3 - 12 how to:
  - Operate bicycles
  - Navigate roads safely

**The Goal:** 90% success of grade 3-8 students across the state over a 16-year period



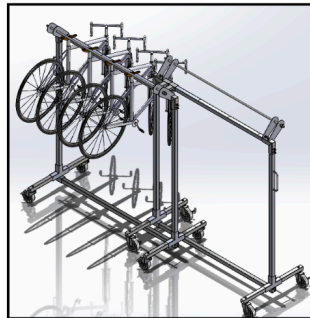
## Design & Development

### Design Approach:

Created 4 conceptual designs, each with their own unique features. After discussing with the client, narrowing the operational requirements, and several iterations our team chose a final design: A Sliding Mobile Rack with a Stabilizing Bar.

### Final Design: MobileRack

Uses two identical racks allowed to slide parallel to each other. Each rack is designed to allow bikes to hang by the nose of their saddle on the top bar where the back of their saddle will be secured via a countersway bar.



## Engineering Specifications

### Efficiency

- Product shall improve the existing load and unload times in the Cascade Bicycle Club warehouse by at least 25%

### Capacity

- Must be able to carry 8 - 12 bicycles

### Size

- Rack cannot exceed a total maximum volume of 10' x 8' x 4' and a total collapsible volume of 4' x 4' x 4'

### Safety

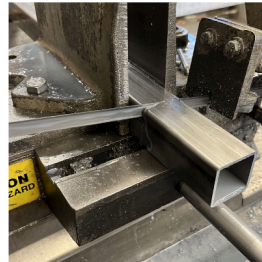
- The rack must not pose a threat to any warehouse worker's health and must be completely safe to use at all times

### Manufacturability

- Full product cost must be less than \$1,500
- Manufacturable at UW Mechanical Engineering machine shop

## Manufacturing

The prototyping phase took around 3 weeks and the whole manufacturing process took around 2 weeks.



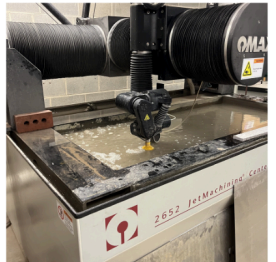
Bandsaw Cutting



MIG Welding



Drilling

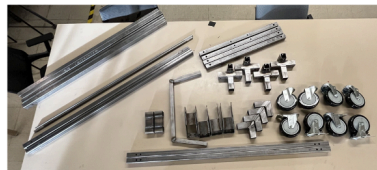


Water-Jet Cutting

## Final Assembly & Testing

### Key Features:

- Assembly process takes around 90 mins
- Capable of holding up to 12 bikes and supports up to 250 lbs per rack
- Collapsible to 50% of its size
- Loading requires very little lifting and time
- Underbudget



### Testing Cases:

Our team tested our MobileRack under various circumstances to ensure impeccability.

#### Static Loading:

- Rack rated to hold 500lbs with a 1.5x safety factor
- Overloaded the rack with lime bikes

#### Ease of Use:

- Moved the rack around when loaded, unloaded, and collapsed
- Getting strangers to load & unload the MobileRack

#### Dynamic Loading:

- Low speed impact tests (if the MobileRack hit wall)
- Tipping tests (if one or more wheels got stuck)

