UNH Positive Pedicab 2022-2023

Mechanical Engineering Department, University of New Hampshire

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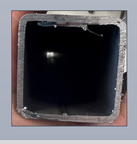
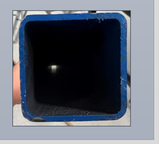
INTRODUCTION

The UNH Pedicab Project is a Mechanical Engineering Student lead project that involves the designing and manufacturing of a pedicab. The idea for building the the pedicab project is the theory of "reciprocity" and meant to align with the goals of the United Nations Sustainable Goals. We believe that a community that supports one another creates a positive environment for everyone. The operator will provide a positive experience (aka. a free ride) to the community in hopes that the community will perform a kind gesture to someone else without asking. The pedicab will be a new carbon-neutral mode of transportation throughout the seacoast region of New Hampshire providing a fun and eco-friendly way to get around.

Design Criteria

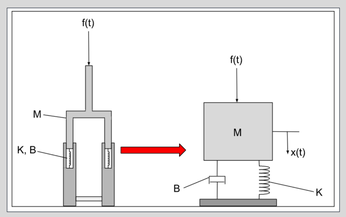
- Frame Composed of A513 High Carbon Steel
- TIG Welded
- Made of 2x2",1x1", & 1.5x1.5" Tube Stock.
- Modeled in SOLIDWORKS & MARC.
- Maximum deflection of 2.5mm.
- F.O.S. of 2.0.
- Less than 200 lbs.

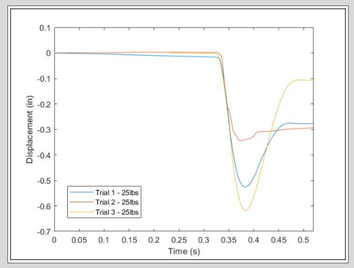




SUSPENSION

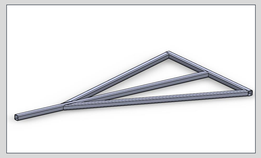
- The pedicab suspension was simulated as a Second Order Mass, Spring Damper System.
- Used a piezoelectric crystal and applied an impulse load to determine the vertical acceleration of the shocks.
- Data was integrated with MATLAB to model the time constant (τ), damping ratio(ζ), and system gain(κ).

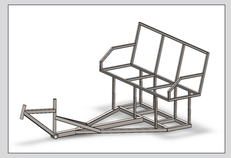


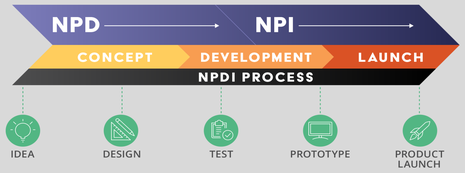


FRAME DEVELOPMENT

- **Phase 1**: Generated Conceptual Drawings
- **Phase 2**: Developed SolidWorks model of frame
- **Phase 3**: Optimized frame to meet customer needs
- **Phase 4**: Prototyped and tested frame for failure
- **Phase 5**: Manufacturability of final prototype



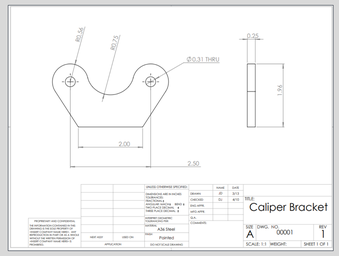


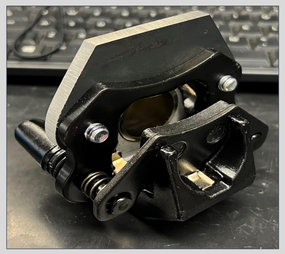


PROTOTYPE TO FINAL PRODUCT DESIGN

BRAKING SYSTEM

- Hydraulic Rear Brake System
- Parking Brake
- Integrated Electric Motor Kill Switch when braking
- Fluid Dynamic calculations done to validate correct hydraulic pressure under braking.

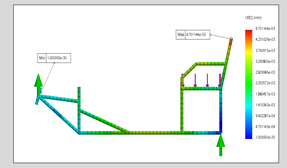




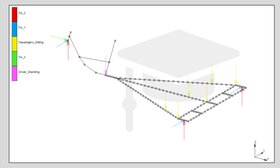
SIMULATIONS & RESULTS

- Verified the final design of our frame using finite element analysis software's (e.g. SolidWorks and MARC student edition)
- Static and Kinematic Analysis Performed
- Based on our design our frame was able to be lightweight at 184 pounds but retain its integrity. It can operate at a speed of 16 mph and have comfortable ergonomics for the operator. In the future possible upgrades include PV solar panels and drag reducing aerodynamics.

SOLIDWORKS



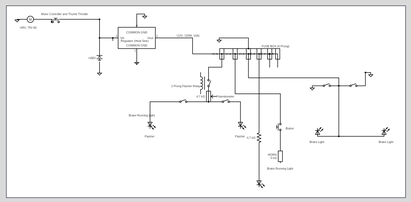
MARC FEA SOFTWARE



ELECTRONICS

E-Bike System

- BAFANG Mid-Drive E-Bike Motor (70A,48V,750 W)
- 48 V Battery (48V, 14,000 mAh)
- 48-12V Direct Current Regulator
- 6-Slot 30A Fuse Box
- 12V- Turn Signals, LED Brake Lights, LED Headlight



SEAT COMPOSITION

- Back Rest: 54"X19"
- Bottom Cushion: 54"X16"

MATERIALS

- 3 in. High Density Foam
- ¼" High-Loft Batting
- ¾" Plywood
- Navy Duck Cloth