

Child Sized Human Powered Vehicle

Abel Aldape, Preston Berchtold, Martin Dorantes, Trent Todd

Association of Mechanical Engineers, Northern Arizona University, Flagstaff, AZ 86011

Abstract

The Spring 2021 HPV Capstone group was tasked with designing and manufacturing a child sized recumbent tricycle. Our client, Professor Perry Wood, wants to take the vehicle to local elementary schools as a hands-on presentation tool to encourage kids to continue in the STEM fields. The tricycle should support riders from 5-13 years of age.

Customer Requirements

- Safety
- Ease of Operation
- Stability
- Educational
- Transportable
- Rollover Protection
- Manufacturability

Engineering Requirements

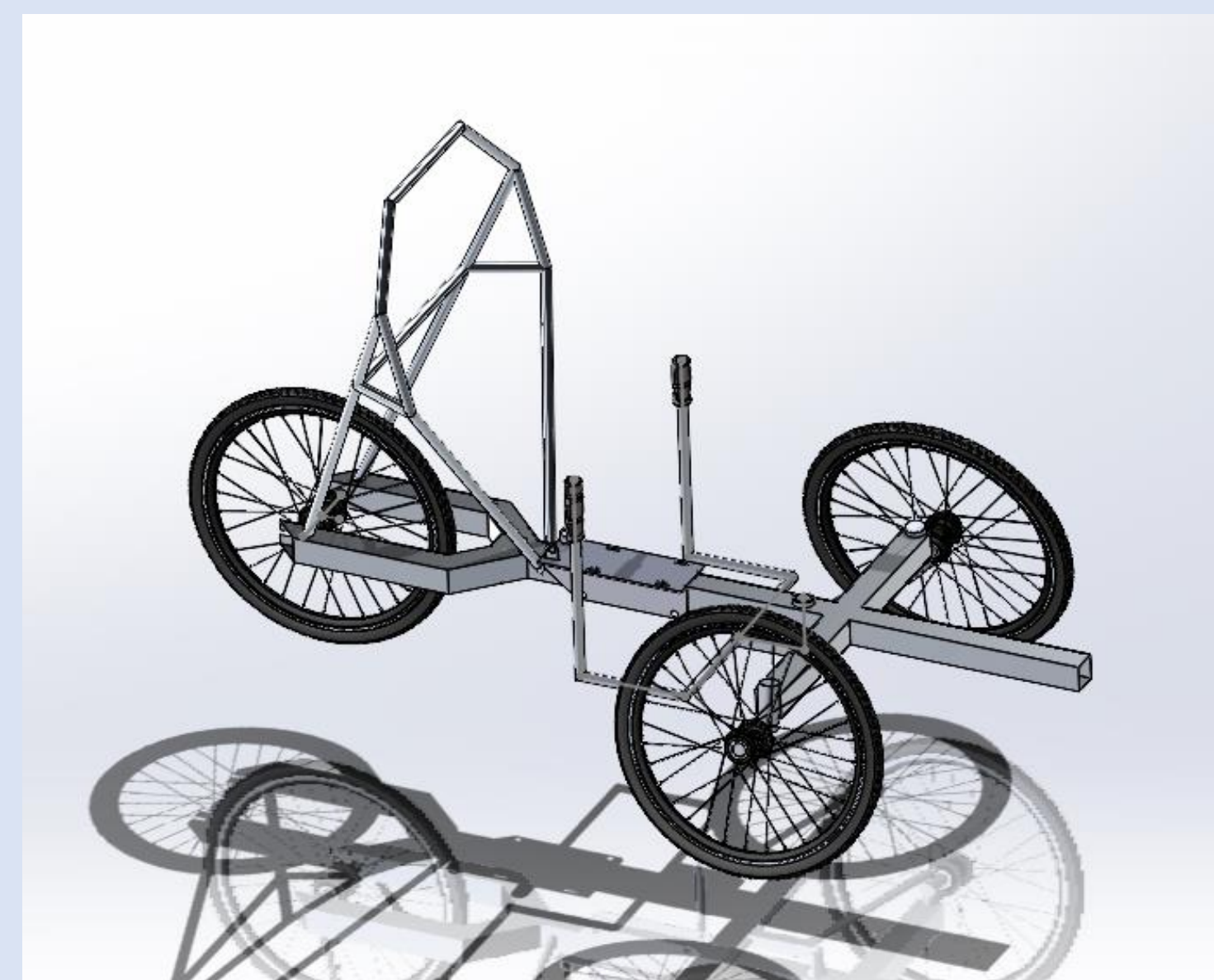
- Braking Distance (<8 m)
- Costs (<\$1,600)
- Minimum of 3 wheels
- Adjustable seat-to-pedal distance
- Volume (<6.5' x 5.5')
- Gear Ratio (4:1)
- Turn radius (<8 m)
- Weight (<45 kg)

Acknowledgements

Perry Wood, David Willy, Paul Howitz, Wyatt Watson

Results

The team was successfully able to complete a fully functional recumbent tricycle. Parts were outsourced but cut, bent, & welded together at the NAU Machine Shop to complete the frame. Other parts were donated by faculty advising previous HPVC capstone projects, including the tires, handles, back rest, and brakes. Despite slight design changes, the tricycle operates as intended to fulfill all design requirements.



Conclusions

The final design meets all requirements created by the client and has gone through all necessary testing procedures. We believe the vehicle is educational and inspirational to encourage younger students to pursue an academic path in engineering.

References

- [1] ASME: Standard Classification of Bikes, F2043.1497, 2018
- [2] M. Roy, "Roll Cage For All Terrain Vehicle," 18-Aug-2020.
- [3] Q. Recumbent, "Recumbent Trikes Perfect for Kids," Recumbent Co, 2020. [Online]. Available: <https://recumbent.co/recumbent-trikes-perfect-for-kids/>. [Accessed: 21-Feb-2021].
- [4] R. Hibbeler, Mechanics of Materials, Upper Saddle River: PEARSON, 2012.

Methods

There were multiple manufacturing processes necessary to fabricate the tricycle. The team became Machine Shop Safety trained and utilized the lathe, vertical mill, horizontal and vertical bandsaws, drill press, pneumatic bender and TIG welder to complete the trike.



Testing

- Braking Distance (<8m): Met- 1.5m
- Cost (<\$1,600): Met- Spent ~\$600
- Minimum of 3 Wheels: Met- Tricycle Design
- Highest Gear Ratio (4:1): Met- 4:1 Gear Ratio
- Adjustability (50 cm): Met- Seat To Pedal Distance, Seat Angle
- Turn Radius (<8m): Met- 1.7 m radius
- Tensile Strength (250-560 MPa): Met-6061 Aluminum 290 MPa
- Volume (<6.5' x 5.5'): Met- 6'x3'
- Weight (<45 kg): Met- 11.5 kg

