Bicycle for Disabled Person with Brachial Plexopathy

Overview
The project was to design a bicycle for an individual suffering from brachial plexopathy. Brachial plexopathy is an injury to the nerves connecting to a shoulder, arm and hand which renders the arm useless. The bicycle needed to be operated safely and comfortably by the customer.

Objectives
The project objective was to design a bicycle that would improve rider safety, stability, comfort, and ease of use while also keeping the product masculine in terms of aesthetics.

Approach
- Initially observed customer riding original bicycle
- Created customer needs based upon observations and customer input
- Performed concept generation and selection on both stability improvement devices and general bicycle products and accessories
- Researched bicycles based upon physical measurements in order to improve rider safety and comfort
- Customer test rode bicycles at The Bicycle Shop in State College and purchased bicycle based upon customer feedback
- Conducted initial testing without balance improvement device with the new bike on a Rails-to-Trails similar to the trail the customer normally rides on
- Created scaled prototype of linear springs mounted to training wheels
- Created alpha prototype consisting of a tread wheels attached to a torsion spring on either side of the rear wheel to improve balance
- Developed a two spring steering damper that minimized unwanted handlebar movement and caused the bicycle to ride in a straight line
- Conducted spring selection and testing based upon length and supplied force to select the springs for the steering damper
- Performed final testing comparing original bike to final prototype using a line deviation test, turning radius test, physical measurement of bikes, and customer survey to quantify improvements made by the prototype bike

Outcomes
- Overall customer satisfaction with bicycle improved by 64% based upon customer survey
- Straight line stability has improved by a factor of 2
- Left hand turning performance improved
- Improved safety and comfort by selecting a bicycle with optimal physical dimension
- Improved ease of use via improved gear shifter