Portable Girder Builder and Flange Support Design

Overview
The goal of the project was to continue and improve upon a design for a portable girder builder, sponsored by High Steel Structures LLC. The girder builder is a machine used by High Steel to clamp and weld large I-beams in their Lancaster and Williamsport locations. The portable girder builder increase efficiency by requiring only one operator and will increase the functional workspace in the shop. High Steel required the girder builder to apply 50 tons of force to each flange, accommodate a variety of flange and web sizes, and create varying weld angles. The major improvements were redesigns of: the flange support, the compressive pistons and extender rods, and the web table. With these new components, the girder builder is now able to handle swept and cambered beams, as well as flanges with variable widths.

Objectives
The team was to analyze the design, make improvements, and specify the mechanical and electromechanical components. These items were to be consolidated into the 3D SolidWorks model of the portable girder builder and animated to show functionality.

Approach
- Determine current girder building techniques and customer requirements
- Analyze current Girder builder design and make improvements
- Update and upgrade the SolidWorks model to contain components and design changes
- Animate the SolidWorks model to reflect the functional movements
- Analyze the design using Finite Element Analysis and design calculations
- Create a functioning steel prototype of the flange support

Outcomes
The team made several key design changes to the girder builder and identified stock components such as ball screws, hydraulic cylinders, hydraulic motors, and jack screws. Upon request from High Steel Structures, the team provided the 3D drawing files and a Bill of Materials to the sponsor who will begin to fabricate a full size prototype of the portable girder builder. The final design will maximize the floor space at High Steel, reduce the process to one operator, allow for easier creating of swept and cambered girders, and increase volume through a production time reduction.