ArcelorMittal - Bloom Manipulator for 35”

Overview
The company sponsor, ArcelorMittal, produces railroad and crane rail at its Steelton plant and in the rolling process, a steel bloom passes through the 35” mill. This is where the rail begins to take its shape through five roughing passes where between the fourth and fifth passes, the bloom needs to be rotated 90°. This is done through a violent kicking process by four mechanical fingers which can leave the bloom with marks resulting in defects on the final product. Therefore, it is important to modify or change this method of rotation the bloom so that the defects are reduced and the quality is increased. The student team is required to develop a solution that will perform this rotation in a more controlled manner resulting in fewer defects on the final steel rail.

Objectives
The team was tasked with redesigning the current bloom manipulator such that it:
- Minimizes defects on the finished product
- Rotates the bloom in under 3 seconds in a more controlled manner
- Has a final cost of less than $75,000
- Is installed in less than 2 weeks

Approach
- Sites visits and meetings were conducted in order to observe the current bloom manipulator and to identify customer needs and relative importance of each
- Review of patents for several types of bloom manipulators and existing products was completed
- Target specifications were established from the team objectives
- Four concepts were generated based on these specifications and underwent concept selection with a weighting chart
- Motor torque equations, rotation equations and FEA analysis were completed to determine required horsepower, degrees of rotation and stability of design
- Inventor CAD model was developed for all details of the design and drawings were generated for build specifications
- Computer animation of the Inventor model was created to show how the process works

Outcomes
Finally, list the outcomes for this project making sure to clearly convey their implications for the sponsoring company:
- The sponsor will reduce defects in the final rail and increase product quality
- The sponsor will have a new approach to a method of rotating the bloom instead of the method that has been in place since the mill was established
- The sponsor will have a method that is similar to the current one to reduce operator training time