CAPSTONE COPPER WET SCRUBBER REPLACEMENT PROJECT

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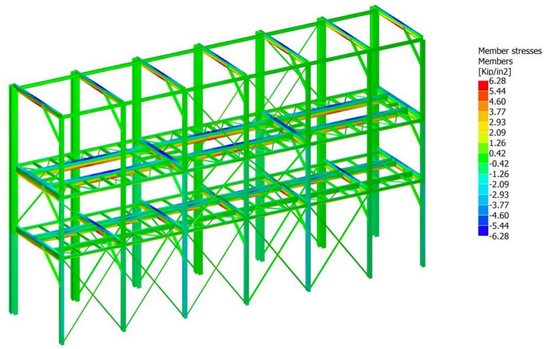


Figure 1. Member Stresses

Executive Summary

Copper Capstone, a mining company, is replacing three existing wet scrubbers with new dust collectors. The wet scrubbers currently sit on a steel frame on the exterior of a fine crushing plant building. As the geometry and weight of the dust collectors will be different from that of the wet scrubbers, a structural analysis and improvements are required on the steel frame and its connections. The best construction option found was to install the new dust collection system using as much of the existing structure as possible. This decision was made to reduce costs and environmental impact. Additionally, the best construction option includes orienting the new dust collectors parallel with the building. That decision was made to include the most efficient structural systems which in turn simplifies the construction of the structure.

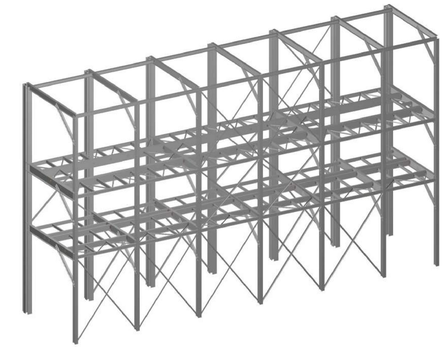


Figure 2. Structure Rendering

Introduction

Copper Capstone is a mining company in Miami, AZ. Part of their mining process is the breaking down of sediments into a fine powder. To do this they currently utilize a mechanical system called wet scrubbers to mitigate dust in the crushing process. The wet scrubber system is very large and uses a significant amount of water. They need a new dust collection system to replace their outdated one. The goal is to install efficient, waterless dust collectors to increase productivity and save water.

This goal comes with its own set of challenges. The construction must be accomplished using sequencing, as to minimize the time the plant is shut down. The goal is to shut down the plant for no longer than 4 hours between each dust collector start. We have provided a design that accomplishes this.

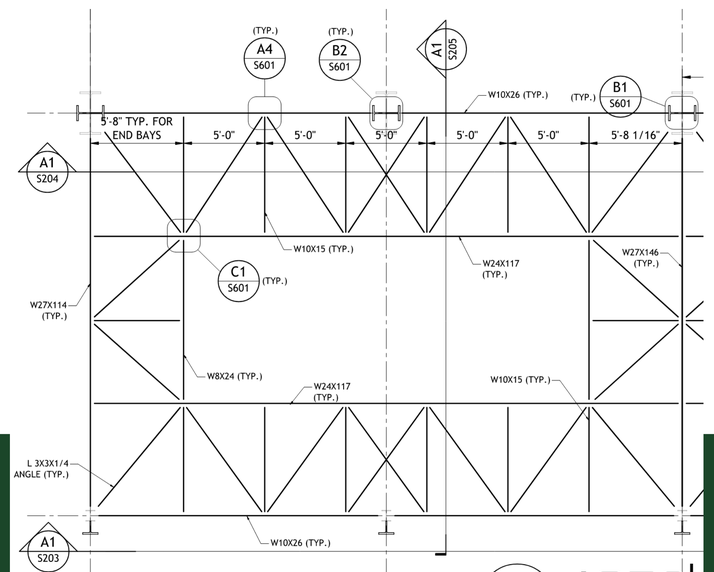


Figure 3. Typical 4072'-0" Framing

Option Selection

The design and engineering for the first phase of installation was completed by another engineering firm. We were tasked with the design and engineering of phase 2. This included the installation of three dust collectors. We provided our sponsor with layout options. They are as follows:

1. Maintain the same orientation and layout the other engineering firm produced.
    1. This would create an aesthetically pleasing and uniform design. However, it required all the existing structure be demolished and new structure be constructed.
2. Place dust collectors parallel with plant and add an additional story
    1. This option created the ability to add an additional dust collector. However, it reduced the likelihood of reusing existing structure due to the increase in loads.
3. Place dust collectors parallel with plant
    1. This option fulfilled all requirements given by our sponsor, while also giving us the best possibility of reusing existing structure.

We recommended option 3 be selected. Our project sponsor agreed, and we moved forward with this arrangement.

Discussion

There were many challenges with this project. Working with an existing structure is never easy because there are so many unknowns. How much structural integrity does the existing design have? What are the non-visible structural systems (foundations, connections, etc.)? Without the ability to visit the site, we were unable to answer some of these questions. However, we used the resources we had to make educated assumptions and created a design that is not far from being construction ready.

We could have taken the easy route, and simply copied the design of phase 1. Instead, we put in much more effort and proved that there is a more efficient and more economic design. This will save our client time and resources.

Results

Option 3 was designed using spreadsheets, Ram Elements, and Ram Connection. The spreadsheets were used for load determination, and the finite element software was used to analyze the structure.

The existing columns are to be retrofit with WT members. This increases strength and gives them the necessary structural integrity to support the new loading.

The existing structure depended heavily on the fine crush plant for lateral support. As to avoid analyzing the plant, we added lateral force resisting systems to the structure, so the dust collector support is self sufficient. These LFRS take the form of moment and brace frames and can be retrofitted easily.

The entire 4072'-0" deck will be removed and replaced with new members, while 90% of the lower and upper decks will be conserved.

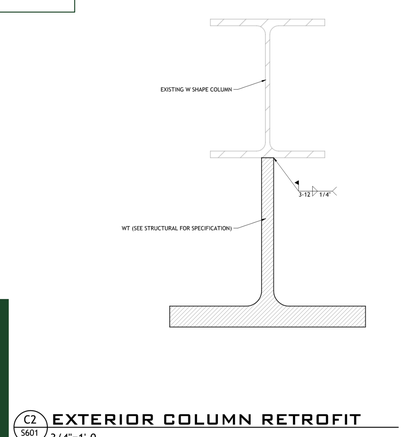


Figure 4. Exterior Column Retrofit



Figure 5. Existing Structure