



What is Brownfield Engineering?

When you imagine a large industrial construction project, you might picture a new plant or a building being erected in the middle of an empty field. These types of constructions are known as *greenfield* projects. They offer a great amount of relative freedom when it comes to design, as there are few existing factors to consider; however, for the vast majority of industrial clients, new projects focus on expanding or renovating their existing facilities for new or upgraded processes.

These are considered *brownfield* projects.

Brownfield Considerations

While brownfield projects can save time and money by avoiding new building construction, these each come with unique challenges that require consideration during the design process. For example, a plant often has to remain in operation during the construction process, or only has a limited shutdown window. If a flammable chemical such as hexane is used at the site, this eliminates the use of all non-intrinsically safe equipment. Foundations may need to be dug by hand or vapor barriers may need to be constructed. In other cases, field welding to existing steel may not be allowed because the buildup of dust raises the threat of fire or explosion.

Many different factors can limit the type of construction methods available, making the design and engineering of these projects all the more important. In this whitepaper, we will discuss the three keys to a designing a constructible, successful brownfield engineering project.

The Three Keys to a Successful Brownfield Design

1. Precision Field Measurements

Brownfield projects are either extensions of an existing structure or are constructed within the framework of a standing facility. Whether it's an expansion or an upgrade, any new design may require connecting new and existing members. Depending on the size and scope of the project, some of these new members can be field fabricated by the in-house maintenance team to fit, but more often, larger projects are sent out to a third party fabrication shop. Therefore, knowing the exact location and space constraints of these existing members is key to providing an accurate and constructible design to the owner and contractor.

In recent years, the arrival of technologies like 3D laser scanning and modeling (*pictured on page 1*) has allowed engineers and designers to collect field data safely, quickly, and with exceptional accuracy. Not only are the existing structural elements cataloged, but existing equipment, utilities, and piping are also represented in the 3D model. Sometimes, avoiding these existing items is critical to project success and the 3D scan and model allows the engineer to verify that the layout of the new structure avoids any costly interferences. Additionally, the laser scanning process is much safer and more thorough than hand measurements during a walkthrough.

2. Operational Understanding

Providing access to a new or existing piece of equipment is a common task in industrial engineering; however, this can be difficult if the existing space is limited. Providing a walking surface on all sides of the equipment may not be possible so it is critical to understand both how the equipment works and how it will need to be serviced. A successful design may only require access to a single side, but operational use must be considered. For example, a design that allows a worker access to flip an on/off switch, but has no means of safely applying lubricants or switching filters would ultimately be a failure.

It is also important to consider why a worker would be accessing this area. If 9 times out of 10, it is for maintenance that includes a large bucket of tools or loading a heavy bag of ingredients, then providing access with a ladder should be a last resort and efforts should be made to provide safer stair access or to connect to an existing walkway with a better egress path.

3. Think Constructability

Constructability can be one of the most overlooked factors in design, but can also be one of the most critical in determining if a project finishes on time and under budget. This is especially true in brownfield engineering. Construction inside an operational plant can be a true challenge, with many considerations taking place on a larger scale. If it will be difficult to get large members into a congested project area, the engineer should look at framing a load path with shorter members even if it is not the most obvious configuration.

Other considerations may take place on a smaller scale. For example, framing a new member into an existing girder with a beam already attached to the opposite side may cause an interference with the

bolts of the existing connection. One solution would be to remove the bolts to place the new beam, requiring temporary supports, but it would be easier to simply design the new member a few inches over. This small decision, repeated multiple times, can have a large impact to the project, and benefit the client's continuation of operations.

Conclusion

Knowing the proper formulations and possessing the ability to crunch numbers are crucial skills for any engineer; however, the significance of a creative imagination is often overlooked, but is just as important for providing cost-effective and constructible designs. The goal of any design should be a final product that adds the most benefit to the client. This includes everyone from upper management to the worker on the ground whose daily productivity and safety are directly impacted by choices made during the engineering process.

These decisions can be even more critical when dealing with the inherent limitations and challenges that come with a brownfield project.

About ADF Engineering

ADF Engineering is a leading provider of process engineering and facility engineering solutions for the food, feed, fuel, and bioscience industries. We have a reputation for providing cutting edge, high quality and cost effective engineering solutions to industrial clients throughout the United States and Canada, as well as, across the globe including China and Australia. We understand that every project is unique, therefore, having a strong set of core competencies combined with experience is essential to our success. ADF assembled a sizeable team of extremely talented engineers in all critical engineering disciplines at three strategic U.S. locations. Contact ADF Engineering at (937) 847-2700, or visit us on the web at www.adfengineering.com.

About the Author

Derek Jacobs, SE, PE, has more than 10 years of experience in industrial and commercial structural engineering. Derek is a principal at ADF, where he manages a structural engineering team of eight engineers and designers, and oversees design of a wide range of structural projects.