

Construction Costs

OVERVIEW

The geographic location selected for a new facility greatly influences construction costs. Therefore, it is important to understand upfront the location variables that impact construction costs and take them into consideration throughout a project. In this edition of *Insights*, we will review the most significant factors, outside of the facility design, that impact construction costs as well as how Quest evaluates these factors during the site selection process.

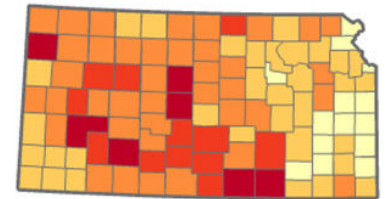
CLIMATE AND NATURAL DISASTERS

The climate of a location impacts construction from both a cost and schedule perspective. Facility design in cold weather locations must account for snow loading and frost depth. From a schedule standpoint, the seasonal implications of cold weather locations can go beyond the site boundaries as utility extensions are likewise affected by unfavorable temperature conditions. Humidity is also a major consideration of construction costs. In high or low temperature areas, critical humidity requirements inside the facility can affect building envelope design and also HVAC costs for years. Furthermore, the local climate can wield significant power over the construction staying on schedule, especially during the early phases of the project before the exterior shell is completed. Rain, for example, can delay site preparation or prevent foundations from being poured.

Natural disasters can result in unexpected and substantial costs, both operationally and financially. Where, when, and how intensely a natural disaster will strike are elements that cannot be controlled. However, companies can, and should, analyze the risks of such occurrences as part of the site selection process, and subsequently design and construct their facilities to lessen the impact of potential natural disasters. For earthquake risks, Seismic Site Class is considered during site analysis and then accounted for during design and construction. For example, locating in Seismic Zone D impacts foundation design, steel, piping, and duct work. Even within a state, such as Tennessee in the visual to the left, there can be a variety of seismic zones.



Quest uses Geographic Information Systems (GIS) technology throughout the site selection process to evaluate a variety of factors including climate conditions and natural disaster risks. In the early stages of a project, we may use GIS to evaluate natural disaster risks as a factor to determine areas of interest. In the later stages of a project, we would incorporate natural disaster risks into an overall Risk Assessment for each candidate location. The visual on the right depicts tornado frequency by county in Kansas, with the darker red counties having a higher volume of tornado activity. In areas prone to hurricanes and tornados, high winds are accounted for in the design and construction including foundation, steel, cladding, and roofing.

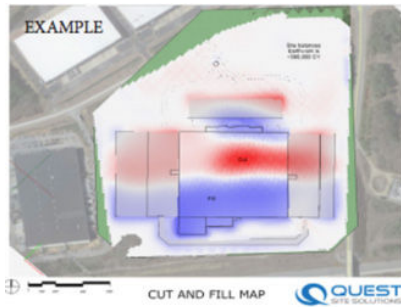


TOPOGRAPHY AND SOILS

Site preparation costs, including earthwork to adjust the natural topography, can be a significant component of the construction costs for a new facility. Not only do these cut and fill costs vary between sites, but they can also vary substantially within a site based on where within the site boundaries the facility is located and even by which direction it is oriented. In addition to the topography, the soils can have a considerable effect as they can vary greatly from location to location, and even just across a site. Low soil bearing pressure impacts slabs, piles, and foundation type. As an example, the study of a riverfront site recognized the need for pile foundations at a cost of more than \$2,000,000.



Unsuitable soils impact site work, foundations, and roadways. Expansive soils require lime treatment due to changing moisture conditions. Karst topography with sink holes and caves impacts the design and cost of foundations. Accounting for the various soils across a site measured against specific process needs such as pits, cranes or tower loads can have a substantial effect on the design and construction and present opportunities to optimize site layout early.



In the initial stages of a site selection project, Quest examines USDA Soil Surveys to evaluate soils at a site if geotechnical studies have not yet been completed. Once finalist locations have been determined, geotechnical investigations will be conducted with soil boring locations and depths for loads specific to the project. Additionally, Quest utilizes SCOPE®, a proprietary site assessment software that calculates the the construction cost differential for each location using an extensive historical cost database combined with current project data, to compare construction costs during the site selection process. As the example to the left shows, SCOPE® accounts for topographic characteristics to generate the cut and fill estimates based on the positioning of the facility on the site. A recent study of three sites in north Texas saw a delta of \$400,000 in basic earthwork.

LABOR AND CONSTRUCTION MATERIALS

Construction labor costs can vary significantly by location, in part due to labor availability, and the labor cost differentials should be taken into consideration when comparing facility construction costs between locations. A recent automated facility in southern Illinois needed specific electrical controls labor skills at a 50% increase to regular electrical labor rates. Additionally, the cost of construction materials varies by location and should be accounted for in financial calculations.

Quest utilizes construction cost indices, such as RSMeans, and our own historical database to compare cost differentials between locations. In a recent high-level assessment for a prospect, construction cost variations of nearly 30% were found to exist between four candidate locations. Quest also analyzes labor data from a variety of third party sources to understand the employment concentration and wages in the construction sector in each of the candidate locations for a project.

SITE SELECTION PROCESS

While the factors that impact construction costs are a key considerations in the site selection process, they only scratch the surface regarding the level of scrutiny that is required as part of a comprehensive location analysis. Utilities, workforce, operating costs, and others are also an important part of the process. Balancing these items, and thoroughly evaluating each of them, ensures selection of the optimal location that results in maximum return on investment for the project.

David Hardy oversees Quest's Site and Facility Services by providing leadership to the design and estimating teams and helps develop efficient and cost-effective packages. He engages with clients early in the project development process and works closely with Quest's leadership team. He helps to implement a consistent preconstruction approach that addresses scope development, schedule, team makeup, and deliverables. David earned a Bachelor of Science in Design from Clemson University and is a LEED Accredited Professional with licenses in multiple states as an Architect.

