

# BUILDING ON THE FOUNDATION OF TOMORROW SINCE 1986



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## An Economical Substitute for Deep Foundations



Hydraulically-installed steel foundations are emerging as an economical substitute for H-piles and other deep foundation systems in the construction of commercial and industrial buildings, with *total installed costs typically 25% to 50% less* than deep foundations and significant time savings.

### Why Deep Foundations?

Among deep foundations, H-piles installed to refusal or bedrock are a common foundation system for commercial and industrial buildings located in poor soils. H-piles can support loads far greater than aggregate piers or common helical piers, and in practice, have been among the most economical systems to bear higher building loads in poor soils. Notwithstanding, H-pile total installed cost, inclusive of material, equipment mobilization, and pile driving, is highly expensive, creates high levels of vibration, encounters problems with cobbles and boulders, and requires placement of a concrete pile cap upon completion.



## H-Pile Cost

Over the years, we've found that H-pile total installed cost is commonly \$40 to \$60 per linear foot in the Midwest and Northeast regions. That cost can vary widely, especially upward, depending upon the ratio of mobilization cost to project scale, size of H-beam, and installation time. Typically, three or four H-piles are installed beneath each building column location. The H-piles are then covered with a reinforced concrete cap. Most H-pile installations extend more than 50 feet below ground surface, costing \$2,000 to \$3,000 per pile, so \$6,000 to \$9,000 for three or \$8,000 to \$12,000 for four to support each building column. It's not unusual for H-pile installations to extend 100 feet below ground surface, effectively doubling the aforementioned costs. For a low-rise building with 50 columns, the minimum total installed cost for H-piles is likely \$300,000 to \$600,000, and \$600,000 to \$1.2 million for deeper piles. Add to this the cost of reinforced concrete installation for pile caps before building columns can be erected.

## Geotechnical Conditions

Hydraulically-installed steel foundations are a shallow foundation alternative to H-piles and other deep foundations. Their installation is

fast and to shallow depth, produces negligible vibration, and benefits from utilizing a small-diameter, shallow drilled hole so that significant cobbles or boulders are drilled through prior to hydraulic installation. Before steel foundations for substituting H-piles or other deep foundations can be considered, soil borings must be taken and terminated at appropriate depths as directed by a geotechnical engineer. This is necessary to determine the composition and strengths of both the uppermost and lower soil layers. It can then be determined whether the uppermost soil layers are suitable for providing the lateral earth pressure necessary for the steel foundations to have sufficient bearing capacity. Even weak soils can be highly capable of supporting high bearing loads. Understanding the lower soil layers is important for determining how they will respond to the total mass of the uppermost layers. Rarely is an especially weak lower soil layer present at such a depth that it would cause unacceptable total building settlement with the steel foundation system.

## Steel Foundations

Driving a tent stake into the ground requires increasing force to sustain downward movement because of increasing skin friction. This also is how a shallow steel foundation develops its high bearing capacity. With so much surface area, the pipe and fins of a steel foundation can develop hundreds of kips of foundation bearing capacity with increased depth and increased surface area. Even a single small Structural Foundation can provide more than 100 kips of bearing capacity in soils of poor strength. Bearing capacity is verified during the hydraulic installation process. A single steel foundation installed beneath a building column in low-rise commercial and industrial buildings can supply sufficient capacity for ultimate loads. An added benefit is that building columns can be welded or bolted directly to the steel foundation top plates.

## When to Use

There is no one-size-fits-all foundation system. The soil conditions and loads of each building application can benefit from potentially several foundation options. Structural Foundations and Haengel & Associates Engineering help you by evaluating the suitability of multiple foundation system candidates for each application. That said, for commercial and industrial building applications in poor soils where ultimate bearing loads are less than 300 kips, we recommend hydraulically-installed steel foundations for their superior cost advantage of 25% to 50% over H-piles and other deep foundation systems. For higher loads in these applications, H-piles and other deep foundation systems should continue to be given consideration.

Our solutions can save you a LOT of money.

*...superior cost*







*advantage of 25%  
to 50% over  
H-piles and other  
deep foundation  
systems.*



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