A Comprehensive Introduction to

High-Capacity Industrial & Commercial Helical Piles

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VERSAPILE
HELICAL PILE CONTRACTORS

Helical Piles: A Better Way to Build Foundations?

If you need a deep foundation to meet the rigorous demands of a commercial project, you're in luck. We live in an era where the old limits to our construction abilities are fading.

New materials, technology, and engineering allows us to build better structures in more locations. Truly, I think we're enjoying a golden age in commercial construction.

At the forefront of this 'golden age' are helical pile foundations.
Helical piles elicit a range of reactions.

Some people believe they're the foundation of the future.

Others think they're an untested, unproven fad that will soon disappear.
As life tends to go, I feel the truth is found in the middle of those extremes.

Problem is, much of the knowledge on helical piles tends to circulate within the industry. It doesn't often make its way to a general audience. Even worse, marketing speak has confused the conversation and made the technology seem overly-complex.

Yes, helical piles are a big topic. After all, they're a science in their own right. That doesn't mean they can't be easily understood.

I wrote this guide to show the real story of helical piles and their use in commercial projects. This guide is not going to argue that helical piles are "better" than other foundations. It also won't try to sell you on helical piles.

My goal is to give you a comprehensive, but accessible, introduction to helical piles. We'll cover where they come from, how they're built, how they work, and more.

Finally, this is an introduction to helical piles. It's not a technical manual. If you want to dive deep, I'll cover additional resources in their own section at the end of this guide.

The Misinformation Problem

Since the invention of the helical pile, engineers have improved how they're designed, tested, and installed. Now, there's a “helical pile renaissance” in the industry. Everything from transmission towers to oil pipelines are being supported with helical piles. Foundation companies are rushing to meet intense demand.

With this rapid growth comes a problem: misinformation. And there’s an endless amount in the helical pile world.

Manufacturers muddy the waters with marketing jargon. Opponents perpetuate tired myths. Companies, in a bid for business, portray helical piles as a miracle foundation.

You know how it goes with the internet - anyone with a keyboard can be an “expert”.

I wrote this guide based on my 10+ years of experience in the helical pile industry. My business, VersaPile, is built on the principles of solid engineering and safety. We employ smart engineers and do things by-the-book. I don't say that to brag. I say that so you know what I write in this guide is based on engineering fact and not “feeling”.

However, while this guide is based on engineering fact it's not engineering advice. If you’d like to talk engineering, our team would love to chat with you. Remember that each project is unique. No guide, book, or video will engineer a safe foundation. Only an engineer can do that.

Caveats out of the way, it’s time to dive into the world of helical piles. Specifically, the world of the mid-1800s.

A Brief History of Helical Pile Foundations

How did a foundation technology created almost 200 years ago by a remarkable engineer endure until today and find new across industries?

A Brief History of Helical Piles

In the 1830's foundation technology was limited. Driven piles were common under structures in good soil. But they offered subpar performance in loose soils, particularly the sandy soil found along coastlines.

This limited the construction of structures like lighthouses, bridges, and piers. Of particular concern to engineers at the time were lighthouses.

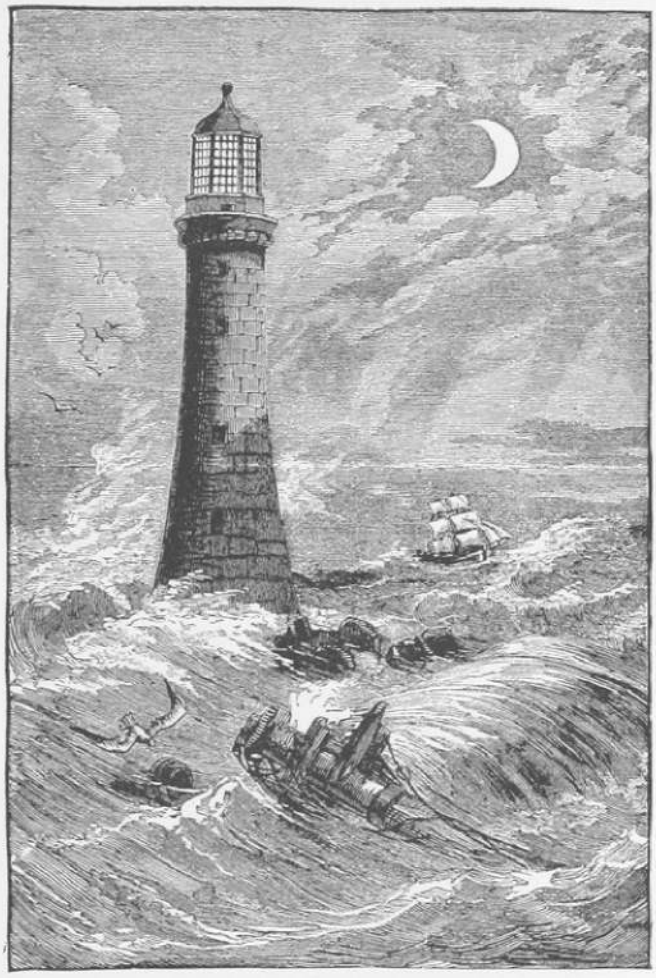
Lighthouses have long provided safe navigation for ships carrying trade and passengers. In a world before GPS, they were crucial navigation tools.

Their role as safety infrastructure, however, required they be constructed in the most challenging areas.

This is the reason we see massive stone lighthouses dotting coasts across the world. The epic bulk was the only way they could resist the violence of the seas. In areas where such construction wasn't possible, there were no other options.

As marine travel increased, the demand for safer harbors and better navigation grew more dire.

But to make a stronger building, it takes a stronger foundation. That foundation would come from a fascinating man named **Alexander Mitchell**.



EDDYSTONE LIGHTHOUSE.

The Helical Pile is Invented

The art of soil mechanics was still young in the early 19th century. Few engineers understood the interactions between soil and deep foundations.

At the time, driven timber piles were the most common deep foundation. They were easy to install and cheap. Simply strike a timber pile with a heavy weight until it refuses to drive deeper. The process didn't require a deep knowledge of soil mechanics or equipment.

Enter Alexander Mitchell, inventor of helical piles and a remarkable character. Born in Ireland in 1780, he would receive little formal education as a child. What education he did receive revealed a keen mathematical mind. Unfortunately, by age 22 he would lose his sight to an illness.

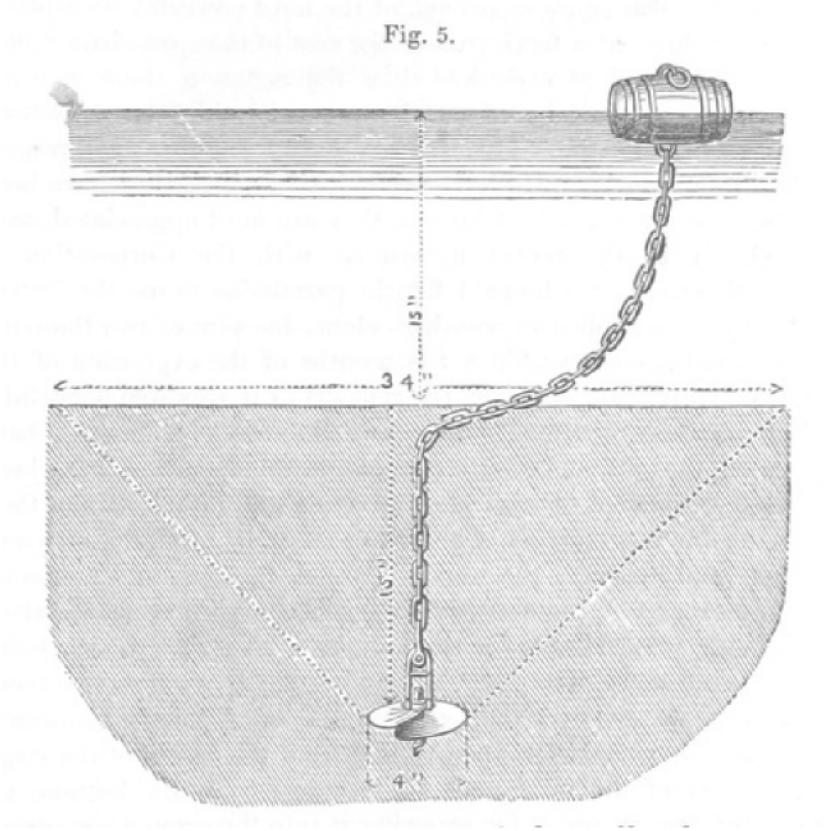
Mitchell's lack of education and sight did not dampen his spirit. He borrowed £100 from his brother and started a brick making business. By 1830 he had expanded into construction and business was booming.

It was here that Mitchell turned his attention from bricks to iron.

Mitchell's "screw pile" design was inspired by the mooring systems designed to secure ships in harbors.

"Screw anchors" had been in use for some time as an alternative to weighted anchors, which struggled to hold ships in storms and strong waves.

It was discovered that a helical turned into the sand offered exponentially increased resistance to tension forces.



Mitchell took inspiration from these helical anchors and applied the idea to a structural foundation. He wisely reasoned the soil conditions on a sandy coast were little different than the sandy floor of a harbor. By adding a helix plate to a cast iron shaft, he judged it would offer firm support to heavy structures in loose and sandy soil.

His approach shows an inspired understanding of soil mechanics for the time. Mitchell appreciated how helix geometry, install depth, and the soil properties affect the foundation.

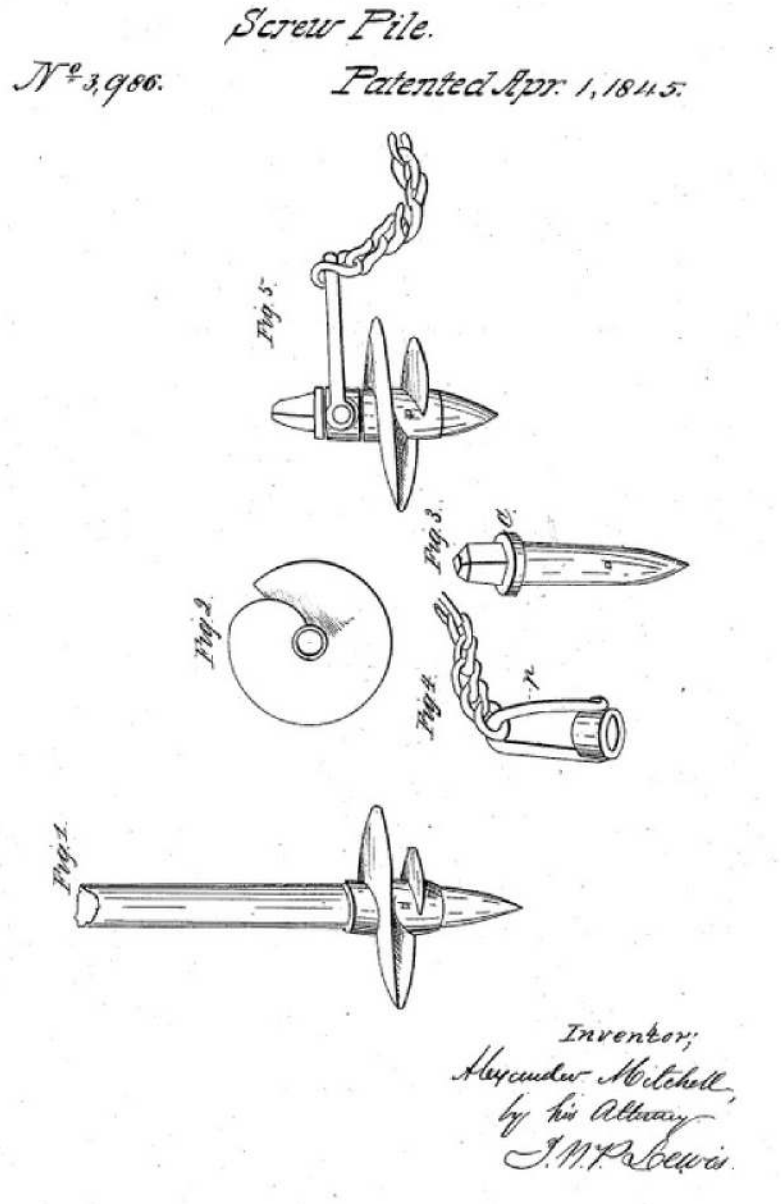
This was a time when most engineers had little, or zero, notion of soil mechanics. Mitchell, with no formal engineering education, had discovered something revolutionary.

As legend goes, Mitchell sought to test his new invention in secret around 1832.

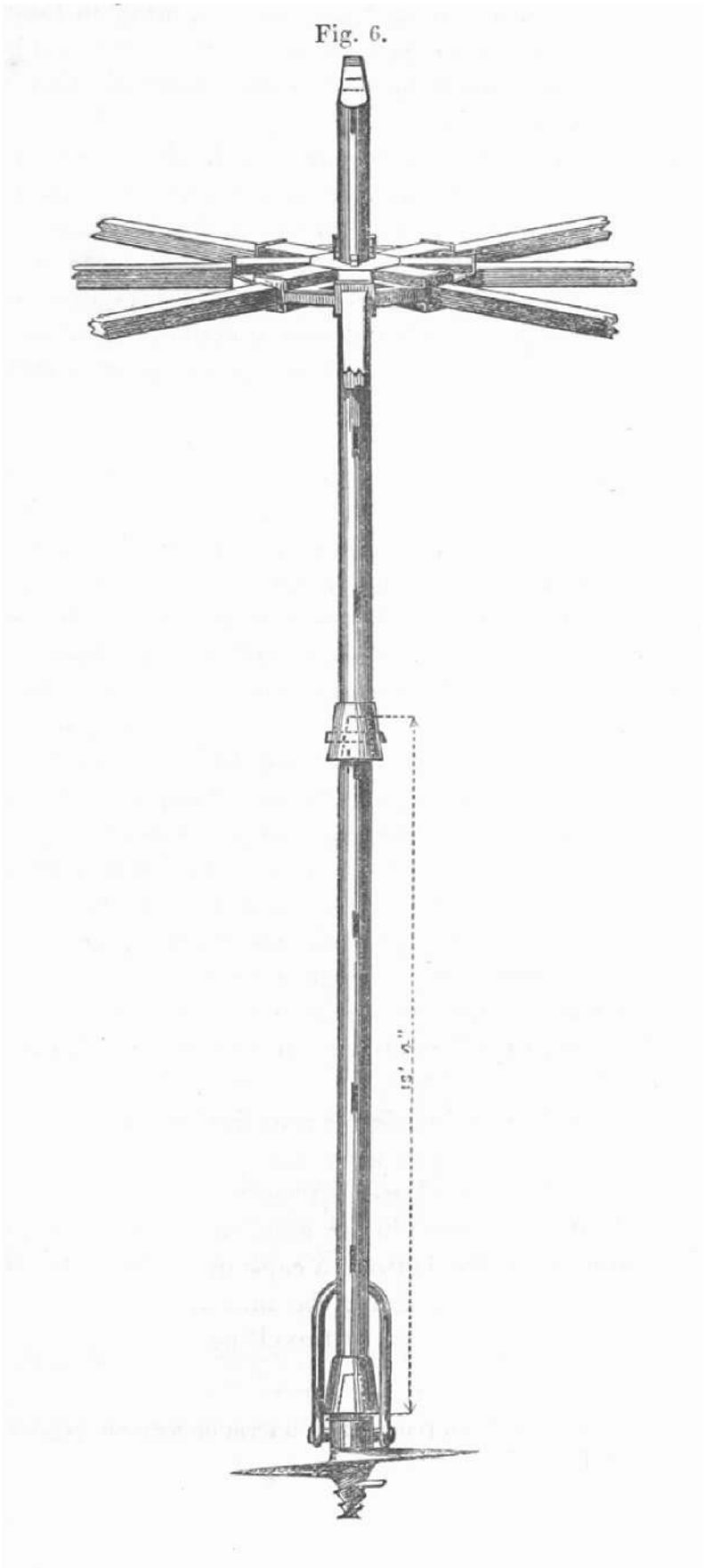
He clandestinely rowed to a sandbank in Belfast Lough. Along with his 19-year old son John, they managed to turn a pile some depth into the sand. The only evidence of their test was a lone cast iron shaft sticking slightly out of the water.

Returning the next morning, Mitchell found his pile unmoved.

His concept proven, Mitchell applied for a patent for the first-recorded "screw pile" in 1833.



US patent no3,986 for Mitchell's "Screw Pile". Note the US patent was applied for several years after the British patent.



Early drawing by Alexander Mitchell of his "screw pile" invention. The pile shaft here is coupled to a capstan for installation by hand.

The design should look familiar to anyone who has seen a modern helical pile. If anything, it's surprising how much modern helical piles share with the early designs.

The engineering principles Mitchell had applied produced an invention that would change the construction world.

Like many new innovation, acceptance would not happen immediately.

Mitchell struggled to garner initial interest in his "screw piles". Engineers were wary that such a unique design could ever work.

But, by a stroke of fate, Mitchell would soon get the chance to test his new foundation.

That's an incredible story in itself, but we'll get back to it later. For now, what's important to know is that helical piles would gain global acceptance and use over the next 100 years.

Helical Piles Decline, Then Make a Comeback

In the decades after their invention helical piles supported countless lighthouses, bridges, and piers. They became so common that engineers and architects often neglected to make any special note of their use. For structures in poor soil, it was assumed helical piles would be used.

Middle Bay Lighthouse near Mobile, Alabama. Constructed 1885 on helical piles.

Despite their advantages, their capacity and versatility was limited by the engineering of the day.

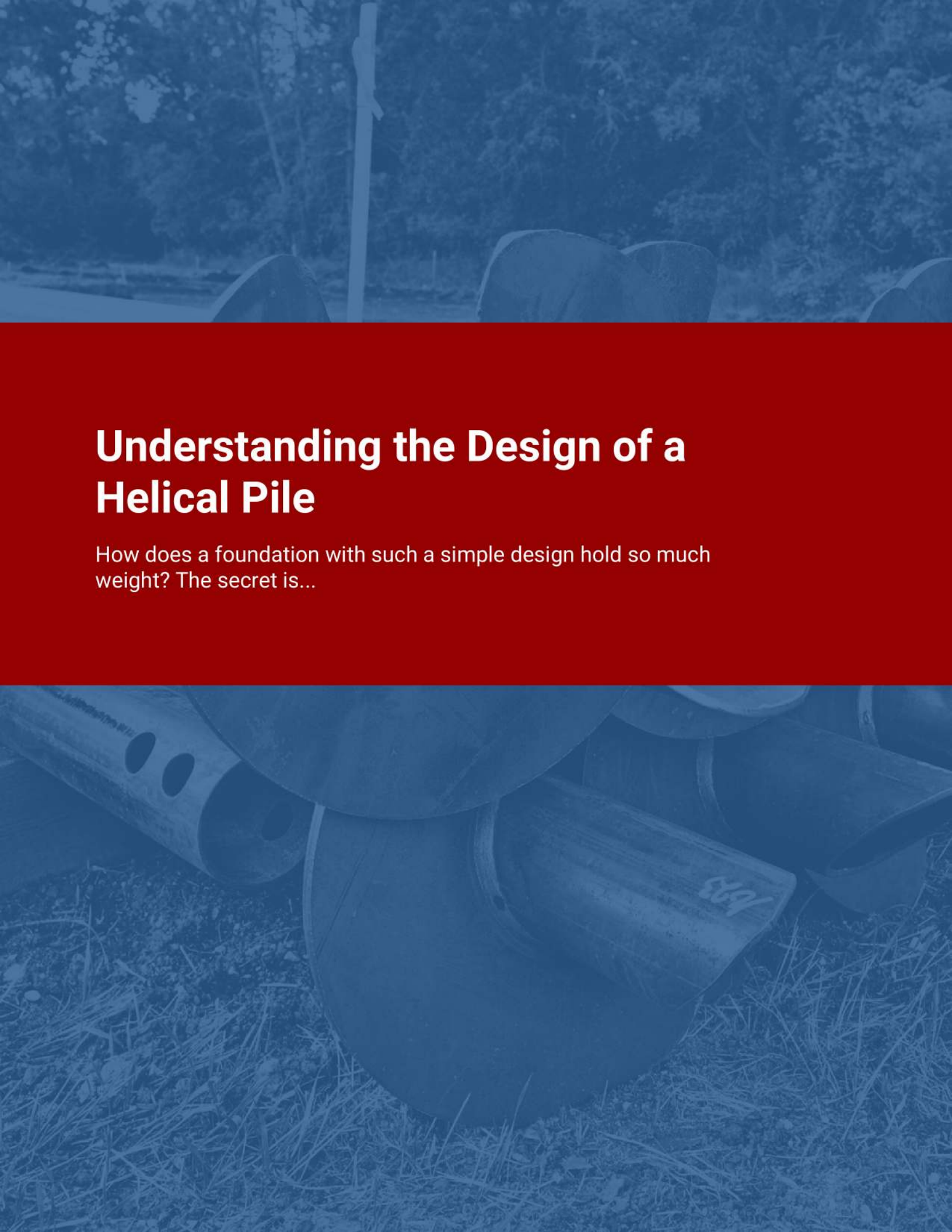
As construction became more mechanized, it was easier to build machines that drove timber piles with steam power. Helical piles would experience a decline until the 1950's.

It was in the 1950's that hydraulic power gave birth to a new wave of construction technology.

The invention of the hydraulic drive made helical piles quick and easy to install. What used to take teams of workers days to install by hand now took a single machine operator mere hours.

Engineers and builders revived helical piles and began refining them. Over the next few decades helical piles rapidly improved their efficiency, capacity, and install speed. By the 1980's, many parts of the commercial construction industry began to use helical foundations. Today, their wide-spread use in residential and commercial projects are a testament to their staying power.

But what is it exactly about helical piles that's guaranteed their place in modern construction?



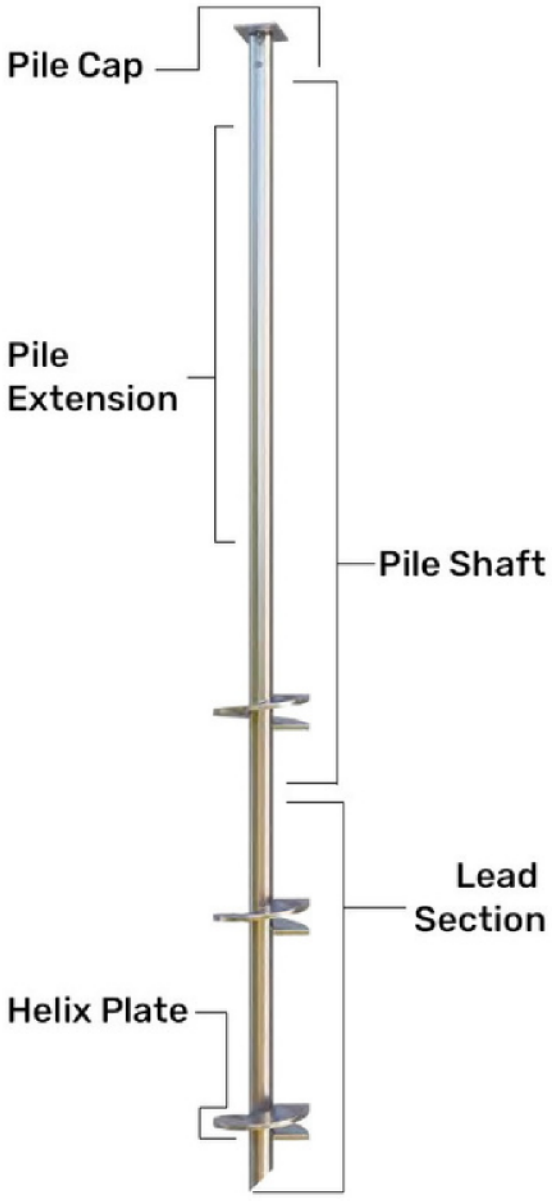
Understanding the Design of a Helical Pile

How does a foundation with such a simple design hold so much weight? The secret is...

Anatomy of a Helical Pile

Helical piles operate on a straight-forward principle. One or more helix-shaped plates are welded to a round or square steel shaft. The pile is turned into the ground using hydraulic power. Once installed, it resists loads via the bearing action of the helical plates and shaft friction.

This diagram of a helical pile shows the major components. After we look at the separate components, we'll talk about why the helical pile design works so well.



Pile Shaft

The pile shaft makes up the "body" of the helical pile, and is what all other components attach to.

Typically, the pile shaft will be constructed of a hollow round pipe, hollow square shaft, or a solid square bar. Steel is the standard material.

Lead Section

At the bottom of the pile is the lead section. This is usually made in a 5 or 10 foot length. It contains the pilot point and one or more helix plates.

The pilot point is typically cut to a 45 degree angle to make installation easier. However, you may see other types of pilot points depending on the site requirements.

Extensions are often added to the top of the lead section to lengthen the helical pile.

Anatomy of a Helical Pile (Continued)

Extension Section

As the pile is turned into the ground, extension shafts (that may include additional helices) are coupled to the lead section. More on couplers below.

One of the benefits of this system is that helical piles can be quickly adapted on-site in response to unexpected soil conditions.

Let's say that, during the design phase, the geotechnical report indicated appropriate stratum at about 25 feet. Install day comes and the crew discovers the soil in one section is still muck at 25 feet. In this case, extensions are added until the appropriate stratum is reached.

Couplers

A coupler connects pile extensions together so the installer can reach the required depth. One of the benefits of this system is that a helical pile can be quickly lengthened on-site. This is extremely useful when dealing with variable soils.

Couplers come in a variety of designs. They may be threaded, bolted, or welded depending on the project.

Helix Plate

A helix plate is made from a steel plate that's (usually) stamped into a spiral shape and welded to the pile shaft. It's what provides the bulk of the capacity to the pile.

When a pile has multiple helixes (pl. helices), they are attached to the shaft in a way that guarantees they follow the same path through the soil. This minimizes soil disturbance and increases the pile's capacity.

A helix plate also follows a defined pitch, typically 3", regardless of the diameter of the plate.

The number of helices on a pile depends on the application and design requirements. High-capacity piles in challenging soil may have 4 or more helices.

Pile Cap

After the helical piles are turned into the ground, they still need to become a cohesive foundation. This is achieved with a pile cap. A pile cap adapts the top of a helical pile to whatever structure is being supported.

Pile caps can be as simple as a sleeve and steel bearing plate, or they can be beautifully designed custom adapters.

Why Does The Helical Pile Design Work?

What is it about a helical pile that makes it such an effective foundation even for large-scale industrial and commercial construction projects?

Why Does the Helical Pile Design Work?

Soil provides support, not pile shaft

The helices on a helical pile do more than turn it into the ground. They distribute load to the surrounding soil which, when combined with friction on the shaft, gives the helical pile its load resistance. This is the primary factor that makes helical piles unique. Because the strength comes from the helix plate, the pile shaft can be narrow in comparison. That's why a humble 7" diameter helical pile shaft could potentially support upwards of 170,000lbs of capacity (depending on other factors).

Shaft design protects against lateral forces

The small diameter of the helical pile shaft compared to the helix plate gives it excellent protection against lateral forces like shifting soil or frost. Frost offers a great example of this resistance. In much of North America, frost is a leading cause of foundation failure. This often takes the form of a foundation that has shifted, sunk, or heaved. Due to the low surface area of the pile shaft, it better resists the lateral force of heaving and sinking soil.

Can be extended on-site to reach desired stratum

Extensions are easily added to helical piles during install to reach the desired pile depth. In cases where the reality of the soil differs from the expected conditions, a helical pile can be extended until desired stratum is reached.

Why Does the Helical Pile Design Work? (Continued)

Installation torque can confirm (or refute) soil conditions and correlates to capacity

Installation torque measures the rotational force needed to install a helical pile.

The more torque it takes, the more resistance that pile is receiving from the soil. Generally speaking, as torque (resistance) increases so does pile capacity.

Engineers have understood the relationship between torque and capacity since the 1960's. It wasn't until 1989 that an empirical relationship between torque and capacity was formally established.

In the decades since, many organizations have published their own torque correlations.

Using this correlation, pile designers can calculate how much installation torque will be needed to reach desired capacity.

The capacity-to-torque relationship can be expressed in this formula:

$Q_t = K_t T$

Q_t is the ultimate capacity of the helical pile

K_t is the capacity-to-torque correlation factor (more on this in a moment)

T is the average installation torque

Capacity-to-torque correlations can be a powerful tool when design a helical foundation. Just a few of the things a helical designer can use these correlations for are:

- Value-engineering a cost-efficient foundation
- Obtaining parameters for ethical design
- Potentially increasing pile capacity (on approval from geotechnical engineer)
- Confirm soil assumptions
- And more

The Process to Designing & Installing a Helical Foundation

It takes a lot of planning and preparation to design and install a rock-solid helical foundation that will stand the test of time

The Design Phase

There's a wide range of technical factors that guide the design of a helical pile foundation. They influence not only the helical piles themselves, but also the equipment that will be used for install.

Getting into technical detail on pile design is beyond this guide, but some of the design factors considered are:

- Required load capacity
- Type of structure to be supported
- Site conditions (geotechnical report, site survey)
- Project schedule
- Feasibility study (site access, safety considerations, sensitive locations)

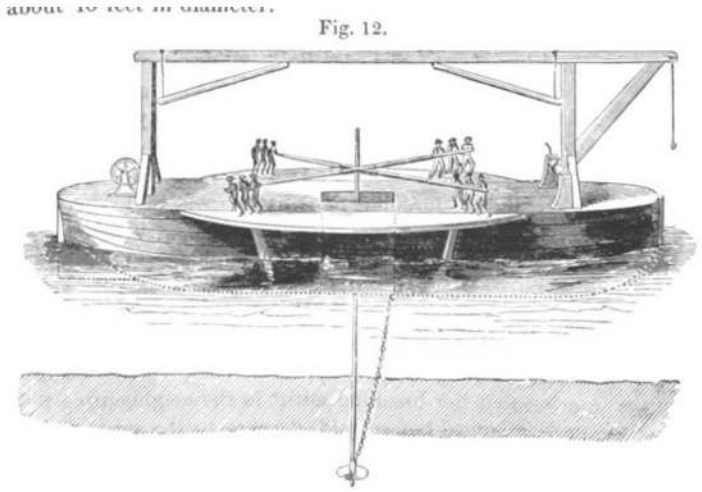
Thanks to the various empirical relationships helical piles have to the soil, pile capacities can be reliably estimated during the design phase.

At VersaPile, like other quality helical pile contractors, we use the design phase to value-engineer the foundation. Instead of specifying a generic design, we customize the foundation to the project. This versatility is one reason helical pile foundations have become common in challenging locations.

Once the foundation design is finalized, the project can move to installation.

Before any helical piles are installed, a quality contractor will put plenty of planning and calculation into the design.

The Install Phase



In the early days, helical piles were installed by hand with teams of workers.

These days, hydraulic drive heads like this Digga UD300 can apply the force of 10,000 workers.

180 years ago, helical piles were installed by teams of workers turning them into the ground by hand. Efficient for the time, yes, but far from ideal.

Today, we use hydraulic power. Its ability to apply great force with comparatively small equipment makes it perfect to install helical piles.

It starts with a hydraulic drive head. This provides the rotational force needed to "turn in" the helical pile.

The drive head can be attached to almost anything with a hydraulic motor. For commercial projects, excavators and skidsteers are commonly used. However, you may see an ingenious array of install equipment designed to meet specific needs.

Top-tier foundation contractors will have a number of different machines in their arsenal so they can tackle any project.

Contractors will also have trucks and trailers to transport the helical piles and equipment. The best-equipped contractors will even have support vehicles such as welding trucks.

Examples of Installation Equipment

The equipment used to install helical piles is vast and varied. Here's a sample of some of the equipment we use at VersaPile to get the job done.

This Kubota mini-excavator was able to install these piles for protective bollards right from the trailer.

A "family photo" of some of the equipment we use to install helical piles at VersaPile.

A Deere 290G excavator installing high-capacity helical piles for a 5-storey multi-use project.

A tractor trailer transported these high-capacity helical piles. Smaller piles can be hauled by a heavy-duty

This mini excavator has a clamping hand to help maneuvar helical piles into place.

Post-Install Testing

Once the helical piles are installed, the contractor performs load-testing to ensure they meet specifications.

There's many ways to perform a load test, and each one has its pros and cons.

- Which load test is used and the specific piles to be tested depends on a few elements:
- Site conditions
- Soil conditions
- Project requirements
- Torque readings and other installation data

Generally, the helical pile contractor will work with a geotechnical engineer to help choose the piles to be tested. Geotechs are a key part of a helical pile foundation, and their guidance helps future-proof the project.

Load testing is a highly engineered process. To get into detail here would make this a very long section. If you want to know more about load testing, our team at VersaPile would be happy to send you some resources. Check the end of this book for contact info.

A hydraulic jack attached to a steel test-rig applies force to test the compressive resistance of a helical pile.

An engineer monitors the tests and assess the results. Good engineering equals a strong foundation.

On-Going Support

Here's where the true foundation experts are separated from, well, everyone else.

Each phase has been carefully planned and executed. Installation and load testing is complete. The builder is hard at work assembling the project on top a firm foundation.

At this point, many foundation contractors figure their work is done and quickly move on. While they can't be blamed for keeping busy, they often forget the most important part of the project:

Ongoing support.

Despite what some claim, helical pile foundations aren't "set and forget". No foundation is.

Once the piles are in the ground, it's not unusual for additional questions to come up. Sometimes a little advice is needed for mating the piles to the structure. Or, someone needs insight into a specific piece of data from the installation.

Whatever the question or issue, a good foundation contractor will be happy to provide quick support after installation.

Beware of contractors who can't wait to drive off into the sunset and ignore emails.

If you're looking at helical contractors, take your time to scrutinize them. Some extra due diligence can save you big headaches down the road.

The truly exceptional foundation contractors are thrilled to do whatever it takes to make your project run smoothly.

This worker is carefully laser-leveling the piles to ensure the foundation is 100% ready-to-go. Contractors that pay attention to the small details, also pay attention to the big ones.

Where Are Helical Piles Being Used?

Trying to list all the projects where helical pile foundations are being used could fill a book in itself.

Where Helical Piles Are Used

Transmission & Utility Towers

Transmission lines and utility towers like wireless internet are excellent candidates for helical piles. Often placed in remote or challenging locations, these structures are easily held fast by properly installed helical piles.

Oil & Gas

Pipelines, equipment pads, generators, and pumpjacks can all be supported by helical piles. Because helical piles cause minimal soil disturbance and can be readily removed, they make site remediation simple.

Where Helical Piles Are Used

Power Transmission & Distribution

The power industry has used helical foundations for decades to support smaller transmission towers and power lines. Today helical piles can support all aspects of T&D construction, from distribution stations to remote transmission lines.

Where Helical Piles Are Used

Multi-Story Buildings

It's a myth that helical piles are unsuitable for multi-story structures.

In many cases, helical piles are ideal solutions to the limited access and noise ordinances common to these projects.

Agricultural

Grain bins, towers, equipment pads, and out-buildings are a handful of the uses for helical piles in the ag sector. Structures like grain bins can have complex and dynamic loading requirements, something helical piles are excellent at managing.

Helical Pile Case Studies

There’s no better way to understand helical piles than to take a first-hand look at real-world stories of how they’re used

The Maplin Sands Lighthouse

The first case study might not be what you expect. In fact it's not even one of my companies' projects. This one took place halfway across the world over 180 years ago.

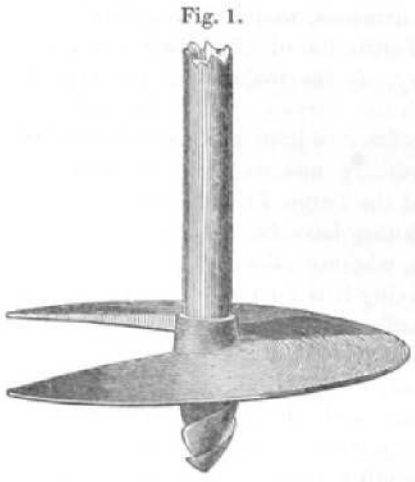
The Maplin Sands Lighthouse was the first recorded use of a helical pile foundation. Although technically, the Wyre Light would be the first structure built on screw piles as it was finished in 1840 - slightly before Maplin.

However, the piles at Maplin were installed months before Wyre. That's why, in my opinion, Maplin Sands can still be called the first.

Problem

A lighthouse was needed at the southeastern edge of Maplin Sands, in the River Thames. The vicious storms and powerful currents made it a dangerous passage for goods and people.

Poor soil had so far prevented the construction of a lighthouse in this area. Driven piles would not provide adequate support, and no other options existed. This was an opportunity for helical piles.



Above: A handmade model of the Maplin Sands Lighthouse, showing a cutaway view of the helical pile foundation.

Left: A close-up diagram of an early helix by Alexander Mitchell. This design would have been used at Maplin Sands.

The Maplin Sands Lighthouse

Solution

James Walker, a respected Scottish engineer, heard of Alexander Mitchell's new screw pile foundation. Walker was a member of Trinity House, the lighthouse authority in England.

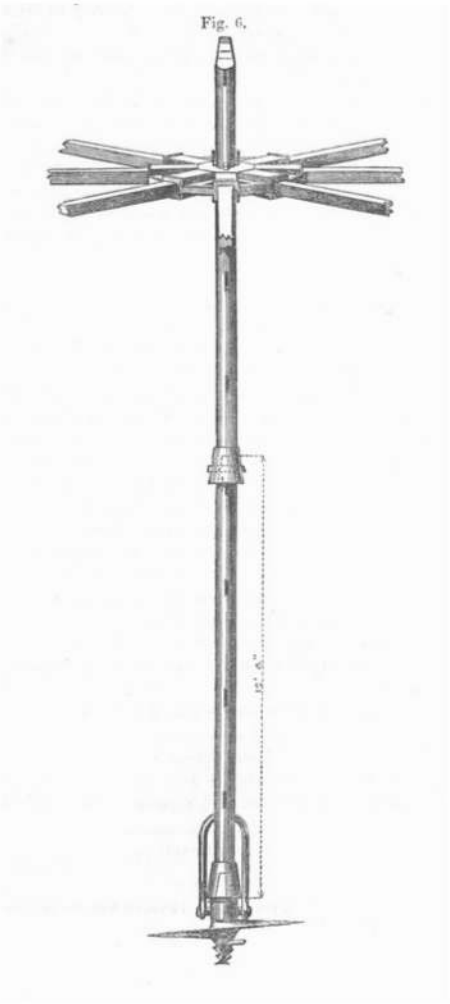
He trusted Mitchell's engineering and staked his reputation on the new technology. On Walker's recommendation, Mitchell agreed to install the helical piles at Maplin Sands and test their durability.

Mitchell and his crew installed nine cast-iron helical piles into the sand at a depth of 25ft. The pile shafts were 5" in diameter with a 3' diameter screw (helical) plate. A heavy raft of wood with a capstan helped turn the piles into the ground.

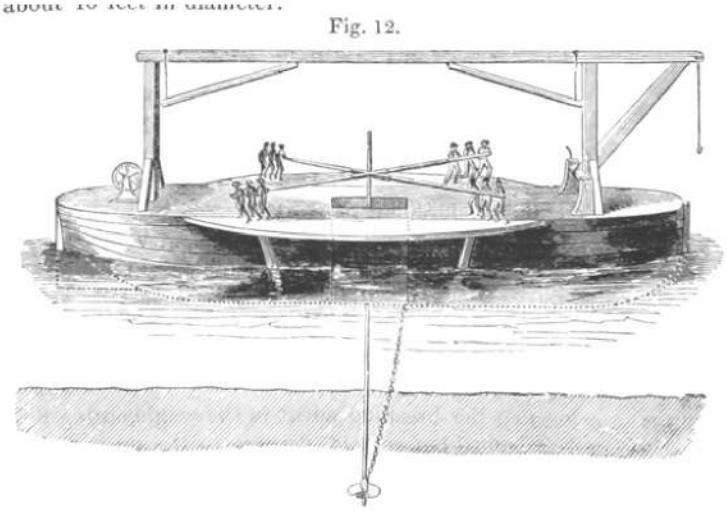
The crew numbered around 40 workers. Installation began on August 28th, 1838 and finished nine days later.

The total cost of the foundation was £1200 in 1838. If we adjust for inflation and convert to Canadian, it's just over $230,000. Today, a similar helical foundation would cost dramatically less.

To test the foundation, they loaded it with 200 tons of stone. Two years later, the foundation had experienced no creep. Satisfied with the results, the lighthouse was completed by 1840.



An example of the type of helical pile Alexander Mitchell used for the Maplin Sands Lighthouse. Note the capstan on top for manual installation.



In an era before hydraulic power, it took teams of workers brute force to turn helical piles into the ground. This image depicts the raft and capstan used at Maplin Sands.

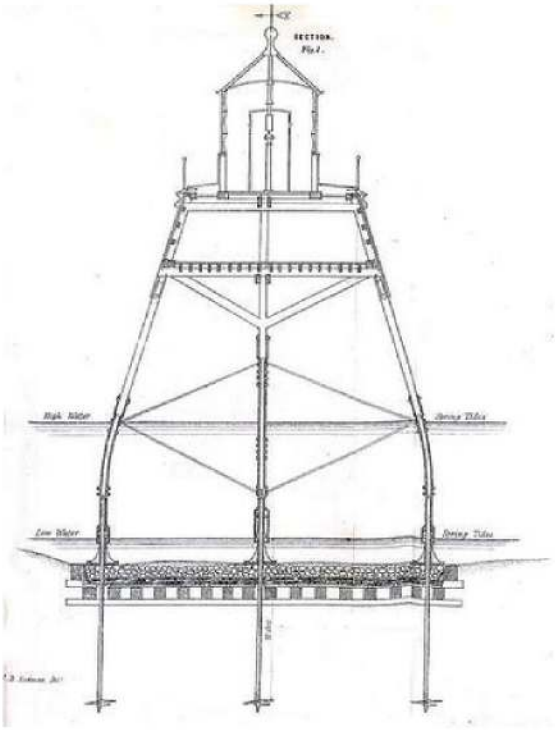
The Maplin Sands Lighthouse

Result

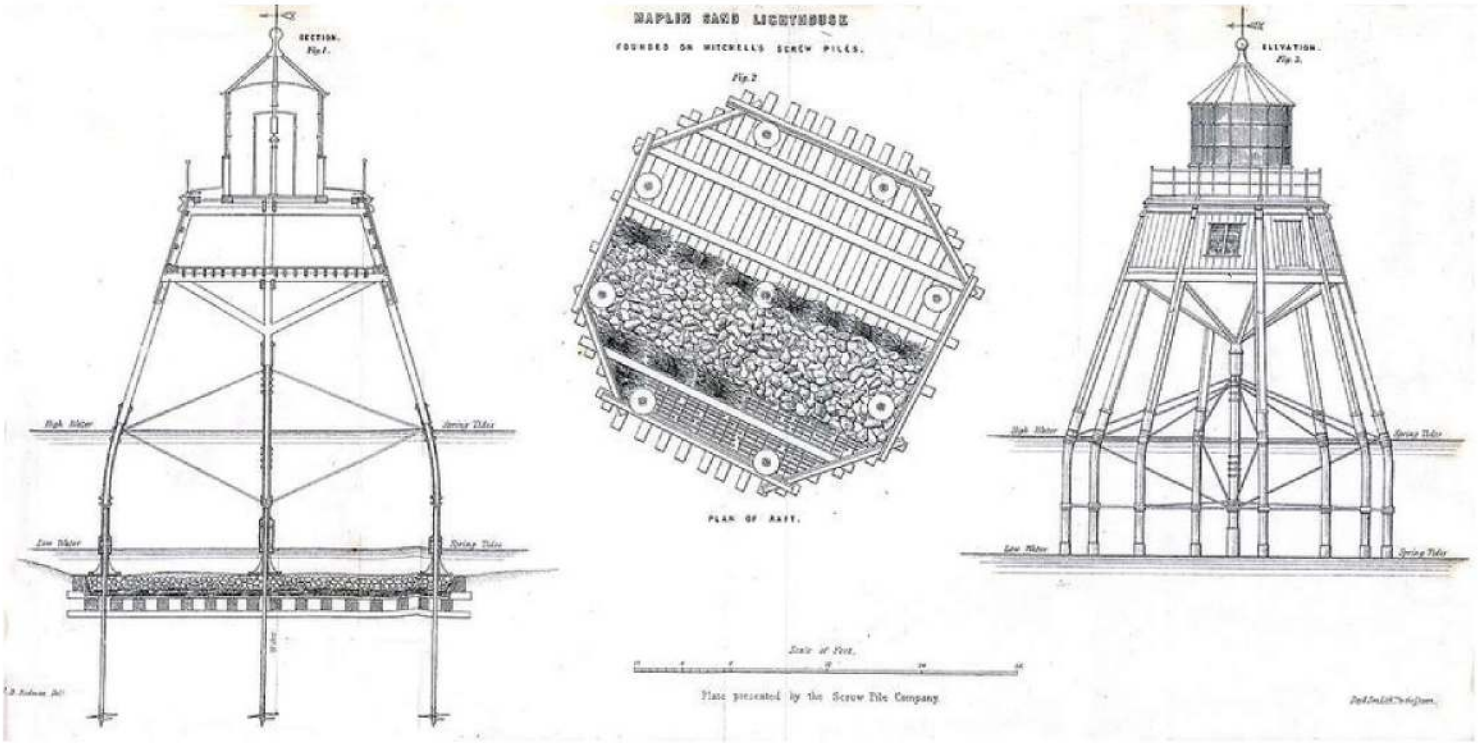
The Maplin Sands Lighthouse would protect mariners from the Thames for over 92 years.

The lighthouse experienced no foundation issues during its life. Its downfall in 1932 would come from the flow of the relentless Thames.

Strong tidal streams scoured soil from beneath the lighthouse, undermining the helical foundation. After nearly a century of service, the lighthouse was swept away. It was not the helical piles that failed, but instead the ground itself that had been washed away by constant



Blueprint drawing of the Maplin Sands Lighthouse structure.



The lighthouse at Maplin Sands showed the world a way to build in locations previously inaccessible. While few have even heard of this lighthouse today, it played a crucial role in the establishment of helical piles.

210,000lb Helical Piles for 5-Storey Mixed Use Building

A common, and incorrect, assumption made by some is that helical piles are unsuitable for high-capacity projects. The reality couldn't be more different, with helical piles able to support 500,000lbs and beyond.

In this project, VersaPile used helical piles to help Porchlight Developments (Porchlight) save a tough situation when last-minute changes threatened their project.

Problem

During the construction of a five-storey mixed use building in Winnipeg, MB, Porchlight discovered their chosen rooftop HVAC units were not available. Replacements units were found, but they were so different the structural design had to be revised.

After the redesign, Porchlight discovered the previously-installed precast piles no longer met the design criteria. Driven piles were infeasible due to the tight work site and nearby parkade walls. The only options were caisson piles or helical piles.

Large capacity piles require large helices. On this project, VersaPile used helix diameters between 30" to 35".

Pre-existing concrete walls made driven piles infeasible. Helical piles install with zero disturbance, which made them a strong choice on this sensitive jobsite.

210,000lb Helical Piles for 5-Storey Mixed Use Building

Solution

Porchlight contacted their geotechnical engineer, Silvestre Urbano, to see what options they had. Silvestre's previous experience working with VersaPile inspired him to recommend helical piles as a solution.

Helical piles offered a straightforward, efficient mobilization strategy. Because they install with minimal equipment and disturbance, they were a perfect fit for site requirements. Existing structures, like the parkade walls, would not be subject to damage from vibration as with driven piles.

VersaPile mobilized with a John Deere 290G 30ton excavator, a New Holland C245 skidsteer, and a RAM 3500 with trailer. The 290G excavator used a high-capacity Eskridge D1400 115 kip-ft torque drive to turn the piles into the ground.

Seven helical piles were installed over the course of three days, with an additional day needed for a CWB certified welder to install the pile caps.

The ability to install helical piles mere feet from existing structures made it simple to install this high-capacity pile a few feet from a newly-built wall.

Result

In less than one month from first being contacted by Porchlight, VersaPile finished installing the last pile. This includes lead times for manufacturing and shipping custom high-capacity piles from Western Canada.

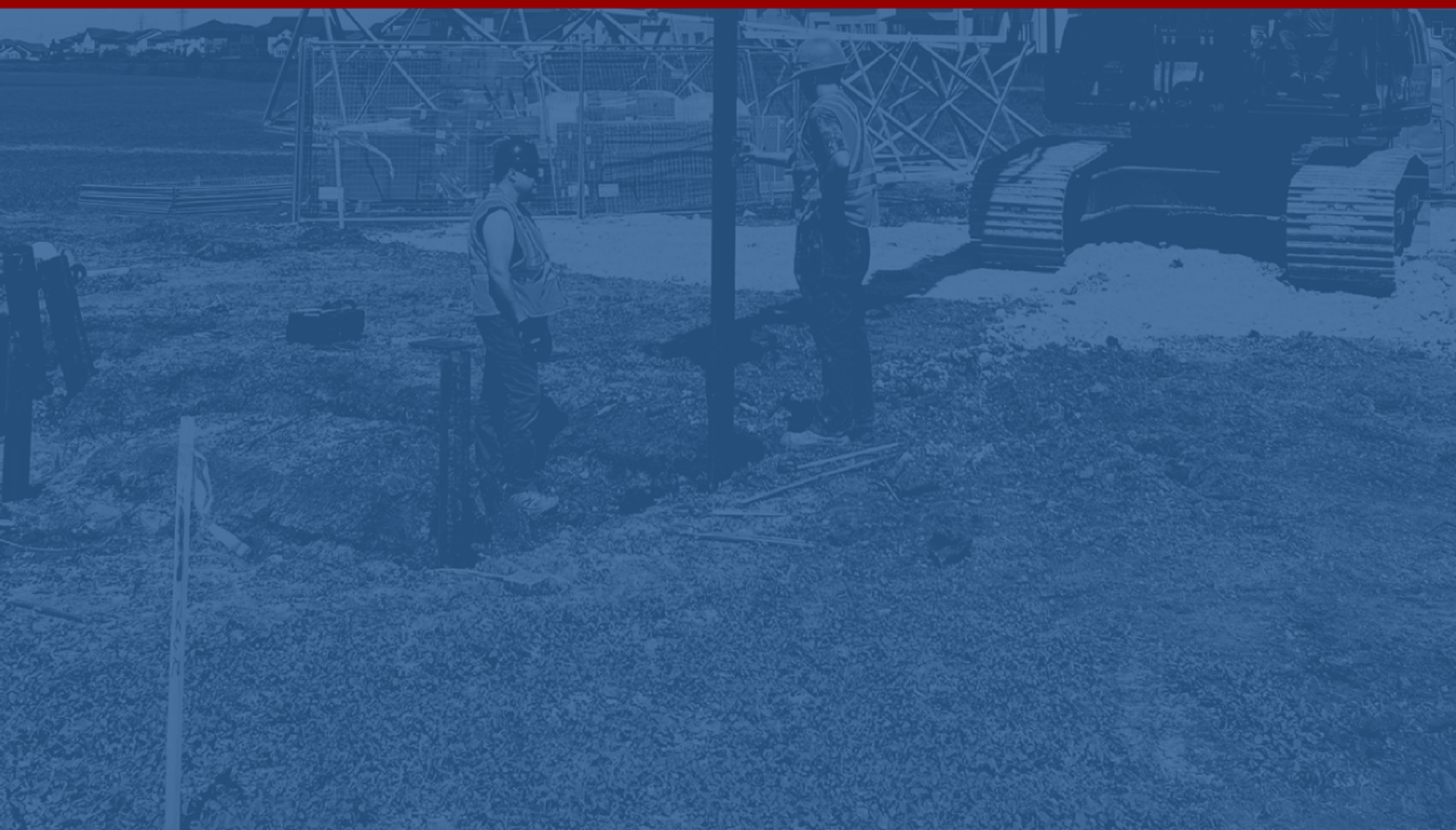
The helical piles VersaPile installed were verified to meet loads up to 210,00lbs and gave Porchlight the support they needed to move forward.

What could have been an expensive roadblock was solved in a few weeks with expert engineering and rock-solid products.

Excavators are maneuvarable and minimize site disturbance, making them a favourite for installing helical piles.

The Pro’s and Con’s of Helical Piles

Let’s cut through the noise and assess helical piles from a neutral viewpoint.



The Pro's of Helical Piles

Quick and comparatively easy installation, even in difficult conditions
Helical piles don't require multiple heavy machines, trucks, and workers running around a jobsite. They can be readily installed in remote locations, on uneven terrain, or in tight spaces. Piles even been installed in basements of occupied buildings using compact electric-driven equipment.

Can be removed from the ground and reused
If a helical pile needs to be removed for any reason, it's simply turned out of the ground using a helical drive. There's no soil disturbance, which means no extra site remediation. The removed piles can be inspected, and if engineer-approved can be safely reused. A huge time-and-cost savings for environmentally sensitive sites or temporary foundations.

No tailings/spoils
Other foundations technologies require pre-drilling or excavation, which creates spoils that must be dealt with. Helical piles install without drilling or excavation, so there's no mess to haul away.

Easily extended on-site
If a foundation needs to go deeper it usually means more drilling, driving, or digging. The cost in money and time for these modifications adds up fast. Helical piles can be quickly extended on-site with prepared extensions. Additional sections are added to the helical pile until the appropriate depth is reached. An expensive fix for other foundations is a brief delay for helical piles.

Extremely long-lasting
In the majority of cases, a helical pile foundation will far outlive the structure it supports. Helical piles can be protected from corrosion with galvanizing, sacrificial material, or anode systems. Properly manufactured and installed, helical piles can have a lifetime measured in centuries.

Can be customized to suit the exact project
Many of the design aspects of a helical pile can be customized to create a value-engineered foundation that's as effective as it is efficient.
stead of the project fitting the foundation.

The Pro's of Helical Piles

High-performance in poor-quality soils

Poor quality soils are common-place across North America. Helical piles easily pass through saturated, sloughing, and sloppy soils without issue. No need to sleeve or dewater, saving time and money on site.

Huge range of pile caps and transitions

A nearly limitless variety of pile caps and transitions can be engineered for a helical pile foundation to attach to practically any structure. This lets the foundation fit the project, instead of the project fitting the foundation.

Helical piles can be installed in a range of weather conditions, including a snowstorm.

A good contractor can install a helical pile nearly anywhere, making them a versatile support.

Pile caps connect the helical piles in the ground to the structure aboveground. Pictured here is a high-capacity pile cap that ties multiple piles together.

The Con's of Helical Piles

May hit refusal in certain soils
Large boulders, debris, and extremely dense soils can pose a challenge for helical piles. Often, they can be maneuvered around these obstructions or find ways through them. Other times, these types of soil may be incompatible with helical piles.

Lack of knowledge amongst engineers
Engineers are a critical part of the construction industry. Unfortunately, helical piles are not included as regular curriculum for engineers in most schools. This can make it difficult to find an engineer that understands, and appreciates, helical pile foundations.

Non-standard "helical" piles cause confusion
Variations of helical piles such as augered piles, duckbill piles, ground anchors, and ground screws litter the market. These variants lack standard design and universally accepted engineering principles. However, they're often sold with the same claims as helical piles. Be warned, these are not helical piles and are not backed by 180+ years of engineering improvements.

Can have lower resistance to lateral/bending forces
Because of the, comparatively, smaller shaft size on a helical pile they have a lower resistance to lateral forces compared to other types. However, this can be overcome with various design tactics such as grillages or pile caps.

The foundation contractor makes a huge difference to performance
Who installs a helical pile foundations matters as much, and even more, than the piles themselves. Lazy contractors who take shortcuts will install a bad foundation. Care should be taken to find a contractor who has outstanding technical knowledge, engineering, experience, and customer service.

This helical pile was built and installed by a shoddy contractor. Inevitably, it failed. Bad helical contractors are a major headache for every professional in the industry.

Summarizing Helical Pile Foundations

What does all this talk about helical piles actually mean for the industry?

Helical Piles: Here to Stay?

The world of helical piles is not as confusing or niche as it may appear.

Yes, bad marketing and crooked contractors have muddied the waters. But ignoring helical piles because of some bad actors would be a shame.

As we've seen, helical piles have been supporting structures for over 180 years. Despite their temporary fall from popularity, helical piles are coming back in force right now.

They're not a "miracle" foundation. Don't believe anyone who tells you that. However, helical piles are unique foundations with clear benefits for the right project. There's a reason more engineers, contractors, and designers opting to use them.

What does that mean for you and your construction projects?

It means if you aren't including helical piles in your foundation consideration, you could be getting left behind.

Timelines and budgets are tighter than ever, which means it's up to you to make the absolute most out of every hour you have. Among the many reasons a project may use helical piles, the greatly reduced installation time is certainly a primary consideration.

There's one more thing to consider about helical foundations as well, and that's the fact they produce drastically **fewer CO2 emissions** than concrete.

According to calculations our team has done using publicly-available data, we've estimated a helical pile foundation may output over **98% fewer emissions** than a comparable concrete solution.

Helical piles are here to stay and make a huge impact on the world of commercial, industrial, and municipal construction. Reading this book was a great step to becoming more familiar with them, but if you want to dive deeper then here's some resources I recommend...

Additional Resources

If you're interested in learning more about helical piles, I've outlined a few resources I've personally found extremely helpful.

Deep Foundations Institute Helical Pile Foundation Design Guide

https://dfi.org/

This book is an essential resource for diving deeper on the selection, design, installation, and testing of a helical pile foundation. This short book is an excellent read for engineers and designers. Even people in non-technical roles will appreciate the insight into helical piles.

Why It's Helpful

- Data-backed information published by one of the foremost authorities in deep foundations
- Heaps of quality information, images, and diagrams
- Uncovers industry best-practices for better pile design
- Clearly-written and easy to understand

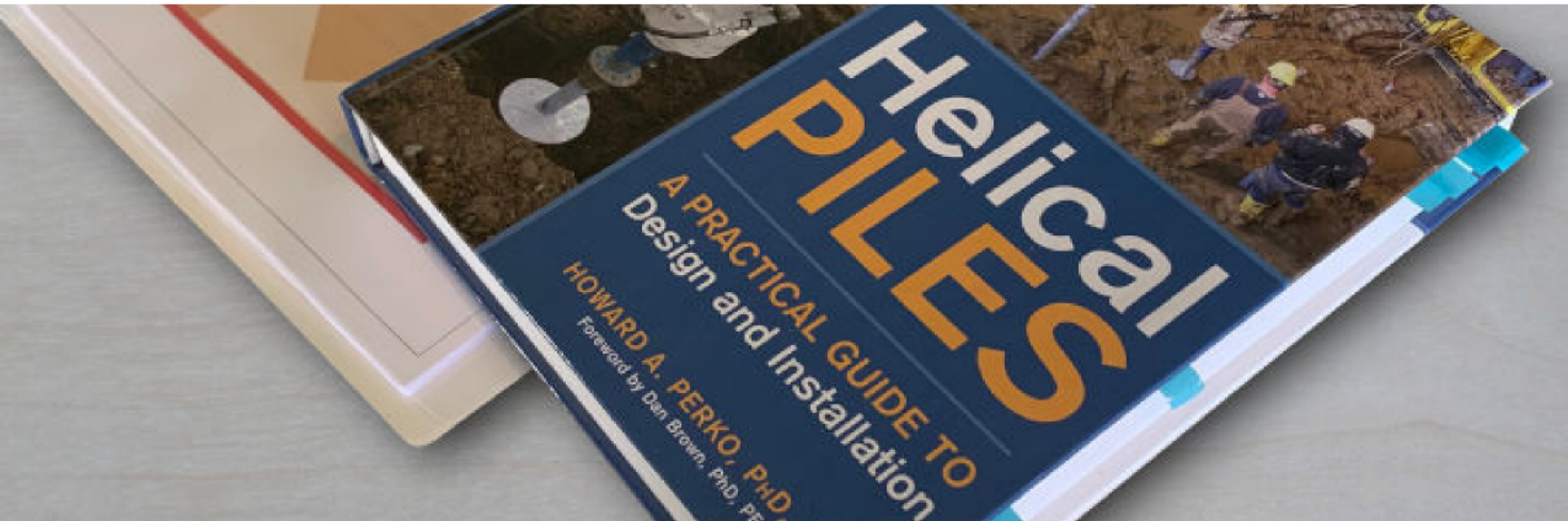
Helical Piles: A Practical Guide to Design and Installation

https://www.amzn.com/0470404795

Written by Howard Perko, an engineer with 20+ years of experience and many degrees, this is the foremost guide to helical piles. Written from a non-biased perspective, any helical contractor worth their salt will be familiar with this book. If you want to get serious about helical piles, this is your book.

Why It's Helpful

- Written in a non-biased, scholarly way
- Backed by real-world data and testing
- A widely-known and accepted guide to helical pile foundations
- Currently unrivaled in its depth and scope of information on helical piles



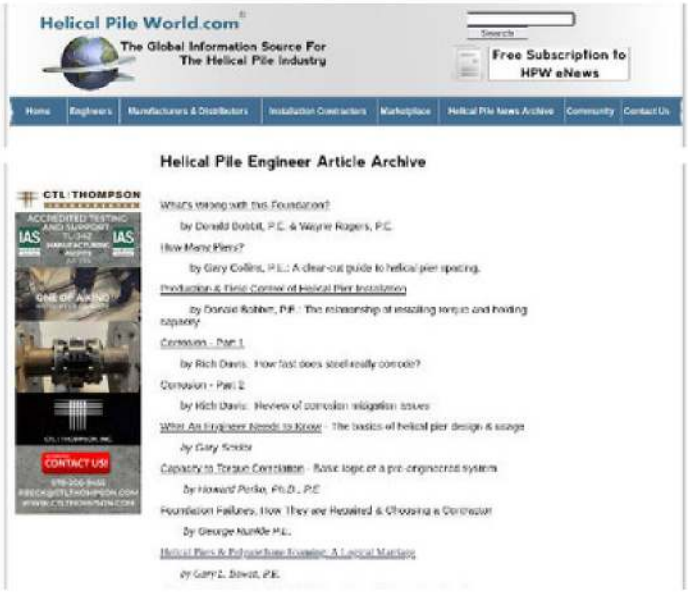
Additional Resources (con't)

Helical Pile World
https://www.helicalpileworld.com/

Run by Bill 'Bones' Benkemper, a long-time expert in the industry. Helical Pile World is a leading resource for commercial helical piles and a superb source of information. Bill also runs a helical pile newsletter that's useful for staying up-to-date in the industry.

Why It's Helpful

- Great source of industry news and updates
- Directories of helical pile manufacturers and installers
- In-depth technical library
- Foundation articles written by engineers



Bibliography

We all stand on the shoulders of giants. I'm immensely thankful to the people and organizations in the helical foundation industry who publish high-quality resources. Here's the resources I used during the creation of this eBook.

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Questions about helical pile foundations?

Want to know more about helical foundations for your commercial, industrial, or municipal construction project? Get in touch with our team of foundation experts and we'll set you on the right path

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