

MAGNUM Informational Bulletin ISO-HAP1-12B

# Helical Pile Applications in Oil and Gas Industry

by Howard A. Perko, Ph.D., P.E.

Magnum Geo-Solutions, LLC



Copyright 2011, 2012, 2013, 2014 – Magnum Piering. May be distributed and printed by express written permission of the author only.



#### U.S. Manufacturer of Foundation Products



800.822.PIER

## Magnum Helical Pile Sizes



	Magnum® Helical Pile Products	System Ratings & Specifications										
		Shaft Specifications					Structural Capacity (Tension & Comp)		Maximum	Capacity to	Geotechnical Capacity (Tension & Comp)	
		Design Wall Gauge (in)	Outside Diameter (in)	Approx Weight (plf)	Min. Yield Strength (ksi)	Min. Tensile Strength (ksi)	Ultimate (tons)	Allowable (tons)	Torque (ft-lbs)	Torque Ratio (ft <sup>-1</sup> )	Ultimate (tons)	Allowable (tons)
	MH220	0.20	2.88	5.7	46	62	30	15	5,000	9.0	23	11
	MH313	0.13	3.00	4.0	65	80	22	11	4,000	8.0	16	8
	MH313R	0.13	3.00	4.0	65	80	22	11	6,000	8.0	24	12
	MH325	0.25	3.00	7.4	65	80	55	28	8,000	8.0	32	16
	MH325R	0.25	3.00	7.4	65	80	55	28	12,500	8.0	50	25
Custom engineer sizes up to 16" diameter shaft or larger available upon request.	MH3521	0.21	3.50	7.4	65	80	45	23	10,000	7.0	35	18
	ec MH3521R	0.21	3.50	7.4	65	80	45	23	13,000	7.0	46	23
	MH425	0.25	4.50	11.4	65	80	96	48	22,000	5.7	63	31
	MH425R	0.25	4.50	11.4	65	80	96	48	27,000	5.7	77	38
	MH431	0.31	4.50	13.9	65	80	122	61	28,000	5.7	80	40
	MH431R	0.31	4.50	13.9	65	80	122	61	32,000	5.7	91	46
	MH530	0.30	5.50	16.7	125	135	273	137	53,000	4.7	125	62
	MH536	0.36	5.50	19.8	100	150	270	135	83,000	4.7	195	98
	MH625	0.25	5.72	14.6	65	80	128	64	40,000	4.6	92	46
	MH625R	0.25	5.72	14.6	65	80	128	64	45,000	4.6	104	52
	MH637	0.37	5.72	21.2	65	80	199	100	54,000	4.6	124	62
	MH637R	0.37	5.72	21.2	65	80	199	100	65,000	4.6	150	75
	MH646	0.46	5.72	25.9	65	80	250	125	66,000	4.6	152	76
	MH646R	0.46	5.72	25.9	65	80	250	125	80,000	4.6	184	PRODU
	MH832	0.32	8.63	28.5	42	58	175	88	<i>85,000</i>	3.1	132	06

From Magnum 2011
Product Catalog

## Why Use Helical Piles?





✓ Save Money

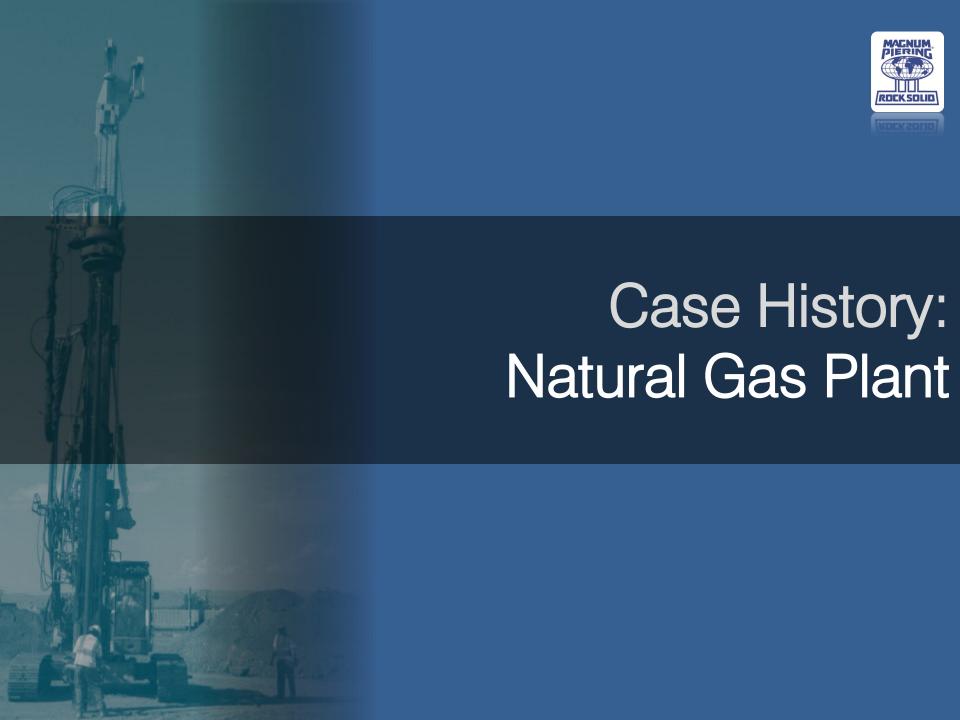
- ✓ Easy to Transport to Remote Sites
- ✓ Doesn't Produce Drill Spoil
- ✓ Minimal Site Work

#### **✓** Save Time

- √ Rapid Installation
- ✓ No Concrete Curing
- ✓ Set Platforms Directly on Piles

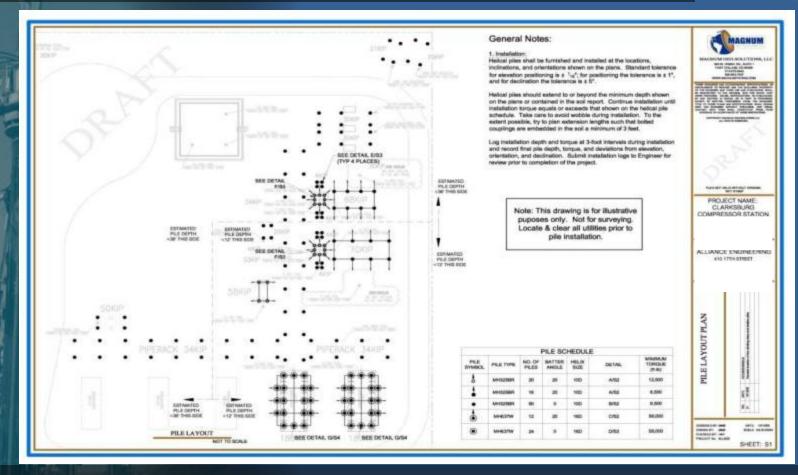
#### ✓ Proven Technology

- ✓Invented in 1836
- ✓ Appears in 2009 IBC & API11G
- ✓ ISO2009 Accredited Manufacturer



## Overall Plant Layout





Compressor platforms were only part of overall foundation plan for gas compressor station. All components (pipe racks, filters, fuel skids, dehydrators, etc.) were constructed on helical piles.

## Gas Compressor Pad





Designing the foundations for vibrating machines is not as simple as dividing the weight amongst the piles. The lifespan and maintenance cycle of compressors and other machines is greatly diminished with improper foundation design and excessive vibrations.

#### Performance

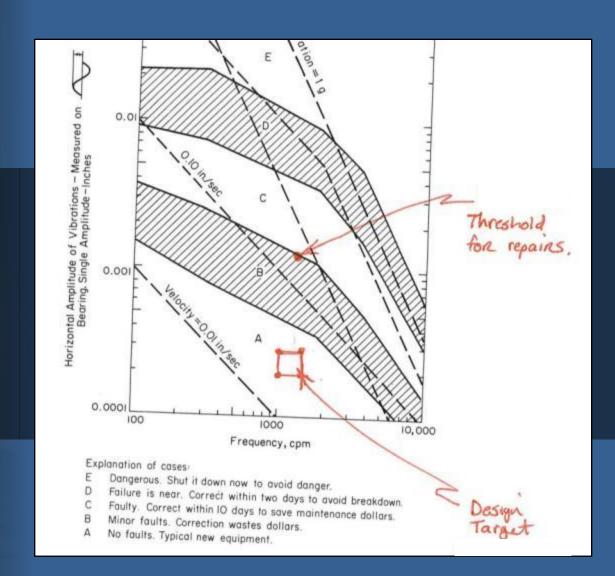




For Equipment Operating at 1,000 to 1,400 cpm:

Target vibration amplitude = <0.0003 inches

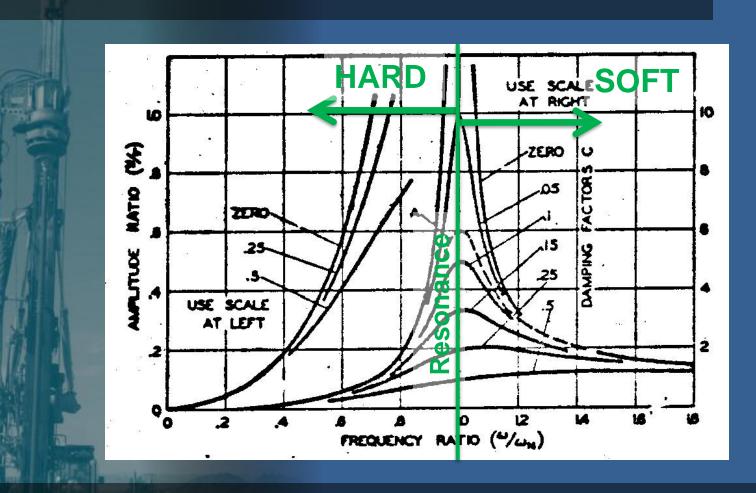
Threshold for repairs = >0.0015 inches



Copyright © 2014 - Howard A. Perko

## Vibration Amplification

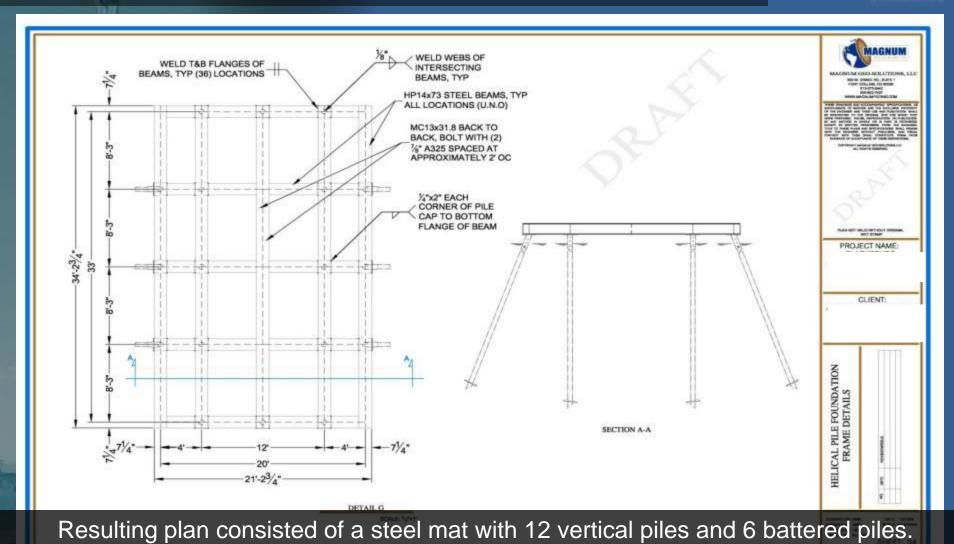




The goal is to design an economical concrete-less helical pile supported foundation whose natural frequency (i.e. stiffness) is far enough away from resonance so as to avoid excessive vibration. A foundation can be designed hard or soft.

## Compressor Foundation Plan





Copyright © 2014 - Howard A. Perko

## Pile Installation





Magnum does not perform installations. Instead we partner with local specialty foundation companies like this crew from West Virginia.



Copyright © 2014 – Howard A. Perko

## Compressor Pad Construction





## Completed Compressor Pad



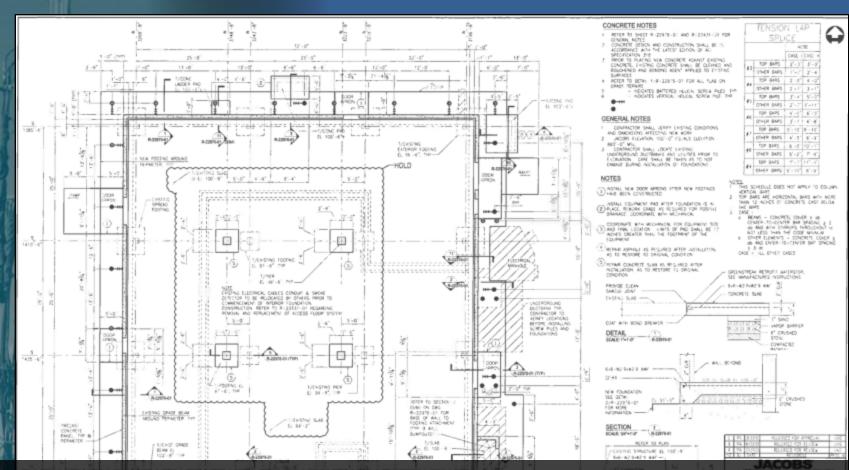


Helical piles saved \$100,000 per compressor pad versus conventional heavy reinforced concrete mat. Compressors were started without incident, vibrations were within target levels, and compressors continue to operate without flaw.



## Control Building Plans



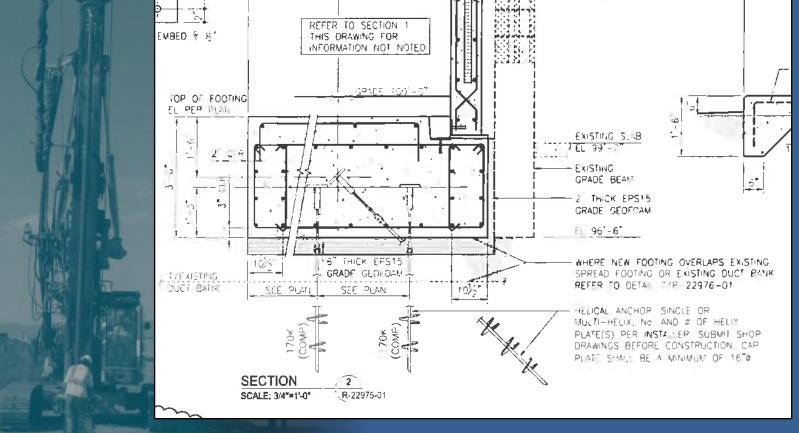


Recent regulation changes require blast-proof walls around refinery control buildings. This requires construction of new reinforced concrete enclosures. Use of helical piles does not produce drill spoil. Piles can resist compression and tension.

## Control Building Details

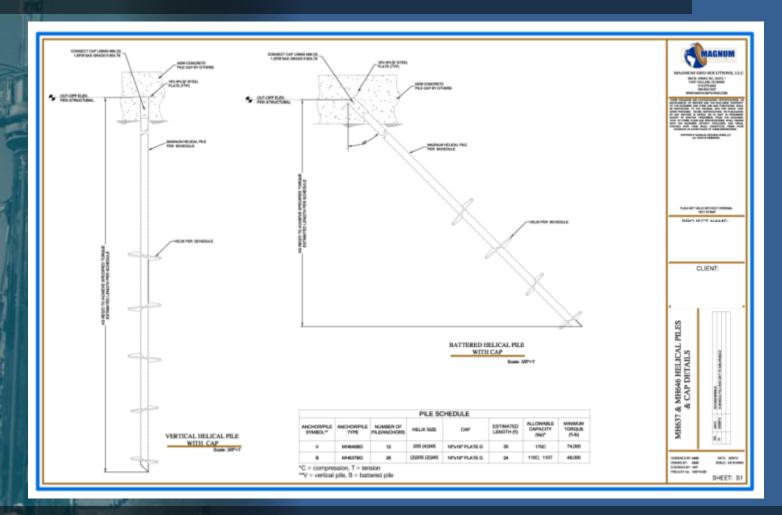


Jacobs Engineering used helical piles for compression, tension, and lateral loads (by battering) to support the new concrete enclosures.



#### Helical Pile Details





Magnum Geo-Solutions provided engineering support. Magnum Piering, Inc. supplied products. Design compression and tension capacity = 110 kips working.

#### Installation and Load Tests





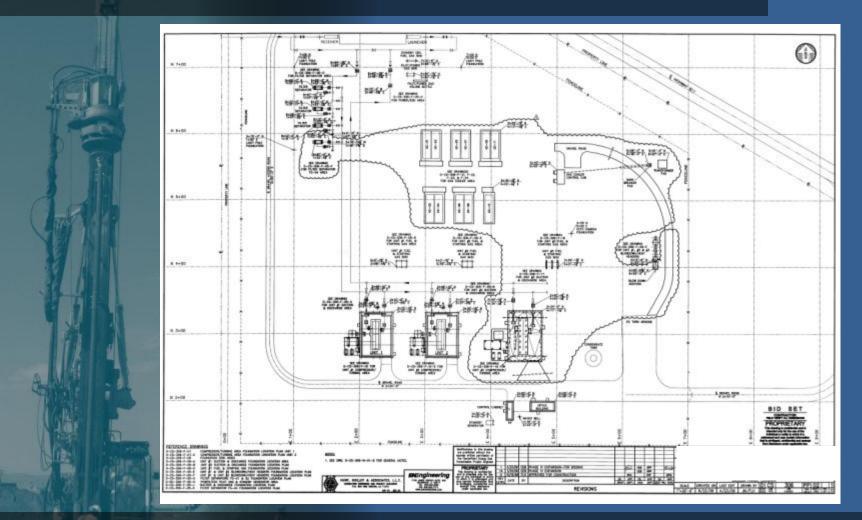


Load tests passed with good results. Measured 0.28 inches movement at 110 kips design compression and tension loads. Installation was completed on budget and on schedule.



#### Foundation Plan



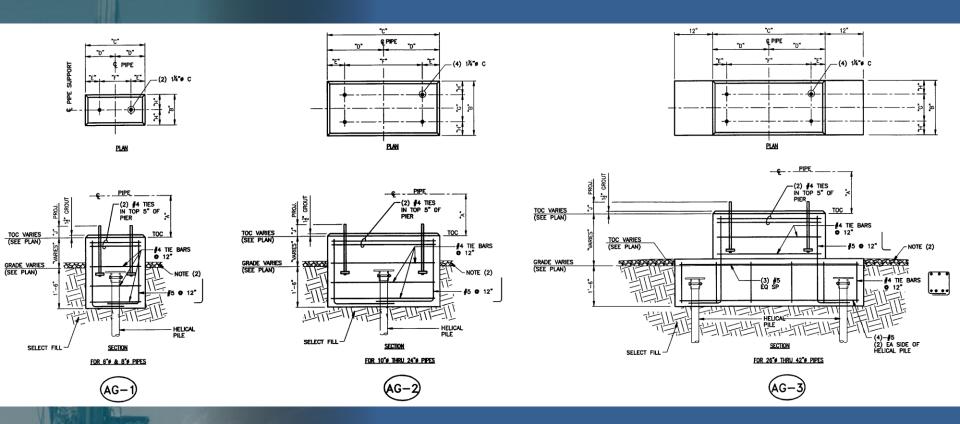


Hunt, Guillot & Associates, LLC of Ruston, LA provided design of compressor station with helical piles and concrete pile caps.

Copyright © 2014 – Howard A. Perko

## Pipeline Support Details





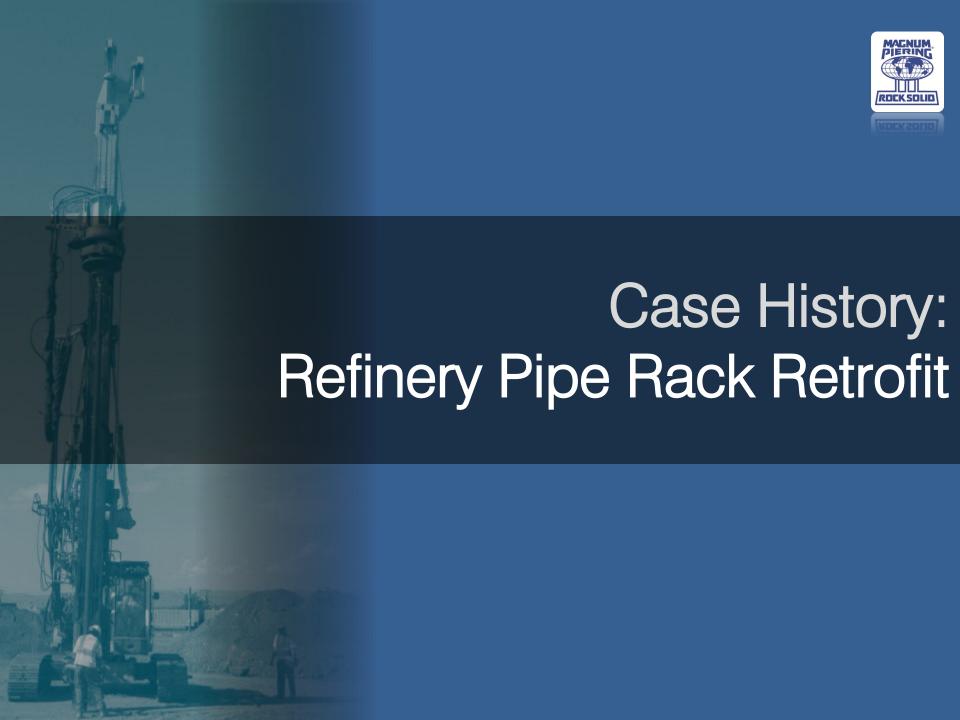
#### Installation Photos







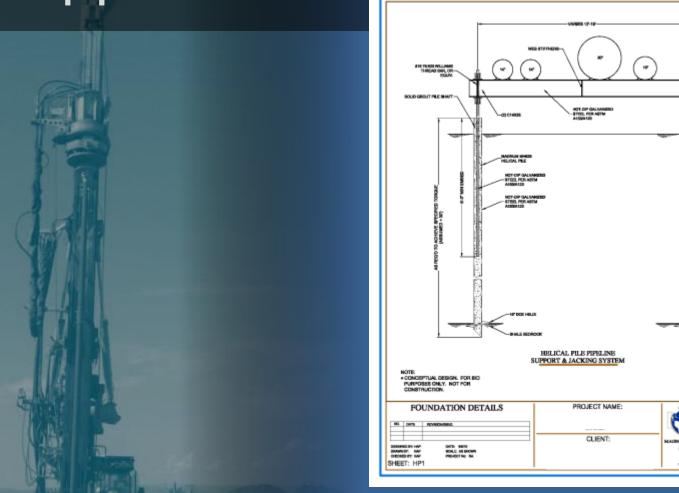
MH425 helical piles installed on schedule and on budget.



Support Detail



NOT TO SCALE



Several miles of existing pipe lines constructed on timber piles with steel cross members experienced settlement and degradation. This detail showing MH530 piles with threadbar and steel cross beam was submitted as a solution.

## Installation Photographs



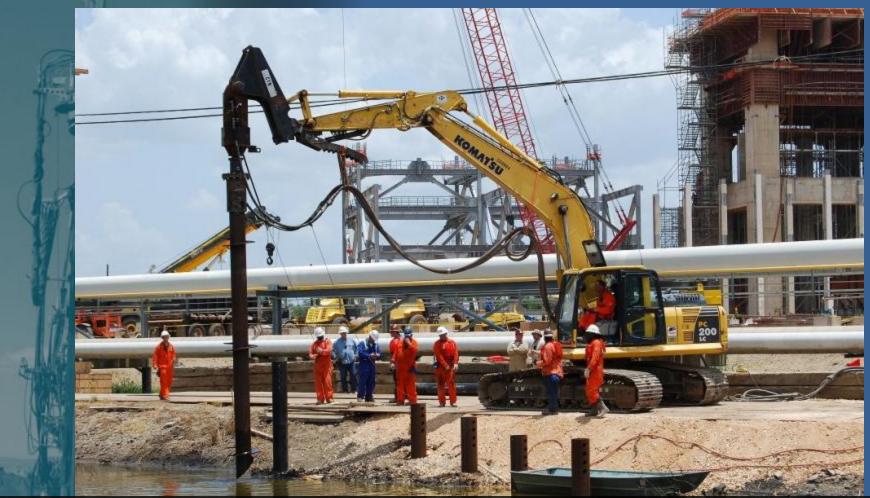


Helical piles were installed on schedule despite challenging work environment. Contractor was able to successfully and safely lift and re-align pipe lines.



## Installation Over Water





Installation of helical piles over water helped protect wetlands from risks of silt, spoil, and contaminants.

Copyright © 2014 – Howard A. Perko

#### Use of Battered Piles





Contractor was able to replace 80 large pre-cast driven piles under this pipeline thrust block with just 20 helical piles by incorporating batter angle to handle lateral loads.

## Pipeline Support





Adjustable caps were used under pipe racks so that bolting could be done instead of welding.

#### Limited Site Access





Helical piles installation equipment was able to access areas that drilling and pile driving equipment could not.

Copyright © 2014 – Howard A. Perko

## Difficult Ground





Helical pile equipment was able to access areas with soft subgrade buy using wooden mats.

Copyright © 2014 – Howard A. Perko









# Case History: Benzene Tank





#### Helical Pile Installation

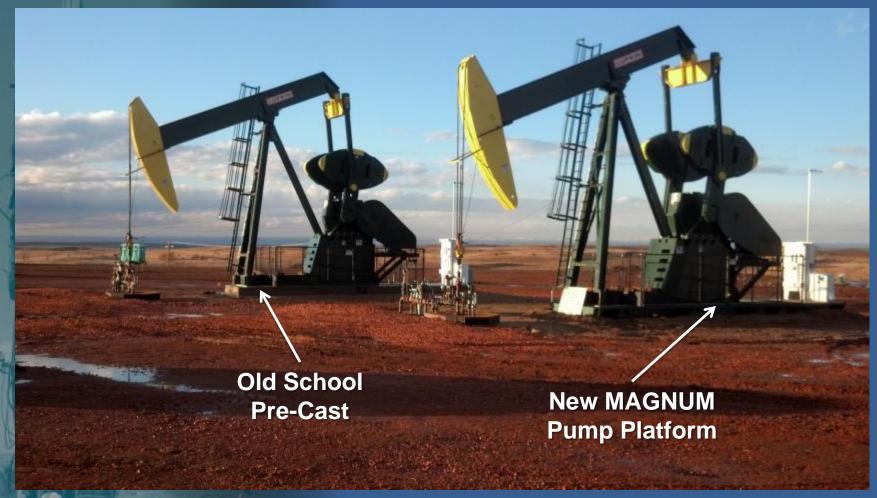




Installation of 10 helical piles is completed in less than one day.

## Pump Unit in Place







## **Contact Information**

Magnum Piering, Inc.

www.magnumpiering.com 800-822-PIER (7437)

6082 Schumacher Park Drive

West Chester, OH 45069

