

H A Y W A R D B A K E R I N C .

VIBRO PIERS

Aggregate Piers for Shallow Foundations

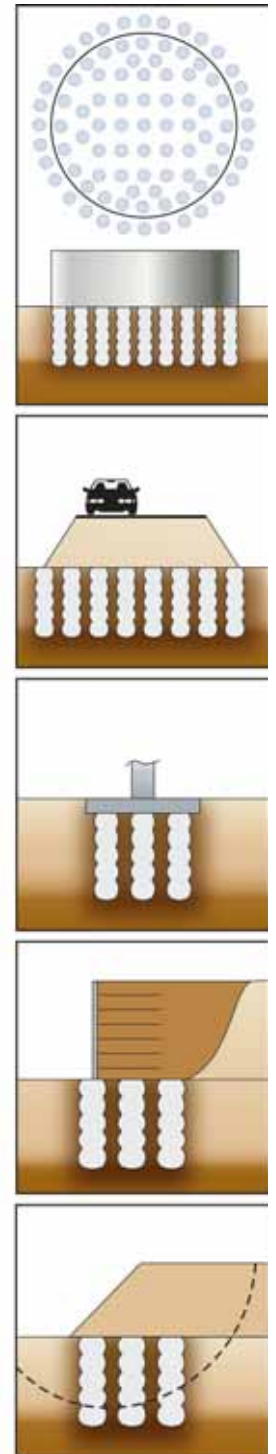
*With over 60 years of experience
on thousands of projects,
Hayward Baker can mobilize
quickly to install a Vibro Pier
system that is often more
cost-effective than other
foundation systems.*



Vibro Piers, also known as aggregate piers, are typically installed to intermediate depths of 5 to 20 feet for the support of new loads. Suited for light to heavy loads, on large or small projects, Vibro Piers are quick to install and very effective at reinforcing the surrounding soil.

Vibro Piers reinforce the ground to increase bearing capacity, reduce settlement, increase global stability and decrease seismic deformations. Vibro Pier technology utilizes a powerful down hole vibrator to compact select aggregate in lifts. The vibratory energy and ramming action of the vibrator causes the dense aggregate to interlock and form a stiff pier that engages the surrounding soil, providing reinforcement and increased shear resistance.

As North America's largest geotechnical contractor, Hayward Baker has the resources to design, build and warranty your project. The vibrators are manufactured in-house, ensuring that performance and reliability are the best in the industry. Hayward Baker's network of regional offices and strategically-located, full-service equipment yards means fast mobilization and reduced start-up costs.



**HAYWARD
BAKER**
Geotechnical Construction



Vibro Pier Technology...

Vibro Piers incorporate the best aspects of the deep vibratory densification technique with the most cost-effective equipment to install aggregate reinforcement for the support of new loads. The technique was specifically developed as a fast and economical treatment for poorly placed fills and shallow cohesive, mixed and layered soils.

Construction Process

Typical construction begins with pre-drilling the pier location to create a full-depth hole with a diameter that is equal to the final pier design diameter. In soft soils, a slightly smaller diameter may be used due to pier enlargement during compaction.

Aggregate is then introduced to the hole and compacted in lifts by repetitive ramming with a powerful, specially-designed vibrator.

The technique will yield reinforced ground conditions to increase bearing capacity and shear resistance, and reduce settlement from new loads. Anchor bars are incorporated during pier construction when tension resistance is required.

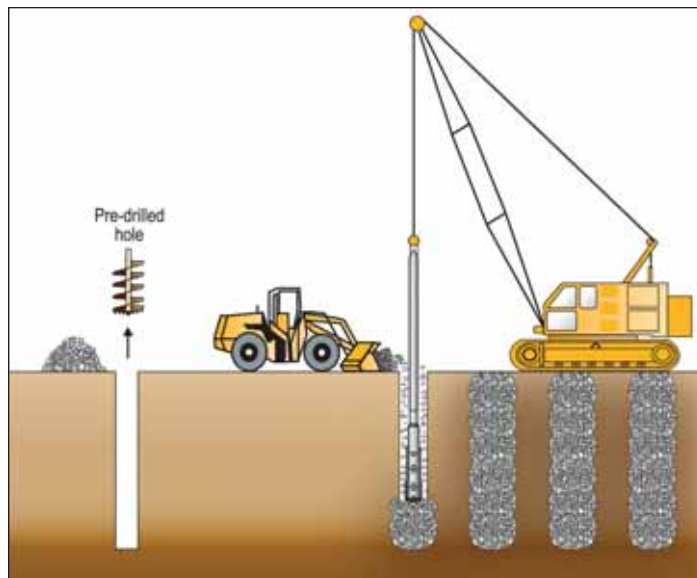
For soils in which the pre-drilled hole will not stay open, the bottom feed process can be used to avoid the need for casing. In the bottom feed process, aggregate is fed through a tremie pipe attached to the vibrator.

For seismic applications, Vibro Piers can be very effective in reducing dynamic settlement. If loose granular layers are present, the process is a very effective densification technique, reducing the liquefaction potential.

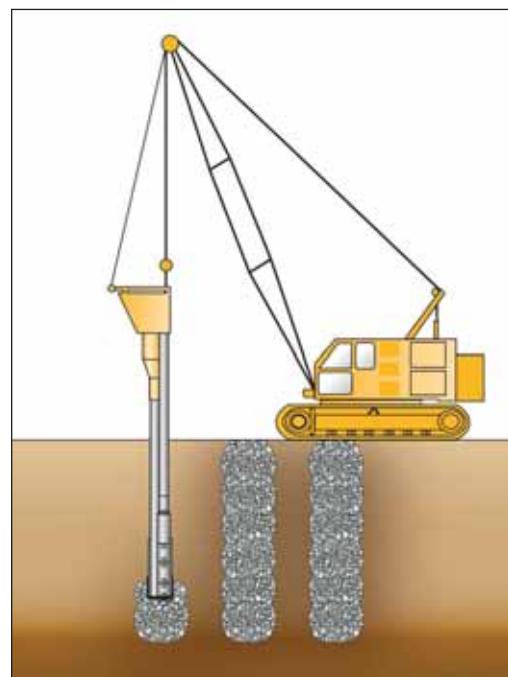
Application

Vibro Piers are suited for support of lightly to heavily loaded structures where soil conditions are soft to medium stiff. Structures that have been successfully supported by Vibro Piers include:

- ◆ *Multi-story buildings*
- ◆ *Commercial centers*
- ◆ *Parking structures*
- ◆ *Retaining walls*
- ◆ *Warehouses*
- ◆ *Wind turbine towers*
- ◆ *Storage tanks*
- ◆ *Roadway embankments*
- ◆ *Schools*
- ◆ *Slopes*

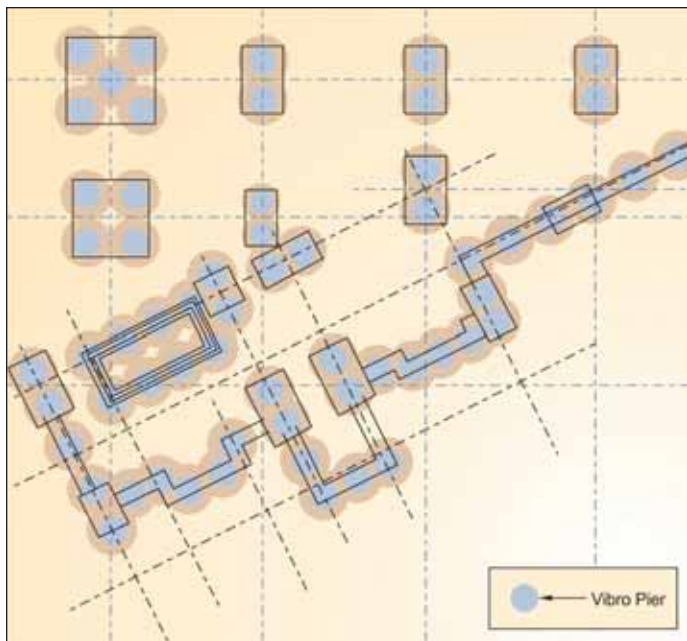


Vibro Pier construction utilizes a pre-drilled hole which stays open during pier construction. A graded, crushed aggregate is then added and compacted in lifts.



With the bottom feed process, the aggregate is conveyed through a tremie pipe to the vibrator tip. The method eliminates the need for casing in unstable soils.

“Vibro Piers significantly reduce construction schedules and project costs by permitting the use of shallow spread footings rather than traditional deep foundation systems.”



A typical arrangement of Vibro Piers for the support of a new building foundation.

Site Investigation

Determining the following ground conditions assists in the design:

- ◆ Gradation of the strata
- ◆ Location of the existing groundwater table
- ◆ Variation of stratigraphy across the project site
- ◆ Shear strength and compressibility of the soil
- ◆ Sensitivity and Atterberg limits

Design

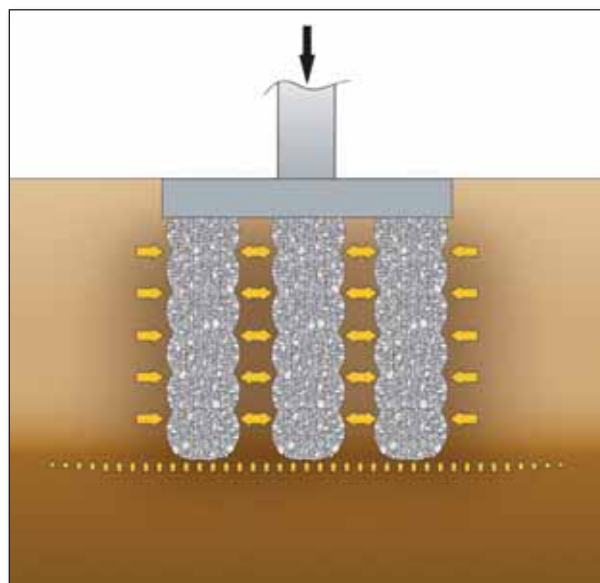
Hayward Baker will design, construct and warranty the Vibro Pier ground reinforcement system.

Quality Control / Quality Assurance

Quality control and quality assurance plans are an essential part of each Vibro Pier program and ensure that the foundation system will meet the project's needs.

Quality control includes procedural inspection and documentation of the work activity, pre-drill diameter and depth, time and energy parameters, aggregate quantity and treatment depth.

Performance of the Vibro Pier system is verified by a Vibro Pier Modulus Test to confirm the pier modulus used in the design.



Schematic of subsurface stress distribution.



Vibro Pier Modulus Test to verify system performance.

Advantages of Vibro Piers

- ◆ *Fastest and least expensive of all the ground reinforcement methods for cohesive soils*
- ◆ *Cost savings over deep foundation designs*
- ◆ *Reduces seismic deformations*
- ◆ *Installed with the highest imparted energy of any aggregate pier system*
- ◆ *Piers are sized for the design load and soil conditions*
- ◆ *Installation methods are customized for the site conditions*
- ◆ *Applicable for stabilization of new embankments*
- ◆ *Permits construction on soft or uncontrolled fills*



Why Should You Choose Hayward Baker Vibro Piers?

Hayward Baker's network of regional offices and full-service equipment yards means fast mobilization and reduced start-up costs. From the job start-up to installation of the last Vibro Pier, attention to quality control ensures that project specifications are achieved.

Using Vibro Piers as part of your foundation system significantly reduces construction schedules and project costs by permitting the use of shallow spread footings rather than a traditional deep foundation system.

Hayward Baker, North America's leader in specialty geotechnical construction, is committed to providing the most economical solution that satisfies the technical requirements of each project. Whether a common situation, or one that requires unparalleled experience and creativity, Hayward Baker assists engineers, contractors and owners with identifying and implementing the right solution for their project.

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