

AGGREGATE PIERS

Aggregate piers for shallow foundations

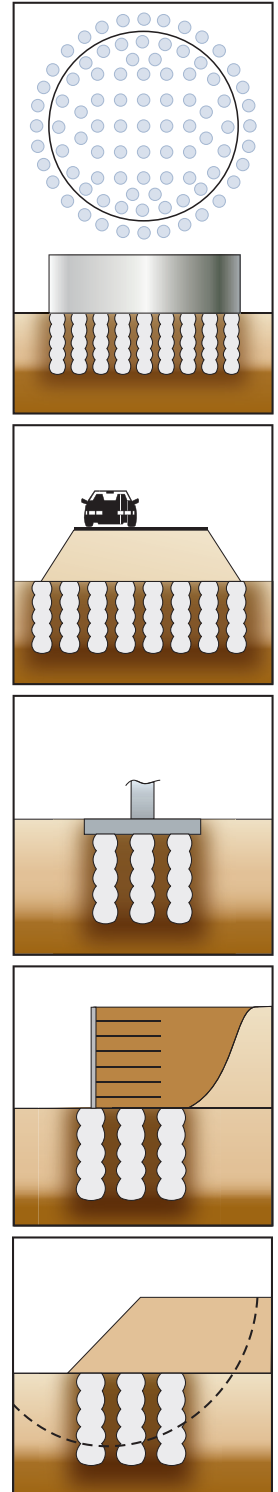
With over 10 years of experience on thousands of piers, Keller can mobilize quickly to install an aggregate pier system that is often more cost-effective than other foundation systems.



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, aggregate piers are quick to install and very effective at reinforcing the surrounding soil.

Aggregate piers reinforce the ground to increase bearing capacity, reduce settlement, increase global stability, and decrease seismic deformations. Aggregate pier technology uses a powerful down hole vibrator to compact select aggregate in lifts. The dense aggregate interlocks to form a stiff pier that engages the surrounding soil to provide reinforcement and increased shear resistance.

As the world's leader in geotechnical solutions Keller 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.



Aggregate Pier Technology...

Aggregate 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.

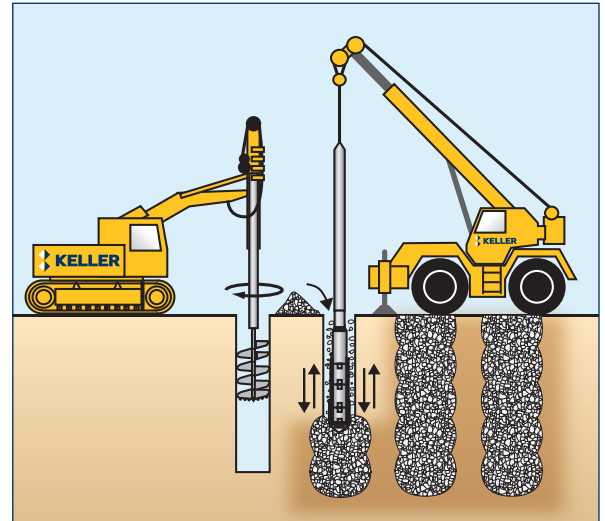
For soils in which the pre-drilled hole will not stay open, the bottom feed process can be used to avoid the need for casing. In the bottom feed process, aggregate is fed through a tremie pipe attached to the vibrator.

For seismic applications, aggregate 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.

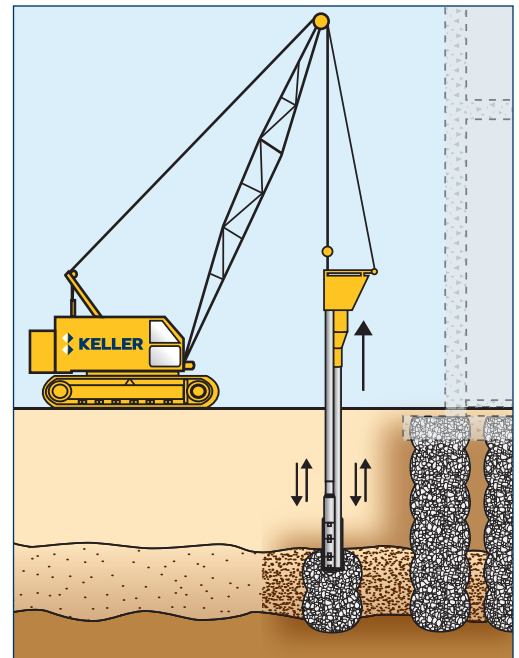
Application

Aggregate 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 aggregate piers include:

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

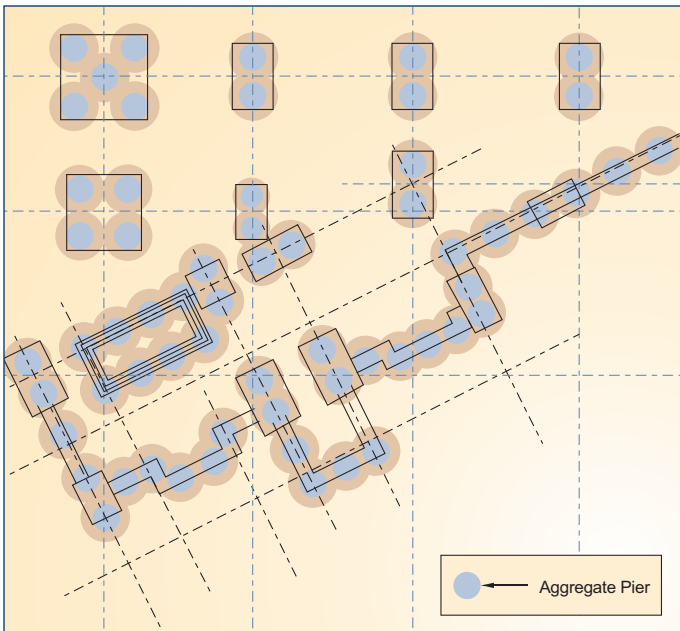


Aggregate pier construction uses a pre-drilled hole which stays open during pier construction. A graded, crushed aggregate is then added and compacted in lifts.

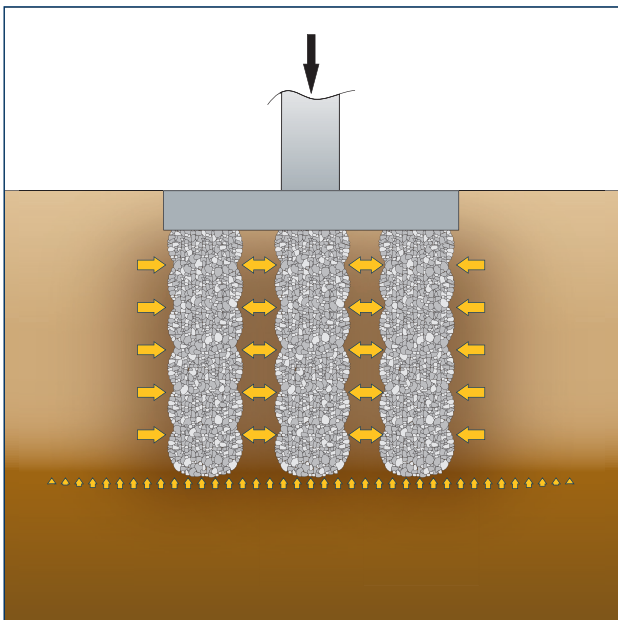


With the bottom feed process, the aggregate is conveyed through a tremie pipe to the vibrator tip. The method eliminates the need for casing in unstable soils.

“Aggregate 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 aggregate piers for the support of a new building foundation.



Schematic of subsurface stress distribution.

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

Keller will design, construct, and warranty the aggregate pier ground reinforcement system.

Quality Control / Quality Assurance

Quality control and quality assurance plans are an essential part of each aggregate 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 aggregate pier system is verified by a modulus test to confirm the pier modulus used in the design.



Aggregate pier modulus test to verify system performance.

Advantages of Aggregate 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*



Keller aggregate pier and pre-drill equipment.

Why Should You Choose Keller Aggregate Piers?

As a leading specialty geotechnical construction firm, Keller provides a full range of ground engineering techniques and solutions, related to earth retention, foundation support, ground improvement, and ground treatment.

Built on a reputation of safety and quality, Keller sets the standard for performance and innovation through our commitment to the integration, implementation, and further development of advanced technologies for

specialized geotechnical construction. With technical excellence, and teamwork at our core, we deliver projects safely, on budget, and on schedule.

Offering a wide range of services, including design-build packages, Keller meets the needs of our clients by providing comprehensive cost-effective solutions to the most complex problems.



Design-Build Services for the Complete Range of Geotechnical Technologies

Grouting

Fracture grouting/compensation grouting
High mobility (rock/fissure) grouting
Injection systems
Jet grouting
Low mobility (compaction) grouting
Permeation (chemical) grouting
Polyurethane grouting

Ground Improvement

Cutter soil mixing
Dry soil mixing
Dynamic compaction
Earthquake drains
Rapid impact compaction
Rigid inclusions
TRD - soil mix walls
Vibro compaction
Vibro concrete columns
Vibro (Aggregate) Piers®
Vibro stone columns
Wet soil mixing
Wick drains

Deep Foundations

CFA piles (auger cast)
Displacement CFA piles
Drilled shafts
Driven piles
Franki piles (PIFs)
Helical piles
Jacked piers
Macropiles®
Micropiles

Earth Retention

Anchors
Anchor block slope stabilization
Gabions
Micropile slide stabilization system (MS³)
Sculpted shotcrete
Secant or tangent piles
Sheet piles
Slurry wall - structural or cutoff
Soil nailing
Soldier piles & lagging

Additional Services

Dewatering
Ground freezing
Pit underpinning
Slab jacking

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