low impact development technical workshop series

PIN Foundations

Topics

Applications

Design and Construction

Flow Control Credits

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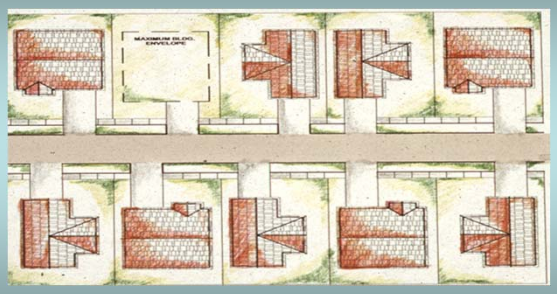
The challenge is to better maintain native characteristics of soils during and after construction



In a typical, dense residential development there can be 50% more roof than road impervious area.

The typical construction approach is to strip, cut, fill and pound

Management of large clearing and grading operations expensive and time consuming.

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Other Foundation Systems

Minimal footprint

Screw anchors

Heavy Equipment
Site Pours
Carbon Release

Vertical piling

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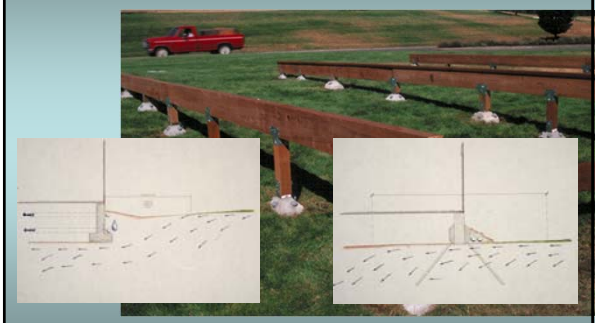
The challenge is to better maintain native characteristics of soils during and after construction



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Wall Systems

Preparation

- Remove minimal material.
- Pea gravel then foam (isolates wall).
- Place forms, pour and drive pins.

Pin placement

- Preferred method is to place pins after pour.
- Can place pins before pour.

Can be applied to different construction applications.

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Wall Systems

Can be used on slopes (stepped) but strormwater credit is reduced due to additional soil disturbance.

Conventional construction from the foundation up with some additional considerations.

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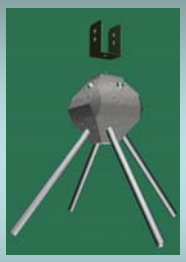
Diamond Piers

- Reduced weight and volume
- No excavation, grading or site pours

Battered Pile Groups with Precast Concrete

Diamond Piers



- DP 50: 50 lbs. residential decks, 1 inch pins.
- DP 75: 75 lbs. homes and light commercial, 1.25 inch pins.
- DP 100: 100 lbs. homes and light commercial, 1.5 inch pins.
- DP 200: 200 lbs. homes and light commercial, 2.0 inch pins.

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Diamond Piers

- Removable Pins
- Bracket Adjustment
- Height Adjustment

Diamond Pier Installation

- Two or three person crew.
- 20-30 minutes per pier.
- No excavation, heavy equipment or site repair.

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Diamond Pier Installation

- Picking the right hammer: primarily driven by soil type determined during initial design.
- Installing pins...

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Diamond Pier Installation

Removing pins...pin sits ~3/4 in above pier.

One and four bolt bracket configurations.

Height adjustment.

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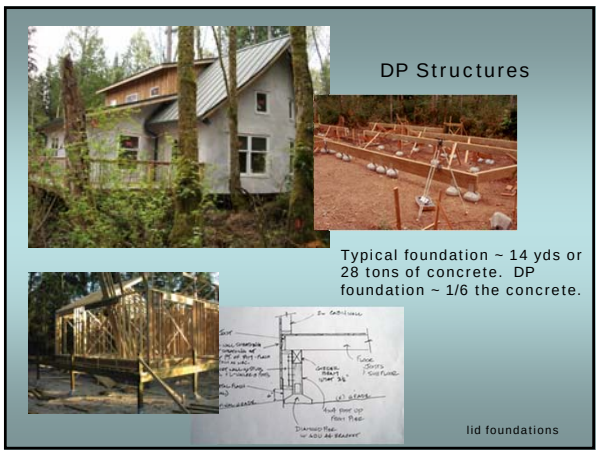
Diamond Pier Installation

Framing and utilities


DP Structures


DP Structures


DP Structures
Typical foundation ~ 14 yds or 28 tons of concrete. DP foundation ~ 1/6 the concrete.
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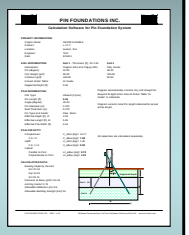
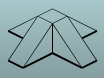
Diamond Pier Design

- Phi angle: internal angle of friction…describes how granular soils hold up when stacked.
- Cohesive strength: characteristic of clay soils.
- In place unit weight.


PIN FOUNDATIONS INC.
Calculation Software for Pin Foundation System



4 pins of equal length per pier. Pin length includes that portion embedded in the pier.

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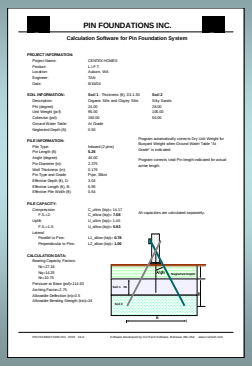
Diamond Pier Design


PIN FOUNDATIONS INC.
Calculation Software for Pin Foundation System

Consider phi angle, cohesive strength and unit weight to determine equivalent bearing area.

Can cut pin if obstacle encountered, but 60% of length should remain.

Arching factor: 2x pile diameter.

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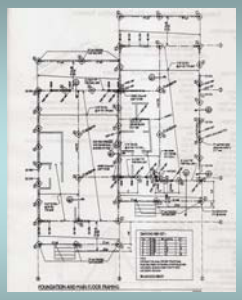
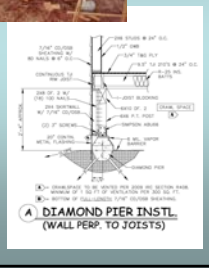
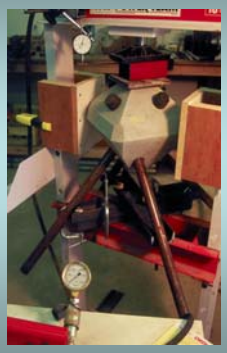
Diamond Pier Submittals





PIN Inc. uses soil work to determine pier configuration. Architect determines loads and location of piers.

Structural Testing



- Concrete head restricts pin from changing angle and provides platform for structure...not load bearing.
- Structural limits

DP-100: 9000 Pounds

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Structural Testing and Certification

Prescriptive load chart in normal construction conditions (soils, structure and site) for DP 50 and 75.

DP 100 and 200 requires soil testing and analysis (site specific) for load.

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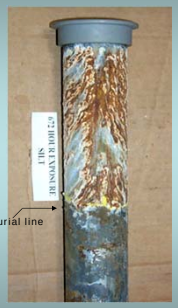
Performance and Durability



Salt Spray Corrosion Test - PSI

- Frost soil heave: pin angle retards uplift and point of pier cleaves/deflects soil around pier.
- Corrosion protection: low oxygen environment reduces corrosion.

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Cost

- Pier costs = 2.5x model # (e.g. DP 100 = $250).
- Cost driven by house size and load paths...i.e. number of piers.
- For poor soils DP cost increase ~ 10-15%. Conventional foundation can increase several hundred percent.
- If stormwater requirements not triggered SFR may not realize savings...that is changing.
- At subdivision scale reduced grading and excavating, and improved stormwater management can induce savings.

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Flow Control Credits

No step forming

- Model as pasture on existing soil if roof runoff is dispersed on the up gradient side of structure according to BMP T5.10 (best flow control credit for low impact foundations).

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Flow Control Credits

Step forming

- Use equation below to determine what portion of roof can be modeled as pasture on existing soil:

$A_1 - [dC(0.5)/dP] \times A_1 = A_2$

A_1 = roof area draining to up gradient
dC = depth of cuts into soil profile
dP = permeable depth of soil (A horizon + some B horizon)
A_2 = roof area modeled as pasture on existing soil

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