Repairing Existing Structures Using Steel Piers or Helical Piles

By: Donald J. Clayton, PE

ECP Steel Piers™

ECP Torque Anchor™ Brand of Helical Screw Piles

Earth Contact Products, LLC
Corporate Office and Manufacturing Facility
15612 South Keeler Terrace, Olathe, Kansas 66062
913 393-0007 - FAX 913 393-0008
Toll Free – 866 327-0007

Texas Sales Office & Warehouse
1340 Post & Paddock, Suite 200, Grand Prairie, Texas 75050
972 206-7002 – FAX 972 206-2022

Engineering Office
4417 Lartan Trail, Richardson, Texas 75082
972 480-0007 – FAX 972 480-0009

Presentation Outline

I. "Fix the Disease then the Symptoms"

A. Find the cause of the distress – "The disease"

1. Moisture Problems
   a. Under slab or crawlway plumbing leaks
   b. Negative Drainage at the perimeter
   c. Improper watering or no watering
   d. Improperly functioning foundation drainage systems, sumps and pumps
   e. Overgrown trees and shrubs adjacent to the foundation

2. Foundation Maintenance
   a. Insure that there is proper roof drainage with gutters, downspouts and splash blocks
   b. Eliminate trapped water in planter beds
   c. Install perimeter footing drains where the water table may rise above the footing
   d. Install swales and French drains to improve surface and subsurface drainage
   e. Install Irrigations system to maintain moisture levels

3. Site Problems
   a. Layers of undesirable material underground (Peat, Buried Trees, Rubble, Land fill, etc.)
   b. Extensive filled areas (consolidating soil)
   c. Cut and fill – (Combination expansive and consolidating soil)
   d. Steep incline – (Lateral soil movements)

B. Fix the "disease"

C. Treat the distress – "The symptoms"

II. Two Methods for Correcting the "Symptoms"

A. Steel Resistance Piers (End Bearing Piles)

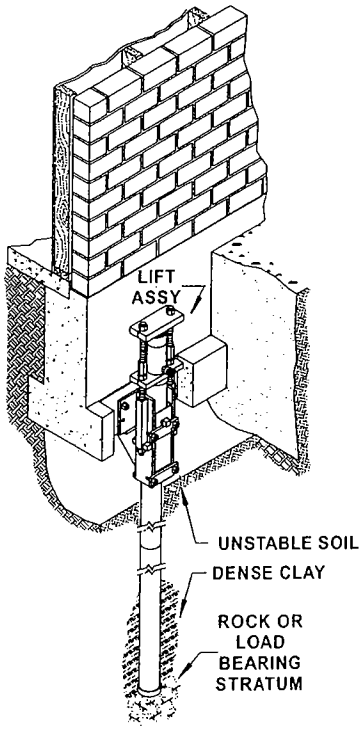
1. Benefits
   a. Quick installation with portable equipment
   b. Easy installation in limited access areas
   c. Soil testing helpful, but not necessary
   d. 100% of piers are field load tested during installation
   e. All weather installation
   f. Little or no "down drag" on pier pipe
   g. No installation vibration
   h. Immediate loading

2. Steel Piers derive support from the end of the pier bearing upon rock or other verified suitable firm bearing

3. Steel Piers do not derive support from the soil

4. Product selection controlled by:
   a. Weight of settled structure
   b. Footing strength
   c. Product capacity
   d. Pier Spacing
   e. Factor of Safety

5. The structure provides the reaction force when installing the pier pipe



ECP Steel Pier Assembly

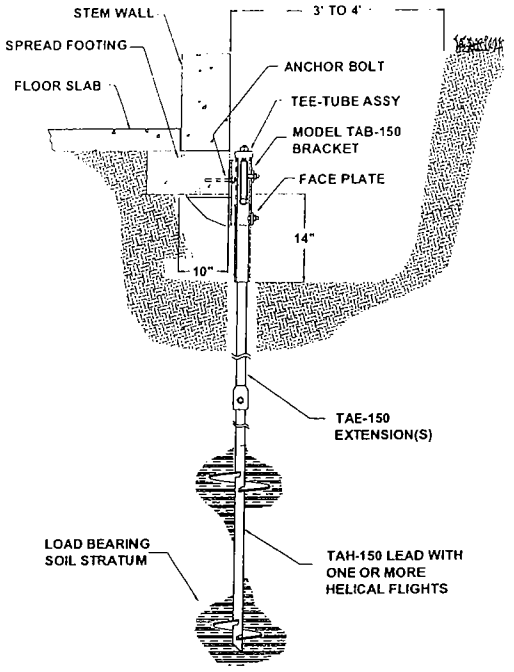
B. Helical Screw Pile (Soil Bearing Deep Foundations)

1. Benefits:
   a. Quick installation
   b. No vibrations when installing the pile
   c. All weather installation
   d. Little or no "down drag" on the pile
   e. Easy installation in limited access areas
   f. Minimum disturbance to the site
   g. Reusable in temporary applications
2. Product selection is controlled by:
   a. Soil capacity
   b. Shaft torsional limits
   c. Installation torque
   d. Product mechanical capacity
   e. Pile spacing
   f. Factor of Safety
3. Helical Screw Pile capacity is directly related to soil capacity
4. Knowledge of the soil is the key to successful Helical Screw Pile installations
   a. Soil test is highly recommended
   b. Helical piles are not appropriate for some soil conditions
      1. Areas where rock is near the surface
      2. Buried debris
   c. Strength of Load bearing soil stratum determines the helical pile configuration
      1. Weak soils require larger diameter helical plates
      2. Dense soils require smaller diameter plates
   d. Capacity of the helical pile is a function of:
      1. The strength of the steel components
      2. The strength of the soil that contains the helical plates
5. Helical Screw Pile Design Considerations
   a. Standard Bearing Capacity Equation -- $P_u = \Sigma A_H (cN_c + qN_q)$,
   b. Helical screw pile design considerations

      Relationship between Installation torque and ultimate capacity - Pu = k x T

      K = 9 to 10 for square bar products

      K = 6 to 9 for tubular products



ECP Torque Anchor™ brand helical screw pile and foundation bracket

III. Determining foundation loads (Detailed examples follow)

A. Break the structure into component parts
1. Roof framing and roofing
2. Ceiling & insulation
3. Exterior covering
4. Wall & floor framing, wall covering, insulation and flooring
5. Stem wall, concrete slab and flooring
6. Live loads
7. Soil loads

B. Soil Overburden – The most overlooked element when estimating loads
   1. Difference between lifting force and working load
   2. Soil near the footing must be lifted in addition to the structural weight
   3. Over time, much soil overburden will dissipate
   4. If soil exists above a spread footing, soil overburden load can be significant
   5. If we ignore the soil overburden, it is possible that the foundation support system may not be able to lift the structure

C. Foundation Load Distribution - Pile spacing rule of thumb
   1. 8" x 16" Spread footing with up to 2,000 lb/lf load
      a. Frame wall = 3-1/2' on center
      b. Footing with Cast 24" concrete stem wall = 8-1/2' on center
      c. 20" Monolithic turned down foundation = 8' on center
   2. 12" x 24" spread footing with up to 5,000 lb/lf load
      a. Footing with 12" high stem wall = 7' on center
      b. Footing with 18" high stem wall = 8-1/2' on center
      c. 24" Monolithic turned down foundation = 5-3/4' on center

D. Job specific Issues
   1. Unsupported column height
   2. Load Testing -- Net deflection of less that 1" under full load with rebound of 1/2" is generally considered acceptable