CASE HISTORY

ECP STEEL PIERS™
STANDARD MODEL 350

New Foundation & Structural Floor Stabilizes Residence
Broomfield, Colorado

The engineer called for a complete rebuild of the foundation and basement floor system for this unstable upscale residence. The house was built upon expansive soil using shallow concrete caissons. The extensive renovation consisted of installing 65 steel piers inside the basement, excavating soil from the basement area, disconnecting and abandoning the original concrete caissons that supported the structure, installing a new perimeter drainage system and installing a new structural floor system.

Project Summary	
Project:	Repair and Renovation Residential Structure Broomfield, Colorado
Engineer:	York Engineering & Survey Services, Inc. Denver, Colorado
Installing Contractor:	Park Range Construction, Inc. 2755 South Raritan Street Englewood, Colorado
Product Installed:	Model 350 ECP Steel Pier™
Number of Placements:	65
Average Depth:	30 ft
Ultimate Capacity:	99,000 lb
Average Test Load:	53,000 lb
Average Working Load:	26,500 lb
Factor of Safety:	2.0 : 1 Test Load to Working Load 3.7 : 1 Ultimate To Working Load

The Model 350 ECP Steel Pier™ System installed here used 3-1/2 inch diameter tubular steel pier pipe that was hydraulically driven to an average depth of 30 feet below the footing to reach a geologic stratum that provided verified end bearing for supporting the structure.

Photographs from top:

- Workers demolished the basement slab and remove up to 18” of soil to allow for disconnecting the existing concrete caissons and clearance for the new structural floor.
- The technician at right is using a rock drill to provide pier pipe access through shallow rock and boulders.

Each pier was advanced through the expansive soil until the pier encountered firm load bearing. Once reached, each ECP Steel Pier™ was field load tested. This field load test consisted of placing a force greater than the required design load on each pier. This kind of 100% load testing verified that the bearing stratum at each pier placement was suitable for long term structural support. In this case the engineer wanted a factor of safety of twice the design load on each pier. In addition to this field load test verification, the Model 350 Pier System provided an ultimate mechanical capacity of over 3.7 times the design load. Long term reliability is assured by this kind of design and load testing.

At each of the 65 pier locations a pier bracket was attached to the foundation. Once all piers were installed, inspected and load tested, the structural weight was transferred from the concrete caissons under the structure to the ECP Steel Piers™. This gentle and uniform load transfer was accomplished by banks of hydraulic jacks that were all connected through manifolds to hydraulic pumps. One jack was installed on each pier bracket to accomplish the load transfer and any required foundation elevation adjustment.

Photographs from top left:

- The pier installation configuration is shown. A drive stand was attached to the pier bracket. The pier pipe was then driven hydraulically to the bearing stratum. Notice that there are several 3-1/2 foot long sections of pier pipe visible next to the drive stand.
- A technician monitors the installation of the ECP Steel Pier™ pipe.
- Each ECP Steel Pier™ was load tested to twice the engineer's load requirement. Here a hydraulic ram applies the test load to the pier. The force on the system is monitored by the pressure gauge.
- Once all steel piers were installed and tested, the entire structural weight was transferred at the same time from the builder's caissons to the steel pier placements. This minimized the stress to the foundation beams and allowed for recovery of any lost elevation.

Photographs below:

- The original concrete caissons were cut from the foundation beam once the building weight was transferred to the ECP Steel Piers™, and then a soil retaining system was installed below the concrete beam prior to fabricating the new structural floor.

With all of the ECP Steel Piers installed, tested and loaded; the project was ready for installation of the perimeter drain pipes and the new structural floor system. The new floor design was supported off the ECP Steel Piers™ and the existing concrete perimeter beams. The floor spanned above the soil under the house. This design provided support and stability to the entire structure on the 30 foot deep ECP Steel Piers™. The structure would no longer be subjected to the shrinking and swelling of the expansive soils found near the surface.

Photographs above:

- The view at the top right shows all piers installed with the loads transferred. The project is ready for the installation of the perimeter drainage piping and the structural floor system.
- In the photograph left above one can see the joist and girder framework being installed to support the new suspended concrete floor. The center photo shows the corrugated steel deck installation on top of the joist and girder framework. Finally, the new floor was cast. A radiant heating system was embedded to provide warmth in the basement.

Photograph right:

- Once the floor system was completed, final cosmetic touches made the space ready for decorating.

The project was completed on time and within budget by using ECP Steel Piers™.