

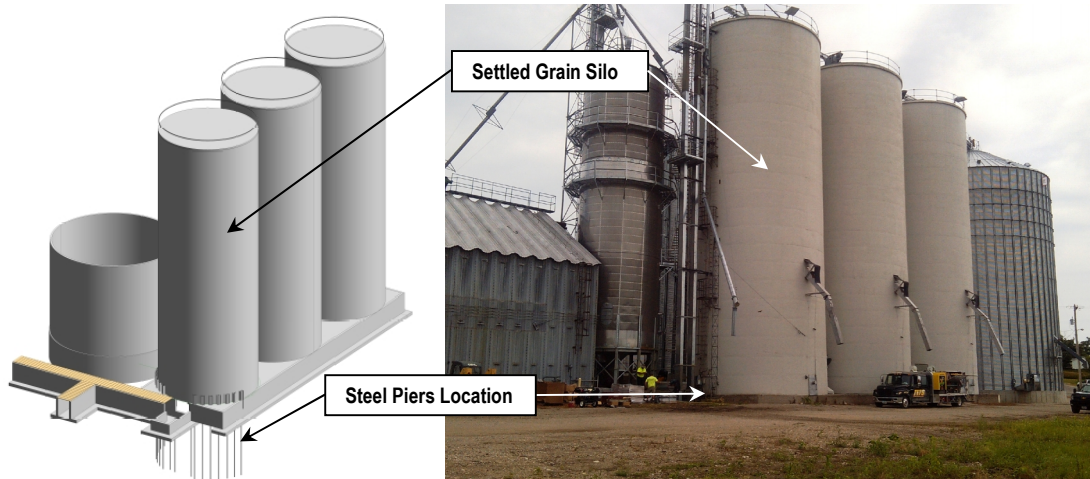
# CASE HISTORY

## ECP STEEL PIERS™ MODEL PPB-350



Poor drainage caused softening of the soil underlying the foundation at one side of a 100 foot tall, 30 foot diameter grain silo. The total structural weight of the silo was estimated at 680,000 pounds and the silo has a grain capacity of 1,265 tons. The engineer estimated that the northwest portion of the foundation had settled four inches causing the silo to tilt.

### Leaning Grain Silo Restored with ECP Steel Piers™ Garrison, Iowa

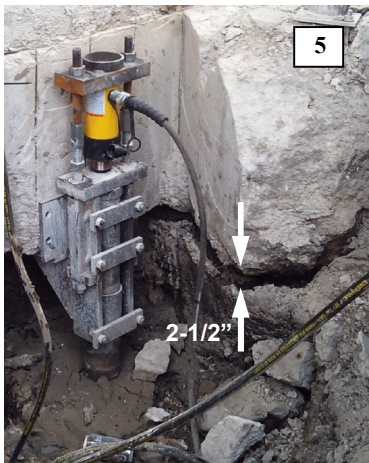


The engineer concluded that the settlement was the result of compromised support under the foundation as a result of moisture intrusion through a crack between the walls and slab. The subsequent freeze and thaw cycles over several years expanded the foundation crack allowing more water intrusion each year, which eventually permitted flow and erosion of the underlying soil. The moisture laden soil under the footing and void under the silo caused the failure of foundation support for a part of the structure. Maximum settlement exceeded four inches.

The engineer recommended deep foundation piles to transfer the structural load from the failing soil under the footing to a suitable load bearing stratum below the surface. ECP Steel Piers™ were selected for rapid repair and restoration of lost elevation with the least disturbance to the weak soil adjacent to the silo foundation. The PPB-350 Steel Pier System uses 3-1/2 inch diameter pier pipe. For additional stability, and to increase the moment of inertia (stiffness) of the steel pier, 4 inch diameter pipe sleeves were installed over the pier pipe. The sleeve joints and the pier joints were staggered to strengthen the coupled joints of the pier system.

The Model PPB-350 ECP Steel Piers™ were installed on this site using vibration free hydraulics to achieve depths between 35 and 50 feet below grade where end bearing was encountered. Once end bearing resistance was found, a proof test was applied to each pier. Depending upon where the piers are mounted on the structure, proof test forces ranged from 56,000 to 66,000 pounds. All testing was performed prior to placing the ECP Steel Piers™ into service.

Project Summary			
Project:	Johnson Farms Grain Silo Restoration		
Installing Contractor:	Iowa Wall Sawing Independence, Iowa	Engineer:	Mark Schuchard, P.E. VJ Engineering, Coralville, Iowa
Product Installed:	ECP Model PPB-350 Steel Pier™ with 4" Sleeving to 25 feet		
Number of Placements:	18	Average Proof Test:	60,000 lb
Ultimate Capacity:	86,000 lb	Average Working Load:	48,000 lb
Factor of Safeties:	1.3:1 Test Load to Working Load		1.8:1 Ultimate to Working Load



- ### Installation and Restoration Sequence
1. Prior to ECP Steel Pier™ installation, access for the pier brackets and pipes were made. Most of the steel piers were installed on the outside of the silo, but where there were obstructions outside; the piers were installed from the inside of the silo.
  2. The PPB-350 Footing Brackets were installed and bolted in place with the bracket bearing plates in contact with the undersides of the footings. The technician is shown installing the 3-1/2 inch diameter pier pipe into the soil until suitable firm bearing was encountered. Once the bedrock was reached at depths ranging from 35 to 50 feet, the technician installed 25 feet of 4 inch diameter sleeve over the pier pipe to stiffen the pier shaft and strengthen the coupled joints. Following the pipe and sleeve installation, each placement was proof tested to 60,000 pounds to verify the competency of the load bearing stratum.
  3. Once all of the piers were installed and proof tested, hydraulic rams applied 48,000 pounds of force at each placement simultaneously to recover the lost elevation. The load at each placement location was monitored by a pressure gauge.
  4. Lifting the silo was accomplished by placing a 25 ton hydraulic ram between the top of the pier pipe and a lifting assembly that was attached to each pier bracket.
  5. The engineer specified a maximum recovery of 2-1/2 inches. Full recovery was restricted by external connections to the silo and other existing structural conditions.
  6. Once the lost elevation was recovered, the bolts on the pier caps were tightened and the hydraulic lifting rams and lifting assemblies removed. Afterwards, the void beneath the silo slab was injected with polyurethane foam to provide uniform support under the slab prior to filling the silo.

Disturbed soil in the area of work was replaced and concrete that was removed for access to the foundation was replaced. Drainage corrections insured that the cause of the settlement was removed.

This successful project was completed on time and within budget by Iowa Wall Sawing.

**ECP Steel Piers™**  
*"Designed and Engineered to Perform"*

