Case Study

PNA JOINT STABILIZERS IMPROVE WAREHOUSE OPERATIONS

A national auto parts supplier has a 400,000-square-foot facility in New York that services the company's East Coast stores. It loads and unloads about 30 trailers per day.

Various types of material handling equipment, including reach-fork trucks, order pickers, dock stockers and pallet jacks, are used to move inventory between the docks and bulk storage racking. The maximum load carried is about 5,000 lbs.

Challenges

Soon after the auto parts supplier moved into the facility, the company discovered the floor joints were loose and rocking.

Most contraction joints were saw cuts that relied solely on aggregate interlock to transfer loads, resulting in the positive load transfer loss when the joints opened, leading to concrete damage and expensive equipment repairs. Patches didn't last.

PNA Solution

PNA Joint Stabilizers are the optimal solution for loose, rocking joints in industrial floors, especially in high-speed lanes. The auto parts supplier used the stabilizers at the distribution center, and 10 years after installing the product, the stabilizers are working as well as ever.

Background

The floor slabs at the facility are 7 inches thick, with joints spaced 18.75 by 20 feet apart. The concrete – a normal 4,000-psi mix – was only reinforced with dowels at widely spaced construction joints. No load transfer devices were used in the contraction joints.

When the joints opened over time, positive load transfer was lost, causing the panels to move

up and down independently. Lift truck drivers began noticing bumps and knocking sounds as they crossed the deflecting joints. Joint edges began to chip and break, requiring patches that failed to last.

The facility manager at the distribution center estimates the warehouse replaced 20 load wheels per month because of the joint issues. The costs didn't stop there.

"We also replaced two bearings per load wheel, along with switches, springs, bump stops and other related parts that were affected by the constant hard jolting," he says. "You also have to factor in the labor costs that it takes to repair each vehicle and the lost productivity of the operator while the lift is down."

A consultant recommended filling the joints with semi-rigid material, but that didn't work. Other options the facility manager considered included retrofit dowels and sub-slab grout injection, but both had severe drawbacks. Sub-slab injection was expensive, and there was no guarantee the fix would be permanent, especially with the big temperature swings the floor experienced. Retrofit dowels could handle the thermal changes, but were even more expensive and would have required prolonged downtime, disrupting operations. That wasn't an option.

"Besides safety, our highest priority in this building is production," the facility manager says. "Any downtime can cost the company thousands in lost work time and would keep us from getting the product to our stores, resulting in lost sales."

The Fix

After evaluating the alternatives, the auto parts supplier chose to conduct a trial using the Joint Stabilizer system to see if it would resolve the distribution center's joint deflection problems. The company installed the stabilizers in 10 loose joints in 2005. Crews placed four stabilizers at each joint intersection and spaced others every 4 feet along the joints and in a few cracks.

The auto parts supplier measured differential deflection under load, before and after repair. The "before" readings ranged up to 0.050 inches – well above the maximum threshold of 0.010 inches defined in the ACI 360R-10 industry standard for lift truck traffic with small, hard wheels. After workers installed the stabilizers, deflection was reduced to only 0.001-0.002 inches, resolving the problems that had plagued the facility for many years.

Relative joint movement before and after installation of SD7 joint savers

Joints tested	Differential movement before repair	Differential movement after repair
Mean of all 10 joints (160 total readings, 16 readings per joint)	**0.021 in. (0.53 mm)**	**0.001 in. (0.03 mm)**
Worst joint (greatest movement before repair)	**0.050 in. (1.27 mm)**	**0.002 in. (0.05 mm)**
Best joint (least movement before repair)	**0.003 in. (0.08 mm)**	**0.001 in. (0.03 mm)**

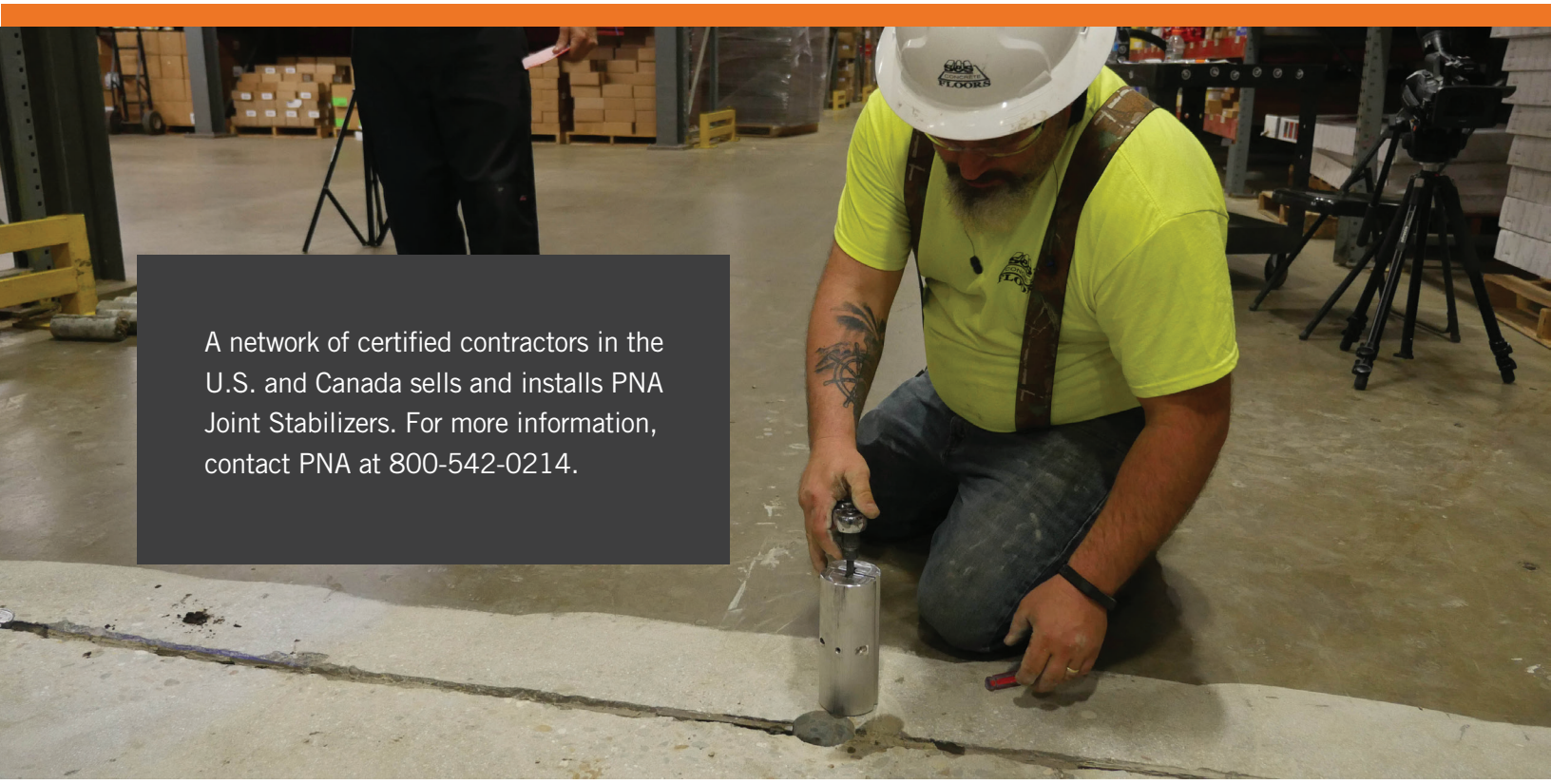
The auto parts supplier monitored the trial repairs for 2.5 years. Although the joints continued to widen, the stabilizers retained their effectiveness, and the movement under load remained minimal. Heartened by this success, the company decided to repair all the high-traffic lanes in the facility.

In 2008, an additional 1,542 stabilizers were installed. The plant remained operational while the work was completed, with minimal interruptions. Deflection readings after the floor was stabilized matched those obtained during the trial.

Ten years later, in 2018, a team returned to the facility to see how the Joint Stabilizers were performing. A forklift truck carrying a 5,000-pound load was driven over the joints that had been stabilized a decade earlier and new deflection readings were taken. The readings showed deflection values between 0.001 and 0.003 inches – virtually unchanged from when the stabilizers were first installed, and still well below the 0.010-inch threshold for differential deflection specified by ACI for small, hard-wheeled truck traffic.

The team also installed several new stabilizers in joints where deflection problems had surfaced over the previous decade. In these cases, the amount of deflection decreased from a maximum of 0.021 inches to an average of 0.004 inches after stabilization.

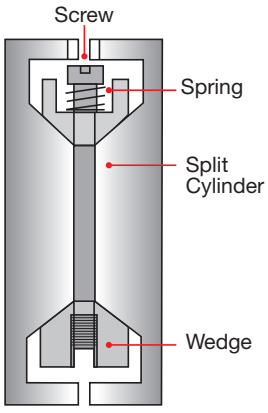
The facility manager, who still works at the distribution center, says the Joint Stabilizers "have significantly reduced the amount we have to lay out for wheels and bearings on our lifts. They've also increased the comfort and safety of our lift drivers, reducing the amount of vibration they are exposed to daily."



A network of certified contractors in the U.S. and Canada sells and installs PNA Joint Stabilizers. For more information, contact PNA at 800-542-0214.

The Joint Stabilizer is an aluminum cylinder that is split into two halves lengthwise. The cylinders are 3 inches in diameter and are 5, 6 or 7 inches tall. The device fits into a drilled hole centered on the joint. A screw pushes the two halves apart when torqued, locking them into place with about 8,000 pounds of force.

Springs maintain the outward force, even if the joint subsequently opens wider from drying shrinkage or thermal contraction. Installation of each cylinder can be completed in minutes. And because it's a mechanical device that doesn't involve chemical curing like sub-slab injection and retrofit doweling, the floor can be brought back into service immediately after installation.



JS7 (7") JS6 (6") JS5 (5")

ACI 360R-10 Guide to Design of Slabs-on-Ground Section 6.2

"Joints or crack stability measurements below 0.010 inch (0.25mm) for joints or cracks subjected to lift truck wheel traffic with small hard wheels will have good service life. For lift truck traffic with large, cushioned rubber wheels, a joint or crack stability measurement of 0.020 inch (0.51mm) should have good service life."