When Good Floors Go Bad

White Paper: Industrial Productivity Series

Initial Release: Winter 2009

PRIME RESINS
Injecting Life into Infrastructure
A BARTON INDUSTRIES COMPANY

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When Good Floors Go Bad

All buildings have them and we rely heavily on them, yet most floors are neglected. Your company could be paying the price for it.

There are two types of floors — those that are conducive to productivity and those that can be labeled productivity black holes. The first type helps make you money, while the second steals from you in ways you may have never considered.

Impact on Productivity

Warehouse floors come in many shapes and sizes: Large, small, heavy duty or regular, polished or coated, super flat or sloped to drain. No matter the type of floor, they all can have the same common problems.

Random cracks, bad joints, curled edges (thumping joints), spalls (pot holes), delaminations (overlays), and moisture problems can and do occur on older floors as well as many that have been newly constructed.

All these problems cost you valuable time and money. Many people never consider what bad floors are costing them in lost productivity and related costs. It is those "related costs" that are often overlooked and under-valued.

Most warehouse facilities run a fleet of electric hard wheeled forklifts. These lifts do not have a suspension system to absorb the shaking, rattling, jarring, thumping, and other forms of abuse that bad floors can deliver to them. All have expensive electronic components and batteries that can cost thousands of dollars to replace. Main drive and out-rigger tires are replaced long before they wear out due to damage. Forklift batteries are expensive and constant jarring knocks the paste off the plates causing them to short out prematurely. Forklift operator fatigue also becomes an issue when the jarring and bouncing begins to affect a driver's productivity. Recently in one facility a worker on a double pallet electric walkee/rider pallet jack was thrown coming around a corner and broke her wrist as a result of a bad floor joint. This incident resulted in a worker's compensation claim and a reduction in productivity due to this reportable lost time injury.

Figuring out whether or not a floor problem exists can be easily done by analyzing forklift maintenance expenses. How many batteries and tires were purchased last year? What was the average age of any replaced parts? Were parts replaced due to wear or damage? Often a piece of equipment will be off the floor for days while being repaired, awaiting the arrival of parts and leading to more lost productivity. While these increased maintenance costs may affect different department budgets, the impact is reflected by the company's bottom line. The solution is to fix the problem at its source, allowing everybody to win. Fleet and maintenance costs, operator fatigue, longer cycle times, and reduced building value can all impact a company's productivity and bottom line. Prime Resins can help facilities increase productivity by providing the materials, tools, and expertise needed to fix the problem at its source – the floors.

Common Issues

Slab Curl: As concrete cures moisture is lost from the concrete mix. The surface can cure faster than the middle and bottom of the slab. As the water is hydrated the concrete contracts the top of the slab contracts creating surface tension. This tension causes the ends of the slab section at the joint to pull (curl) up creating a void between the concrete slab and the soil below. As the forklift drives across the

floor the weight causes the slab to deflect allowing the tire to impact the joint face of the adjacent slab panel. Over time the joint edges deteriorates. Slab curl must be addressed first before repairing the joints. This step is often overlooked and often just more joint sealant is placed in the joint. This will fail as joint sealants are designed for movement in expansion and contraction (joints opening and closing) not in shear (up and down movement). If you have rocking slabs they must be stabilized first or you are just wasting time and money.

Solution – Inspection and sounding to locate and map voids is the first step. Once done the map can be used as a guide for areas to be treated and when based on budget limitations. A scale of 1 – 3 can be used to prioritize different areas.

Injection of a high strength, high density polyurethane foam (Prime Flex 985 – LX10) is used to stabilize the slabs and prevent rocking. This process can be done even when the facility is in operation or after hours. Typically holes are drilled through the floor to inject the resin. The resin reacts to create a dense foam to fill the void and support the slab. Floor can be opened to traffic as soon as 45 minutes after the injection process is done. This eliminates long-term aisle closures waiting for the repair to cure. Once the slabs are stabilized the top of the slabs may need to be ground flush with each other so the slabs are the same elevation across the joint to providing a smooth transition from one slab to the other. This is not due to the stabilization process but the difference in the amount of curl from slab to slab surface.

If joint edge deteriation (spalling) has occurred then rebuilding / repairing of joint nosing shall be done prior to filling of joints with a semi rigid epoxy or polyurea joint filler. Repair of joint nosing should be done with an epoxy or polyurea material for long-term durability.

Control Joints: In order to control the location of cracks in the slab due to curing control joints are used. Control joints are cut in the slab at predetermined locations to weaken the slab allowing the concrete to crack from the bottom of the control cut to the bottom of the slab. Control joints need to be cut at the right time and to the right depth, generally they are cut one-fourth the slab thickness. In most new facilities the joints are not filled right away. It is best to wait as long a possible to allow concrete shrinkage to occur. Concrete can shrink as much a 1/8" in 20 feet during cure and into the first year. Waiting as long in the first year as you can will reduce joint material stress.

Solution: Joints should be filled with a semi rigid epoxy (Joint Shield 5000) or polyurea joint filler (Joint Shield 5500 GP). For new construction an epoxy filler will perform better in green floors (new slabs –less than one year in age) and after a year epoxy or polyurea will perform well. Polyurea based resins are affected by moisture during installation and in green concrete can cause bonding issues. Polyureas are faster to set up and are used when minimal down time is required and for cooler and freezer applications due to the temperatures. Joint fillers typically have relatively low bond strength. This is by design so as not to weld the joint together, if too much joint movement is encountered, the filler will loose bond before causing the concrete to crack. All joints should be saw cut and cleaned prior to filling to ensure a clean bondable concrete sidewall surface. Joints should be free of any dust dirt and debris when filling. Joints should also be over filled and then shaved or ground flush with concrete. The goal is to have a totally smooth transition from one slab to the next.

Random Cracks: Random cracks in a floor can occur for a variety of reasons; control joints not cut soon or deep enough, excess shrinkage, overloading, sub base problems allowing slab deflection.

Solution: Typically these random cracks are filled by a rout and seal method or filled by gravity feeding with epoxy resin. The material can be the same semi rigid material used in the control joints or a high strength epoxy effectively welding the slab back together and making any slab movement occur at the joints.

Spalls: Spalls, pop outs, voids, chips, are common in older floors due to abuse, normal wear and tear, equipment movement, or machinery anchor bolt removal. Unprotected joint edges can also be spalled back.

Solution: These can be repaired using an epoxy or polyurethane based resin. For small repairs (1 inch X 1 inch) filling with a neat epoxy (Prime Bond 3000 or Prime Bond 3100) or a fast setting polyurethane (Floor Fix) resin will be okay. For larger areas use a mortar made from any of these resins mixed with an oven dried sand. The amount of sand to add can vary but is generally from 2 – 5 parts sand by volume to mixed resin. When using a mortar make sure to "prime" the area to receive the mortar first with just the mixed resin (no sand). For spall repair it is important to have a vertical edge along the perimeter of the spall, do not featheredge the repair material, and surrounding concrete should be in good shape. Saw cutting or grinding may be necessary to accomplish this step. There are several manufacturers offering dry dustless equipment for these applications. Spall shall be clean and free of any dust, debris and water. Fill spall with mortar and allow to cure. Unlike concrete the repair mortar does not need to be worked after placing, mix, fill, level, and leave alone to harden.

Consult product data sheet for cure times of product you are using.

Delaminations: Some floors have an overlay applied to them. These can vary in makeup and thickness but are generally 1-1/2 – 3 inches thick. Sometimes these overlays will become un-bonded (delaminated) and sound hollow and begin to crack.

Solution: Removal and replace is very expensive, time consuming and disruptive to the facility. Most commonly these can be repaired by epoxy injection (Prime Rez 1200 or Prime Rez 1100). In extreme cases or highly abusive floors pining is done in conjunction with epoxy injection. Holes are drilled through the overlay and into the slab and a high strength low viscosity resin is injected into the delaminated area to re-bond the overlay back in place. When pining is done the process will include drilling deeper into the existing slab and inserting steel or composite pins in to help hold and provide additional shear capacity.

Conclusion: Improving Productivity

When looking for productivity improvements, the answer may be right under your feet. Prime Resins, Inc. is a leading manufacturer of polyurethane grouts and epoxies used for infrastructure repair and restoration. For over twenty-eight years, Prime Resins has helped contractors, municipalities, facility owners, and utility companies achieve the best long-term repair value. For more information about floor repair techniques visit www.primeresins.com or call 800-321-7212.