When the coatings crew from Tri-County Decorating, Inc. first bid the job, it was originally spec’ed to be a straightforward flooring system install on a new concrete floor at a medical equipment manufacturing plant. In fact, the floor coatings work was the final step in a building addition project and was scheduled to take place mere days before the arrival and installation of state-of-the-art manufacturing machinery, which was being shipped to the plant from overseas. However, a monster lurked under the floor waiting to turn the simple flooring installation into a massive resurfacing project with an almost impossible deadline.

The building’s owner, Swiss Automation, Inc., manufactures high-tech hydraulic and pneumatic components, such as valves and connectors, for the medical industry. Since they create such sensitive equipment, plant cleanliness is of prime importance, closely resembling clean-room standards. In fact, the entire plant floor is scoured clean approximately every 12 hours to remove dust and oil, cutting solution vapor deposits from the manufacturing processes. With a round-the-clock production schedule taxing their facility, Swiss decided to build an additional 14,000 square foot work area and shipping dock onto the existing building. They hired Tri-County Decorating, Inc. to apply a protective polymer overlay, 20-mil thick epoxy coating onto the new addition’s approximately 12,300 square feet of concrete flooring.

The new slab-on-grade concrete was installed at a thickness of 6-inches, and fiber-reinforced with a designed air content of one- to two-percent, and a compressive strength of 5,000 psi. A vapor barrier was also installed under the slab. When the concrete had cured, Tri-County’s crew began the coatings installation process.
A QUICK STOP TO A FAST START

“We installed two 10-mil WFT coats of CrownShield 50, No. 320 epoxy base and top coat system onto the newly cured concrete substrate for a DFT of 20 mils,” recounts Joseph Hathaway, Tri-County’s project superintendent. “After the curing mats were removed, we found some holes in the floor surface.” Since holes of this nature are not unusual, Hathaway and his crew agreed to patch them as part of the surface preparation. But the floor itself had other ideas.

“As our sub-contractor, Blast Master, was lightly shot-blasting the surface with a Blastrac 10D using 280 shot, he noticed that it was suddenly loose and scaling in some areas,” Hathaway says. “We stopped the light cleaning process, which is used for thin coating applications, and did a surface inspection, sounding the floor with chains and tapping hammers.”

To determine the extent of the damaged concrete, the crew dragged chains across the floor, listening for any distinctive “hollow” sounds. They then tapped the hollow-sounding points with a hammer to verify that they were indeed “bad,” and marked the spots with landscaping markers. All of the marked areas of concrete would then have to be replaced.

“To everyone’s surprise, the soundings showed that approximately 70 percent of the new concrete floor would have to be removed,” recounts Hathaway. “What started out as a simple job turned into a very big job, very, very quickly. It was a huge shock, especially with such a tight deadline.” But the Tri-County crew didn’t allow the setback to faze them.

BELOW ▼ Arriving on the job at the end of the 14,000 sq. ft. addition project, the crew from Tri-County Decorating, Inc. was prepared to quickly install an epoxy polymer flooring system onto the medical equipment manufacturing plant’s new concrete floors. According to the project schedule, the crew had only a few days to install the floor before the delivery and installation of state-of-the-art manufacturing equipment. But when the 12,300 sq. ft. floor started scaling under light shot blast surface prep, the crew discovered that their flooring installation project had turned into a resurfacing nightmare.
“We knew that we had three avenues available to fix this unforeseen problem,” he continues. “We could use a scarifier, we could chip out the bad concrete by hand, or we could aggressively – and slowly – shot blast the concrete to remove the bad sections. But we had to select tools that would not damage the sound concrete underneath the deteriorated areas.”

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THE FIFTH TRY IS THE CHARM
Tri-County quickly assembled a team that included the general contractor, Calgore Construction, and Bill Dimmick, operations manager from Crown Polymers, the polymer manufacturer whose products had been specified for use on the now-seriously-troubled concrete floor. The team tried a wide variety of equipment to remove the damaged concrete.

The original specified shot blaster was too light for this type of heavy removal. Chipping hammers were quickly determined to be too slow. A walk-behind scarifier bounced over the rough surfaces and damaged the sound concrete, leaving deep bruises. Next, the team tried a walk-behind diamond-grinder, and it removed the soft spots, but left behind the irregular surface areas. Finally, the team came up with another shot blaster, SASE T40SD, 16-inch blast width, using 390 shot media that successfully removed the deteriorated concrete without damaging the sound concrete underneath it. It was slow cutting at approximately four to six feet per minute per pass, but it nearly picked up all the debris with its vacuum attachment even when the surface profile became very irregular.

In order to make up for the days that were lost in the “Great Equipment Search and Trial,” Hathaway and his eight to 10-man crew blasted the floor from 5 am to 10 pm for two days straight. “We ran the shot blaster very slowly over the floor for two solid days,” Hathaway says. “Those were two very long days filled with countless passes of the shot blaster.” Because the deterioration depth of the concrete was not consistent, there was no average number of equipment passes that could be ascertained.

The damaged concrete was so pervasive that the crew had to remove large sections at depths ranging from one-half to three-quarters of an inch – many down to the exposed aggregate. “On average we took the floor down to a depth of three-eighths of an inch,” explains Hathaway.

Once the entire surface had been shot blasted, the Tri-County crew used diamond grinders to “knock off all of the high
spots remaining on the aggregate.” Finally, they could turn their attention to fixing—and ultimately coating—the concrete floor.

FILLING IN THE HOLES

Tests showed that the concrete surface had an average air content of eight percent—four to eight times greater than designed. To prevent this porous concrete from soaking up the epoxy polymer concrete prefill, the concrete was primed with CrownPrime, No. 302. This two-component, 100 percent solids epoxy penetrated deep into the concrete, providing additional strength, as well as a non-porous surface.

“We used 18-inch Wooster rollers with three-eighths-inch nap to roller-apply the CrownPrime to an approximate thickness of 10 mils WFT,” Hathaway states. “After the primer cured overnight, we could focus on the pre-fill leveling work and of course filling in the big craters.”

The depths of the areas to be patched ranged from “the thickness of a feather” to one-half of an inch—averaging across the floor at three-eighths-of-an-inch. All of these recessed areas needed to be made level with the rest of the floor.

To repair the deeper areas with the polymer concrete overlay, CrownPrime was mixed with a specially graded patching sand supplied by the polymer manufacturer. The crew then hand-troweled the epoxy polymer concrete (EPC) onto the floor’s irregular surfaces, packing it tightly into and around the exposed aggregate stones. “We spread the EPC into some areas that were an inch deep,” Hathaway says with a shake of his head. “But, in the end, we got the required compaction of the EPC in the deeper areas with one lift. The balance of the shallow floor areas were filled with a CrownPrime self-leveling aggregate prefill EPC that was squeeged over the surface of the concrete to create a nearly smooth and level surface in one single application.”

Next, the crew cleaned the contraction joints. On average, the joints were one-and-a-half inches deep and three-sixteenths-of-an-inch wide. The joints were filled with CrownFlex Joint Sealer, No. 505. This load-bearing, 100 percent solids, non-shrink modified epoxy features 100 percent elongation without deforming when loads travel over its surface. When poured into the contraction joints, the floor’s grade was re-established. Once the joint sealer had cured, the crew used a walk-behind diamond grinding unit to smooth any high protrusions or rough patches that remained on the floor surface. Now, after heroically dealing with the surface strength-charred concrete floor and removed all of the damaged concrete, they roller-applied 10 mils of CrownPrime to strengthen and seal the concrete’s surface. Deep areas in the floor were then patched with CrownPrime EPC using shovels, rakes, and hand trowels. Shallow areas in the concrete were filled with CrownPrime slurry EPC. The crew then hand-poured CrownFlex Joint Sealer into the contraction joints.

ABOVE ▲ After crews shot-blasted the entire 12,300 sq. ft. concrete floor and removed all of the damaged concrete, they roller-applied 10 mils of CrownPrime to strengthen and seal the concrete’s surface. Deep areas in the floor were then patched with CrownPrime EPC using shovels, rakes, and hand trowels. Shallow areas in the concrete were filled with CrownPrime slurry EPC. The crew then hand-poured CrownFlex Joint Sealer into the contraction joints.

ABOVE ▲ The addition’s new concrete floor was 6”-thick, slab-on-grade and fiber-reinforced with a designed air content of 1% to 2% with a 5,000 psi compressive strength, or so they thought. When the concrete surface was lightly shot-blasted with a Blastrac 10D and 280 shot, some areas began to loosen and scale. There were also holes in the surface, some of which were deep enough to hide the blade of a utility knife. The crew stopped the cleaning process and after a thorough surface inspection, sounded the floor with chains and tapping hammers.
When the crew returned to the cured floor, they sanded it using the grinding machine’s sanding attachment. The sanded floor was then vacuumed with a walk-behind sweeper in preparation for the installation of the self-leveling lift.

The lift consisted of CrownShield SL, No. 315, a 100 percent solids, non-shrink, self-leveling overlay, pigmented light gray. Using a flower petal mixing paddle attached to a mixing drill, the crew mixed the three-component system kits. They then buckled cleats onto their work boots, covering them with duct tape to ensure that they stayed in place and stepped onto the floor. “We flooded the floor in wind rows with the flowable epoxy polymer concrete mixture and used gauge rakes to spread it onto the concrete surface to a depth of one-eighth-of-an-inch. It was a snow plow effect,” chuckles Hathaway. “The now smooth polymer concrete overlay was level without broadcasting any aggregate. It was backrolled with spike rollers to assist air release, and we left it to cure overnight. As we stood back and looked at our new smooth floor before leaving the building, we were pleased at the application and coverage rate of slightly over 3,200 square feet per hour.”

The floor’s final lifts consisted of CrownShield 50, No. 320 — the coating originally selected for the protective overlay prior to discovering the concrete’s defects. This two-component, 100 percent solids, pigmented light gray, epoxy base and top coat system was mixed in a 2:1 volume ratio. The crew then squeegeed and backrolled the epoxy onto the floor to a 15-mil thickness.
“While the epoxy was still wet, one of our guys hand-broadcasted Crown’s vinyl flakes in a random pattern onto the floor to add a decorative appearance to a tough industrial floor overlay,” Hathaway says. After another long day, the crew went home, allowing the floor to cure overnight.

The following morning brought a rested crew to a pristine floor. “The floor was intact without imperfections. We didn’t have to do any prep work and could get right down to the business of completing this project,” recounts Hathaway.

That business consisted of installing the final top coat, Crown Clear 50, No. 324, a two-component, 100 percent solids, low-odor, non-shrink, clear epoxy top coat. Again, using the squeegee and backroll method, the crew installed the clear epoxy to a thickness of 10 mils WFT. “We then hand-broadcast aluminum oxide onto the wet epoxy and backrolled it into the epoxy to give it durability and additional anti-slip properties to comply with ADA and OSHA standards,” Hathaway says.

A BEAUTIFUL FINISH

“That was it,” says Hathaway proudly. “After two and a half weeks, we were finally done — and ahead of schedule.” In fact, the crew would have been finished even earlier, but the general contractor wanted to run additional concrete tests throughout the surface preparation process.

“Tri-County has worked with the general contractor for about 25 years,” Hathaway continues. “And the general contractor has worked for Swiss Automation for about 25 years, so we all have an excellent working relationship.” And no doubt this monster of a job bonded that great relationship! CP

FLOYD DIMMICK, SR. is co-founder and technical director of Crown Polymers, an international polymer manufacturer of concrete repair products and floor systems. Active in the design and application of polymer products for more than 40 years, he has developed new polymer technologies that are patented in the U.S. and Canada. He teaches polymer classes for contractors and has published numerous papers. He is currently active on committees for ACI, ASTM, SSPC, NACE and other organizations. He may be reached at info@crownpolymers.com.

LEFT The first lift consisted of CrownShield SL, a 100% solids, non-shrink, self-leveling epoxy polymer overlay. After mixing the 3-component system with a flower petal mixing paddle attached to a mixing drill, the crew poured the epoxy polymer mixture onto the floor. Donning duct tape covered cleats and using gauge rakes, the crew stepped onto the floor, spreading the epoxy to a 1/8” depth. They then used spike rollers to backroll the epoxy to assist with the air release process.

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