



ENHANCE FOOD AND PERSONNEL SAFETY BY PROMPTLY REPAIRING FLOOR CRACKS IN FOOD AND BEVERAGE FACILITIES

Why and How Timely Fixes Are an Important Part of Facility Maintenance

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A small crack in a floor can be easy to ignore. But if left to wander and explore, it will grow more and more.

That's the inherent danger in not promptly addressing cracks in seamless industrial flooring systems — especially those found in challenging operating environments. What may start out as a hairline crack can quickly expand and spread due to foot and vehicle traffic, as well as cleaning protocols and other exposures.

Even before it expands, but especially after, a crack can create a sanitation concern in food processing areas, as it may become a harborage point for bacteria that prevents germs from being sanitized during cleanings. A crack in a distribution warehouse floor may become a catching point for trips and falls, expanding each time a worker's toe or forklift inadvertently clips its edge.

Whether they're a potential source of contamination or a safety concern, cracks in resinous flooring systems are fortunately relatively easy to repair in food and beverage facilities. However, installers need to follow particular procedures depending on the type of crack that needs repaired. For example, they'll need to understand whether the crack is active (a dynamic crack) or stationary (a static crack), and they'll need to know what crack filler materials to use to ensure compatibility with the existing flooring system. This paper offers some guidance on how to make the best repairs possible to enhance both food and personnel safety.



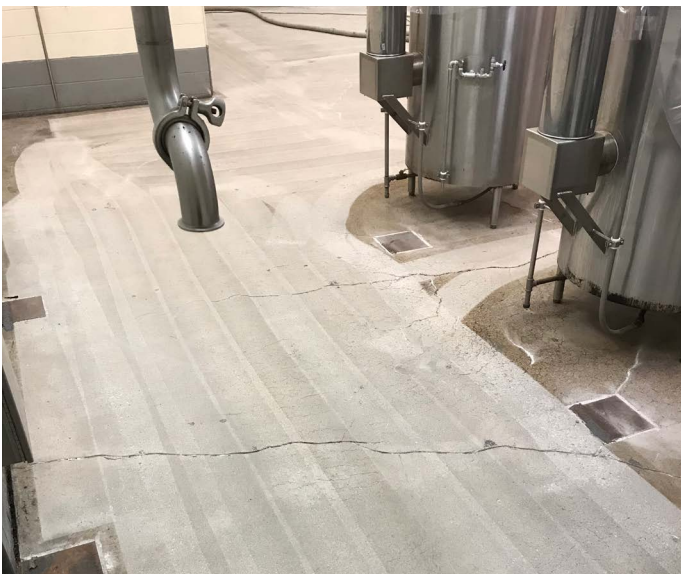
Concrete cracks may occur anywhere throughout food and beverage facilities and should be addressed using the proper repair techniques depending on the type of crack that exists.

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THE HAZARDS OF CRACKS

Cracks in seamless resinous flooring systems may occur anywhere throughout food and beverage facilities, but they're most found in areas subject to frequent stresses from traffic, equipment, cleanings and environmental conditions.

Crack-causing traffic may include rolling carts in processing and packaging areas; forklifts in warehouses; and even general pedestrian activities in hallways, break rooms, and lobbies. Loading docks are especially prone to flooring cracks as tow motors move loaded pallets on and off trailers. In addition, areas around heavy equipment that vibrates have a higher likelihood of cracking, particularly at attachment points.



Areas around heavy equipment that vibrates are prone to cracking, particularly at and near attachment points.

Cleanings may involve the use of harsh disinfectants that wear away incompatible flooring materials, hot water and steam cleanings that create thermal shock conditions, or even ultraviolet exposures that kill germs yet degrade certain types of flooring. Each treatment can run the risk of deteriorating flooring materials to the point that cracks will develop and then expand if not mitigated. Similar conditions may occur in chemical storage areas where spilled substances may weaken the floor.

Flooring cracks caused by environmental conditions are commonly found in cold storage areas, as well as any area subject to constant thermal cycling. For example, transition zones and thresholds between ambient temperature areas and refrigerators and freezers are a common place for cracks to occur.



It's important for food and beverage processing facilities to promptly repair cracks to eliminate bacteria harborage points and enhance food safety.

In any of these places, a crack can pose a trip/fall hazard for employees, leading to potential lost time injuries and insurance claims. Each time a small crack is bumped, it may open wider and become a hangup spot for those trips. As wheeled traffic pivots on those weak spots, the flooring will deteriorate even more, causing an even greater hazard. An ignored crack can potentially spread to the point that a simple repair is no longer feasible. In such cases, those larger repairs could have been avoided if the smaller initial crack had been repaired promptly.

From a food safety perspective, cracks in processing and production areas can be especially troublesome. Once fluids breach even a hairline crack, it can be difficult, if not impossible, to ensure those areas are properly sanitized with cleaning procedures. The small lip under a crack may be just enough room for various bacteria to hide and be missed during cleanings. And as that lip continues to grow, there will be even more room for bacteria to harbor and proliferate between the concrete substrate and lower layer of delaminated flooring. Eventually, sanitation procedures may become a losing battle around that crack.

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HOW TO PREVENT CRACKS

With safety at stake — and potentially the bottom line if a contamination event or injury were to occur — it's best to repair any crack in a resinous flooring system as soon as possible. It's also important to do everything possible to minimize the potential for cracks to develop in that system in the first place. That starts with the concrete pour, as any cracks in that surface have the potential to telegraph upwards to the flooring system installed on top.

Minimizing cracks in new concrete is the responsibility of the contractor, who needs to focus on preparation and proper curing. That means ensuring the subgrade is well compacted, that there's a low ratio of water to cement and that proper reinforcements are used as needed. This person also needs to follow a variety of other best practices, including properly placing control and expansion joints. Ideally, the concrete should be left to cure for 30 days or more to identify any early crack formation before installing flooring. However, in many cases, that wait time isn't feasible. In such cases, a variety of specialized coatings that are compatible with green concrete can be used within a flooring system to overcome any continued movement of the slab as it fully cures.

Of note, the American Concrete Institute (ACI) recommends that industrial floor joints not be filled for 60 to 90 days after a floor slab pour, or at least as long as possible. Its guidelines note that this delay is helpful to allow control and construction joints time to open closer to their ultimate width through the concrete shrinkage process. For freezer and cooler areas, the Institute also notes that the floor should be stabilized at its ultimate operating temperature for seven days prior to installation. The same suggestions are in place for treating cracks.

When the time comes to install the resinous flooring system, cracks will be far less likely to occur in the flooring if the building was acclimated to in-use conditions. That means the building was fully enclosed with the HVAC system running, allowing concrete and building materials to dry and shrink or expand as they would in everyday operations. Waiting until that time is the easiest way to avoid excessive cracking in flooring systems.

Naturally, installing flooring under an ideal time frame isn't always possible. In those cases, and even in ideal ones, facility managers, flooring suppliers and installers should collaborate on the most appropriate systems to use given the area of the plant and the anticipated exposures that flooring will encounter. Planning ahead will allow everyone to consider installing specialized layers such as membrane crack fillers, which are designed to bridge small cracks in the concrete so the flooring over top won't face the potential shearing forces of a crack moving from below. Installers may also be able to consider installing a flooring system everywhere except at joints and then fill in those sections later — after the building is acclimated — so the flooring system won't have a chance to crack initially and then will not be isolated from the joint when it's filled in.

Despite the best precautions against them, cracks may eventually form in any flooring system. When they do, installers can engage in the repair protocols that follow.

HOW TO REPAIR DYNAMIC CRACKS

Dynamic cracks are active. They occur anywhere the mechanism that is causing the cracking is still present, whether that's from temperature fluctuations, loading, freeze-thaw cycles or other factors. Such cracks are typically unexpected, although ones that form at cold joints can be somewhat predictable. Regardless, they require special care to mitigate due to their active status.

A dynamic crack may occur from a building's subbase shifting or settling after construction. Even if that settling has seemingly ceased, such cracks should be treated as moving joints and honored through the system during repairs. The same is true for heaving cracks — those that occur from a building's slab lifting due to changing soil conditions. Moisture-laden clay soils, poor drainage, frost and even tree roots can cause such heaving.

Seismic cracks are another common type of unexpected dynamic crack. They can be caused by movement of the ground under or near a building, which may occur from natural seismic activity or man-made forces. For example, nearby railroad tracks may send sufficient vibrations through the ground to crack flooring. When such forces are in play, it's best to identify their cause and determine the best way to isolate the flooring from this movement, if possible.

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Any one of the previous types of dynamic cracks could indicate a structural problem with the building's design. Therefore, it is highly important for facility managers and repair technicians to determine the root cause of a dynamic crack before repairing it. For example, if the crack shows active movement or visible heaving, they'll need to consult a structural engineer first before attempting repairs. Otherwise, any repairs may be likely to fail.

To properly repair a dynamic crack, remember that forces will continue to work on the flooring material that covers the crack. Therefore, repair technicians need to plan for that movement. The recommended approach is to make a sawcut through the finished flooring system and then only fill that void in on the two sides — and not the bottom — to achieve two-point adhesion (**Figure 1**). The cut should be to a depth of 3/4-inch deep and a minimum width of 1/4-inch using a diamond blade saw attached to a vacuum to minimize dust entering the notch. This notch width ensures there will be sufficient surface area available for the flooring system patch to form a strong bond to the concrete.

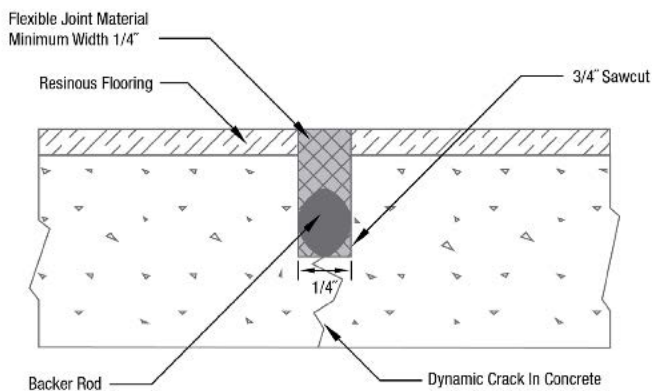


Figure 1. Best practices for repairing dynamic cracks include cutting a minimum 1/4" wide by 3/4" deep notch through the finished flooring system and concrete before adding a backer rod and applying flexible joint material on top. The backer rod prevents three-point adhesion, allowing the repair material to move downward with expansion, rather upward where it may cause a repair to crack.

To prevent three-point adhesion, installers should then force a bond breaker, such as a closed-cell backer rod, into the cut notch. This backer rod should be 1/8-inch wider than the notch to prevent the resinous flooring material that will be applied on top from sneaking by the rod and adhering to the bottom of the notch. This bond prevention is critical because as the dynamic crack moves, the backer rod allows room for movement of the flooring material downward within the notch, rather than pushing everything upward and causing the repair to crack.

A variety of materials may be used to fill dynamic cracks, with rigid and semi-rigid materials often being specified. Facilities will want to match the topcoat material to the existing floor, but the crack and joint filler should be chosen based on the compatibility of its properties with the conditions surrounding the repair area. For example, in a high-temperature or thermal shock environment, a urethane cement with elasticity is likely a better choice than a rigid epoxy. If a quick return to service is needed, the facility manager may opt for a fast-curing polyurea crack filler. That same polyurea may be used in areas with temperatures lower than 50°F. For cold or freezer storage applications down to 20°F, a methyl methacrylate (MMA) may be the best choice.

When considering which materials to use, a semi-rigid crack and joint filler like Resufloor™ 3580 will be useful if the repair joint is intended to move a little. This material has a unique combination of hardness and flexibility that supports heavy loads while minimizing chipping. It is flexible enough to absorb hard heavy wheeled traffic, yet it's also sufficiently rigid to support heavy loads at the joint edges. Alternatively, the more rigid Resufloor™ 3500 crack and joint filler can be used when there's no need for the repair to have flexibility. When fully cured, it does not elongate.

Greater flexibility may be warranted for certain repairs. In such cases, a flexible polyurethane sealant like Loxon® 1K may be used. The material is flexible, resilient and rubber-like and adheres to a variety of substrates. This non-sagging option can also be used for vertical cracks, such as those found in cove bases that rise up the wall. Choosing the right product that won't sag or flow out of those repair areas is necessary.

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HOW TO REPAIR STATIC CRACKS

Unlike dynamic cracks, static cracks are dormant. They are either not likely to become active in the future or their movement is so insignificant that a repair will not be affected.

Craze cracking is a common type of static crack. These hairline cracks are visible in the surface cream, or laitance, of the concrete slab. They typically do not extend very deep and usually occur due to the concrete cream drying rapidly. In addition, the cracks are typically cosmetic and simply affect the concrete's appearance, not its structural integrity. Therefore, craze cracking usually does not require any special treatment. It can typically be mitigated in a prime coat for flooring, as that primer will bridge the thin, shallow cracks and form a continuous film over top. With that material applied, craze cracking is therefore unlikely to telegraph upwards to the flooring system.

Plastic shrinkage cracks are also hairline cracks that form on the surface of concrete. They typically form within the first few hours following a pour, while the fresh concrete is still in a plastic, or wet, state. They are caused by rapid evaporation of surface water in the concrete as the slab cures. Most often, plastic shrinkage cracks represent non-structural cracking and are static. However, experts should analyze them to ensure they are not continuing to grow over time and do not show signs of heaving. During concrete pours, installers can often avoid plastic shrinkage cracks by placing proper control joints, per ACI 302.1R-15.

Static cracks can also form at control joints, which are intended to crack, as well as due to damage to the concrete surface.

When flooring installers spot craze cracking or plastic shrinkage cracks prior to or during prep for a new installation, they can mitigate them by patching the floor using various materials, including sealants and fiberglass mesh.



During the restoration of this food and beverage processing facility floor, installers first removed the existing flooring (top), bringing it down to bare concrete for a clean, prepared surface. Next, they followed proper crack filling protocols for repairing both dynamic (shown as the straight, parallel and perpendicular lines) and static (shown as the wavy lines) cracks (middle). Finally, they applied a full coat of resinous flooring material over top to restore the facility for operation (bottom).

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Prior to filling static cracks, installers will need to prepare the surface by removing all laitance, debris and sealers for a clean bonding surface. Next, they should make a sawcut over the crack, using a V-notch blade attached to a vacuum to collect dust from the sawing process (**Figure 2**). This V-notch cut is particularly important, as it provides more bonding surface area for the applied sealant compared to a straight blade cut in which just the edges of the joint would be available for bonding. Because it would be impractical to use a blaster on static cracks to create a concrete surface profile (CSP) of 2 to 3, the V-notch essentially creates a CSP of 1 to 2 to aid in bonding.

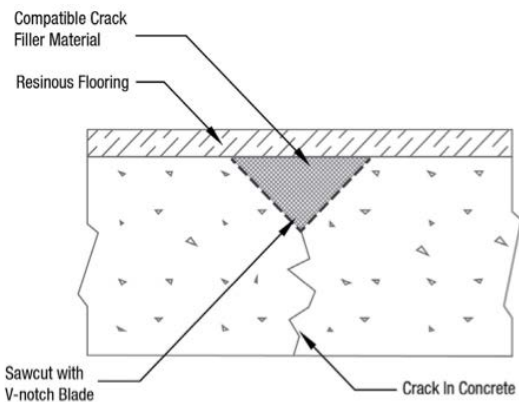


Figure 2. Static crack repairs involve cutting a V-notch in the surface surrounding the crack to provide more surface area for bonding the crack filler material to the concrete substrate.

When repairing static cracks on elevated slabs (i.e., slabs on a building's second floor or higher), installers should consider taking an extra step and use a fiberglass mesh material for reinforcement (**Figure 3**). This mesh increases the tensile strength of the joint, which helps to mitigate the movement of the concrete and the flooring system on top. Mesh isn't required on a building's ground floor because the concrete won't flex there like it does on elevated slabs. When using fiberglass mesh, installers should apply a 6-inch piece that straddles cracks by 3 inches on each side.

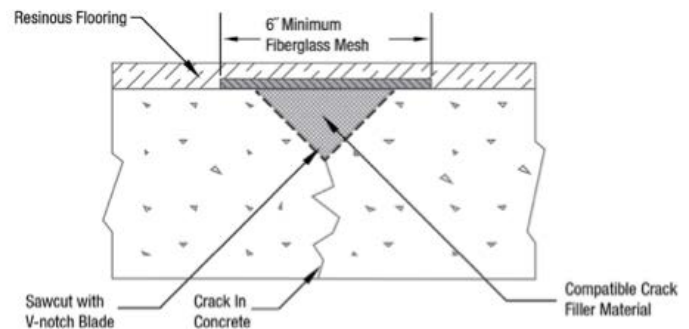


Figure 3. Static crack repairs on elevated slabs can benefit from using a minimum 6"-wide fiberglass mesh for reinforcement. This mesh strengthens the joint and mitigates movement of the concrete and the flooring system on top.

Like with dynamic cracks, the proper filler materials for static cracks depend on their compatibility with the existing flooring, as well as the conditions surrounding the repair area. Installers also need to consider different materials when the crack is less than or greater than 1/4 inch.

For smaller cracks, epoxy crack fillers offer a general-purpose solution. They can either be self-leveling materials that flow into cracks or pastes that need to be putty knifed or troweled into place and smoothed. For example, using Resufloor™ Glaze with Cab-O-Sil® is a common solution for epoxy flooring systems. This mix of 1 pint of Resufloor Glaze hardener, 1 quart of Resufloor Glaze resin and 3 quarts of Cab-O-Sil offers a thick epoxy patch material that can be worked into the joint. If the crack is greater than 1/4 inch, the Resufloor Glaze materials can be mixed with Resufloor™ Screed III, which contains a silica sand aggregate that makes the material thicker for deeper fills. Resufloor™ MPE offers an even thicker build coat if needed.

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Similar protocols can be followed when repairing cementitious urethane or MMA flooring systems, with thicker materials used for larger cracks. For example, installers can repair smaller cracks with thinner systems like the cementitious urethanes Poly-Crete™ SL or Poly-Crete™ MD or graduate to Poly-Crete™ WR if the crack exceeds 1/4 inch. These flexible systems are especially helpful in repairing cracks where high temperatures are in play and when the flooring will experience thermal shock or water washdowns. Crack fillers for MMA systems may include the self-leveling slurry Crylaflor™ SL Filler for smaller cracks or MMA-based Crylaflor™ Tex polymer concrete for larger ones. These materials offer a fast return to service of about an hour, making them useful for quick repairs.

THE IMPORTANCE OF TIMELY REPAIRS

Obvious cracks in food and beverage facility flooring systems can be hard to miss, but small, cosmetic hairline cracks can often be overlooked. In either case, if the underlying cause is not addressed, that small or larger fissure can expand, creating a domino effect of serious, expensive damage that can lead to food safety concerns, lost time injuries and even shutdowns. As a result, it is critical for facility managers to stay on top of cracks and implement repair procedures as promptly as possible. Engaging in site audits with qualified flooring suppliers is a helpful way to spot early cracks and even identify areas where they may be likely to occur. It's much better to identify those deficiencies then, compared to when an official auditor walks the plant, spots a concerning crack and calls for an unplanned shutdown until it can be repaired. When making repairs, facilities should follow the provided guidance to make the best repairs possible and thereby enhance both food and personnel safety.

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FIGURES AND CAPTIONS

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