

Why is it Raining in my Parking Structure?

• By Scott Weiland

Ever wonder why it is raining inside your parking structure? Well, it is a sign that your parking structure needs attention. Water is the No. 1 cause of parking structure deterioration. Water-saturated concrete can freeze, expand, and spall. Combined with oxygen, water can also cause corrosion of the concrete reinforcing. Exposure to deicing salts accelerates this process.

Leaks in the top level allow water to reach the reinforcing steel, but also expose the levels below to the same deterioration.

Reinforcing steel expands as it rusts, this process leads to concrete cracking and additional spalling. Spalled concrete provides less cover or protection of the reinforcing, which leads to further (and accelerated) deterioration if it is not repaired in a timely manner.

The top level of your parking structure not only provides possibly the least desirable parking spaces, it serves as the roof of the facility. Controlling water in the form of rain or melting ice and snow at this level is the least expensive way to extend the life of your parking structure and minimize maintenance costs. This starts with conducting water to drains as efficiently as possible.

Ponding water saturates the concrete, which leads to deterioration. The installation of supplemental drains can easily and permanently address this issue. The cost of a supplemental drain is \$2,000 or more, depending on the distance to the closest pipe riser and local market conditions.

Leaks in the top level allow water to not only reach the reinforcing steel, but also expose the levels below to the same deterioration as above, to

a lesser extent. Leaks occur at natural and man-made cracks in the concrete and/or at failed joint sealant. Concrete is weak in tension and non-prestressed concrete is expected to crack when subjected to temperature and shrinkage volume changes. Cracks also occur when the structure is subjected to heavy vehicle and snow loads.

It is generally accepted that cracks that leak water or exceed .013" need to be routed and sealed. Polyurethane is the most common type of sealant for this type of repair and will cost approximately \$4.50/LF (Linear Foot) or more. Less common cracks exceeding .035" are assumed to have lost aggregate interlock required for structural shear transfer and should be glued back together. Epoxy injection is a common method of repair for this type of crack and the cost is approximately \$85.00/LF or more. Some cracks can be gravity fed from the top side, which would reduce the cost to approximately \$45.00/LF, or more.

Joints that are expected to move (such as expansion, construction, and control joints) have been historically sealed with polyurethane sealant. A common precast parking structure assembled from many pieces will have many of these joints. It is widely accepted that joint sealant in a parking structure should have a life expectancy of 7 to 10 years, depending on the exposure and the owner's



commitment to maintenance. However, the life expectancy is also dependent on the proper joint design, specification, surface preparation, and installation. Even with material and labor warranties, premature joint failure can result in finger pointing and damaged reputations and should be avoided.

Before replacing failed joint sealant, it is important to understand why the material failed prematurely so that mistakes are not repeated. There are four basic types of joint failure to consider:

- 1- Adhesive Failure
- 2- Cohesive Failure
- 3- Substrate Failure
- 4- Loss of Sealant Properties

Adhesive failures are typically the result of improper surface preparation, installation, or both. This is where the sealant separates cleanly from and the sides of the joint. *Cohesive failure* is when the sealant is split within itself. This is typically the result of poor joint design and material specification, but could also be the result of improper proportioning of the installed sealants, missing backer rods or bond breaker, or a combination of these factors. *Substrate failure* occurs when the sealant remains tightly bonded to the substrate, but the substrate separates from itself. This can result from wheel loads impacting an exposed edge of concrete, cracking around welded double tee flange connections, or freeze thaw damage to the substrate. *Loss of sealant properties* can occur as a result of natural aging, which appears as crazing, drying out and hardening of the surface, reversion to its natural uncured or original tacky state as a result of high temperatures and ultraviolet light exposure, or improper mixing of a two-component sealant.

Failed sealant should be removed, the sides of the joint ground, the surface primed, and a sealant validated by the Sealant, Waterproofing, and Restoration Institute (SWR) installed. The cost to replace polyurethane sealant is approximately \$ 4.50/LF, or more.

Leaks, whether from cracks or failed joints allow water and corrosive chemicals to penetrate the concrete and reach the reinforcing steel, as well as the vehicles and concrete levels below. This leads to degradation of the parking structure that can be easily and inexpensively avoided. Ensuring that your parking structure is watertight provides one of the best Return on Investment (ROI) when it comes to parking structure maintenance.

An annual wash down in the presence of a restoration engineer will easily identify where ponding and leaks occur and expose the sealant for visual inspection. A restoration engineer can also provide the necessary details and product specifications to execute these repairs, as well as inspect the installation.

SCOTT WEILAND is a Professional Engineer with Innovative Engineering Inc. He can be reached at sweiland@ieiusa.com.



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