

# Guarding Against Common Parking Garage Problems

By Rick Edelson

“...My garage is spalling and the concrete is breaking up. Is this dangerous? That white stuff is dripping from the concrete and ruining the paint on the cars. What do I do? Chunks of concrete are falling from the ceiling. How do I stop this before someone gets hurt? My floor is cracking. Will it fall down?...”

**T**hese are some of the most frequently asked questions when an owner hires a professional to look at a garage deterioration. What causes the



*My garage is spalling and breaking up! Is this dangerous?*



*That white stuff is dripping from the concrete and ruining the paint on the cars. What do I do?*

deterioration? The answer in almost every case is water; and, in some cases, the deterioration is accelerated by poor original design or construction deficiencies. In the colder regions of the U.S., where it is common practice to apply salt to the roads to melt snow and ice, the problem is compounded by salt-laden snow that clings to the bottom of cars entering a parking garage. As the snow melts, salt water falls on the floor and is absorbed into the concrete where it then comes in contact with the steel reinforcing bars in the concrete. This creates an absolutely perfect environment for corrosion or rusting. As steel reinforcing bars rust, they expand with a tremendous force, up to more than 10 times their original size. This force breaks the concrete and causes spalling, or chipping, and cracking. In coastal regions, salt water, in the form of airborne salt, attacks concrete in the same manner as road salt. In warmer regions, however, the problem of corrosion is much less severe.

## Structural Problems and Solutions

Let's look at each of the problems, the specific causes, the repairs to correct the problems, and, most importantly, the easy and inexpensive ways to prevent the problems.

### Spalling

Spalling concrete can lead to dangerous structural instability due to the loss of concrete and corrosion of the reinforcing steel. Repairing spalling concrete is simple, yet expensive. Basically, the deteriorated concrete is removed, the rust is cleaned off the reinforcing bars (bars are replaced if severely corroded), the bars are then coated with a corrosion inhibitive coating, and new, specially modified concrete is placed and bonded to the old concrete.

Prevention is easy and inexpensive: clean the garage floors. The floors should be routinely broom cleaned and washed down to remove salt before it is absorbed into the concrete. Also, reseal the floors every three to five years. Most buildings have a water repellent sealer applied to the concrete floors at the time of construction. Sealers are excellent because they help prevent water from being absorbed into the concrete, but they must be reapplied every 3 to 5 years to remain effective. Reapplication is a major deterrent to absorption of salt water. The cost of reapplying a sealer is relatively low compared

to repairing deteriorated concrete. Costs associated with repairing spalled floors can be as high as \$20 or \$30 per ft<sup>2</sup>. The cost of sealing can be as low as \$0.35 per ft<sup>2</sup>. When deterioration of concrete extends to the underside of garage floors, the repair can be as high as \$50 or \$80 per ft<sup>2</sup>.

## Cracks

Cracks, by themselves, did not cause deterioration of concrete. Water enters the cracks, comes in contact with the reinforcing bars, then causes the corrosion and the related spalling; or water enters the cracks and expands as it freezes, causing the concrete to spall and crack even more. Cracks in the floor can be caused by many things, such as normal shrinkage or thermal expansion and contraction. They can also be induced by structural over-stresses in the floor-framing members, however. If the cracking is severe, that is, more than random isolated cracks, it is always prudent to have a professional engineer investigate the underlying causes. Other than cracks caused by structural over-stresses, repairs usually involve cutting or routing the crack into the shape of the groove and then filling the groove with high-quality sealant to prevent the penetration of water. Repair costs can be as high as \$2.50 to \$5.00 per linear feet of crack. Building owners and managers can't prevent the cracking. It occurs as a result of normal shrinkage of concrete or can also be caused by improper structural design and/or poor construction practices.

## Lime

That white deposit dripping onto cars is water-soluble lime, which is dissolved and leached out of concrete by water passing through the cracks in the concrete. Once lime falls on a car, it is guaranteed to remove the car's finish, and nothing except immediate removal can prevent the damage. Overhead gutters are often installed to divert water coming through cracks away from cars, but this does not solve the problem—it only treats the symptom. The only true solution is to seal the cracks in the floor that are allowing the water to pass through the concrete.

## Surface Cracking, Scaling, and Peeling

Surface crazing, scaling, peeling, or alligator-pattern cracking are surface imperfections usually allowing both corrosion related deterioration and freezing water deterioration to occur at a very rapid pace. They are generally the result of poor quality concrete or poor construction techniques. Water simply enters the concrete at these surface imperfections, with almost no resistance, and then causes the deterioration. There is absolutely nothing that can be done to prevent deterioration related to these defects. The only possible repair is the removal



*Chunks of concrete are falling from the ceiling. How do I stop this before someone gets hurt?*



*My floor is cracking. Will it fall down?*

and replacement of the inferior concrete, in much the same manner as the repair for spalling concrete. If these conditions are noticed early in the life of the structure, compensation or repair may be sought from the contractor.

In conclusion, proper design, good construction practices, and proper maintenance are the best means for providing a long-lasting durable garage structure.



**Rick Edelson** is the Vice President at Tadjer-Cohen-Edelson Associates, Inc., a structural engineering firm located in Silver Spring, Maryland. He is a Past-President of ICRI and currently serves as Chairman of the Technical Activities Committee.