



# Coffee Break Training - Fire Protection Series

## Building Construction: Concrete Spalling

No. FP-2014-18 May 6, 2014

**Learning Objective:** The student will be able to list considerations needed to repair spalled concrete in fire-resistive and noncombustible construction.

Concrete is a common building material used in fire-resistive and noncombustible construction. To enhance concrete's tensile strength, steel is embedded in the mixture while the concrete is being made.

Concrete in building construction is subject to a condition called spalling. "Concrete spalling is usually caused by corrosion of the steel reinforcement bars embedded in the concrete matrix, but can be caused by other ferrous elements either fully or partially embedded in the structure. Steel frame window systems, handrails, structural I-beams, metal pipes and conduits are among the most common of the damage causing building components. Corrosion of the reinforcement steel however, is by far the most common cause of spalling and splitting in older concrete structures."<sup>1</sup>



The concrete that once protected this steel reinforcing bar has spalled, exposing the reinforcement to the elements, including the heat from a fire.

In addition to affecting the building's structural integrity, the consequences of spalling that exposes steel reinforcement materials have a potential fire safety consideration as well. The exposed steel is highly susceptible to damage from increased heating, further weakening the structure and increasing the risk of catastrophic failure. (Please see Coffee Break Training FP-2012-50 for a discussion of heat influences on steel construction.)

When inspections or preincident planning reveals reinforced concrete with exposed steel, steps should be taken by a qualified person or company to repair the problem. These steps include:

1. Determining the cause and extent of deterioration. The cause of the problem should be thoroughly investigated to prevent a recurrence.
2. Identifying the repair objectives. While restoring structural integrity and durability are important safety concerns, the building owner may be equally concerned about leakage control and improving aesthetics.
3. Giving consideration to the environmental and logistical limitations to making the repairs. Depending upon the scale of damage, the repairs likely cannot be accomplished in a single work period.
4. Evaluating the need for temporary support and shoring. The extent of damage may be so severe that isolating the problem and providing support and shoring may be required.
5. Selecting the appropriate repair materials. The materials and method must be approved for the existing configuration to ensure the repairs remain in place.
6. Repairing the steel that was damaged by exposure. Steel that has been exposed likely has been weakened and should be repaired to match its original strength.<sup>2</sup>

For more information, take the NFA Online self-study course "Principles of Building Construction" (Q0751) at <http://www.usfa.fema.gov/nfa/nfaonline/>.

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