

FAQS*

PARKING DECK SERVICE LIFE

Frequently Asked Question:

An inspection of a newly constructed elevated concrete parking deck with a pachometer revealed that the concrete cover averaged 0.5 in. (13 mm) rather than the specified 2 in. (51 mm). Should structural integrity be a concern? What can be done to ensure that the expected service life of the parking structure is not compromised?

Significance:

This situation often occurs as a result of poor construction and quality-control practices. The owner and the engineer must determine whether the deficiencies are severe enough to warrant remedial action.

Answer:

The engineer and owner should be concerned with the current structural integrity of the parking deck, as well as long-term serviceability.

First, the results of the pachometer inspection should be verified by representative exploratory concrete excavations. The pachometer will give accurate results if the structural concrete member is relatively lightly reinforced, where the effect of secondary reinforcement and closely located parallel bars will not substantially influence the readings. Also, the pachometer may be misleading if used at temperatures below 40 °F (4 °C) due to the batteries used in these devices. Detailed information on the use of pachometers is available in ACI 228.2R.¹

If measurements within

exploratory openings verify with the pachometer data, the next step is to check the thickness of the slab. If the thickness of the slab is as designed, but the cover is reduced, the structural capacity will probably not be reduced. The effect of the reduced cover on structural capacity, however, should be investigated. If the thickness of the slab deviates significantly from the design, a structural analysis using the as-built conditions should be performed. Remedial action may be necessary if the as-built slab is inadequate to carry the intended loads. ACI 318-99,² in Section 7.5.2.1, states that "tolerance for cover shall not exceed minus 1/3 of the minimum concrete cover required..."

In any event, the durability of the deck has been compromised and premature deterioration due to corrosion of the reinforcing steel should be expected. The following remedial options are available:

- **Penetrating Sealer**—Sealers are used to minimize moisture and, to a lesser degree, chloride transport to the reinforcement. Periodic reapplication may be required depending on the type of sealer used and the severity of the exposure conditions;
- **Waterproofing Membranes**—A waterproofing membrane is usually more effective than penetrating sealers. Membranes usually reduce the oxygen supply to the reinforcement and effectively minimize chlorides and moisture transport; and
- **Bonded Overlays**—Bonded overlays reduce the transport of moisture and chlorides to

the slab reinforcing steel, and also increase the load-carrying capacity of the slab through composite action.^{3,5}

Additional information on remedial treatments is available in ACI 222R,⁶ 515.1R,⁷ and 548.3R.⁸

References

1. ACI Committee 228, "Nondestructive Test Methods for Evaluation of Concrete in Structures (ACI 228.2R-98)," American Concrete Institute, Farmington Hills, Mich., 1998, 62 pp.
2. ACI Committee 318, "Building Code Requirements for Structural Concrete (ACI 318-99)," American Concrete Institute, Farmington Hills, Mich., 1999, 369 pp.
3. ACI Committee 548, "Standard Specification for Latex-Modified Concrete (LMC) Overlays (ACI 548.4-93)," American Concrete Institute, Farmington Hills, Mich., 1993, 6 pp.
4. ACI Committee 548, "Guide for Polymer Concrete Overlays (ACI 548.5R-94)," American Concrete Institute, Farmington Hills, Mich., 1994, 26 pp.
5. AASHTO-AGC-ARTBA Task Force 30, "Guide Specifications for Concrete Overlays of Pavements and Bridge Decks," 1990.
6. ACI Committee 222, "Corrosion of Metals in Concrete (ACI 222R-96)," American Concrete Institute, Farmington Hills, Mich., 1997, 30 pp.
7. ACI Committee 515, "A Guide to the Use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete (ACI 515.1R-79)," American Concrete Institute, Farmington Hills, Mich., 1979 (Revised 1985), 44 pp.
8. ACI Committee 548, "State-of-the-Art Report on Polymer-Modified Concrete (ACI 548.3R-95)," American Concrete Institute, Farmington Hills, Mich., 1995, 47 pp.