
Standard Specification for

Protective Sealers for Portland Cement Concrete

AASHTO Designation: M 224-23

Technically Revised: 2023

Technical Subcommittee: 4c, Markings and Coatings



American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This specification describes the properties of protective sealers for highway uses to be applied to hardened concrete for the purpose of protecting new concrete or prolonging the life of sound in-service concrete.
- 1.2. Sealers may be divided into two basic types: coatings, which remain on the surface; and penetrants, which penetrate into the concrete to some measurable depth.
- 1.3. The values stated in SI units are to be regarded as the standard.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - < M 233, Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete
 - < T 384, Protective Sealers for Portland Cement Concrete
- 2.2. *Environmental Protection Agency Standard:*
 - < EPA 450/3-84-019, Procedures for Certifying Quantity of Volatile Organic Compounds Emitted by Paint, Ink, and Other Coatings
- 2.3. *Other Documents:*
 - < Pfeifer, D. W., and M. J. Scali. *Concrete Sealers for Protection of Bridge Structures*. National Cooperative Highway Research Program Report 244. NCHRP, Transportation Research Board, Washington, DC, 1981, 138 pp.
 - < Munshi, S., and L. Millstein. *Low-Cost Bridge Deck Surface Treatment*. FHWA/RD-84/001. Federal Highway Administration, U.S. Department of Transportation, Washington, DC, 1984, 70 pp.

3. SELECTION OF THE SEALER

- 3.1. A number of performance categories must be considered when choosing a sealer. There are basic properties that are universally significant for all sealers and other special properties that depend on the intended application. The performance categories include the following:
 - 3.1.1. *Universal Properties:*

- 3.1.1.1. All sealers, by definition, are intended to reduce water penetration into concrete and to extend the service life of the concrete. Most sealers for highway structures are used to reduce the ingress of chlorides from deicers or seawater to protect the embedded reinforcing steel from corrosion. Therefore, improving concrete resistance to water and chloride penetration is a basic property of all sealers.
- 3.1.1.2. Highway structures are exposed to their environments, so all sealers must work under a variety of environmental conditions (temperature and moisture) and be durable to weathering and alkalis present in the concrete. Reasonable curing or drying time is also needed, so that the sealers are not damaged by rain shortly after treatment and to avoid lengthy lane closures for deck sealer installation. Good vapor transmission of sealed surfaces is a preferred property of most sealers, since this property allows moisture that is present or able to penetrate into the treated structure to dry as environmental conditions permit.
- 3.1.1.3. Nonbreathable sealers have limited applications in highway structures, since preventing concrete from drying between rain events limits the sealer effectiveness at slowing moisture-driven deterioration mechanisms. Improperly applied, nonbreathable sealers can trap water in concrete and increase moisture-driven deterioration. Sealers should be effective on both new and older concrete, but specific materials can be tested and specified for each condition.
- 3.1.2. *Effectiveness*—Coatings should form an impervious membrane tightly bonded to the concrete surface, while penetrants should seal the surface pores and fill the capillaries of the concrete. Sealers should maintain their protective properties through wide temperature fluctuations and when subject to all chemical and physical conditions at the site of use.
- 3.1.3. *Freeze-Thaw, Scaling, and Concrete Durability*—Sealers can be used to improve the concrete's resistance to cyclic freezing damage or surface scaling. Special tests recreating cyclic freezing conditions are presented to evaluate these properties. Sealers have also been used to extend the service life of structures with other concrete distress. Such deleterious reactions are highly dependent on-site conditions and materials, and no widely useful test can be proposed to characterize the ability of sealer to slow or stop all types of concrete deterioration. However, in a general sense, the ability of sealer to retard moisture ingress will be a determining factor in the likelihood that such reactions will be affected.
- 3.1.4. *Economy*—It is desirable that the chosen sealer be low in initial cost. However, this should not take precedence over life-cycle costs; that is, cost should include consideration of frequency of reapplication necessary to maintain effectiveness.
- 3.1.5. *Traffic Exposure Resistance*—Sealers on traveled surfaces must not reduce the frictional properties of the concrete; some types may, with the use of a cover aggregate, increase the frictional properties. Coatings must be resistant to traffic wear; penetrants should be evaluated according to depth of penetration because they will wear away with the concrete. If an overlay will be placed after sealer application, wear will not be a factor. Rapid curing may also be needed if applied during short lane closure periods.
- 3.1.6. *Application and Curing*—Ease and simplicity of application without the use of special skills or equipment is desirable, but not critical. It is usually advantageous for a material to cure or dry in a few hours so that neither damage by rain nor lengthy closure of the facility is necessary.
- 3.1.7. *Color*—Color and final appearance may be important for some structures. If color of the treated concrete is important, test blocks should be treated with candidate materials for evaluation prior to use.
- 3.1.8. *Safety*—Safety should be carefully considered. Several of the materials involve toxic or hazardous components. Others may have to be heated. Refer to Section 7 for details.