could be initiated. Most states cut a full-depth 102-mm gap completely across the pavement and fill the gap with asphalt material. Michigan has designed a hydraulic device, mounted on a maintenance truck, that forces a 102-mm strip of preformed foamed plastic filler into a 76.2-mm (3-in) wide gap cut by a Vermeer saw. Although some of the strips have been pulled out by traffic, the joint is considered successful at this time.

For new construction, several recommendations can be made. To avoid infiltration from below and from the sides, a thin asphalt concrete base should be placed before the slab is poured, and shoulders should be paved. The joint should be sealed by a preformed polychloroprene sealer that should also seal the joint vertically at each side of the slab. Special care should be used in placing dowels at the joint, so that no misalignment occurs.

Some thought might be given to different thicknesses for the traffic and passing lanes. Heavy commercial vehicles use the traffic lane most of the time and the severe repetitive compressive stresses they cause would be reduced by using a thicker pavement.

ACKNOWLEDGMENT

This research was sponsored by the Ohio DOT in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

Thanks are due to Leon Talbert, C. W. Gray, W. J. Anderson, and Martin Burke of the Ohio DOT for administrative and technical assistance during the project. Thanks are also due to Richard Glasser of Babcock and Wilcox Company and to David Timmerman and Thomas Brittain of the University of Akron for technical help. Kenneth Klika of the University of Ohio performed the experimental work in the laboratory and in the field.

REFERENCES

1. Design, Construction and Maintenance of Portland Cement Concrete Pavement Joints. NCHRP, Synthesis of Highway Practice 19, 1973.
2. E. R. Leeman and D. J. Hayes. A Technique for Determining the Complete State of Stress in Rock Using a Single Borehole. Proc., 1st International Congress, International Society of Rock Mechanics, Lisbon, Oct. 1966, Vol. 2, pp. 17-24.
3. A. M. Richards. Causes, Measurement, and Prevention of Pavement Forces Leading to Blowups. Ohio Department of Transportation, Rept. OHIO-DOT-10-76, Oct. 1976.

Publication of this paper sponsored by Committee on Sealants and Fillers for Joints and Cracks.

Notice: The Transportation Research Board does not endorse products or manufacturers. Trade and manufacturers' names appear in this paper because they are considered essential to its object.

Abridgment

Evaluation Methods for Bridge Deck Membranes

W. P. Chamberlin, R. J. Irwin, and D. E. Amsler, New York State Department of Transportation, Albany

An evaluation of 44 applications of waterproofing membranes placed on rehabilitated concrete bridge decks in New York state is reported (1). The applications were not designed as field experiments but were made by a variety of state maintenance forces under normal working conditions.

Unsound concrete had generally been removed, but the level of residual chloride in unexcavated portions of the deck was not determined. Evaluations were based on copper-copper sulfate half-cell potential and electrical resistivity measured between one and five years after membrane placement. In a few instances, measurements were also made at the time of membrane placement, but more commonly placement was not observed. The paper deals primarily with the evaluations of data collected under these less-than-ideal circumstances.

Thirty of the applications were of one of two liquid-applied membranes that had been New York State Department of Transportation (NYSDOT) standards between 1958 and 1974. Their performances were compared and found to be superior to that of a representative national sample of about the same age distribution studied under a National Cooperative Highway Research Project study.

The national experience with membranes at that time was generally considered unsatisfactory. These standard membranes were then used as the norm against which the performances of 14 experimental membranes (both liquid and sheeting type) were evaluated. The experimental membranes, as a group, were found to have performed better at comparable ages than the standard membranes, but not outstandingly so.

In addition to the evaluation of specific membrane applications, the study resulted in the following more generally applicable conclusions:

1. Three of the only four membrane installations that consistently performed better than 75 percent of the norm group were observed to have been preceded by careful leveling and smoothing of the deck surface.
2. The physical condition of membranes examined in core samples, including the integrity of their bonds, was generally consistent with the level of electrical resistance measured at the site (Table 1).
3. The physical condition of concrete examined in core samples, including rebar corrosion, was generally

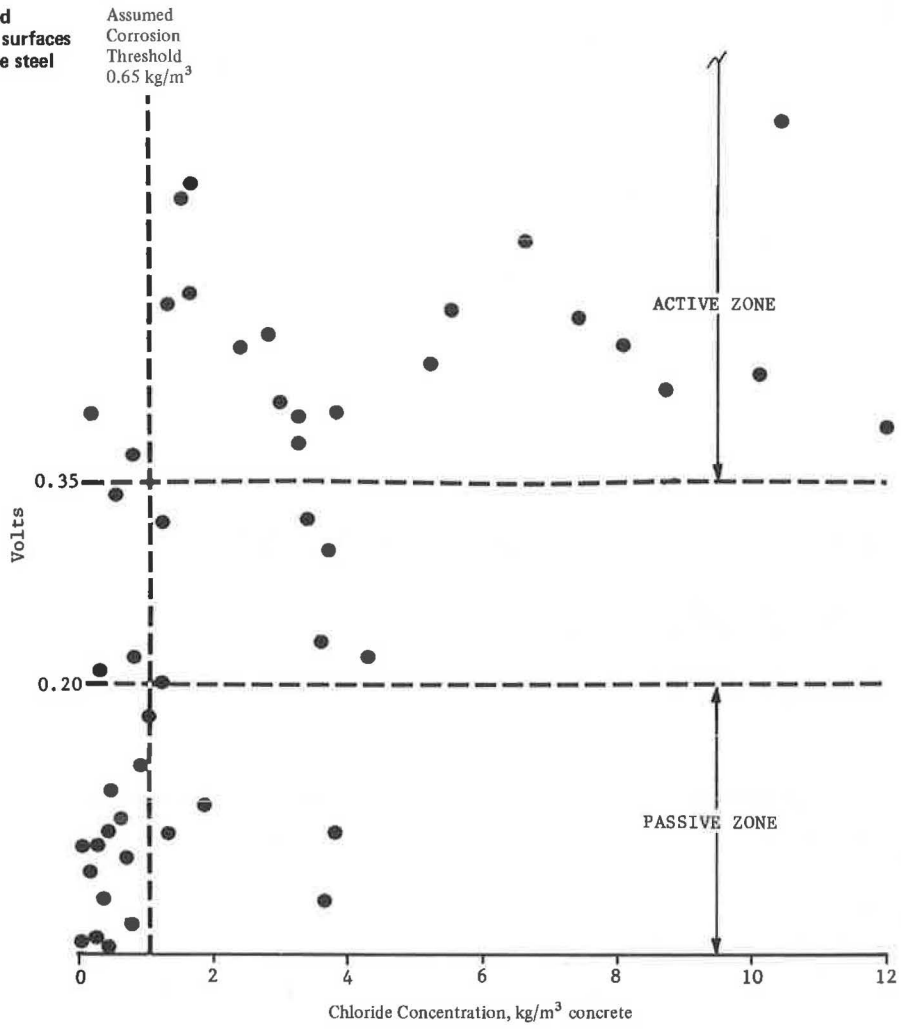
Table 1. Resistance related to membrane condition.

Electrical Resistance (kΩ)	Poor Appearance		Not Bonded to Deck		Not Bonded to Surface	
	Total Cores	Percentage	Total Cores	Percentage	Total Cores	Percentage
<100	9	45	9	44	9	44
>500	15	33	14	7	15	20

Table 2. Potential related to core condition.

Electrical Potential (V)	Cracked or Disintegrated		Steel Rusted	
	Total Cores	Percentage	Total Cores	Percentage
>0.35	12	58	7	57
<0.20	13	0	11	18

Figure 1. Half-cell potentials measured through bituminous concrete wearing surfaces and chloride content at the level of the steel reinforcement.



consistent with the level of electrical resistance measured at the site (Table 2).

4. Measurements of half-cell potential greater than 0.35 V were highly associated with chloride contents in the vicinity of rebars greater than 0.65 kg/m³ (1.1 lb/yd³) of concrete, and those less than 0.20 V with chloride contents less than 0.65 kg/m³ (Figure 1).

5. In spite of the presence of a membrane, 40 percent of all installations examined had active rebar corrosion over 25 percent or more of their deck surface areas.

REFERENCE

1. W.P. Chamberlin, R.J. Irwin, and D.E. Amsler. Waterproofing Membranes for Bridge Deck Rehabilitation. Engineering Research and Development Bureau, New York State Dept. of Transportation, Research Rept. 52, May 1977.

Publication of this paper sponsored by Committee on Corrosion.