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MICHIGAN
STATE HIGHWAY DEPARTMENT
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A COMPARISON OF A VINYL COATING SYSTEM WITH A RED LEAD-BROWN LEAD-ALUMINUM COATING SYSTEM FOR BRIDGES

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A COMPARISON OF A VINYL COATING SYSTEM WITH A RED LEAD-BROWN LEAD-ALUMINUM COATING SYSTEM FOR BRIDGES

At the request of Mr. Sam Cardone, Bridge Division, samples of a vinyl metal primer and a vinyl aluminum paint were tested for their suitability as bridge paints. These vinyl materials were tested in comparison with the presently used red lead, brown lead, and aluminum paint coating system. Sets of steel panels finished in the two systems were subjected to salt fog corrosion and accelerated weathering tests.

Preparation of Test Panels

Steel test panels for each of the two coating systems were divided into three groups. One group of panels consisted of new steel which was thoroughly cleaned before coating. A second group of panels had been purposely rusted in the salt fog chamber to the point of scaling and pitting, then sandblasted just prior to coating. The third group had been rusted in the same manner, but this group had been only hand wire brushed prior to coating. The recommended procedures for hand brush application of the coatings were followed.

Three coats were used in the red lead - brown lead - aluminum system. Successive coats were not applied until the previous coating was thoroughly dry. Four coats were used in the vinyl system; one coat of vinyl primer and three coats of vinyl aluminum paint. These applications were made to the panels prepared as previously noted. Reference panels were retained of each of the two coating systems for each of the three methods of panel preparation.

Corrosion Test

The relative corrosion resistance of the two coating systems was determined on panels prepared in the three methods mentioned. ASTM Test Method B 117-49T was

followed as nearly as possible with the laboratory salt fog chamber which approximates the ASTM standard. Two panels of each material and preparation combination were cross-scratched with a knife across their faces through the coatings to the metal. Results of the 168 hour corrosion tests are summarized in Table 1. Photographs of these test panels are shown in Figures 1 and 2.

Blistering of the paint film occurred on all panels coated with the vinyl system regardless of panel condition or preparation. This was especially heavy on the vinyl coated wire brushed pre-rusted steel panels. Blistering of the paint film was only slight to non-existant on the panels coated with the red lead - brown lead - aluminum system.

The only objectionable discoloration resulting from the corrosion test was on the wire brushed pre-rusted steel panels. The vinyl system discolored to a moderate amount whereas the red lead - brown lead - aluminum system failed.

Rust creepage at film breaks was very light for both systems for all conditions tested except the red lead - brown lead - aluminum system on wire brushed pre-rusted steel where it failed completely. This rust creeping and discoloration was due to a complete breakdown of the protective film.

Accelerated Weathering

One panel of each coating system and metal preparation method was subjected to accelerated weathering in an Atlas Twin-Arc Weather-Ometer. A cycle consisting of 1 hour of water, 1-1/2 hours of light, 2 hours of water, and 16-1/2 hours of light was used. The test was continued for 24 cycles of 21 hours each. This approximates one year of natural weathering. Results are recorded in Table 2 and shown in Figure 3.

All panels tested lost considerable luster. This, however, would not be too objectionable to the use for which these coating systems are intended. The only significant result of the artificial weathering tests is the medium amount of discoloration of the vinyl

coated wire brushed pre-rusted steel panels. This would present an unsightly appearance for any type of application. It appears to be due to blistering very similar to that found in the corrosion test of the same material and panel conditions. This is due to a breakdown of the coating system originating at localized points below the paint surface.

Conclusions

From the results of the qualitative tests reported here, the present Department bridge coating system of red lead - brown lead - aluminum paint is superior to the vinyl system on new steel and on sandblasted pre-rusted steel. On hand wire brushed pre-rusted steel neither system is satisfactory and such a procedure would not be recommended. This re-emphasizes the necessity of thorough preparation of the steel prior to coating.

TABLE 1

CORROSION TEST RESULTS			
Coating System and Panel Preparation	Rating [1]		
	Blistering	Discoloration	Rust Creeps At Film Breaks
Red Lead - Brown Lead - Aluminum System			
New Steel	10	9	9
Sandblasted Rusted Steel	8	9	9
Wire Brushed Rusted Steel	9	0	0
Vinyl System			
New Steel	5	9	9
Sandblasted Rusted Steel	7	9	9
Wire Brushed Rusted Steel	2	5	9

[1] Average of two panels rated 0-10 as follows:

10 - None
8 - Light
5 - Medium
2 - Heavy
0 - Complete Failure

TABLE 2

WEATHEROMETER TEST RESULTS		
Coating System and Panel Preparation	Rating [1]	
	Discoloration	Loss of Luster
Red Lead - Brown Lead - Aluminum System		
New Steel	9	3
Sandblasted Rusted Steel	8	3
Wire Brushed Rusted Steel	8	3
Vinyl System		
New Steel	9	2
Sandblasted Rusted Steel	8	2
Wire Brushed Rusted Steel	5	2

[1] Panels rated 0-10 as follows:

10 - None
8 - Light
5 - Medium
2 - Heavy
0 - Complete Failure

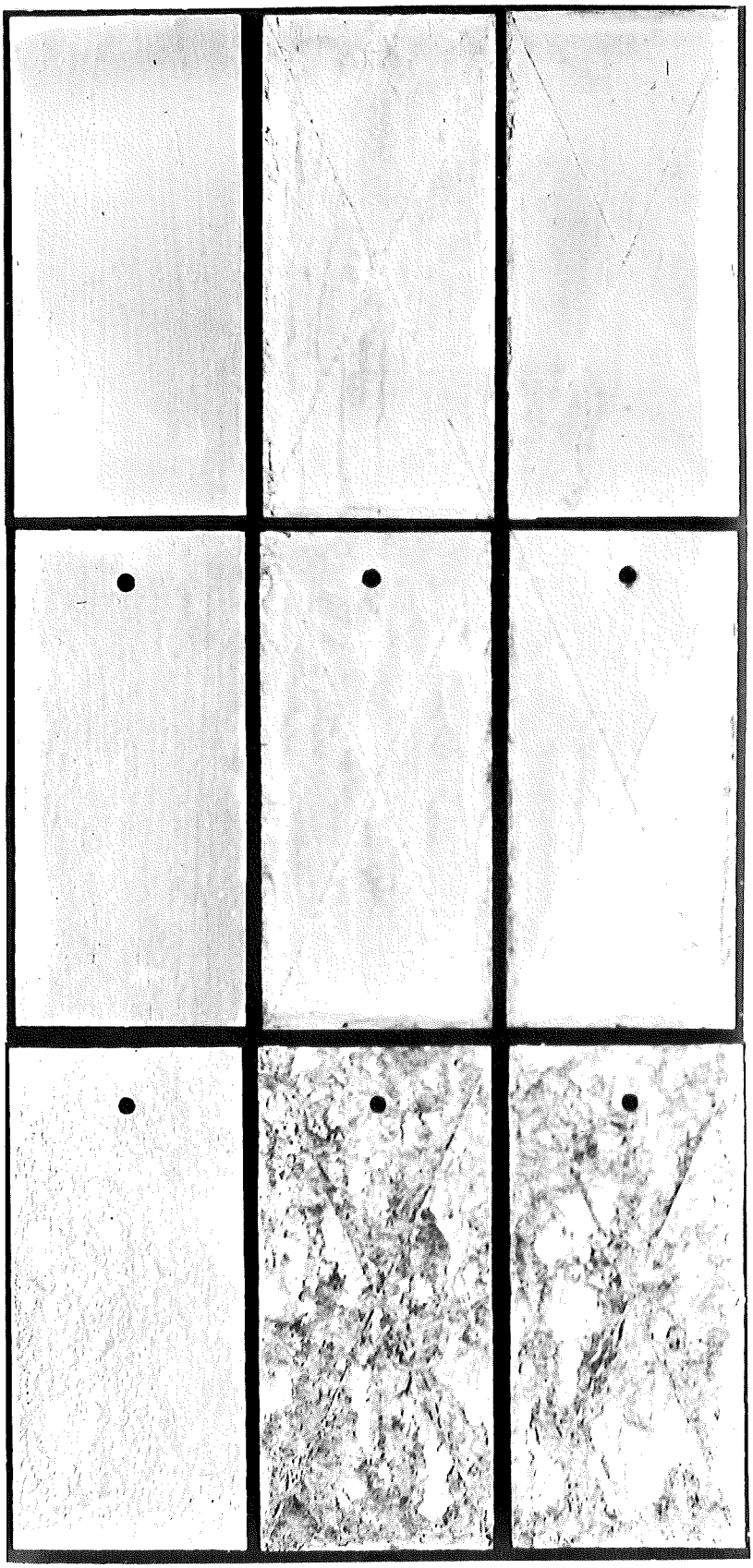


FIGURE 1. RESULTS OF 168 HOUR CORROSION TEST ON RED LEAD, BROWN LEAD, AND ALUMINUM PAINTED PANELS.

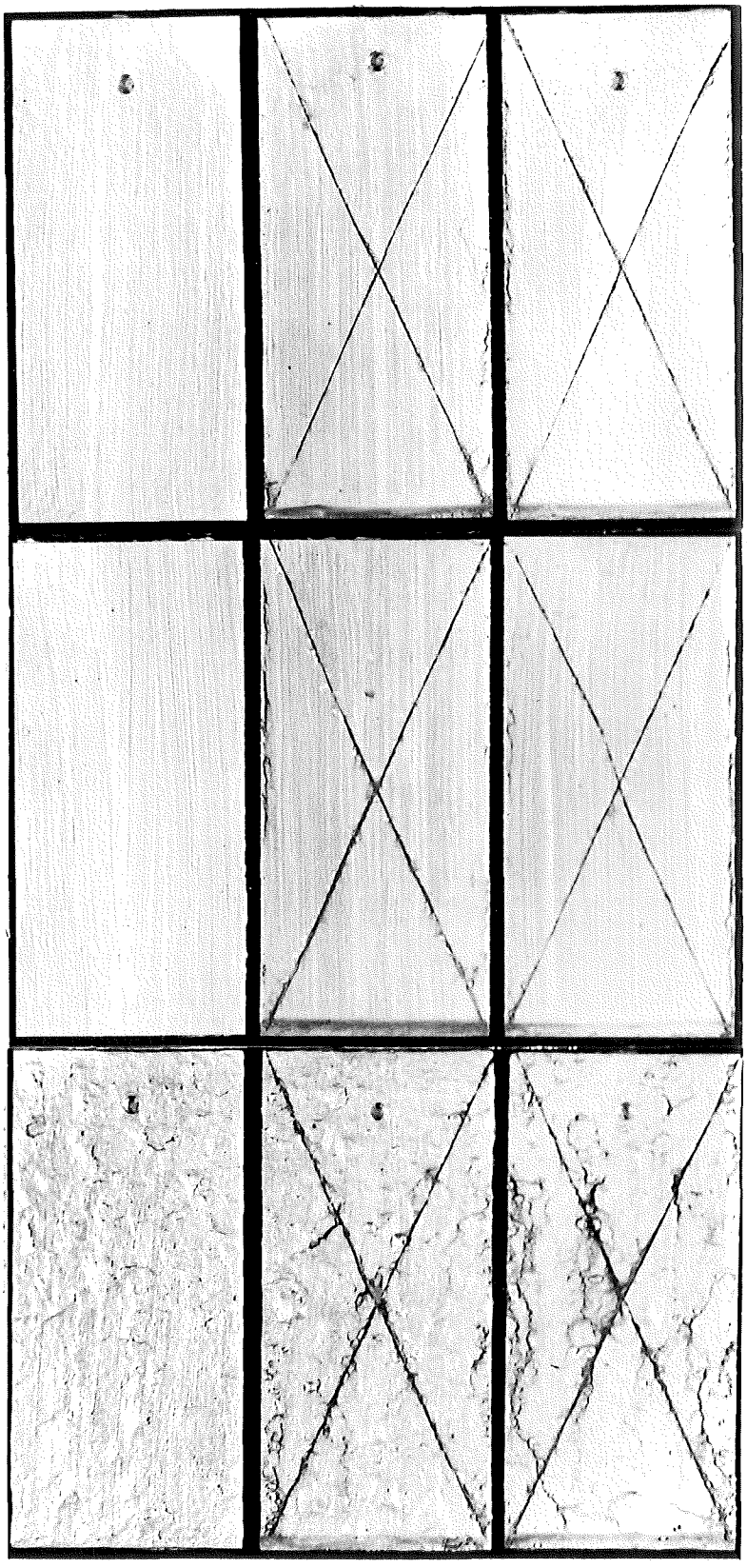
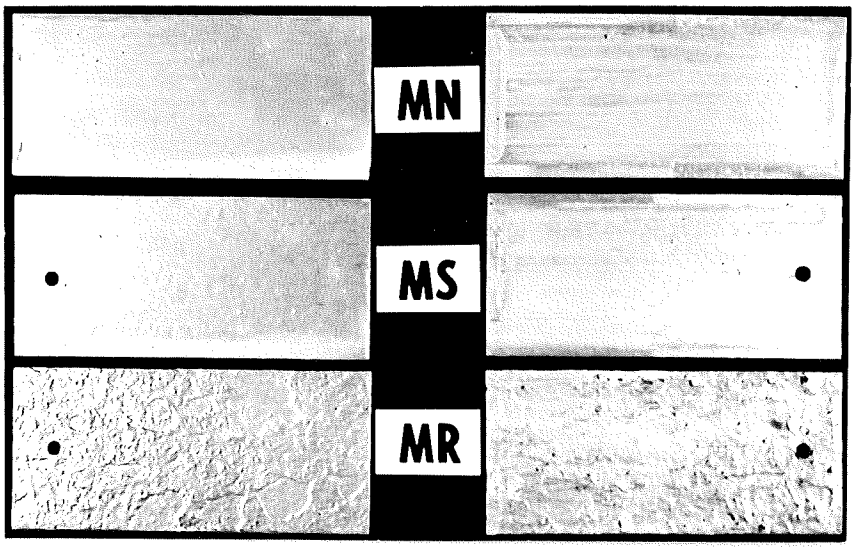


FIGURE 2. RESULTS OF 168 HOUR CORROSION TEST ON VINYL PAINTED PANELS.



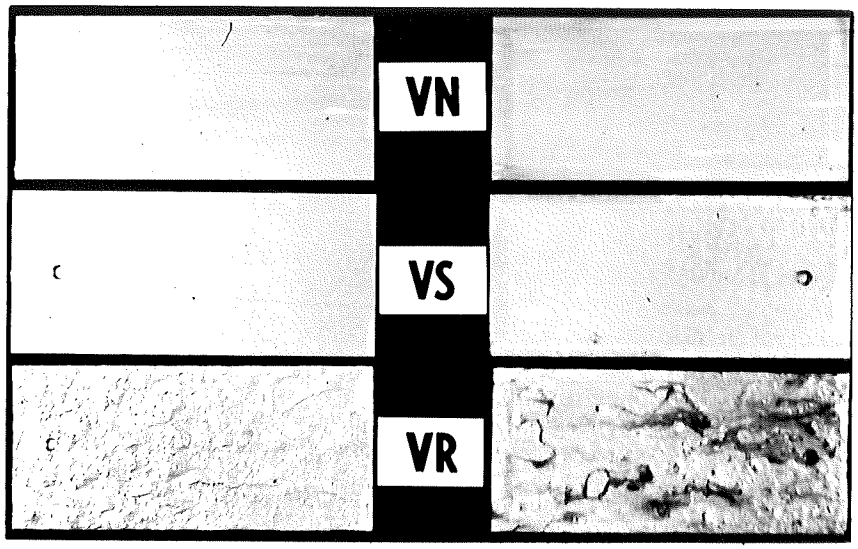
NEW STEEL

SANDBLASTED PRE-RUSTED STEEL

WIRE BRUSHED PRE-RUSTED STEEL

UNTESTED PANELS TESTED PANELS

RED LEAD-BROWN LEAD-ALUMINUM PAINTED PANELS



NEW STEEL

SANDBLASTED PRE-RUSTED STEEL

WIRE BRUSHED PRE-RUSTED STEEL

UNTESTED PANELS TESTED PANELS

VINYL PAINTED PANELS

FIGURE 3. RESULTS OF 24 CYCLES ACCELERATED (1 YEAR SIMULATED) WEATHERING.