OFFICE MEMORANDUM

MICHIGAN
STATE HIGHWAY DEPARTMENT

November 2, 1966

To: W. W. McLaughlin
Testing and Research Engineer

From: E. A. Finney

Subject: First Progress Report on Evaluation of Experimental Paint Coatings for Bridge Steel on S01 of 33031, S02 of 33032, and S07 of 38131. Research Projects 49 G-50(4) and (5). Research Report No. R-602.

In continuation of the Department's coatings evaluation program, and in accordance with one of the agreements reached at a meeting held in H. E. Hill's office on July 2, 1964, the Office of Construction selected three new bridges for field testing of experimental paint coatings on structural steel, as outlined in C. B. Laird's letter to you dated August 5, 1964. A. J. Permoda has prepared the following summary.

The selected bridges are located on US 127 between Mason and Jackson. The following three paint systems are under evaluation on these bridges, to determine comparative performance over blast-cleaned steel:

System 1: the Department's system consisting of No. 1A(1) primer, plus Paints Nos. 2A(2), 3A(1), and 5B field-applied in that order as topcoats (designated the Test Control System).

System 2: an all-vinyl system based on California specifications, consisting of a white vinyl primer, plus gray and aluminum topcoats field applied in that order.

System 3: a combination system also based on California specifications, consisting of a zinc silicate primer, plus No. O-WP and aluminum vinyl topcoats field-applied in that order.

To permit comparative evaluation and minimize the location variable, each paint system was used to coat half of two bridges, as follows:

System 1: two west spans of S01 of 33031 (Bellevue Road), and two west spans of S02 of 33032 (Columbia Road)

System 2: two east spans of S01 of 33031 (Bellevue Road), and three east spans of S07 of 38131 (Territorial Road)

System 3: two east spans of S02 of 33032 (Columbia Road), and three west spans of S07 of 38131 (Territorial Road).

All three paint systems were applied to give a total minimum dry film thickness of 5 mils on the bridge steel, consisting of rolled-beam girders, diaphragms, and expansion bearings. The steel was blast-cleaned to a No. 6 commercial grade for two systems, and to a No. 10 near-white grade for the zinc-silicate-primed system.

Summary of Painting History

Steel cleaning, shop and field painting, and incidental repairs are outlined as follows:

A. Cleaning and Shop Painting at the Douglas Steel Co., Lansing.

1. Cleaning by sandblasting, outdoors, using a hand-operated nozzle.
2. Using airless spray guns, application of the No. 1A(1) primer in April and May 1965, the zinc silicate primer in June, and the white vinyl primer in July and August.
3. Outdoor storage of the steel after shop painting, awaiting shipment to the bridge sites.

B. Steel Erection and Field Painting by Parmalee and Carpenter, General Contractors.

1. Transfer of shop-primed steel to the bridge sites, with erection during August and September 1965.
2. Welding of shear developers, forming, and concrete decking during September and October.
3. Field repair of the primers and application of field coats, as follows:

   a. Before onset of winter, complete application of the test control system first field coat at Bellevue Road (Fig. 1), and at Columbia Road except for the outer portion of the fascia beams. The No. 2A(2) paint was applied by roller and brush.

   b. Delay by the contractor in completing the vinyl-primed and zinc-silicate-primed systems, which required field repair, because of low temperatures late in the construction season and for other reasons.

   c. From May through July 1966, field repair of the other two primers (including cleaning of over-winter rust-back of the steel by sandblasting), and application of remaining field coats with an airless spray gun (Binks equipment).

Discussion of Paint System Application

Several comments should be made regarding the painting and its initial performance:

1. Diaphragms of the Bellevue Road test control paint system were mistakenly shop-primed with the white vinyl. This was permitted to remain, but was shop-over-coated with the No. 1A(1) primer. Thereafter, the specified field coats were applied.

2. Charring of the primers was evident on the underside of the girders' top flange after field welding of the spiral shear developers. Charring damage was worst on the white vinyl, intermediate on the No. 1A(1) primer, and barely noticeable on the zinc silicate primer.

3. Considerably retarded curing of the zinc silicate primer on some diaphragms was due to faulty stacking after priming at the fabricators, and this resulted in extensive damage to the primer during transit to the bridge sites and during erection, especially at Columbia Road.

4. As mentioned earlier, two of the test primers and part of the third were not overcoated in the field before the onset of winter, as had been specified. As a result, varying amounts of rust-back occurred to the blast-cleaned and primed steel during the winter exposure, which may be classified roughly as follows:

a. The system of No. 1A(1) primer and 2A(2) overcoat gave excellent, rust-free protection over a winter of exposure, at a 3-mil minimum dry film thickness.

b. The No. 1A(1) primer on the Columbia Road fascia beams gave almost rust-free protection over a winter of exposure, at a 1.5-mil minimum dry film thickness (Fig. 2).

c. The white vinyl primer, at a 2-mil minimum dry film thickness, gave the poorest protection of the three test primers, especially at Bellevue Road where about 20 percent of the steel had to be recleaned due to rust-back over the winter of exposure (Fig. 3).

d. The zinc silicate primer on the diaphragms gave variably good-to-poor performance due to improper curing, as previously mentioned. Performance over a winter's exposure on the girders was acceptably good at a 3-mil minimum dry film thickness, but disappointing in that the primer did not provide cathodic protection at erection scratches.

Summary

Construction scheduling for the three bridges did not favor completion of the experimental painting in the 1965 season, and forced a carry-over into the 1966 season. This necessitated extensive field cleaning by sandblasting to remove the rust-back that resulted during winter exposure of blast-cleaned and primed girders having erection damage or inadequate paint thickness. It is felt that satisfactory paint repairs were made by the contractor (Parmalee and Carpenter) to insure meaningful test paint systems. These repairs were completed by the contractor with commendable cooperation.

Final dry film thickness of the paints was heaviest for the test control system (on the average, a minimum of 6 mils), and generally met specification requirements for an average 5-mil minimum on the other two systems.

W. S. Hamilton, Project Engineer, and District Engineers were most helpful in supervising the painting to specification requirements.

Comparative field performance of the three test systems will be determined by future inspections, which will be reported.

OFFICE OF TESTING AND RESEARCH

E. A. Finney, Director
Research Laboratory Division

EAF:AJP:jcb

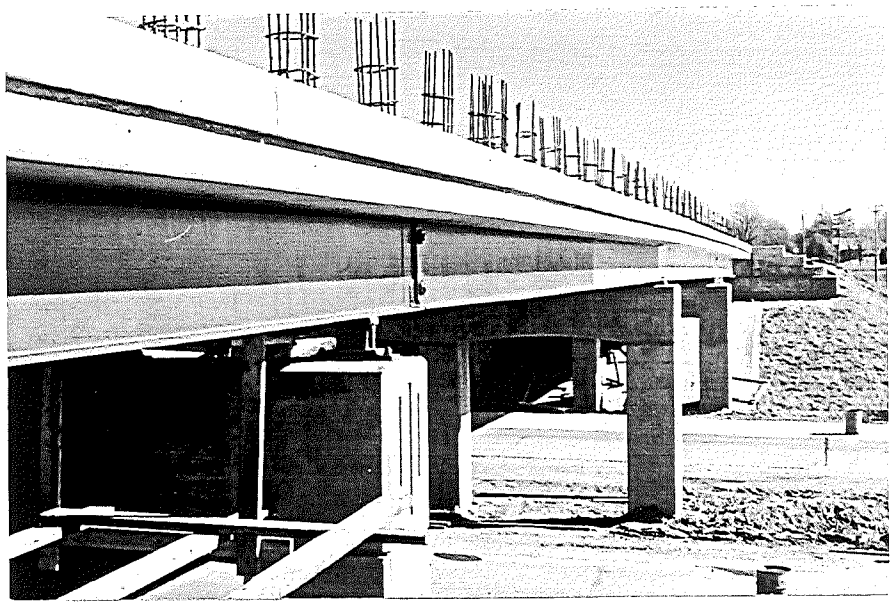

Figure 1. First field coat of No. 2A(2) Brown being applied over red lead primer on October 29, 1965 on two west spans of Bellevue Road. White vinyl primed east spans are in background.

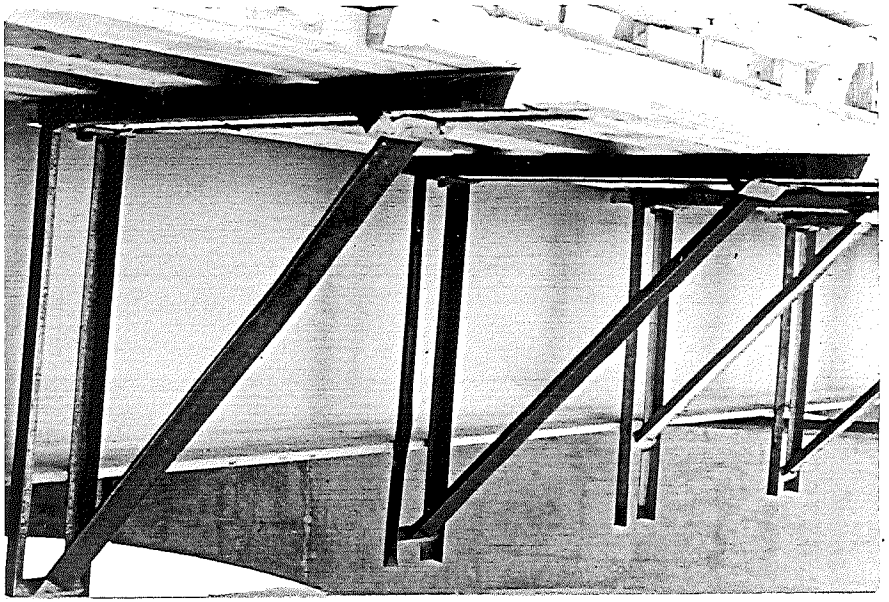

Figure 2. Almost rust-free condition of No. 1A(1) Red Primer over blast-cleaned steel after a winter of exposure on north fascia of Columbia Road (photographed spring 1966).

Figure 3. Rust-back on white vinyl primer over blast-cleaned steel after a winter of exposure on north fascia of Bellevue Road (photographed spring 1966).