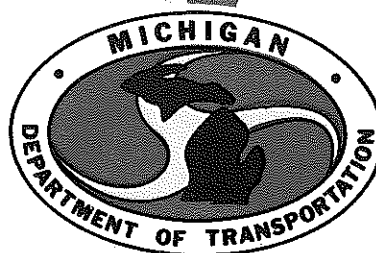


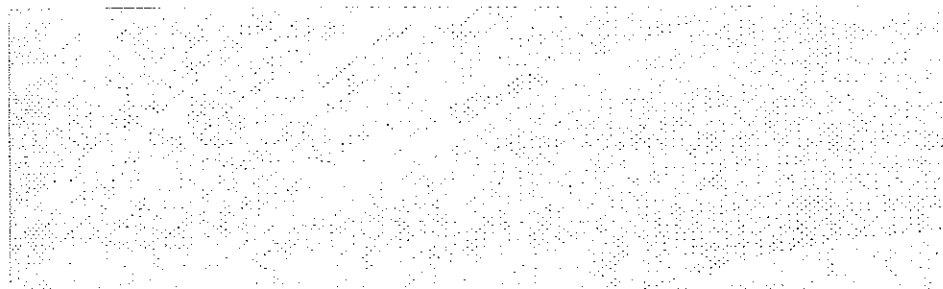
INVESTIGATION OF THE FIELD COATING OF  
ENVIRONMENTALLY EXPOSED WEATHERING STEEL  
Interim Report



**MATERIALS and TECHNOLOGY DIVISION**



0049399



TA418.76 .T56 1986 c.1 c. 4  
Investigation of the field  
coating of environmentally  
exposed weathering steel

TA418.76 .T56 1986 c.1 c. 4  
Investigation of the field  
coating of environmentally  
exposed weathering steel

INVESTIGATION OF THE FIELD COATING OF  
ENVIRONMENTALLY EXPOSED WEATHERING STEEL  
Interim Report

Gary L. Tinklenberg

Research Laboratory Section  
Materials and Technology Division  
Research Project 83 G-261  
(Work Plan No. 92)  
Research Report No. 1272

Michigan Transportation Commission  
William C. Marshall, Chairman;  
Rodger D. Young, Vice-Chairman;  
Hannes Meyers, Jr., Carl V. Pellonpaa,  
Shirley E. Zeller, William J. Beckham, Jr.  
James P. Pitz, Director  
Lansing, February 1986

The information contained in this report was compiled exclusively for the use of the Michigan Department of Transportation. Recommendations contained herein are based upon the research data obtained and the expertise of the researchers, and are not necessarily to be construed as Department policy. No material contained herein is to be reproduced—wholly or in part—without the expressed permission of the Engineer of Materials and Technology.

## INTRODUCTION

In 1984 a research project was initiated to document the painting of two unpainted weathering steel structures (the original work plan is attached as Appendix A). This work plan was later amended to include four more structures (Appendix B); however, to date, none of those structures has been completed. The first structure, the service drives of 8 Mile Rd over US 10, was completed in the Fall of 1984. The second structure, Grand River Ave over I 96, was completed in the Fall of 1985. The work plan required that research personnel observe and document the painting operation and report the finding within six months of project completion.

There were a number of contract problems that caused some of the work plan variables to be left out of the 8 Mile Rd contract. Specifically, the two different abrasives and the two different suppliers of the same generic type of paint systems. They were included in the Grand River contract, however.

The following report will describe the cleaning and coating of each structure, a one-year review of the 8 Mile Rd structure, and some comparisons with the repainting of an A-36 (carbon steel) structure. Research personnel were on the site as much as possible but not 100 percent of the time. Painting at night (a contract requirement due to very high daytime traffic volumes), distance (about 100 miles from the Laboratory), weather, and other projects limited the amount of time we could be on site. A detailed log of the painting activities is on file in the Research Laboratory along with several hundred slides.

### THE 8 MILE RD STRUCTURES

#### Background

The 8 Mile Rd-US 10 interchange was built in 1965. These structures were among the first weathering steel structures built in the United States. The interchange consists of four structures, a 1,838-ft high-level structure that carries the bulk of 8 Mile Rd traffic over US 10, two service drives (214 ft and 216 ft) and a small ramp bridge (60 ft). The two service drives and the ramp bridge were used as the test site. The typical clearance for the service drives was approximately 15 ft. Due to a narrow right-of-way vertical side walls were used (Fig. 1).

These structures were chosen for a number of reasons:

- 1) They were the oldest weathering steel bridges.
- 2) The location was the test site for numerous panel exposures, thus the environment and corrosion rates were well documented.
- 3) There were concerns about the high rates of corrosion, in comparison to a nearby non-highway environment.

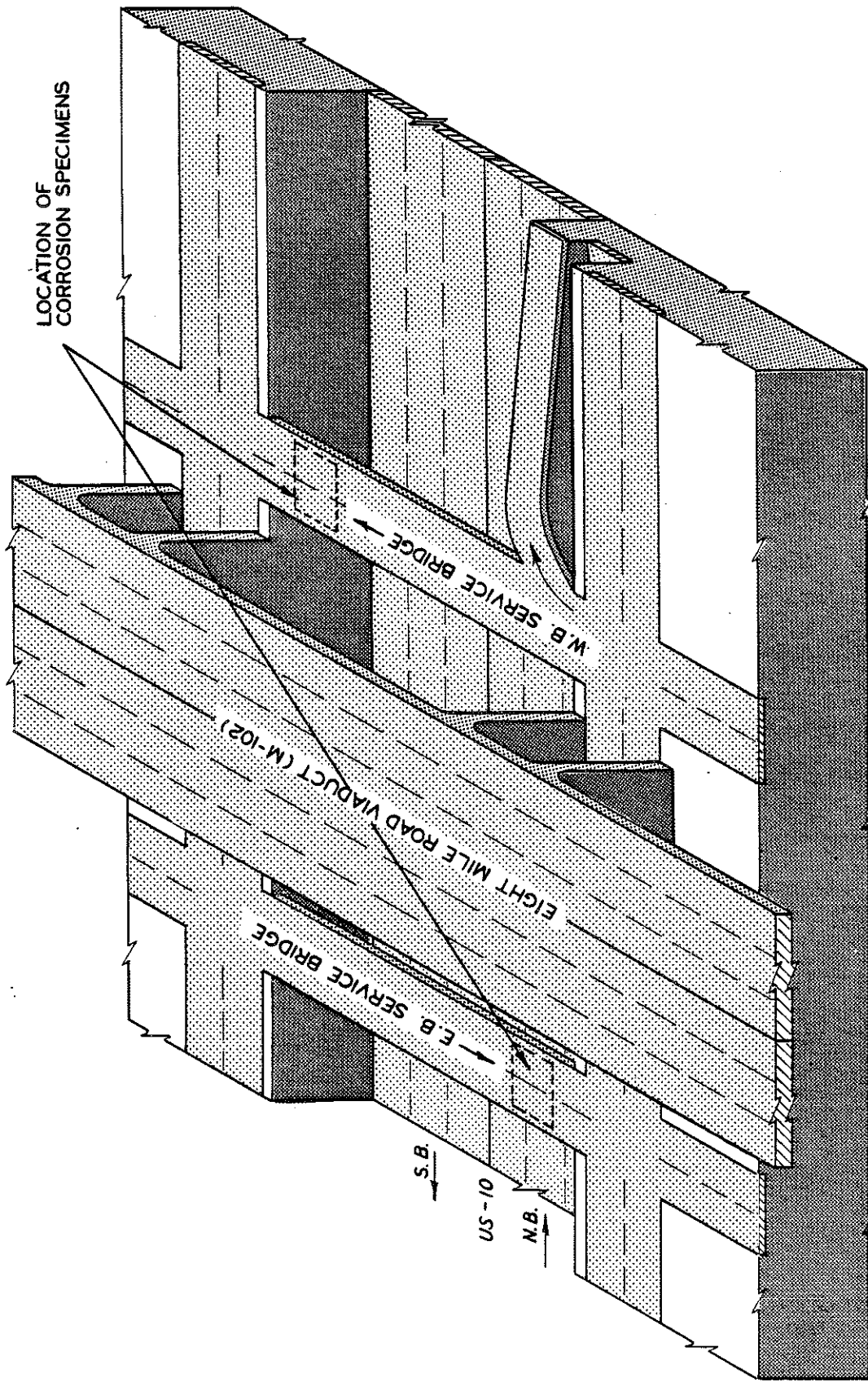


Figure 1. Complex intersection at the Eight Mile Road and the John Lodge Expressway; note location of corrosion specimens.

4) From previous research work (1) the structures were known to exhibit many small pits.

### Surface Preparation

The contract (a complete set of specifications is included as Appendix C) called for the appearance of a near-white blast. In the laboratory we had determined that to meet the actual requirements of a near-white blast, particularly the requirement that all visible rust be removed and only slight rust stains remain, was extremely difficult and expensive due to the numerous small pits. Small rust deposits were visible in the pits upon close examination. If one held the visual standards close to the surface and looked at the surface from about 24 in. the "appearance" of the two were very close. This procedure is used on all painting contracts involving weathering steel.

The contractor started blasting on July 18, 1984 and chose to use Ottawa silica sand. The procedure was to blast and prime all three structures and then put on the intermediate and top coats. Approximately 100 tons of sand were used on 36,000 sq ft or 5.56 lb/sq ft. The contractor stated that this was double what he normally used; however, the SSPC Manual's footnote indicates that 8.5 lb are required for a near white blast on "normal" rusty steel. (The discrepancy may be due to the fact that the contractor was comparing to blasting an old alkyd rather than rusty mild steel and SSPC used blasting variables that are much more inefficient than the typical values used on the structures.)

### Painting

The system was supplied by Ameron and all three coats were airless sprayed. Although the spray technique was adequate, the painters exhibited numerous application traits that substantially increased the amount of paint required to achieve the minimum dry film thickness. Some of the factors that were noted are:

- 1) Numerous runs and sags,
- 2) Stiff wrist technique,
- 3) Poor triggering technique,
- 4) High atomization pressures,
- 5) Worn tips,
- 6) Failure to check wet film thicknesses,
- 7) No quality control procedures.

Additionally, the contractor chose to apply the primer in two coats on many areas. The blasting or clean-up operations would take longer than planned; therefore, they would only have enough time to "lightly coat the surface to hold the blast," before all traffic control had to be out of the right-of-way. These areas were randomly distributed among the areas where attempts were made to obtain the required thicknesses. It was easier and faster for the contractor to apply a second coat to the

entire surface. The average dry film thicknesses are much higher than the specified minimum. (Whenever a minimum is specified it is expected that the average dry film thickness will be higher by about 1 to 3 mils.)

### The Cost

The cost information is contained in Table 1. The bids were well below the estimates. This soon corrected itself as bids on the second project were much closer to estimates.

TABLE 1  
COST INFORMATION

Structure	Engineering Estimate		Bidders	Bids		Engineering Estimate Cost/sq ft		As Bid Cost/sq ft	
	Entire Contract	Cleaning & Painting		Total	Cleaning & Painting	Entire Contract	Cleaning & Painting	Entire Contract	Cleaning & Painting
8 Mile Rd (38,000 sq ft)	136,230	115,200	1	83,980	73,000	3.784	3.200	2.33	2.03
			2	114,800	103,800			3.19	2.88
			3	195,063	157,000			5.42	4.36
Grand River Ave over I 96 (83,000 sq ft)	392,856	173,300	1	421,056	271,810	1	2.08 <sup>2</sup>	1	3.27
			2	427,651	200,000			1	2.40
			3	455,771	220,000			1	2.65
			4	456,068	220,000			1	2.65
			5	508,485	— <sup>3</sup>				
			6	511,141	—				
			7	561,383	—				

<sup>1</sup> There were many other items in addition to painting in this contract. The overall lowest bid was awarded; however, not the lowest cost per sq ft.

<sup>2</sup> The engineer's estimates are based on tonnage, not sq ft. Due to the thin web sections in this structure the estimate was low.

<sup>3</sup> The only information we received on the highest bidders was the total bid.

### The One-Year Evaluation

A one-year evaluation is only useful to find gross mistakes. There should be very few, if any, corrosion failures. The structures are in excellent shape. There were no rust failures. The only negative aspects found were:

- 1) An area in the center of the eastbound structure over the southbound lanes had an area about 6 ft long where the blue top coat was missing.
- 2) Dirt was accumulating on the runs and sags, highlighting them.
- 3) Some rust staining from areas that cannot be coated with normal bridge painting techniques.

### THE GRAND RIVER AVE OVER I 96 STRUCTURE

Most of the same general conditions that applied to the 8 Mile Rd structures also apply to the Grand River Ave structure. The structure was built in 1972 and was painted in the late Summer and Fall of 1985.



This contract did contain the contract provisions for the use of at least two different abrasives and paint systems. An extensive written and photo log is on file.

### Surface Preparation

The contractor started blasting with 'Starblast.' Starblast is a low-silica, fine-grain, dense blasting sand supplied by DuPont. Although the blasters made no effort to effect maximum blasting economies, they were very satisfied with the product as a blasting medium. The "appearance" of a near-white blast was achieved routinely, only those areas that were completely missed required touch-up after inspection.

After using Starblast on 75 percent of the surface area, the contractor switched to 'Copper Blast,' a copper slag abrasive. There was a noticeable decrease in overall quality of the first day's production. This was attributed to the establishment of an application routine that worked well with Starblast but that was not adequate for Copper Blast. The next day's production, although better, was still not adequate. After the third day with the same results the contractor asked that he be allowed to mix Copper Blast and Starblast. Since we already learned something of the differences between the two products, and to achieve maximum quality on the job, he was allowed to do this. We could not get a comparison of blasting rates because the quality of the two surfaces was not the same. However, we did conclude that on weathered weathering steel Starblast produced the "appearance" of a near-white at a higher rate than Copper Blast. (This may not be the case for existing painted steel.)

Due to the problems with blasting materials, exact product usage could not be determined. It appeared, and was roughly calculated to be similar to the 8 Mile Rd structure. It is important to remember that this was the contractor's first experience with this abrasive and with this type of steel, and that no efficiency tests were conducted. Therefore, all that can be concluded is that Starblast was, at worst, the same number of lb/sq ft as silica sand.

### Paint Application

The east half of the structure was painted with an epoxy zinc-rich primer, a polyamide epoxy intermediate and an aliphatic urethane supplied by Ameron. The west half was the same type of system supplied by Tnemec. Although there were some personal preferences by the applicators, they were varied. Both systems did well with no major application differences noted. Dry film thickness averages were higher than the minimum specified dry film thickness. The application technique varied with the six different painters. In general, however, the application was even with very few runs or sags. Prior to the cure of the top coat the surface adjacent to a large mass of concrete cooled below the dew point causing the top coat to fade in these areas. These will be repaired in 1986 by a reapplication of the top coat.

### Costs

A summary is contained in Table 1.

### Summary

This report was written as a brief overview of the work to date. The research program will continue in the Summer of 1986 with four more structures. There simply is not enough information to reach any conclusions except that we have found nothing which will cause us to change our research procedures or policy recommendations, which were based on laboratory studies and it appears that a small sized abrasive has some advantage over a larger sized abrasive.

APPENDIX A

July 23, 1984

Mr. Douglas A. Bernard, Chief  
Demonstration Projects Division  
Federal Highway Administration  
400 Seventh Street, S.W.  
Washington, D.C. 20590

Dear Mr. Bernard:

Your Ref: Demonstration Projects Program  
Cooperative Agreement Work Order  
DTFH 71-84-4504-MI-06

This transmits one copy of the signed agreement for the Experimental Project No. 4,  
"Protective Coatings for Structural Steel" for \$34,000.

We are looking forward to carrying out this project under the Demonstration  
Projects Program.

Sincerely,

TESTING AND RESEARCH DIVISION

*Martin L. O'Toole*

Martin L. O'Toole  
Acting Engineer of Testing & Research

MLO:LTO:cgc

cc: D. A. Merchant  
H. F. Derks  
L. T. Oehler

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	JMR	JUL 23 1984		GRC
	RMV			CJA
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	JWB			FC
	TAC			MLD
	CDC			JK
	JBA		MDOT TESTING & RESEARCH DIVISION	FILE
	ELG			



U.S. Department  
of Transportation  
**Federal Highway  
Administration**

Region 5  
Michigan Division

P. O. Box 10147  
315 West Allegan Street  
Lansing, Michigan 48901

June 26, 1984

**RECEIVED**

JUN 27 1984

Mr. James P. Pitz, Director  
Michigan Department of Transportation  
Lansing, Michigan

Director  
Department of Transportation

Dear Mr. Pitz:

**Demonstration Projects Program  
Cooperative Agreement Work Order DTFH 71-84-4504-MI-06**

Enclosed is a letter from Mr. Douglas A. Bernard along with two copies of the subject Agreement. Please execute the Agreements as per the instructions and return one copy to Mr. Bernard.

Sincerely yours,

*Jerry L. Poston*

Jerry L. Poston  
Assistant Division Administrator

For: David A. Merchant  
Division Administrator

MLO	
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GDT	
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Enclosure

MLO	✓
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JUL 9 1984

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Copies

→ M.L. O'Toole - Action - Orig Attach.  
J. Venturino

✓ Tmk.




U.S. Department  
of Transportation  
**Federal Highway  
Administration**

400 Seventh St., S.W.  
Washington, D.C. 20590

JUN 18 1984

HHO-41

Mr. James Pitz  
Director, Michigan Department  
of Transportation  
425 West Ottawa  
P. O. Box 30050  
Lansing, Michigan 48909

Through:   
Mr. David A. Merchant  
Division Administrator  
Lansing, Michigan

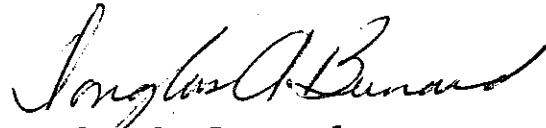
Dear Mr. Pitz:

Enclosed are two copies of a Work Order for a statewide evaluation of an epoxy-zinc paint system applied to an exposed ASTM 588 steel. This Work Order is issued under our Cooperative Agreement signed and dated October 6, 1980, and Amendment No. 1.

Please execute both copies of the Work Order, enter the name of the principal investigator under ARTICLE IV - KEY PERSONNEL of the Work Order, and return one copy with original signatures to this office.

Any questions concerning the Work Order may be directed to Project Manager Nelson J. Castellanos of this office at (202) 426-9212.

Sincerely yours,



Douglas A. Bernard  
Chief, Demonstration  
Projects Division

Enclosures

cc: RFHWA John O. Hibbs, Region 5, Homewood, IL, HEO-05

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 DEMONSTRATION PROJECTS PROGRAM  
 COOPERATIVE AGREEMENT WORK ORDER

WORK ORDER NO.: DTFH71-84-4504-MI-06

EFFECTIVE DATE: JUN 14 1984

ISSUED BY:

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 400 7TH ST. S.W.  
 WASHINGTON, D.C. 20590

COOPERATING AGENCY:

Michigan Department of  
 Transportation  
 425 West Ottawa  
 P. O. Box 30050  
 Lansing, Michigan 48909

EXPERIMENTAL PROJECT NO.

4, Protective Coatings for Structural Steel

ACCOUNTING AND APPROPRIATION DATA:

248-15-73-1C-1060-4504

FUNDS AVAILABLE: NTE \$34,000

THE COOPERATING AGENCY AGREES TO PERFORM ALL THE SERVICES SET FORTH IN THE ATTACHED SCHEDULE FOR THE CONSIDERATION STATED HEREIN. THE RIGHTS AND OBLIGATIONS OF THE PARTIES TO THIS WORK ORDER SHALL BE SUBJECT TO AND GOVERNED BY THE SCHEDULE AND THE COOPERATIVE AGREEMENT

DATED 12/5/83

COOPERATING AGENCY:

Michigan Department of  
 Transportation  
 425 West Ottawa  
 P. O. Box 30050  
 Lansing, Michigan 48909

ISSUING OFFICE:

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 400 7TH ST. S.W.  
 WASHINGTON, D.C. 20590

BY (AUTHORIZED SIGNATURE)

*Martin L. O'Toole*

BY (AUTHORIZED SIGNATURE)

*H.C. Wieland 6/14/84*

TYPED NAME: Martin L. O'Toole

DATE: July 23, 1984

TYPED NAME: H. C. Wieland

DATE:

TITLE: Acting Engineer of Testing and Research

TITLE: Division Engineer

ARTICLE I - STATEMENT OF WORK

The Cooperating Agency shall provide for the evaluation of an epoxy zinc-rich paint system which will be applied to an exposed ASTM A588 weathering steel in accordance with the attached work plan.

ARTICLE II - WORK PLAN

The work/evaluation plan attached as Exhibit A is herein approved subject to the modifications in Exhibit B.

ARTICLE III - PERIOD OF PERFORMANCE

Preparation of the initial report shall be completed by October 1, 1985. The second phase of the evaluation and periodic progress reporting shall be completed upon failure of the coating and/or termination of the evaluation on October 1, 1990.

ARTICLE IV - KEY PERSONNEL

The Cooperating Agency shall assign the following individual(s) as principle investigator(s):

GARY L TINKLENBERG (Name)  
MICH DOT PO. Box 30049 (Address)  
LANSING MICH 48909  
517-322-1632 (Telephone)

ARTICLE V - CONSIDERATION AND PAYMENT

The Federal Highway Administration (FHWA), Demonstration Projects Division, agrees to reimburse the Cooperating Agency up to \$34,000 for costs incurred for the testing and evaluation of the protective coatings as detailed in the work plan. Following acceptance of the initial report by the FHWA Demonstration Projects Division, the Cooperating Agency may submit a voucher for costs incurred under this Work Order not to exceed 75 percent of the amount being provided for this evaluation. After acceptance of the final report, the Cooperating Agency may submit a final voucher.

Funds provided by this Work Order shall not be used by the Cooperating Agency as matching funds for federally funded programs or projects.



## WORK PLAN

The Problem

The cleaning and costing of exposed ASTM A588 weathering steel has shown itself to be different and more difficult than for normal painted steel. A number of attempts both in the United States and other countries have not gone well, and in at least one case - and probably more - has resulted in litigation. The major problems seem to be the difficulty in obtaining the required degree of surface preparation at "normal costs" for that degree, the thick paint films that are necessary due to the very rough surface and the inability to completely remove deicing salt residue from the surface. To date, the paint systems that best tolerate these parameters are epoxy zinc-rich types. There are doubts whether or not there is enough expertise in the current bridge painting industry to properly apply these system, and this being the case, should we specify an easier to apply system?

Scope

Contracts will be let to clean and coat two existing structures in an urban environment using a new special provisions and a high technology paint system. The influences of existing steel conditions, surface preparation media, and coating systems on overall corrosion control performance will be evaluated.

Objective

The objective of this project is to document the various conditions that affect coating life on environmentally exposed weathering steel. With this information, we will be in a better position to make further recommendations.

Status of Known Research

Little, if any, data are available. Michigan has completed many accelerated test that have been instrumental in arriving at a starting point. However, no published field data have been found specifically addressing the painting of weathering steel.

## Field Evaluation

There are many factors that have effects on the overall coating performance. Due to limited funds, we will pursue only some of the basic factors that have pronounced effects on normal steel and will try to determine whether these factors are any different on environmentally exposed weathering steel.

Two bridges will be selected in the Detroit metropolitan area. The existing conditions on these structures will be thoroughly photographically documented. Steel samples will be taken for chemical analysis. Two separate contracts will be prepared. In order to reduce potential for inspection variables, both contracts will be assigned to the same construction projects engineer.

To evaluate the effects of blasting media, at least 25 percent but no more than 75 percent of each structure will be blasted with "Starblast." (Starblast is a trade name for a staurolite sand available only from DuPont. It is unique in that it offers a small particle size with high density at a very competitive applied cost.) The remaining portion of the structure can be blasted with the contractor's choice of abrasive as long as it meets the normal specification requirements.

Any of the products listed in the Qualified Products List for coating weathering steel may be used, but the contractor must use at least two systems on equal portions of the structure. These are all three-coat multi-component systems that have performed well in our laboratory on environmentally exposed panels.

During the entire coating operation, Research Laboratory and Construction personnel will be on the job site. It will be the responsibility of Research personnel to observe and document the following conditions:

### A. Problem description

- Overall rating of the coating (percent of rust)
- Condition of the coating for the various structural members

location (interior or exterior panel)  
rusting  
appearance  
cracking

B. Weather conditions (temperature and humidity)

- While cleaning the surface
- While applying the prime, intermediate, and finish coats

C. Surface Preparation and Placement of the protective coating

- specifications applicable to the coating
- technique and materials used to prepare the surface
- genetic classification of the coating and percent composition
- equipment used for the application
- unit prices (per area)
- time intervals between coats
- dry film thickness
- construction problems
- proprietary name, if applicable

D. Periodic checks on effectiveness

- overall condition of the steel coating
- coating condition of the various structural members

location (interior or exterior panel)

rusting

blistering

appearance (fading)

adhesion

mechanical damage

- life cycle cost analysis

Reporting

The evaluation of paint performance over a 60-month period following the application.

Reports shall be as follows:

12 month: After the last coating application, an initial report shall be published which includes a summary of the data along with the results from the first field evaluation. A draft copy of the report will be submitted to FHWA for review and comments. FHWA review is to be completed and comments furnished to the Cooperating Agency within 30 days.

36 month: After the last coating application, an interim report will be published with the results of all field evaluations conducted to that date.

60 month: After the last coating application, the final report will be published for the field evaluations conducted to that date. The report should include findings and recommendations as well as any discussion useful in the assessment of the cleaning and coating techniques. The information in the report should be presented in a form easily understood and summarized. A draft final report will be submitted to FHWA for review and comment following completion of the evaluation. FHWA review is to be completed and comments furnished to the Cooperating Agency within 60 days. A reproducible copy of the final report shall be furnished to FHWA.

Cost Estimate

<u>Estimated Costs</u>	<u>First Year</u>	<u>Third Year</u>	<u>Fifth Year</u>
Labor	\$21,100	\$1,000	\$1,000
Travel	5,100	400	400
Report	<u>3,000</u>	<u>          </u>	<u>2,000</u>
TOTAL	\$29,200	\$1,400	\$3,400

Exhibit B

Add the following statement to the field evaluation section on Page 2 of Exhibit A.

"The exact location of the two structures will be submitted to the Demonstration Projects Division for approval prior to incurring any cost in this project."

APPENDIX B



U.S. Department  
of Transportation  
**Federal Highway  
Administration**

400 Seventh St., S.W.  
Washington, D.C. 20590

JUN 4 1985

Reply to: HHO-41

Mr. James Pitz  
Director, Michigan Department  
of Transportation  
425 West Ottawa  
Post Office Box 30050  
Lansing, Michigan 48909

Through: D. A. MERCHANT  
Mr. David A. Merchant  
Division Administrator  
Lansing, Michigan

Dear Mr. Pitz:

Enclosed are two copies of Modification No. 1, Work Order No. DTFH71-84-4504-MI-06 for evaluation of an epoxy-zinc paint system for ASTM 588 steel. The Modification adds four bridges to the project, and increases the funding for monitoring, evaluating, and reporting by \$20,700. The Modification also requires changes to the qualified products list to assure different coating systems are used in each contract.

Please execute both copies of the Work Order Modification and return one copy with original signatures to this office.

Any questions concerning the Work Order may be directed to Mr. Robert Gausman of this office at (202) 426-9212.

Sincerely yours,

Douglas A. Bernard  
Chief, Demonstration  
Projects Division

Enclosures

cc: RFHWA John O. Hibbs, Region 5, Homewood, IL, HEO-05

DATE: JUN 7 1985

<input checked="" type="checkbox"/> Div Adm	<input type="checkbox"/> P and R
<input checked="" type="checkbox"/> Asst D/A	<input checked="" type="checkbox"/> Bridges
<input checked="" type="checkbox"/> DVA Sec	<input type="checkbox"/> Environment
<input checked="" type="checkbox"/> Asst Coord	<input type="checkbox"/> OMSG
<input type="checkbox"/> Adm Mgr	<input type="checkbox"/> Safety
<input type="checkbox"/> Dist A	<input type="checkbox"/>
<input type="checkbox"/> Dist C	<input type="checkbox"/>
<input type="checkbox"/> ROW	<input type="checkbox"/>

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 DEMONSTRATION PROJECTS PROGRAM  
 COOPERATIVE AGREEMENT WORK ORDER

WORK ORDER NO.: DTFH71-84-4504-MI-06  
 Modification No. 1

EFFECTIVE DATE: MAY 31 1985

## ISSUED BY:

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 400 7TH ST. S.W.  
 WASHINGTON, D.C. 20590

## COOPERATING AGENCY:

Michigan Department of  
 Transportation  
 425 West Ottawa  
 Post Office Box 30050  
 Lansing, Michigan 48909

EXPERIMENTAL PROJECT NO. 4, Protective Coatings for Structural Steel

ACCOUNTING AND APPROPRIATION DATA: 248-15-73-1C-1060-4504 = \$34,000  
 248-15-73-1C-1060-5504 = \$20,700

FUNDS AVAILABLE: Funds increased \$20,700  
 Total funds now available NTE \$54,700

THE COOPERATING AGENCY AGREES TO PERFORM ALL THE SERVICES SET FORTH IN  
 THE ATTACHED SCHEDULE FOR THE CONSIDERATION STATED HEREIN. THE RIGHTS  
 AND OBLIGATIONS OF THE PARTIES TO THIS WORK ORDER SHALL BE SUBJECT TO  
 AND GOVERNED BY THE SCHEDULE AND THE COOPERATIVE AGREEMENT  
 DATED 12-5-83.

Expiration Date: October 1, 1991

## COOPERATING AGENCY:

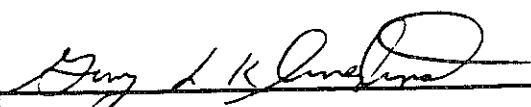
Michigan Department of  
 Transportation  
 425 West Ottawa  
 Post Office Box 30050  
 Lansing, Michigan 48909

## ISSUING OFFICE:

U.S. DEPARTMENT OF TRANSPORTATION  
 FEDERAL HIGHWAY ADMINISTRATION  
 400 7TH ST. S.W.  
 WASHINGTON, D.C. 20590

BY(AUTHORIZED SIGNATURE)

BY(AUTHORIZED SIGNATURE)



TYPED NAME:

TYPED NAME: Gary L. Klinedinst

DATE:

DATE: MAY 31 1985

TITLE:

TITLE: Division Engineer



Experimental Project Program Work Order No. DTFH71-84-4504-MI-06 is modified as follows:

ARTICLE III - PERIOD OF PERFORMANCE

Preparation of the initial report for the bridges being added to the evaluation shall be completed by October 1, 1986. Evaluation and reporting of the additional bridges shall be completed upon failure of the coatings and/or termination of the evaluation on October 1, 1991.

ARTICLE V - CONSIDERATION AND PAYMENT

The amount FHWA agrees to reimburse the Cooperating Agency for monitoring, evaluating, and reporting of the paint system being applied to weathering steel is increased from \$34,000 to \$54,700 in accordance with Exhibit C.

Articles I, II, and IV remain unchanged.

Exhibit B  
Modification #1

The statement in Exhibit B is modified as follows:

The location of the two bridges to be named in the original Work Order are M-102 (8 Mile Rd.) over U. S. 10 and the Grand River Road over I-96 both in the Detroit metropolitan area.

Add the following statements to Exhibit B as additional modifications to Exhibit A:

The bridges to be added as part of this modification include the northbound and southbound structures of I-275 over Northline Road, Ecorse Road over I-275, and I-75 over Fort Street, all in the Detroit metropolitan area.

In order to assure a variety of coating systems will be applied to measure comparability, materials named in the Qualified Products List will be limited to groups of three per contract, with each contract listing different products.

Exhibit C

The cost estimate included in Exhibit A for the monitoring, evaluating, and reporting of the two bridges in the original work is modified to add \$20,700 for monitoring, evaluating, and reporting for the additional bridges included in this Modification. The estimated cost for this additional work is as follows:

	First Year	Third Year	Fifth Year	
Labor	\$7,730	\$1,010	\$1,010	
Travel	5,112	400	400	
Report	<u>3,000</u>	<u>          </u>	<u>2,000</u>	
Total	\$15,842	\$1,410	\$ 3,410 =	\$20,662 use \$20,700

Breakdown of first year labor

Average hourly wage = \$21/hour (includes 1.6 labor additive factor)

Man-hours/bridge = 80

4 bridges

320 total man-hours

320 hours x \$21/hour = \$6,720

+ inspection trip at \$1,010 = \$7,730

APPENDIX C

MICHIGAN  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAYS

SPECIAL PROVISION  
FOR  
CLEANING AND COATING EXISTING A-588 STEEL  
STRUCTURES UNDER FHWA WORK PLAN 92  
TYPE 4

5.04(15)

04-05-85

a. Description.-This work shall consist of the complete blast cleaning and coating of the metal surfaces of existing A-588 steel structures and other steel structures with heavy corrosion, including downspouts and all brackets. If any portion of the deck is to be removed, then the top of all the exposed top flanges shall also be blast cleaned and prime coated according to this specification. Utility conduits shall also be cleaned and coated according to this specification but shall be done only when called for on the plans. This work excludes hand railings and chain link fence enclosures.

Terminology used herein is in accordance with the definitions used in Volume 2, Systems and Specifications of the SSPC Steel Structures Painting Manual (1982 Edition).

b. Coating System.-The Contractor shall select a complete coating system from the approved coating systems listed in the attached Qualified Products List (QPL), or from the Research Laboratory. Since this is a research project at least two, but not more than three different systems shall be used on equal portions of the structure.

The color for the top coat shall match color number 15200 of Federal Standards Number 595a dated January 2, 1968. The Contractor shall supply the Engineer with the product data sheets before any coating is done. The product data sheets shall indicate the mixing and thinning directions, and the recommended spray nozzles and pressures.

c. Cleaning of Structures.-All areas of oil and grease on surfaces to be coated shall be cleaned with clean petroleum solvents and then all the surfaces to be coated shall be blast cleaned to a near-white finish as defined in SSPC-SP10. See SSPC Visual Standards. (See Note 1).

All fins, tears, slivers, and burred or sharp edges that are present on any steel member, or that appear during the blasting operation, shall be removed by grinding and the area reblasted to give a 1 to 2 mil surface profile.

Scaling hammers may be used to remove heavy scale but heavier type chipping hammers which would excessively scar the metal shall not be used.

Abrasives used for blast cleaning shall be any two of those listed in the attached Special Provision for Abrasives Used For Bridge Cleaning Prior To Coating. At least 25%, but not more than 75%, of the structure shall be blasted with either product. The abrasive shall have a gradation such that it will produce a uniform profile of 1 to 2 mils, as measured with Testex Replica Tape.

5.04(15)

All abrasive and paint residue shall be removed from steel surfaces with a good commercial grade vacuum cleaner equipped with a brush-type cleaning tool, or by double blowing. If the double blowing method is used, the exposed top surfaces of all structural steel, including flanges, longitudinal stiffeners, splice plates, hangers, etc., shall be vacuumed after the double blowing operations are completed. The steel shall then be kept dust free and primed within 8 hours after blast cleaning.

Care shall be taken to protect freshly coated surfaces, bridge bearing components, hand railings, galvanized fence enclosures, all appurtenances, and any adjacent concrete from blast cleaning operations. These areas shall be protected from blast cleaning operations by masking. Blast damaged primed surfaces shall be thoroughly wire brushed or if visible rust occurs, be reblasted to a near-white condition. The wire brushed or blast cleaned surfaces shall be vacuumed and reprimed.

For structures with piers, a minimum of 5 feet on each side of the piers shall be blast cleaned on the same day and primed as a unit to prevent damage to previously primed surfaces.

d. Mixing the Coating.-The coating shall be mixed with a high shear mixer (such as Jiffy Mixer) in accordance with the manufacturer's directions, to a smooth, lump-free consistency. Paddle mixers or paint shakers are not allowed. Mixing shall be done, as far as possible, in the original containers and shall be continued until all of the metallic powder or pigment is in suspension.

Care shall be taken to ensure that all of the coating solids that may have settled to the bottom of the container are thoroughly dispersed. The coating shall then be strained through a screen having openings no larger than those specified for a No. 50 sieve in ASTM E11. After straining, the mixed primer shall be kept under continuous agitation up to and during the time of application.

e. Thinning the Coating.-In general the coatings are supplied for normal use without thinning. If it is necessary to thin the coating for proper application in cool weather or to obtain better coverage of the urethane top coat, the thinning shall be done in accordance with the manufacturer's recommendations.

f. Conditions for Coating.-Coating shall be applied only when the following conditions have been met:

1. Temperature.-The temperature of the air and the steel shall be above 50 F for coatings other than the top coat. For the urethane top coat, the temperature of the air and steel shall be above 40 F. Coatings shall not be applied if the temperature is high enough to cause blistering.

2. Humidity.-The coating shall not be applied when the relative humidity is greater than 90 percent nor when a combination of temperature and humidity conditions are such that moisture condenses on the surface being coated.

g. Coating of Structures.-After the surface to be coated has been cleaned and approved by the Engineer, the coatings shall be applied with the spray nozzles and pressures recommended by the producer of the coating system, so as to attain the film thicknesses specified. The minimum dry film thickness for the primer shall be 3 mils, for the intermediate coat:

3.5 mils, and for the urethane top coat: sufficient to provide complete coverage and a uniform appearance (See Note 2). The dry film thickness will be determined by use of a magnetic film thickness gage. The gage shall be calibrated on the blasted steel with plastic shims approximately the same thickness as the minimum dry film thickness. A Tooke film thickness gage may be used to verify the coating thickness when requested by the Engineer (See Note 3). If the Tooke gage shows the primer coat to be less than the specified minimum thickness, the total coating system will be rejected even if the total dry film thickness exceeds the minimum.

If the application of coating at the required thickness in one pass produces runs, bubbles, or sags, the coating shall be applied in multiple passes of the spray gun, the passes separated by several minutes. Where excessive coating thickness produces "mud-cracking," such coating shall be scraped back to soundly bonded coating and the area recoated to the required thickness.

All dry spray shall be removed, by sanding if necessary. In areas of deficient primer thickness, the areas shall be thoroughly cleaned with power washing equipment, as necessary to remove all dirt; the areas shall then be wire brushed, vacuumed, and recoated.

Proper curing conditions will be required between the application of all coats. Minimum curing times for each product of the system are listed on the Qualified Products List.

After the steel is primed, it shall be vacuumed again before subsequent coating. If for any reason this vacuuming does not remove all the accumulated dust and/or dirt, or if more than 3 weeks has elapsed since the steel was primed, or if in the opinion of the Engineer the surface is unfit for top coating, the surface shall be scrubbed with a mild detergent solution (any commercial laundry detergent) and thoroughly rinsed with water and allowed to dry for 24 hours before the surface is coated.

All metal coated with impure, unsatisfactory, or unauthorized coating material, or coated in an unworkmanlike or objectionable manner, shall be thoroughly cleaned and recoated or otherwise corrected as directed by the Engineer.

h. Provisions for Field Inspection.-The Contractor shall furnish and erect scaffolding meeting the approval of the Engineer to permit inspection of the steel prior to and after coating.

Rubber rollers, or other protective devices meeting the approval of the Engineer, shall be used on scaffold fastenings. Metal rollers or clamps and other type fastenings which will mar or damage freshly coated surfaces shall not be used.

i. Protection of the Work.-Pedestrian, vehicular, and other traffic upon or underneath the structure shall be protected as provided under Subsection 1.05.13 of the 1984 Standard Specifications. All portions of the structures (superstructure, substructure, slope protection, and highway appurtenances) shall be protected against splatter, splashes, and smirches of coating or coating material by means of protective covering suitable for the purpose. Similar protection shall be afforded any highway appurtenances that could be damaged by blast cleaning operations. The Contractor shall be responsible for any damage caused by his operations to vehicles, persons, or property.

During blast cleaning operations, the Contractor shall make provisions for protecting existing traffic from any hazards resulting from the blast cleaning operations. These provisions shall include a type of barrier system which would protect against direct blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling on the traveled portions of the pavement, and prevent the spreading of abrasive materials and debris into an area which would create a traffic hazard.

Whenever the intended purposes of the protective devices are not being accomplished, work shall be suspended until corrections are made. In addition, any abrasive material and debris deposited on the pavement, shoulders, or slope paving in the working area shall be removed before those areas are reopened to traffic.

j. Stenciling Requirement.-At the completion of the coating, the completion date (month and year) and the number of the type of coating system used shall be stenciled on the structure in 4-inch numbers; for example: 6/85-4. The paint used for this marking shall be the same as the top coat except the color shall be black.

The numbers shall be stenciled on the inside of each fascia beam at the approaching traffic end of the structure. The two required markings shall be located at least 10 feet above ground level or the fill slope elevation and at least 10 feet from the abutment. If these locations are not applicable to the structure, the locations of the two markings will be designated by the Engineer.

k. Measurement and Payment.-The completed work as measured for CLEANING AND COATING EXISTING A-588 STEEL STRUCTURES AND OTHER STEEL STRUCTURES WITH HEAVY CORROSION TYPE 4 will be paid for at the contract unit prices for the following contract items (pay items).

<u>Pay Item</u>	<u>Pay Unit</u>
Cleaning Existing Steel Structure, Type 4 (Str. No.).....	Lump Sum
Coating Existing Steel Structure, Type 4 (Str. No.).....	Lump Sum
Cleaning & Coating Existing Utility Conduits (Str. No.)...	Lump Sum

Stenciling is considered a part of the work of Coating Existing Steel Structure, Type 4 (Structure Number) and will not be paid for separately.

The following notes are listed only to be a help to the bidder in determining the bid. They are not contract provisions, but point out some of the not so obvious problems we have encountered during our blasting and coating of weathered A-588 steel and heavily corroded structural steel.

Note 1. In many areas, especially under joints, the steel is heavily pitted. The complete removal of the last remaining trace of visible rust products is practically impossible. This being the case the definition of a near-white blast cannot be achieved. To solve this problem in these areas the appearance of a near-white blast is required, i.e. when compared to the visual standard the surface shall look the same. Even this is difficult but it does allow for very, very small rust deposits at the base of a pit.



Note 2. Once again the pitting in the blasted surface causes a problem. The dry film thickness of the primer varies greatly, typically between 3 and 12 mils. The specification calls for a minimum of 3 mils; to achieve this much more paint than normal is required in a pitted area. The inspector is instructed to look for the low areas.

There are some spray techniques and equipment that greatly affect the amount of urethane that is required for complete coverage and a uniform appearance. These include the application technique of both the primer and the intermediate coat.

Note 3. All dry film thickness gages shall be calibrated on a relatively smooth section of the blasted web, not in a heavily pitted area.

## MICHIGAN DEPARTMENT OF TRANSPORTATION

Qualified Product List  
Systems Listed in Alphabetical Order by Producer  
Use: Coating of Existing A-588 Structures and  
Other Steel Structures with Heavy Corrosion  
Type 4

Producer	Represented By:	Coats	Products	Dry Film Thickness Mils Min.	Color	Min./Time Between Coats Hrs.
Ameron Protective Coatings Division 201 N. Berry Street Brea, California	B. Marshall Ameron Protective Coatings Division 313-886-5555	1st	Dimetcoat 68	3.0	—	48
		2nd	Amercoat 383HS	3.5	White	24
		3rd	Amercoat 450GL	*	15200	
Koppers Elmhurst, Illinois 312-530-6300	Same	1st	Organic Zinc Rich	3.0	—	48
		2nd	200 HB	3.5	White	24
		3rd	Koppers 1122B	*	15200	
Mobil Chemical Co. 901 N. Greenwood Ave. Kankakee, Illinois 60901 815-933-5561	George J. Langevin 419-241-0894	1st	Mobilzinc 4	3.0	—	48
		2nd	Series 89 Epoxy	3.5	White	24
		3rd	Mobilthane 40-W-9	*	15200	
P.P.G. Industries 9933 Lawler Ave. Suite 260 Skokie, Illinois 60077 312-677-0560	Lou Eggert Same	1st	Aquapon Zinc Rich	3.0	—	48
		2nd	Aquapon 97-3	3.5	White	24
		3rd	Pitthane CP36B5	*	15200	
Porter Paint Company 400 South 13 Street Louisville, Ky 40201 502-588-9200	Pontiac Paint Company 1310 W. Wide Track Dr. Pontiac, Michigan 48058	1st	Zinc Lock 308	3.0	—	48
		2nd	MCR 43	3.5	White	24
		3rd	Hythane	*	15200	
Sherwin Williams	Sherwin Williams 2121 South Cedar Lansing, Michigan 48910 517-482-5587	1st	Zinc Clad 7	3.0	—	48
		2nd	Tile Clad II	3.5	White	24
		3rd	Rexthane	*	15200	
Tnemec Company, Inc. North Kansas City, Missouri 64116	Russ Brown & Assoc. Brad Brown 962 Dowling Bloomfield Hills, MI 48013 313-645-9130	1st	90-94 Tneme-Zinc	3.0	—	48
		2nd	Series 66 Epoxoline	3.5	White	24
		3rd	Series 73 Endura Shield III	*	15200	

\*The urethane top coat shall be of sufficient dry film thickness to completely cover the intermediate coat and produce a uniform appearance.

MICHIGAN  
DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAYS

SPECIAL PROVISION  
FOR  
ABRASIVES USED FOR BRIDGE CLEANING PRIOR TO COATING

T&R:GLT

02-27-85

The abrasive used for blast cleaning shall be an approved low dusting abrasive. Currently the following are approved:

1. Starblast - DuPont - Independence, Ohio
2. Copper Blast - Rocky Mountain Energy - Magna, Utah
3. Green Lightning - International Minerals & Chemicals Corp. - Mundelein, Illinois

The surface profile height shall be 1 to 2 mils as measured with Testex Replica Tape.

Before the blast cleaning of a beam, the top of the bottom flange shall be scraped (with a garden hoe, for example) to remove the accumulated dust and dirt.