

NDOT Research Report

Report No: NV-RDT-10-001

---

# **NON-SACRIFICIAL, ANTI-GRAFFITI COATING 2009 EVALUATION**

---

**May 2010**

Prepared by Research Division  
Nevada Department of Transportation  
1263 South Stewart Street  
Carson City, Nevada 89712



## TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NV-RDT-10-001	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Non-sacrificial, Anti-graffiti Coating 2009 Evaluation		5. Report Date April 2010	
		6. Performing Organization Code C803	
7. Author(s) Materials Division		8. Performing Organization Report No. NV-RDT-10-001	
9. Performing Organization Name and Address  Nevada Department of Transportation 1263 South Stewart Street Carson City, Nevada 89712		10. Work Unit No.	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address  Nevada Department of Transportation 1263 South Stewart Street Carson City, Nevada 89712		13. Type of Report and Period Covered Field evaluation Sept. – Oct. 2010	
		14. Sponsoring Agency Code NDOT	
15. Supplementary Notes			
16. Abstract <p>Graffiti eradication is a problem for the Nevada Department of Transportation (NDOT). Over 12,000 man-hours are spent on graffiti eradication each year. One recognized graffiti abatement method is the use of non-sacrificial, anti-graffiti coating. NDOT uses non-sacrificial, anti-graffiti coating as an abatement strategy to easily remove graffiti from the public's view. NDOT conducts an annual evaluation of non-sacrificial, anti-graffiti coatings in order to keep current with industry innovation and improved product formulations. Products that meet NDOT's performance expectations are added to the Qualified Product List.</p> <p>Fourteen products from twelve participating suppliers were evaluated on three different substrates. Of these products, three were chosen for additional durability evaluation. This report provides the results of the 2009 evaluation.</p>			
17. Key Words Anti-graffiti; Graffiti abatement; Anti-graffiti coating; Non-sacrificial, anti-graffiti coating		18. Distribution Statement No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 21161; <a href="http://www.ntis.gov">www.ntis.gov</a> .	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 46	22. Price Free

NON-SACRIFICIAL,  
ANTI-GRAFFITI COATING  
2009 EVALUATION



A Report on Research Sponsored by  
NEVADA DEPARTMENT OF TRANSPORTATION  
Carson City, Nevada



May 2010

## **NOTICE**

The Nevada Department of Transportation and the authors do not endorse specific products, manufacturers, vendors, or businesses. Product, manufacturer, and business names appear herein because the names are considered essential to the objective of this report.

## **DISCLAIMER**

This work was sponsored by the Nevada Department of Transportation. The contents of this report reflect the views of the authors. The authors are responsible for the facts and accuracy of the data presented herein. The contents are not a reflection of the official views or policies of the Nevada Department of Transportation. This report is not a standard, specification, or regulation. This report is distributed in the interest of information exchange and no liability will be assumed for its contents or use thereof.

# TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	v
LIST OF TABLES.....	vii
LIST OF FIGURES .....	viii
TERMINOLOGY .....	ix
CHAPTER 1 - INTRODUCTION	
1.1 Introduction .....	1
1.2 Background.....	2
1.3 Report Outline.....	2
CHAPTER 2 - RESEARCH STUDY DESIGN	
2.1 Evaluation Panels.....	3
2.2 Materials Tested .....	3
2.3 Test Protocol.....	4
2.4 Product Installation and Removal Information.....	4
2.5 Evaluation .....	5
2.6 Durability Testing.....	5
2.7 Gloss Measurements.....	5
CHAPTER 3 - FIELD APPLICATION AND REMOVAL DATA	
3.1 Coating Application Data .....	7
3.2 Graffiti Removal Data .....	8
CHAPTER 4 - GRAFFITI REMOVAL RESULTS	
4.1 Panel 1.....	9
4.2 Panel 2.....	11
4.3 Panel 3.....	13
4.4 Panel 4.....	15
4.5 Panel 5.....	17
4.6 Panel 6.....	18
4.7 Panel 7.....	20
4.8 Panel 8.....	22
4.9 Panel 9.....	24
4.10 Panel 10.....	25
4.11 Panel 11.....	27
4.12 Panel 12.....	29
4.13 Panel 13.....	31
4.14 Panel 14.....	33
CHAPTER 5 - SUMMARY	
5.1 Summary .....	35
5.2 Recommendations.....	35
REFERENCES	
References .....	36

## ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the Nevada Department of Transportation's (NDOT) Research, Materials, and Maintenance and Operations Divisions. These divisions provided expertise, labor, equipment, and materials.

Additionally, the authors' deepest appreciation is extended to the many manufacturers and suppliers that repeatedly traveled so far to apply coatings and remove graffiti on the evaluation panels. Their responsiveness and flexibility during the construction of the panels was phenomenal. We are grateful for the cooperation and assistance of the following companies:

Americrete/Graff Shield International Incorporated  
Representative: Paul Porreca  
P.O. Box 2488  
Santa Fe Springs, CA 90670  
(909) 615-0986

Aquarius Coatings Incorporated  
Representative: Lee Elver  
190 Marycroft Avenue Unit 5  
Woodbridge, ON L4L 5Y1  
Canada  
(800) 551-2298

Monopole Incorporated  
Representatives: Tony Khalil and Pablo Castorena  
4661 Alger Street  
Los Angeles, CA 90039  
(800) 491-9977

PPG Protective & Marine Coatings  
Representatives: Mike Johnson and Brad Jones  
4353 South DeWolf Avenue  
Del Rey, CA 93616  
(559) 281-6713

Pro-Seal Products Incorporated  
Representative: John Elliott  
601 Cherry Court  
Fairfield, CA 94534  
(707) 864-2009

RG Surface Treatment Specialists LLC  
Representative: Ruben Guerra  
1033 Rose Glen Avenue  
Rosemead, CA 91770  
(213) 923-8806

SEI Chemical Incorporated  
Representatives: Ross Sklar, Evan Wright, and Sabra Tibbals  
3430 Union Pacific Avenue  
Los Angeles, CA 90023  
(323) 263-4575

## ACKNOWLEDGEMENTS (CONTINUED)

Sherwin Williams Company, The  
Representatives: Dee McNeill and Paul Trautmann  
45 NE Loop 410 Suite 680  
San Antonio, TX 78216  
(210) 851-2286

Southern Nevada Precast Incorporated  
Representative: Rylee Robinson  
4910 Donovan Way Suite C  
North Las Vegas, NV 89081  
(435) 310-0062

TK Products  
Representative: Bill John  
11400 West 47<sup>th</sup> Street  
Minnetonka, MN 55343  
(952) 938-7223

United Coatings  
Representative: Shawn Carney  
19011 Cataldo  
Spokane Valley, WA 99037  
(800) 541-4383

Vision Quest Distributing  
Representative: Gary Clark  
1380 Greg Street Suite 236  
Sparks, NV 89431  
(775) 331-7844

## LIST OF TABLES

### CHAPTER 2

TABLE 2.2 Product Information .....	3
TABLE 2.7 Gloss Measurements for Unpainted Concrete Panels .....	6

### CHAPTER 3

TABLE 3.1 Coating Application Data .....	7
TABLE 3.2 Graffiti Removal Data .....	8



## LIST OF FIGURES

### CHAPTER 4

FIGURE 4.1A Removal - Painted Panel 1 .....	9
FIGURE 4.1B Removal - Unpainted Panel 1 .....	9
FIGURE 4.1C Removal - Fractured Fin Facing Panel 1 .....	10
FIGURE 4.1D Close-up of Removal - Fractured Fin Facing Panel 1 .....	10
FIGURE 4.2A Removal - Painted Panel 2 .....	11
FIGURE 4.2B Removal - Unpainted Panel 2 .....	11
FIGURE 4.2C Removal - Fractured Fin Facing Panel 2 .....	12
FIGURE 4.2D Close-up of Removal - Fractured Fin Facing Panel 2 .....	12
FIGURE 4.3A Removal - Painted Panel 3 .....	13
FIGURE 4.3B Removal - Unpainted Panel 3 .....	13
FIGURE 4.3C Removal - Fractured Fin Facing Panel 3 .....	14
FIGURE 4.3D Close-up of Removal - Fractured Fin Facing Panel 3 .....	14
FIGURE 4.4A Removal - Painted Panel 4 .....	15
FIGURE 4.4B Removal - Unpainted Panel 4 .....	15
FIGURE 4.4C Removal - Fractured Fin Facing Panel 4 .....	16
FIGURE 4.4D Close-up of Removal - Fractured Fin Facing Panel 4 .....	16
FIGURE 4.5A No Removal - Painted Panel 5 .....	17
FIGURE 4.5B No Removal - Unpainted Panel 5 .....	17
FIGURE 4.6A Removal - Painted Panel 6 .....	18
FIGURE 4.6B Removal - Unpainted Panel 6 .....	18
FIGURE 4.6C Removal - Fractured Fin Facing Panel 6 .....	19
FIGURE 4.6D Close-up of Removal - Fractured Fin Facing Panel 6 .....	19
FIGURE 4.7A Removal - Painted Panel 7 .....	20
FIGURE 4.7B Removal - Unpainted Panel 7 .....	20
FIGURE 4.7C Removal - Fractured Fin Facing Panel 7 .....	21
FIGURE 4.7D Close-up of Removal - Fractured Fin Facing Panel 7 .....	21
FIGURE 4.8A Removal - Painted Panel 8 .....	22
FIGURE 4.8B Removal - Unpainted Panel 8 .....	22
FIGURE 4.8C Removal - Fractured Fin Facing Panel 8 .....	23
FIGURE 4.8D Close-up of Removal - Fractured Fin Facing Panel 8 .....	23
FIGURE 4.9A No Removal - Painted Panel 9 .....	24
FIGURE 4.9B No Removal - Unpainted Panel 9 .....	24
FIGURE 4.10A Removal - Painted Panel 10 .....	25
FIGURE 4.10B Removal - Unpainted Panel 10 .....	25
FIGURE 4.10C Removal - Fractured Fin Facing Panel 10 .....	26
FIGURE 4.10D Close-up of Removal - Fractured Fin Facing Panel 10 .....	26
FIGURE 4.11A Removal - Painted Panel 11 .....	27
FIGURE 4.11B Removal - Unpainted Panel 11 .....	27
FIGURE 4.11C Removal - Fractured Fin Facing Panel 11 .....	28
FIGURE 4.11D Close-up of Removal - Fractured Fin Facing Panel 11 .....	28
FIGURE 4.12A Removal - Painted Panel 12 .....	29
FIGURE 4.12B Removal - Unpainted Panel 12 .....	29
FIGURE 4.12C Removal - Fractured Fin Facing Panel 12 .....	30
FIGURE 4.12D Close-up of Removal - Fractured Fin Facing Panel 12 .....	30
FIGURE 4.13A Removal - Painted Panel 13 .....	31
FIGURE 4.13B Removal - Unpainted Panel 13 .....	31
FIGURE 4.13C Removal - Fractured Fin Facing Panel 13 .....	32
FIGURE 4.13D Close-up of Removal - Fractured Fin Facing Panel 13 .....	32
FIGURE 4.14A Removal - Painted Panel 14 .....	33
FIGURE 4.14B Removal - Unpainted Panel 14 .....	33
FIGURE 4.14C Removal - Fractured Fin Facing Panel 14 .....	34
FIGURE 4.14D Close-up of Removal - Fractured Fin Facing Panel 14 .....	34

## \*TERMINOLOGY

<b>Terminology</b>	<b>Definition</b>
Abrasion Resistance	The ability of a coating to resist being worn away and to maintain its original appearance and structure when subjected to rubbing, scraping, or wear.
Bleeding	The diffusion of coloring matter through a coating from the substrate; also, the discoloration arising from such diffusion. In the case of printing ink, the spreading or running of a pigment color by the action of a solvent such as water or alcohol.
Blistering Resistance	The ability of a coating to resist the formation in the film of dome-shaped, liquid- or gas-filled projections resulting from local loss of adhesion and lifting of the film from the previously applied coating or the substrate.
Coating	A liquid, liquefiable or mastic composition that is converted to a solid protective, decorative, or functional adherent film after application as a thin layer.
Dirt Resistance	The ability of a coating to resist soiling by foreign material, other than microorganisms, deposited on or embedded in the dried coating.
Durability	A relative term indicating degree of permanency. It may be applied to individual protective, decorative, or functional properties,...but if used in a general way, for example, "the excellent durability of a paint," implied the ability of the described coating to retain, to the indicated degree, all the properties required for the continued service of the coating.
Flattening Agent	A material added to paints, varnishes, and other coating materials to reduce the gloss of the dried film.
Gloss	Angular selectivity of reflectance, involving surface-reflected light, responsible for the degree to which reflected highlights or images of objects may be seen as superimposed on a surface.
Graffiti Resistance	The property of coatings to be resistant to the application of graffiti or exhibiting easy removal of graffiti without surface damage.
Mar Resistance	(1) Ability of a coating to resist visual damage caused by light abrasion, impact, or pressure. (2) Resistance of the surface of the coating to permanent deformation resulting from the application of a dynamic mechanical force.
Matte	Lacking luster or gloss. Synonymous with "flat" in paint terminology.
Sealer	A liquid composition to prevent excessive absorption of finish coats into porous surfaces; also a composition to prevent bleeding.

\*All terminology is verbatim from ASTM standards listed in the references as numbers 1, 2, and 3.

# Non-sacrificial, Anti-graffiti Coating 2009 Evaluation

## CHAPTER 1 - INTRODUCTION

### 1.1 Introduction

Clark County, Nevada contains the greater Las Vegas metropolitan area which is an international tourist destination and home to almost two million people. The area population has grown significantly in the last several decades and along with this growth there has been an increase in problems correlated with urban living. One such problem is the crime of graffiti vandalism. The resource challenges connected with abatement and eradication of graffiti are problematic as the frequency and size of graffiti vandalism incidences continues to rise. The Nevada Department of Transportation (NDOT) is responsible to remove graffiti in its right-of-way and devotes over 10,000 man-hours per year for Las Vegas area graffiti removal. An additional 2,000 man-hours are spent removing graffiti in other urban and rural areas. NDOT has been evaluating non-sacrificial, anti-graffiti coatings on an annual basis since 2005 because of the increasing right-of-way maintenance costs associated with graffiti removal. This effort, along with other techniques for graffiti prevention, abatement, and eradication is part of NDOT's proactive attempt to keep its right-of-way free of unsightly scrawl.

Graffiti are crude drawings and writings that are scratched or painted on surfaces such as walls or highway structures so as to be seen by the traveling public. Spray paint is often used as the material of choice for defacing property. Defacing property with graffiti is considered vandalism and is punishable by law in Nevada. However, graffiti continues because it is also a complex social problem. Graffiti are sometimes used to communicate social and political messages. There are some individuals that consider graffiti an art that warrants display and there are other people that believe graffiti are part of pop culture.

There are three main types of graffiti. Types include hip-hop graffiti, gang graffiti, and generic graffiti. Hip-hop graffiti constitutes the majority of the graffiti in the United States and is a main element of the hip-hop culture. Gang graffiti are placed to "mark territory" and generic graffiti are messages that are non-threatening such as "Trombone Was Here." The causes for graffiti placement are numerous and it is unlikely that graffiti will disappear from public view anytime soon. Meanwhile, public and private budgets are strained as numerous resources are used to remove graffiti from the many highway structures and buildings where graffiti have been placed.

Highway structures and appurtenances affected by graffiti vandalism include bridges, soundwalls, retaining walls, barrier rails, and traffic signs. These structures and appurtenances collectively cost in the billions of dollars in the United States and the traveling public expects that highway agencies maintain these components to an acceptable aesthetic standard. There is increasing political and public pressure to remove graffiti in a timely manner as graffiti has far reaching effects in the local community. In addition to the financial burden of graffiti removal and the "loss" of these dollars that could have been better spent elsewhere, there is detriment to tourism industries, decreased property values, and a threat to the quality of life in neighborhoods. There are many psychological costs associated with living in an area that looks unkempt and the well-being of citizens is jeopardized as graffiti are considered a sign of chaos. Law-abiding citizens avoid public places where graffiti are prevalent and stop shopping or start avoiding those areas affected. This avoidance can advance the criminal element and create further neighborhood deterioration. Graffiti vandalism has many consequences and eradication is a high priority for highway agencies and businesses (4).

There are approximately ten recognized abatement techniques employed by different states to counter the effects of graffiti vandalism. One of these techniques is to use graffiti resistant coating on surfaces. There are two types of graffiti resistant coating that can be applied to resist the application of graffiti or assist with the removal of graffiti. One type of coating is sacrificial and the other type of coating is non-sacrificial. Sacrificial coatings are removed along with the graffiti and must be reapplied after each graffiti removal to achieve additional protection. Non-sacrificial coatings are

considered to be permanent and graffiti can be removed repeatedly without harming the coating or substrate. These coatings help to protect porous surfaces from absorbing stains deep into the substrate. Procedures for graffiti removal may damage the substrate and contribute to premature deterioration of the substrate if graffiti resistant coating is not used.

NDOT uses non-sacrificial, anti-graffiti coating as one of its abatement strategies in the struggle to eliminate graffiti from the public's view. In order to keep current with industry innovation and improved product formulations, NDOT evaluates non-sacrificial, anti-graffiti coating. This report is a summary of the results from the 2009 evaluation.

## **1.2 Background**

Investigation into the development of a generic non-sacrificial, anti-graffiti coating specification for use as a qualifier for products evaluated by NDOT's Product Evaluation Committee was conducted. Several conclusions resulted from the investigation. Foremost in the findings was that there are many types of compositional chemical formulas for non-sacrificial, anti-graffiti coating products. Writing a compositional specification for each type of formula based on known successful results would prove to be exhaustive and tenuous at best. Additionally, some non-sacrificial, anti-graffiti coatings are specifically formulated to be used on specific types of substrates and this is an additional complication to specification development. Often, a manufacturer will not warranty its products if the products are not used as a system or with the manufacturer's specific removal agent. It is not practical for NDOT to keep apprised of where each particular product is located for every individual project that is accomplished over many years. Thus, enforcing a warranty by determining which removal agent can be used for each occurrence of graffiti removal would prove difficult. Also, not only must the coating be used on different substrates, the coating must be applied on a variety of other coatings such as paint, stain, or varnish. Manufacturers occasionally recommend that their non-sacrificial, anti-graffiti coating be used in conjunction with the manufacturers' other paint or stain product lines and this cannot be guaranteed because of regulations that prevent NDOT from sole sourcing products.

NDOT has determined that field evaluation is the most feasible method for qualifying non-sacrificial, anti-graffiti coating products because of the before-mentioned issues with writing a comprehensive and enforceable specification for non-sacrificial, anti-graffiti coatings. One benefit of the anti-graffiti coating evaluation program is to identify products that NDOT may approve for inclusion on the Qualified Product List (QPL) under subsection 502.02.05a Anti-graffiti Coating (Permanent, Non-sacrificial). Products on NDOT's QPL are preapproved for use on construction contracts that are executed across the state. However, the approval and placement of a product on the QPL does not guarantee any purchase of that product.

## **1.3 Report Outline**

NDOT invited numerous suppliers to participate in the 2009 evaluation of non-sacrificial, anti-graffiti coatings. The outcome was the submission of fourteen products for evaluation by twelve different suppliers. All products were placed on three types of substrates including painted concrete panels, unpainted concrete panels, and a soundwall with fractured fin facing. The research study design can be found in Chapter 2. Research study design information includes a list of materials tested, test protocol, installation and removal details, and evaluation procedures. Chapter 3 contains the field coating application and graffiti removal data. Chapter 4 is a summary of the graffiti removal results and has numerous figures illustrating the panels after graffiti removal efforts. Chapter 5 consists of a summary and recommendations.

## CHAPTER 2 – RESEARCH STUDY DESIGN

### 2.1 Evaluation Panels

NDOT provided three different substrates upon which the non-sacrificial, anti-graffiti coating systems were applied. Substrates included a painted concrete barrier rail and an unpainted concrete barrier rail. The painted and unpainted concrete barrier rails were located immediately behind the NDOT Maintenance and Operations Division at 1301 Old Hot Springs Road, Carson City, Nevada, 89706. A concrete soundwall with fractured fin facing was also used for evaluation purposes and located approximately two miles away from the Maintenance and Operations Division on US 395.

### 2.2 Materials Tested

Fourteen products were evaluated from twelve participating suppliers. The following TABLE 2.2 lists the coating system information for the products evaluated. Information includes the panel number where each coating system was placed and available technical or specification data offered by the suppliers.

**TABLE 2.2 Product Information**

PANEL NO.	NON-SACRIFICIAL, ANTI-GRAFFITI COATING SYSTEM INFORMATION
1	System consists of three products. There is a deterrent to waterproof the substrates, a lift designed to be removed easily, and a biodegradable removal agent. The deterrent is a water-base clear polymer, the lift is a water-base clear polymer, and the removal agent is a water-base product.
2	System composed of a two-component aliphatic polyurethane coating. A sealer is required for uncoated surfaces and was used on the unpainted concrete panel. Part A of the two component system is a water reducible polyacrylate polyol mixture. Part B has hexamethylene diisocyanate. The sealer is a water-base product. The removal agent has an organic base.
3	System includes a two-component siloxane coating and a removal agent. Part A of the two component system contains silicone, n-butyl acetate, and epoxy. Part B contains silane and solvent naphtha. Part A is mixed with Part B in a ratio of 4 parts resin to 1 part cure.
4	System is comprised of two-component aliphatic water-based polyurethane. Part B contains homopolymer of hexamethylene diisocyanate.
5	System consists of polycarbon/polycarbonate sealer and coating along with a removal agent.
6	System includes a siloxane coating with silica.
7	System is comprised of two-component fluoro co-polymer polyurethane. Part B contains hexamethylene diisocyanate polymer.
8	System composed of a two-component urethane-modified acrylic coating and removal agent. A sealer is required for uncoated surfaces and was used on the unpainted panel. The removal agent was solvent-based. Part B contains homopolymer of hexamethylene diisocyanate.
9	System is a single step acrylic-silicone blend.
10	System contains a single-component blend of aliphatic urethane resins and biodegradable removal agent. Component contains toluene and homopolymer of HDI.
11	System is single-component silicone rubber dispersion through water-based solution.
12	System has two-components. Part A is mainly methyltrimethoxysilane and Part B is water-based.
13	System composed of a two-component aliphatic polyurethane coating. A sealer is required for uncoated surfaces and was used on the unpainted concrete panel. The removal agent has an organic base.
14	System includes a siloxane coating with silica and a flatting agent was added.

## 2.3 Test Protocol

The protocol for the field evaluation of non-sacrificial, anti-graffiti coating systems was in the process of being formalized during the 2009 evaluation. Although an informal policy was used for previous years, it was determined that developing a written policy would ensure integrity and consistency for future evaluation events and assist with documentation and reporting procedures. The protocol used for the 2009 evaluation was scrutinized and lessons learned from the evaluation will be incorporated into future proceedings.

The testing protocol consisted of a five-step process whereby information was collected in a systematic manner with the intention of providing sufficient justification for the product evaluations. The following steps and quick summaries are provided as general information for the reader:

- *Step 1: Application.* Included in the application to be completed prior to acceptance for field evaluation was completion of the “External Request for New Product/Procedure Field Test” form, certification that the coating meets the “Non-sacrificial, Anti-graffiti Coating Checklist,” warranty provisions, and the Material Safety Data Sheet for all components of the coating system.
- *Step 2: Prescreen Acceptance Criteria.* Product prescreen acceptance criteria included verification that the supplier complied with the “Non-sacrificial, Anti-graffiti Coating Checklist.” The checklist included criteria such as durability information, satisfactory performance record, volatile organic content information, dirt resistance criteria, and removal agent facts.
- *Step 3: Field Evaluation Process.* The field evaluation process consisted of activities required to complete the evaluation as well as documentation that recorded timing and responsibilities.
- *Step 4: Evaluation.* The evaluation step included the completion of the “Graffiti Removal Form” for each product by each evaluator. The form contained timing, tools, damage, appearance, and comment information for each substrate evaluated.
- *Step 5: Results Announcement.* The Product Evaluation Coordinator was responsible to inform each supplier about the results of the performance evaluation.

## 2.4 Product Installation and Removal Information

All panels were visually separated, numbered, and assigned to each supplier. The panels were rinsed thoroughly using a garden hose with low pressure municipal water and allowed to dry a minimum of five days after which representatives were invited to place their anti-graffiti coating systems. Representatives were allowed multiple days for coating application, although most representatives finalized coating placement within several hours. After coating application, a minimum of one week of cure time was permitted after which NDOT applied graffiti to the coated concrete panels. Four different colors of aerosol spray paint were placed as the graffiti and the graffiti consisted of red, pink, green and black stripes. These colors were chosen because the colors are a common choice for vandals. The graffiti cured on the panels for one week and the representatives were invited to return and remove the graffiti from the panels. Coating application and graffiti removal information is summarized in TABLE 3.1 Coating Application Data and TABLE 3.2 Graffiti Removal Data.

Weather data were collected for the coating application time periods to ensure that climatic conditions did not fall outside the range of manufacturers’ application recommendations for ambient air temperatures, relative humidity, and substrate temperatures. The weather data were typical of the early fall season in the Carson City, Nevada area and within conformance of manufacturers’ application directions.

## **2.5 Evaluation**

Representatives were allowed one hour to remove the graffiti from each concrete panel. Evaluators documented the graffiti removal process and subjectively judged the removal results according to several criteria. Criteria for evaluation included ease or difficulty of graffiti removal, evidence of paint residue, damage to coating or substrate, final surface appearance, dirt resistance, gloss measurement, and other damage such as blistering or softening. The panels were reviewed individually. However, the final appearances of all panels were collectively considered by evaluators for each product. Evaluators came to group consensus before making recommendations about whether or not coating systems performed satisfactorily and warranted further durability testing. Chapter 4 contains a summary of the evaluators' comments regarding the graffiti removal results along with recommendations for further durability testing.

## **2.6 Durability Testing**

Durability testing is conducted for all coating systems deemed satisfactory by evaluators after initial graffiti removal operations. Experience has proven that some coating systems may not last through many additional graffiti removal cycles before coating failure, despite the fact that the coating is purported to be non-sacrificial. Durability testing is defined as the application of graffiti and successful removal of graffiti for an additional amount of cycles that will prove the coating system to be non-sacrificial. Additionally, the coating system must maintain an acceptable final appearance as similarly evaluated in the initial evaluation event. Evaluators concluded that the coating systems on panels 4, 7, and 14 displayed results that warranted further durability testing.

## **2.7 Gloss Measurements**

The Maintenance and Operations Division has determined that coatings with gloss finish are a distraction for drivers when sunlight reflects off the coated surfaces at certain angles. Therefore, all anti-graffiti coating systems must exhibit low gloss level measurements. This stipulation is communicated in the application and prescreen acceptance criteria. Measurements were taken to determine if the coating systems met NDOT's matte or flat requirement of an average gloss level measurement of less than eight.

A hand held gloss checker was used to take gloss level measurements on the unpainted concrete panels. The gloss checker was calibrated before use and the 60 degree meter optical system was used for measurement. The 60 degree optical system was used because this optical system is referenced in the ASTM D 6578, "Standard Practice for Determination of Graffiti Resistance (2)." This optical system was used in past evaluation events and will assist with consistent evaluation practices. The surfaces to be measured must be flat as surfaces that are rough or curved cannot be measured properly. A total of twelve measurements were collected and averaged for the final gloss level measurement for each product. TABLE 2.7 contains the gloss measurements for the unpainted concrete panels. By observation it was determined that panels 6 and 8 have gloss measurements that do not meet NDOT's criterion and these products were not considered for durability testing regardless of final surface appearance of the panels.

**TABLE 2.7 Gloss Measurements for Unpainted Concrete Panels**

<b>Panel Number</b>	<b>Gloss Measurements</b>												<b>Average Gloss Measurement</b>
Panel 1	4	8	11	6	7	4	9	3	6	4	7	6	<b>6</b>
Panel 2	1	3	4	1	2	1	3	2	1	4	3	1	<b>2</b>
Panel 3	0	0	0	1	1	0	0	1	0	0	1	1	<b>0</b>
Panel 4	3	7	0	1	0	3	2	1	3	0	7	1	<b>2</b>
Panel 5	4	1	0	10	8	12	6	7	10	8	4	0	<b>6</b>
Panel 6	33	46	41	53	26	46	47	51	38	46	42	37	<b>42</b>
Panel 7	3	8	9	6	3	7	9	6	3	6	3	8	<b>6</b>
Panel 8	30	29	26	19	17	23	20	21	26	24	21	24	<b>23</b>
Panel 9	3	3	5	1	0	5	1	3	5	5	5	3	<b>3</b>
Panel 10	0	0	0	1	0	0	1	0	3	1	0	0	<b>1</b>
Panel 11	2	3	1	5	1	3	2	6	4	4	2	2	<b>3</b>
Panel 12	0	1	4	2	3	2	0	1	4	5	4	2	<b>2</b>
Panel 13	8	5	6	1	3	6	7	8	7	3	2	7	<b>5</b>
Panel 14	3	6	9	8	3	6	10	11	6	2	1	1	<b>6</b>



## CHAPTER 3 – FIELD APPLICATION AND REMOVAL DATA

### 3.1 Coating Application Data

The non-sacrificial, anti-graffiti coatings were applied by representatives on September 21, 22, and 27 in 2009. Representatives used several methods to apply the coatings including brush, roller, spray bottle, hand sprayer, and airless sprayer. Representatives applied the number of coats and required mil thicknesses according to manufacturers' instructions. The substrate temperatures were recorded to provide evidence of environmental conditions at time of placement. TABLE 3.1 contains a summary of the coating application data for the panels.

**TABLE 3.1 Coating Application Data**

Panel Number	Date Coating Applied	Coating Application Methods	Estimated Thickness Dry Mills	Number of Coats Applied	*Substrate Temperature °F
1	9/21/2009	Brush / Spray bottle	3	2	49.4
2	9/22/2009	Brush / Roller	2 to 3	1	44.7
3	9/21/2009	Brush / Roller	2	1	68.3
4	9/21/2009	Brush / Roller	3 to 6	2	54.1
5	9/21/2009	Hand sprayer / Spray bottle	Unknown	2	51.2
6	9/21/2209	Hand sprayer / Roller	2	2	59.2
7	9/21/2009	Brush / Roller	2	2	56.3
8	9/21/2009	Brush / Roller	2 to 3	2	55.5
9	9/22/2009	Airless sprayer	2	2	44.5
10	9/21/2009	Brush / Roller	3	2	44.1
11	9/21/2009	Brush / Hand sprayer / Roller	1	1	57.0
12	9/21/2009	Brush / Roller	1	1	59.0
13	9/22/2009	Brush / Roller	2 to 3	1	45.0
14	9/27/2009	Roller	2	1	Unknown

\* Note that substrate temperature is the lowest temperature of the three substrates where products were applied.

### 3.2 Graffiti Removal Data

The cured graffiti were removed by representatives on October 5 and 12 in 2009. Representatives used various implements to remove the graffiti in addition to supplied water and manufacturers' removal agents. Implements included scrubber pads, scrub brushes, paint brushes, pressure washers, and rags. The amount of time the representative spent removing the graffiti was noted for each panel. TABLE 3.2 contains a summary of the graffiti removal data for the panels.

**TABLE 3.2 Graffiti Removal Data**

Panel Number	Date Graffiti Removed	Implements Used for Graffiti Removal in Addition to Water and Removal Agents	Painted Concrete Surface Time of Removal	Unpainted Concrete Surface Time of Removal	Soundwall Fractured Fin Surface Time of Removal
1	10/5/2009	Paint brush / Pot-type scrubber pad / Scrub brush	11:57 a.m. to 12:28 p.m. (31 minutes)	10:57 a.m. to 11:30 a.m. (33 minutes)	12:48 p.m. to 1:20 p.m. (32 minutes)
2	10/5/2009	Scrub brush	*12:58 p.m. to 1:58 p.m. (60 minutes)	*12:53 p.m. to 1:53 p.m. (60 minutes)	2:40 p.m. to 3:05 p.m. (25 minutes)
3	10/5/2009	Scrub brush	*1:14 p.m. to 1:30 p.m. (16 minutes)	*1:20 p.m. to 1:35 p.m. (15 minutes)	1:50 p.m. to 2:09 p.m. (19 minutes)
4	10/5/2009	Scrub brush	12:45 p.m. to 1:30 p.m. (45 minutes)	12:09 p.m. to 12:41 p.m. (32 minutes)	2:26 p.m. to 2:55 p.m. (29 minutes)
5	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
6	10/5/2009	Three methods demonstrated: rags only, rags and removal agent, and pressure washer	12:14 p.m. to 12:19 p.m. (5 minutes)	11:58 a.m. to 12:00 p.m. (2 minutes)	Unknown
7	10/5/2009	Pot-type scrubber pad / Pressure washer / Scrub brush	9:12 a.m. to 9:27 a.m. (15 minutes)	9:05 a.m. to 9:12 a.m. (7 minutes)	9:47 a.m. to 10:14 a.m. (27 minutes)
8	10/5/2009	Rags / Scrub brush	10:45 a.m. to 10:57 a.m. (12 minutes)	10:58 a.m. to 11:06 a.m. (8 minutes)	11:23 a.m. to 12:05 p.m. (42 minutes)
9	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
10	10/5/2009	Paint brush / Pressure washer	*9:03 a.m. to 9:24 a.m. (21 minutes)	*9:02 a.m. to 9:24 a.m. (22 minutes)	9:39 a.m. to 9:57 a.m. (18 minutes)
11	10/5/2009	Scrub brush	9:35 a.m. to 9:49 a.m. (14 minutes)	9:52 a.m. to 10:07 a.m. (15 minutes)	10:38 a.m. to 11:05 a.m. (27 minutes)
12	10/5/2009	Rags / Scrub brush	11:09 a.m. to 11:21 a.m. (12 minutes)	11:23 a.m. to 11:51 a.m. (28 minutes)	12:15 p.m. to 12:30 p.m. (15 minutes)
13	10/5/2009	Scrub brush	*12:58 p.m. to 1:46 p.m. (48 minutes)	*1:00 p.m. to 1:46 p.m. (46 minutes)	2:32 p.m. to 2:55 p.m. (23 minutes)
14	10/12/2009	Rags (No water)	8:33 a.m. to 8:47 a.m. (14 minutes)	8:15 a.m. to 8:30 a.m. (15 minutes)	9:04 a.m. to 9:30 a.m. (26 minutes)

\*Times may overlap because representative worked on graffiti removal on more than one panel at a time.

## CHAPTER 4 – GRAFFITI REMOVAL RESULTS

### 4.1 Panel 1

#### Painted concrete panel

There was difficulty with the graffiti removal and the representative was observed scraping off the graffiti with the metal/handle portion of a paint brush. This scraping action caused damage to the coating and some damage to the painted substrate. There was paint residue noted along with discoloration after the surface was dry (FIGURE 4.1A).

#### Unpainted concrete panel

There was difficulty with the graffiti removal and the representative was observed scraping off the graffiti with the metal/handle portion of a paint brush. This scraping action caused damage to the coating. There was only a trace amount of paint residue left on the substrate after removal effort (FIGURE 4.1B).

#### Soundwall with fractured fin facing panel

There was damage to the coating and substrate after the graffiti removal operations. Evidence of green and pink paint residue was reported. One evaluator mentioned that the coating became discolored (FIGURES 4.1C and 4.1D).

#### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of difficulty of graffiti removal, damage to coating and substrate, discoloration, and paint residue during initial graffiti removal operations. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

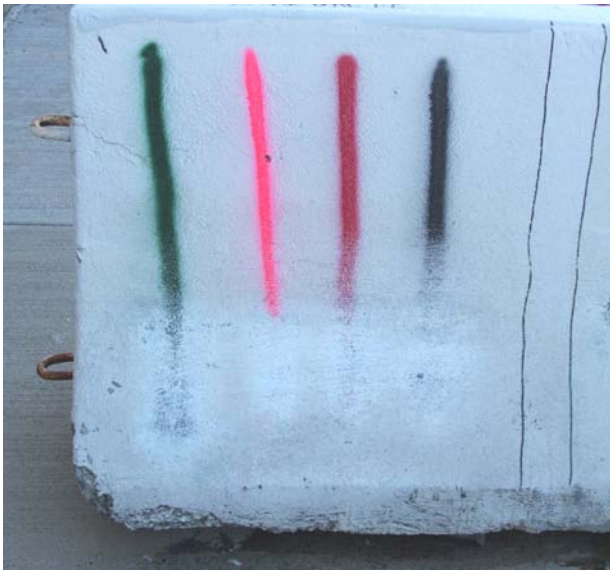


FIGURE 4.1A Removal – Painted Panel 1

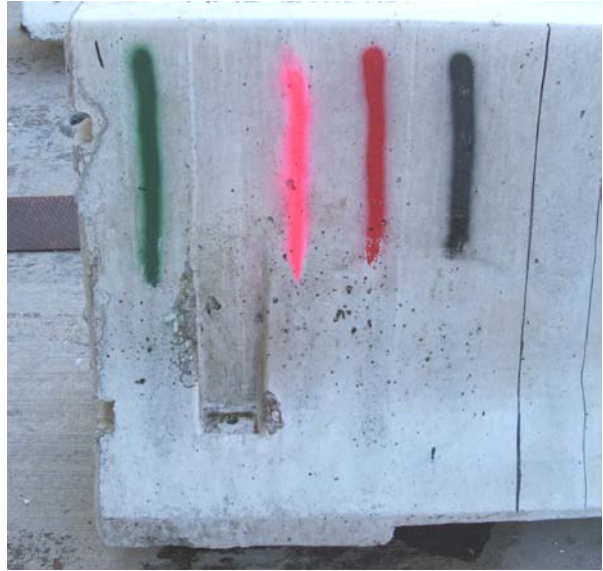


FIGURE 4.1B Removal – Unpainted Panel 1



**FIGURE 4.1C Removal - Fractured Fin Facing Panel 1**



**FIGURE 4.1D Close-up of Removal - Fractured Fin Facing Panel 1**

## 4.2 Panel 2

### Painted concrete panel

There was difficulty with the graffiti removal when the representative used the manufacturer's removal agent and the representative borrowed a removal agent from another vendor. One evaluator documented the vigorous scrub action employed by the representative. There was paint residue observed as well as blistering (FIGURE 4.2A).

### Unpainted concrete panel

The representative used several removal agents with unsatisfactory results and thereafter borrowed a removal agent from another vendor. There was a trace amount of paint residue as well as blistering (FIGURE 4.2B).

### Soundwall with fractured fin facing panel

There was difficulty with the graffiti removal and the representative borrowed a removal agent from another vendor. There was damage to the coating, paint residue, and discoloration of the coating detected (FIGURES 4.2C and 4.2D).

### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of difficulty of graffiti removal, paint residue, blistering, and damage and discoloration of the coating. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

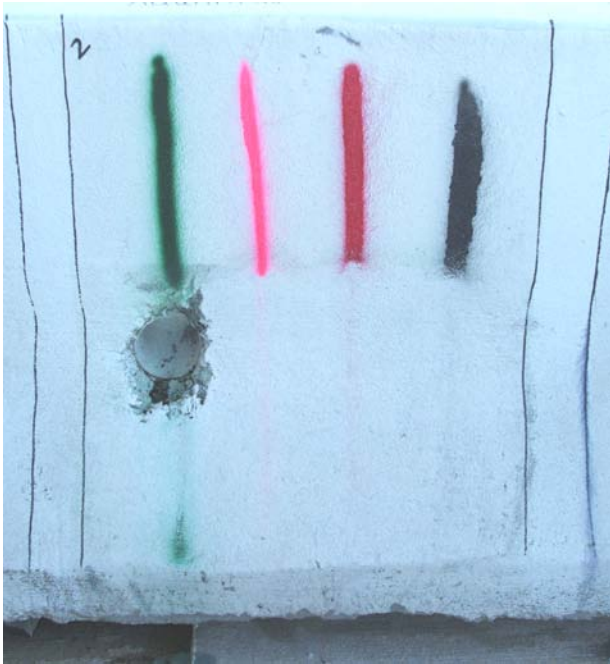


FIGURE 4.2A Removal – Painted Panel 2

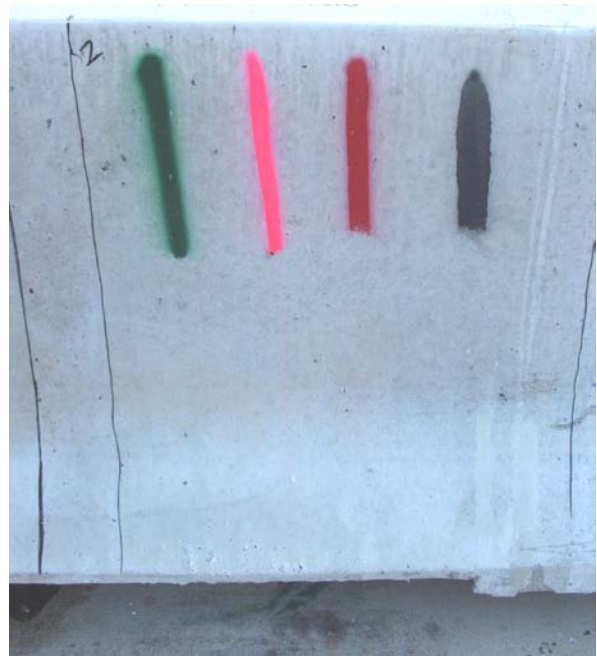


FIGURE 4.2B Removal – Unpainted Panel 2





**FIGURE 4.2C Removal - Fractured Fin Facing Panel 2**



**FIGURE 4.2D Close-up of Removal - Fractured Fin Facing Panel 2**

### 4.3 Panel 3

#### Painted concrete panel

Paint residue was observed (FIGURE 4.3A).

#### Unpainted concrete panel

There was appreciable paint residue and coating discoloration (FIGURE 4.3B).

#### Soundwall with fractured fin facing panel

There was damage to the coating and substrate after graffiti removal operations. Evidence of paint residue and coating discoloration were recorded by all evaluators (FIGURES 4.3C and 4.3D).

#### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of paint residue, coating discoloration, and damage to the coating and substrate. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

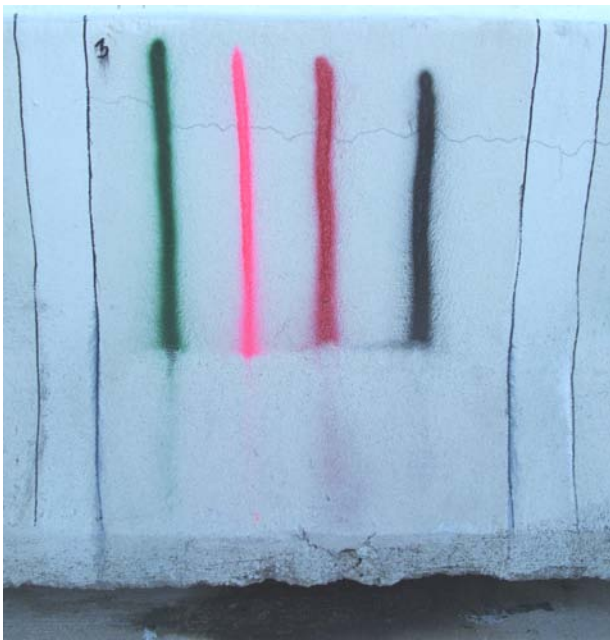


FIGURE 4.3A Removal – Painted Panel 3



FIGURE 4.3B Removal – Unpainted Panel 3



**FIGURE 4.3C Removal - Fractured Fin Facing Panel 3**



**FIGURE 4.3D Close-up of Removal - Fractured Fin Facing Panel 3**



#### 4.4 Panel 4

##### Painted concrete panel

There was difficulty with the graffiti removal and the representative was observed using various removal agents with unsatisfactory results. An additional removal agent was delivered to the representative during the last few minutes of the allowed removal time and the graffiti was removed to the satisfaction of the evaluators. There was no apparent paint residue and no damage to the coating or substrate (FIGURE 4.4A).

##### Unpainted concrete panel

There was difficulty with the graffiti removal and the representative was observed using various removal agents with unsatisfactory results. An additional removal agent was delivered to the representative during the last few minutes of the allowed removal time and the graffiti was removed to the satisfaction of the evaluators. There was no perceivable paint residue and no damage to the coating or substrate (FIGURE 4.4B).

##### Soundwall with fractured fin facing panel

There was no reported paint residue. There was a small area where the coating was removed from the substrate. It was debatable as to whether the representative scrubbed the coating off during graffiti removal or if the area was skipped during the coating application (FIGURES 4.4C and 4.4D).

##### Recommendation

The recommendation was to pursue further durability testing of this coating system. Refer to Subsection 2.6 regarding additional durability testing. If further evaluation determines that the product can last through numerous graffiti removal cycles, the product will be identified for inclusion on the Qualified Product List.

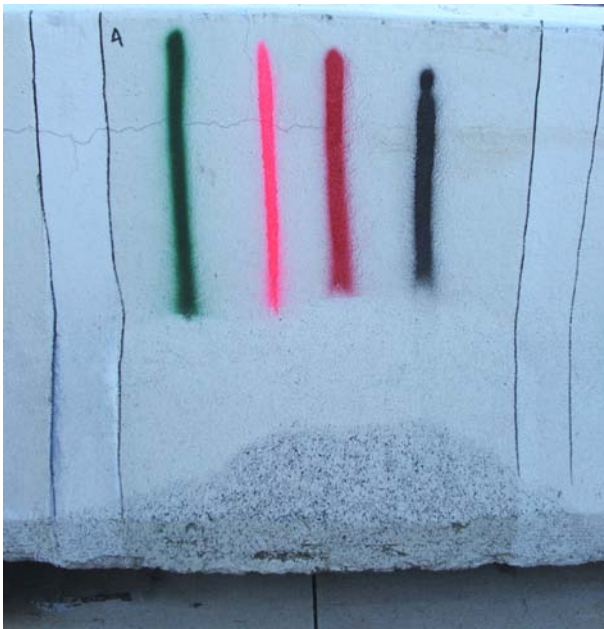


FIGURE 4.4A Removal - Painted Panel 4

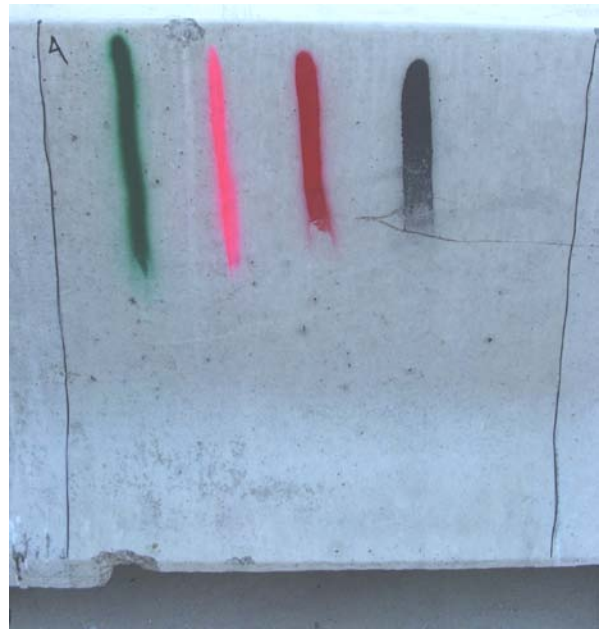


FIGURE 4.4B Removal – Unpainted Panel 4



**FIGURE 4.4C Removal - Fractured Fin Facing Panel 4**



**FIGURE 4.4D Close-up of Removal - Fractured Fin Facing Panel 4**

#### 4.5 Panel 5

##### Recommendation

The coating system was disqualified because the representative did not return for the graffiti removal operations (FIGURES 4.5A and 4.5B).

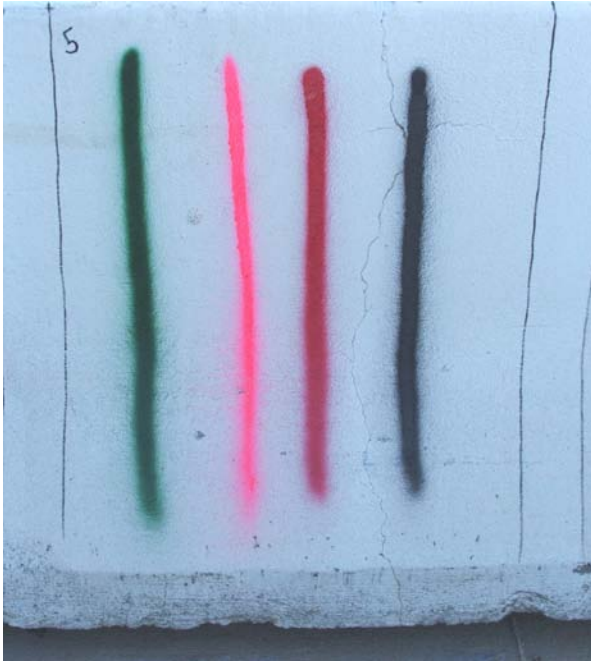


FIGURE 4.5A No Removal – Painted Panel 5

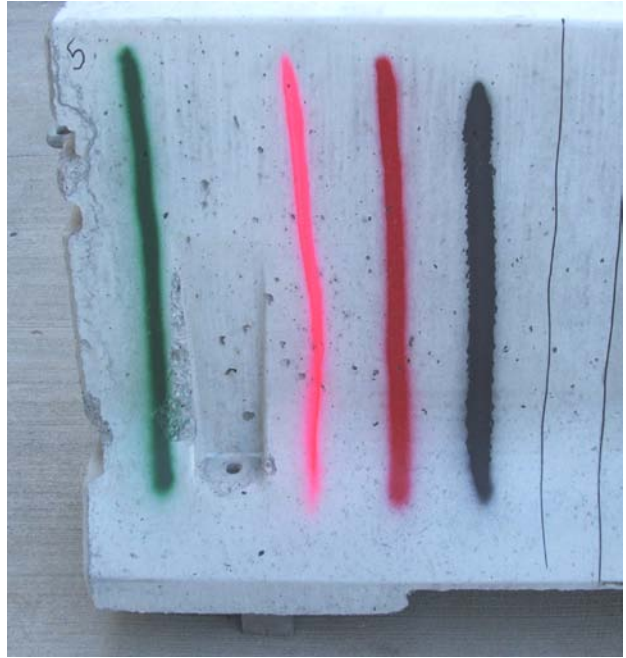


FIGURE 4.5B No Removal – Unpainted Panel 5

#### 4.6 Panel 6

##### Painted concrete panel

There was noticeable lack of dirt resistance as dust and grit readily adhered to the panel and the surface was tacky to touch (FIGURE 4.6A).

##### Unpainted concrete panel

There was noticeable lack of dirt resistance as dust and grit readily adhered to the panel and the surface was tacky to touch. The gloss measurements were much higher than the allowable criterion specified for anti-graffiti coatings (FIGURE 4.6B).

##### Soundwall with fractured fin facing panel

There was noticeable lack of dirt resistance as dust and grit readily adhered to the panel and the surface was tacky to touch (FIGURES 4.6C and 4.6D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of unacceptable gloss measurements. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

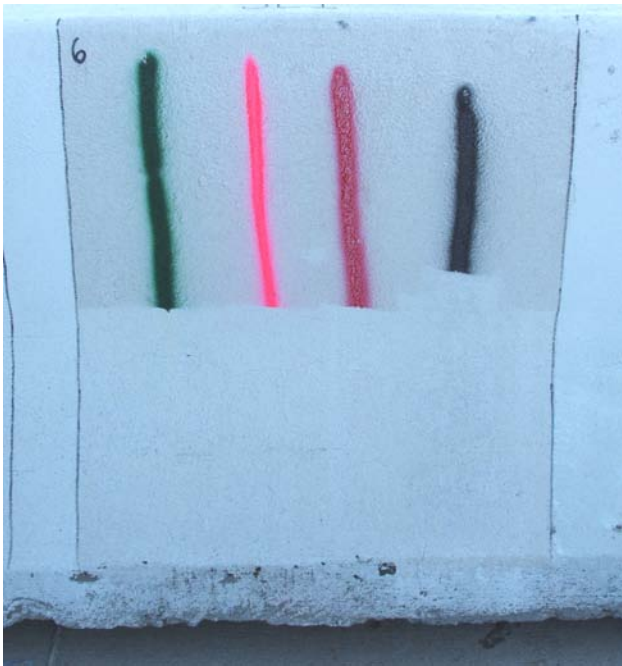


FIGURE 4.6A Removal - Painted Panel 6

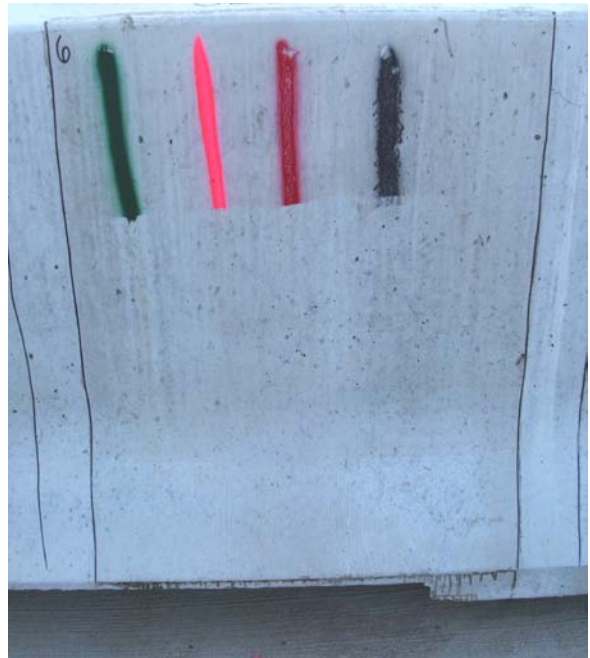


FIGURE 4.6B Removal - Unpainted Panel 6





**FIGURE 4.6C Removal - Fractured Fin Facing Panel 6**



**FIGURE 4.6D Close-up of Removal - Fractured Fin Facing Panel 6**

#### 4.7 Panel 7

##### Painted concrete panel

All evidence of graffiti was removed with the exception of a very trace amount of green color paint. Overall, the final surface appearance was considered acceptable according to evaluators (FIGURE 4.7A).

##### Unpainted concrete panel

All evidence of graffiti was removed and the final surface appearance was considered acceptable according to evaluators (FIGURE 4.7B).

##### Soundwall with fractured fin facing panel

Most evidence of graffiti was removed. The representative ran out of the removal agent and chose not to borrow any removal agent (FIGURES 4.7C and 4.7D).

##### Recommendation

The recommendation was to pursue further durability testing of this coating system because there appeared to be potential for the system. It was anticipated that the final surface appearance of the soundwall would have been more acceptable had the representative had more removal agent to use. Refer to Subsection 2.6 regarding additional durability testing. If further evaluation determines that the product can last through numerous graffiti removal cycles, the product will be identified for inclusion on the Qualified Product List.



FIGURE 4.7A Removal - Painted Panel 7

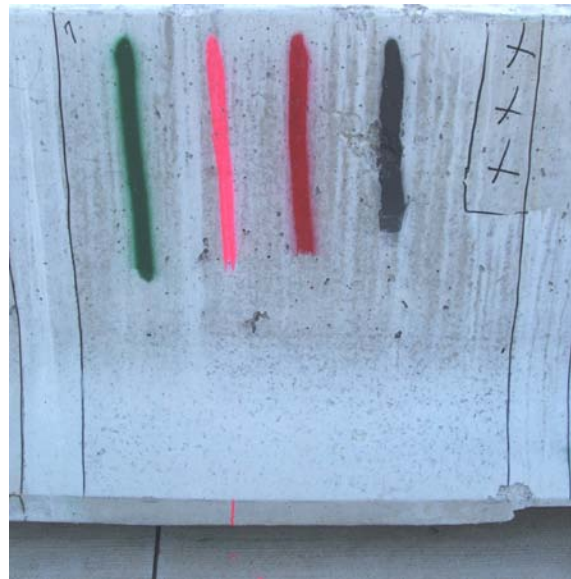


FIGURE 4.7B Removal - Unpainted Panel 7



**FIGURE 4.7C Removal - Fractured Fin Facing Panel 7**



**FIGURE 4.7D Close-up of Removal - Fractured Fin Facing Panel 7**



#### 4.8 Panel 8

##### Painted concrete panel

There was green, pink, and red paint residue left on the substrate. The residue was especially noticeable with regards to the green color paint. The coating was slightly damaged due to the vigorous removal (FIGURE 4.8A).

##### Unpainted concrete panel

The final surface appearance was considered acceptable by evaluators, although there was a trace amount of green paint residue (FIGURE 4.8B). The gloss measurements were much higher than the allowable criterion specified for anti-graffiti coatings.

##### Soundwall with fractured fin facing panel

Green paint residue was noticeable and evaluators mentioned there was difficulty with graffiti removal (FIGURES 4.8C and 4.8D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of difficulty of graffiti removal, an unacceptable amount of green paint residue on the soundwall panel, and unacceptable gloss measurements. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

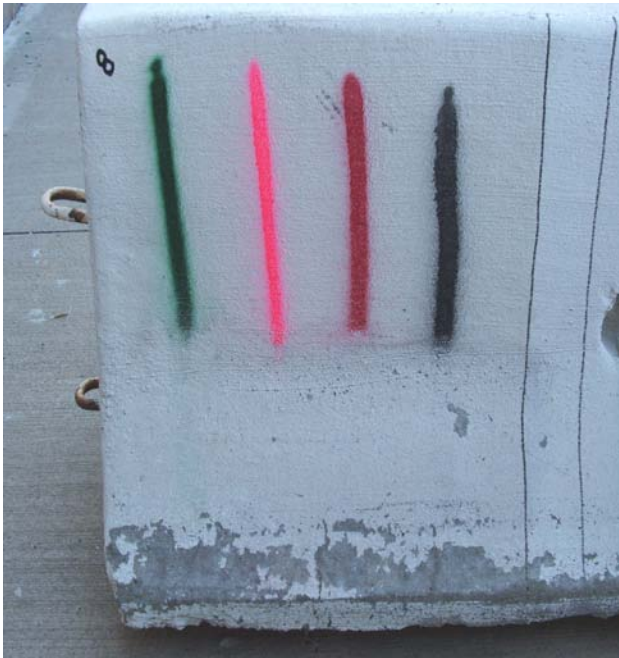


FIGURE 4.8A Removal – Painted Panel 8

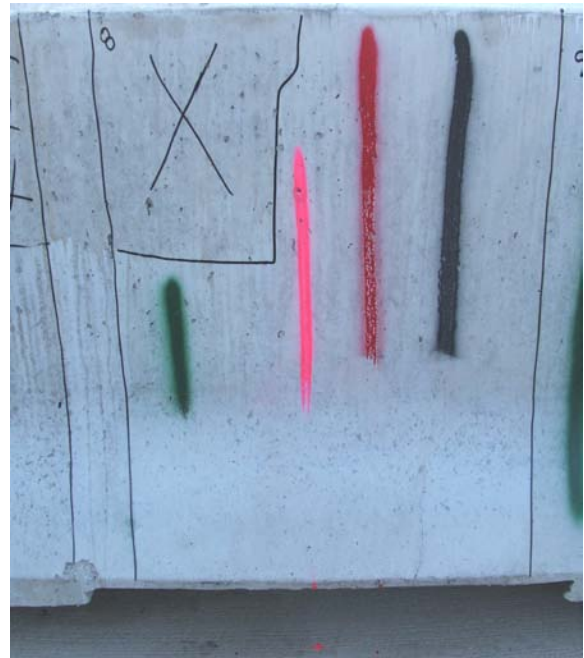


FIGURE 4.8B Removal – Unpainted Panel 8





**FIGURE 4.8C Removal - Fractured Fin Facing Panel 8**



**FIGURE 4.8D Close-up of Removal - Fractured Fin Facing Panel 8**

#### 4.9 Panel 9

##### Recommendation

The coating system was disqualified because the representative did not return for the graffiti removal operations (FIGURES 4.9A and 4.9B).

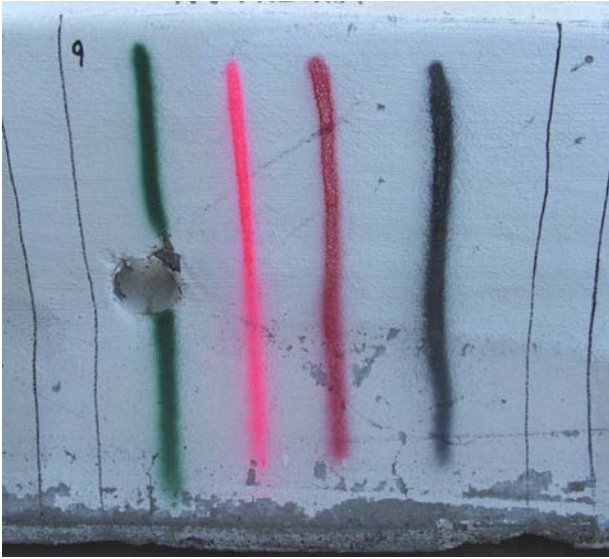


FIGURE 4.9A No Removal – Painted Panel 9

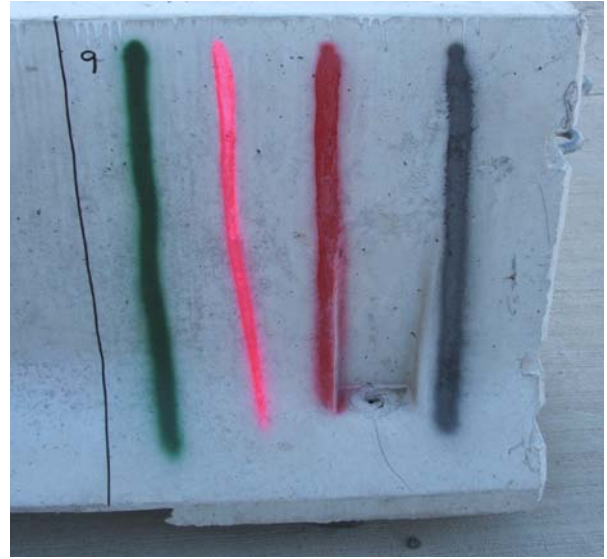


FIGURE 4.9B No Removal – Unpainted Panel 9

#### 4.10 Panel 10

##### Painted concrete panel

There was noticeable paint residue with possible coating deterioration due to high pressure washing (FIGURE 4.10A).

##### Unpainted concrete panel

Coating and substrate damage was noticeable due to high pressure washing. One evaluator mentioned that the surface looked blotchy with an efflorescence-type appearance (FIGURE 4.10B).

##### Soundwall with fractured fin facing panel

There was green paint residue and damage to the coating and substrate (FIGURES 4.10C and 4.10D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of paint residue and damage to the coating and substrate. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

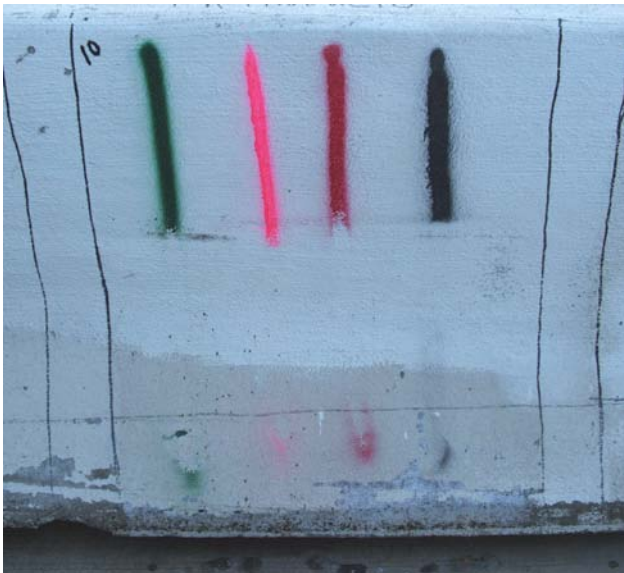


FIGURE 4.10A Removal – Painted Panel 10

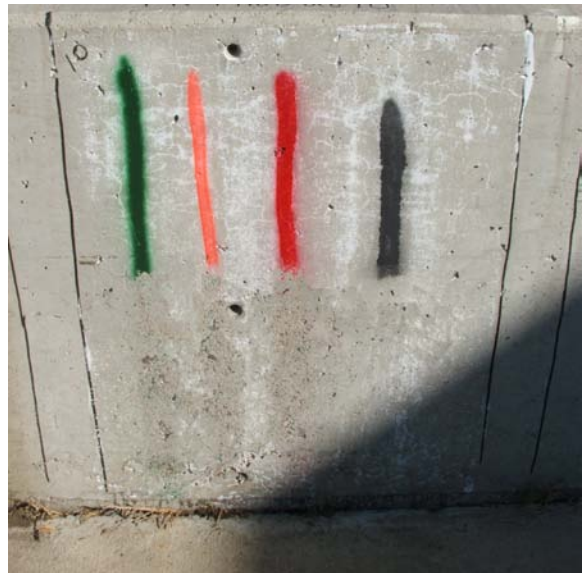


FIGURE 4.10B Removal – Unpainted Panel 10





**FIGURE 4.10C Removal - Fractured Fin Facing Panel 10**



**FIGURE 4.10D Close-up of Removal – Fractured Fin Facing Panel 10**

#### 4.11 Panel 11

##### Painted concrete panel

Black and red paint residue was observed. Additionally, there was damage to the substrate and the coating discolored (FIGURE 4.11A).

##### Unpainted concrete panel

The coating was removed from several areas and one evaluator mentioned that the remaining coating had discolored (FIGURE 4.11B).

##### Soundwall with fractured fin facing panel

The coating system was completely removed from the substrate (FIGURES 4.11C and 4.11D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of paint residue, coating discoloration, and damage to the coating and substrate. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.



FIGURE 4.11A Removal – Painted Panel 11

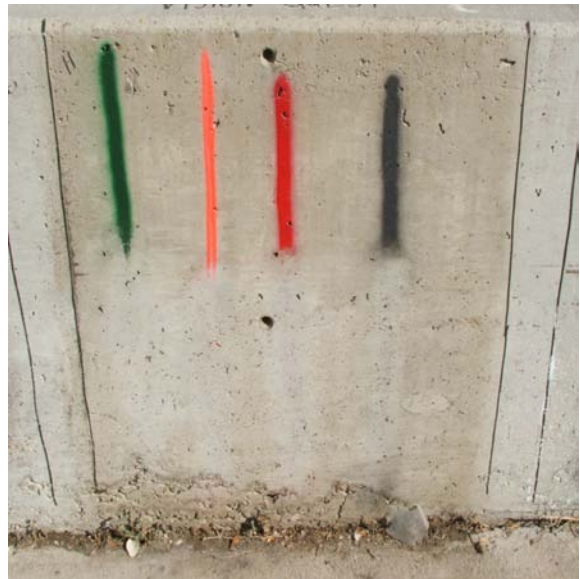


FIGURE 4.11B Removal – Unpainted Panel 11



**FIGURE 4.11C Removal - Fractured Fin Facing Panel 11**



**FIGURE 4.11D Close-up of Removal - Fractured Fin Facing Panel 11**



#### 4.12 Panel 12

##### Painted concrete panel

Paint residue was conspicuous for all colors. One evaluator documented that there was damage to the coating along with coating discoloration (FIGURE 4.12A).

##### Unpainted concrete panel

Residue paint was appreciable for all colors. All evaluators mentioned that coating discoloration was apparent (FIGURE 4.12B).

##### Soundwall with fractured fin facing panel

There was difficulty with the graffiti removal and the coating was damaged to a point where little evidence of coating remained (FIGURES 4.12C and 4.12D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of paint residue, discoloration, and damage to the coating. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

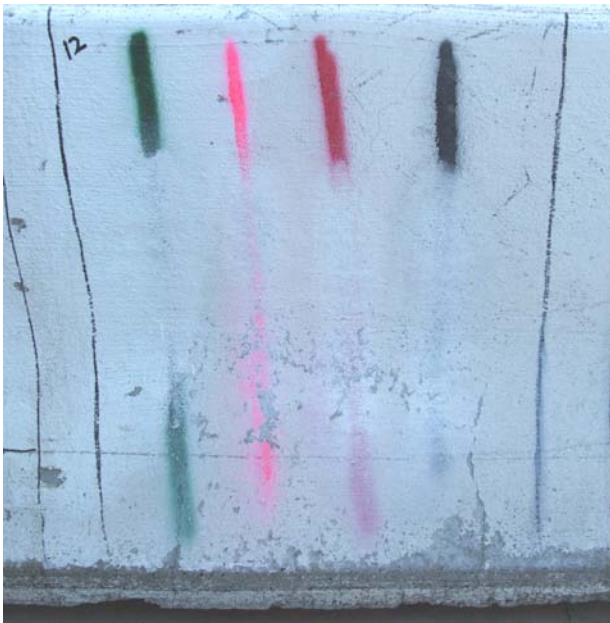


FIGURE 4.12A Removal – Painted Panel 12



FIGURE 4.12B Removal – Unpainted Panel 12



**FIGURE 4.12C Removal - Fractured Fin Facing Panel 12**



**FIGURE 4.12D Close-up of Removal - Fractured Fin Facing Panel 12**



#### 4.13 Panel 13

##### Painted concrete panel

There was damage to the coating and smeared paint residue (FIGURE 4.13A).

##### Unpainted concrete panel

There was distinct paint residue along with damage and discoloration of the coating (FIGURE 4.13B).

##### Soundwall with fractured fin facing panel

A substantial amount of paint residue was noted and the coating and substrate were damaged in the removal process (FIGURES 4.13C and 4.13D).

##### Recommendation

The recommendation was to not pursue further durability testing of this coating system because of paint residue, discoloration, and damage to the coating and substrate. Refer to Subsection 2.6 regarding additional durability testing for the panels. The representative is welcome to participate in the next scheduled evaluation if deficiencies are corrected.

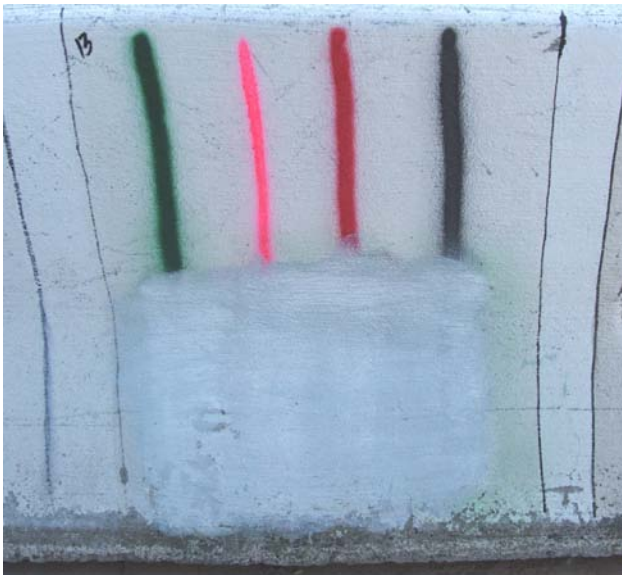


FIGURE 4.13A Removal – Painted Panel 13

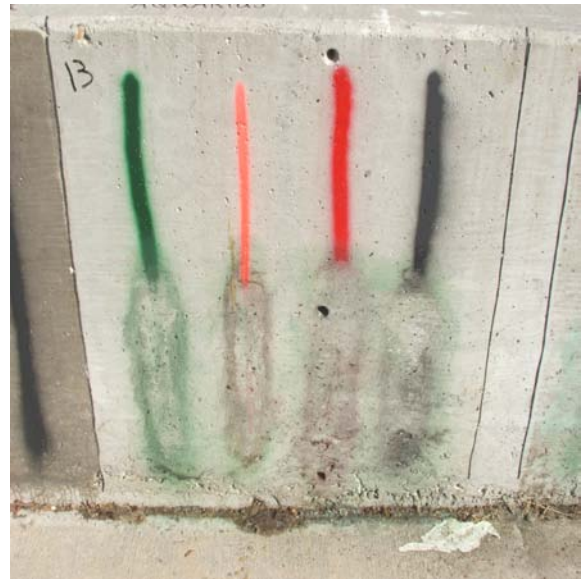


FIGURE 4.13B Removal – Unpainted Panel 13



**FIGURE 4.13C Removal - Fractured Fin Facing Panel 13**



**FIGURE 4.13D Close-up of Removal - Fractured Fin Facing Panel 13**

#### 4.14 Panel 14

##### **Painted concrete panel**

There was trace paint residue immediately following graffiti removal operations. However, within one week the trace paint residue was gone. The final surface appearance was considered acceptable. Some dust collection was reported on the surface (FIGURE 4.14A).

##### **Unpainted concrete panel**

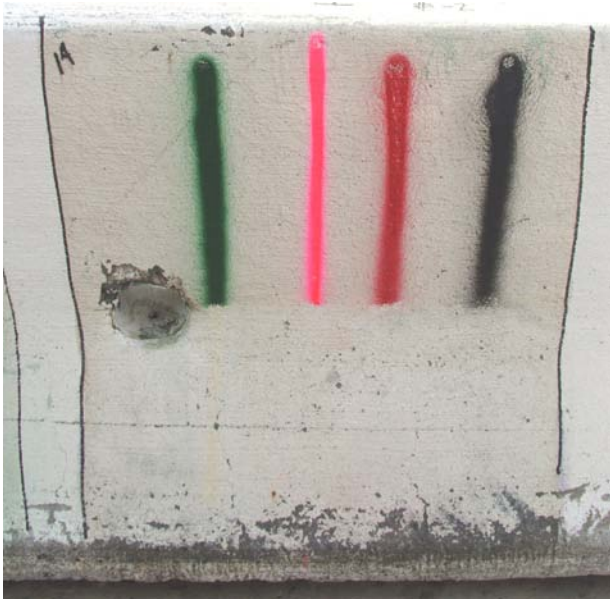
There was ease of graffiti removal and the final surface appearance was considered acceptable despite a lack of dirt resistance (FIGURE 4.14B).

##### **Soundwall with fractured fin facing panel**

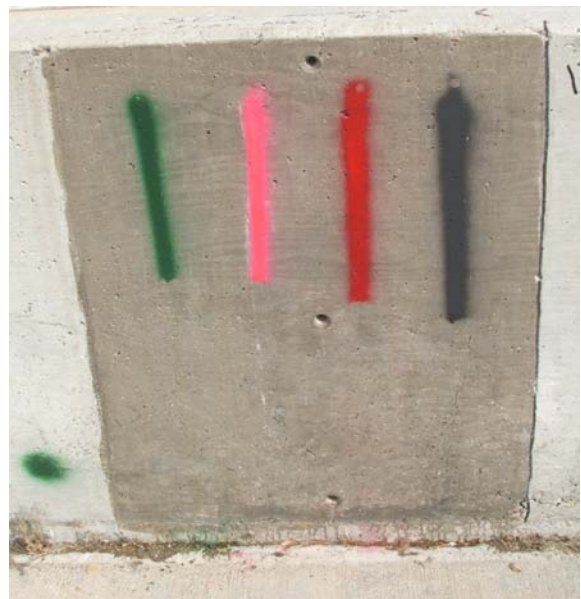
There was ease of graffiti removal and the final surface appearance was considered acceptable (FIGURES 4.14C and 4.14D).

##### **Recommendation**

The recommendation was to pursue further durability testing of this coating system. Refer to Subsection 2.6 regarding additional durability testing. If further evaluation determines that the product can last through numerous graffiti removal cycles, the product will be identified for inclusion on the Qualified Product List.



**FIGURE 4.14A Removal - Painted Panel 14**



**FIGURE 4.14B Removal – Unpainted Panel 14**





**FIGURE 4.14C Removal - Fractured Fin Facing Panel 14**



**FIGURE 4.14D Close-up of Removal - Fractured Fin Facing Panel 14**

## CHAPTER 5 – SUMMARY

### 5.1 Summary

The non-sacrificial, anti-graffiti coating evaluation was a collective effort by the Research, Materials, and Maintenance and Operations Divisions to find satisfactory products for addition to the Qualified Product List. The effort also initiated investigation into a non-sacrificial, anti-graffiti coating specification and improved the documentation protocol for the evaluation program. Although it was determined that a compositional anti-graffiti specification was not feasible, a six page protocol document was developed that will assist future evaluators with the numerous organizational and operational issues that occur with any research endeavor. Moreover, evaluators reached agreement that three of the coating systems evaluated demonstrated results that warranted additional durability testing.

### 5.2 Recommendations

The evaluators concluded that the non-sacrificial, anti-graffiti coating systems on panels 4, 7, and 14 displayed results that warranted further durability testing. NDOT will continue to evaluate these panels by applying and removing graffiti for numerous cycles until it can be proven the coatings are non-sacrificial. Products that continue to perform in a satisfactory manner through many graffiti removal cycles will be added to the Qualified Product List.

There are additional changes that can be made to optimize the evaluation protocol for future events. The following improvements are recommended:

- Develop and finalize the scheduling for the 2010 evaluation at least three months in advance of expected start date. Advance planning allows for a thorough product review process.
- Improve the application and prescreen process by requiring in-depth technical data for all coating systems, including the removal agents.
- Verify that representatives arrive with the same products as proposed in the application process. Often, representatives arrive with different coating systems or removal products than what was proposed in the applications.
- Consider supplying representatives with the typical removal agents used by NDOT personnel to amplify “real world” conditions. Some removal agents were more effective than other removal agents and it is unknown if the superior removal agents would have provided better graffiti removal results for many of the coating systems evaluated.
- Examine NDOT’s graffiti removal field operations and determine if this evaluation is representative of conditions in the field. For example, it may be sensible to eliminate the option for representatives to use a pressure washer for graffiti removal if NDOT does not use this method for graffiti removal in the field.
- Purchase gold colored spray paint in addition to the red, pink, black, and green spray paint that is already used as the graffiti medium for evaluation. NDOT’s removal specialists mentioned that the use of gold colored spray paint is becoming a popular medium for vandals and suggested that the color be used in future evaluations.
- Freshly paint the concrete barrier rails used in the evaluation program with at least two coats of appropriate paint or stain product two months in advance of anti-graffiti coating application. A new surface finish that is free of chips, bugholes, pits, cracks, and other detrimental surface imperfections will prevent discrepancy during the graffiti removal evaluation process.

## REFERENCES

1. ASTM D 16, "Standard Terminology for Paint, Related Coatings, Materials, and Applications," ASTM International. West Conshohocken, Pa., 2009.
2. ASTM D 6578, "Standard Practice for Determination of Graffiti Resistance," ASTM International. West Conshohocken, Pa., 2009.
3. ASTM E 284, "Standard Terminology of Appearance," ASTM International. West Conshohocken, Pa., 2009.
4. Grant, Christopher M. (1996, August). Graffiti: Taking a Closer Look. United States Department of Justice: Federal Bureau of Investigation. Retrieved April 13, 2010 from the World Wide Web: <http://www.fbi.gov/publications/leb/1996/aug963.txt>.





Nevada Department of Transportation  
Susan Martinovich, P.E. Director  
Prepared by Research Division  
Ken Chambers, Research Division Chief  
(775) 888-7803  
kchambers@dot.state.nv.us  
1263 South Stewart Street  
Carson City, Nevada 89712