KTA-Tator, Inc.

STEEL BRIDGE COATING AND RECOATING WARRANTY REQUIREMENTS FINAL REPORT

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REPORT DISCLAIMER

"The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Florida Department of Transportation."

METRIC CONVERSION CHART

APPROXIMATE CONVERSIONS TO SI UNITS				
SYMBOL	**WHEN YOU KNOW**	**MULTIPLY BY**	**TO FIND**	**SYMBOL**
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

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16. Abstract

The service life of steel bridge coatings in Florida is occasionally shorter than the intended design life, resulting in the need for increased maintenance painting. This project examined the value of warranty terms potentially included in painting contracts to improve the quality and durability of steel bridge coatings.

The research found that the use of warranty contracts for bridge painting remains uncommon. For the agencies using warranty contracts, the benefit of the warranty remains inherently subjective. All the warranties rely on visually apparent defects at the time of the warranty inspection. Warranties typically define failure in terms of surface corrosion, blistering, or peeling paint. Only one state includes color and gloss concerns. Despite concerns about enforcing warranties, agencies using them do not seem to have any problems with enforcement.

Based on the data generated and reviewed, the report provides a recommended standard specification item for "Value-Added Steel Protective Coating," modeled after other existing warranty language in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction. The report also contains an implementation plan to demonstrate the feasibility and value of the standard specification item. The implementation plan consists of four phases: finalizing the standard specification language, conducting pilot projects, monitoring the coating condition, and an analysis of data.

17. Key Words	18. Distribution Statement		
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EXECUTIVE SUMMARY

The service life of steel bridge coatings in Florida is occasionally shorter than the intended design life, resulting in the need for increased maintenance painting. To some degree, this reduced service life is postulated to be the result of workmanship on the part of coating applicators.

This project examined the value of warranty terms potentially included in painting contracts to improve the quality and durability of steel bridge coatings. The warranties have the potential to cost-effectively incentivize higher quality, increase maintenance intervals, and provide significant savings to FDOT.

The project report provides the results of a national survey of bridge owners, a survey of Florida bridges, and an analysis of coating condition data collected during FDOT bridge condition assessments.

The research found that the use of warranty contracts for bridge painting remains uncommon. For the agencies using warranty contracts, the benefit of the warranty remains inherently subjective. The cost of warranty provisions and enforcement may be more sensible for bridge structures that are exceptionally difficult or costly to maintain or located in corrosive environments.

All the warranties rely on visually apparent defects at the time of the warranty inspection. Warranties typically define failure in terms of surface corrosion, blistering, or peeling paint. Only one state includes color and gloss concerns. Despite concerns about enforcing warranties, agencies using them do not seem to have any problems with enforcement.

Based on the data generated and reviewed, the report provides a recommended standard specification item for “Value-Added Steel Protective Coating,” modeled after other existing warranty language in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

The report also contains an implementation plan to demonstrate the feasibility and value of the standard specification item. The implementation plan consists of four phases: finalizing the standard specification language, conducting pilot projects, monitoring the coating condition, and an analysis of data. It would be beneficial to develop a “Warranty Inspection Guide” consisting of photographs and written descriptions to illustrate examples of what may or may not be a claim.

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Chapter 1 INTRODUCTION

The service life of steel bridge coatings in Florida is occasionally shorter than the intended design life, resulting in the need for increased maintenance painting. To some degree, this reduced service life is postulated to be the result of workmanship on the part of coating applicators. This project seeks to examine the value of warranty terms potentially included in painting contracts to improve the quality and durability of steel bridge coatings. The warranties are intended to cost-effectively incentivize higher quality, increase maintenance intervals, and provide significant savings to FDOT.

This project included six tasks as described below:

- Task 1 included a national survey of bridge owners to determine the general experience with protective coating warranties and identify best practices for coating warranty provisions.
- Task 2 included a survey of Florida bridges and an analysis of coating condition data collected during FDOT bridge condition assessments to identify appropriate performance measures to be used.
- Task 3 included development of contract language for a steel protective coating warranty for new and existing bridges.
- Task 4 included development of an implementation plan to demonstrate the feasibility and value of a steel protective coating warranty for new and existing bridges.
- Tasks 5 and 6 included the development of draft and final reports for the project as well as a project briefing to FDOT.

Chapter 2 SURVEY OF EXISTING PRACTICES

Nationwide Electronic Survey

A nationwide electronic survey was conducted in May 2022, using the online tool Alchemer to collect data from participants. The questionnaire included fill-in-the-blank, multiple choice, and ranking scale questions. Depending on how questions were answered (i.e., yes or no), a follow-up question would be posed. The survey questions were approved by FDOT and then distributed to the Research Advisory Committee (RAC) members, a part of AASHTO, which included members from state DOTs. Additional contacts at state DOTs and other bridge agencies were also sent the survey.

Representatives from 26 different agencies responded to the survey. Respondents provided their name, agency, and contact information at the start of the questionnaire. Overall, more than half of the United States is represented in the results, as depicted in Figure 2-1.

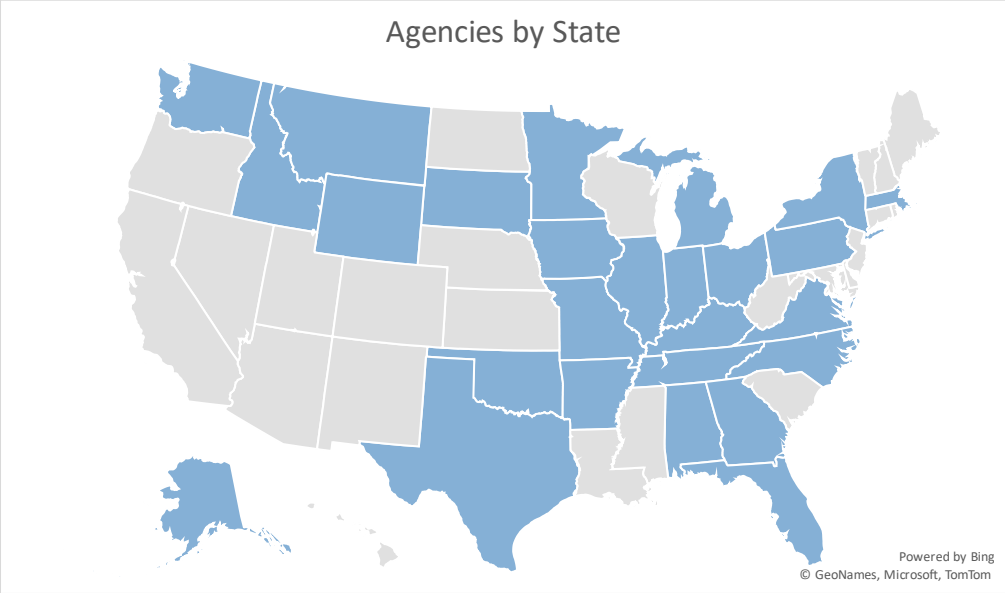

Figure 2-1: Map of Agencies Surveyed by State

The complete survey results are provided in Appendix A, below is a summary of the results to each question.

Question 2 How long does your coating typically last until removal and replacement? Respondents selected a 5-year interval from a drop-down menu. Five-year intervals up to 30 years were available as well as an option for 30+ years. Figure 2-2 presents the results. No agencies reported a typical service life less than 15 years. Three agencies (11.1%) reported that their coating lasted between 15-20 years. Five (18.5%) agencies reported coating life between 20-25 years. Nine (33.3%) agencies reported coating life between 25-30 years. Ten agencies (37.0%) made up the majority and reported their coating lasted more than 30 years before removal or replacement.

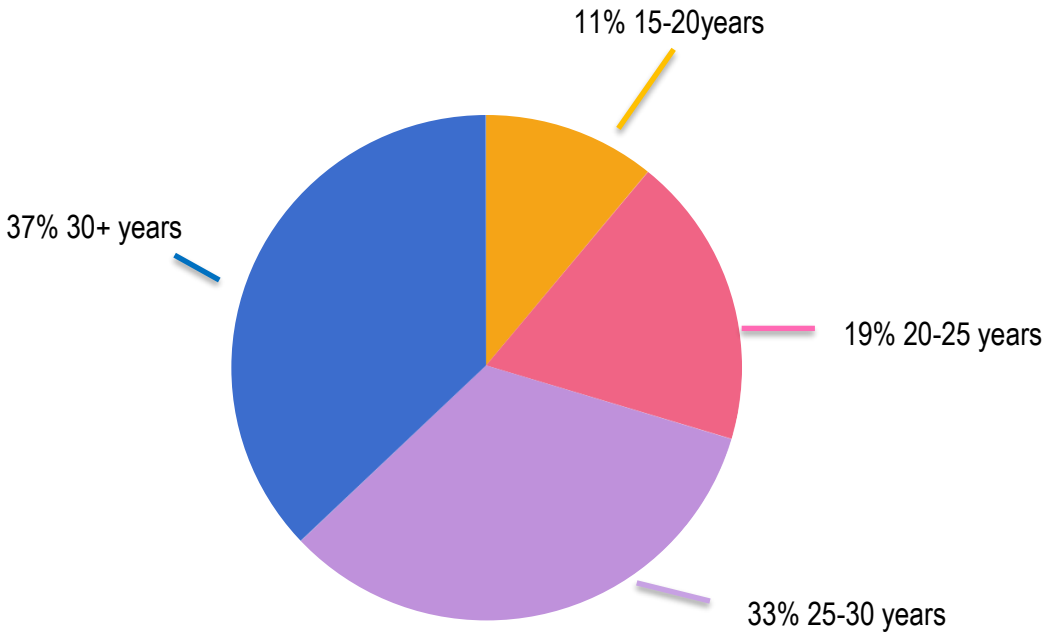

Figure 2-2: Graphical Representation of Question 2 Responses

Question 3 How many times is maintenance required on the coating over the service life before the coating is removed and replaced? Question 3 accepted short answer responses. While several agencies reported that coating maintenance is required between three and five times, eight answers indicated it being required just once over the service life before the coating is removed or replaced. Eight others reported zero, rarely, or never required maintenance. Other agencies had policies based on the length of the service lifetime, including 30- or 40-year maintenance cycles.

Question 4 Do you track coating performance other than from biennial inspection data? This was a Yes/No question. The majority (22 or 81.5%) do not track coating performance other than as required in the biennial inspection. Five agencies (18.5%) do have additional methods to track coating performance beyond biennial inspection requirements.

Question 5 Do you collect Element 515 (steel protective coating) data during your biennial inspection? This was a Yes/No question. Twenty-four (88.9%) reported that they do collect Element 515 data during their biennial inspection, while 3 (11.1%) do not.

Question 6 Please rank from most important to least important. What causes you to repaint your structures? Respondents were asked to rank four repaint criteria, from most to least important when deciding to repaint structures. Figure 2-3 depicts the data collected. Overall, the extent of steel corrosion was the most important consideration followed by coating film failures. Coating appearance and coating age were less important than steel corrosion and coating degradation.

Rank Distribution

Item	Overall Rank	Rank Distribution
Extent of Steel Corrosion	1	
Coating Degradation Independent of Corrosion – (Delamination, Blistering, etc.)	2	
Coating Appearance (Change in color, UV, Degradation, etc.)	3	
Coating Age	4	
	Lowest Rank	 Highest Rank

Figure 2-3: Rank Distribution of the Given Causes for Repaint

Question 7 How often does your agency use the following coating maintenance options? This question accepted the responses "Often, Sometimes, Rarely, or Never" from a drop-down menu. Figure 2-4 depicts the data by count and percent. Most organizations used coating removal and replacement often, spot or zone painting sometimes, spot or zone painting with a full overcoat rarely, and new construction often. Seven agencies reported never applying a full overcoat when spot or zone painting.

Response Count

	Often	Sometimes	Rarely	Never
Coating Removal and Replacement	16 (59.3%)	6 (22.2%)	4 (14.8%)	1 (3.7%)
Spot or Zone Painting	11 (40.7%)	13 (48.1%)	3 (11.1%)	0 (0.0%)
Spot or Zone Painting with a Full Overcoat	3 (11.1%)	5 (18.5%)	12 (44.4%)	7 (25.9%)
New Construction	12 (44.4%)	7 (25.9%)	5 (18.5%)	3 (11.1%)

Figure 2-4: Response Count Data from Question 7

Question 8 Do your current specifications require a qualified facility and/or qualified personnel to monitor the work performed in the field? This was a Yes/No question. The majority (18 or 66.7%) do require a qualified facility and/or personnel to monitor the work performed in the field. Nine agencies (33.3%) do not have these requirements in their current specifications.

Question 11 If yes, what are your requirements for qualified personnel? This question was populated on the questionnaire only for the respondents that selected Yes to Question 8. Figure 2-5 depicts the 16 responses received. Thirteen agencies required contractor certification to SSPC QP2/QP3/NACE AS-1F. Of those, seven agencies also required onsite inspectors with SSPC BCI 1 or NACE 1, five (29.4%) required onsite inspectors with SSPC BCI 2 or NACE 2/3, and one agency (5.9%) did not require onsite inspectors (other than as required by the contractor certification). Four respondents chose "Other" and provided a write-in response. Write-ins included SSPC QP-1 and variations on the given choices.

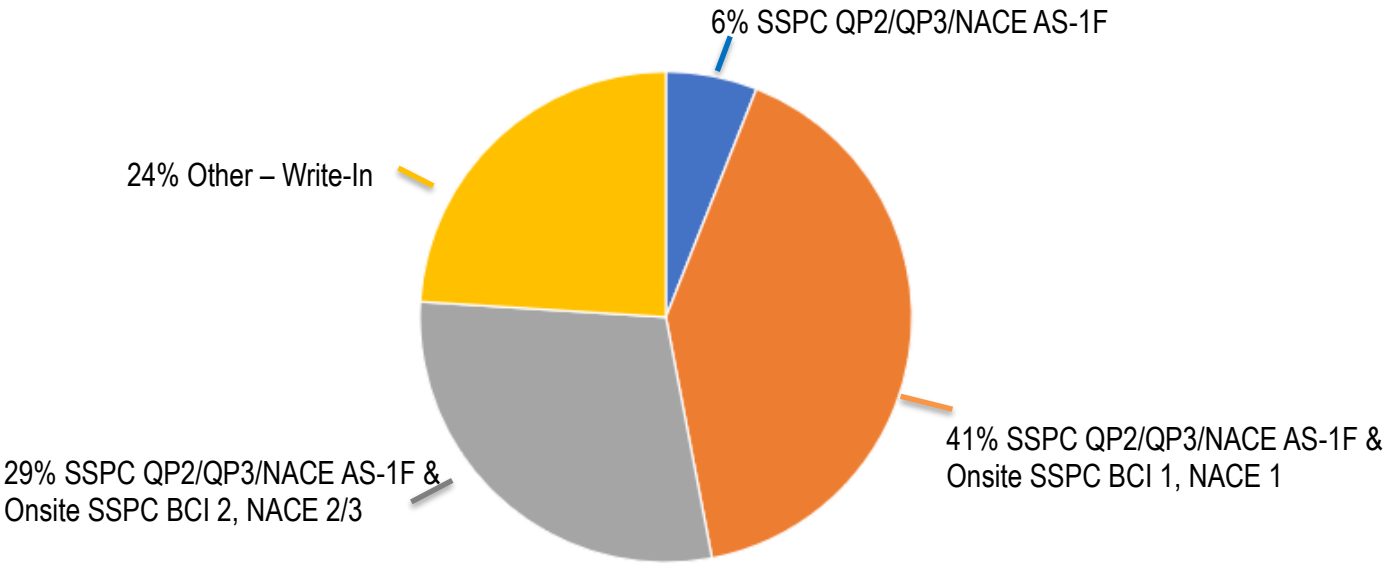

Figure 2-5: Graphical Representation of Question 9 Responses

Question 16 Do you believe warranty contracts could be beneficial? This was a Yes/No question. Twelve (54.5%) reported that they believe warranty contracts could be beneficial, while 10 (45.5%) do not. Each response was asked to elaborate on their reasoning.

Respondents that selected "No," explained that using a warranty contract is, "more trouble than it is worth." Another wrote, "theoretically I believe that [they] are useful, but unless an agency has the resources to enforce them, they are not practical." Some agencies preferred alternatives, including third-party inspections and detailed specification language.

On the other hand, those that selected "Yes," believe that warranty contracts could incentivize increased performance, quality of work, and accountability for both the contractor and the agencies. However, they express these benefits as being contingent upon the ability to enforce the contract.

Question 17 Why do you believe warranty contracts aren't beneficial? This question received a variety of short answer responses that revolved around the challenges of enforcement, costs of warranty provisions, and belief that current practices provide the desired results.

Question 25 What do you think the typical length of the warranty should be? This question requested an answer in months. The most common response (six agencies) was 60 months, ten agencies provided responses between 24 and 48 months, four agencies responded 120 months and two agencies replied 240 months.

Question 12 Does your agency use warranty contracts? This was a Yes/No question. Six (22.2%) reported that they use warranty contracts, while 21 (77.8%) reported that they do not. Depending on the response given, a select group of questions followed that elaborated on the topic. Those that responded "Yes" were directed to Questions 13, 14, 18, 19, 20, 23, 24, 30 and 31 while those that responded "No" were directed to Question 15, 16, 17 and 25.

<u>For Agencies Using Warranties</u>

Question 13 Why do you use them? This question received a variety of short answer responses. Two agencies specified that they use warranty contracts because they are required for all contract work. Other agencies choose when to use warranty contracts. The Illinois Department of Transportation utilizes warranty contracts, "for full removal and replacement only, to ensure that quality work is performed," and not for zone or spot painting. Reasons given to use warranty contracts include following best practices, correcting surface preparation, workmanship issues, and early failures.

Question 14 Are your warranty contracts working? This question was split amongst agencies. Three expressed that their warranty contracts worked, while two others expressed that they did not. The Maryland Department of Transportation reported that they do not measure the effectiveness of the warranty program.

Question 18 Why do you believe warranty contracts are beneficial? This question received a variety of short answer responses that revolved around the concepts of improving the quality of the work and holding contractors and materials suppliers accountable.

Question 19 What do you use warranty contracts for? (please select all that apply) provided four checkboxes that detailed potential covered repairs, of which any combination could be selected. "Coating Removal & Replacement" and "New Construction" were selected by 5 (83.3%) of the agencies that use warranty contracts. "Spot or Zone Painting" with and without a full overcoat were selected by 3 (50%) of the agencies.

Question 20 Does your agency have different warranties depending upon location of your structures? This was a Yes/No question. Five (83.3%) reported that their agency does not have different warranties depending upon the location of the structure. One agency (16.7%) determined the warranty based on surface preparation.

Question 23 What support does your agency provide for warranty inspections? This question received the following short answers:

- "Warranty inspections are done by the local Construction Resident staff, Materials & Test Unit staff, and area Bridge Maintenance Staff."
- "A third-party NACE-certified inspector will be hired to mitigate warranty provisions."
- "Regional construction offices are responsible for warranty inspections. MDOT has central office resources to provide assistance when needed."
- "In-House Coating Experts Contractor required to provide all access and other means and methods for inspection."
- "We provide annual reviews of coating systems which are covered by warranties to determine if warranty repairs are necessary."

Question 24 What is the typical length of your warranty? This question requested an answer in months. One agency reported that warranty contracts typically last 60 months, three reported that warranty contracts typically last 24 months, and two reported just 12 months.

Question 30 Do you require bonding or some type of insurance for the paint warranty? This was a Yes/No question. Five (83.3%) reported that their agency requires bonding or some type of insurance. One agency (16.7%) reported that they did not require bonding or some type of insurance.

Question 31 How is the bond or insurance amount determined for your paint warranties? This question received short answer responses. Two agencies weren't sure how it was determined while three indicated that it was a percentage of the price of the work (20%, 25%, and not stated). The respondent not requiring bonding or insurance requires the contractor to bid a line item for the warranty. The contractors bid a small amount in order to minimize their incentive to perform any work.

<u>For Agencies Not Using Warranties</u>

Question 15 Which of the following issues influenced your decision to not use warranties? This question provided eight potential influencing factors and accepted any combination of selections, including write-in responses. Percentages and response count are displayed in Figure 2-6. The most common concern was the Ability to Enforce a Warranty. Other significant concerns were the Ability to Select Meaningful Warranty Criteria, Cost of Warranty and Ability to Select Meaningful Warranty Term. Write-in responses included precedent, policy, federal funding, regulations, and the challenge to keep contracts open past job completion.

Factors Influencing Warranty Survey

Factor	Percent	Responses
Ability to Enforce a Warranty	63.6%	14
Ability to Select Meaningful Warranty Criteria	27.3%	6
Ability to Select Meaningful Term	22.7%	5
Cost of Warranty	22.7%	5
Providing Access for Warranty Inspection	4.5%	1
Longevity of Warranty Coating Repairs	4.5%	1
Contractor' Ability to Provide Warranty Bond/Insurance	4.5%	1
Other – Write-In	36.4%	8

Figure 2-6: Factors Influencing Warranty Survey Data

Question 26 What are your performance criteria for the warranty? If you don't have warranties what should criteria be if you had to have them? (please select all that apply) This question provided checkboxes for eight performance criteria, of which any combination could be selected, including write-in responses. Percentages and response count are displayed in Figure 2-7. The "other" response was that workmanship should be a criterion for warranty contracts.

Warranty Performance Criteria

Criteria	Percent	Responses
Disbonding	92.6%	25
Blistering	92.6%	25
Corrosion	88.9%	24
Cracking	85.2%	23
Density of Pinholes/Holidays	48.1%	13
Aesthetics	44.4%	12
Distribution of Coating Thickness	44.4%	12
Other or Additional Measurements	3.7%	1

Figure 2-7: Warranty Performance Criteria Survey Data

Question 27 Who and when determines the repair method for warranty repair work? If you don't have warranties, who do you believe it should be? (please select all that apply) This question provided checkboxes for six options, of which any combination could be selected, including write-in responses. Results are displayed in Figure 2-8. Respondents were allowed to select multiple choices, but the order of precedence was not reported. It was most common that the owner-approved work procedure or the original project specification determined the repair method for warranty repair work. It was also common that manufacturer recommendations, contractor proposed work procedure, and the product data sheet (PDS) at the time of repair should be referenced. The Write-In responses were "unknown" and "all of the above."

Authority on warranty repair

Repair Method	Percent	Responses
Owner Approved Work Procedure	59.3%	16
Original Project Specification	55.6%	15
Coating Manufacturer Recommendation	29.6%	8
Contractor Proposed Work Procedure	25.9%	7
Product Data Sheet (PDS) at Time of Repair	22.2%	6
Other – Write-In	7.4%	2

Figure 2.8: Authority on warranty repair work by survey data

Question 28 How does your agency pay for warranty? (please select all that apply) This question provided three options: warranty costs are included with the painting cost, listed as a line item, or other – Write-In. A "don't have warranties" selection, directed respondents to Question 29. Percentages and response count are displayed in Figure 2-9. Both "Other – Write-In" responses were mistaken by the questions and meant to fill in "Don't have warranties" and one agency filled in included with painting costs that doesn't use warranties. The majority (18 or 66.7%) do not have warranties and were forwarded to Question 30. Six agencies include the warranty cost with painting and one agency considers it a line item. Both write-in selections were blank.

Warranty payment

Value	Percent	Responses
Including with Painting Cost	22.2%	6
Line Item	3.7%	1
Other – Write-In	7.4%`	2
Don't Have Warranties	66.7%	18

Figure 2-9: Warranty payment survey responses

Question 29 How do you think they should be paid? This was a multiple-choice question of those responding "No" to Question 28. The results are depicted in Figure 2-10. Of the agencies that do not have warranties, 11 (61.1%) believe that the cost should be included with painting, and 6 (33.3%) think it should be a listed line item. One write-in response (5.6%) was left blank.

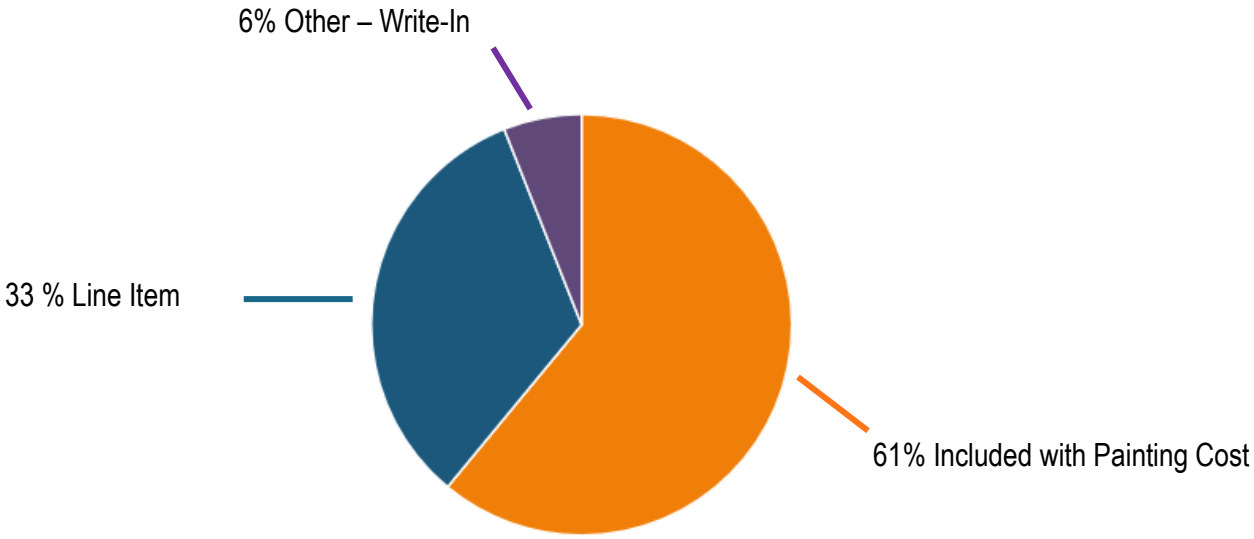

Figure 2-10: Graphical representation of Question 29 responses

Additional Data and Discussion

In 2016, Domestic Scan 15-03 "successful Preservation Practice for steel coatings" concluded that warranties are good practices for improving the quality of bridge coatings. The scan identified several state DOTs and agency owners who employed warranties on steel bridge coating and recoating projects: They included Maryland, Michigan, Oregon, Virginia, and the Golden Gate Bridge, Highway and Transportation

District. It also found that some states like Ohio and Florida used warranties in the past and that Virginia was moving towards using a warranty program.

The present survey identified an additional three agencies using warranty contracts: North Carolina, Illinois, and Triborough and Bridge Authority (New York). Virginia has begun to use warranties, and Ohio has not brought back its warranties because they believe their current specification language has yielded long-lasting products. Michigan still utilizes their program and finds it benefits the longevity of their coating projects.

Table 2-1 summarizes key parameters from six agency coating warranties. These warranty provisions may or may not be invoked in all contracts, yet they provide examples of typical features of bridge painting warranties.

Phone interviews were held with Texas DOT, Michigan DOT, Illinois DOT, Virginia DOT, and the Triborough Bridge & Tunnel Authority (New York) to obtain additional understanding of their experiences using or not using warranty contracts. The main takeaways from these interviews are listed below.

- The states using warranty programs believe they help bring to light any surface preparation defects within the warranty period.
- If issues arise, the contractor fixes the issues within that time.
- It is quite common to call back contractors for touchup before the warranty is done.
- Asked if owners thought the warranty period could be further extended, most states mentioned that they thought extending further would then create further enforcement issues to determine who was at fault.
- States who used the warranties expressed the hope to always use them but did acknowledge the contractors' cost of working on their structures is more than likely higher than those who do not.
- States that do not issue warranties think they could be beneficial but too hard to enforce.
- One state mentioned receiving a letter from one of their unions disagreeing with warranty contracts.
- Another state mentioned their current recoating jobs last 25-30 years without current use of warranties.

During the digital survey, the agencies that use warranty contracts were asked if they require bonding or some type of financial incentive to support an effective warranty. Agencies answered they do and provided the following regarding bonding amounts:

- Twenty percent (20%) of the final coating work value
- Percentage of the total contract price
- Equal to the sum of 25% of the original total contract amount for cleaning and coating items
- One state indicated that the warranty was sustained via the inclusion of a pay item in the contract. This pay item is not owed to the contractor until the warranty period ends and any necessary repairs are completed.

Table 2-1: Summary of Example Bridge Paint Warranty Key Parameters

Owner / Reference	Financial Assurance	Summary Failure Definitions	Warranty Period (Post-Acceptance of the Coated Structure)
MTA Bridges and Tunnels (NY, NY); Specification 009930-3.09B	Bond of 20% of the value of painting work	[Coated area] which exhibits disbonding, cracking, rusting, or otherwise proves defective or fails to comply with the Contract Documents within this warranty and guarantee period such that it complies with the Contract Documents.	Warranty extends for one year for partial repair and two years for full coating work.
Illinois Department of Transportation Guide Bridge Special Provision No. 94	Bond of 20% of the value of painting work (aka cleaning and painting)	The cleaning and painting will be considered distressed if any occurrence of visible rust or rust breakthrough, paint blistering, peeling, or scaling are discovered during the Warranty Period.	Two-year warranty
Michigan Department of Transportation Special Provision 20SP-715A-01	Bond of 25% of the value of painting work (aka cleaning and coating)	1. The occurrence of visible rust or rust breakthrough, coating blistering, peeling, scaling, or unremoved slivers. 2. Coating applied over dirt, debris, blasting debris, or rust products not removed during blast cleaning. 3. Incomplete coating or coating thicknesses less than the minimums specified in the coating specifications. 4. Damage to the coating system caused by the Contractor while removing scaffolding or performing other work.	Two-year warranty
North Carolina Department of Transportation, Special provision PSP015 Painting Existing Structure	Guaranteed under the contract payment and performance bond	1. No visible rust, contamination, or application defect is observed in any coated area. 2. Painted surfaces have a uniform color and gloss. 3. Painted surfaces have an adhesion that meets an ASTM D3359, 3A rating.	One-year warranty

Table 2-1: Summary of Example Bridge Paint Warranty Key Parameters, continued

Owner / Reference	Financial Assurance	Summary Failure Definitions	Warranty Period (Post-Acceptance of the Coated Structure)
Ohio Department of Transportation, Supplemental Specification 885, Painting of Structural Steel with Warranty	Bond of 60% of the value of painting work	1. The occurrence of visible rust or rust breakthrough, paint blistering, peeling, scaling, or unremoved slivers. 2. Paint applied over dirt, debris, blasting debris, or rust products not removed during blast cleaning. 3. Material deficiencies, application deficiencies, incomplete coatings, or coating thicknesses outside the thickness limits specified in the paint system specifications. 4. Damage to the coating system caused by the Contractor while removing scaffolding, forms, or performing other work.	Three-year warranty
Maryland SHA Paint System Performance Warranty (as per NCHRP Project 20 68A, Scan 15-03)	Bond equal to 25% of the total contract price for all items	The work shall be considered defective if visible rust or rust breakthrough, paint blistering, peeling, cracking, chalking, shadow-through, scaling or scaling conditions as noted in the Performance Criteria table occurs during the warranty period. In addition, repairs to fascia beams and fascia bearings that are considered unsightly by the Administration due to spot repair areas shall require the entire fascia beam to be recoated. Performance Criteria table refers to a specific threshold level below which no repair is needed and above which, a complete “bridge element” has to be repainted.	Two-year warranty

Observations from the Digital Survey

- From the digital survey, the use of warranty contracts for bridge painting remains uncommon. For the agencies using warranty contracts, the benefit of the warranty remains inherently subjective, especially regarding the impact of short-term warranty periods on the long-term life (greater than 15 to 25 years) of the coating systems.

- Most special provisions for warranty contracts establish a warranty period of nominally 2 years, a short time relative to the intended design life which may extend beyond 20 years. Repairs at the 2 years address initial defects. The agencies must commit the resources to enforce these provisions, and this is reported as a challenge. The cost of warranty provisions and enforcement may be more sensible for specific bridge structures in corrosive environments.

- The cost of the warranty provisions cannot be determined from the surveys. Although one may quote the cost of bonds or contract line items specifically as the "cost," the contractor may also incur additional costs via internal training and quality control that are not separately priced items. The surveys and follow-up conversations also suggest that an emphasis on good workmanship may be limited and there is an expectation that some warranty remediation will be required. If a contractor knows that they must mobilize to do warranty work, it might be less expensive for the contractor to perform certain touchup at the end of the warranty than be diligent throughout the application. This is because much of the touchup cost is in mobilization and structure access; the repair of 1-2 small areas after the project is completed is more expensive than repairing much larger areas while project access remains in place.

- The warranties typically define failure in terms of surface corrosion, blistering, or peeling paint. Only one state includes color and gloss concerns. All the warranties rely on visually apparent defects at the time of the warranty inspection.

- Warranties apply to contractor workmanship outside the expectations of normal industry practices. Warranties do not address the impacts of the coating system design or coating materials.

Chapter 3 PERFORMANCE MEASURES IN EXISTING WARRANTIES

Table 3-1 summarizes key performance measures from the survey data. Warranty periods of 1, 2, 3, 5, and 10 years were identified. Five of the nine respondents indicated they used general language requiring that coating defects be repaired. One contained a list of unquantified aesthetic issues (rust stains, loss of gloss or rapid change in color) to be restored to a "acceptable" condition. The remaining three required that the coating meet specific color and gloss retention values, have a certain maximum "defective" surface area (2%), or have a specific amount of corrosion (0.3% on flat areas and 1.0% in crevices).

Table 3-1 – Summary of Key Warranty Performance Measures from Survey

Performance Measures	Repair Threshold	Inspection Protocol	Warranty Repair Period	Technical Requirements for Repair
Corrosion	Varies from "all defective areas" to a defined extent of corrosion (e.g., 2%)	Visual inspection for corrosion and staining from accessible areas	Range from 1 to 10 years Most common responses: 2 years (3) 5 years (2) 10 years (2)	In accordance with the specification and manufacturer's instructions
Disbonding, cracking, blistering	Varies from "all defective areas" to "observed defective areas", and "when observed area exceeds 2%"	Visual inspection from accessible areas; adhesion testing in one instance		
Aesthetics (e.g., color and gloss)	Visually discernable patterns, color change of 2.0 ΔE, gloss difference of 30 units.	Visual, ASTM D2244 (color), and ASTM D523 (gloss)		Restore to an acceptable condition

Existing bridge coating warranties, specifications, and special provisions were reviewed to compare financial assurances, key performance criteria, and maintenance warranty features required by various DOT authorities. Most documents were created for use on all agency projects which include bridge work, such as the Ohio DOT's Supplemental Specification 885 "Painting of Structural Steel with Warranty." All documents reviewed were first issued within the past 25 years, however information on the most-current warranty language for each authority was not available during the time of this review. Table 3-2 lists these documents.

Table 3-2 – Bridge Coating Warranty Documents

Document Title	Authority	Date Issued	Type
Warranty for Coatings	New York DOT	October 2007	General
Warranty for Cleaning and Painting Steel Structures	Illinois DOT	May 1999	General
Special Provisions for Warranty on Bridge Coating	Michigan DOT	April 2020	General
Supplemental Specification 885: Painting of Structural Steel with Warranty	Ohio DOT	December 2012	General
Painting Existing Structure	North Carolina DOT	February 2019	General
Maryland SHA Warranty Specification	Maryland DOT	October 2016	General

Previous versions of warranties issued by authorities listed above or draft language from additional agencies were also reviewed. Project-specific warranty language as indicated in the table below may or may not be invoked in all contracts but serves as an example of typical warranty features. Obsolete statutes in these documents offer a reference for historic bonding and performance measures. Language obtained from unfinalized specifications will be noted when referenced here. Table 3-3 lists these documents.

Table 3-3 - Draft or Outdated Warranty Language

Document Title	Authority	Date Issued	Type	Document Status
Bridge Paint Specification	Connecticut DOT	March 2000	General	Draft
Special Provision for Performance Warranty on Bridge Painting	Michigan DOT	November 1989	General	Issued
Special Provision for Performance Warranty on Bridge Painting	Indiana DOT	May 1999	General	Issued
Million Dollar Bridge - 5-Year Maintenance Warranty	Pennsylvania DOT	December 2000	Project-Specific	Draft
Golden Gate Bridge - Two (2) & Eight (8) Year Bonded Maintenance Warranties	Golden Gate Bridge, Highway and Transportation District	Unknown	Project-Specific	Issued
Chesapeake Bay Bridge - Special Warranty and Guarantee	Maryland DOT	Circa 2004	Project-Specific	Draft

Financial assurances required by the warranty bonds were found to be relatively consistent between issuing authorities. These findings matched the digital survey results documented earlier in this report. Typical bonds ranged between 15% to 30% of the total project value. Maryland DOT did not use a percentage to determine bond value for the Chesapeake Bay Bridge project, instead requiring contractors to carry a $10 million bond. This was approximately 16% of the total value of the initial contract. The

highest financial insurance allocation was found in Ohio DOT's Supplemental Specification, which required a bond 60% of the total cost of work be furnished.

The Golden Gate Bridge Highway and Transportation District and Pennsylvania DOT include additional stipulations in the event the bonding company declares insolvency or bankruptcy. Ohio DOT requires maintenance bond issuers must have an A.M. Best Financial Strength Rating (a grade representing the overall financial health of the bond underwriter) of "A- or better," which categorizes the bond holder as "excellent." While this language was omitted in the other documents, it may be included elsewhere in project-specific contract documents. Except for the Golden Gate Bridge warranty, the financial burden of intermediate inspections and repairs falls entirely to the bonded contractor.

No correlation was observed between warranty lengths and the monetary value of the bonds. Warranty periods begin at the conclusion of final quality assurance and control inspections, typically performed by the governing agency personnel and/or engineers designated in the contract documents. All warranties listed in Table 3-2 and Michigan DOT and Indiana DOT warranties in Table specify warranty periods between one and three years. Pennsylvania DOT and Connecticut DOT both require 5-year warranties. Golden Gate Bridge Highway and Transportation District utilize two separate warranties with a total duration of 8 years. The first covers a period of 2 years where the financial burden of repairs falls to both the coating contractor and coating manufacturer, and the second warranty spans the following six years, during which repair responsibility falls only to the coating manufacturer. The Chesapeake Bay Bridge project mandated the longest warranty at 10 years.

Inspection timelines correspond with total contract length and begin following the conclusion of onsite work. Performance and maintenance warranties of one to two years call for inspections immediately before the warranty term expiration with no intermediate work. Three-year warranties require two annual inspections and a final inspection one month before warranty expiration. Five-year warranties vary, calling for either one final inspection 60 days before termination of warranty period or inspections at 11 months, 2 years and 11 months, and 4 years and 11 months. The Golden Gate Bridge project only required inspections 60 days prior to the termination of the warranty and does not explicitly state if this applies to one or both warranty periods. Procurement of equipment, site access, and traffic control during inspections were typically the responsibility of the contractor.

Unacceptable coating defects and failure conditions are to be identified through visual inspections, and general failure types are consistent across authorities. The inclusion of specific testing methods, citations to industry-recognized evaluation criteria, and maximum surface area of failures allowable vary greatly in level of detail. Failures included in 11 of the 12 warranties prohibit, at minimum, the presence of visible rust and rust breakthrough, coating blisters, and foreign debris not properly removed during surface preparation. Insufficient coating film thickness is classified as a defect in four warranties without mention of specific testing equipment or locations to survey.

Notably, specific references to cracking, peeling, and disbondment were not present in all documents. Generalized language such as "or such other defects" are present in all documents reviewed. Illinois and Michigan DOT include provisions for mechanical damage caused by scaffolding removal or other activities

by the contractor. Nonuniformity of color and loss of coating gloss are mentioned as additional defective conditions per the Golden Gate Bridge specification.

Citations to industry standards for defect characterization were only found in four of the warranties listed in Table 3-2 and Table . Such standards include SSPC Vis 2 "*Standard Method for Evaluating Degree of Rusting on Painted Steel Surface* and ASTM D714 *Evaluating Degree of Blistering of Paints*. Other warranties not citing specific standards mandate repairs when visible rust across a bridge component or 1 square foot surface area, whichever is greater, in excess of either 0.3% or 1% is observed through visual inspection. This corresponds to SSPC Vis 2 Rust Grade 6 or 7 or ASTM 610 "Evaluating Degree of Rusting on Painted Steel Surfaces" Grade 6 or 7, however only the former is cited. The Golden Gate Bridge and Million Dollar Bridge project draft language dictated the most stringent rusting degree grade – SSPC Vis 2 Grade 9 – with additional mention of spot, general, and pinpoint rusting, as defined in the SSPC Vis 2 and ASTM 610 standard, only noted in the former project. Blistered coating required repair regardless of extent or frequency.

While loss of coating adhesion is specifically identified as a deficiency requiring repair in most specifications, test methods were only found in specification language from North Carolina DOT drafts. The document mandates the coating must meet a 3A rating per ASTM D3359 *Standard Test Methods for Rating Adhesion by Tape Test* after 12 months of service. Quantity or locations of adhesion tests are not included. Language from the Ohio DOT allows for destructive and non-destructive testing only when defects are observed during visual inspection to determine extent of the defect, but specific test methods are not provided.

Repair of unacceptable coating conditions identified within the warranty period require action be completed within a certain timespan, typically 60 to 90 days of contractor notification or within the same season, with extra allowances are offered in cases of winter weather. Detailed repair procedures are not included within the scope of most reviewed warranty documents, instead referring to other project specifications or manufacturer recommendations. In the event contractors deny liability for damage, appeal processes and conflict resolution are included in the Ohio DOT, New York DOT, Golden Gate Bridge, and draft Connecticut DOT warranty clauses.

Chapter 4 EVALUATION OF FLORIDA DOT BRIDGES

The coating condition on selected Florida bridges was assessed to evaluate various Performance Measures which might be included as part of the warranty. A total of 35 bridges were inspected in District 1, District 2, District 5 and District 7. Figure 4-1 shows Florida's transportation districts.

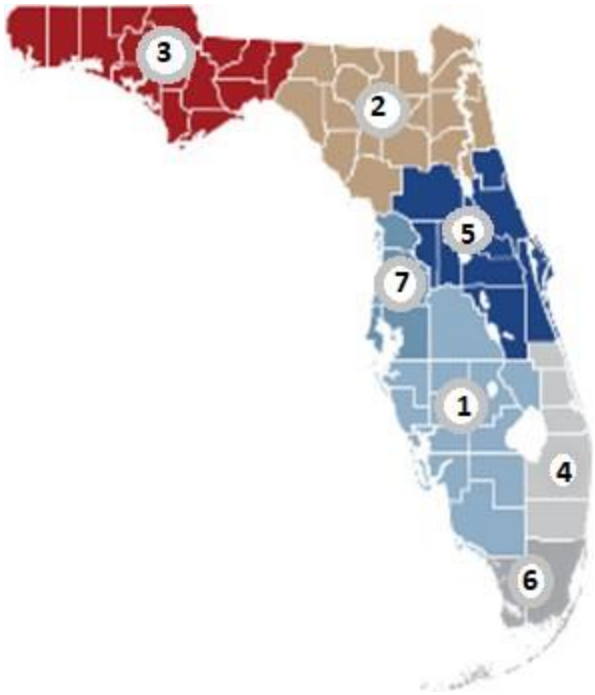

Figure 4-1: Districts of Florida

Data Collected

This section describes the inspection procedures and discusses the overall results. Appendix B provides detailed inspection results for each bridge.

Bridge Demographics and Inspection Data

Demographic and inspection data was obtained from the FHWA InfoBridge website (https://infobridge.fhwa.dot.gov/Home). Bridge Summary Reports from 2021 were reviewed and the NBI Structure Condition Rating and NBE 515 (Coatings) data were downloaded for this analysis. Based on our review, the NBE 515 data item is believed to be the most relevant to coating condition. For steel structures, FDOT maintains the following agency-specific ratings for Steel Protective Coatings; data from 2023 for Element 8516 was also reviewed and included in Appendix B.

- 8516 - Paint on Steel (sq ft)
- 8517 - Weathering Steel Patina (sq ft)
- 8518 - Galvanized or Metalized Steel (sq ft)
- 8519 - Other Steel Protective Coatings (sq. ft)

The approximate date when the coating was last maintained was obtained through interviews with local FDOT and KTA personnel. In some cases, the maintenance date was documented while in other cases was subject to individual recollection. Only dates with some degree of validation are reported on the inspection sheets in Appendix B.

Corrosivity Exposure

Deicing salts associated with bridge corrosion in northern states are not a significant consideration in Florida. Within Florida, the primary corrosivity factor for steel bridge corrosion is their proximity to water, proximity to the ocean, and complexity of the structure. For this study, each bridge was identified as belonging to one of four environment categories.

- Overpass – An overpass is a bridge that passes over another road or land mass. Overpasses were found and inspected in all of the Districts visited.
- Waterway – A waterway bridge is one that passes over a body of water.
- Waterways with Mechanical Lift – Vertical lift or bascule drawbridges where design elements create complexity that can lead to coating breakdown and corrosion.
- Waterways over 60 feet – This category recognizes that the impact of salt water and time or wetness tends to decrease with distance from the water surface.

More than 50% of the inspected bridges were over waterways as these bridges were expected to have more coating condition issues. Table 4-1 describes the bridge population by type and Figure 4-2 shows examples of each bridge type.

Table 4-1: Bridge Type and District

District	Overpass	Waterway-No Lift	Waterways with Mechanical Lift	Waterways over 60 feet	Total
1	1	-	1	-	**2**
2	6	5 (4 fresh water)	2	-	**13**
5	2	-	3	3	**8**
7	4	-	3	-	**7**
TOTAL	**13**	**5**	**9**	**3**	**30**

Overpass

Waterway-No lift

Waterway - Mechanical Lift

Waterway above 60 feet

Figure 4-2: Photos of Bridge Types

Field Inspections

Field inspections were performed with the goal of obtaining an economical assessment that might be used for enforcing a warranty. Specifically, the inspections were performed without any extraordinary access equipment or lane closures. Bridge personnel were present for some inspections and able to provide access to restricted areas in those instances. Inspections took between 30 minutes and 2 hours depending largely on the structure size, condition, and available access. This degree of access was sufficient in many cases but not adequate for high level bridges and longer lengths over water.

Coating system condition assessment is generally started by performing visual inspections. The purpose of the visual inspection is to identify the types of coating failures and the relative area of the coating that has failed. Assessments are performed to identify the degree of rusting, blistering, cracking, lifting and delamination. Industry standards are typically used to perform most of the assessments.

The degree of rusting is typically evaluated in accordance with SSPC VIS-2, Standard Method for Evaluating the Degree of Rusting on Painted Steel Surfaces. The distribution of rust is classified as spot rust, general rust, or pinpoint rust. Spot rusting occurs when the bulk of the rusting is concentrated in a few localized areas of the painted surface. General rusting is used to describe various-sized rust spots randomly distributed across the surface. Pinpoint rust is rust that is distributed across the surface as very small individual specks of rust. In some instances, the rust

that is present is a hybrid of these three patterns and may be described using combinations of the rust grades.

The extent of corrosion is evaluated as a percentage of the total area. The percentages follow a logarithmic scale and are ranked from Grades 10 to Grade 0 representing different percentages of corrosion (rust). The grading system provided in the standard was followed, although the percentages are sometimes reported rather than the grades. The survey results reported represent the proportion of surface defects corresponding to the closest proportion of the scale. For example, a beam surface reported as 3.0% rusted represents a proportion greater than 1.0% (the next lower percentage on the scale) but less than or equal to 3.0%.

Table 4-2 – Percent Corrosion

Rust Grade	Percent Rust	Rust Grade	Percent Rust
10	≤0.01	5	>1 to 3
9	>0.01 to 0.03	4	>3 to 10
8	>0.03 to 0.1	3	>10 to 16
7	>0.1 to 0.3	2	>16 to 33
6	>0.3 to 1	1	>33 to 50

An added utility of the scale is that it can also been used to report the extent of coating defects such as peeling, cracking, blistering, etc.

Dry film thickness (DFT) measurements are generally taken in accordance with ASTM D 7091, "Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Nonferrous Metal." Knowledge of the existing coating dry film thickness is useful to determine breakdown mechanisms and possible extent of repair required. Note that a properly applied coating will exhibit a range of thicknesses. Insufficient thickness is not commonly a warranty issue unless it accompanies another defect.

Color Measurements were made on accessible areas to quantify the color and determine the uniformity of color across representative surfaces. The color was measured using a professional-grade, portable spectrophotometer called Spectro 1 Pro. The device allowed for color measurements to be taken at multiple locations throughout each bridge, where access was possible, on horizontal, vertical, and diagonal surfaces. The color measurement is not affected by coating gloss or glare from the sun, both of which do impact human perception of color.

Measurements were not made on spots which visually looked different from the primary coating (areas painted to cover graffiti, protect steel repair or touchup coating damage, etc.). On bridges where access to multiple areas was possible, multiple measurements were made in different exposure areas (underneath the roadway, on guardrails, in machinery spaces, etc.).

The color difference among any set of measurements was calculated. The calculation for color difference is shown below and represented by ΔE. A higher ΔE value represents greater difference in color. Most experienced observers cannot notice ΔE below 2; clear differences become apparent to most observers around a ΔE of 5.

$$\Delta E = \sqrt{(L2 - L1)^2 + (a2 - a1)^2 + (b2 - b1)^2}$$

Where: L = lightness (0 is Black and 100 is perfect white)
a = red-green (positive values are red, negative values are green)
b = yellow-blue positive values are red, negative values are green)

Discussion of Performance Measures

As mentioned previously, Appendix B provides detailed evaluation results for each bridge. This section will discuss how the Performance Measures may be useful in warranty language using examples from the evaluations.

Coating Age

The approximate coating age was determined based on available records and interviews with knowledgeable personnel. Figure 4-3 shows the distribution of coating ages investigated. Most of the bridges have had a new coating system within the past 4 to 8 years. All the coatings were maintained within the past 16 years.

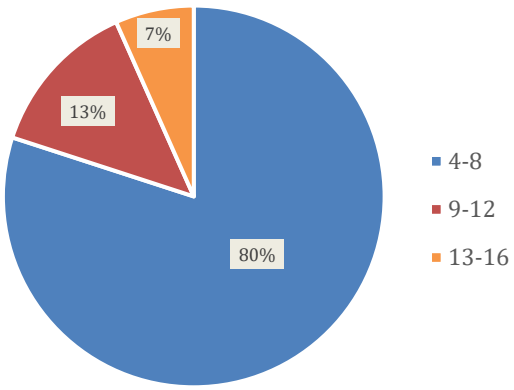

Figure 4-3: Bridge Age (Years)

Bridge Inspection Ratings

The NBI Structure Condition Ratings for these bridges were predominately 6 or 7, with a couple rated 5 and one rated 8. The observed coating conditions do not appear to impact the structure condition rating. This is logical given that multiple factors impact the Structure Condition Rating.

The NBE Element 515, Steel Protective Coating ratings for these structures should have a relationship to the observed coating condition. The good condition of the structures visited is consistent with the 515 data available. Note that the steel lift spans which were surveyed for this project do not have 515 data available since the overall structure is classified as a concrete bridge.

FDOT provided a listing of coated steel bridges and their current NBE 515 condition state. According to the data, there were 1,132 bridges with "paint on steel," comprising 45,445,724 square feet of coated surface. Over half of the bridges do not have any surface area in condition state 3 or 4 (CS-3 or CS-4). About 20 percent of the structures have more than 3% of the surface area in CS-3 or CS-4, though these tend to be smaller structures and only comprise about 8% of the coated steel surface area.

Corrosion

Widespread corrosion was not observed on any of the bridges. A VIS-2 rating of "10" was assigned to 16 of the 34 bridges. The remainder of the bridges had varying degrees of corrosion on some components. Of the 18 bridges with some coating degradation, two stood out as conditions that would warrant repair if they existed 2 to 4 years after maintenance painting. Sixteen bridges had degradation on a fraction of a percentage of the structure and were spread among difficult to coat details like crevices, diagonal bracing and edges of girders.

The most corrosion was observed on Bridge 720022 (Main Street over the St Johns River in Jacksonville). On that structure, 1.0-3.0% corrosion was observed on the floor beams above the water, 0.3-1.0% was observed on girder edges, and 0.3-1.0% was observed on roadway bracing and some bolts. This observation corresponds with 0.98% CS-3 and CS-4 reported for element 515 in 2023 (note that CS-3 and CS-4 encompass more than corrosion).

Bridge #290030 (SR-136 over Suwannee River) exhibited coating delamination and rusting on the lower flange of the outside girders. The 515 NBE reported 21 square feet in CS- 4. The delamination and corrosion were large enough to require warranty repair.

Color

Because of the high UV exposure, Florida bridge coatings can fade if they are not properly formulated. Approved coatings must demonstrate a color shift less than 2 ($\Delta E < 2$) in laboratory tests. High-profile structures such as the Sunshine Skyway bridge are expected to maintain their color for the design service life. Color shift can be determined by comparing color measurements and calculating ΔE as described earlier.

Since reference data for these bridges was not available, multiple measurements were made in accessible bridge areas and the maximum difference among those measurement sets calculated. Figure 4 shows the ΔE values measured in this manner during the field visits. A red line was added at ΔE = 2 as a point of reference to the laboratory criteria. Only 37% of data sets had ΔE values less than 2. Sixty-two percent (62%) of the data sets had ΔE values less than 10 and eighty-six percent (86%) of the data sets had ΔE values less than 20.

On any given bridge, the color consistency can vary in different locations. Bridge #120028 which had a ΔE of 1.66 on its guardrail it had a ΔE of 15.53 on its underneath section. This could be a consequence of the exposure (UV reflected off the water) or another factor.

Florida Bridges

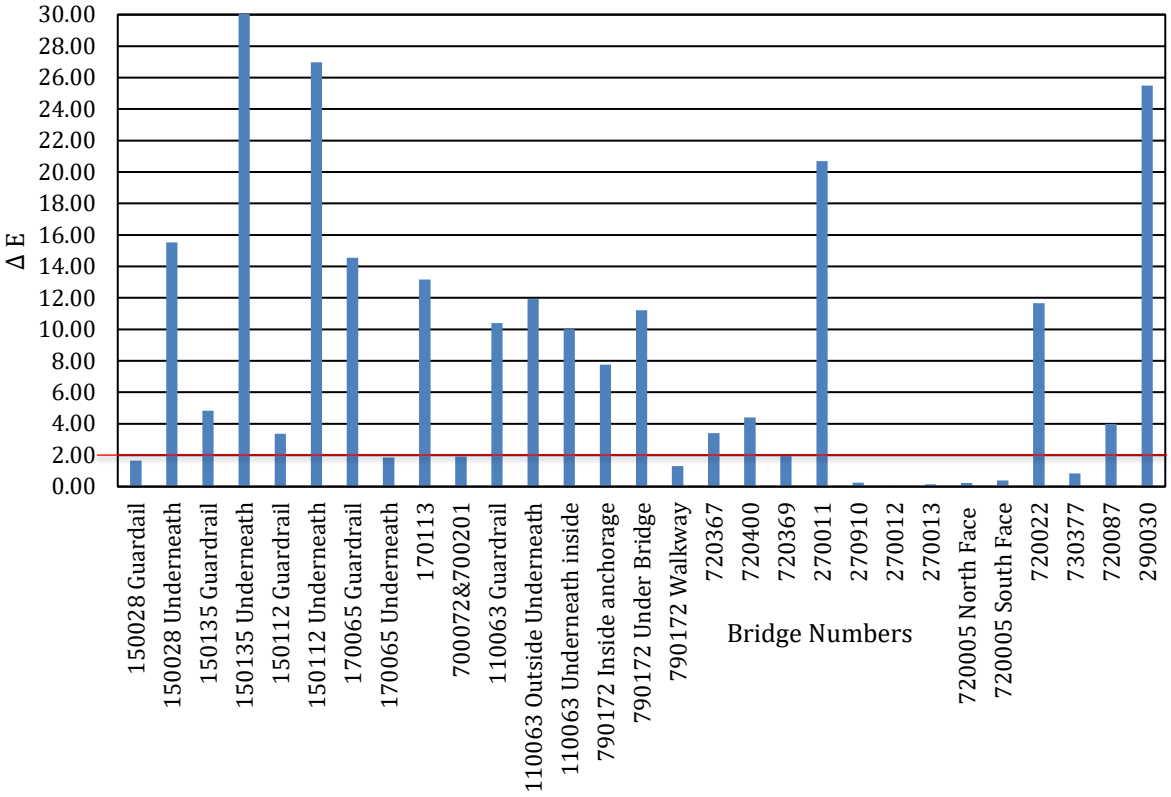

Figure 4-4. Florida Bridges Delta E

Delamination and other Coating Defects

Eleven of the bridges inspected had some degree of coating delamination observed. Two were particularly noteworthy. As mentioned in the rusting discussion, Bridge #290030 (SR-136 over Suwannee River) exhibited coating delamination and rusting on the lower flange of the outside girders. The 515 NBE reported 21 square feet in CS- 4. The delamination and corrosion were large enough to require warranty repair.

Bridge #110063 (SR-44 over St. Johns River) had areas of delamination on 1-3% of the surface area. It appears that the delamination is overcoated, aged coating but if it was evident at a warranty inspection repair would be required. The bridge does not have 515 NBE data available.

Coating Thickness

Coating thickness is a critical quality control check during bridge repainting. It is helpful to measure coating thickness to characterize the coating. Figure 4-5 summarizes the coating thickness data measured during the field assessments.

The data doesn't suggest any concerns with the coating quality or need for warranty work. The sampling procedure used when measuring coating thickness combined with the variability of applied coating thickness make it difficult to compare sets of thickness data taken at two points in time. Except in extreme cases, it would be difficult to determine if the thickness wasn't acceptable upon application or if it had eroded since application.

Coating Thickness Data

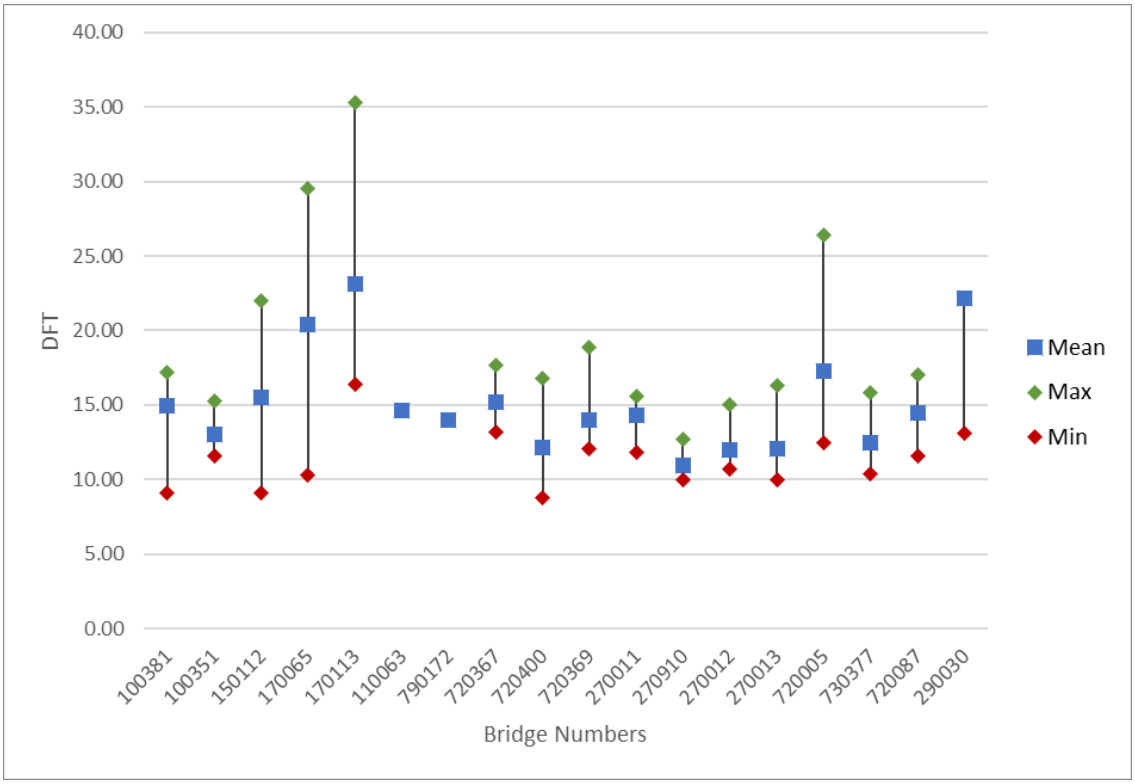

Figure 4-5. Coating thickness data from field evaluations

Recommended Performance Measures

Based on the results of the survey and our observations of FDOT structures, the following performance measures are recommended:

- Corrosion and other coating degradation.
    - Coating exhibiting any areas of NBE 515 CS-3 or CS-4 after 1 or 2 biennial cycles should be repaired to the satisfaction of FDOT. It may be preferable to allow some de minimus amount of CS-3 or CS-4. Alternatively, the criteria could be used to require further investigation by the responsible party and FDOT.
    - The use of VIS-2 ratings to identify areas requiring repair should apply the criteria to sub-areas of the bridge (e.g., each square foot of coated surface or each bridge member).
- Color uniformity and stability.
    - When a structure contains appearance-critical surfaces, they should be called out in the contract for field measurement during the warranty inspection.
    - For appearance critical surfaces, a ΔE of less than 8 should be considered. A less restrictive requirement could be designated for other areas.

Chapter 5 DRAFT CONTRACT LANGUAGE

The recommended approach is to model the steel protective coating warranty after the "VALUE-ADDED" specifications for pavement found in FDOT standard Specifications SECTION 338 and SECTION 355. A draft new standard specification for VALUE-ADDED STEEL PROTECTIVE COATINGS is provided as Appendix C. Key aspects of the specification are discussed below:

Sections 1, 3, 4 and 6 leverage existing concepts of Responsible Party, Statewide Disputes Board and Failure to Perform. Section 5 contains the majority of the coating-specific language. Some noteworthy issues include:

- A two-year warranty period is recommended. This should be sufficient to allow steel exposed at any coating defects to begin rusting. It is a reasonable time for coating film defects to become evident.
- Clause 3 requires the "Responsible Party" to be "pre-qualified with the Department in the category of protective coatings." It may be necessary to explicitly refer to the requirements of section 560 or 561 as appropriate.
- Clause 5.1 refers to "The Department's Steel Protective Coating Assessment Procedures" which is intended to mean the Protective Coating evaluation criteria in the FDOT Bridge Management System.
- In Table 1, the intent is for "color" to be required for selected areas. This requirement could have it's own subparagraph to reduce the chance of confusion with the other requirements. The intent of the current language is for the requirement to be enforced "only when specified." Alternatively, it could apply to "all exterior fascia and bottom flanges" or "any location where fluoropolymer is specified."
- The current color threshold language is from SECTION 646, 649, 715 and 975. For structural steel, less restrictive language could be considered. Note that Clause 3 requires "a field applied mock-up painted sample representing the applied paint system. The mock-up should allow for a representative control sample to be measured and have a surface area of at least 12 square inches. The mock-up should be turned over to the Department prior to final acceptance."
- Clause 5.5 states "Remedial work will not be required if any one of the following conditions is found to apply:" but only lists damage caused by a third party. Additional exemptions may be added or the phasing could be adjusted to include only one exemption.
- Clause 5.5 requires remedial work to begin within 180 days. This can be adjusted as necessary but was deemed reasonable based on its usage in SECTION 646, 649, and 715.
- Clause 6 does not have a Warranty Bond requirement. Based on a review of the Standard Specifications, FDOT seems to prefer revoking the Responsible Party's certificate of qualification to work for the department because of Failure to Perform. If warranty bond language is desired, some version of the following is recommended:

  The Contractor and Coating Manufacturer, jointly, shall provide, along with the Performance Bond, a maintenance bond to cover any/or all defects/failure in material and/or workmanship for a period of two (2) years. This maintenance bond shall cover the 2 year warranty period and will start upon final acceptance of the Contract in accordance with 5-11.

Chapter 6 RECOMMENDED IMPLEMENTATION PLAN

This implementation plan is intended to generate data to demonstrate the value of the coating warranty. The implementation plan consists of four phases: finalizing the standard specification language, conducting pilot projects, monitoring the coating condition, and an analysis of data. Figure 6-1 provides an overview of the implementation process. As the first step in the implementation, the VALUE-ADDED STEEL PROTECTIVE COATINGS should be reviewed and updated based on input from various FDOT stakeholders. The remaining phases are discussed in more detail below.

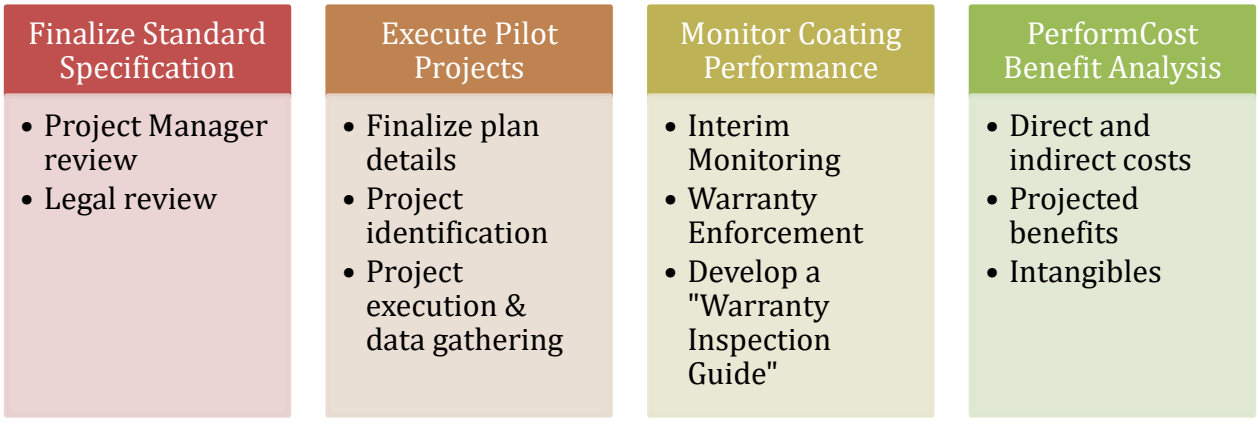

Figure 6-1. Overview of Implementation Plan

Execute Pilot Projects

The nature of steel bridge coating work provides for a degree of variability in performance. Identification and monitoring of multiple projects with and without the warranty provision is necessary to generate statistically significant data to assess the value of the provision.

FDOT currently has approximately 23 programmed steel bridge painting projects covering 59 existing structures where the VALUE-ADDED STEEL PROTECTIVE COATING provision could be invoked. For the purposes of the demonstration, provide the warranty clause as a separately priced bid item, even though it wouldn't be separately priced in the final implementation. Having a separate bid item for the pilot projects should provide a range of estimates on the actual cost of the provision. It also allows the DOT to build cost-benefit studies of projects where the provision was and wasn't invoked. Warranty implementation on new steel structures should also be considered.

Projects of a varied nature should be selected for the pilot study. Since existing bridges with a mechanical lift over saltwater are both difficult to coat and in a corrosive environment, they would likely have the most to gain from a warranty. However, contractors are likely to charge more for the warranty on such a structure than they might charge for a new, rolled beam overpass in the north central part of the state. Knowing both the cost and benefit is essential to understanding the value in each scenario.

The programmed project list contains a structure which was the subject of a general claim during it's last repainting. It is in a harsh environment and arguably experiencing a shorter than expected service life. It seems to be an ideal opportunity to evaluate the proposed warranty language.

Without influencing the quality of the work, it would be helpful if a "surveillance" visit to each project was conducted to collect information which might also inform the warranty study. This may include the following:

- Impressions about the contractors' workforce – experience level, teamwork, personnel changes
- Awareness of the warranty by the workforce (did it influence their behavior?)
- Project conflicts, workmanship concerns, scope changes, or other issues
- Impressions of how the warranty inspection and remediation process will be conducted.

It is assumed that any project that is part of the study (whether the warranty clause is invoked or not) will have independent coatings quality assurance inspection. All QA records should be retained for analysis and reference at the end of the warranty period. Additionally, the records should be reviewed shortly after the completion of the project. Such a review might direct the warranty inspection to particular areas of interest (e.g., areas where rework was performed, or NCR's were issued).

Monitor Coating Condition

Once the project is completed, the coating condition should be evaluated annually to track the degradation regardless of the warranty end date. Such observations/data could be useful to determine if a shorter warranty period is feasible or a longer period is desirable. The annual assessments should include:

- Review of 515 ratings.
- A "limited access" survey of the coating condition. This would be performed by a coatings subject matter expert with whatever access is conveniently available.
- A brief survey report (with photos) should be compiled with the available data for each annual inspection.

It would be beneficial to develop a "Warranty Inspection Guide" consisting of photographs and written descriptions to illustrate examples of what may or may not be a claim. The Guide would help to mitigate disputes between inspectors and contractors during the inspections and improve the consistency of warranty requirement enforcement. By describing visual cues and areas which might deserve special focus, it could help expedite the inspections and support internal training. The Guide could also reference Materials Manual 11.6, Pre-Approved Repair Procedures for appropriate remedial actions.

The warranty inspection should be performed both as envisioned by the warranty specification and with a "failure analysis" mindset where validating measurements are made to confirm visual observations. Such inspections would be performed on both warranty bridges and "control" bridges without the warranty requirement. The inspection should include:

- Visual Inspection
- Coating thickness – nondestructive and destructive, particularly where low thicknesses are observed
- Adhesion evaluation where blistered or delaminated coating is observed
- Color measurements

The warranty inspection plan should clearly delineate work being performed for the purposes of warranty enforcement and those for the purposes of validating the warranty value. For example, the contractor may not be responsible for repair of destructive measurements made to validate acceptable visual observations.

Perform Warranty Cost-Benefit Analysis

The data collected during the pilot project effort should be compiled into a comprehensive report. The report should include an analysis of both quantitative and qualitative aspects of the coating warranty to determine its value to FDOT. As mentioned above, it is important to recognize the statistical significance of any collected data. Simply comparing any two bridges is informative but likely not statistically significant as the distribution of expected performance would be speculative. Increasing the sample size improves the ability to draw statistically significant conclusions.

The warranty costs include both the contractors price for the warranty item as well as the costs of the warranty inspection. Both can be projected based on data collected during the proposed pilot phase.

The warranty benefits include a better initial coating job and the value of any touchup and repair work performed at the warranty inspection. The first benefit can be determined by tracking the performance of both warranty and nonwarranty structures through coating condition data and warranty inspection results. The value of any touchup/repair work can be modeled or observed through additional annual condition assessments.

REFERENCES

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Appendix A

APPENDIX A

Nationwide Survey Results

Report for Best Practices for Steel Bridge Coating and Recoating Warranty Contract Requirements

Response Counts

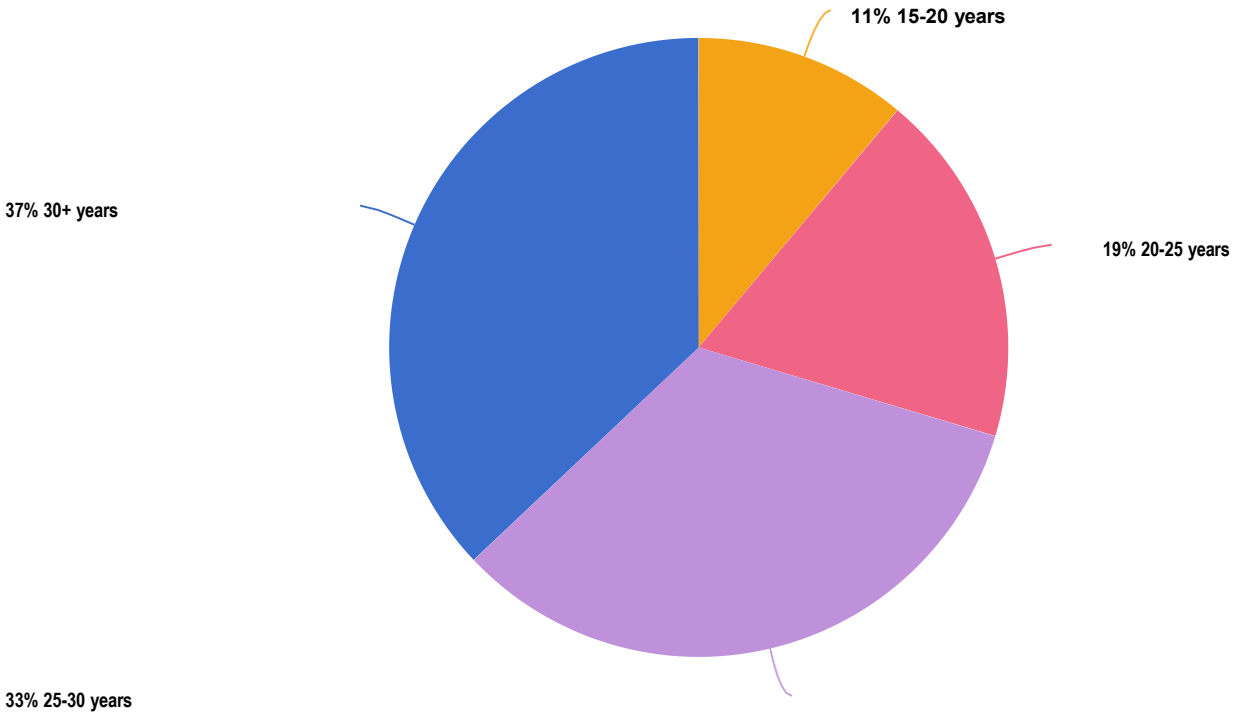
Completion Rate:	**100%**	
Complete		27

Total: 27

1. Please provide the Name of your Agency.

Response ID	Response
7	SDDOT
8	MassDOT
9	ODOT
10	KYTC Maintenance
11	Idaho transportation department
12	Alaska DOT&PF
13	MN Department of Transportation
14	Montana Department of Transportation
15	Washington State Dept of Transportation
16	Tennessee DOT
17	Virginia Department of Transportation
19	MoDOT
20	Wyoming Department of Transportation
21	Va. Dept. of Trans
22	NCDOT Structures Management
23	Alabama DOT
24	Illinois Department of Transportation
25	Iowa DOT
26	Indiana Department of Transportation
27	Michigan DOT
28	ARDOT
29	Ohio Department of Transportation
30	Georgia Department of Transportation
31	PennDOT
32	TxDOT
33	Triborough Bridge & Tunnel Authority
34	Florida's Turnpike Enterprise (FDOT District 8)

2. How long does your coating typically last until removal and replacement?



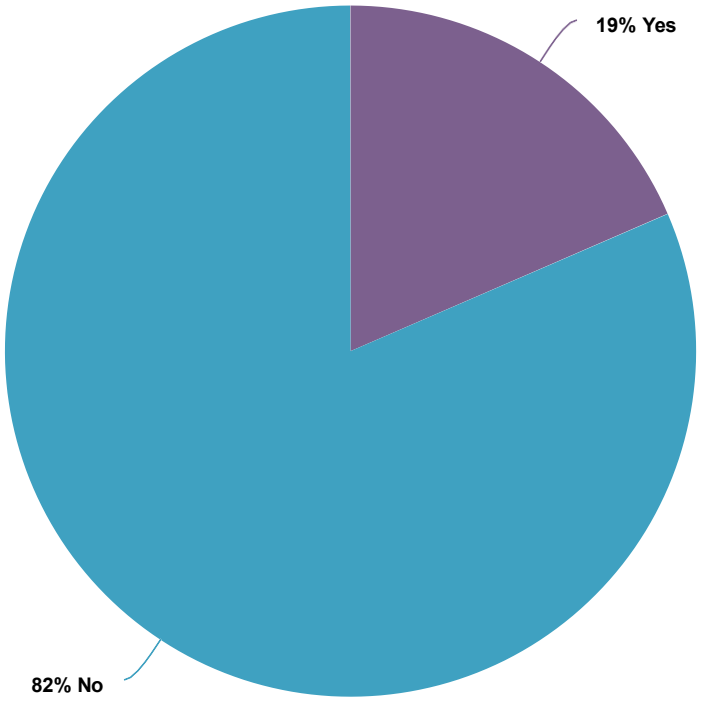
Value	Percent	Responses
15-20 years	11.1%	3
20-25 years	18.5%	5
25-30 years	33.3%	9
30+ years	37.0%	10

Total: 27

3. How many times is maintenance required on the coating over the service life before the coating is removed and replaced?

- Not very often – 1 response
- Once or twice – 2 responses
- Rarely – 3
- 30 years – 1 response
- 40 years – 1 response
- Varies
    - Depends on area – 2 responses
    - Significantly varies – 1 response
    - Spot painting is used 5-10 times – 1 response
- 3 to 5 times – 2 responses
- 1 time – 4 responses
- When Superstructures reach a condition rating of 4 (Poor) Corrosion will dictate actions. Element 107 is used for ratings – 1 response
- 2 to 3 times – 2 responses
- None, unless portion under joints is painted – 1 response
- No scheduled maintenance program but some bridges get washed (not very common) and others may have zone or spot paint done if needed due to coating failure in limited locations – 1 response
- Performed once, but could use maintenance more frequently – 1 response

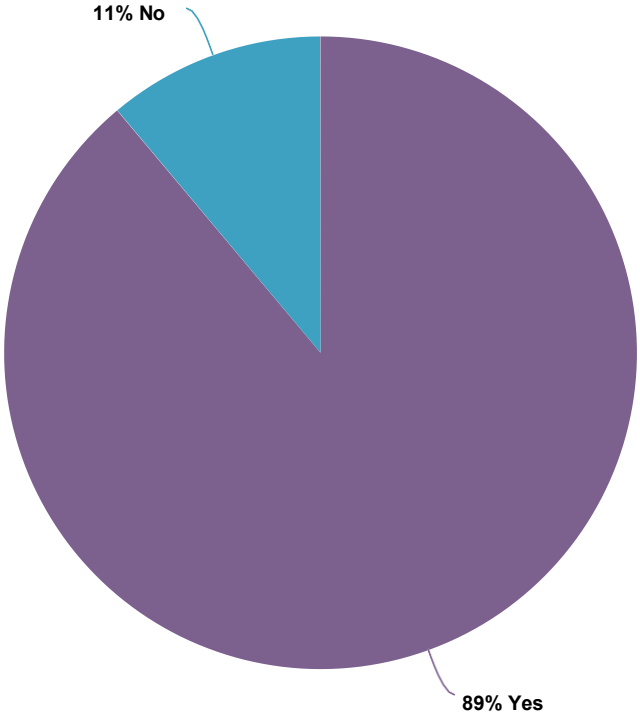
4. Do you track coating performance other than from biennial inspection data



Value	Percent	Responses
Yes	18.5%	5
No	81.5%	22

Total: 27

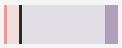
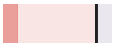
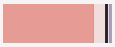
5. Do you collect Element 515 (steel protective coating) data during your biennial inspection?



Value	Percent	Responses
Yes	88.9%	24
No	11.1%	3

Total: 27

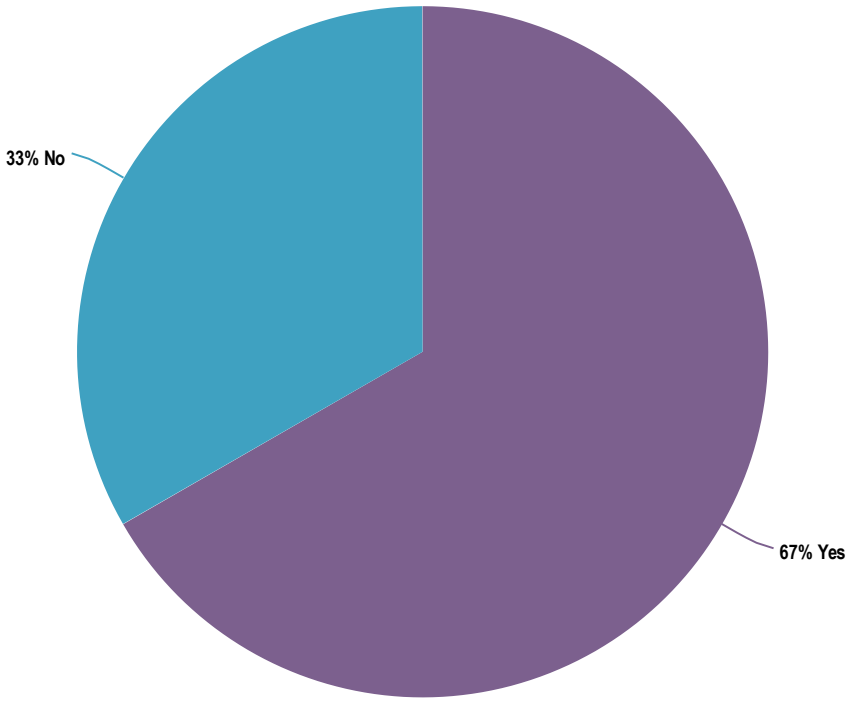
6. Please rank from most important to least important. What causes you to repaint your structures?

Item	Overall Rank	Rank Distribution	Score	No. of Rankings
Extent of Steel Corrosion	1		102	27
Coating Degradation Independent of Corrosion – (Delamination, Blistering, etc.)	2		79	27
Coating Appearance (Change in color, UV Degradation, etc.)	3		54	27
Coating Age	4		35	27

7. How often does your agency use the following coating maintenance options:

Rarely	Often	Sometimes	Never	Responses
Coating Removal and Replacement				
Count	4	16	6	1	27
Row %	14.8%	59.3%	22.2%	3.7%	
Spot or Zone Painting				
Count	3	11	13	0	27
Row %	11.1%	40.7%	48.1%	0.0%	
Spot or Zone Painting with a Full Overcoat				
Count	12	3	5	7	27
Row %	44.4%	11.1%	18.5%	25.9%	
New Construction				
Count	5	12	7	3	27
Row %	18.5%	44.4%	25.9%	11.1%	
Total					108
100.0%					

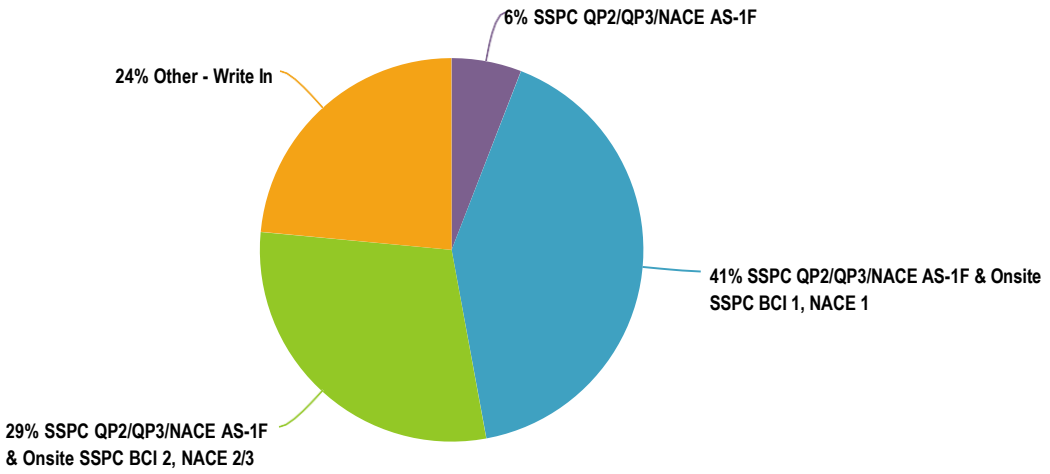
8. Do your current specifications require a qualified facility and/or qualified personnel to monitor the work performed in the field?



Value	Percent	Responses
Yes	66.7%	18
No	33.3%	9

Total: 27

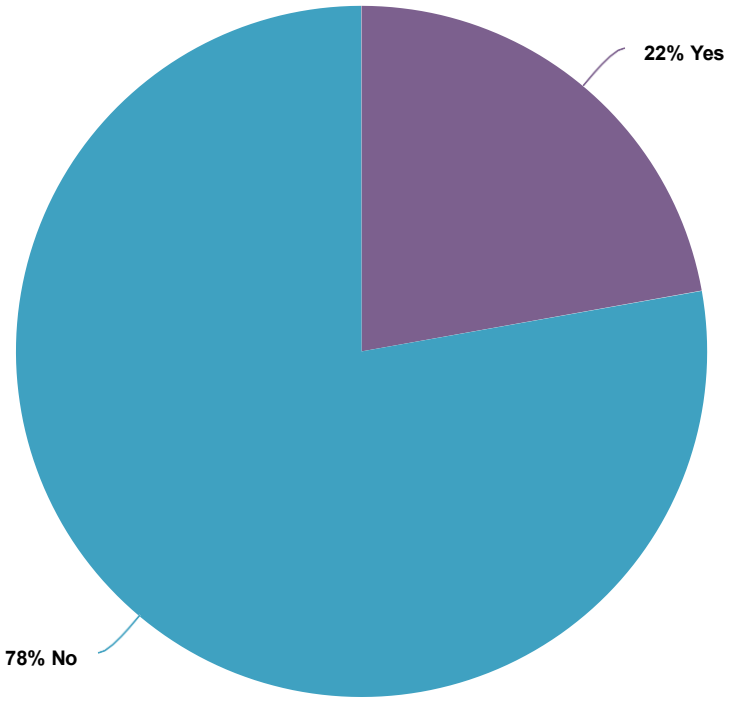
11. If yes, what are your requirements for qualified personnel?



Value	Percent	Responses
SSPC QP2/QP3/NACE AS-1F	5.9%	1
SSPC QP2/QP3/NACE AS-1F & Onsite SSPC BCI 1, NACE 1	41.2%	7
SSPC QP2/QP3/NACE AS-1F & Onsite SSPC BCI 2, NACE 2/3	29.4%	5
Other - Write In	23.5%	4

Total: 17

12. Does your agency use warranty contracts?



Value	Percent	Responses
Yes	22.2%	6
No	77.8%	21

Total: 27

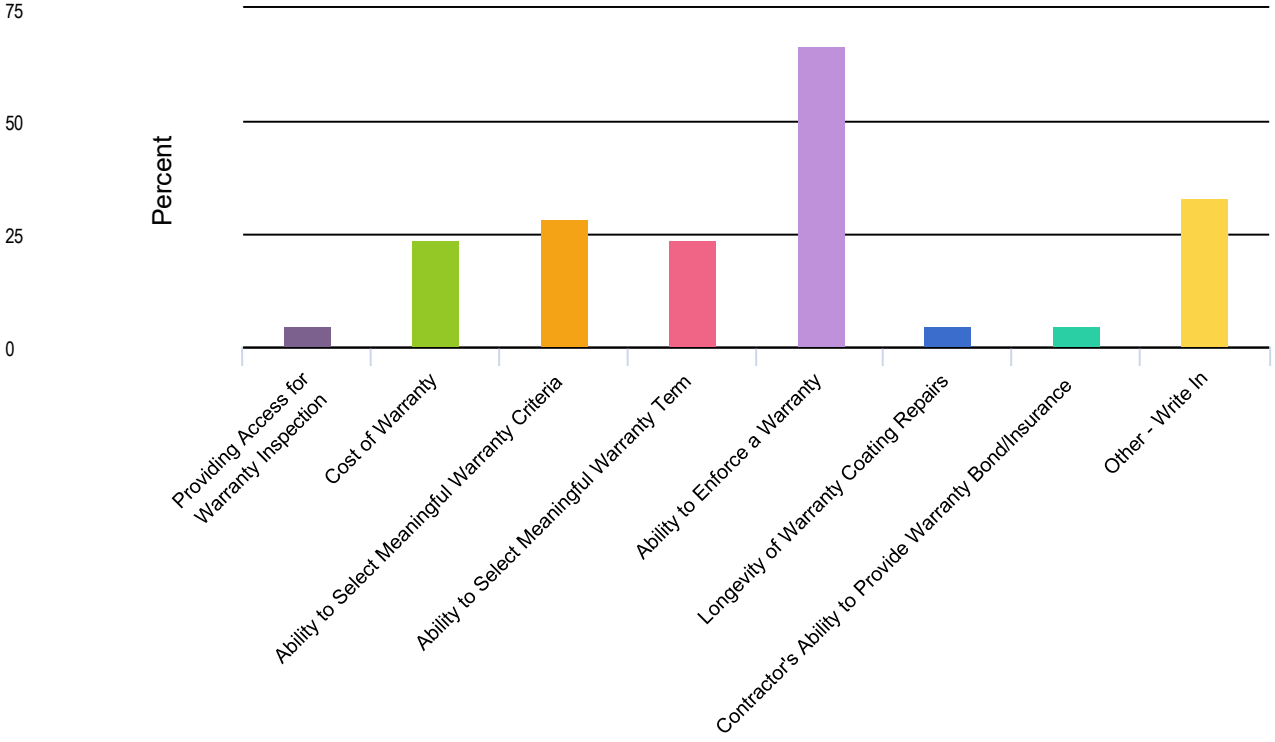
13. Why do you use them?

- It is required to warranty coating applications for 1 year after acceptance. It is mainly for potential workmanship issues of early failures.
- We require all construction contracts have a minimum 12 month warranty on all work.
- For full removal and replacement only, to ensure that quality work is performed. We do not use them for zone or spot cleaning and painting.
- Steel protective coatings are essential to protecting against section loss in structural steel and the warranty provides an opportunity correct surface prep, material or application deficiencies that appear early in the life of the coating.
- Coating Failures Better product Best Practices
- Coating System Warranties are sometimes included with projects as a Value Added Feature.

14. Are your warranty contracts working?

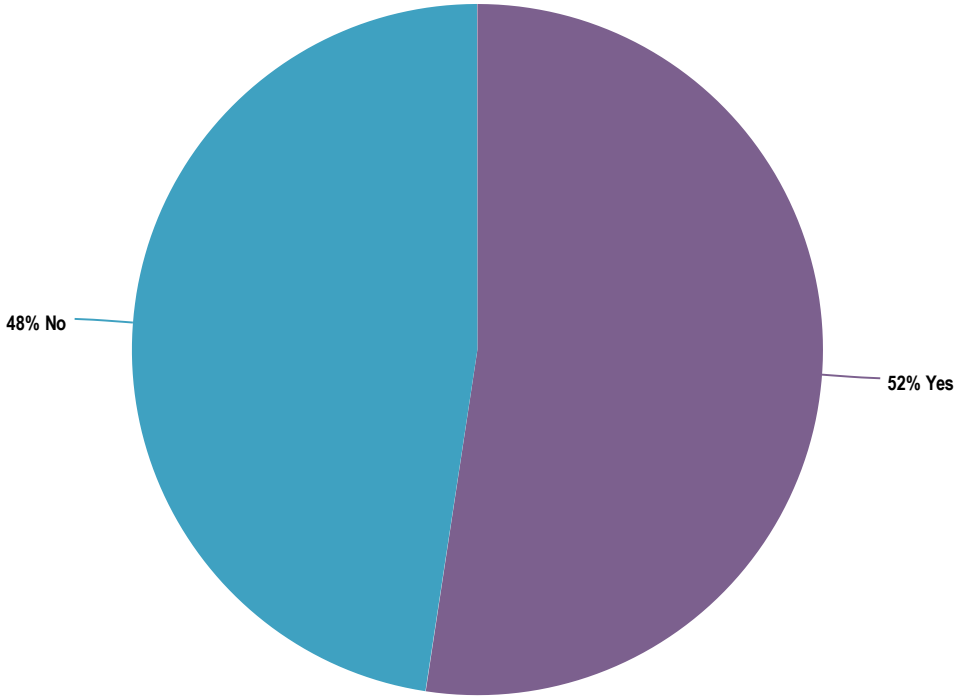
- Not always due to timely inspections. Issues have been found after 1 year anniversary.
- Yes.
- Not really. The contractors only bid about 3500 for the warranty cost because there never is an issue.
- MDOT does not track or measure the effectiveness of the warranty program at this time.
- Yes, contractors must submit a warranty bond for the specified timeframe (1, 2, or 3 years to occur following the winter of the specified year) from substantial completion date.
- Yes, the contract warranties seem to be working fine.

15. Which of the following issues influenced your decision to not use warranties? (please select all that apply)



Value	Percent	Responses
Providing Access for Warranty Inspection	4.8%	1
Cost of Warranty	23.8%	5
Ability to Select Meaningful Warranty Criteria	28.6%	6
Ability to Select Meaningful Warranty Term	23.8%	5
Ability to Enforce a Warranty	66.7%	14
Longevity of Warranty Coating Repairs	4.8%	1
Contractor's Ability to Provide Warranty Bond/Insurance	4.8%	1
Other - Write In	33.3%	7
Total		**40**

16. Do you believe warranty contracts could be beneficial?



Value	Percent	Responses
Yes	52.4%	11
No	47.6%	10

Total: 21

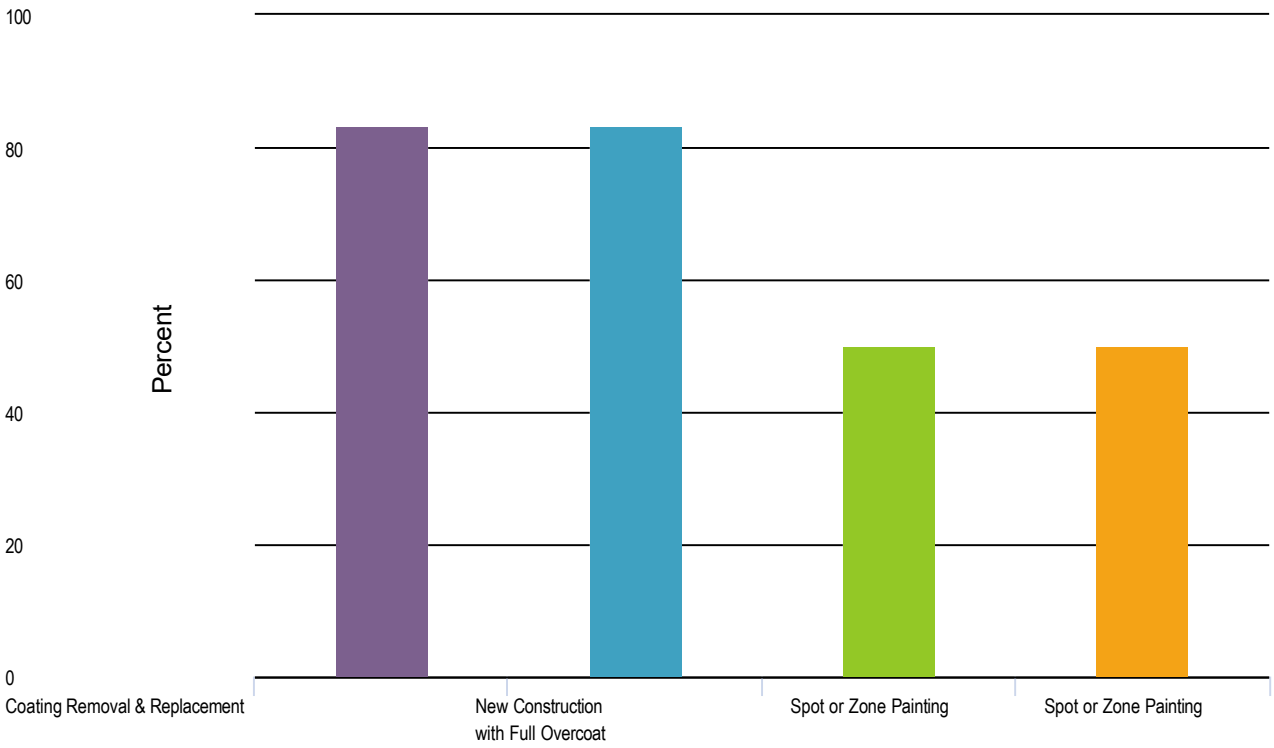
17. Why do you believe warranty contracts aren't beneficial?

- Ability to select and enforce meaningful criteria
- More trouble than it is worth
- Theoretically I believe that are useful, but unless an agency has the resources to enforce them, they are not practical.
- Too difficult to claim warranty, since our construction administration office has approved so much of the materials and construction product throughout the life of the project.
- Increase cost, difficulty proving defective workmanship and enforcing warranty
- Difficulty holding them to the warranty. Getting over charged during the bid.
- Warranties can be difficult to enforce and will increase the costs on all projects.
- Our current specification language and better specification enforcement has yielded long lasting products without the warranty language. But we do have language that would require the contractor to repair if coating performs poorly and a destructive final inspection verifying proper surface prep and coating thicknesses.
- Too difficult to enforce for coatings.
- TxDOT requested our AGC consider warranties for repainting work. They strongly thought it was a bad idea. We are investing on 3rd party inspection instead to insure we get the paint job we are paying for. Difficult to remobilize.

18. Why do you believe warranty contracts are beneficial?

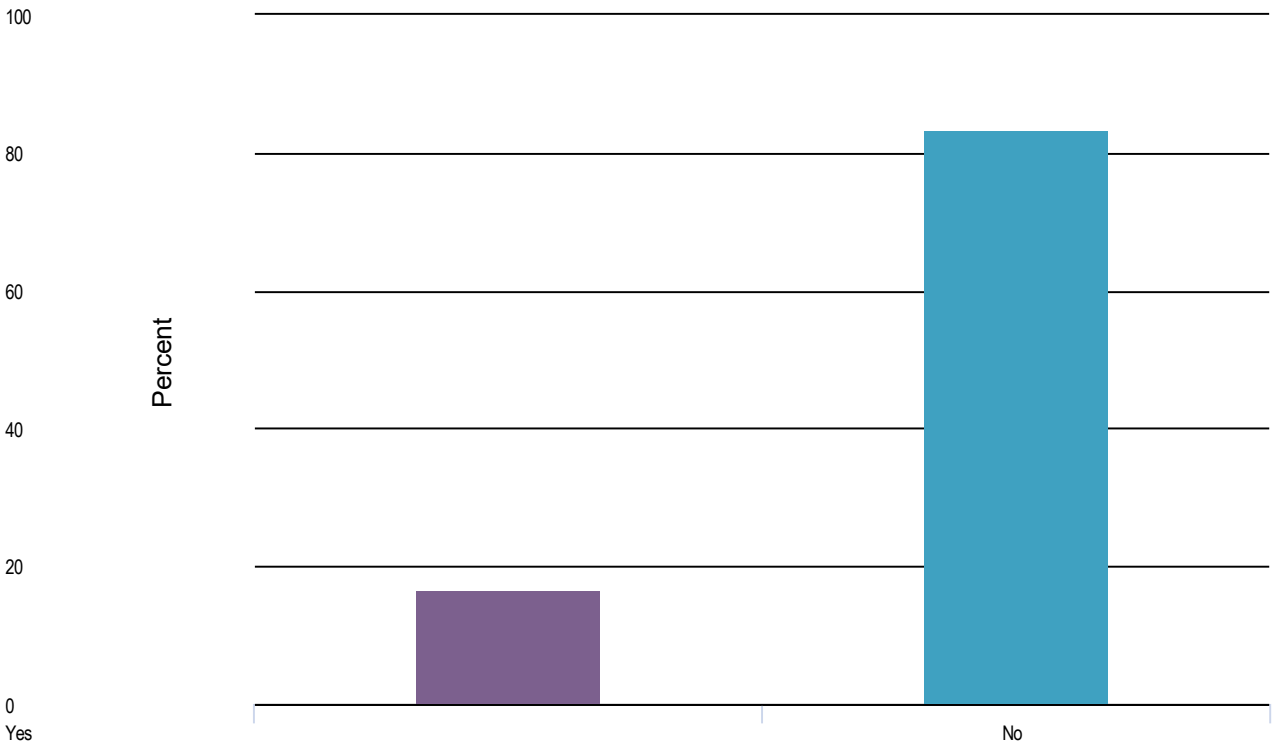
- Might get better work by contractors.
- Hold the contractor and the coating supplier to the performance of the coating.
- One tool in trying to hold the manufacture of the paint and the contractor accountable for their product and workmanship.
- Keeps the Contractor honest. Promotes better workmanship, a neutral party can determine if the failure was caused by something that the contractor did or if it was caused by external factors.
- Warranty contracts (if they could be enforced) would hold the contractor responsible for the work and incentivize quality work.
- Accountability. Unfortunately, we have regulatory and administrative hurdles that make meaningful enforcement very difficult to achieve.
- WYDOT has no experience with warranties, but feel they could be beneficial to protect the State's assets.
- Put some accountability on the contract
- It would provide a contractor an incentive to perform quality work.
- I believe they may be. I have not evaluated the cost/benefits yet.
- If we require a warranty then the DOT will not have to maintain the paint for a specific number of years. Also, the quality of work will improve.

19. What do you use warranty contracts for? (please select all that apply)



Value	Percent	Responses
Coating Removal & Replacement	83.3%	5
New Construction	83.3%	5
Spot or Zone Painting	50.0%	3
Spot or Zone Painting with Full Overcoat	50.0%	3
Total		**16**

20. Does your agency have different warranties depending upon location of your structures?

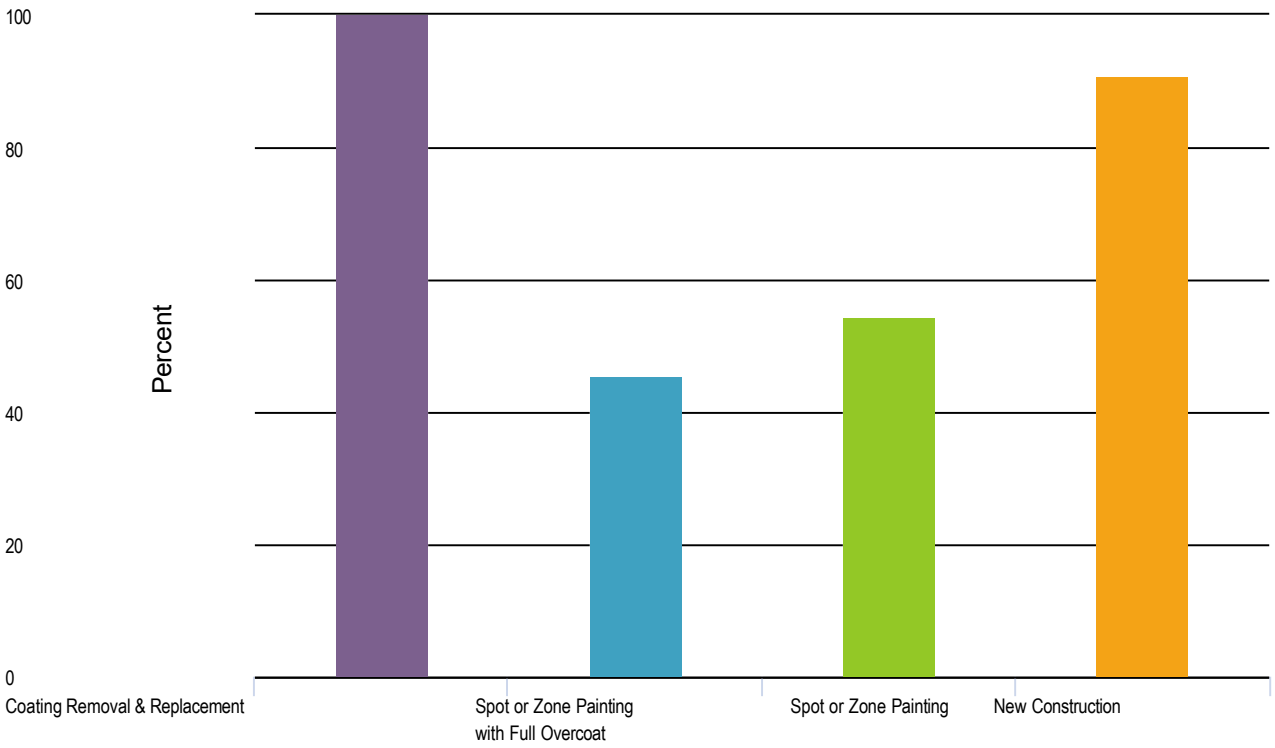


Value	Percent	Responses
Yes	16.7%	1
No	83.3%	5
	Total	**6**

21. Can you elaborate?

The yes respondent indicated that Surface preparation type determines warranty timeframe. 1 year: Spot and/or Spot and Overcoat 2 year: Zone and/or Complete Removal 3 year: Contractor Provided Inspection Environmental defects are excluded from warranty repairs

22. What do you believe warranties should be used for? (Select all that apply)

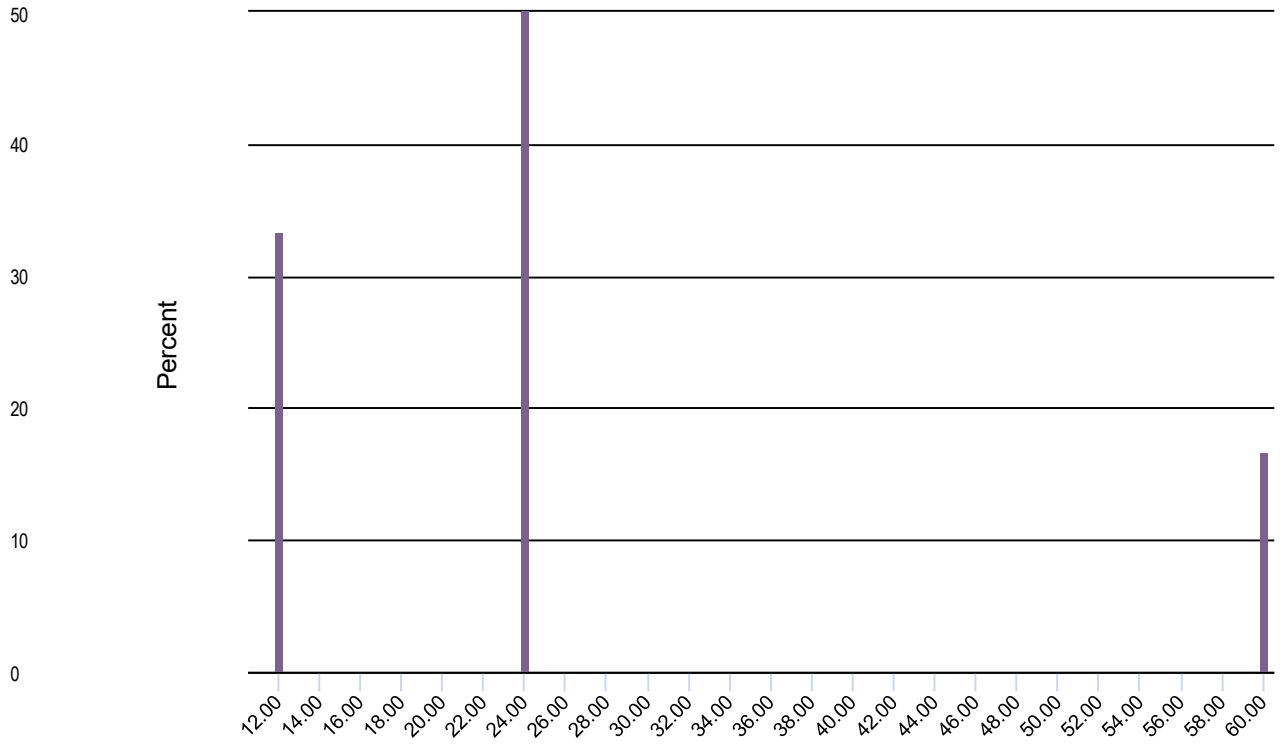


Value	Percent	Responses
Coating Removal & Replacement	100.0%	11
Spot or Zone Painting	45.5%	5
Spot or Zone Painting with Full Overcoat	54.5%	6
New Construction	90.9%	10
	Total	**32**

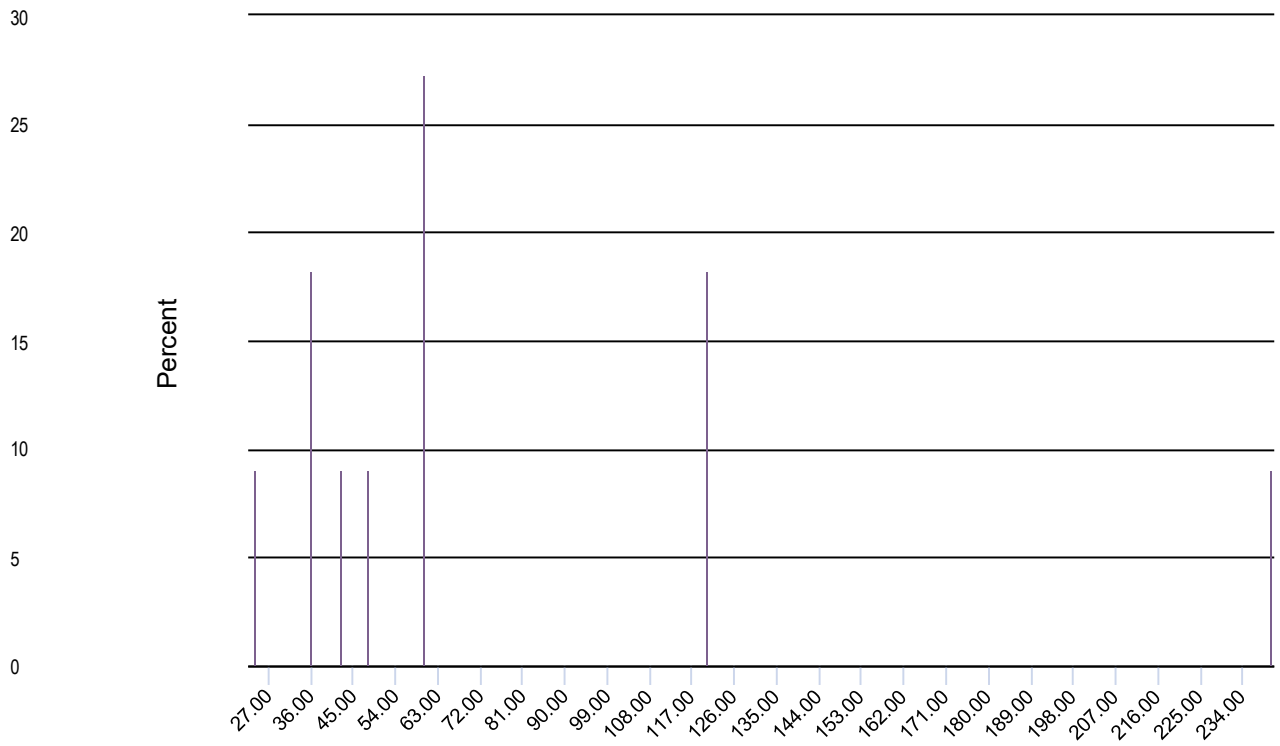
23. What support does your agency provide for warranty inspections?

- Warranty inspections are done by the local Construction Resident staff, Materials & Test Unit staff and area Bridge Maintenance Staff
- A third-party NACE-certified inspector will be hired to mitigate warranty provisions.
- Regional construction offices are responsible for warranty inspections, MDOT has central office resources to provide assistance when needed.
- In-House Coating Experts Contractor required to provide all access and other means and methods for inspection.
- We provide annual reviews of coating systems which are covered by warranties to determine if warranty repairs are necessary.

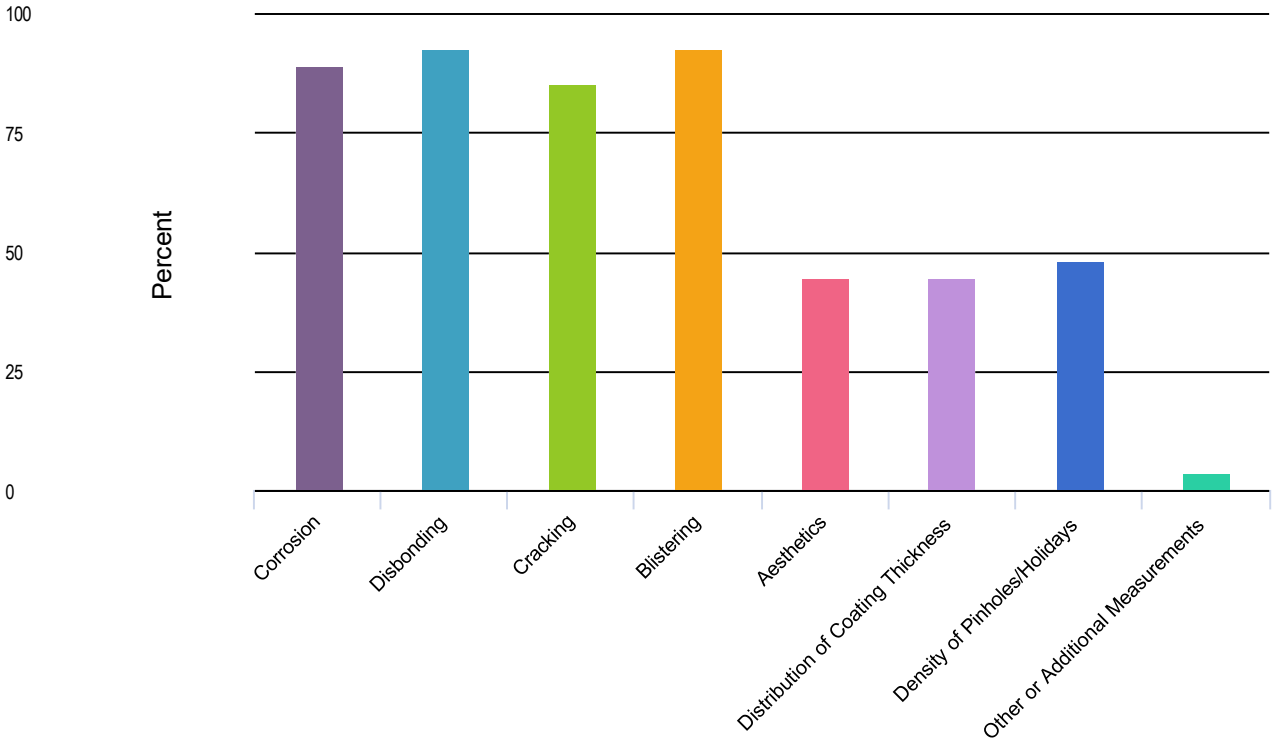
24. What is the typical length of your warranty - please answer in Months format - i.e. 36.



25. What do you think the typical length of warranty should be? Please answer in Months format - i.e. 36.

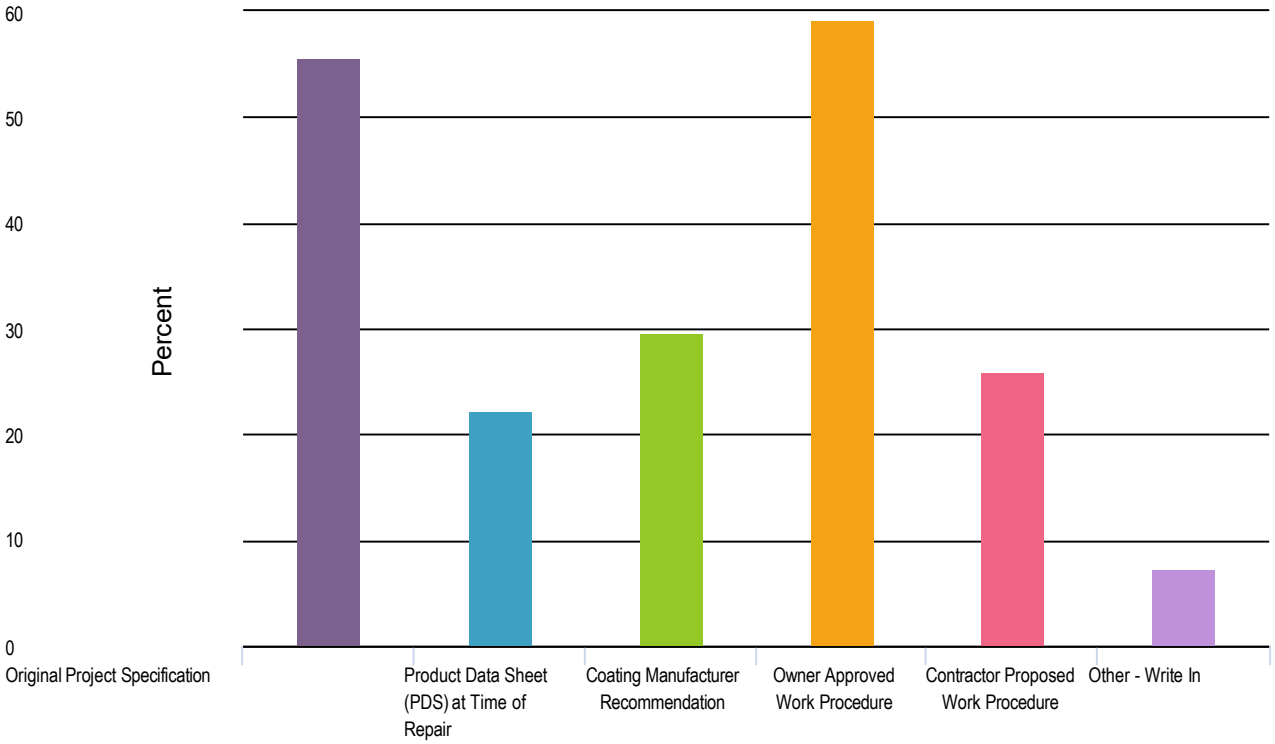


26. What are your performance criteria for the warranty? If you don't have warranties what should criteria be if you had to have them? (please select all that apply)



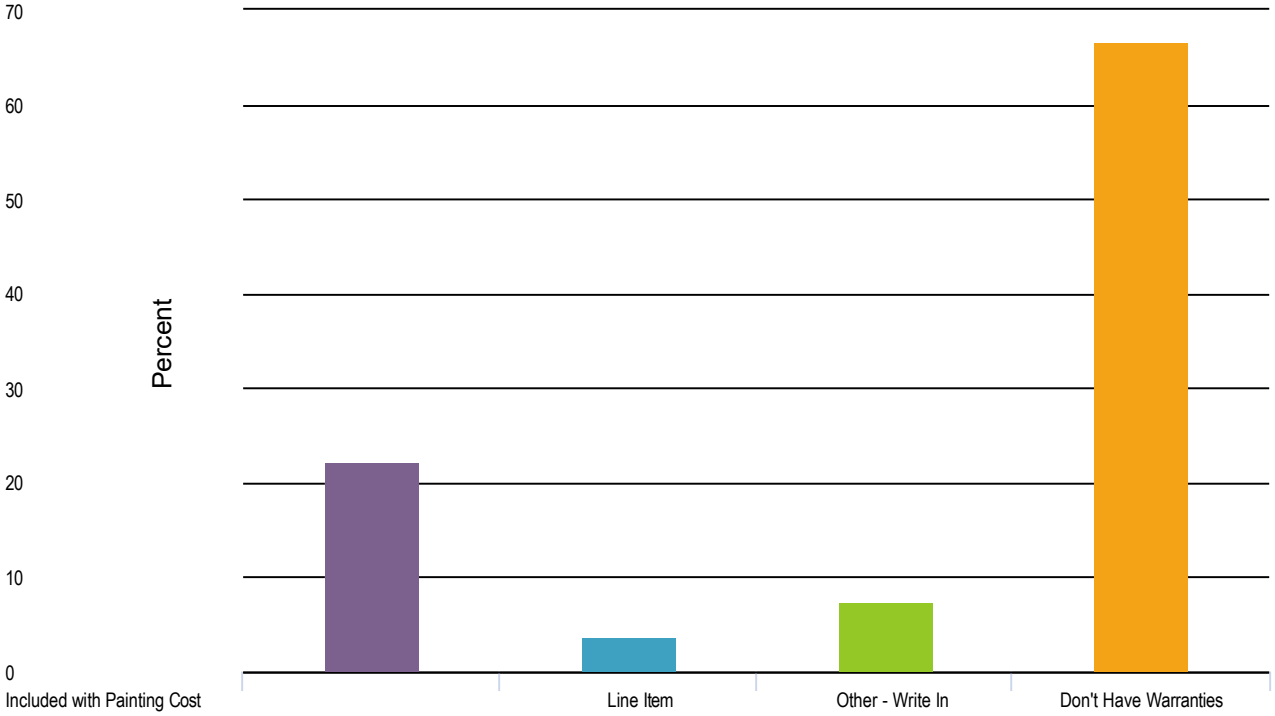
Value	Percent	Responses
Corrosion	88.9%	24
Disbonding	92.6%	25
Cracking	85.2%	23
Blistering	92.6%	25
Aesthetics	44.4%	12
Distribution of Coating Thickness	44.4%	12
Density of Pinholes/Holidays	48.1%	13
Other or Additional Measurements	3.7%	1
Total		**135**

27. Who and when determines the repair method for warranty repair work? If you don't have warranties, who do you believe it should be? (please select all that apply)



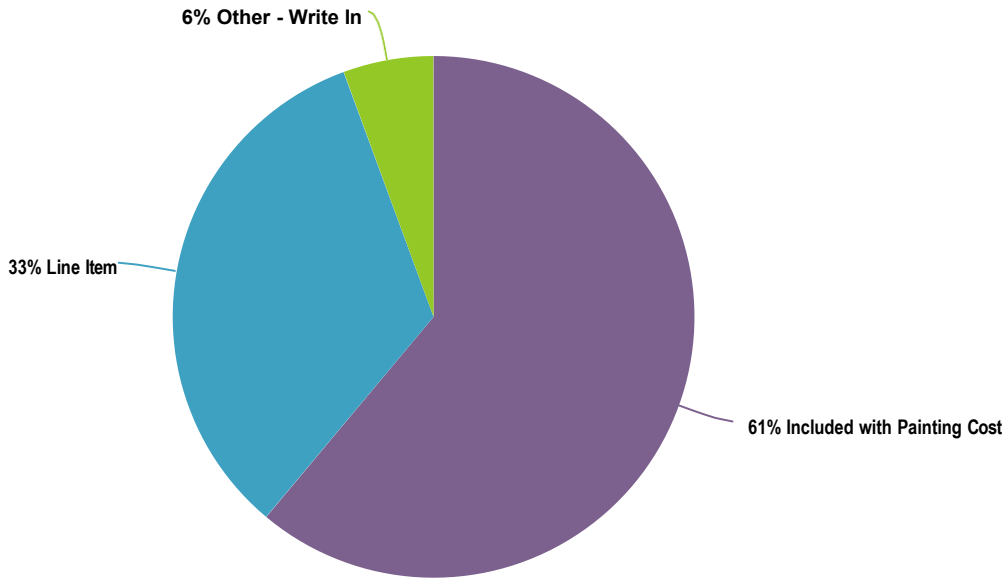
Value	Percent	Responses
Original Project Specification	55.6%	15
Product Data Sheet (PDS) at Time of Repair	22.2%	6
Coating Manufacturer Recommendation	29.6%	8
Owner Approved Work Procedure	59.3%	16
Contractor Proposed Work Procedure	25.9%	7
Other - Write In	7.4%	2
	Total	**54**

28. How does your agency pay for warranty? (please select all that apply)



Value	Percent	Responses
Included with Painting Cost	22.2%	6
Line Item	3.7%	1
Other - Write In	7.4%	2
Don't Have Warranties	66.7%	18
Total		**27**

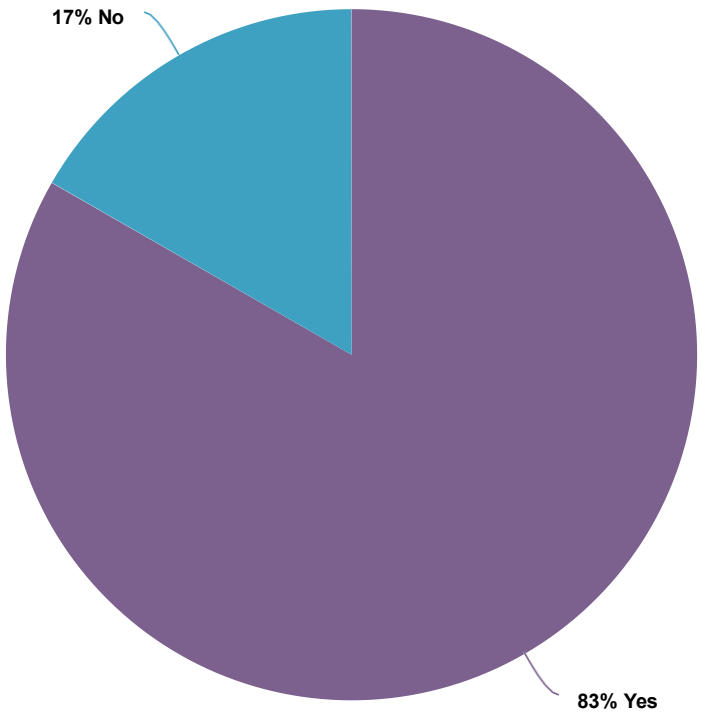
29. How do you think they should be paid?



Value	Percent	Responses
Included with Painting Cost	61.1%	11
Line Item	33.3%	6
Other - Write In	5.6%	1

Total: 18

30. Do you require bonding or some type of insurance for the paint warranty?



Value	Percent	Responses
Yes	83.3%	5
No	16.7%	1

Total: 6

31. How is the bond or insurance amount determined for your paint warranties?

- Not Sure - 2 responses
- Percentage of the total contract price.
- The contractor bids the line item for the warranty. This amount is then held for the duration of the warranty period (24 months) and is then paid out. As stated previously, it doesn't seem to do anything productive. We haven't had issues where the warranty specifications required invocation, and the amount the contractors bid is so small (typically 3500) that there isn't any real incentive to enforce it anyways.
- Equal to the sum of 25% of the original total contract amount for cleaning and coating items.
- 20% of final coating work value

32. Please feel free to provide any additional comments (optional).

- Interested in how many states do warranties and how those projects are funded.
- None at this time
- We have been using shop galvanizing/ metallizing for all new bridges and have moved to field spray metallizing for replacement of coatings. We avoid paint except in local repairs (e.g. bearings).
- What kind of warranty would be appropriate – bumper-to-bumper or partial? It must be defined in the contract what is considered a "failure." Money must be withheld (bond). A neutral third-party capable of determining the root cause must be the one doing the review. For how many years are we going to review the structure (one time after 1-2-3-4 years or annually for (?)-years? What is the pre-determined fix? MN would like to be included in the distribution of the final survey results.
- Some questions/answers may be misleading depending on how you are planning to determine from this data.
- I wish we could have effective warranties, but it has been difficult to get there.
- TxDOT attempts to foster a relationship with the AGC and their repeated indication to us that warranties will not work in Texas does carry weight with us.

Appendix B

APPENDIX B
Bridge Evaluation Data

Bridge #100497

Causeway Blvd / 1-75 (SR-93A)-District 7

Inspected on 1/23/2023 & Painted 2016 OC

SSPC VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: The spots seen in the pictures are mold and spiders

Steel Bridge Coating Ratings (515) for Bridge Number 100497

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	135,065	0	134,310	0	755	0.56%
102 - Steel Closed Web/Box Girder	184,080	184,075	4	1	0	0.00%

Bridge #100498

I-75 SB TO US-301 over SR618EB - I-75 SB- District 7

Inspected on 1/23/2023 & Painted 2016 OC

SSPC VIS 2 Area Rusted: 0.0-.01%

Delamination: None

Notes: Dirt near bolts appears

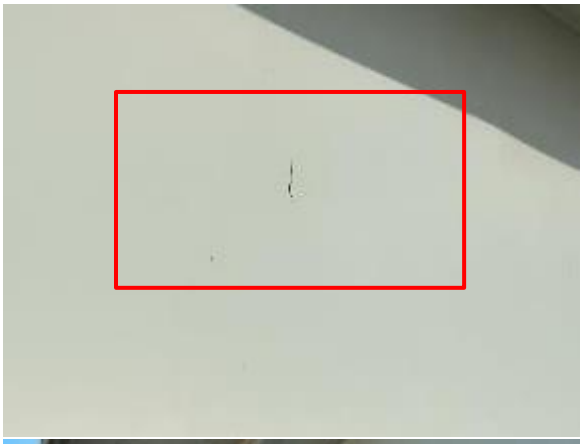
Steel Bridge Coating Ratings (515) for Bridge Number 100498

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
102 - Steel Closed Web/Box Girder	184,080	184,075	4	1	0	0.00%

Bridge #100381

CR676A PROGRESS BD over I-75 (SR-93)-District 7

Inspected on 1/23/2023 & Painted 2016 OC



SSPC VIS 2 Area Rusted: 0.0-0.01%

Delamination: 0.01-0.03% (Two small instance not to metal but prevoius coating)

Notes: Clear Overcoat but edges could not be lifted

DFT: $\bar{X}$= 14.96 Min= 9.1 Max= 17.2

Steel Bridge Coating Ratings (515) for Bridge Number 100381

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	29,153	20,706	2,477	0	6,000	20.58%

Bridge #100351

Valroy Road Over I-75 (SR-93) - District 7

Inspected on 1/23/2023 & Painted 2016 OC

SSPC VIS 2 Area Rusted: 3.0-10.0% at crevies on brackets, 0.01-0.03% on edges of the some of the girders

Delamination: None but clear coat has contaminates

Notes: Lots of spider webs that appeared to be corrosion but are not

DFT: $\bar{X}$= 13.08 Min= 11.6 Max= 15.3

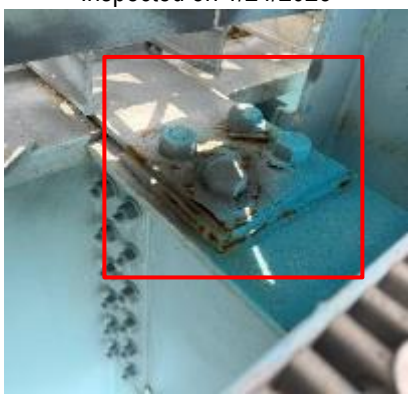
Steel Bridge Coating Ratings (515) for Bridge Number 100351

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	11,265	9,793	1,472	0	0	0.00%

Bridge #150028

SR-666 (ICWW)- District 7

Inspected on 1/24/2023



SSPS VIS 2 Area Rusted: 0.3-1.0% on diagonal, 1.0-3.0% on Guardrails, 0.3-1.0% on floorbeams, 0.3-1.0% on girders, 0.3-1.0% inside Mechanical Room

Delamination: None

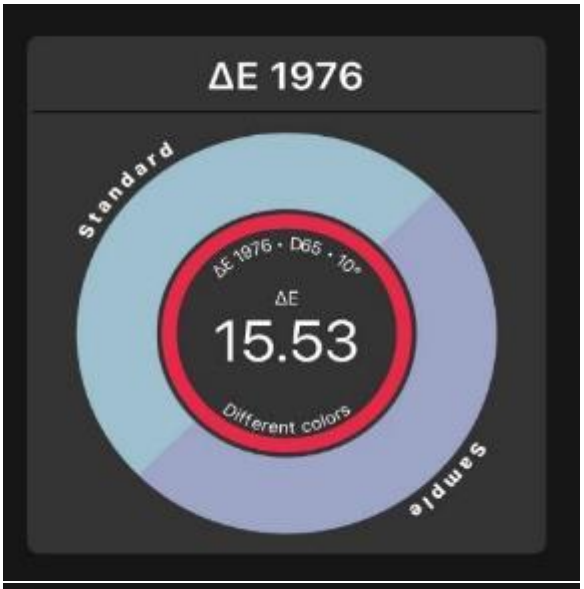
Notes: None

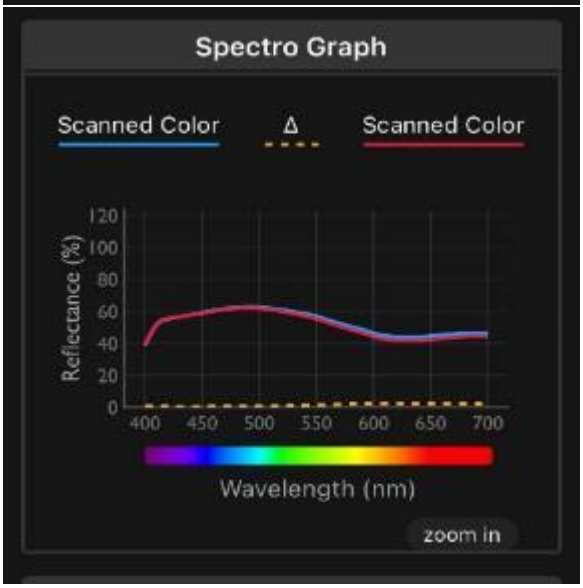
Steel Bridge Coating Ratings (515) for Bridge Number 150028

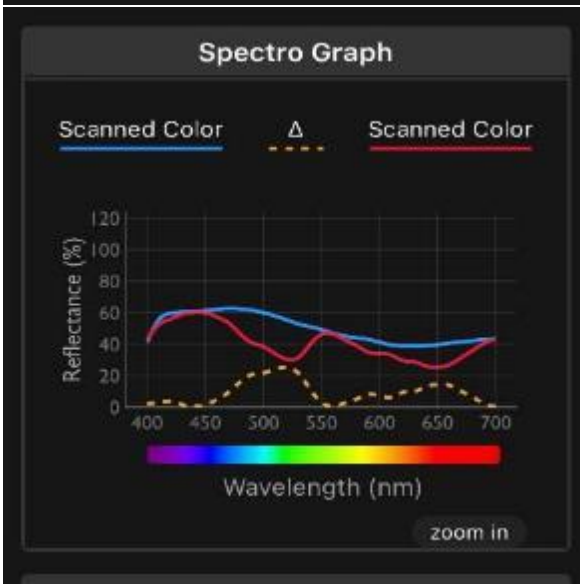
Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Guardrail	76.8057	-12.1163	-9.0024
	76.6406	-11.1921	-8.2586
	77.679	-10.275	-6.7542
Underneath	72.8913	-9.3607	-13.1538
	70.6862	-7.9436	-11.2648
	74.0296	-9.8634	-14.4437
	72.3203	-9.1949	-13.4265
	67.4726	-5.0754	-18.9797

Bridge #150028 (continued)







Guardrail **Underneath**

*The colors are from the highest and lowest values record

Bridge #150135

SR-693 (ICWW)- District 7

Inspected on 1/24/2023

SSPS VIS 2 Area Rusted: 0.03-0.1% on cross beams, 1.0-3.0% on Guardrails, 1.0-3.0% on Floor beams, 0.03-0.1% on Girders, 0.03-0.1% inside Mechanical Room

Delamination: Cracking noticeable on the guardrails

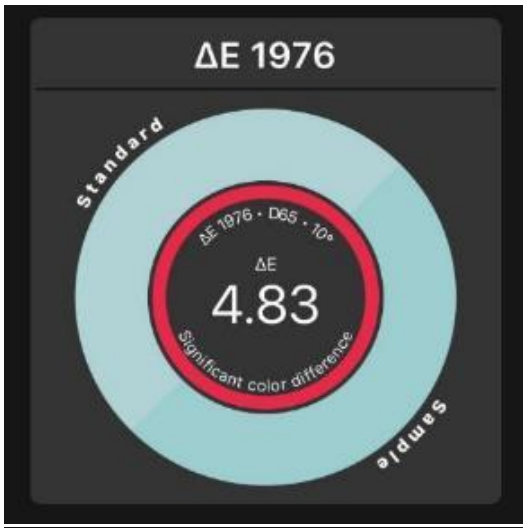
Notes: Big difference in the color between the guardrails

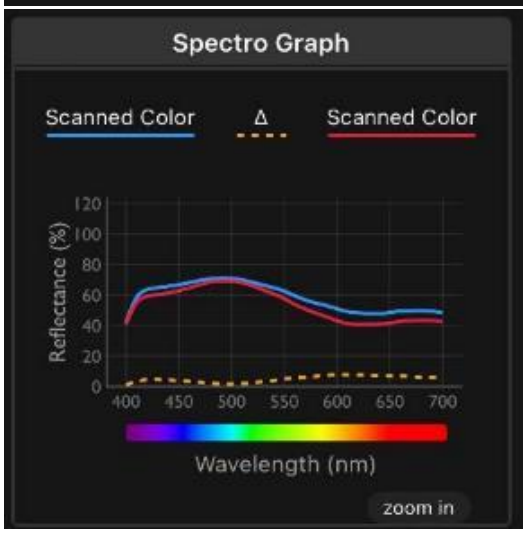
Steel Bridge Coating Ratings (515) for Bridge Number 150135

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

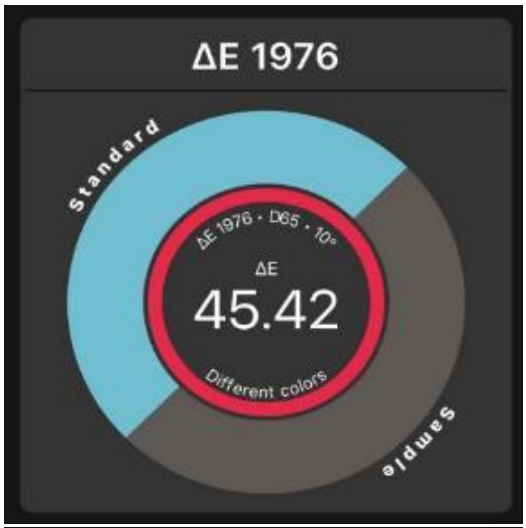
Bridge #150135 (continued)

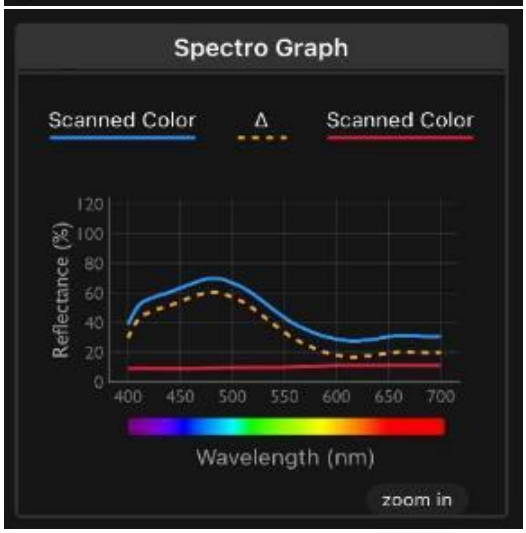
Bridge #150135 (continued) Color Data			
Locations	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Guardrail	80.6884	-11.2623	-8.7057
	77.9738	-15.0903	-11.5452
	78.3379	-13.2234	-9.427
	77.4772	-15.0545	-11.2576
Underneath	38.334	2.0329	3.5302
	62.8822	-23.383	-19.997
	68.4021	-20.6153	-23.3553
	69.5743	-21.0738	-24.5905
	68.8716	-20.9203	-24.4002





Guardrail





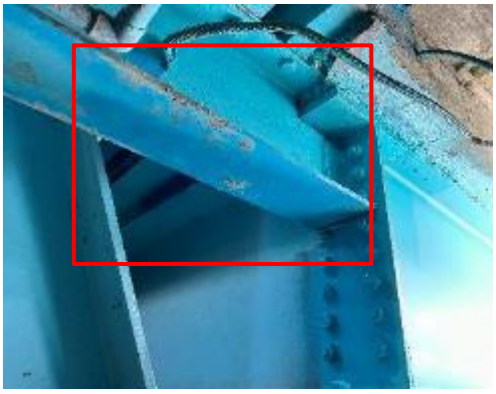
Underneath

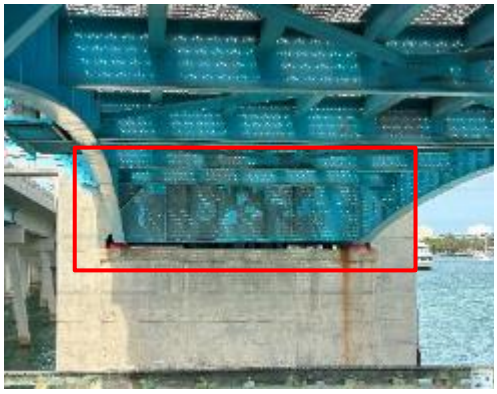
*The colors are from the highest and lowest values record

Bridge #150112

SR 688 WALSINGHAM over INTRACOASTAL WATERWAY-District 7

Inspected on 1/24/2023





SSPS VIS 2 Area Rusted: 0.01-0.03% on diagonal, 0.03-0.1% on Guardrail, 0.01-0.03% floor beam, 0.01-0.03% on Girders, 0.03-0.1% inside Mechanical Room

Delamination: Some cracking on guardrails

Notes: Clear coat on half of bridge has some form of contaminants, looks black on half the bridge (seen in the picture on the right)

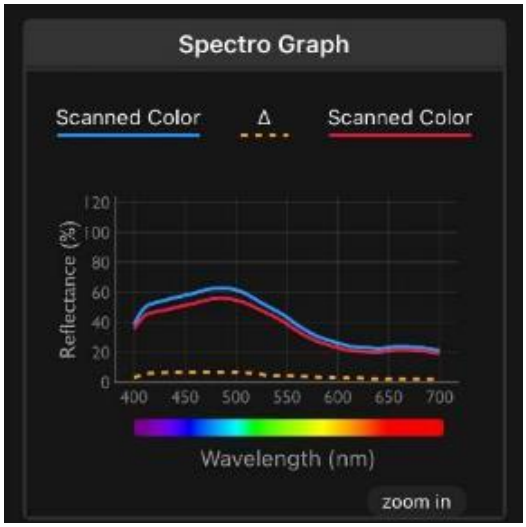
DFT: $\bar{X}$= 15.85 Min= 9.1 Max= 22

Steel Bridge Coating Ratings (515) for Bridge Number 150112 (from InfoBridge, 2021)

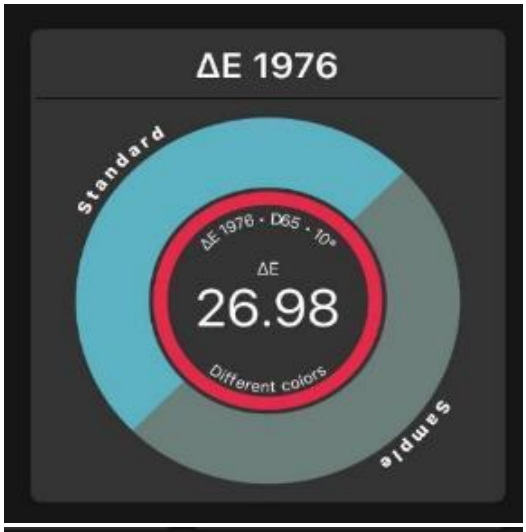
Part Code	Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
113	Steel Stringer	3154	3104	0	50	0	1.59%
107	Steel Girder/Beam	10147	9717	400	30	0	0.30%
152	Steel Floor Beam	2213	2156	57	0	0	0.00%

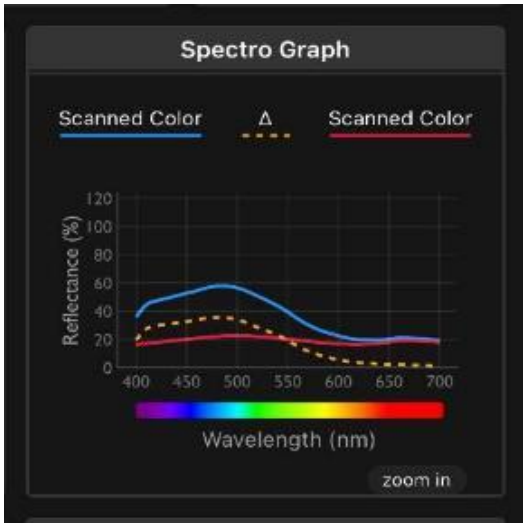
Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Guardrail	64.8668	-22.9121	-20.7872
	67.5359	-24.3025	-23.1403
	64.4665	-23.8814	-21.8787
Underneath	50.7265	-6.2307	-2.7601
	63.2937	-25.2947	-23.2412
	59.9873	-15.1665	-14.2289
	64.592	-25.4303	-23.1762

Bridge #150112 (continued)



Guardrail





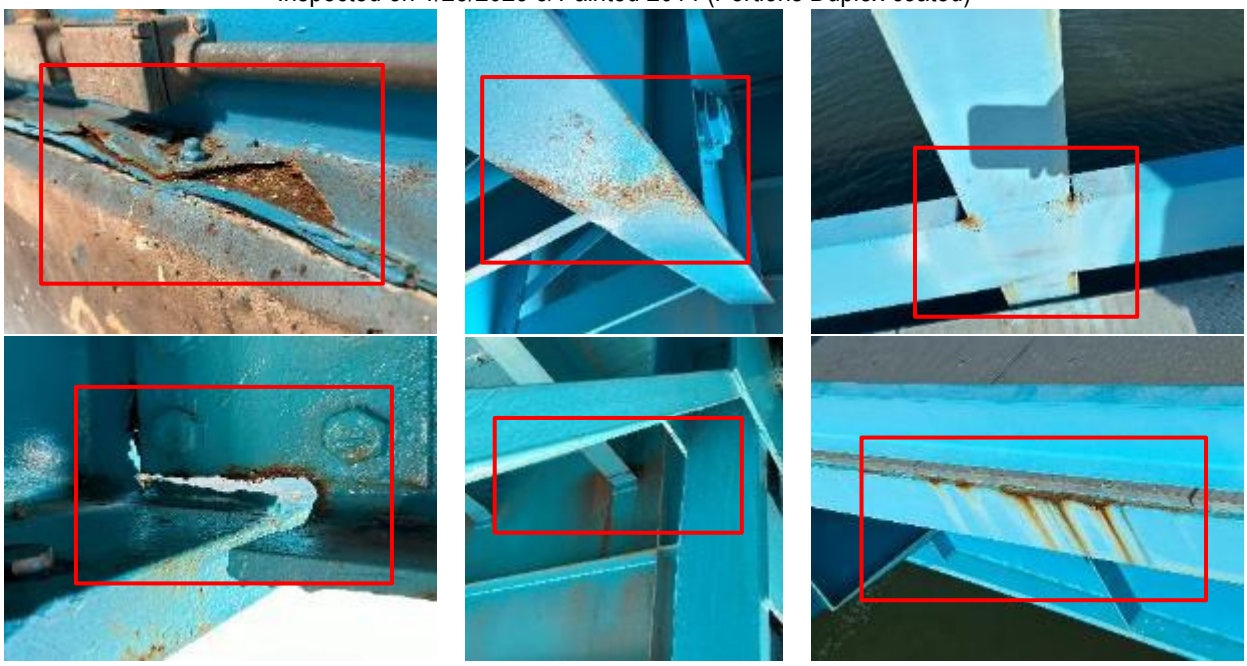
Underneath

*The colors are from the highest and lowest values record

Bridge #170065

Sr 72WB / ICWW-District 1

Inspected on 1/25/2023 & Painted 2014 (Portions Duplex coated)



SSPS VIS 2 Area Rusted: 0.01-0.03% on diagonal, 0.3-1.0% on Guardrail, 0.01-0.03% floor beams, 0.01-0.03% on Girders, 0.3-1.0% inside Mechanical Room

Delamination: In areas of heavy pack rust

Notes: Some areas of heavy pack rust appear to be areas not metalized in previous.

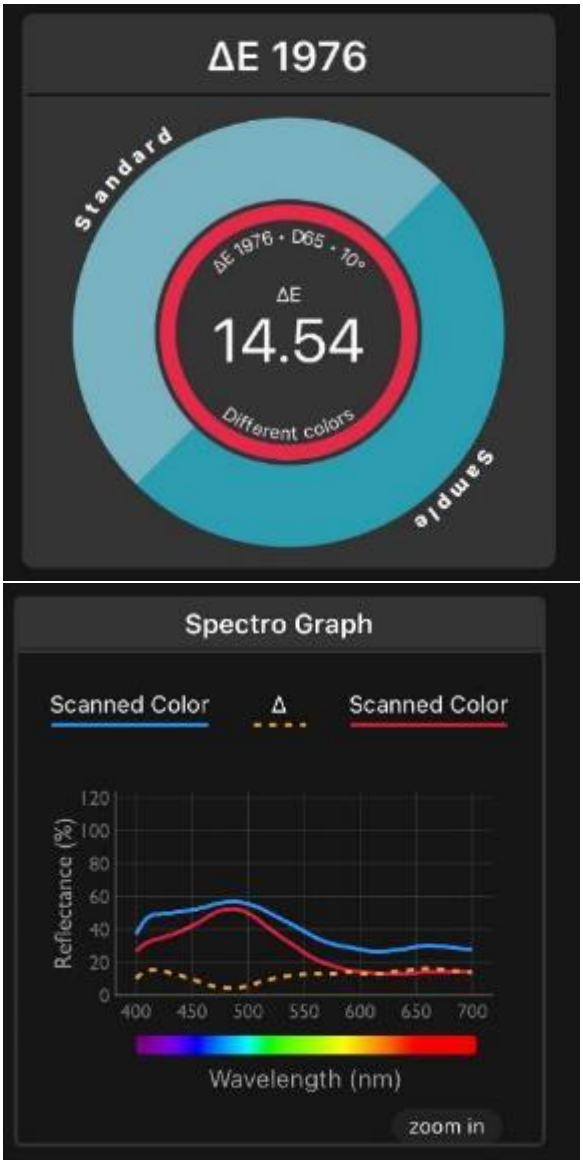
DFT: $\bar{X}$= 20.43 Min= 10.3 Max= 29.5

Steel Bridge Coating Ratings (515) for Bridge Number 170065

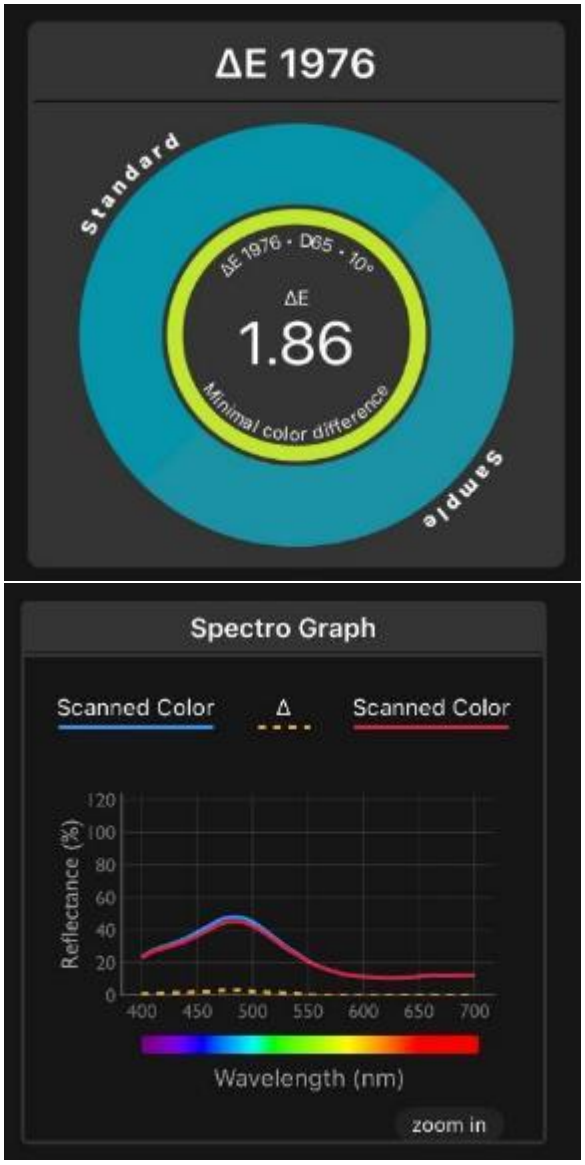
Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #170065 (continued)

Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Guardrail & above bridge	65.6069	-11.9959	-18.992
	56.7723	-25.3979	-25.3561
	55.7511	-27.8749	-28.2265
	66.5086	-16.5103	-19.2569
Underneath	51.5722	-27.9045	-30.6239
	51.0756	-26.4708	-28.8297
	51.4981	-28.2453	-30.6963



Guardrail & above bridge

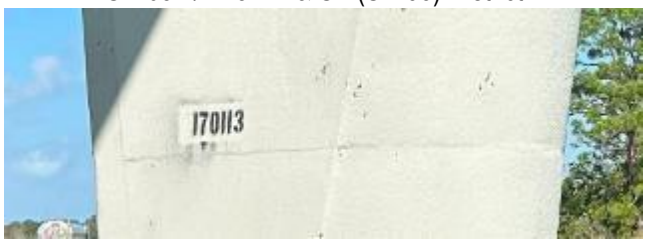


Underneath

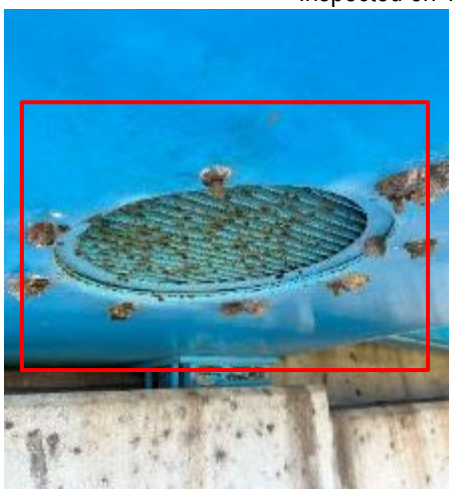
*The colors are from the highest and lowest values record

Bridge #170113

SR-681 / I-75 NB & SB (SR-93)-District 1



Inspected on 1/25/2023 & Painted 2008 (Full RR)



SSPS VIS 2 Area Rusted: 0.01-0.03% overall, 3.0-10.0% on the bearings.

Delamination: None

Notes: Clear coat has some pin holes and contamination.

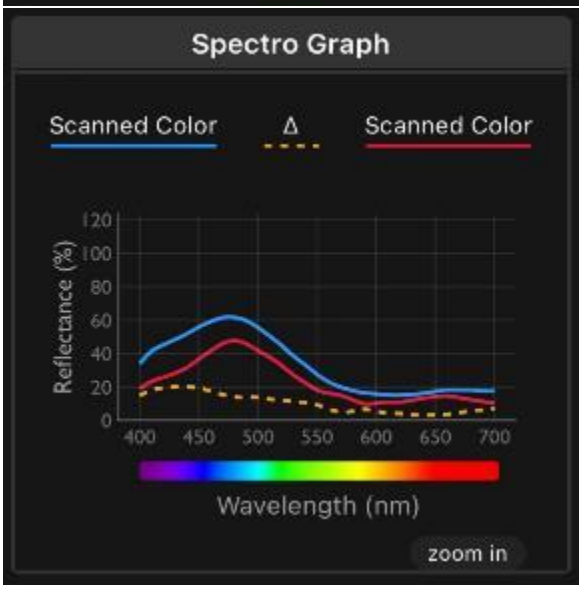
DFT: $\bar{X}$= 23.12 Min= 16.4 Max= 35.3

Steel Bridge Coating Ratings (515) for Bridge Number 170113

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
102 - Steel Closed Web/Box Girder	89,760	85,376	4,224	160	0	0.18%

Bridge #170113 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
50.1955	-24.6146	-30.7486
50.5026	-25.0077	-28.249
55.9669	-26.7161	-35.6735
57.2376	-25.2292	-33.8683
57.1778	-27.1986	-36.7817
58.1719	-26.3548	-36.3885



*The colors are from the highest and lowest values record

Bridge #700061 & 700137

SR 520 over Indian River-District 5

Inspected on 2/7/2023 & Painted 3/23/2017 (Metalize)

SSPS VIS 2 Area rusted: 0.0-0.01%

Delamination: None

Notes: Hard to really see any corrosion

Steel Bridge Coating Ratings (515) for Bridge Number 700061

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	17,050	17,050	0	0	0	0.00%

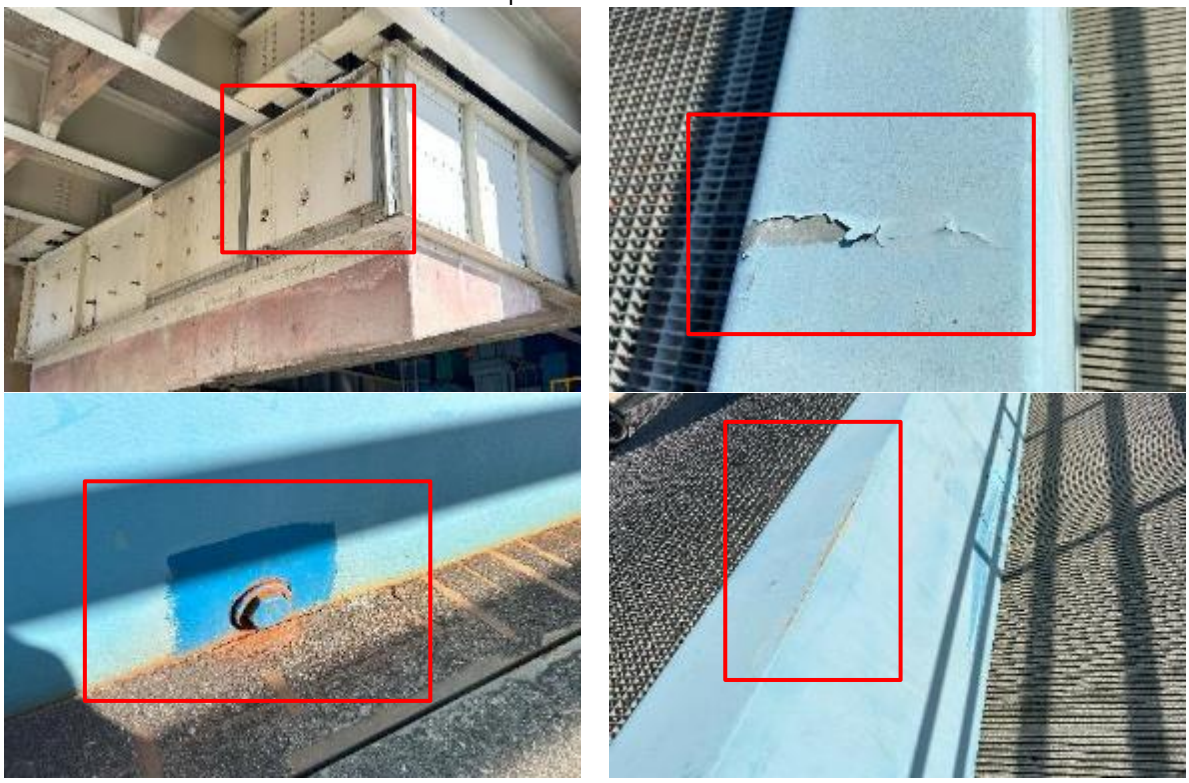
Steel Bridge Coating Ratings (515) for Bridge Number 700137 (from InfoBridge, 2021)

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	21,048	21,018	0	0	30	0.14%

Bridge #700072 & 700201

SR-3 over Barge Canal-District 5

Inspected on 2/7/2023



SSPS VIS 2 Area Rusted: 0.01-0.03% below roadway, 0.1-0.3% on guardrails

Delamination: Some cracking on guardrails

Notes: Couldn't get access underneath, different colors under the bridge (red), blue on top

Steel Bridge Coating Ratings (515) for Bridge Numbers 700072 & 700201

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #700072 & 700201 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
56.5512	-8.3728	-10.3507
56.4569	-9.936	-13.4367
56.5672	-8.2003	-10.5332
57.4341	-7.514	-8.3952

*The colors are from the highest and lowest values record

Bridge #750402

Central Fl Parkway over I-4-District 5

Inspected on 2/8/2023

SSPS VIS 2 Area rusted: 0.0-0.01%

Delamination: None

Notes: Clear coat has streaks and appears to be turning darker (seen faintly in red box)

Steel Bridge Coating Ratings (515) for Bridge Number 750402

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
102 - Steel Closed Web/Box Girder	97,186	97,150	0	0	36	0.04%

Bridge #110063

SR-44 over St. Johns River- District 5

Inspected on 2/8/2023

SSPS VIS 2 Area Rusted: 0.3-1.0% on cross beams, 1.0-3.0% on guardrails, 0.3-1.0% on floor beams, 0.3-1.0% on girders, 0.3-1.0% inside mechanical rooms

Delamination: 1.0-3.0% seen throughout

Notes: Bridge is currently being replaced, areas where touch up was attempted, mold and other contaminants in clear coat

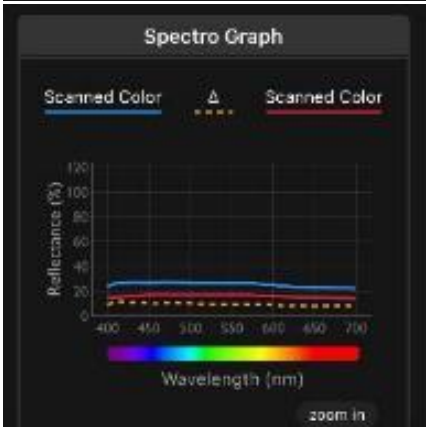
DFT: $\bar{X}$= 14.6

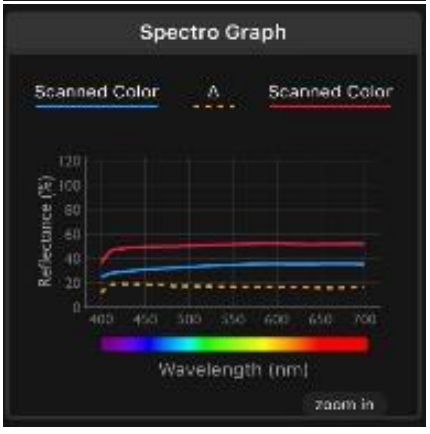
Steel Bridge Coating Ratings (515) for Bridge Number 110063

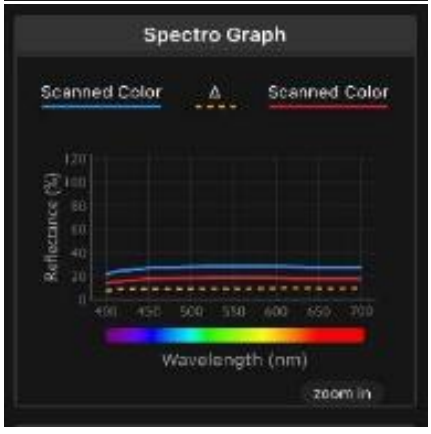
Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #110063 (continued)

Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Guardrail	57.5599	-2.9954	-2.1964
	47.4187	-2.0759	-0.6179
	48.4608	-2.2161	-1.5226
	50.7821	-1.4205	-0.4005
Outside underside	77.0277	0.3007	2.4342
	65.5947	0.8252	5.2488
	66.7441	0.0599	2.8451
	76.5145	0.6452	3.3997
Underneath inside	52.9474	0.2359	5.1523
	50.0884	-1.1066	1.93
	51.2113	-2.1675	0.0166
	60.1436	-0.6704	2.271







Guardrail **Outside underside** **Underneath Inside**

*The colors are from the highest and lowest values record

Bridge #750255

CFRC over US 17/92 (Girder Interiors)-District 5

Inspected on 2/8/2023 & Painted on 8/15/2019 (Full RR only on girders interiors)

SSPS VIS 2 Area Rusted: 0.01-0.03% on interior of girders, appears to have crevice corrosion in some areas attached to interior girders

Delamination: None

Notes: Cross beams and other steel had higher degrees of corrosion but not inspected

Steel Bridge Coating Ratings (515) for Bridge Number 750255

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #700174 & 700181

US-192 over Indian River

Inspected on 2/9/2023 & Painted 6/24/2014 (Portions Duplex coated)

SSPS VIS 2 Area rusted: 0.0-0.01%

Delamination: None

Notes: Limited available access (piers and parallel bridge)

Steel Bridge Coating Ratings (515) for Bridge Number 700174

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	24,425	24,225	200	0	0	0.00%

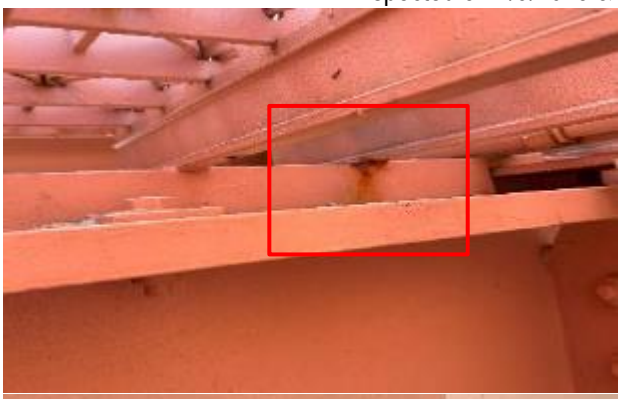
Steel Bridge Coating Ratings (515) for Bridge Number 700181

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	26,660	26,456	0	104	100	0.77%

Bridge #790172

SR-44 over IWW Indian River-District 5

Inspected on 2/9/2023 & Painted 1/29/2019 (Full RR)



SSPS VIS 2 Area Rusted: 0.03-0.1% on cross beams, 0.01-0.03% on guardrails, 0.03-0.1% on floor beams, 0.01-0.03% on exterior girders, 0.0-0.01% inside the mechanical rooms

Delamination: None

Notes: Corrosion at crevice under bridge

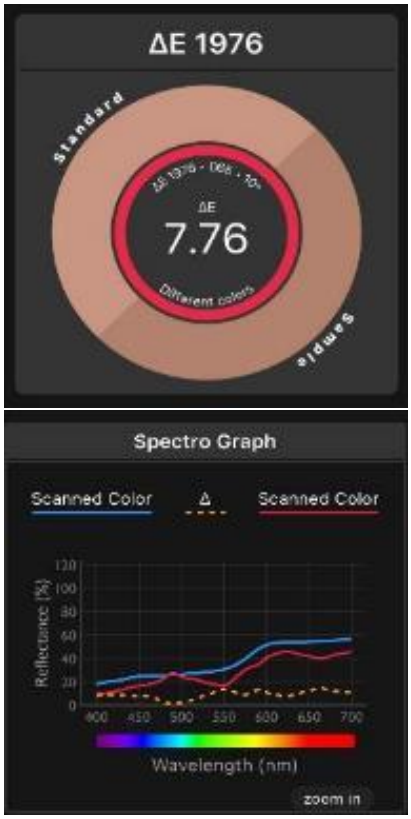
DFT: $\bar{X}$= 14

Steel Bridge Coating Ratings (515) for Bridge Number 790172

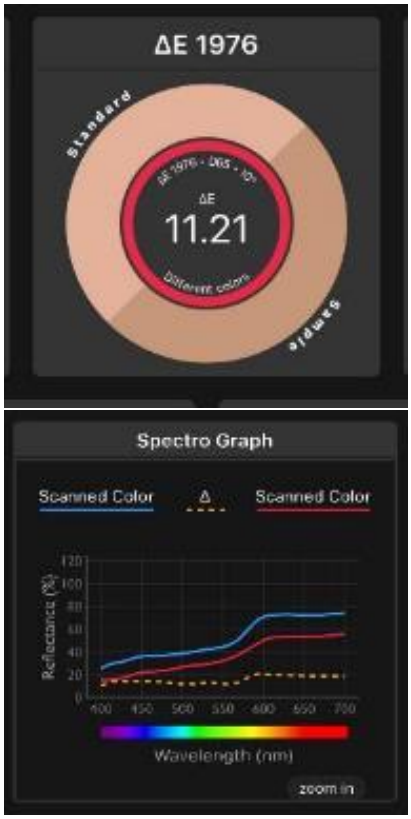
Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #790172 (continued)

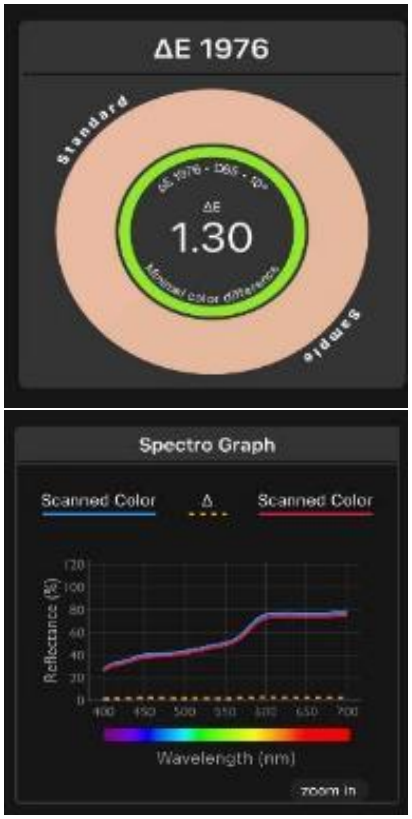
Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
Inside Pier	69.2479	18.5243	21.6142
	61.406	20.3125	20.3422
	69.3474	18.6671	21.6584
	69.0804	18.4485	21.3914
Under Bridge	69.1092	16.8253	26.1794
	78.9054	18.8071	22.2107
	78.556	17.8346	21.7226
	79.1628	18.3474	22.2404
Walkway	80.8537	14.5438	22.8137
	82.0915	16.5815	22.3174
	80.8288	16.3675	22.526
	82.1496	16.6647	22.3317



Inside Anchorage



Under Bridge



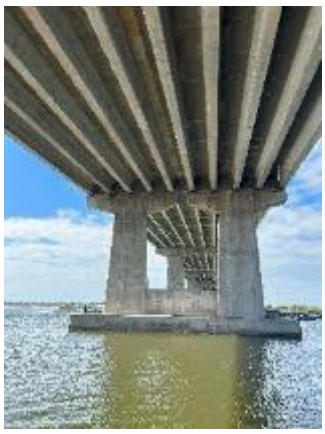
Walkway

*The colors are from the highest and lowest values record

Bridge #790148

SRA1A over Halifax River-District 5

Inspected on 2/9/2023 & Painted 6/7/2019 (Metalize)



SSPS VIS 2 Area rusted: 0.03-0.1% seen from underneath on dock.

Delamination: None

Notes: Hard to see all areas from the dock

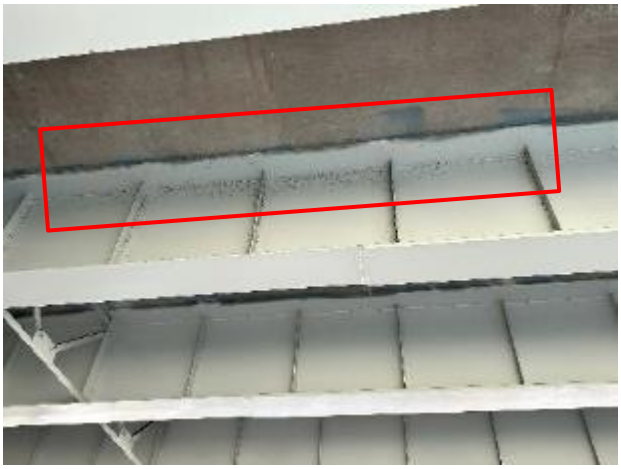
Steel Bridge Coating Ratings (515) for Bridge Number 700174

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	99,460	99,460	0	0	0	0.00%

Bridge #720259 & 720348

I-295 NB (SR-9A) over SR-228 (NORMANDY BLVD.)-District 2

Inspected on 3/1/2023



SSPS VIS 2 Area Rusted: 0.01-0.03% on some diagonal edges.

Delamination: None

Notes: Appears to be mold or spiders in some areas hard to see from sidewalk (right picture)

Steel Bridge Coating Ratings (515) for Bridge Number 720259

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	11,972	11,972	0	0	0	0.00%

Steel Bridge Coating Ratings (515) for Bridge Number 720348

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	10,562	10,562	0	0	0	0.00%

Bridge #720367

I-295 SB (SR-9A) over US-1 (SR-15)-District 2

Inspected on 3/1/2023

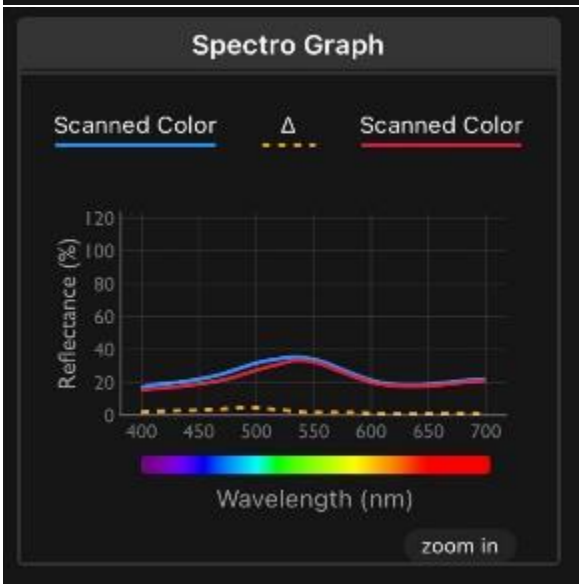
SSPS VIS 2 Area Rusted: 0.0-0.01%
Delamination: Small, quarter-sized spot
Notes: Some pin holes in clear coat
DFT: $\bar{X}$= 15.16 Min= 13.4 Max= 17.7

Steel Bridge Coating Ratings (515) for Bridge Number 720367

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	16,253	16,253	0	0	0	0.00%

Bridge #720367 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
59.4419	-16.9871	6.2952
57.7161	-15.6471	9.3421
57.8103	-16.8373	9.5982
57.9973	-16.1716	9.3741



*The colors are from the highest and lowest values record

Bridge #720400

OLD KINGS RD. over I-295 (SR-9A)-District 2

Inspected on 3/1/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: Some pin holes in clean coat

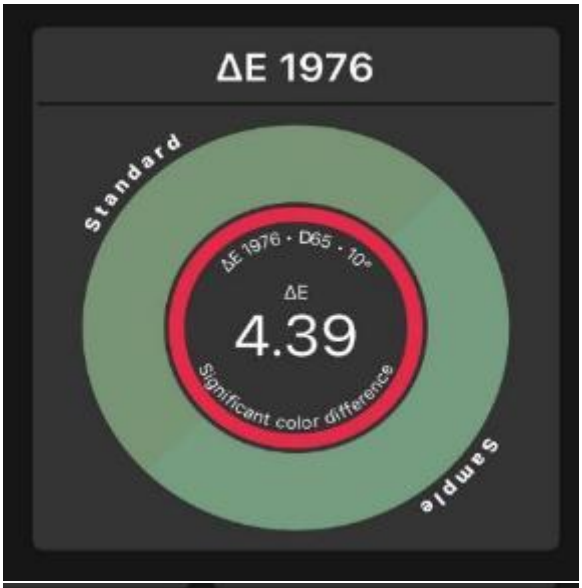
DFT: $\bar{X}$= 12.13 Min= 8.8 Max= 16.8

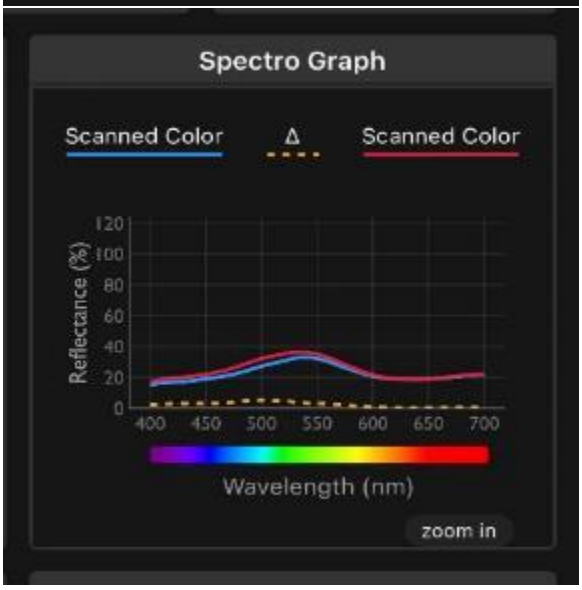
Steel Bridge Coating Ratings (515) for Bridge Number 720400

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	12,566	12,546	11	6	3	0.07%

Bridge #720400 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
59.9601	-17.5196	6.9678
59.4602	-16.8809	9.6467
57.8882	-14.2224	9.7168





*The colors are from the highest and lowest values record

Bridge #720369

TROUT RIVER BLVD. over I-295 (SR-9A)-District 2

Inspected on 3/1/2023

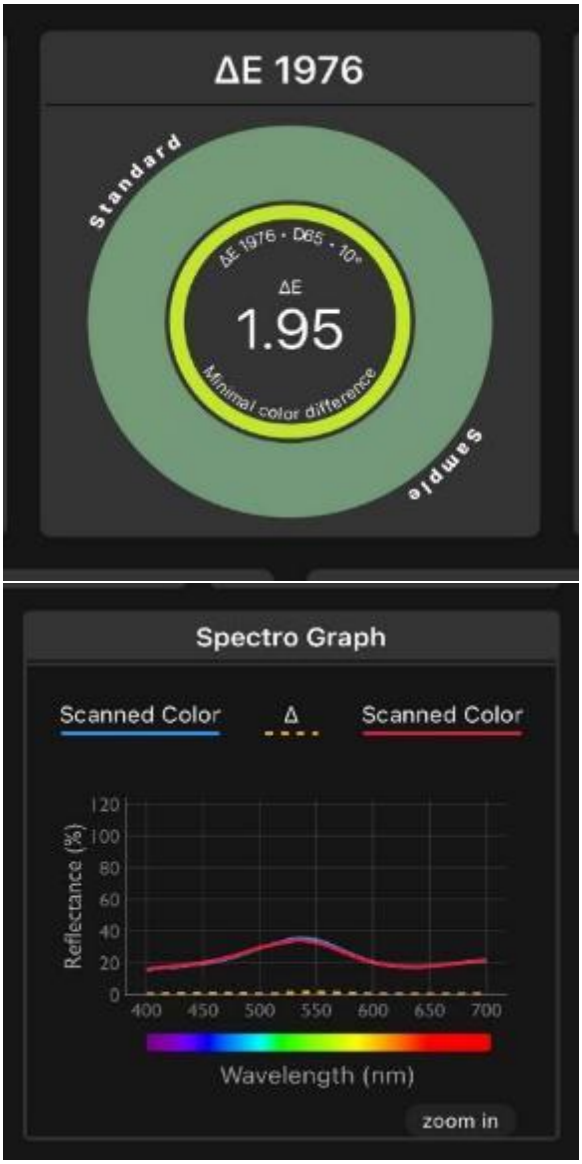
SSPS VIS 2 Area Rusted: 0.0-0.01%
Delamination: None
Notes: Small blisters in clean coat
DFT: $\bar{X}$= 13.98 Min= 12.1 Max= 18.9

Steel Bridge Coating Ratings (515) for Bridge Number 720369

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	35,425	35,004	0	0	421	1.19%

Bridge #720369 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
58.8687	-17.4598	9.3055
58.5607	-16.9172	9.8005
58.307	-16.7513	7.5994



*The colors are from the highest and lowest values record

Bridge #270011

SR-2 over MOCCASIN CREEK-District 2

Inspected on 2/28/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: Dirt on exterior girder

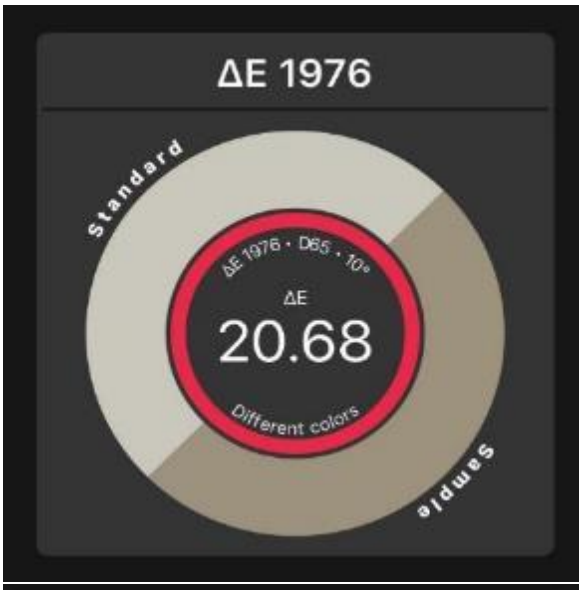
DFT: $\bar{X}$= 14.34 Min= 11.8 Max= 15.6

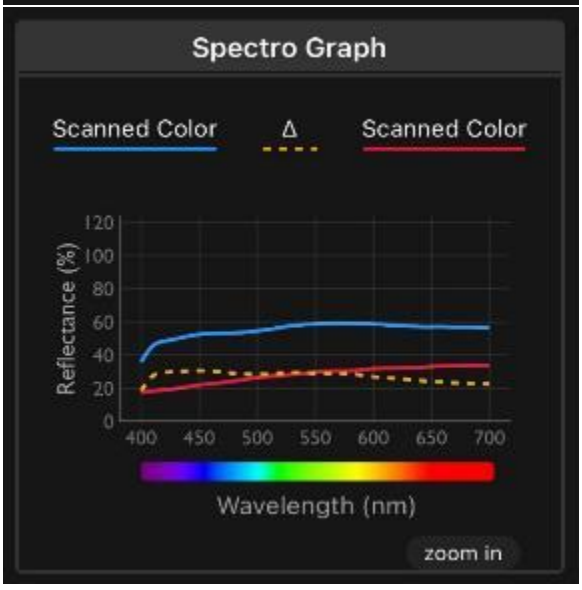
Steel Bridge Coating Ratings (515) for Bridge Number 270011

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	3,500	3,500	0	0	0	0.00%

Bridge #270011 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
80.714	-0.0552	5.7121
61.6782	3.1475	12.4207
80.774	-0.0158	5.6363
71.3413	-5.2833	-2.0314





*The colors are from the highest and lowest values record

Bridge #270910

SR-2 over Breakfast Branch-District 2

Inspected on 2/28/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: Dirt on exterior girder

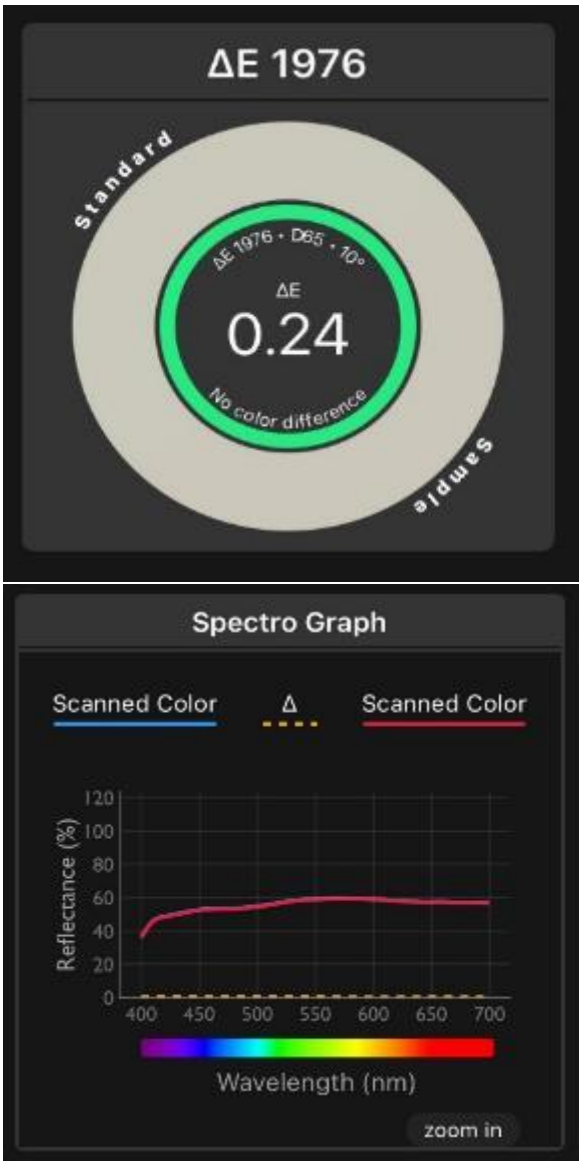
DFT: $\bar{X}$= 10.95 Min= 10.0 Max= 12.7

Steel Bridge Coating Ratings (515) for Bridge Number 270910

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	2,000	2,000	0	0	0	0.00%

Bridge #270910 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
80.9664	-0.0924	5.77
80.7721	0.008	5.864



*The colors are from the highest and lowest values record

Bridge #270012

SR-2 over E. PRONG MOCCASIN CREEK-District 2

Inspected 2/28/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: Dirt on exterior girder, and a lot of vegetation

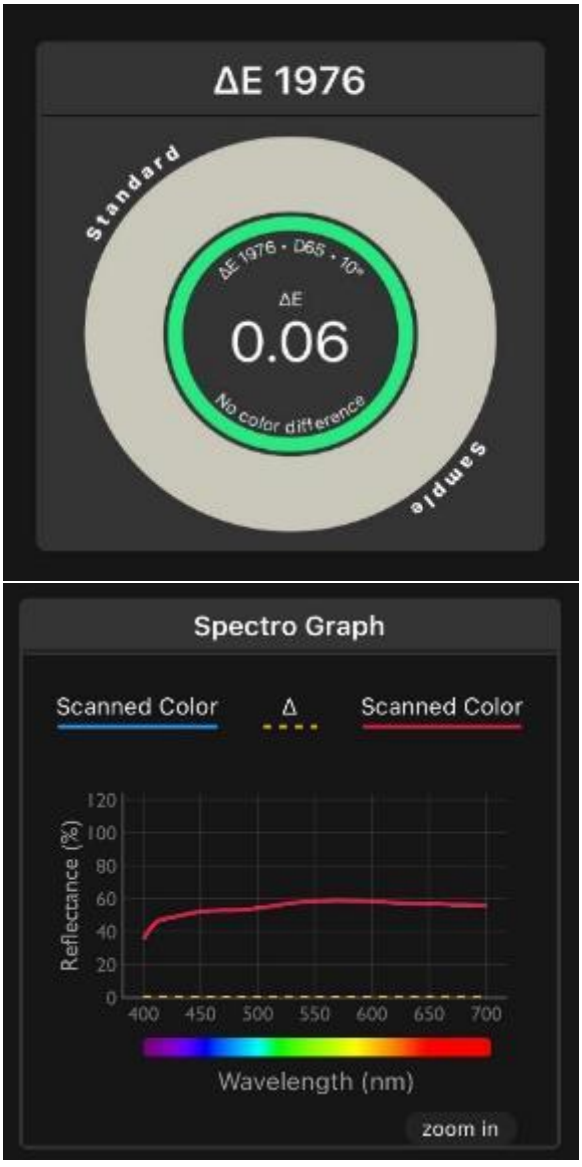
DFT: $\bar{X}$= 12.02 Min= 10.7 Max= 15.0

Steel Bridge Coating Ratings (515) for Bridge Number 270012

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	1,618	1,618	0	0	0	0.00%

Bridge #270012 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
80.5025	-0.0637	5.7018
80.5559	-0.0328	5.7098



*The colors are from the highest and lowest values record

Bridge #270013

SR-2 over SLEEPY J. CREEK-District 2

Inspected on 2/28/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: Dirt on exterior girders

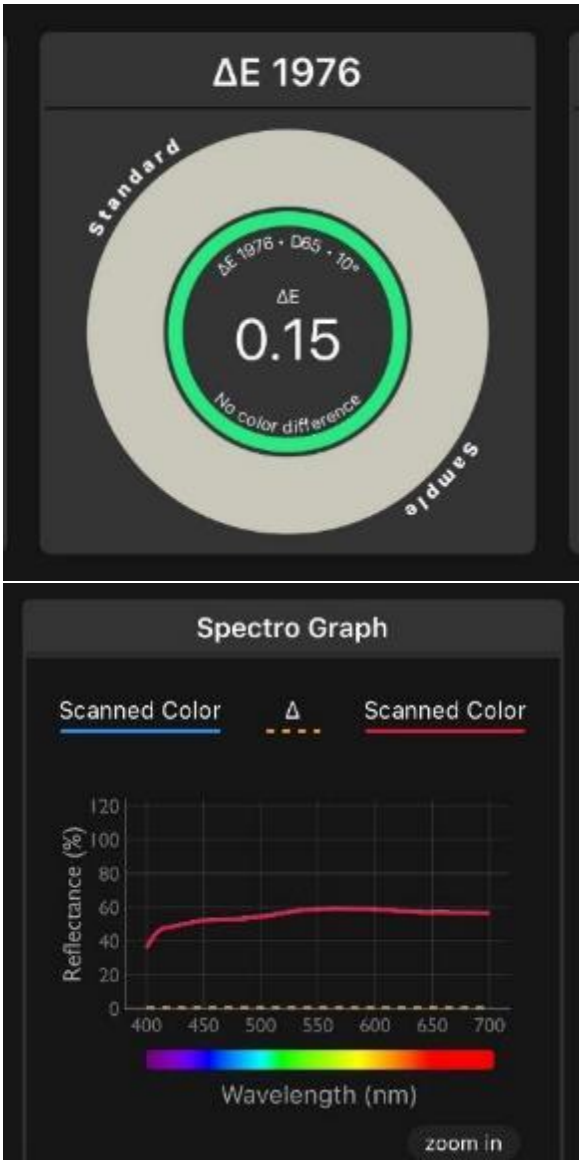
DFT: $\bar{X}$= 12.09 Min= 10.0 Max= 16.3

Steel Bridge Coating Ratings (515) for Bridge Number 270013

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	2,020	2,020	0	0	0	0.00%

Bridge #270013 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
80.7604	-0.0531	5.9236
80.6244	-0.016	5.9355

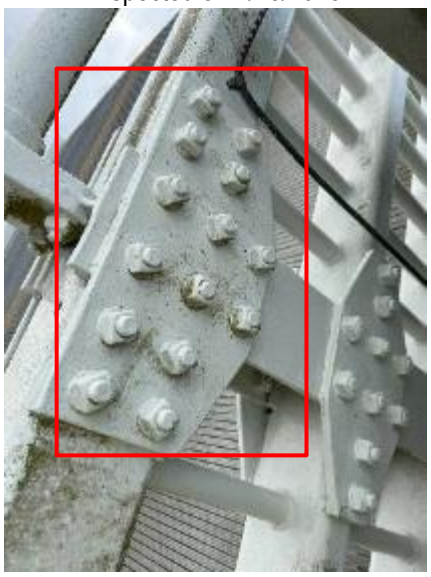


*The colors are from the highest and lowest values record

Bridge #720005

SR-211 over ORTEGA RIVER-District 2

Inspected on 2/28/2023



SSPS VIS 2 Area Rusted: 0.01-0.03% on some bolts, 0.0-0.01% on rest of the bridge

Delamination: None

Notes: None

DFT: $\bar{X}$= 17.26 Min= 12.5 Max= 26.4

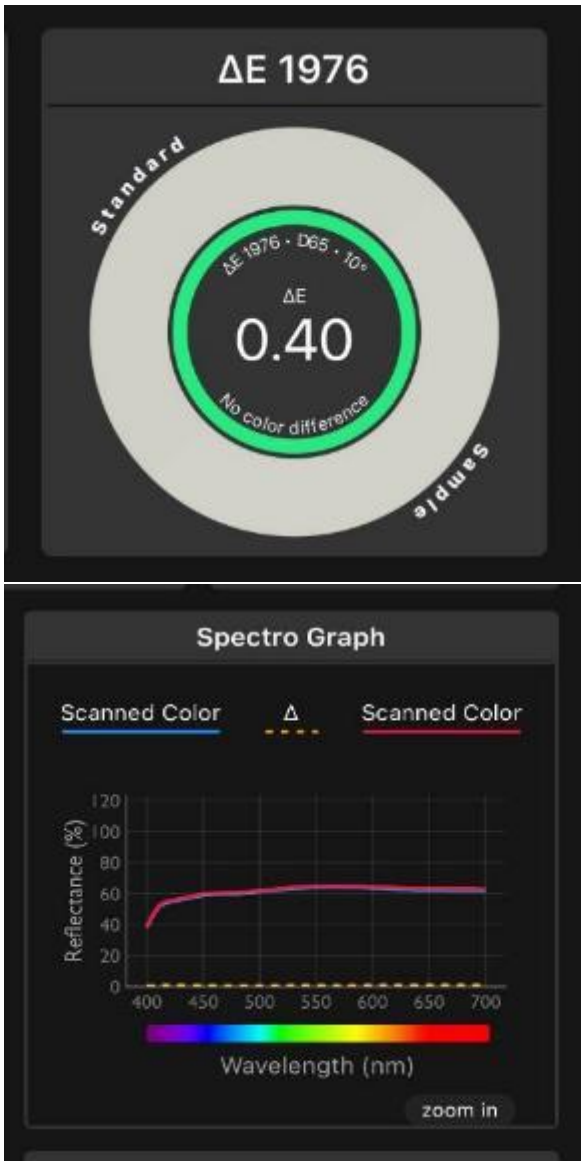
Steel Bridge Coating Ratings (515) for Bridge Number 750005

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
Unavailable						

Bridge #720005 (continued)

Color Data			
Location	**A-10deg-L**	**A-10deg-a**	**A-10deg-b**
North Face	83.7877	-0.2199	4.6972
	83.9625	-0.3048	4.6111
South Face	83.5944	-0.4582	4.3124
	83.9948	-0.3588	4.3344

North Face



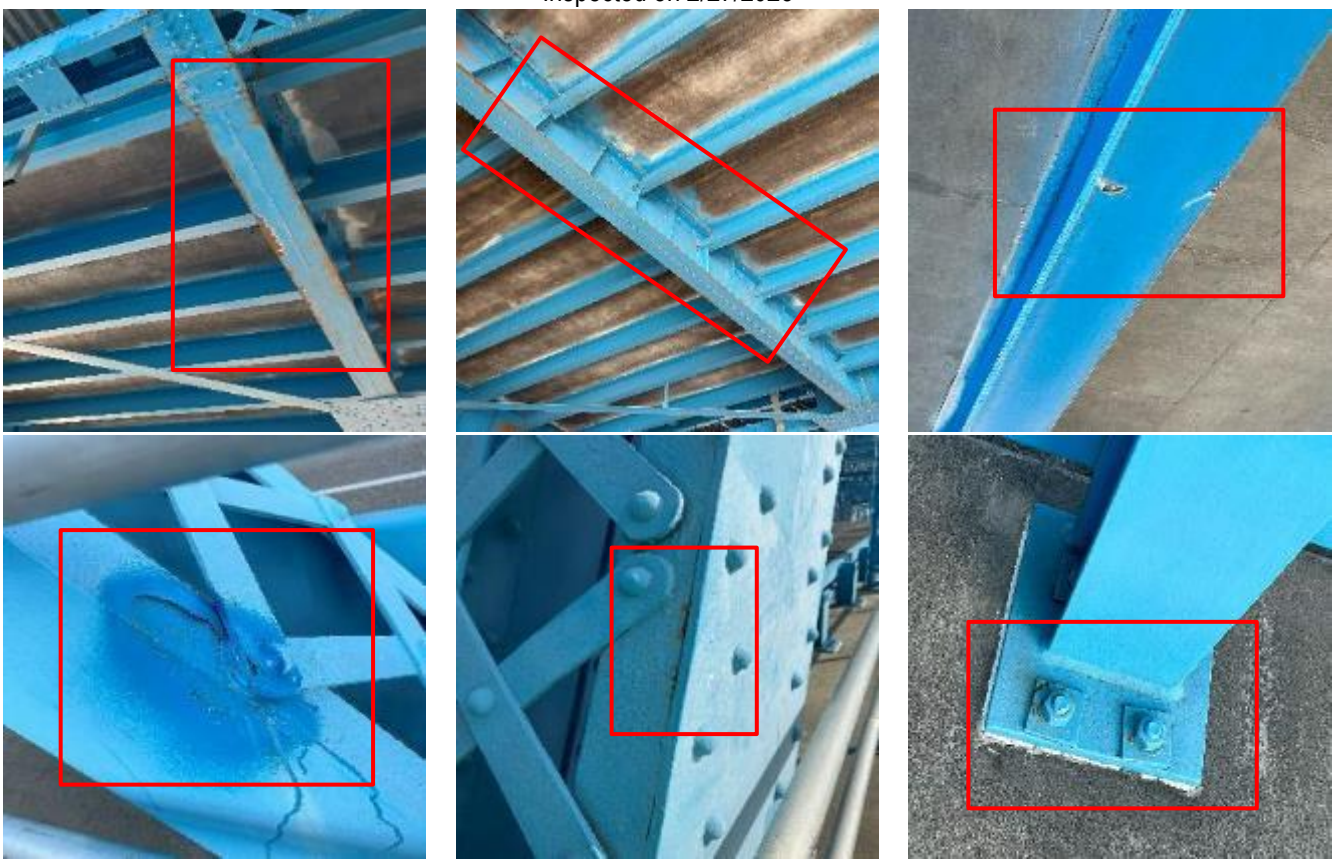
South Face

*The colors are from the highest and lowest values record

Bridge #720022

US-1 (MAIN ST.) over ST. JOHNS RIVER-District 2

Inspected on 2/27/2023



SSPS VIS 2 Area Rusted: 1.0-3.0% on the floor beams above the water, 0.3-1.0% on edges of girders, 0.3-1.0% on roadway bracing and some bolts

Delamination: 0.03-0.1% different parts have delamination, and some have been attempted to be touched up. (Size vary in areas with delamination)

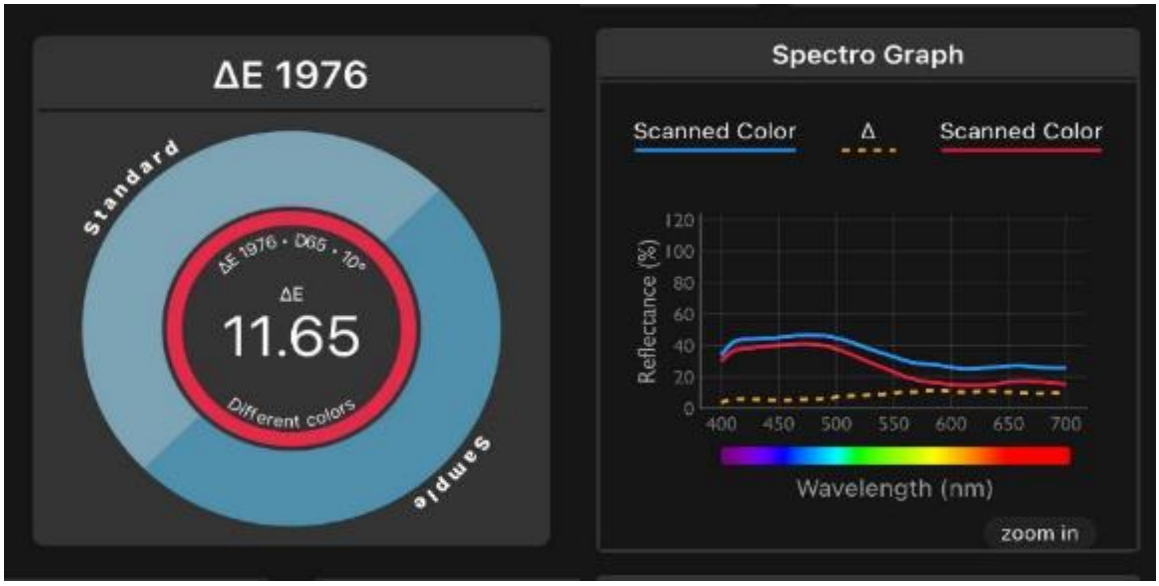
Notes: Areas where touch up was attempted

Bridge #720022 (continued)

Steel Bridge Coating Ratings (515) for Bridge Number 720022 (InfoBridge, 2021)

Part Code	Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
152	Steel Floor Beam	33101	32334	0	0	767	2.32%
162	Steel Gusset Plate	5236	5095	0	0	141	2.69%
107	Steel Girder/Beam	138000	137459	0	0	541	0.39%
113	Steel Stringer	110362	109907	3	5	447	0.41%
120	Steel Truss	267652	265678	354	7	1613	0.61%

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
53.5132	-17.0257	-26.9727
57.7733	-14.5951	-22.8028
62.8295	-11.1999	-17.4979
58.1878	-15.4711	-23.0343



*The colors are from the highest and lowest values record

Bridge #720377

US-17 NB (SR-5) over WATER ST.-District 2

Inspected on 2/27/2023

SSPS VIS 2 Area Rusted: 0.01-0.03%

Delamination: 0.03-0.1% down to the primer in some spots

Notes: Some areas the clear coat has contaminants

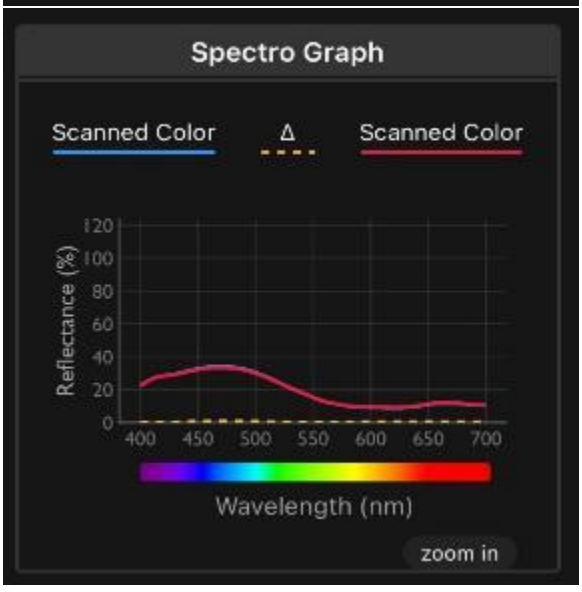
DFT: $\bar{X}$= 12.48 Min= 10.4 Max= 15.8

Steel Bridge Coating Ratings (515) for Bridge Number 720377

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	1,734	1,681	36	0	17	0.98%

Bridge #720377 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
45.281	-18.2415	-30.2357
45.1853	-19.1005	-31.0846



*The colors are from the highest and lowest values record

Bridge #720087

US-1 over Prudential Drive-District 2

Inspected on 2/27/2023

SSPS VIS 2 Area Rusted: 0.0-0.01%

Delamination: None

Notes: None

DFT: $\bar{X}$= 14.48 Min= 11.6 Max= 17.0

Steel Bridge Coating Ratings (515) for Bridge Number 720087

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	66,904	66,904	0	0	0	0.00%

Bridge #720087 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
78.4489	-0.1595	6.9107
74.4714	0.2465	7.429
78.4012	-0.0911	7.0414
76.0246	0.1097	7.1384

*The colors are from the highest and lowest values record

Bridge #290030

SR-136 over SUWANNEE RIVER-District 2

Inspected on 2/28/2023 & Painted 4/17/2013 OC

SSPS VIS 2 Area Rusted: 3.0-10% on lower flange of edge girder, 0.0-0.01% on all other areas

Delamination: 3.0-10% on lower flange of the edge girder

Notes: Appears to be significant delamination and corrosion of lower flange surfaces facing the water

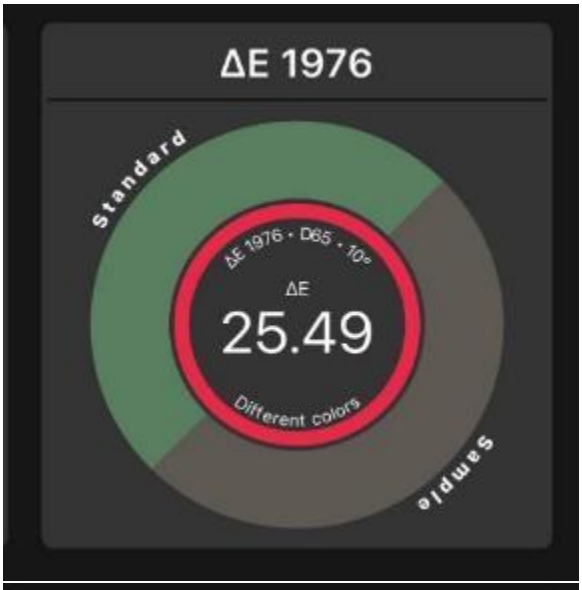
DFT: $\bar{X}$= 22.16 Min= 13.1 Max= 73.1

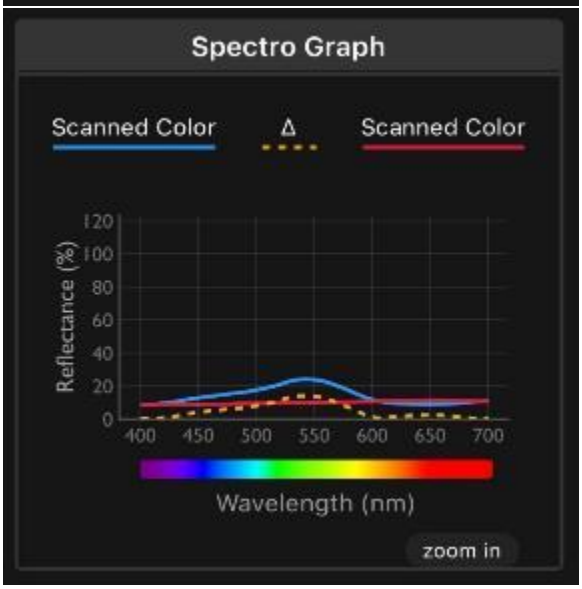
Steel Bridge Coating Ratings (515) for Bridge Number 100497

Parent Element	Total Sq. Ft.	CS1 (Sq. Ft.)	CS2 (Sq. Ft.)	CS3 (Sq. Ft.)	CS4 (Sq. Ft.)	Stage 3 and Stage 4 (%)
107 - Steel Girder/Beam	6,925	6,904	0	0	21	0.30%
113 - Steel Stringer	2,675	2,675	0	0	0	0.00%

Bridge #290030 (continued)

Color Data		
A-10deg-L	**A-10deg-a**	**A-10deg-b**
38.3281	1.977	4.2096
48.5082	-19.2787	8.675
48.2313	-19.27	9.6216
47.6192	-18.5311	9.2351





*The colors are from the highest and lowest values record

Appendix C

APPENDIX C – DRAFT STANDARD SPECIFICATION

SECTION TSP
VALUE ADDED STEEL PROTECTIVE COATING

TSP-1 Description.

Construct value added protective coating, subject to a two year warranty period after final acceptance of the Contract in accordance with 5-11.

For purposes of this Specification, the Responsible Party, as designated herein, is responsible for performance of the value added steel protective coating including continued responsibility for performing all remedial work associated with coating distresses exceeding threshold values determined in accordance with this Section, and as to which notice was provided to the Responsible Party.

For purposes of this specification, the Engineer shall mean the responsible representative of the Department. If the project engineer is not involved at the end of the warranty period, the responsible representative will default to the District Structures Maintenance Engineer or their delegate. The work specified in this Section will not be paid for directly, but will be considered as incidental to other Contract items.

TSP-2 Materials and Construction Requirements.

Meet the following requirements:

Coating New Structural Steel.....Section 560
Coating Existing Structural Steel.....Section 561

TSP-3 Responsible Party.

Prior to any value added protective coating work being performed on the project, the Contractor shall designate a Responsible Party to accept responsibility for maintaining the value added protective coating, when remedial work is required. The Responsible Party may be either the Contractor or the Department approved subcontractor performing the value added protective coating work.

Whether the Responsible Party is the Contractor or a subcontractor, the Responsible Party must be pre-qualified with the Department in the category of protective coatings, and such designation must be made to the Department by the Contractor. The proposed subcontractor must execute and submit to the Department a form, provided by the Department, prior to or concurrent with the Contractor's request to sublet any value added protective coating work, stipulating that the subcontractor assumes all responsibility as the Responsible Party for the value added steel protective coating within the two-year warranty period. Failure to timely designate the Responsible Party will result in the Contractor being the Responsible Party unless otherwise agreed to in writing by the Department.

During execution of the painting work, the Responsible Party shall produce or cause to be produced a field applied mock-up painted sample representing the applied paint system. The mock-up should allow for a representative control sample to be measured and have a surface area of at least 12 square inches. The mock-up should be turned over to the Department prior to final acceptance. This mock-up will be stored by the Department and used as a reference surface for color and any other warranty issues.

Upon final acceptance of the Contract in accordance with 5-11, the Contractor's responsibility for maintenance of all the work or facilities within the project limits of the Contract will terminate in accordance with 5-11; with the sole exception that the obligations set forth in this Section for value added protective coating will continue thereafter to be the responsibility of the Responsible Party as otherwise provided in this Section.

TSP-4 Statewide Disputes Review Board.

The Statewide Disputes Review Board in effect for this Contract will resolve any and all disputes that may arise involving administration and enforcement of this Specification. The Responsible Party and the Department acknowledge that use of the Statewide Disputes Review Board is required, and the determinations of the Statewide Disputes Review Board for disputes arising out of this Specification will be binding on both the Responsible Party and the Department, with no right of appeal by either party.

Meet the requirements of 8-3.

TSP-5 Steel Protective Coating Evaluation and Remedial Work.

TSP-5.1 General: The Department's Steel Protective Coating Assessment Procedures, along with observations by the Engineer, will be used as the basis for determining the extent and the magnitude of the coating distress indicators occurring on the project. In the event the level of any distress indicator exceeds any of the threshold values defined below, remedial work as described in TSP-5.4 by the Responsible Party will be required.

The Department will monitor the steel protective coating for distress indicators and may require remedial action at any time. The Department may conduct a Coating Condition Survey of the value added protective coating following the final acceptance of the project, and at intermediate times throughout the warranty period with findings provided at the discretion of the Department. Such work will be paid for by the Department.

The final coating condition survey, if determined by the Engineer to be necessary, shall be conducted within 120 days before the end of the warranty period, unless otherwise agreed upon by the Department. Results will be provided to the Responsible Party for those conditions exceeding contract threshold values requiring remedial action that the Department believes to be an obligation of the Responsible Party. The Department will be responsible for all costs associated with the surveys. If the survey findings, intermediate or final, are to be disputed by the Responsible Party, written notification must be submitted to the Department within 30 calendar days of the date of receipt of the information from the Department. *Note to editors: Consider whether language is necessary for the event that the dispute extends beyond the warranty period.*

During the warranty period, the Responsible Party may participate with the Department in the Coating Condition Surveys upon request. The Responsible Party shall provide their own access in coordination with the Department. The Responsible Party shall not conduct any destructive evaluation without prior approval by the Engineer.

TSP-5.2 Protective Coating Distress Indicators: The Department will consider measures of substrate corrosion (rusting, rust bleed, rust staining, and rust breakthrough) and coating film defects (blistering, peeling, cracking, and chalking) and well as observed specification noncompliances (coating over rust and missing layers of coating) as distress indicators for the purposes of the warranty.

TSP-5.3 Threshold Values and Remedial Work: Descriptions of each distress indicator and threshold values are described in Table TSP-1. When an area has a distress indicator meeting or exceeding the threshold value, the area is considered nonconforming and remedial work must be performed.

Table TSP-1

Distress Indicator	Threshold Value	Remedial Work
Indication of substrate corrosion including rusting, rust bleed, rust staining, rust breakthrough, and pack rust. Stains generated from external sources must be excluded.	Any area of 12 square inches containing more than a cumulative surface area of defect exceeding 0.4 square inches of visible spot rusting, pinpoint rusting, or general rusting as determined by SSPC-VIS 2.	Any or all such surfaces along with appropriate over-lap areas shall be repaired in accordance with the specification.

Distress Indicator	Threshold Value	Remedial Work
Any blisters, cracking, and/or loss of adhesion. Loss of adhesion will include disbonding, delamination, lifting, spalling, flaking, chipping of any layer, including old paint, mill scale, and embedded abrasive.	Cumulative surface area of defect in excess of 100 square inches.	The defective coating shall be completely removed, and the area prepared and recoated in accordance with the specification. If an acceptable remediation plan is submitted by the Responsible Party, the Engineer may approve a remedial approach that retains layers of paint which are determined to be free of defects.
NBE Element 515 Condition States 3 and 4 (CS-3 and CS-4)	Any CS-3 or CS-4 condition reported during initial or routine safety bridge inspections.	The Engineer shall be responsible to determine if any reported instanced of either CS-3 or CS-4 are defects which require remediation under the terms of this warranty.
Color (applicable only to surfaces which are designated "appearance critical" in the contract documents).	Paint systems shall exhibit no total color difference (ΔE*ab) greater than 8.0 units. A ΔE*ab value exceeding 8.0 units per the International Commission on Illumination L*a*b* 1976 (CIELAB) space and color difference formula, measured in accordance with ASTM D2244, will constitute a color retention failure. The Department will measure and enter in the Department's database the CIELAB color chromaticity coordinates for the color of the topcoat, applied to a mock-up painted sample representing the applied paint system using a BYK-Gardner Handicolor colorimeter using D65 illuminant and 2-degree geometry settings. The Department-measured CIELAB chromaticity coordinates shall define the initial color and will be used for resolution of color retention failures and the resolution of color retention disputes	Submit a plan to the Engineer for remediation to include a complete overcoat in conjunction with other required coating repairs. Upon approval by the Engineer, complete the remedial work in accordance with the submitted plan.

TSP-5.4 Remedial Work: The Responsible Party will perform all necessary remedial work described within this Section at no cost to the Department. Should an impasse develop in any regard as to the need for remedial work or the extent required, the Statewide Disputes Review Board will render a final decision by majority vote.
Remedial work will not be required if [*any one of*] the following condition[*s*] is found to apply:
a. Determination that the deficiency was the responsibility of a third party or its actions, unless the third party was performing work included in the Contract.

If a measured distress value indicates remedial action is required per Table TSP-1, the Responsible Party must begin remedial work within 180 calendar days of notification by the Department or a ruling of the Statewide Disputes Review Board.

The Disputes Review Board will determine the allowable duration for the completion of the remedial work, but not to exceed six months.

In the event remedial action is necessary and forensic information is required to determine the source of the distress, the Department may perform destructive testing of the protective coating. The Responsible Party will not be responsible for damages to the protective coating because of any forensic activities conducted by the Department.

The Responsible Party has the first option to perform all remedial work that is determined by the Department to be their responsibility. The Responsible Party must complete all remedial work to the satisfaction of the Engineer. Any disputes regarding the adequacy of the remedial work will be resolved by the Statewide Disputes Review Board. Approval of remedial work does not relieve the Responsible Party from continuing responsibility under the provisions of this Specification.

The Responsible Party shall provide a remedial action plan to the Engineer in writing prior to beginning any remedial work. Meet the requirements of the Specifications when performing any remedial work. Provide maintenance of traffic and containment during remedial work at no additional cost to the Department. Lane closure restrictions listed in the original Contract will apply to remedial work. Containment requirements during surface preparation and coating listed in the original Contract will apply to remedial work. Written requests to obtain permission for lane closures for either forensic investigation or remedial work must be made to the Engineer 48 hours in advance of any lane closures. Do not perform any lane closures until written permission is given by the Engineer.

If remedial work necessitates a corrective action to any other affected Contract work, perform these corrective actions using similar products at no additional cost to the Department.

TSP-6 Responsible Party's Failure to Perform.

Should the Responsible Party fail to timely submit any dispute to the Statewide Disputes Review Board, fail to satisfactorily perform any remedial work, or fail to compensate the Department for any remedial work performed by the Department and determined to be the Responsible Party's responsibility in accordance with this Specification, the Department will suspend, revoke or deny the Responsible Party's certificate of qualification under the terms of Section 337.16(d)(2), Florida Statutes, for a minimum of six months or until the remedial work has been satisfactorily performed (or full and complete payment for remedial work performed by others made to the Department), whichever is longer. Should the Responsible Party choose to challenge the Department's notification of intent for suspension, revocation or denial of qualification and the Department's action is upheld, the Responsible Party will have its qualification suspended for an additional minimum of six months.

The remedial work is not an obligation of the Contractor's bond required by Section 337.18, Florida Statutes.