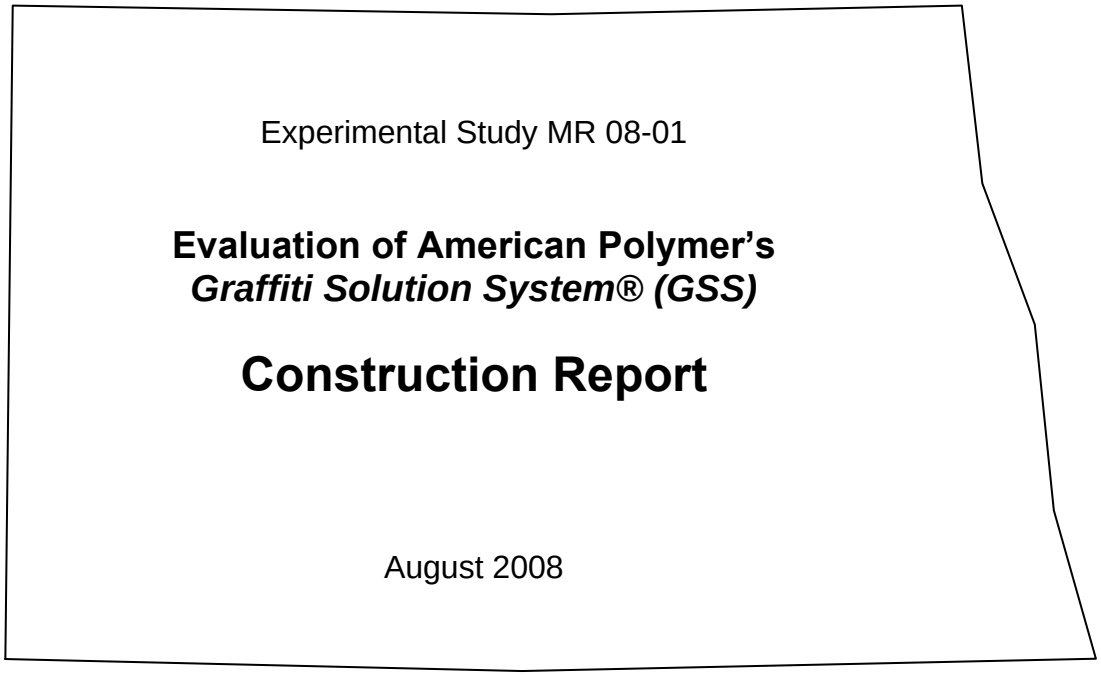
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION



Experimental Study MR 08-01

Evaluation of American Polymer's
Graffiti Solution System® (GSS)

Construction Report

August 2008

Prepared by

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Written by
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Purpose and Need

The NDDOT's mission is to provide a transportation system that safely moves people and goods. This mission wouldn't be complete without recognizing and understanding how safe North Dakota communities *feel* within this system. A substantial threat to a community's sense of security is graffiti. The public presence of graffiti degrades communal spaces and creates a fear of escalating crime.

Numerous NDDOT projects are defaced or "tagged" with graffiti every year, including bridge abutments, piers and retaining walls. Graffiti brings an atmosphere of disregard with it, and once a structure is tagged, further vandalism is often inevitable. Surrounding properties may become targets, and soon the area is deemed dangerous and avoided by the general public. The immediate removal of graffiti prevents this downward slope by maintaining a respect for public property and enhancing a community's confidence in their leadership's ability to control disorderly behavior.

The NDDOT does not have a formal anti-graffiti program. Anti-graffiti efforts are location and project-specific. Although several anti-graffiti coatings have been tested on new structures, these products have been sacrificial in nature and have necessitated the reapplication of the coating after the graffiti was removed. During recent years, the average price paid for these products has been between $0.80-$1.26/SF.

If graffiti is observed by NDDOT maintenance personnel – or called to their attention – an attempt is made to remove it. If unsuccessful, the tagged area is painted over by NDDOT staff or a contractor. An attempt is made to match the original paint or surface color; however the often dark and/or varied colors of graffiti are not conducive to this effort.

Research is needed to evaluate products that make graffiti removal faster and easier, without compromising a structure's aesthetics. This project proposes an evaluation of American Polymer's *Graffiti Solution System® (GSS)*, a non-sacrificial anti-graffiti solution.

The vendor asserts that their product has "pure affinity" polymers within the patented coatings that, when applied to substrates, act as a sealant, improve adhesion, preserve color, and protect the surface while preparing it for graffiti removal. American

Polymer's product *Erasol*® is a non-flammable, biodegradable liquid that may be sprayed on the prepared surface in order to lift off the graffiti. The graffiti can then be sprayed off with water.

Objective

The objective of this research is to evaluate the application of the coatings and the effectiveness of the graffiti removal. The research will involve observing both the product application and multiple graffiti removals.

Scope

GSS® product application and evaluation will take place on the east abutment of the Heart River Bridge in Mandan, ND. The Heart River Bridge was rebuilt during the summer of 2008. In the past, the old structure was frequently vandalized.

Photo 1: Heart River Bridge, looking West

American Polymer's *GSS*® representative Michael Mann is the technical support for the product application. The cost of the *GSS*® materials is estimated to be $1.45/ft^2. Based on previous projects, the manufacturer estimates labor to cost $1.00 - $1.50/ft^2.

This project will comprise approximately 215 square feet of the east abutment. Assuming 3 coats of product, the estimated total cost is $1750.

The *GSS*® product will be evaluated over 10 years, the length of time American Polymer guarantees their product without re-application. The Materials and Research Division will lead the evaluation. The factors that will be evaluated are appearance of treated area, presence of graffiti, ease of graffiti removal and appearance of treated area after graffiti removal. A visual evaluation will be conducted on a yearly basis, or as often as graffiti incidents dictate. A report by Materials and Research will be published every 2 years.

Location

This project is located at the Heart River Bridge in Mandan, North Dakota. The original bridge was constructed in 1946. During the summer of 2008, the old bridge was demolished and a new Heart River Bridge constructed.

The new bridge (bridge number 94-915.101) is a 3-span concrete bridge with its east abutment serving as the anti-graffiti test area. The appropriate polymer coatings will be applied based on the American Polymer representative's recommendation for a concrete substrate.

Photo 2: Heart River Bridge: East Abutment

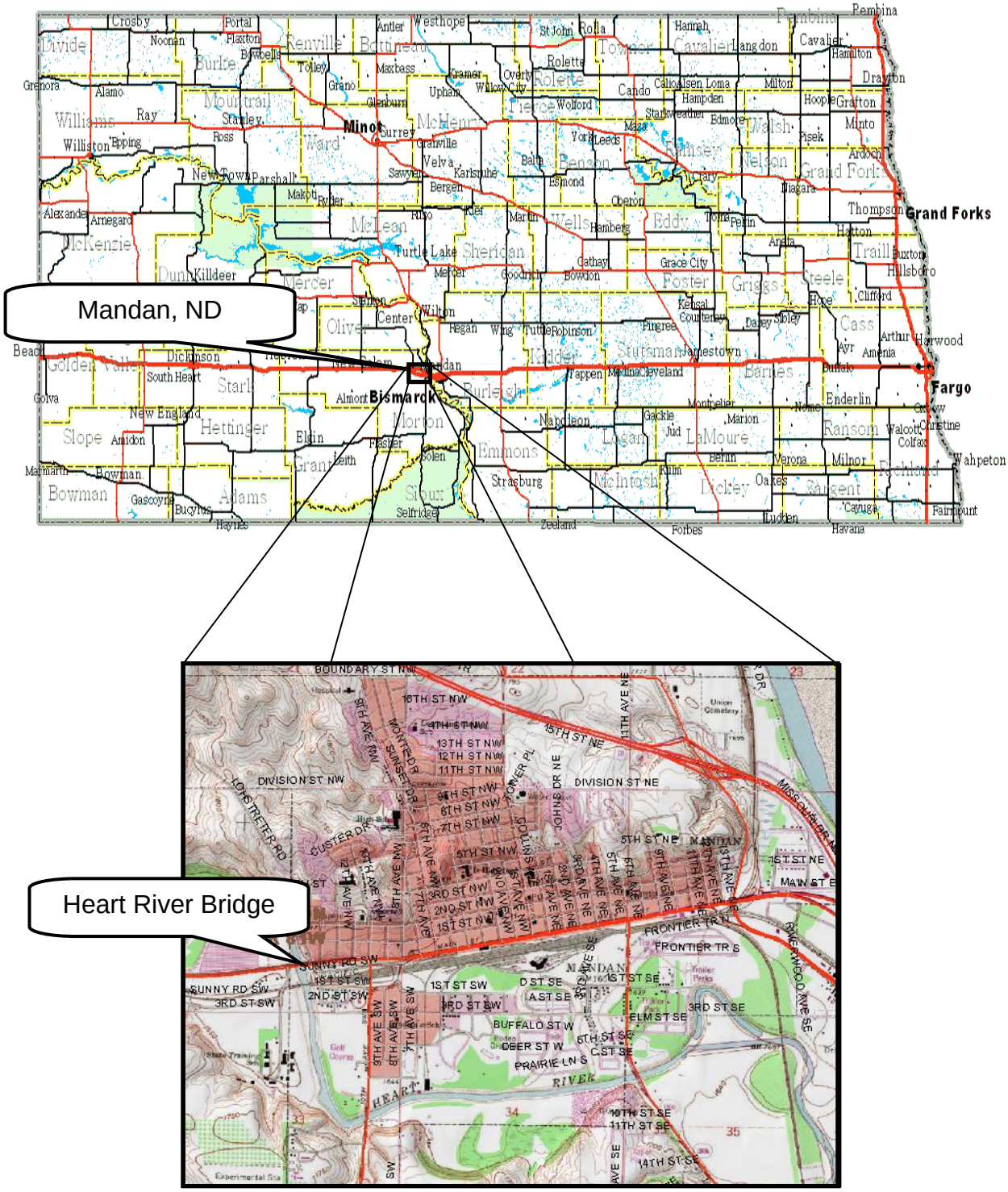

Figure 1: Location of Heart River Bridge in Mandan, ND

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Graffiti Solution System® Overview

The application of American Polymer's Graffiti Solution System® *(GSS)*, a system involving 2 base coats and 1 top coat, took place in September 2008 on the Heart River Bridge in Mandan, ND. American Polymer representative Michael Mann was present to apply the *GSS*® base and top coat onto approximately 450 square feet of the bridge's east abutment, a space frequently hit with graffiti. The size of the test area and estimated number of coatings changed as Materials & Research became more familiar with the product. Following the application, the treated concrete was tagged with spray paint both before and after the cure time had passed. The *GSS* removal agent *Erasol*® was used during the removal process.

GSS® Application

American Polymer's *Graffiti Solution System*® was applied as a NDDOT experimental project on September 29-30th, 2008. The first day, Monday the 29th, the American Polymer representative, M & R personnel and Dean Schloss, Bismarck District, met to discuss the application process and additional supplies needed. The additional supplies needed were two 9" steel roller frames with handles, four paint rollers, an extension handle, latex gloves, eye goggles, stirring sticks, lacquer thinner (or mineral solvent), two respirator masks, a push broom, and two 5 gallon buckets of water. It was also arranged to rent two airless paint sprayers – one the first day for the water-based base coat, and another the second day for the oil-based top coat. An electric generator from Materials and Research was brought to supply power to the paint sprayers.

The process at the Heart River Bridge began with using a push broom to remove loose dirt on the abutment. Since the bridge was quite new, this was an effective method of cleaning and preparing the surface. See Photos 3 & 4. In other situations, the surface should be cleaned off with highly pressurized water the previous day and allowed to dry.

Photo 3: Test area

Photo 4: Brooming off debris from abutment

Next, the base coat "Clear VU High Solids Base Coating AP 307" was mixed up with a wooden paint stick. The base coat can also be mixed up by pouring it repeatedly between 2 buckets to ensure uniformity. The intake of the paint sprayer was placed into the base coat bucket, the generator turned on, and the paint sprayer primed and pressurized.

Photo 5: Base Coat

Photo 6: Paint sprayer intake

The manufacturer's representative sprayed on the base coat in a horizontal fashion starting at the top of the abutment to the bottom, and then vertically from left to right. M & R personnel vertically back-rolled the coating immediately after it was sprayed on using a paint roller and extension handle. See Photos 6 & 7.

Photo 6: Base coat application

Photo 7: Backrolling base coat

The base coat seals porous substrates, protects the color and texture, and improves the adhesion and coverage of the top anti-graffiti coat. Concrete substrates demand a base coat, although others such as steel may need only the top coat to fulfill the system's purpose. The first base coat took 20 minutes to apply, or about 22.5 ft^2/min. The coating turned a translucent blue where there was residual moisture in the wall. This happened on one area of the abutment. See Photo 8. The manufacturer's representative assured that some blue coloring was acceptable and it would most likely diminish shortly. After about 10 more minutes the blue was barely visible. See Photo 9.

Photo 8: Blue tinted residual moisture

Photo 9: Diminished blue tint ≈10 min later

The first coat was considered set and ready for the second coat when it was dry to the touch yet still slightly "tacky" – about 30 minutes later in this case. The second coat was done in the same manner as the first, sprayed in a cross-hatched pattern

followed by back-rolling vertically. The second coat application took only 17 minutes, or about 26.5 ft^2/min. The total quantity of base coat used was about 3 gallons. Therefore one gallon of base coat could be used to cover 150 square feet of area.

The application of the base coating was finished by 3:19 p.m. A dry time of 18-24 hours is needed, and so it was agreed to meet at 9:30 a.m. the next morning, allowing 18 hours to pass before the application of the anti-graffiti top coat. Site clean-up involved thoroughly washing out the airless paint sprayer by running water from the 5-gallon buckets through it – according to the manufacturer's recommendations – and then carrying it back to the truck along with the remaining base coat and paint rollers.

The second day began with picking up the second airless paint sprayer meant for use with oil-based paints, and driving out to the Heart River Bridge again. The same supplies were used as in the base coat application, with the addition of 2 buckets for mixing up the two-part top coat and a thermo-gun. The thermo-gun was used to measure the temperature of the abutment's surface, which was 54.5° F and within the proper range of 40°-100° F.

The paint sprayer, paint rollers, cans of top coat and buckets were moved close to the abutment atop the rip rap. The first top coat mixture was pigmented a gray color in order to cover up an area of about 42 ft^2 of existing graffiti on the abutment. The gray color was not an exact match to the color of the abutment, but for this study an exact match was not requested. The top coat had two components, consisting of 4 parts "Part A" and 1 part "Part B" mixed together in a bucket with a wooden paint stick. See Photos 10 & 11.

Photo 10: "Part A" & "Part B" of pigmented top coat

Photo 11: Mixing "Part A" & "Part B"

The pigmented top coat application began at 9:40 a.m. and was rolled on in a cross-hatched pattern, first horizontally, and then vertically. The paint sprayer was not used due to the small area receiving the pigmented coating and so as not to contaminate the clear top coat – to be used shortly – with the pigmented coating inside the sprayer. The graffiti-tagged area was covered with its first pigmented coat by 10:16 a.m., 36 minutes later, at a rate of 1.17 ft^2/min. See Photos 12 & 13. The dry time needed between coats is approximately 1 hour, just until the first coat is slightly "tacky" to the touch.

Photo 12: Rolling on pigmented coat

Photo 13: Touching up Joint

Next was the application of the first clear top coat. The large can of clear top coat was opened and mixed with a wooden paint stick in order to redistribute the flattening agent that had settled to the bottom. See Photos 14 & 15. This mixing was to last for about 5 minutes, or the solution could have been mixed by pouring it between buckets 5 times.

Photo 14: Settled flattening agent

Photo 15: Distributing flattening agent

The first clear top coat application took 21 minutes on an area of 408 ft^2, an application rate of 19.43 ft^2/min. Once again it was applied in a cross-hatched fashion with a clean roller-brush for backrolling. At this point it was noticed that there was still some blue from yesterday indicating residual moisture. See Photo 16.

Photo 16: Faint blue on one wall

It was also decided to spray and backroll some of the excess top coat onto the south wing wall to see how the anti-graffiti properties worked without a base coat. The wing wall consisted of highly texturized concrete and had a Surface Finish 'D' already on it. The manufacturer's representative indicated that *GSS*® is compatible with most surface finishes. See Photos 17 & 18.

Photo 17: Spraying Top Coat on wing wall

Photo 18: Backrolling wing wall

The second pigmented coat application began at 11:30 a.m., more than an hour after the first, and was rolled on horizontally, then vertically. It was finished up by 11:45 a.m. for a roll-on application rate of 2.8 ft^2/min. A new roller brush was attached to the extension handle to prepare for backrolling the next clear coat.

After an hour-long dry time, the second clear coat application was sprayed on both vertically and horizontally, and backrolled at a rate of 31.38 ft^2/min. This final coating application was done in 13 minutes at 12:05 p.m. The manufacturer's representative recommended a curing time of 7-10 days. Full curing time is normally 7 days, but due to the lack of sunlight hitting the abutment a longer curing time was advised.

Lacquer thinner was passed through the paint sprayer to remove the solvent-based top coatings, although the preferred solution to use is methyl ethyl ketone (MEK). See Photos 18 & 19. The supplies were gathered and loaded into the truck and the project was completely finished by 12:30 p.m. On a side note, the paint sprayer that was used to apply the top coats had some residual reddish material in it, possibly deck stain, which may have gotten into the product.

Photo 18: Laquer thinner

Photo 19: Passing laquer thinner through paint sprayer

Photos 20 & 21 illustrate the abutment before and after the product application.

Photo 20: Before Product Application

Photo 21: After Product Application

Evalution

Six days after application of the *GSS*®, Materials & Research personnel went out to the Heart River Bridge to apply graffiti on the test area. This was to test the product's ability to allow graffiti removal even when the area is tagged before the cure time has passed. Four areas on the abutment were tagged with orange, solvent-based spray paint, including the north wing wall with no base coat. Starting on the south end of the east abutment, the applications were marked from 1 to 4 along with the date. See Photos 22-25.

Photo 22: Solvent-based Paint

Photo 23: Spray-painting test graffiti

Photo 24: Test Graffiti

Photo 25: Test Graffiti

On October 14, 2008, Materials & Research personnel returned to the Heart River Bridge to attempt graffiti removal using American Polymer's *GSS*® removal solution *Erasol*®. The supplies needed for this endeavor were the *Erasol*® solution in a spray bottle, a brass brush, a low pressure water source (in this case a Hudson sprayer), protective gloves and eyewear.

First, *Erasol*® was sprayed on according to the *GSS*® Application Guide, starting at the top on the section marked "10/06 3". See Photo 26. The entire tagged area was sprayed and the solvent-based paint was broken up with a brass-bristled brush. The graffiti lifted off the substrate, and any further scrubbing simply spread the paint residue around. See Photo 27.

Photo 26: Spraying *Erasol*®

Photo 27: Brass brushing off graffiti

Photo 28: Rinsing with low-pressure

Photo 29: Graffiti removed

Next, water was sprayed on with a Hudson hand-pump sprayer. See Photo 28. This did remove most of the graffiti, yet a faint dark shadow still appeared. See Photo 29. It appeared as though more *Erasol*® along with additional brushing and a water sprayer with higher pressure would likely remove the graffiti completely. Since *Erasol*® neutralizes on contact with water, further work couldn't be done on the wet surface and the area was left to dry. Materials & Research personnel agreed to return the following week with a higher pressure water source.

On October 23, 2008 M&R personnel went to Heart River Bridge to meet Bismarck District staff, including Gary Feist, Jim Colling, Dean Schloss, Jamie Demaree and Kent Leysring. The Bismarck District staff had come to observe the graffiti removal as well as to bring their culvert washer for use as a source of higher water pressure.

The tagged areas were sprayed with *Erasol*® and the solution was allowed to soak in for a few minutes. The graffiti was then scrubbed with the brass brush to "lift" the graffiti off the substrate. If any graffiti paint wasn't lifting, more solution was sprayed on it and it was brushed again.

After the graffiti appeared to be fully lifted, Kent Leysring used the culvert washer to spray the wall with moderately pressurized water. The graffiti was completely removed. This process occurred on all 4 sections on the abutment, entirely removing the graffiti. See Photos 30-32.

Photo 30: Spraying *Erasol*®

Photo 31: Rinsing with moderately pressurized water

Photo 32: After graffiti removal

The only exception to this success was the north wing wall of the east abutment, the wall that had received only the top coat. The lack of a base coat on this texturized surface made graffiti removal a challenge. This area was sprayed with pressurized water; however there was still some remaining graffiti, even after repeated spraying and scrubbing.

Materials & Research had also sprayed a small amount of black colored graffiti on the abutment to test out a different type of spray paint. This too was easily removed. The Anti-Graffiti Solution System was overall a success.

At the suggestion of Jim Colling, M & R personnel went down beneath the Expressway Bridge to observe the vandalism done there. The concrete abutments and piers, as well as parts of the steel substructure, were heavily covered with graffiti. See Photos 33 & 34.

Photo 33: Portion of Expressway Bridge abutment

Photo 34: Expressway Bridge piers

The *Erasol*® product was tested on some old graffiti and a small portion did come off, but it was obvious that a coating underneath the graffiti was needed for the *Erasol*® product to work. In the case of this bridge, a pigmented version of the *GSS*® coating could be used to cover the current graffiti, as well as to allow for easy future graffiti removals.

Summary

American Polymer's *Graffiti Solution System*® effectively protected the surfaces where the coating system was properly applied. Following the coating application, all that was needed to lift and remove graffiti from the wall was *Erasol*® solution, a brass brush and moderately pressurized water. American Polymer guarantees this coating system for at least 10 years and suggests it will likely last 15-20 years as based on a prior independent field investigation done by KTA-Tator, Inc. The guarantee covers an absence of peeling, flaking, chalking or discernable fading as well as the ability to remove graffiti without staining, shadowing, ghosting or any other changes in appearance. There is no need for reapplication after using the *Erasol*® solution to clean tagged, protected surfaces.

The final cost of this product supplied by American Polymer was $668.00, which included the base coat, top coats, *Erasol*®, trigger-sprayer and shipping costs. The technical assistance and travel costs of the manufacturer's representative were

provided as a courtesy by American Polymer. The only additional cost to the NDDOT was the rental of 2 airless paint sprayers totaling $60.00, and the purchase of additional supplies totaling $44.33. This amounted to a grand total of $772.33, which comes to approximately $1.72/ft^2 (without labor).

A provisional cost comparison between this permanent product and sacrificial products used in the past is approximately $2.70/ft^2 for *GSS*® versus the average cost of $0.99/ft^2 paid for sacrificial products during the last 3 years. These are initial costs, including material and labor at the time of application, without consideration of product lifespan.

If the NDDOT were to use *GSS*® on more structures, a person certified to apply *GSS*® must be used in order to take advantage of the product's warranty. Certification requires training from an American Polymer representative, which carries a fee of $1500 plus the representative's travel expenses.

Recommendation

It is recommended that American Polymer's *Graffiti Solution System*® be used on additional NDDOT surfaces that may be subjected to graffiti vandalism. The cost is minimal given the manufacturer's warranty and project life. A system such as *GSS*® would be especially worthwhile in areas that have already been tagged, wherein the product can be tinted to cover existing graffiti as well as to facilitate future removals. A special provision (SP) may be developed with items covering material and performance requirements that highlight the advanced performance possibilities of non-sacrificial anti-graffiti products.