Detecting Corrosion Early Extends Service Life of Bridge Paint Coating

What Was the Need?
Maintaining and repairing Minnesota’s more than 4,000 steel bridges challenge local and state budgets, as well as bridge maintenance crews and bridge inspectors who evaluate each structure at least once every two years.

Effective paint coating systems protect steel structures against corrosion, particularly at beam ends, joints, bearings and other locations where water and roadway salt can corrode bridge elements.

Keeping bridge paint coatings in good condition is critical to protecting the underlying steel elements. When bridge inspections identify localized corrosion, these areas must be cleaned and a maintenance paint coating applied to limit the long-term damage potential from corrosion and to extend the service life of the bridge.

Using a 2014 review of state practices in bridge maintenance painting operations, MnDOT developed the Steel Bridge Coating Condition Assessment Photographic Field Guide and the Bridge Maintenance Painting Manual to help bridge inspectors rate coating systems and identify appropriate maintenance strategies.

How well specific paint coating systems perform in Minnesota in terms of workability by paint crews, surface preparation needs, coating durability, corrosion control and bridge element service life remained of interest to MnDOT’s Bridge Office.

What Was Our Goal?
MnDOT sought to identify maintenance paint coating systems that crews could use with minimal surface preparation to extend the life of existing paint coatings on steel bridges.

What Did We Do?
Four paint coating manufacturers provided product recommendations to apply in limited surface preparation applications. Researchers selected five maintenance paint coating systems for field evaluation. Paint coating manufacturers then trained MnDOT bridge maintenance crews to apply these coatings at five areas on two bridges over Ayd Mill Road in St. Paul. Each bridge provided easy access with limited traffic control needs. Each of the five areas included a beam end, a joint and a bearing.

Before work began, the project team inspected the site. Then trained MnDOT bridge maintenance crews cleaned and prepared surfaces and applied primer, noting mixing and application performance of the different primers. After the primer coatings had cured enough to topcoat, crews applied finishes coatings and evaluated each system’s mixing performance, ease of application, drying time and finished appearance. Researchers monitored performance of each test section for three years following application. After the third year of application, researchers also tested adhesion of the maintenance paint coatings, evaluated performance data and then prepared final recommendations.
Before applying the new paint, a crew member notes the surface preparation level deployed at each area of beam that was to be painted.

What Did We Learn?

Each of the five maintenance paint coating systems performed well enough to extend the service lives of the bridges exhibiting localized corrosion. Timing is crucial to achieve a durable treatment and extend the service life. Once corrosion has been identified, the sooner a maintenance paint coating can be applied, the better to reduce effort in surface preparation and to ensure a longer-lasting treatment. If coating deterioration is caught early enough, a more cost-effective and efficient level of surface preparation can be utilized and a maintenance paint coating system can be expected to perform well for five years.

If the existing paint coating was a solvent-based material, new maintenance paint coatings could be either water- or solvent-based. If the existing paint coating was water-based, the new maintenance paint coating must be water-based.

Maintenance painting can be scheduled based on the inspected condition rating of the bridge paint coating system:

• If in good condition, no maintenance painting is required; the coating can be re-evaluated during the next inspection.
• If in fair condition, maintenance painting should be completed within two years.
• If in poor condition, maintenance painting should be completed within one year.
• If in severe condition, the paint coating should be removed and replaced.

Other factors, such as pitting with rusting and anti-graffiti coatings, which were impossible to remove with the surface preparation methods employed, adversely affected the performance of the maintenance paint coating. Paint coating removal and replacement should be considered for bridges exhibiting pitting with rusting or with anti-graffiti coatings.

What’s Next?

Researchers prepared recommendations for MnDOT to use in updating its Bridge Maintenance Painting Manual. These included conditions for when to apply maintenance paint coatings and when to remove paint and recoat bridges. MnDOT may eventually consider the tested generic maintenance paint coating systems for its approved products list, a process that will include investigation of the material properties of each system.