

## SUMMARYREPORT



U.S. Department of Transportation  
Federal Highway Administration

**Turner-Fairbank**  
Highway Research Center

Research, Development,  
and Technology  
Turner-Fairbank Highway  
Research Center  
6300 Georgetown Pike  
McLean, VA 22101-2296

<https://highways.dot.gov/research>

# Industry-Recognized Corrosion Prevention Worker Certifications Effectiveness Evaluation

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**FHWA Contact: Frank Jalinoos, HRDI-30, (202) 493-3082,  
[frank.jalinoos@dot.gov](mailto:frank.jalinoos@dot.gov)**

## SCOPE

The Senate and House Appropriation Committee reports to accompany the U.S. Department of Transportation and the U.S. Department of Housing and Urban Development, and Related Agencies Appropriation Bill, 2017 (H. Rept. 114-243 and S. Rept. 114-606) requested the Federal Highway Administration (FHWA) to assess the impact and value of certification requirements for workers performing bridge corrosion prevention work. The language from the House and Senate reports states:

### House Report

The Committee directs FHWA to conduct a study comparing the cost effectiveness of industry-recognized corrosion prevention worker certifications on federally funded corrosion prevention bridge and overpass projects. The study shall compare no less than 12 currently obligated projects preserving the structure of bridges using corrosion prevention and mitigation systems, including at least 6 projects that utilize an industry recognized corrosion prevention worker standard and no less than 6 similar currently obligated projects that do not use an industry recognized worker standard. The study shall include a comparison of the time to complete projects, initial quality control (QC) reports, and budgetary overruns. The FHWA shall submit the results from its study in a report to the House and Senate Committees on Appropriations no more than 2 years after enactment of this act.”

### Senate Report

The Committee directs FHWA to conduct a study comparing the cost-effectiveness of industry-recognized corrosion prevention worker certifications on federally funded corrosion prevention bridge and overpass projects. The study shall compare no less than 12 currently obligated projects preserving the structure of bridges using corrosion prevention and mitigation systems, including at least 6 projects that utilize an industry recognized corrosion prevention worker standard and no less than 6 similar projects that do not use an industry recognized worker standard. The study shall include a comparison of the time to complete projects, initial QC reports, and budgetary overruns. The FHWA shall submit the results from its study in a report to the House and Senate Committees on Appropriations no more than 2 years after enactment of this Act.

This report documents the research conducted on worker certifications for blasting and painting, as well as the information analyzed from specific bridge corrosion prevention projects. It is important to understand that throughout this report, much of the discussion centers on contractor (bridge painting contracting firm) certification, as that type of program has been implemented for some time. The specific issue of worker (blaster/painter) certification is newer, and in the process of being implemented selectively within the bridge painting industry. The programs

are linked as part of contractor certification criteria which now includes the use/requirement of certified workers.

## SUMMARY OF SPECIFIC FINDINGS

The study explored the specific items requested by the congressional language cited above. In all cases discussed and reviewed with the various State department of transportation (State DOT) bridge owners, it was found that little to no data were tracked or recorded that tied overall project quality to worker certifications. Consequently, it was not possible to establish specific links between data relative to specific bridge painting projects and the certification status of workers on those jobs. However, the overall consensus from the various State DOT bridge owners was that contractor certifications have been very successful in allowing owners to make informed choices for contractors, and that the program has improved overall quality. The feeling is that the newer worker certifications (and the associated training) will be a benefit to the contractors, and consequently, the bridge owners, but to what level has yet to be determined.

In exploring the specific items requested, the findings can be summarized as follows:

- **Time-to-Complete Projects – Various States** provided qualitative input regarding this question. Time-to-mobilization on a project is a major issue in the bridge painting industry and this time-to-mobilization frequently has an impact on delivery time for the entire project. Mobilization time is most often impacted by ongoing workload of the specific contractor and climate conditions before and during the job. Availability of qualified workers was cited as a long-term impacting issue for contractors, but no specific data related to the delay in executing jobs was cited by stakeholders. The available certification programs intend to alleviate qualified worker shortfalls as the program matures into the mainstream of the industry.
- **Initial Quality Control Reports – QC documentation** for bridge painting projects is institutionalized through the contractor certification programs presently mandated by many States. As such, QC records are not directly impacted by the certification status of individual workers. This issue was explored specifically with State DOT technical personnel and no direct link between quality of the work and specific certification status of workers could be established. For the most part, the development and interpretation of quality records is the purview of QC inspectors for the contractor and the owner.

- **Budgetary Overruns – Budget impacts** of worker certification could not be directly established in this analysis. Bridge painting work is accomplished on almost a 100 percent fixed price bid basis, so the end results from a budget standpoint are primarily pre-established during the competitive bidding process. Any potential cost savings realization achieved through use of certified vs. non-certified workers would be transparent to the owner agency and (only perhaps) noticeable to the contractor through more efficient accomplishment of job tasks. In discussing this issue with contractors interviewed during this study, no direct links were provided above the general admission that a better trained workforce performs blasting and painting tasking in a higher quality and cost efficient manner. This general conclusion is important to the promotion of training to specific worker tasks, but the direct line to value of certification in particular is difficult to establish.

## BACKGROUND

The FHWA has sponsored an active program in applied research related to corrosion protection and control for highway infrastructure for several decades. Individual States also have periodically sponsored their own research projects and developed individual requirements for corrosion prevention of highway infrastructure assets. The FHWA program has historically worked cooperatively with these State efforts to find common technology and management solutions to shared national issues.<sup>1 2 3</sup>

The use of industry-certified corrosion-prevention contractors has been a developing issue in the highway sector for approximately 20 years. The self-governing Painting Contractor Certification Program (PCCP) run by the Society for Protective Coatings (SSPC) has been successfully adopted by over 20 State highway agencies as a requirement for hiring contractors that have demonstrated expertise, equipment, and knowledge to successfully, and safely conduct work to access and rehabilitate coatings on operating highway bridges. This program, while managed by a non-profit professional trade association with direct governance from the participating contractors, has significant interaction, input, and feedback from the technical personnel within the public sector (the State highway agencies and FHWA). It is viewed as having value due to its active SSPC-administered auditing component and a disciplinary action criteria, which can (and has) removed certifications from contractors that fail quality audits or commit safety or contractual violations.

With the success of training and certification of the industrial painting firms through SSPC-PCCP, the rational progression

<sup>1</sup> "Environmentally Acceptable Materials for the Corrosion Protection of Steel Bridges," FHWA-RD-96-010.

<sup>2</sup> "Guidelines for Maintenance Painting of Steel Bridges," FHWA-RD-97-092.

<sup>3</sup> "Lead Bridge Paint Removal, Containment, and Disposal," FHWA-RD-94-100.

of the program was to bring quality and consistency to the workforce through development and implementation of a progressive tiered certification program for blasters and painters – that is, *individual worker certification, in addition to the existing contractor certifications*. In 2007, SSPC, NACE International (formerly the National Association of Corrosion Engineers), and the International Union of Painters and Allied Trades (IUPAT) worked cooperatively to develop training and certification in this area. This program is now implemented via the contractor certification programs of SSPC-PCCP and, more recently, NACE-International, as the NACE International Institute Contractor Accreditation Program (NIICAP). The contractors within these programs have supported the worker-level certification requirements as these requirements have provided a consistent source of skilled and experienced workers to place on their jobs which are, by definition, located at bridges all around the country on the various components of the highway system. The program also aims to develop continuity of the workforce by providing a job-retention inducement and a career path for experienced workers through workforce development as in a traditional apprentice-journeyman arrangement.

The timing of this subject study and analysis is concurrent with present national level questions and initiatives in this area. These include the President’s recent Executive Order, Expanding Apprenticeships in America (June 15, 2017) that doubled Federal investment in workforce development and apprenticeship programs. In addition, the success of similar initiatives in other nations (e.g., Germany) has shown that investment in apprenticeship on a national scale can dramatically increase the quality of products and the quality of life of workers, particularly in their early employment years.<sup>4 5</sup>

With the increase in the overall costs associated with rehabilitation and corrosion prevention of our Nation’s bridges, the expectation of bridge-owner agencies has increased dramatically regarding the expected performance duration of protective coatings systems. Where a satisfactory life span for a coating system was once 10 years, coating systems are now expected to last at least 25 years. In many cases, the life cycle design of bridge structures has now exceeded 100 years, so longevity (directly related to quality of coating systems) has become a critical value item.

The quest for quality in coating long-term performance has pushed coatings materials technology, but many of the key factors associated with ultimate coating performance are directly related to application quality. Quality can be directly linked to the skill and ability of the craftsmen doing the work. One significant manner of increasing and maintaining this level of quality application is through

consistently applied worker training. This could take the form of workers becoming certified in the work through an industry-developed program that is jointly recognized by both the industry and the end-user (State DOTs) community.

## STUDY METHODOLOGY

In order to address the question posed by the House and Senate Committees on Appropriations, FHWA initially contacted stakeholders within the bridge coatings sector. These included union (IUPAT), trade association (SSPC, NACE), and bridge owner agencies. Initial agency contacts were made through FHWA Division Office bridge personnel. These contacts were used to define the scope and details of the issue, the status of worker certification programs, and to determine an efficient manner for data collection and interpretation of the limited data available to address the question.

A brief technical survey was sent to all FHWA division offices. Results of this questionnaire led to further, more detailed discussions with selected State technical personnel that showed knowledge in the subject and willingness to assist in development of information on the topic.

An initial finding from detailed conversations with FHWA Division and State technical personnel indicated that quantitative data relating the production and quality of blasting and painting of individual workers on specific projects does not exist. For this reason, the scope of the inquiries with knowledgeable field technical personnel (State and contractors) was expanded to investigation of bridge projects across the portfolio of the States interviewed. In this manner, a more realistic and accurate picture of the impact (or lack thereof) of certified workers on bridge painting operations can be reported.

In the course of this study, FHWA ultimately gathered information from 12 State DOTs, estimated to pertain to over 30 individual, currently obligated, infrastructure projects. Details for the individual States and projects are discussed below.

## FIRM CERTIFICATION HAS BROUGHT VALUE

Industry-based certifications of firms involved in bridge painting operations have become an essential component of bridge preservation programs for many States over the past two decades. State-by-State requirements for such certifications have become a successful component of these operations, particularly in efforts to limit the impact of the abrasive blasting removal of older paints from bridges (due to lead exposure). This has been particularly true for the many thousands of older structures that were originally

<sup>4</sup>“This Country Has the Real Apprentice,” US News and World Report, July 5, 2017.

<sup>5</sup>“Apprenticeship Programs in a Changing Economic World,” Eric A. Hanushek and Ludger Woessmann, Brookings Institute, June 28, 2017.



painted and subsequently maintained with paints containing toxic constituents. The removal of lead-containing paint began a movement of training and certifying contractors due to safety regulations in this area.

The primary organization providing certifications for bridge painting contractors is SSPC: The Society for Protective Coatings. This not-for-profit professional trade organization has a diverse membership that spreads across demographics of structure owners, contractors, engineers, paint and equipment suppliers, labor, and safety professionals. A primary mission of SSPC has been education of members to work safely and in a quality manner regarding industrial painting of large structures.

The SSPC's PCCP was established in the 1990s to address the growing technical demands of structure owners (public and private) and of contractors as regulations and corrosion performance demands increased. The program has a first level requirement for certification of a contractor based on the construction and implementation of an internal QC and quality management system. This first level, termed QP-1 certification, is mandatory prior to the contractor receiving further specialty certifications such as QP-2 (hazardous paint removal), QP-3 (shop painting), etc.

As of this writing, there are 320 contractors certified by SSPC under the QP-1 (quality) program and 197 certified by SSPC under the QP-2 (hazardous paint removal) program. There are three contractors presently accredited to do field blasting and painting under the more recently established NACE NIICAP program.

The contractor certification programs have been used as a tool to limit liability and improve quality on bridge painting jobs. Several other owners of infrastructure (utilities, U.S. Army Corps, U.S. Navy) have also found such programs useful. However, these certifications have been for contracting firms rather than individual workers.

Over the past several years, the U.S. Navy and other organizations have begun mandating specific training and certification programs for inspectors and applicators of coatings on the *worker level*. SSPC: The Society for Protective Coatings, NACE International: The Corrosion Society, and union organizations have led development and implementation of training and certification activities for abrasive blasting and painting personnel in recent years.

## EXISTING CERTIFICATION PROGRAMS

In the 1990s, firm level qualification for abrasive blasting and painting began with SSPC QP-1 certification. This certification demonstrates that the contractor has the capability to perform high-quality surface preparation and

coating application in the field on complex industrial and marine structures. This is evaluated through an audit type review, both in the form of paperwork documentation as well as on-site evaluation of practices.<sup>6</sup> This certification provided the industry a national standard to assess firm-level capability prior to contract award. The QP-1 certification answered an industry need for those that required the use of industrial painting contractors.

**Table 1. Applicable Contractor-specific SSPC Standards for Infrastructure Coatings.**

SSPC QP-1	Field Application to Complex Industrial and Marine Structures
SSPC QP-2	Field Removal of Hazardous Coatings
SSPC QP-3	Shop Painting Certification Program
SSPC QP-5	Certification for Coating and Lining Inspection Companies
SSPC QP-6	Contractor Metallizing Certification
SSPC QP-7	Painting Contractor Introductory Program
SSPC QP-8	Installation of Polymer Coatings and Surfacing on Concrete and Other Cementitious Surfaces
SSPC QP-9	Standard Procedure for Evaluating the Qualifications of Commercial Painting and Coating Contractors
SSPC QS-1	Standard Procedure for Evaluating a Contractor's Advanced Quality Management System
SSPC QN-1	Nuclear Coating Supplement

Also in the 1990s, the prominence of lead paint removal led to the development of QP-2 certification. The QP-2 standard and certification were designed to build on the guidelines established in QP-1, and provide facility owners with a means to evaluate the primary capability of industrial paint contractors specific to the needs of hazardous paint removal projects. It was driven by the need to meet an industry-wide need for better control and improved worker safety in the removal of hazardous paint in the field. This certification is at the firm level and does not certify individual workers, and can only be attained if the firm is QP-1 certified.

In addition to QP-2, SSPC developed worker training in regards to lead removal. The C-3 and C-5 training classes are targeted at supervisors (competent persons) who will be performing duties on hazardous paint removal projects on industrial structures or components in the shop or in the field. These classes target training workers in practices

<sup>6</sup> <https://ampp.org/qp-program/qp-quick-links/access-job-forms>.

that ensure safety of the worker and the environment. These worker level certifications are used as standard practice within the bridge painting industry, and they have been successful at minimizing the impact of lead-paint removal on the surrounding environment and on workers. These certifications (C-3/C-5) are linked to a contractor's maintenance of their firm's QP-2 certification and are not specifically linked to the Coating Application Specialist (CAS) worker certification discussed further later in this report. It is also important to recognize that the rapid growth of PCCP in general was particularly linked to the need for a program like QP-2 to meet the specifics of contractor compliance with OSHA's Lead in Construction Rule that was published in 1993. So although QP-1 (quality) is a prerequisite for other specialized QP endorsements, it was the regulatory need for QP-2 that led to the institutionalization of this program within the bridge painting community.

Following the collective, robust effort of the industry (led by the contractors themselves) to implement contractor certification for industrial painting, efforts were undertaken within the industry to reach down to the individual craft workers of the industry and establish individual worker certification programs. The motivation for these efforts was led by the contractors themselves and by the unions that represent blasters and painters, including IUPAT. The SSPC and NACE International worked cooperatively with the union to develop training and certification programs that would create a baseline of knowledge and quality practices that would lead to the development of a career path for craft workers in blasting and painting. These efforts led to a collective set of training materials and standards with each trade organization establishing its own path to certification. The contractors have viewed this effort as a primary means of revitalization of a skilled workforce supply that has had a deficit for many years. A complete list of current individual worker certifications is shown in Table 2.

Table 2. Currently Available SSPC Individual Worker Certifications.	
Type of Training/ Certification	Title of Class
SSPC C-7	Abrasive Blasting
SSPC C-12	Spray Applicator
SSPC C-14	Marine Plural Component
CAS Level 1	Coating Application Specialist
CAS Level 2 Interim	Coating Application Specialist
CAS Level 2 Full	Coating Application Specialist

In 2008, NACE and SSPC issued the Coating Applicator Specialist (CAS) joint standard, SSPC ACS-1/ NACE 13 Coating Applicator Certification. These associations recognized a need for a comprehensive craft worker training and certification program designed to “meet ever-increasing facility owner demands for quality work completed safely.” The intent of these programs is to certify individual industrial painters to the “highest standard of craftsmanship.” The SSPC states on their Website that the process of certifying workers through the process they have laid out will take many years and have developed an interim program which allows the current workforce some time to certify or test out.

**Contractor and Worker Certification are Linked In Present Implementation**

The CAS implementation plan is linked to achieving or maintaining QP-1 certification of the firm. Within the SSPC certification structure, the implementation of CAS certification for individual workers is linked directly to the PCCP certification of the painting contract firm. Specifically, the use of CAS certified workers is called out as a specific “audit item” in the SSPC audit checklist for the PCCP certification of the contracting firm. Because there is presently a ramp up of craft workers obtaining certification, SSPC is using a 50-percent rule to define compliance, meaning that half of the workers on any particular job at any given time are required to hold some level of CAS certification. That is, if the firm is utilizing at least 50 percent of its workers with CAS, it will presently pass its audit. This provision was put in place as an interim requirement to assist in implementation while accounting for the time necessary to process the workforce through the training and certification program. The SSPC’s plan is to implement 100 percent compliance for certified craft workers by 2020.

The SSPC has developed two levels of certification:

- CAS Level 1: A craft worker that is considered an entry-level/trainee application specialist. Level 1 Application Specialists customarily work with and under the supervision of Level 2 Application Specialists. CAS Level 1 requires passing a test related to blasting and painting knowledge. A level 1 CAS is considered to have met and exceeded the qualifications of an individual who is SSPC C7 or SSPC C12 Certified or both.
- CAS Level 2: Level 2 represents the ultimate goal for the program for the label of “Certified Applicator.” Level 2 is divided into “interim” and “full” certification levels. These levels relate to the documented past experience level of the worker (2 years vs. 3 years) and the number of hours of formal skills training (150 hours and 450 hours respectively). This certification level

applies to a craft worker with significant classroom training that passes a knowledge and skills test for abrasive blasting and painting.

It should be noted that research indicates that many contractors have different workers within a crew who perform abrasive blasting and other workers who apply paint. In spite of this, the certification program presently requires training and demonstration in both skill sets. This should be noted as an additional roadblock regarding implementation.

The NACE International has also established its own contractor certification program (NIICAP) over the past 2 years. This program has three contractors presently certified to perform field painting while its specific program for auditing contractors is currently under development. In addition, the NIICAP program does not presently contain a robust approach to lead-containing paint removal (QP-2 under the SSPC program). The intent is to implement worker certification as a key element to this NIICAP program – similar to the implementation within the SSPC program.

## **INFORMATION OBTAINED FROM STATE HIGHWAY AUTHORITIES**

A survey was sent out to all 52 FHWA division offices, related to the types of bridge coatings projects underway and the potential certifications held by the selected contractors. Based on the results of this survey, specific State highway authorities were contacted to determine the details of their use or non-use of certification programs for contractors and workers for bridge painting operations. By contacting a wide variety of State DOT bridge coating specialists, this research effort provided insight into the performance of contractors and workers relative to bridge painting operations that far exceed the minimum dozen jobs prescribed in the congressional language. Since specific quantitative measures of long-term paint performance quality are not recorded on jobs in a manner related to specific workers, this broad-based approach was taken to ensure an accurate picture of the impact and effectiveness of worker certification on these jobs.

Almost all States contract major bridge painting work, although many States use their own State highway maintenance crews to perform small cleaning and painting jobs as part of their normal bridge maintenance efforts. In addition, some States have dedicated State crews for large toll structures. For the contracted bridge painting work, each State operates under its own set of specifications, so there is State-to-State variability in the details of requirements. However, it was found that these efforts had a significant amount of commonality within the practices of the various States. Most States that have active, robust painting programs do require certification of contractors through the

SSPC PCCP program. The certification most commonly required is a level QP-1 (quality painting) and QP-2 (removal of hazardous coating material (e.g., lead containing paint)). These requirements were implemented by States within their State standard specification and individual project special provisions over the past 25 years in order to ensure that the contractors hired to do this work demonstrate a minimum threshold of technical and administrative competence in the practices of blasting and painting. In addition, these requirements also carry the attachment of the associated SSPC Audit program, which SSPC uses to monitor and evaluate the office and field practices of their certified contractors on at least an annual basis. This audit function has an associated disciplinary component that SSPC has used to de-list several contractors in the past based on poor adherence to quality, safety, and regulatory requirements. The States that require this certification generally view this audit and disciplinary component as a value-added proposition of the program. The summaries and analyses that follows are based on individual interviews with knowledgeable representatives from each State's DOT.

### **Pennsylvania DOT (Penn DOT)**

The Penn DOT has had long interest in implementing a PCCP program, but has had difficulty doing so due to concerns over the appearance that certification requirements limit the ability of some firms to bid on work. Recent State level legislation has been enacted to alleviate these concerns and PennDOT is now using certified contractors on all major bridge painting jobs. Discussions with these bridge owners centered on experience executing four recent bridge painting efforts over the past several months.

The Penn DOT and representatives from Allegheny County provided significant insight into recent projects where CAS worker certification was and was not mandated. The Penn DOT representatives that provided input to the study were in consensus that painting contractor certification was a useful tool for them to achieve quality blasting and painting work in a manner that complies with regulations. This was noted as especially valuable on high-value (large, difficult) jobs where access to the structure is a major cost, limited time was available for the work, and traffic impact needed to be minimized or prevented. Allegheny County recently painted two bridges with the same contracting firm performing the work. One job required CAS certified workers, while the other did not. Feedback from the bridge owner and the contractor indicated no negative impact on cost, time to complete, or quality of these jobs due to the additional CAS certification requirement. The union contractor indicated that an increased emphasis on technical training of craft workers has been long overdue in the bridge painting industry, and that certification is a practical method to validate this training. While these two jobs do not indicate a stark real time cost or quality impact or windfall related to the use of certified workers, their



comparison does directly show that implementation of training and certification requirements can be accomplished without adverse impact to contracting and job execution.

### **Massachusetts DOT (Mass DOT)**

The Mass DOT uses certified contractors (i.e., companies certified to SSPC QP standards) on almost all jobs, but does set aside (generally smaller) jobs on occasion that are open to bid by non-certified contractors. This is typical of the approach taken by several States that have the concern of continual refreshing of their local contractor pool. By allowing contractors that have less (or no) experience in bridge painting to obtain that experience on a “lower risk” job, the State can encourage that contractor (if successful) to proceed to enter the certified pool and make itself available for future competitively bid work. Technical personnel for Mass DOT painting operations indicated that they have seen qualitative value associated with certified workers. They cite that there is an improvement in quality with experience of the worker and anything that can be done to encourage continuity within the highly transient workforce has a positive effect. This impact was not specifically measured or apparent in any of the recorded jobsite quality assurance data as these data are not ever related to a specific worker. Discussions with Mass DOT focused on three specific projects executed in 2017 and four projects executed in 2018.

### **Minnesota DOT (MnDOT)**

The MnDOT has not moved to require certified contractors on its bridge painting jobs, but it does continue to maintain a high-level quality bridge painting oversight program run by experienced personnel. The MnDOT has historically had a small pool of bridge painting bidders and has a concern that requirements for certification will further limit that bidding pool and/or add incremental cost without a corresponding value. The MnDOT continues to evaluate this position and maintains detailed information about each application in the construction files. The MnDOT technical personnel for bridge painting were very familiar with the details of the contractor and worker certification programs but did not see the value of making these programs a requirement given the specifics of their bridge painting program. The MnDOT specifically discussed this issue relative to results of a single larger project contracted last year.

### **Michigan DOT (MDOT)**

The MDOT requires bridge painting contractors to be SSPC QP-1 and QP-2 certified. The MDOT has a “provisional” certification based on SSPC QP-7 that allows contractors to work on smaller quantity projects to obtain the QP-2 certification they need to bid larger jobs in the future. Contractors are not allowed to bid on a project unless these certifications are on file with MDOT. Technical personnel from MDOT did not have any specific data from their projects that related quality or job performance impact to the certification status of workers on the job.

### **Maryland State Highway Administration**

The Maryland State Highway Administration (SHA) has a unique hybrid approach to the use of certification for bridge blasting and painting jobs. The Maryland SHA has long been a leader among States in having a dedicated bridge painting program within the State highway bridge office. This program has dedicated technical personnel working for the State and has an annual budget, which targets bridge maintenance painting over a multi-year period. As such, the Maryland SHA was an early adopter with regard to requiring SSPC QP-1 and QP-2 certification for painting contractors. The State feels that this program has provided value in terms of quality (and hence, performance) and also reduced liability for lead paint removal jobs. However, despite the success linked to the use of contractor certification, Maryland does not require contractors to use CAS-certified workers on their jobs. They leave this decision up to the contractor, citing the successful performance of their pool of regular contractors prior to the establishment and integration of CAS into the QP-1 certification program. So, although QP-1 requires CAS workers (as is being phased in today), the Maryland SHA specifically informs contractors that this specific provision is not required in Maryland. Discussions with the Maryland SHA focused on issues impacting their entire portfolio of recent and ongoing projects, including specific discussions of execution of four projects from the past year.

The Maryland SHA has a long-term commitment to full time third-party quality assurance (QA) oversight of all its bridge blast and painting jobs. This is a traditional approach to quality where the contractor is responsible for QC and the State, under separate contract, hires certified inspectors to conduct stop-point signoff inspections that require the process to stop for inspection prior to proceeding. State technical personnel feel that this is essential to achieving quality and serves as their primary gauge on quality of work done by the contractor. Data taken are standard with environmental conditions monitored and spot inspections of blast profile, paint thickness, and paint-coating finish quality to verify more extensive QC measurements made by the contractor’s QC lead. The Maryland SHA is not alone in this third-party approach to quality assurance. Most States with robust, successful painting programs have in-house and contracted trained and certified inspection personnel. The implementation of worker certification, at this time, has not had an impact on the use of third-party inspectors.

The limitations on time-to-completion were most often attributed to weather conditions and occasional rework, but most often attributed to a slow initial mobilization on specific jobs. The Maryland SHA has not traditionally used financial penalties (e.g., liquidated damages) as disincentive to contractors to motivate job schedule, but plans to change this approach in the near future.

The Maryland SHA does not see a direct link between the certified workers on a particular job and the ability to meet budget and quality standards. Jobs are performed on a fixed-price basis and are completed within budget in almost all cases now that lead regulations are understood. Back in the initial days of the impact of lead regulations, budget overruns were very common due to the industry learning curve of the regulations. This was one of the primary overall drivers for the implementation of SSPC QP-2 certification of contractors as a requirement.

The Maryland SHA is subtly unique in its approach to bridge painting as it has a long-standing status for bridge painting technology within the bridge/structures office, whereas many States have bridge painting technologists housed in the materials or chemistry division. In addition, Maryland has a dedicated annual bridge painting budget, which was \$12 million in 2018. This provides a consistent work flow for contractors to rely upon and Maryland has a regular set of contractors that understand their expectations and bid on their work. They also get new bidders from time to time, but some contractors continue to do work in Maryland, while others do not bid future jobs due to full time QA requirements and high expectations.

An important point was brought up in discussion: the desire to certify and expand the scope of work done by blaster/painter trades – namely scaffolding and containment. Many contractors hire a service or subcontractor to do this work. The mobilization, set up, and movement of containment is typically a relatively large portion of the labor hours on the job. Requirements to have only CAS-certified workers on jobs could have a bleed-over effect to redirect the balance of man-hours between various trades on jobs. Having certified (and therefore, most likely, higher paid) workers performing significant amounts of lower-skilled tasks is a potential area of concern for contractors and owners alike.

Maryland has its own specification based requirement for an apprenticeship approach to workers. This does not require CAS per se, but the Union Hall program is a direct source of meeting this requirement for jobs in Maryland. As mentioned previously, Maryland specifies SSPC QP-1 but allows a waiver for the CAS requirement as specified in the job special provisions.

### **California DOT (CALTRANS)**

The CALTRANS requires QP-1 and QP-2 for painting contractors working within the State. They have provisions to allow for non-certified contractors to enter the workspace for lower value, less complex jobs. This allows new contractors to build their experience base, but these jobs are rare. The CALTRANS has recently agreed to pursue inclusion of provisions requiring the use of certified workers within their bridge painting provisions – even for jobs that do not require contractor firm certification. This requirement is not yet implemented.

The State also maintains a robust bridge maintenance painting operation using district crews made up of State employees. Interestingly, these State blaster/painters are internally trained through the State's own internal apprenticeship program. This program rotates new, less experienced blaster/painters around to various districts within the State so that they can gain experience under various working conditions under the direct supervision of more experienced personnel. After 4,000 hours of work experience, they are considered journeyman level and can become job foremen. This is similar to the experience requirements of SSPC of 3,000 hours for CAS Level 2. The State performs a significant number of maintenance painting jobs with in-house crews but let's jobs out to contract when difficult access to the structure makes it optimum to hire a contractor that has special access equipment and containment. Discussions with CALTRANS focused on specifics of a large recent major bridge painting project in southern California, along with experiences from several State-crew maintenance jobs around various districts of the State. Specific discussions involved experiences on three recent major projects and cumulative experiences from at least a dozen maintenance painting jobs over the past 2 years.

The CALTRANS is keenly aware of CAS worker level certification requirements and is monitoring the implementation of these requirements within the context of their job-to-job oversight of their contractors. The CALTRANS has not seen specific metrics on particular jobs that indicate directly the value of worker-level certification. A possible exception may be analysis of the number of rework orders on specific jobs as related to the CAS certification level of the contractor. Efforts were made cooperatively with CALTRANS to examine existing data with this analysis as a goal, but these data were not readily available in a form useful to the subject analysis. The focus for CALTRANS is on inspection and oversight of each specific contractor to ensure quality of each project. The CALTRANS does see the use of certified workers as a useful pathway for contractors to show commitment to quality and employee skill improvement over time. On CALTRANS' larger structures, the use of certified workers has been increasing.

### **Other States Queried**

Other States queried and responses received included the following:

- **Idaho DOT** has been requiring QP-1 and QP-2 for several years since almost all of their bridge repainting projects require removal of lead containing paint.
- **North Carolina DOT** requires QP-1 and QP-2 certification and also has specific submittal requirements for personnel intending to work on North Carolina projects.



- **Nevada DOT** normally, though not always, specifies that painting of structural steel members must be in conformance with SSPC requirements for safety and workmanship. Most ongoing projects are with weathering steel not structural steel, hence not applicable for further investigation (as weathering steel is not normally painted, or painted very minimally.)
- **Tennessee DOT** does require corrosion prevention worker certifications. It requires AISC plant certification for the structural steel fabrication plants where the plants apply primer to the girders prior to shipment (fully painted girders as well as the ends of weathering steel girders). Painters applying the top coat in the field are required to have SSPC certification.

Other States responded that they do not require certification of workers. These particular States have fewer bridges and, hence, less robust bridge painting programs. States reporting not requiring certified workers were:

- Alaska
- South Dakota

## INPUT RECEIVED FROM PROFESSIONAL TRADE ASSOCIATIONS

The SSPC provided input regarding the number of workers that have been trained and certified. The following input, shown in Table 3, was provided in the fall of 2017. The number of certified/trained workers may have increased throughout the conduct of this study, but the general point evident in these data are that the program is clearly in its early stages. While there are a lot of industry personnel that have gone through the training that makes up the backbone of the certification program, there are not currently enough certified workers to accommodate all work on a nationwide basis. The advocates for the program note that these numbers are increasing rapidly and cite the requirement for certified contractors (a well-established program in many States) to phase-in certified workers. Presently auditors

use a 50-percent rule on each jobsite as an indicator that the program will continue to garner healthy acceptance.

It can be seen from Table 3 above that the SSPC C-7, C-12, and C-14 programs are far more mature and yield higher numbers than the CAS program at this point in time. These numbers are primarily the product of the U.S. Navy and the U.S. Department of Defense mandates for use of personnel trained to these skills-based programs on their jobs. These programs are viewed by specifiers as having successfully raised the bar on quality of cleaning and application of marine industrial coatings through introduction of workers to consistent and technically correct curricula and hands-on introduction to these skills. In order to be “certified” as a blaster or painter, these programs also require documented experience of 800 hours on the job. The SSPC presently allows reciprocity for holders of C-7 and C-12 to forego the practical exam portion of CAS certification. The SSPC presently promotes the specification of CAS Level 2 “interim”, which requires 150 hours of classroom training, as opposed to “Full” which requires an additional 300 hours of classroom training.

## INPUT FROM CONTRACTORS

The bridge blasting and painting industry consists of a mix of union and non-union contractors. While there are several large painting service firms in the United States, most companies are small to medium sized and tend to work regionally. The largest cost element of bridge painting jobs is generally labor, but equipment and consumable materials (fuel, paint, and abrasives) are significant cost items as well. Since work on existing bridges is, by definition highly dependent upon location of the bridge, mobilization of workers, and equipment (including control of traffic and access to high structures and structures over moving, active traffic) make the work of bridge painting highly specialized and highly experience-based. This is difficult work by its nature and protection of workers and the environment, and maintenance of safety on active jobsites is non-trivial.

**Table 3. Trained and Certified Corrosion Prevention Workers as of Fall 2017.**

Type of Training/ Certification	Title of Class	Number of People who have taken class/ been certified as of end of 2016
SSPC C-7	Abrasive Blasting	4,200+
SSPC C-12	Spray Applicator	1,400+
SSPC C-14	Marine Plural Component	1,300+
CAS Level 1	Coating Application Specialist	106
CAS Level 2 Interim	Coating Application Specialist	633
CAS Level 2 Full	Coating Application Specialist	91

Contractors in the industry (both union and non-union) have embraced certification of industrial painting firms through the SSPC PCCP (QP) program over the past twenty years. Their goals of establishing a knowledge and process “floor” for these operations to create a fair competitive bidding environment and a culture of basic regulatory compliance has taken root. Through extension of this self-governing contractor certification program, the contractors have also recently embraced the “next step” of including certification of individual workers as a mandate of firm certification. Through discussions with contractors during this study, it is fair to say that the jury is still out with regard to the effectiveness of the worker certification relative to improved quality and value on the jobsite. Contractors provided input to the research team that indicated that while they certainly desire trained and qualified workers that are instantly and confidently effective in blasting and painting, they find that certification is not a direct indicator of the effectiveness of the worker. The culture of on-the-job training is deeply embedded in the painting contractor world, so the full embrace of certification as a substitute for directly observed experience may still be lagging in a natural sense; it is important to note that most contractors tend to have a core of a few full time, senior workers that “do it the right way”, or at least “do it their way” and those workers are usually supplemented on jobsites with lesser known, local workers. On each job, these lesser-known workers are given a chance to demonstrate skills and productivity and turnover is frequent. There is an opportunity for a robust certification program to shortcut this typical “crew search” stage of jobs, but the sense is that the current certification programs are not robust enough to provide this level of confidence within the contractor community.

## INPUT FROM UNION/ TRADE ORGANIZATIONS

In addition to querying the certifying associations, State DOTs, and the contractors, The IUPAT was also queried. The organization confirmed that determination of projects for study will depend on States that are contacted. State level requirements of certification/ training generally fall into the following categories:

- States that require certification
- States that are new to requiring certification
- States that have been requiring certification for a long time
- States that do not require certification
- States planning on/preparing to require CAS certifications

The IUPAT provided the following examples of level of implementation of certified worker requirements in the form of CAS.

- Illinois: CAS certification requirement is planned to become law in the near future.

- Pennsylvania: CAS certification requirement is planned to become law in the near future.
- Connecticut: CAS certification is being specified in State level specifications.
- Massachusetts and Rhode Island: Anticipating that CAS certification will be specified in State level specifications (likely to adopt Connecticut’s implementation plan).
- California: Legislation requiring CAS certification is planned to become law in the near future.
- Minnesota: Likely to implement CAS certification requirement in the near future.

## ON-SITE EXAMINATION OF ONGOING BRIDGE PAINTING PROJECTS AS VALIDATION OF FINDINGS

The FHWA staff examined several projects were examined in detail by visiting onsite operations and discussing research issues with State DOT personnel and contractors. Among these was a large, multiyear project in California. This project involved repainting of an existing bridge in southern California. The duration of the project was over two years. The site was visited near the conclusion of the work and interviews with CALTRANS project management and responsible onsite contractor personnel informed the input from this site. The contractor on the job is an SSPC QP-1/2 certified contractor with a national work profile. This contractor works on bridges, but also on many other large, non-highway structures. The contractor stated that the 50-percent rule presently implemented for QP-1 auditing was followed throughout the job. This compliance required focus on hiring and shifting some employees between the subject job and other jobs during the 2-year duration. It is worth noting that this particular contractor is non-union, but was required by local agreement to employ a few workers from the local union hall throughout the job. The personnel in charge of this job, from the State and the contractor, were both positive regarding the benefits of worker certification, but could not point to any specific data, or quality-related results, that indicated direct jobsite value from the certified vs. uncertified workers employed during the duration of the job. This job used CALTRANS’ (somewhat unique) waterborne paint, and all painters coming from other types of work required specific on-the-job training in order to properly apply this paint. In addition, this job was cited as very successful in that it came in far under budget estimates and was completed almost a year earlier than predicted. This result was based on the innovation of the contractor in accessing the very large structure and staging on the ground with adequate air utilities to run out to the far reaches of the work (almost one mile). This job setup avoided the need for lane closures, sped up the job, and saved money.

In addition, several jobs in the State of Maryland were closely examined. Maryland was an early adopter of contractor certification requirements, but specifically omits requirements related to worker certification. The jobs examined ranged from a repainting of a bridge railing (a relatively small job) to an entire bridge blast and repaint. These jobs were running effectively and resulted in high quality work, but were all significantly delayed due to poor weather in the spring. Maryland attributed the high-quality workmanship to quality assurance and oversight by full time State employees. These jobs employed a mix of blasters and painters that were both certified and uncertified. According to the contractor supervision onsite, all workers regardless of certification status are given a practical blast and paint test with supervision on site by foremen and are monitored closely before they are allowed to work more freely on their own. The contractors interviewed did not indicate that certified workers were any more likely to perform better than uncertified workers. The overall sentiment was that this is an industry with very challenging, hard, and dirty work and some people take to it and stick with it, and some do not. The basic certification levels presently provided by CAS are not sufficient to discriminate between these two groups.

## CONCLUSIONS

1. Bridge owner agencies are highly focused on achieving long-term performance from maintenance painting operations. Quality paint application operations are highly desirable. Most States have shown a willingness to consider, and frequently embrace, the existing certification programs in an effort to achieve high-quality results.
2. Owners that require contractor certification universally find value in this requirement. Bridge agencies see contractor certification as a means to achieve baseline knowledge and experience among the contractors that bid these highly technical, challenging jobs.
3. Owners expressed varying opinions on the perceived value of worker level certification. These certifications are somewhat transparent to bridge owners as they are embedded within present requirements that focus on contractor (firm) certification. The current phased-in addition of worker certifications, which is contingent on keeping a contractor's certification, means that States will likely be seeing more certified workers on the job as the contractors move forward with the program.
4. Determination of the specific value of worker certification from job records and individual job results is challenging if not impossible. The vast majority of the industry relies heavily on real time, independent QC/quality assurance inspection to ensure compliance with specifications. This approach does not depend on certified/uncertified worker status.

5. States indirectly provide endorsement to the value proposition associated with trained workers as indicated by the specification of various training and apprenticeship programs by states. These programs demonstrate that task specific training is of value, but there is more than a single approach to success in this regard.
6. The community of certified industrial painting contractors has accepted the premise of certified workers through the embedment of worker certification requirements within the framework of contractor certification requirements. However, there is no consensus within the contractor community that certified workers provide a significant real increase in quality or productivity on highway bridge painting jobs.

## APPENDIX

### Questions Related to the use of Corrosion Prevention Worker Certifications on Federally Funded Corrosion Prevention Bridge and Overpass Projects.

FHWA has been tasked by Congress to assess the impact and value of certification requirements for workers performing bridge corrosion prevention work. For this effort, we are focusing on *worker* certifications for painting and coatings. This direction specifically requires FHWA to compare data related to completion time, QC details, and budgetary overruns from at least 12 bridge corrosion prevention projects (6 with certification requirements and 6 without). As an initial step in this effort, FHWA requested input regarding the present status of bridge corrosion preservation requirements from several State highway authorities. Any insight, quantitative or qualitative, regarding the impact of certification requirements on the cost, timely delivery, or quality of bridge preservation activities is of value to our effort.

As a follow-on to this initial query, FHWA is seeking the assistance of State bridge owners in identifying those 12 specific projects so that an assessment can be made for a report to Congress.

Thank you in advance for your assistance in this effort. The following questions are provided as guidance to inform your potential response and input.

### Questions for SHA Personnel Regarding Bridge Preservation Certification

**Priority – please answer these questions as a minimum.**

1. Does your State require certification for *workers* involved in bridge painting and coatings operations? If yes, does your state require SSPC QP-1 or NACE NIICAP for bridge painting contractors? If not, please skip to question 4.



2. If your State does require certification for inspectors, contracting firms, or individual blasters and painters, please list the specific certifications that are commonly required. This list may include:
  - >SSPC or NACE inspector certification,
  - >SSPC QP or NACE NIICAP certification for firms,
  - >SSPC CAS-1/NACE 13 worker certification, or
  - >SSPC C-7 and C-12?
3. Does your State have active, federally-funded bridge preservation work that requires the use of certified bridge preservation workers? Would it be possible for FHWA to use time, quality, and budget information from these projects in order to assess the value of the certification requirement?
4. Likewise, does your State have active, federally-funded bridge preservation efforts that *do not* require worker certifications as defined above? Would it be possible for FHWA to use time, quality, and budget information from these projects to assess the value of the certification requirement?
5. If your State does not require worker certifications for bridge preservation efforts, state the primary reason. (e.g. regulatory, monetary, necessity)
6. Has your State already studied the qualitative or quantitative effects of requiring certification for bridge preservation activities? This might include metrics such as *time to complete projects*, *initial QC reports*, and *budgetary overruns*, or longevity of the resulting protective coating work. If so, can FHWA access this information?

We need to find 12 projects to track: 6 with worker certification and 6 without. If you have projects with similar specifications but differing requirements for certification, would it be possible for us to review data from those projects?

**Secondary Questions – please answer these questions as desired.**

1. In addition to painting, are specific certifications required for workers applying metalizing and galvanizing?
2. Does your State impose the same level of requirements for workers or contractors regardless of size or location of the job?
3. Does your State see value in industry recognized corrosion prevention *worker certifications* for bridge painting projects?
4. Does your State require certified workers for other types of maintenance and technical construction tasks? (e.g., welding, asphalt/concrete construction, ironworking, Maintenance of Traffic (MOT)/safety) and has that requirement of certification brought an increase in the level of quality received on the jobs?
5. Is requiring the use of worker certifications beyond what is currently required for work in your State being considered? If so, what worker certifications are being considered in the future?
6. Do you require training and certification for *State employees* engaged in bridge preservation painting work?

The report herein was sent by FHWA's Administrator Nicole R. Nason to the Chairman and Vice Chairman of the Senate Committee on Appropriations; the Chairman and Ranking Member of the House Committee on Appropriations; the Chairman and Ranking Member of the Senate Subcommittee on Transportation, Housing and Urban Development, and Related Agencies, Committee on Appropriations; and to the Chairman and Ranking Member of the House Subcommittee on Transportation, Housing and Urban Development, and Related Agencies, Committee on Appropriations.

**Researchers**—This Summary Report was developed by Chip Becker (FHWA) and Bob Kogler (sub-contractor of SES Group and Associates, LLC) under FHWA's Corrosion and Coatings Program (Infrastructure Materials Laboratories Contract No. DTFH61-17-D-00017). SES Group and Associates, LLC served as the contractor to FHWA. For additional information, contact Frank Jalinoos, in the FHWA Office of Infrastructure Research and Development, located at 6300 Georgetown Pike, McLean, VA 22101-2296.

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