

**Oregon Department of Transportation  
Cathodic Protection Training and Certification Plan (CPTCP)**

**01215 LOCATE AND REMOVE NEAR SURFACE METAL**

**SKILLS REQUIRED:**

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP system performance and life
- B. Operation of metal detectors and rebar cover meter
- C. Removal of surface metal
- D. Preparation and patching of excavations resulting from removal of surface metal
- E. Knowledge of all requirements of Section 01215 of the Special Provisions "Locate and Remove Near Surface Metal"
- F. Knowledge of special safety and health protection requirements for project and task

**OBJECTIVE:**

The objective is to provide personnel who can reliably locate and remove surface metal and near surface metal that would cause short circuits or a low resistance path between the zinc coating and the reinforcing bars and mark near surface rebar for additional concrete cover as specified in Section 01235 "Replace Damaged Concrete."

**CERTIFICATION:**

Skill A: Knowledge of Cathodic Protection Principles Related to Near Surface Metal

The trainee will be given a written examination consisting of 20 questions with multiple choice answers to determine his or her knowledge of the basic concepts of cathodic protection systems as related to near surface metal.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system as related to near surface metal, and how his or her job relates to the success of the overall project.

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill B: Locating Metal in Concrete

## Laboratory Test

On prepared 2 foot x 2 foot test slabs, the trainee will locate five unknown metal objects of varying size with the metal detector and locate and determine the depth of five reinforcing bars at different depths up to 1.5 inches to show that the trainee understands and can use these instruments. The trainee must complete this test with no significant errors in technique or measurement to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination with the orientation of the slab altered. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

## Job Site Test:

On a 10 foot x 10 foot area of the bridge the trainee will locate and mark the location of all metal within 0.5 inches of the surface and determine the correct action to take (i.e. remove, mask, or install additional cover). The area will be inspected to determine whether any metal has been missed or incorrectly marked. The trainee must complete this test with one error or less to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

## Skill C: Removal of Near Surface Metal

### Classroom Test:

The trainee will describe the complete procedure for removing surface metal utilizing hand and power tools. The trainee must complete this test without omitting or failing to adequately describe one of the elements of this procedure to pass. Additional training is required if the trainee does not pass the test. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.25\*

### Job Site Test:

On the same 10 foot x 10 foot section of the bridge used for skill C certification, the trainee will remove all surface metal marked for removal. There will be at least one object of each type existing on the section. The trainee will be observed on procedure and results for compliance with the specifications and all safety requirements. The trainee must complete this test with no deficiency in the work to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.7\*

Skill D: Preparation and Patching of Near Surface Metal Excavations

Job Site Test:

On the same 10 foot x 10 foot section of the bridge used for skills C and D certification, the trainee will prepare and patch all excavations resulting from surface metal removal. The trainee's work will be inspected for proper preparation of excavation, selection and mixture of patch material, and placement of patch material. The trainee must complete this test with no deficiency in the work to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill E: Knowledge of Special Provision 01215 "Locate and Remove Near Surface Metal"

Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the specified work requirements and acceptance criteria presented in this section. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill F: Knowledge of Safety and Health Requirements

Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete 40 hours of work in this QCE to become certified. The work will

be closely evaluated by the instructor. The work must conform to all requirements of the project drawings and specifications.

ODOT Certification Approval:

The trainee's certification for this QCE will be approved by ODOT provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours

## **01235 REPLACE DAMAGED CONCRETE**

### **SKILLS REQUIRED:**

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP System performance and life
- B. Identification and removal of damaged concrete
- C. Mixing and placement of formed and pumped patch concrete
- D. Knowledge of all requirements of Section 01235 of the Special Provisions "Replace Damaged Concrete"
- E. Knowledge of special safety and health protection requirements for project and task

### **OBJECTIVE:**

The objective is to provide qualified personnel who can safely and reliably locate and replace any damaged concrete on the bridge and to add concrete to increase the depth of shallow rebar that has been identified and marked from Section 01215 "Locate and Remove Near Surface Metal."

### **CERTIFICATION:**

Skill A: Knowledge of Cathodic Protection Principles Related to Concrete Replacement.

#### **Classroom Test:**

The trainee will be given a written examination consisting of 20 questions with multiple choice answers to determine his or her knowledge of the basic concepts of cathodic protection systems as related to concrete replacement.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system as related to concrete replacement, and how his or her job relates to the success of the overall project.

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

**Skill B: Identify and Remove Damaged Concrete**

**Classroom Test:**

The trainee will describe the complete procedure for identifying and removing damaged concrete. The trainee must complete this test with no omission or failure to adequately describe more than one elements of this procedure to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.33\*

**Job Site Test:**

The trainee will be required to identify weak, damaged and CP incompatible concrete at pre-selected areas on the bridge. The trainee will be required to remove the concrete by approved methods. To pass this test the trainee must follow all approved methods and correctly identify and remove the concrete necessary to rehabilitate the bridge and prepare it for subsequent patching. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

**Skill C: Mix and Place Formed and Pumped Patch Concrete**

**Classroom Test:**

The trainee will describe the complete procedure for mixing, equipment operation, placing, finishing and curing concrete patches. The trainee must complete this test without omitting or failing to adequately describe more than one element of this procedure to pass. A session of additional training will be required if the trainee does not pass the test. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.5\*

**Job Site Test:**

The trainee will mix patch concrete and pump it into forms in the area prepared on the test slab in B above. Equipment must be operated correctly to provide a patch that meets all requirements of the project drawings and specifications. The test area will be subjected to the tests described in Sections 01235.71 and 01235.72 of the Special Provisions. The trainee must complete this test without failing to follow all procedures and remove all necessary concrete, and limit concrete removal to the minimum necessary to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill D: Knowledge of Special Provision 01235 “Replace Damaged Concrete”

Classroom Test:

The trainee will be given a written examination consisting of questions to assure that the trainee understands the specified work requirements and acceptance criteria of Section 01235 “Replace Damaged Concrete.” A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill E: Knowledge of Safety and Health Requirements

Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete 80 hours of work in this QCE to become certified. The work will be closely evaluated by the instructor. The work must conform to all requirements of the project drawings and specifications.

ODOT Certification Approval:

The trainee will be approved by ODOT for performance of this QCE provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours

## **01240 INSTALL REFERENCE CELLS**

### **SKILLS REQUIRED:**

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP system performance and life
- B. Operation of DC voltmeters and AC resistance meters
- C. Operation and maintenance of portable reference cells
- D. Conducting corrosion potential surveys
- E. Conditioning and calibrating reference cells
- F. Operating rebar locators and rebar cover meters
- G. Excavating for and installing reference cells
- H. Knowledge of Section 01240 of the Special Provisions "Install Reference Cells"
- I. Knowledge of special safety and health protection requirements for project and task

### **OBJECTIVE:**

The objective is to provide personnel who can measure the corrosion potentials on the concrete surface of the bridge and use them to plot equi-potential contour maps; condition and calibrate reference cells; and install reference cells.

### **CERTIFICATION:**

Skill A: Knowledge of Electricity and Cathodic Protection Principles Related to Reference Cells

#### **Classroom Test:**

The trainee will be given a written examination consisting of 20 questions with multiple choice answers to the trainee to determine his or her knowledge of the basic concepts related to cathodic protection systems.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system and how his or her job relates to the success of the overall project.

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill B: Operation of Voltmeter and Ohm Meter

Laboratory Test:

The trainee will measure five unknown resistances using an AC resistance meter and five unknown DC voltages set up in the lab to show that the trainee understands and can correctly use these instruments. The trainee must complete this test without procedural errors or measurement errors exceeding +/- 5% to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

On the bridge the trainee will measure five resistances between rebar that the instructor has recently measured. The trainee's measurements must be performed using correct techniques, showing proper care for the instrument and be within +/- 10% of the instructor's measurements to pass. For readings more than +/- 10% different the resistance will be re-measured immediately by the instructor to determine if there had been a change. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill C: Operation and Maintenance of Portable Reference Cells

Classroom Test:

The trainee will describe and perform the procedures used to inspect a contaminated portable reference cell, determine whether it is ready for use and prepare it for use. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill D: Conducting Corrosion Potential Surveys

#### Classroom Test:

The trainee will describe the complete procedure for conducting corrosion potential surveys. The trainee must complete this test without omitting or failing to adequately describe more than one element of this procedure to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.5\*

#### Job Site Test:

The trainee will lay out a 9 foot x 9 foot area on the bridge into a 36 inch grid pattern; prepare the surface for taking corrosion potentials; set up the equipment; take potentials with a voltmeter datalogger; and prepare an equipotential contour map of the area using a computer with a printer/plotter. The instructor will randomly re-measure a minimum of 10% of the survey potential readings. If these agree within +/- 10% of the trainee's results, if the map accurately represents these measurements, and there are no procedural errors, the trainee will pass this test. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 2.0\*

#### Skill E: Conditioning and Calibrating Reference Cells

#### Classroom Test:

The trainee will describe and perform the procedures used to inspect a contaminated reference cell, determine whether it is ready for use and prepare it for use. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.25\*

#### Job Site Test:

The trainee will condition and calibrate one of each type of permanent reference cell. The trainee will be observed for correct procedures including measurement of the calibration potential with respect to a standard reference cell. The trainee must complete this test with calibration potentials within +/- 10% of instructor determined value, with a correctly completed report, and no procedural errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not

pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill F: Operating Rebar Locator/Cover Meters

Job Site Test:

On the bridge the trainee will be required to correctly locate and determine the depth of five reinforcing bars in a 5 foot x 5 foot area to show that the trainee understands and can use these instruments. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill G: Excavating For and Installing Reference Cells

Classroom Test:

The trainee will describe the procedures used to excavate for and install a reference cell and prepare it for use. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.25\*

Job Site Test:

The trainee will excavate for and install one reference cell of each type in locations selected by the Engineer on the bridge. The trainee will select the exact location for the saw cuts by using the rebar locator/cover meter. The instructor will verify the saw cut location before allowing the trainee to proceed. Installation will proceed with the instructor observing for correct procedure and checking each task prior to allowing the trainee to proceed. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.5\*

Skill H: Knowledge of Section 01240 of the Special Provisions "Install Reference Cells"

Classroom Test:

The trainee will be given a written examination to determine whether the trainee understands the specified work requirements and acceptance criteria of this section. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and will be retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be allowed to take the job site test and will not be certified to perform this QCE.

Hours: 0.5\*

Skill I: Knowledge of Safety and Health Requirements

Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete a corrosion survey for one zone and two complete reference cell installations to become certified for this task. The work will be closely checked by the instructor. The work must conform to all requirements of the project drawings and specifications.

ODOT Certification Approval:

The trainee will be approved by ODOT for performance of this QCE provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours

**01245 LOCATE AND ELIMINATE ELECTRICAL DISCONTINUITIES IN REBARS**

SKILLS REQUIRED:

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP system performance and life

- B. Operation of voltmeters and ohm meters
- C. Operating rebar locator/cover meters
- D. Establishing access to rebars and performing resistance measurements
- E. Preparing and patching excavations resulting from gaining access to rebar
- F. Performing shielded metal arc welding
- G. Knowledge of all requirements of Section 01245 of the Special Provisions "Locate and Eliminate Electrical Discontinuities in Rebars"
- H. Knowledge of special safety and health protection requirements for project and task

**OBJECTIVE:**

The objective is to provide personnel who can reliably locate reinforcing bars, measure bars for electrical continuity with the king bar, and establish continuity between bars and the king bar by welding connections.

**CERTIFICATION:**

Skill A: Knowledge of Electricity and Cathodic Protection Principles Related to Rebar Continuity

**Classroom Test:**

The trainee will be given a written examination consisting of 20 questions with multiple choice answers to determine his or her knowledge of the basic concepts related to cathodic protection systems.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system and how his or her job relates to the success of the overall project.

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill B: Operation of Voltmeter and Ohm meter

**Laboratory Test:**

The trainee will be required to correctly measure five unknown resistances using an AC resistance meter and five unknown DC voltages set up in the lab to show that the trainee understands and can use these instruments. The trainee must complete this test with no measurement errors exceeding +/- 5% and no procedural errors to pass. A session of

additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

On the bridge the trainee will be required to correctly measure five resistances between rebar that the instructor has recently measured. The trainee's measurements must be performed using correct techniques, showing proper care for the instrument and be within +/- 10% of the instructors measurements. For readings more than +/- 10% different, the resistance will be re-measured immediately by the instructor to determine if there had been a change. The trainee must complete this test with no measurement errors exceeding +/- 10% and no procedural errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill C: Operating Rebar Locator/Cover Meters

Laboratory Test:

On prepared 2 foot x 2 foot test slabs, the trainee will correctly locate and determine the depth of five reinforcing bars at different depths up to 1.5 inches. The trainee must complete this test with no measurement errors and no procedural errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

On a 10 foot x 10 foot area of the bridge the trainee will correctly locate and mark all rebar within 1.5 inches of the surface. The area will be inspected to determine whether any metal has been missed or incorrectly marked. The trainee must complete this test with no measurement errors and no procedural errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill D: Establishing Access to Rebar and Performing Resistance Measurements

Classroom Test:

The trainee will describe the reasons for and procedures used to measure continuity in rebar. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

On a 10 foot x 10 foot area of the bridge the trainee will use a rebar cover meter and an AC ohm meter to locate hidden rebar and measure the resistance between rebar on the bridge. Five measurements are required for this test. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill E: Preparing and Patching Excavations Resulting From Gaining Access to Rebar

Job Site Test:

On the same 10 foot x 10 foot section of the bridge used for skill C and D certification, the trainee will prepare and patch all excavations resulting from surface metal removal. This work will be inspected for proper preparation of excavation, selection and mixture of patch material, and placement of patch material. The trainee must complete this test with no deficiency in the work to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill F: Perform Shielded Metal Arc Welding

Classroom Test:

The trainee will describe the complete procedure for connecting rebar by welding according to Section 01245. The trainee must complete this test without omitting or failing to adequately describe more than one element of this procedure to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.5\*

#### Laboratory Test:

Trainee will complete two test specimens following the "Continuity Welding Plan" submitted according to Section 01245.02. Test specimens will be fabricated from ASTM A615 reinforcing bars, with a three-inch-long No. 4 bar welded transversely to the middle of a 12-inch-long No. 8 bar.

A passing grade is a score of 100% with proper operation of welding equipment and all test specimens passing macroetch examination.

Hours: 1.0\*

If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Skill G: Knowledge of Special Provision 01245 "Locate and Eliminate Electrical Discontinuities in Rebars"

#### Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the specified work requirements and acceptance criteria presented in this section. There will be one clearly stated question for each of the specified requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill H: Knowledge of Special Safety and Health Protection Requirements for Project and Task

#### Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

#### Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete 40 hours of work in this QCE to become certified. The work will

be closely checked by the instructor. The work must conform to all requirements of the project drawings and specifications.

ODOT Certification Approval:

The trainee will be approved by ODOT for performance of this QCE provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours

## **01255 PREPARE ANODE SURFACES**

SKILLS REQUIRED:

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP system performance and life
- B. Knowledge of environmental requirements
- C. Knowledge of concrete surface requirements for zinc application
- D. Knowledge of equipment and materials
- E. Operating surface preparation system
- F. Knowledge of Section 01255 of the Special Provisions "Prepare Anode Surfaces"
- G. Knowledge of special safety and health protection requirements for project and task

OBJECTIVE:

The objective of this plan is to provide personnel who can safely and reliably prepare the concrete surfaces for zinc coating such that the cathodic protection system will perform properly and reliably in protecting the bridge reinforcing steel for the design life of the system. In addition, the trained personnel must be aware of and strictly adhere to environmental safeguards and requirements.

CERTIFICATION:

Skill A: Knowledge of Cathodic Protection Principles as Related to Surface Preparation

Classroom Test:

The trainee will be given a written test consisting of 20 questions with multiple choice answers to determine his or her knowledge of the basic concepts related to cathodic protection systems.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system and how his or her job relates to the success of the overall project.

Hours: 1.0\*

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

#### Skill B: Knowledge of Environmental Requirements

Classroom Test:

The trainee will be given an examination consisting of 10 questions to assure that each person has basic knowledge of the system, where his or her work will be performed, responsibilities to the community and the environment, and how his or her job relates to the success of the overall project.

A passing grade is a score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

The trainee will demonstrate that the trainee can operate and control the containment systems along with the temperature/humidity/air flow controls necessary for him/her to perform the needed job functions. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

#### Skill C: Knowledge of Surface Requirements for Zinc Application

Classroom Test:

The trainee will be given an examination consisting of 10 questions to determine whether the trainee understands the factors in surface preparation critical to zinc adhesion to the concrete. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Job Site Test:

On the bridge the trainee will identify, correct and control the normal adverse surface preparation conditions that are encountered of the bridge. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill D: Knowledge of Equipment and Materials

Classroom Test:

The trainee will describe the equipment and materials utilized for preparation of the concrete surface prior to zinc coating. The trainee must complete this test with no errors or omission of essential elements to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.25\*

Job Site Test:

The trainee will set up the equipment for operation, make adjustments as required, perform routine maintenance and provide abrasive sand as needed. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill E: Operating Surface Preparation System

Classroom Test:

The trainee will describe the operating procedure for the surface preparation system, including masking, surface environmental factors, materials and inspection. The trainee must complete this test with no errors or omission of essential elements to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.25\*

#### Job Site Test:

The trainee will mask and abrasive blast a 5 foot x 5 foot area on the bridge. The trainee must complete this test without using improper procedures, improperly using equipment, or following safety procedures to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill F: Knowledge of Special Provision 01255 “Prepare Anode Surfaces”

#### Classroom Test:

The trainee will be given a written examination consisting of questions to assure that the trainee understands the specified work requirements and acceptance criteria of this section. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and will be retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee is not eligible for the job site test and will not be certified to perform this QCE.

Hours: 0.5\*

Skill G: Knowledge of Special Safety and Health Protection Requirements for Project and Task

#### Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

#### Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete 40 hours of work in this QCE to become certified. The work will be checked by the instructor. The work must conform to all requirements of the project drawings and specifications.

#### ODOT Certification Approval:

The trainee will be approved by ODOT for performance of this QCE provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours

## **01260 APPLY ZINC ANODES**

### **SKILLS REQUIRED:**

- A. Basic understanding of electricity, corrosion and cathodic protection system and the factors which are critical to proper CP system performance and life
- B. Advanced understanding of the effects of concrete surface conditions on CP system performance and life
- C. Identification and masking of surfaces which are not to be sprayed
- D. Surface inspection and conditioning before surfaces are sprayed
- E. Knowledge of thermal spraying system features and operational procedures and knowledge of testing equipment and procedures.
- F. Knowledge of short circuit detection and control system Features and operation of System.
- G. Application of zinc to concrete
- H. Inspection and testing
- I. Knowledge of Section 01260 of the Special Provisions “Apply Zinc Anodes”
- J. Knowledge of special safety and health protection requirements for project and task

### **OBJECTIVE:**

The objective of this plan is to provide personnel who can safely and reliably apply thermally sprayed zinc to concrete coastal bridge surfaces to achieve the required thickness, bond strength and surface conditions.

### **CERTIFICATION:**

Skill A: Knowledge of Electricity and Cathodic Protection Principles Related to Anode Application

Classroom Test:

The trainee will be given a written test consisting of 20 questions with multiple choice answers to determine his or her knowledge of the basic concepts related to cathodic protection systems.

The trainee will be given an oral examination to assure that he or she has basic knowledge of the cathodic protection system and how his or her job relates to the success of the overall project.

A passing grade is a combined score of 70% or better. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

**Skill B:** Knowledge of Effects of Concrete Surface Conditions on Anode Performance

Classroom Test:

The trainee will be required to correctly answer 10 questions to show that the trainee is knowledgeable about the effects of the concrete surface conditions on CP system performance and life. A passing grade is a score of 70% or better. A lower score will require additional training in this skill. After one session of additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified for this QCE.

Hours: 0.3\*

**Skill C:** Identification and Masking of Surfaces Which Are Not to Be Sprayed

Classroom Test:

The trainee will be required to correctly answer 10 questions to show that the trainee understands how to identify areas to be masked, materials and procedures for masking and requirements for effective bonding of masking materials. A passing grade is a score of 70% or better. A lower score will require additional training in this skill. After one session of additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified for this QCE.

Hours: 0.3\*

**Skill D:** Surface Inspection and Conditioning Before Surfaces Are Sprayed

Classroom Test:

The trainee will be required to correctly answer 10 questions to show that the trainee understands how to inspect for and identify the surfaces to be sprayed for anode terminal plate installations, aggregate exposure, moisture, cleanliness and know what procedures to follow if deficiencies are found. A passing grade is a score of 80% or better. A lower score will require additional training in this skill. After one session of

additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified for this QCE.

Hours: 0.3\*

Skill E: Knowledge of Thermal Spraying System Features and Operational Procedures and Knowledge of Testing Equipment and Procedures

Classroom Test:

The trainee will be given a written test consisting of 20 questions with multiple choice answers to determine his or her knowledge of thermal spraying systems including: electrical, wire feed and pneumatic subsystems equipment and operation; gun operation (including automatic, if used); zinc film performance requirements and test procedures.

A passing grade is a score of 70% or better. A lower score will require additional training in this skill. After one session of additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified for this QCE.

Hours: 1.0\*

Skill F: Knowledge of Short Circuit Detection and Location System

Classroom Test:

The trainee will be required to correctly answer 10 questions to show that the trainee understands how the short circuit detection/location and post-process location systems function and how to set them up for use, maintain and repair them. A passing grade is a score of 80% or better. A lower score will require additional training in this skill. After one session of additional training the trainee will be allowed another examination. If the trainee does not pass this test within three examinations the trainee will not be certified for this QCE.

Hours: 0.3\*

Skill G: Application of Zinc to Concrete

Job Site Test:

For hand held arc spray systems the trainee will demonstrate his or her skill in applying zinc to a 4 foot x 4 foot overhead area on the bridge as designated by the instructor following the approved procedures for performing this work. The trainee must complete this test with no improper use of equipment or deficiency in safety procedures to pass. A session of additional training will be required if the trainee does not pass the test. After one session of additional training the trainee will be allowed another examination. If the trainee does not pass this test the trainee will not be certified for this QCE.

Alternately, if an automated gun handling system is used, the trainee will be required to demonstrate his or her skill in the setting up, adjusting and operating the automatic

system in addition to the arc spray to apply zinc on the designated concrete surface following all of the above requirements for conditions, procedures and results.

Certify only technicians who demonstrate the ability to reliably produce acceptable zinc coatings. The instructor will verify this ability by:

(a) Visual Examination – Visually inspect test specimens using a lens with a magnification of at least 10. Acceptable coatings have uniform appearance and follow the form of concrete surface, and do not contain any lumps, blisters, coarse texture, or loosely adhering particles, or any cracks, pinholes, or chips that expose the concrete substrate.

(b) Adhesion Test – Make three (3) adhesion measurements according to ASTM D 4541, Test Method A. Acceptable coatings have at least 50 psi adhesion strength.

(c) Thickness Test – Acceptable test specimen coating thickness is greater than 0.015 inches with no more than 0.002 inches variation.

Hours: 1.0\*

Skill H: Inspection and Testing

Job Site Test:

The trainee will demonstrate skill in inspecting and testing the results of his or her work. On the 4 foot x 4 foot zinc sprayed surface from H above, the trainee will conduct four thickness and two bond strength measurements. The instructor will check the measurement results. The trainee must complete this test with no errors to pass. A session of additional training will be required if the trainee does not pass the test. After additional training the trainee will be allowed to take another examination. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 1.0\*

Skill I: Knowledge of Section 01260 of the Special Provisions “Apply Zinc Anodes”

Classroom Test:

The trainee will be given a written examination to determine whether the trainee understands the specified work requirements and acceptance criteria of this section. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and will be retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

Skill J: Knowledge of Special Safety and Health Protection Requirements and Procedures for the Project and Task

#### Classroom Test:

The trainee will be given a written examination consisting of multiple choice questions to determine whether the trainee understands the safety and health requirements for this project and the trainee's task. There will be one clearly stated question for each of the requirements and a minimum of four incorrect and one correct answer for each question. A passing grade is a score of 100%. If the trainee does not achieve a passing grade, the trainee will be given additional training and retested. A 24 hour waiting period between tests for study is required. If the trainee does not pass this test within three examinations the trainee will not be certified to perform this QCE.

Hours: 0.5\*

#### Trial Service Period:

Upon successful completion of the certification tests listed above, the trainee must successfully complete 40 hours of work in this QCE to become certified. The work will be checked by the instructor. The work must conform to all requirements of the project drawings and specifications.

#### ODOT Certification Approval:

The trainee will be approved by ODOT for performance of this QCE provided the trainee has successfully completed the certification tests for each of the listed skills and has completed all work in conformance with all requirements of the project drawings and specifications during the trial service period. Certification approval can be withdrawn during the course of the project if the performance of the individual fails to satisfy the requirements established by the project drawings and specifications.

\*minimum contact hours