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# Welding in an Infrastructure System TRAINING COURSE

Welding is an integral feature used in many different components of our infrastructure system. Some of those components for bridges would include piling, girders, bearings, bracing, expansion joints, railing and deck forming. Another group is ancillary structures that may include sign structures, light poles, sign mast poles, and traffic signals. Welding is also often used for temporary structures, temporary shoring and other construction activities. This presentation focuses on what Phil Fish, of Fish & Associates, likes to call "Welding 101, the Basics".

Instruction will include the different weld codes, material requirements, weld performance qualification, weld procedure specifications, and welder performance qualifications. Discussion will also include details like filler metal (electrode) requirements, preheat, post heat, electrode storage, residual stress, weld cracking, etc. And finally, instruction will cover weld quality, the roles of quality control and quality assurance.

## MEET THE INSTRUCTORS

Philip Fish, CWI, is nationally recognized for his experience in fracture and fatigue analysis, nondestructive testing and inspection (Level III certifications), strain gauging, weld inspections, steel connection details, forensic analysis of steel structures, and developing comprehensive quality assurance programs for large scale structural steel fabrication. He conducts multiple seminars and courses nationally each year on bridge inspection methods, fracture critical bridge structures, and structural steel welded and bolted connections.

Curtis Schroeder, PE, CWI, is a Ph.D. candidate where he is performing research on the application of phased array ultrasonic testing to bridge welds. Curtis has over 4 years' experience in phased array ultrasonic research and writing engineering guidance documents for improved fatigue and fracture design of steel structures and fitness-for-service evaluation. He has also aided in the revision and development of bridge inspection and welding training courses.



## LEARNING OBJECTIVES

- Have a basic understanding of welding history and development
- Understand the fundamental parts of the American Welding Society welding codes, including the AWS D1.5 Bridge Welding Code, the AWS D1.1 Structural Welding Code, the AWS D1.4 Structural Welding Code for Reinforcing Steel, the AWS D1.6 Structural Welding code for Stainless Steel, and the AWS D1.2 Structural Welding Code for Aluminum
- Understand the difference between the many weld joints, weld materials, weld performance qualifications, and welder qualifications
- Understand the issues related to poor welding, such as cracking, slag, porosity, lack of fusion, etc.
- Attendees will be exposed to Nondestructive testing methods, like Ultrasound, Magnetic Particle, and Dye Penetrant
- Understand the welding inspection requirements related to internal quality control and quality assurance

### COMMENTS FROM A FEW PAST ATTENDEES

- *"This was a good meeting. Kept all interacting and I didn't feel the need to sleep like in most meetings!" - Member of Iowa DOT*
  - *"I appreciate the hands-on approach to this class. This is beneficial." - Member of Iowa DOT*
  - *"Excellent class!" - Member of Illinois DOT*
- Register at <https://engineering.purdue.edu/CAI/SBRITE/Training>



## AGENDA

8:00 - Introduction and Welcome  
Course Announcements

8:10 – History of Welding

8:25 – Types of Structures  
Redundant, Fracture-critical  
Fracture control plan

8:45 – Plans and Provisions  
Special provisions, Construction and  
Materials Manual

9:05 – AWS D1.5 Bridge Welding Code  
Bridge Girders, Bearings, Drains and  
downspouts, Expansion Joints

9:45 – AWS D1.1 Structural Welding Code  
Piling, Steel Grid Floor, Signs and  
Temporary Structures

10:15 - Break

10:25 – AWS D1.4 Structural Welding Code:  
Reinforcing Steel

10:50 – Railing  
D1.5 Steel Railing  
D1.6 Stainless Railing  
D1.2 Aluminum Railing

11:10 – Types of Welds & Weld Symbols  
Fillet, CJP, PJP, Plug, Slot, Symbols

12:00 - Lunch Break

1:00 – Weld Qualification  
PQR, WPS, AWS Requirements

1:45 – Welder Performance  
Electrode control, joint penetration, preheat,  
heat input, post heat, weld finish

2:15 – Weld Quality  
Welding issues, acceptable profiles, Visual  
Inspection, NDE

2:55 - Break

3:05 – Weld Inspection  
Internal QC, QA

3:25 – Pile Welding

3:50 – Stud Welding

4:15 – Temporary Shoring

4:45 - Course Wrap-up