Qualification of Welding Procedures for Bridges: An Evaluation of the Heat Input Method

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This work is an evaluation of the heat input method for qualification of welding procedures for bridges. The heat input method is one of four methods presently allowed by the ANSI/AASHTO/AWS Bridge Welding Code for qualification of welding procedures, and it is the preferred method for most processes. In this study, the heat input is examined for how well it works with consideration of the experience of fabricators and the actual influence of heat input and other important factors on weld quality. Code requirements for qualification are explained, existing procedures are examined and incorporated with previous work, and an experiment was conducted using specimens from actual weldments. Conclusions are drawn, and recommendations are made for improvements to the heat input method of qualification.

Chapter 1 - Introduction

In order to achieve quality in steel bridge welding, the Bridge Welding Code (1995, 1996) has been adopted by 49 of the 50 states and many toll authorities, municipalities, and other transportation agencies. A basic requirement of the code is that welding be accomplished in accordance with approved procedures. For most procedures, approval is based on qualification testing, which, as described in the AASHTO Bridge Welding Code commentary, is intended to "prove that conformance to the welding procedure specification will produce weld metal with the specified soundness, strength, ductility, and toughness."

Welding procedures are comprised of many variables - amperage, voltage, travel speed, polarity, consumables, etc., and procedures must be qualified based on these variables. The premise of the code is that qualification testing be conducted which represents the variables to be used in the actual work. This approach is logical, but there is reason to question just how well the present qualification test method represents the work.

Since the code was first published in 1988, thousands of qualification tests have been conducted, and two interesting facts have been observed. First, despite the large number of welding variables and the innumerable combinations, procedures do not actually differ very much in practice. Fabricators are all doing about the same thing, with one or two major differences between them, and so they are all conducting about the same test. This raises the question of whether there is any value in repeating the same qualification tests over and over again. Second, even as the variables do change, the test results do not change. This suggests that either there is no significant difference in mechanical properties of the welds produced by