

SPA5. Box Girder Welding Sequence: Longitudinal Welds

Michael J LaDeau, North Harris Montgomery Community College System

Introduction

My poster will illustrate a welding sequence for the longitudinal joint welds of a box girder that minimizes distortion caused by the welding process. Box girders have many uses primarily in highway construction and various crane structures including bridge cranes, gantry cranes, and portal (or ship-to-shore) cranes. Unlike the highway industry where curved box sections are sometimes required, the crane industry requires straight box sections where loads are either supported from a cantilevered section or moved by a trolley supported by two parallel box girders. The concept of box sections has been increasingly used where design considerations include stabilizing structures and components subject to torsion or eccentric loads.

Technical Approach & Results

The poster will include a box girder cross section illustration showing the typical components a box girder including internal members used to keep the shape of the box, prevent buckling of the primary members, and facilitate the manufacturing of the girder. This illustration is given for general information only.

Data in the form of a graph will be given for fabrication consideration that accounts for the longitudinal contraction that will occur from the welding process. A factor will be given to estimate how much length will be lost per unit of box girder length. In all cases, this reduction in length can cause excessive gaps between spliced girder sections or misalignment of structural components.

The overall emphasis of the poster will be to illustrate with 3D models (graphical illustrations) how a box section distorts as each joint is welded longitudinally along the box. There are four primary welds, and a proper welding sequence will use the distortional effects caused by welding to shape the girder in a favorable way. Graphics will show the result each subsequent weld has on the structure and give distortion values of a given box. Data from four identical units recently welded for overhead crane use will provide the results. The final illustration will show a straight box within some acceptable tolerance range.

Conclusions

The sequence shown will be one developed from both knowledge of the effects that welding has on structures and experience gained from trial and error. Facilities with modern welding machines equipped with multiple electrodes may not be so concerned with the sequence of welds, but proper welding methods and calibration is required to control the distortion. For most facilities where material handling and piece positioning are cost considerations, the weld sequence is vital. The sequence illustrated is used on box sections where desired amounts of camber are fitted into the structure before final welding or burned (by flame-cutting) into the web plates before fitting. Other welding sequences could be used to impose a certain amount of desired camber into a box fitted with no camber.