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67th IIW Annual Assembly & International Conference

13th - 18th July, 2014 | Seoul, Korea

Matthew McFadden (MM) was a CCIW bursary recipient to attend the 67th IIW Annual Assembly & International Conference in Seoul, Korea. This is the first attendance of MM to an IIW event and the primary reason was to accept the 2014 Henry Granjon Prize (Category C): Design and Structural Integrity for his manuscript, *“Weld effective lengths of rectangular hollow section T-connections under branch bending”*. In addition to receiving the award, his manuscript is being published in IIW’s journal, *“Welding in the World”* and MM was to give a presentation during the joint meeting of Commissions X, XIII & XV on July 15th, 2014. The goals of MM’s attendance were to strengthen Canada’s presence within the IIW community, establish valuable international relationships and contribute his expertise in structural design to the relevant working units.

The participation began at the Opening Ceremony on the evening of July 13th where MM was honoured to receive the Henry Granjon Prize alongside other reputable prize winners. The following three days consisted of meetings throughout the daytime with social events and entertainment in the evenings. The International conference lasted from 17th-18th of July. A brief summary of the meetings attended by MM are included herein.

C-X: Structural performances of welded joints – fracture avoidance

The focus of the Commission X meetings, chaired by Dr. Fumiyoshi Minami, was on the development of practical guidelines for “Fitness-for-Service” fracture assessment of weld flaws. Specific attention was paid to residual stresses, toughness of welds and strength mismatch between base and weld metals.

Some interesting presentations given during the C-X meetings were:

Doc. X-1770-14 “Numerical evaluation of the effects of a mitigation treatment on the residual stresses of a tubular dissimilar metal weld” O. Doyen, D. Ayrault, A. Bonaventure, CEA Saclay, France

This subject is relevant to pipe connections in pressure vessels between dissimilar metals, commonly found in nuclear facilities. The objective was to improve the stress distribution on the inside of welded pipes using an external laser stress improvement technique.

Doc. X-1777-14 “Numerical study on influence of specimen size upon welding residual stress and inherent deformation” R. Gadallah, J. Blandon, T. Imai, H. Murakawa, Osaka University, Japan

This presentation included an excellent explanation of welding residual stresses and emphasized the need to mitigate them in order to improve fatigue life. The benefits of post-weld heat treatment were demonstrated through finite element analysis.

C-XIII: Fatigue of welded components and structures

The focus of the Commission XIII meetings, chaired by Prof. Gary Marquis, was on fatigue testing and evaluation, stress analysis, design and assessment of welds.

Interesting discussions on the methods of analysis currently used for fatigue-induced crack initiation and propagation took place at the meetings. Crack initiation is currently assessed using the notch stress analysis method while crack propagation uses fracture mechanics. Notch stress analysis is typically not utilised in practical engineering applications since crack initiation is only a small portion of the fatigue process. Both methods include extensive analysis of notch stresses developed at the weld toe which is typically not quantified in the Canadian bridge engineering industry. Simplified methods outlined in the Canadian Highway Bridge Design Code (S6-06) are commonly used for determining the remaining fatigue life of steel bridges.

C-XV: Design, analysis and fabrication of welded structures

The focus of the Commission XV meetings, chaired by Mr. Robert Shaw, was on design guidelines for welded structures, welding of high-strength structural steels and innovative structural repair techniques.

A presentation given by Timo Bjork of Finland (Doc. XV-1471-14) outlined the details of an experimental program focused on the punching shear capacity of fillet welded T-Joints made of direct quenched ultra-high-strength steel plates. The effects of cold-forming and heat input were studied by comparing the experimental results to values obtained by finite element analysis (which had good agreement). The test specimens had a variety of single-pass and multi-pass fillet welds and were loaded under direct shear and combined shear and bending. As expected, the shear capacity was lower for specimens subject to combined shear and bending and it was found that the heat input had minor impact on the connection capacity.

Another interesting presentation which was given by Mikihiro Hirohata of Japan (Doc. XV-1469-14) discussed an alternative crack repair method for spliced joints using a combination of fillet welding and epoxy bonding. Fatigue-related cracks in the base metal of steel beams are commonly repaired using bolted cover plates which are bulky and visually unappealing. This alternative repair method consists of a steel cover plate that is bonded to the base metal using epoxy resin, in combination with fillet welds at each end. Elastic finite element analysis showed that epoxy bonding reduces the notch stresses at the weld toe which is highly beneficial for cyclically-loaded structural components. This is a somewhat new and innovative repair alternative and the author has plans to do full-scale testing in the future to validate the results of the finite element analysis. Other factors, such as surface preparation of the base metals and different types of epoxy, will also be investigated.

Attending the IIW Annual Assembly & International Conference was a highly valuable experience. It is a great opportunity for academics, manufacturers, inspectors, consultants and students from different countries to collaborate and discuss important issues about welding technologies, ongoing research and design methodologies.