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EXPERIMENTAL& FINITE ELEMENT ANALYSIS OF STRENGTH OF FILLET WELD FOR TWO 1020 MS PLATES

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ABSTRACT
The aim of the present work is to analyze experimentally and to simulate a fillet welding joint between two 1020 mild steel plates using 302 stainless steel as the weld metal and analyze the joint for thermal and residual stresses developed in them. Then the weld joint is to be analyzed for residual stresses superimposed on thermal stresses. After the results are obtained the aim is to suggest improvement in the joint by minimizing the stresses and reducing chances of stress corrosion cracking by a change in the weld metal. T-joint fillet welding is the most common welding in many engineering applications. Transport vehicles, marine ships, mobile plant equipment are few examples where fillet welding are used extensively. Analysis of welded structures is still remaining challenge for the designer to produce desired output results. In welding process rapid heating and cooling introduced residual stress and geometrical deformations. Heat effected zone plays pivotal role in determining the strength of a welded joint which changes the properties of parent material and reduce the strength after welding operation. There are many cases which structures are continuously under cyclic loading when the fatigue life of the welded joints is a major design consideration

KEYWORDS: Toe radius, Fillet weld, Tensile and Compressive strength.

INTRODUCTION
Welding is a manufacturing process of creating a permanent joint obtained by the fusion of the surface of the parts to be joined together, with or without the application of pressure and a filler material. The materials to be joined may be similar or dissimilar to each other. The heat required for the fusion of the material may be obtained by burning of gas or by an electric arc. The latter method is more extensively used because of greater welding speed. Welding is extensively used in fabrication as an alternative method for casting or forging and as a replacement for bolted and riveted joints. It is also used as a repair medium e.g. to reunite a metal at a crack or to build up a small part that has broken off such as a gear tooth or to repair a worn surface such as a bearing surface. Welding is the most commonly used process for permanent joining of machine parts and structures. Welding is a fabrication process which joins materials (metals) or thermoplastics, by causing union (A. Thirugnanam 2014). In the joining process of welding application uses heat and/or pressure, with or without the addition of filler material. Various auxiliary materials, e.g. shielding gases, flux or pastes, may be used to make the process possible or to make it easier. The energy required for welding is supplied from outside sources Welding, a metal joining process can be traced back in history to the ancient times. In the Bronze Age, nearly 2000 years ago, circular boxes made of gold were welded in lap joint arrangement by applying pressure. Later on in the Iron Age, Egyptians started welding pieces of iron together. But welding as we know nowadays came into existence only in the 19th century. Sir Humphrey Davy produced an electric arc using two carbon electrodes powered by a battery. This principle was subsequently applied to weld metals. Resistance welding finally developed in the year 1885by Elihu Thomson. Acetylene gas was discovered in 1836 by Edmund Davy, but it could not be used in welding application due to lack of a proper welding torch. When the require welding torch was invented in 1900, oxy-acetylene welding became one of the most popular type of welding mainly due to its relatively lower cost. However in the 20th century it lost its place to arc welding in most of the industrial applications. Advance welding techniques like Plasma Arc Welding, Laser Beam Welding, Electron Beam Welding, Electro-Magnetic Pulse Welding, Ultrasonic Welding, etc. are now being extensively used in electronic and high precision industrial applications.

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Figure 1-1: Structure failed due to fatigue

Fatigue cracking on bridge structures is quite often occurred where always induced dynamic loads. The crack started from weld defects at the intersection between the filleted welds connecting to the longitudinal stiffeners to the girder web and the butt welds made for transverse splices in the longitudinal stiffener. Fatigue damage involving web crack on a girder, as well as in flange to web weld caused by the radial stress in fig 1.2

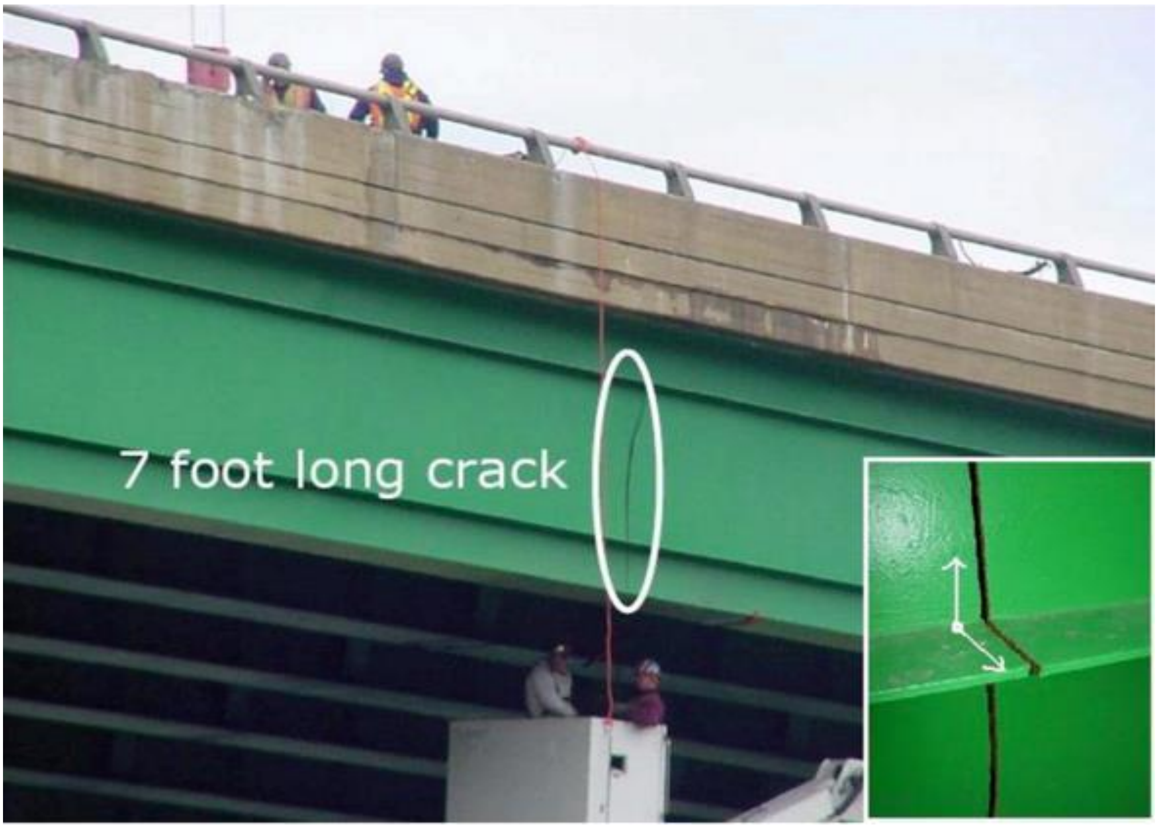

Figure 1-2: Fatigue cracking in a bridge girder from weld defects

The damage was caused by the fatigue cracking on the structure was found and reported that the connection between flanges to the web was made by fillet welding (Haghani 2012). The cracks on the girder web of bridgcan grow with radial stress component as seen in Fig

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Figure 1-3: Example of radial and tangential cracks

As the stories of building getting higher and the spans of bridge are getting longer, there are greater demands for high performance joints capability. T-joint fillet welds are extensively employed in various engineering applications. The welded joints has residual stress which interrupt the life of structures. Processes for the fatigue analysis of metallic structures.

re now well defined, both in the stress-life or strain-life regimes (Aygul 2012). It has been recognized for some considerable time that the design of fabricated welded structures can be heavily dependent on the fatigue life of welded regions. Finite Element tools are often used to analyse complex welded joints. Figure 1-5 shows an analysis of a multi-sided weld joint using FEA. The optimization of such designs is therefore dependant on having good predictions of the fatigue life at the weld. The fatigue life of welded metallic structures is dependent on the increased levels of stress found at the weld toe, root or throat due to weld geometry and the reduction in material properties with the heat affected zone. In addition to this, the amount of fusion of the weld into the parent metal and whether there is hot or cold fusion at a weld end all add to the inherent variability of welded structures. In short, the prediction of a robust fatigue life at a weld is extremely difficult.

This project was carried out FEA analysis with an overview of the work in the area of weld fatigue. Its includes industrial real world applications of current weld life prediction and modelling methods which gave an insight into the decisions to be taken to achieve robust results.

CONCLUSION

The ultimate purpose of the project has been achieved with developing techniques of the finite element analysis of fillet welded joint. In this project, the effect of weld toe radius on tensile strength and compressive strength of fillet weld joint has been analyzed.

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