

## **Residual Stresses Around Holes Cut in Steel Railsides for Truck Frames**

Camden R. Hubbard , Oak Ridge National Laboratory  
Oak Ridge, TN 37830-6065

and

Joaquin Del Prado Villasana and Sean Fleming, Metalsa Roanoke, Inc.  
Roanoke, VA 24019

Weight, strength and durability are important in large truck frames known as railsides, but so are the safety and economics of the manufacturing methods. Numerous holes are cut into the railside truck frames for several reasons including points of attachment to the frame and for reduction of weight. Since the field conditions for a truck frame are more demanding and variable than in automobiles, the holes potentially could be a site for fatigue failure. Thus knowledge of the stresses is important so stresses and related fatigue life can be controlled. This study aimed to understand the residual stresses introduced by four different methods for making the holes in two different steels currently in use for railside truck frames. The hole cutting methods studied were NC punch pierce, NC drilling, plasma arc cutting, and CO<sub>2</sub> laser cutting. A 1-inch diameter hole was cut in 6 mm thick, approximately 250 mm square steel plates of MET 1123, a heat-treated steel, and HSLA, a high strength low alloy steel. Many of the plates were shot blasted before making the hole and a few were shot blasted after the hole was cut.

The Neutron Residual Stress Mapping Facility at HFIR-ORNL was used for measurement of the residual stresses at mid thickness of the plate as a function of distance from the edge of the hole. The hoop stresses showed the largest tensile stress values for all the methods. The stresses introduced by cutting the hole typically extend up to 8 mm from the edge of the hole. The thermal methods (plasma and laser cutting) show higher values of residual stresses, likely due to the kinetics of cooling and changes in microstructure of the material. Extensive studies of the fatigue life and crack propagation rates were also performed. There is a complex relation between the metallurgical, thermal, and mechanical aspects generated by the different methods of making holes.

*The research at the Oak Ridge National Laboratory's High Temperature Materials Laboratory was sponsored by the U. S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Program.*