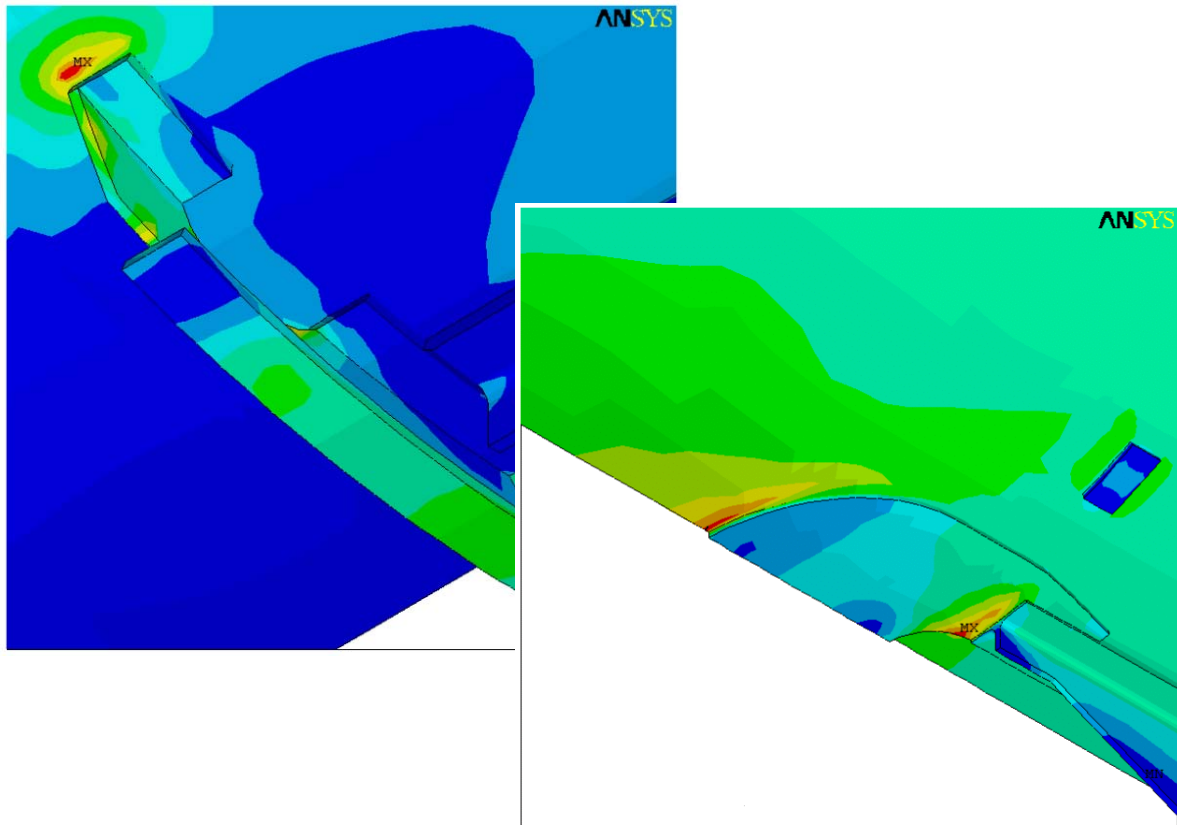


# FINITE ELEMENT STRESS AND FATIGUE ANALYSIS OF A THRU-SILL TANK CAR

**PURPOSE:** Perform a stress analysis and fatigue life prediction of a thru-sill tank car.

HLA Engineers, Inc. was requested to address the cause of fatigue cracking of an aluminum tank car, and to provide suggestions to remedy the problem. At the bolster-end of the cars, the tank is secured laterally and vertically by circumferential straps. At the center of the cars, the tank is attached longitudinally to the steel sill beam by a series of bolts between the steel sill and aluminum “anchors” welded to pads on the aluminum tank shell. At the outboard ends of the center anchors, transverse (circumferential) stiffeners are installed, and the cracks occur typically in the welds between the stiffeners and the tank shell. To determine the source of the cracking, a finite element computer model was developed for the subject aluminum tank car. The physical components of the car were translated into a mathematical finite element model for simulation. Basic AAR Train-Action Design Load Cases were investigated to determine which ones show high stress in the area of the center anchors and transverse stiffeners. Dynamic Excitation of the cars was also considered. Structural and Fatigue Analysis was performed. The Attachment was redesigned to produce a lower stress and better fatigue life in the connection.



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