NATIONAL TRANSPORTATION SAFETY BOARD
Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594

January 11, 2008

MATERIALS LABORATORY FACTUAL REPORT Report No. 07-119

A. ACCIDENT

Place	:	Minneapolis, Minnesota
Date	:	August 1, 2007
Vehicle	:	I35W Highway Bridge
NTSB No.	:	HWY07MH024
Investigator	:	Gary Van Etten

B. COMPONENTS EXAMINED

Portion of the east gusset plate from node U10W.

C. DETAILS OF THE EXAMINATION

The portion of the east gusset plate of node U10W received for laboratory examination was cut from a larger piece of this gusset plate, which was attached to the U10W end of diagonal L9/U10W. The larger piece was held to the diagonal with rivets, as shown in figure 1. The east gusset plate was fractured along the lower/north row of rivet holes for the rivets attaching the gusset plate to the upper end of the diagonal as well as elsewhere around the end of the diagonal. The rivet heads from along the lower/north edge of the rivet pattern were ground off, and the rivet shanks were partially punched through. The plate was also cut adjacent to the next row of rivets. Figure 2 shows the larger piece of the plate after removal of the rivet heads and after most of the cut had been made. After the cut was completed, the piece of the gusset plate containing the fracture was removed from other structure and sent to the NTSB Materials Laboratory for examination.

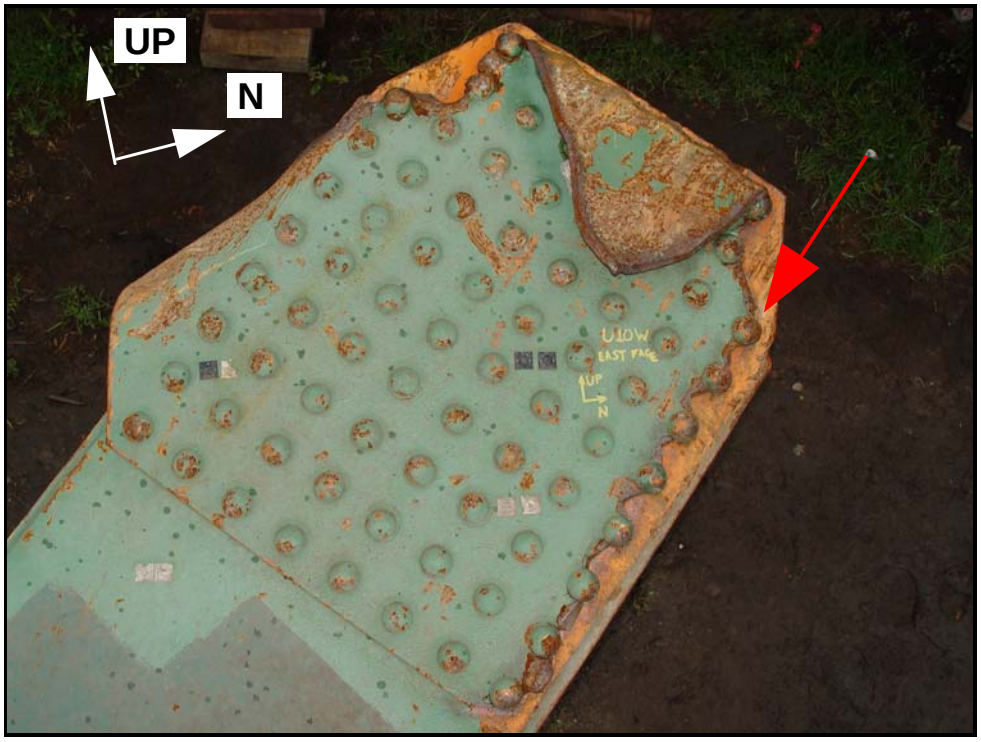
Figure 3 shows the gusset plate piece received in the laboratory. The cut location is identified. The rivet holes had been labeled on-site, starting with 1 at the lower/south end and ending with rivet hole 8 near the upper/north end.

The gusset plate piece had minor residual bending deformation along its length from rivet hole 6 to its upper end. All fractures in the gusset plate piece were typical of ductile overstress fracture. There was no noticeable out-of-plane deformation adjacent to the fracture between rivet holes 3 and 7. Figure 4 shows the fracture in this area. Below rivet hole 3 the plate was bent away from the east side plate of the diagonal, and the plate fracture ligaments between rivet holes 1 and 2 and between holes 2 and 3 were twisted.

Above hole 7 the gusset plate was also bent away from the east side plate of the diagonal, slightly between holes 7 and 8 and more noticeably above hole 8. The plate showed significant necking deformation adjacent to the fracture ligaments, especially the tensile fracture areas as described below.

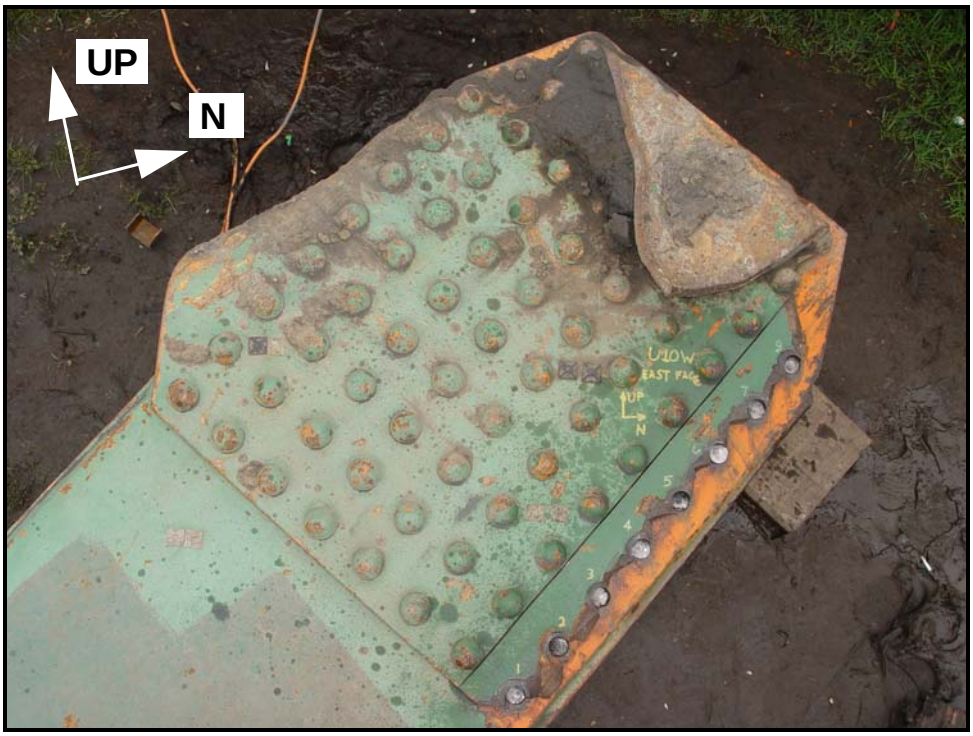
As can be seen in figure 4, from hole 3 to hole 8, the fracture proifle between the holes had a step-like pattern, with a horizontal ligament and a vertical ligament. The vertical ligaments intersected the lower rivet holes tangentially, indicative of fracture under shear stresses, and the horizontal ligaments intersected the rivet holes perpendicularly, indicative of fracture under tensile stresses. Based on the deformation patterns associated with the fracture, the tensile load directions associated with the fracture from hole 3 to hole 8 was nearly vertical, approximately perpendicular to the tensile fracture ligaments, and varied slightly from hole to hole. Arrows in figure 3 and 4 indicate tensile load directions. Significant tensile elongation of the tensile fracture ligaments was noted.

James F. Wildey II
Supervisory Metallurgist



ImageNo:0711A00567, Project No:2007100015

Figure 1. Overall view of the piece of the east gusset plate at node U10W attached to the U10W end of diagonal L9/U10. The arrow indicates the lower/north row of rivets.



ImageNo: 0711A00566, Project No:2007100015

Figure 2. Overall view of the piece of the east gusset plate at node U10W attached to the U10W end of diagonal L9/U10W after removal of the rivet heads from the lower/north row of rivets and cutting adjacent to the next rivet line.

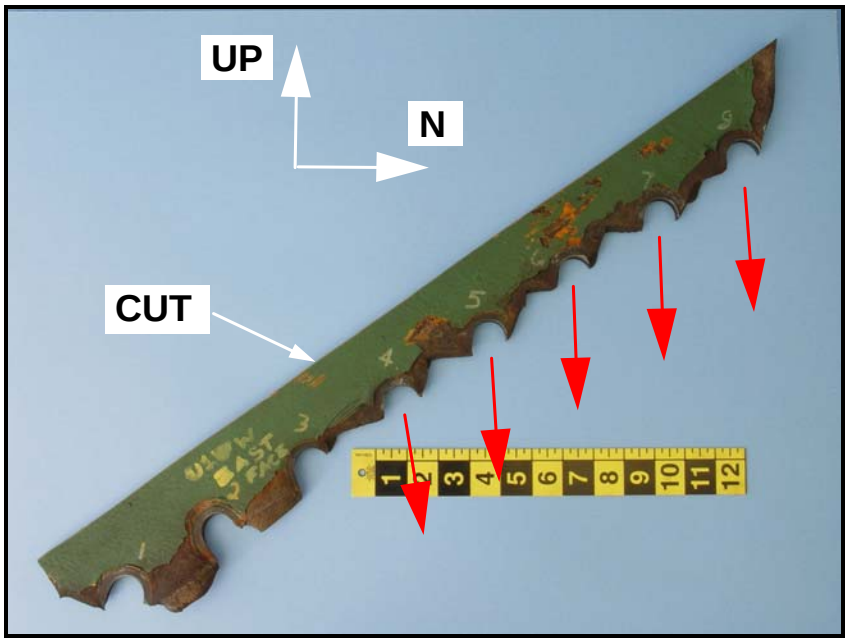


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Figure 3. Overall view of the portion of the gusset plate removed from the east gusset plate of node U10W. Arrows indicate load directions associated with the fracture at rivet holes 4 through 8.

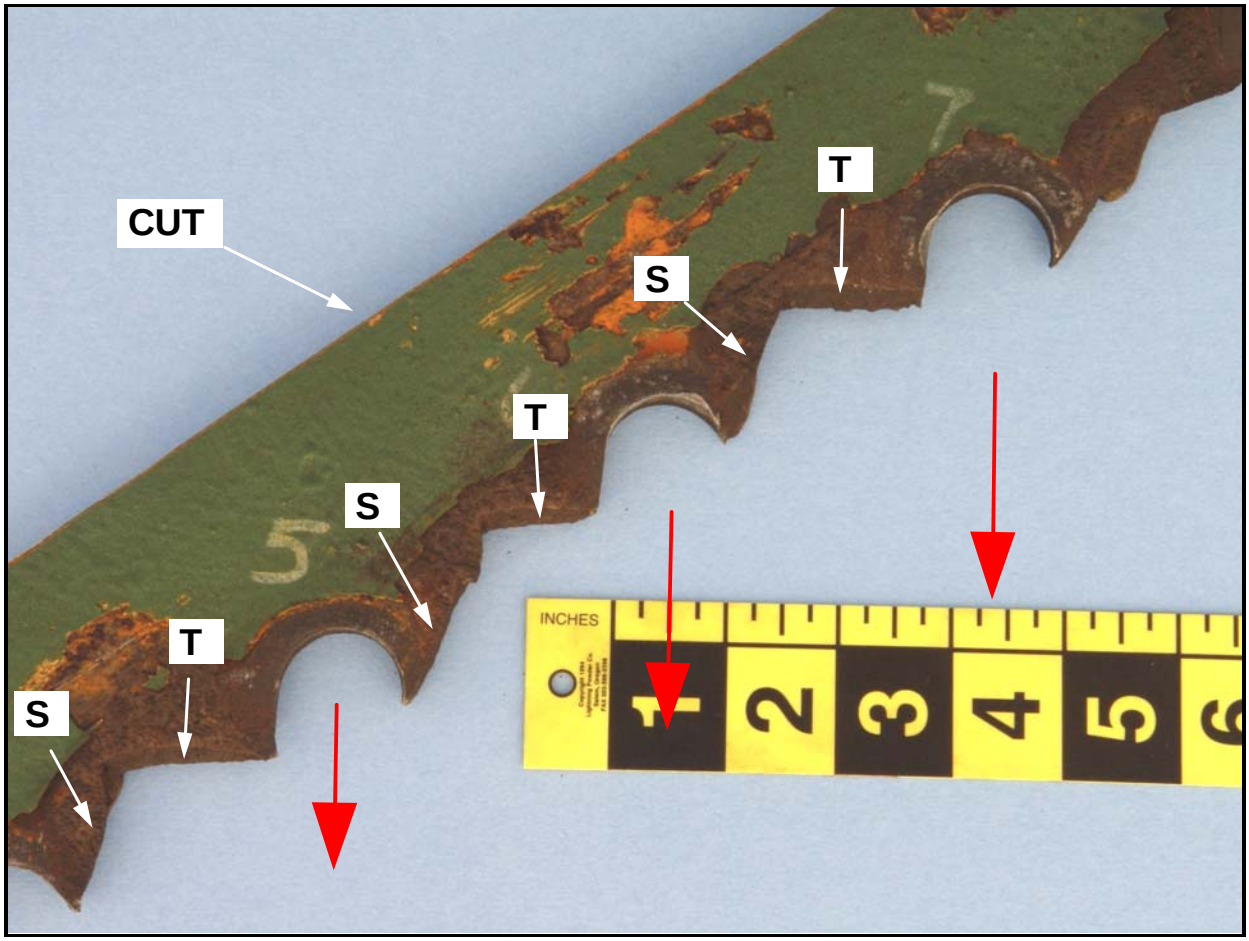

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Figure 4. Fracture between holes 4 and 7. Arrows "T" indicate tensile fracture areas, and arrows "S" indicate shear fracture areas in the fracture ligaments between adjacent rivet holes. Tensile loading directions are indicated by unlabeled arrows.