

# NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering  
Materials Laboratory Division  
Washington, D.C. 20594



March 31, 2011

MATERIALS LABORATORY FACTUAL REPORT

Report No. 11-006

## A. ACCIDENT

Place : Gray Summit, Missouri  
Date : August 5, 2010  
Vehicle : 2003 Blue Bird school bus  
NTSB No. : HWY10MH018  
Investigator : Jennifer Morrison  
HS-20

## B. COMPONENTS EXAMINED

2 hydraulic brake lines

## C. DETAILS OF THE EXAMINATION

Two hydraulic brake lines, found leaking upon inspection after the accident, were submitted for examination. The brake lines are shown in Figure 1. The lines were brazed; double wall low-carbon steel tubing<sup>1</sup>. X-ray fluorescence analysis determined the brake lines were zinc coated for corrosion protection. The lines did not have any unique identifiers so the lines were label Line #1 and Line #2 by the Material Laboratory examiner.

The visual examination of Line #1 found the exterior surface of the line to be discolored with several areas of loosely adhering corrosion scale. The corrosion scale was cleaned from the line in accordance with ASTM G1 designation C3.5 and then reexamined. It was determined that corrosion did not full penetrate wall thickness of the line; however, the copper brazing was exposed in several spots as shown in Figure 2.

The visual examination of Line #2 found the exterior surface of the line to be discolored with several areas of loosely adhering corrosion scale similar to that found on Line #1. Visual examination revealed a full-penetration hole in the line due to corrosion. After the line was cleaned in accordance with ASTM G1-designation C.3.5, the hole in the line was measured and found to be 0.06 inch in length and 0.03 inch in width as shown in

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<sup>1</sup> Society of Automotive Engineers material standard J527, "Brazed Double Wall Low-carbon Steel Tubing";  
Revision date November 2000.

Figure 3. Other areas of corrosion on Line #2 partially penetrated the line wall thickness exposing copper brazing similar to that found on Line #1.

Nancy B. McAtee  
Chemist

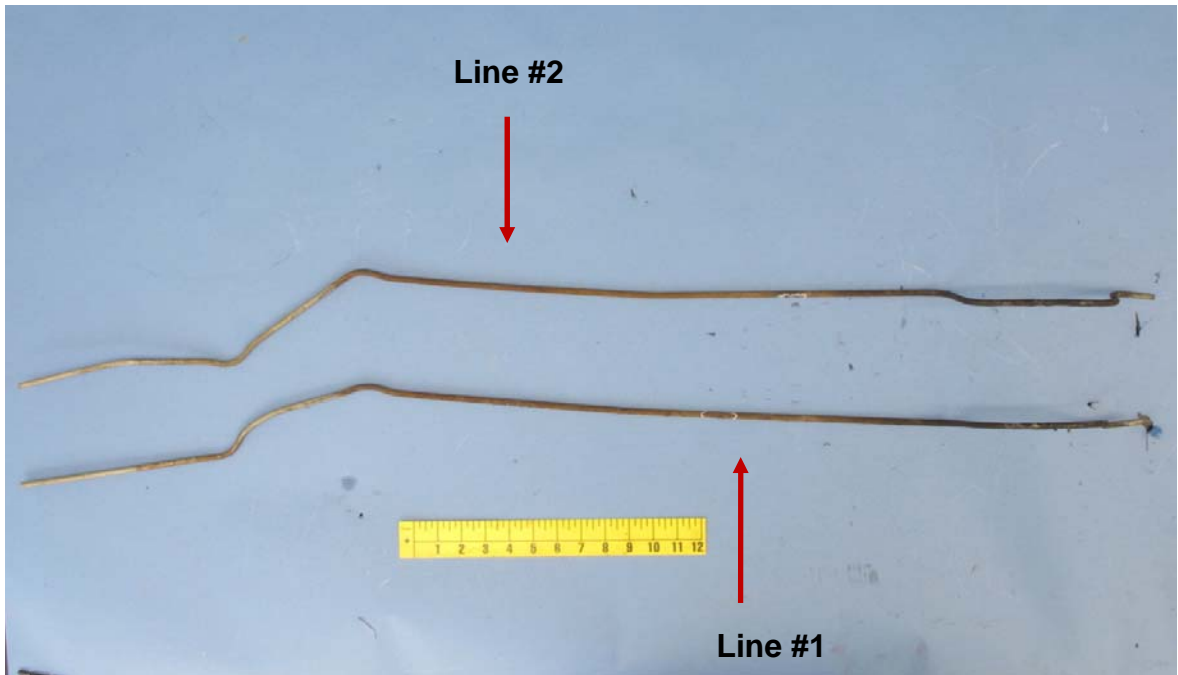
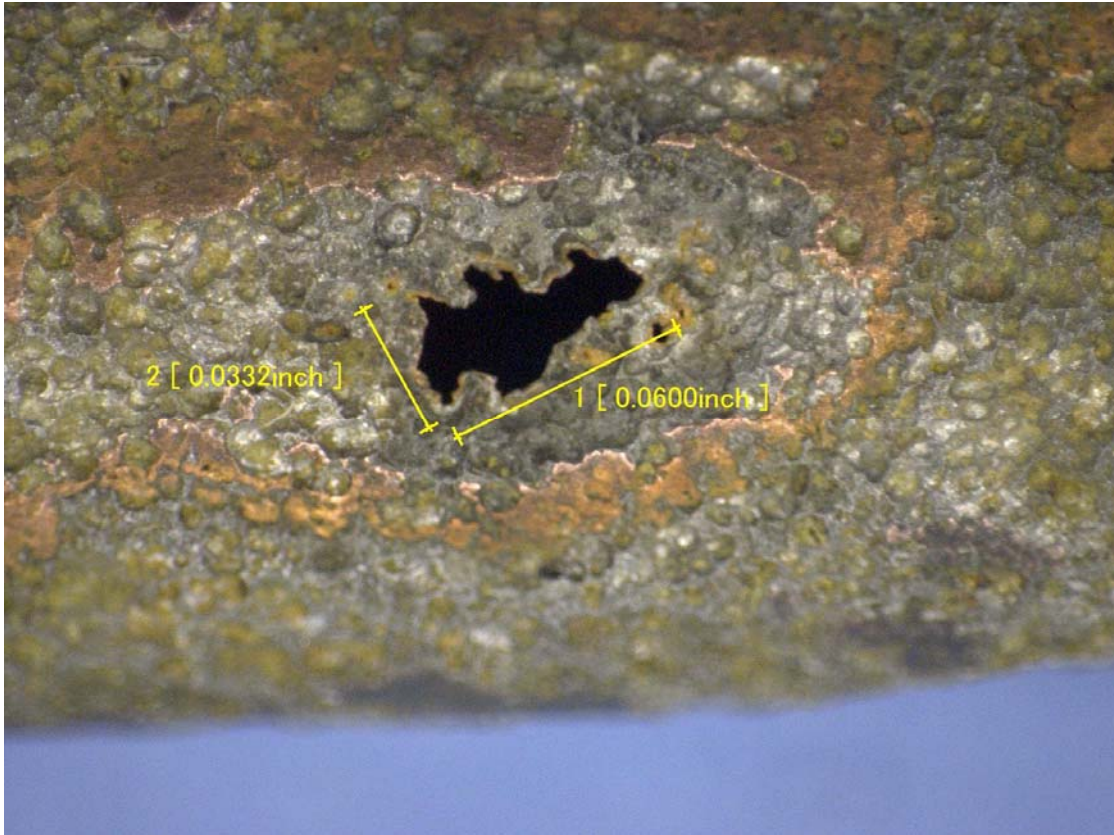


Figure 1. Overall photograph of Line #1 and Line #2.



Figure 2. Area with corrosion on Line #1.



**Figure 3. Hole in Line #2.**