NATIONAL TRANSPORTATION SAFETY BOARD

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

July 13, 2015

MATERIALS LABORATORY FACTUAL REPORT Report No. 15-020

A. ACCIDENT INFORMATION

Place	:	Penwell, Texas
Date	:	January 14, 2015
Vehicle	:	TX Dept. of Criminal Justice Inmate Transport Bus
NTSB No.	:	HWY15MH004
Investigator	:	Peter Kotowski, HS-20

B. COMPONENTS EXAMINED

1) Front left tire;
2) Guardrail end treatment.

C. DETAILS OF THE EXAMINATION

On January 14, 2015 at approximately 7:50 a.m. (local time), a bus operated by the Texas Department of Criminal Justice was traveling westbound on Interstate 20 (I-20) near Penwell, Texas when it departed the roadway on the approach to a rail line overpass. The bus collided with a roadside barrier and subsequently departed from the elevated section of highway. The bus then collided with a Union Pacific freight train comprised of four locomotives and 58 cars that was traveling from Los Angeles, California to Marion, Arkansas, and was underneath the highway overpass. As a result of the crash, two corrections officers and eight inmates were fatally injured. The remaining bus occupants were transported to Medical Center Hospital in Odessa, Texas, for treatment of their injuries.

The left front tire from the transport bus was sent to the NTSB Materials Laboratory for examination as was the end treatment from the guardrail on the median side of the westbound approach. The findings from the examination of each item are presented in the sections that follow.

1. Tire examination

The tire was received by the NTSB Materials Laboratory as shown in figure 1. The tire was manufactured by Hankook and was an AH12 model tire. The tire identification number (TIN) was displayed on the outboard sidewall of the tire and was DOT BB3T PKH 4813, which indicated that the tire was manufactured in 48th week of 2013. Other notable markings on the tire were as follows:

- 11R22.5 TUBELESS
- 148/145M 120 PSI
- STANDARD RIM: 8.25
- 16 P.R. [ply rating] LOAD RANGE H
- TREAD 5 PLIES – SIDEWALL 1 PLY – STEEL
- MAX. LOAD SINGLE 3000 kg (6610 LBS) AT 830 kPa (120 PSI) COLD
- MAX. LOAD DUAL 2725 kg (6005 LBS) at 830 kPa (120 PSI) COLD
- PSD35000

The “O” in “DOT” on the full TIN-side of the tire (outboard-facing side) was used for establishing reference clock positions on the tire, as indicated in figure 1, with 12:00 starting at the “O” and proceeding clockwise. Photographs of the outboard sidewall, tread, and inboard sidewall were taken at each clock position and are included in Appendices A – C. Visual examination indicated that there was a circumferential tear in the outboard sidewall of the tire from approximately the 2:00 position to the 5:00 position, as shown in figure 1. Closer examination revealed two additional features between 3:00 and 4:00 (centered approximately at 3:15), as shown in figures 2a and 2b. The first feature was a circular hole that measured 5/8 inch in diameter. The second feature was a triangular gouge approximately 1 inch across located approximately 3 inch clockwise from the hole.

Light-colored scuff marks were observed on the sidewall of the tire radially inward and clockwise of the hole and triangular gouge, several of which are indicated in figure 2b. The composition of the light-colored material was determined by pressing a piece of carbon tape into the marks and pulling the tape off, which lifted a sample of the material off of the tire. The sample was examined using a scanning electron microscope equipped with energy dispersive spectroscopy (EDS). The resulting spectrum is shown in figure 3. The elements that were detected included titanium (Ti), iron (Fe), oxygen (O), aluminum (Al), silicon (Si), and Calcium (Ca).

2. Guardrail end treatment examination

The guardrail end treatment was received by the laboratory as shown in figures 4 and 5. The end treatment was struck and damaged by a motor vehicle the day prior to the accident and was set in the median adjacent to the shoulder as shown in figure 6a. The guardrail was positioned and photographed in the lab at an angle similar to the photograph taken in the field as shown in figure 6b.

Additional deformation and damage to the end treatment, as indicated in figure 6b, was observed by comparing the two photographs. There were multiple lateral impact damage marks on the face of the end treatment and deformations to the flange around the perimeter of the face, as indicated in figure 6b. There was also a counterclockwise twist to the end treatment, consistent with torsional deformation, and a tear in the sheet metal behind the head of the end treatment.

The end treatment was examined for features with a similar size and spacing as the features that were observed on the sidewall of the tire (described previously) but none were found.

Donald Kramer, Ph.D.
Sr. Materials Engineer

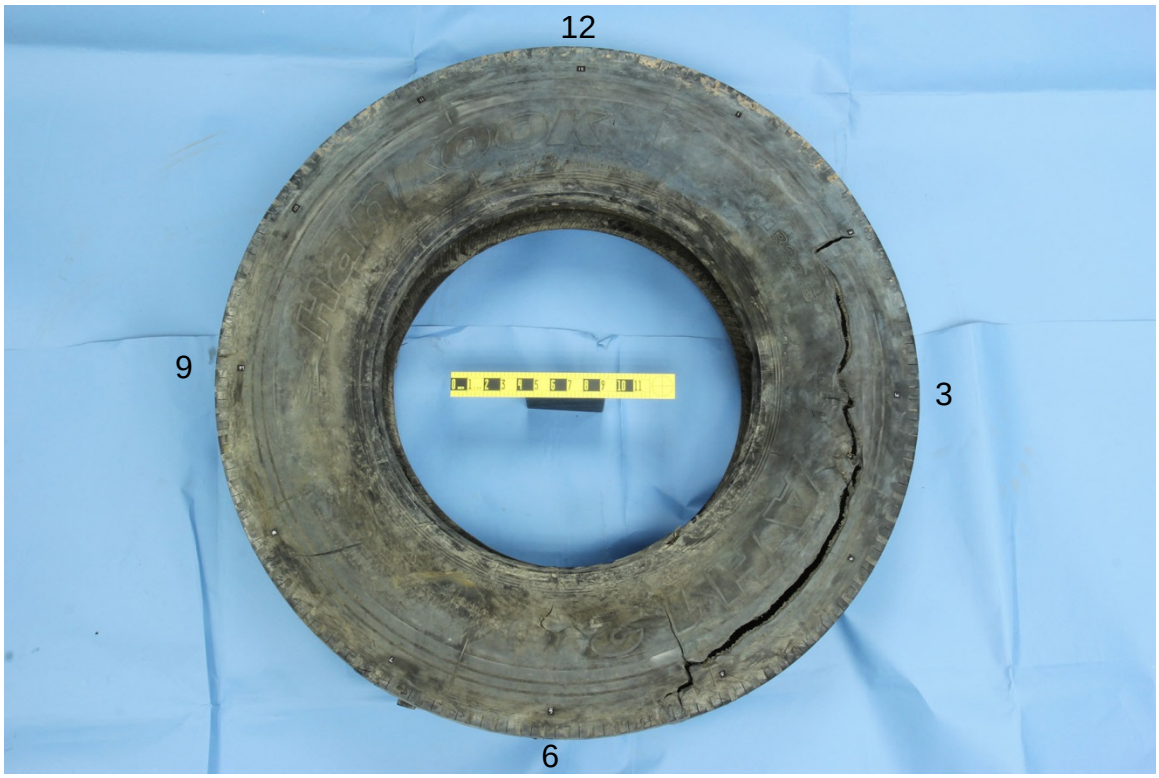

Figure 1: The outboard sidewall of the left front tire. The indicated clock positions are referenced off of the “O” in “DOT”, part of the tire identification number.

a)

b)

Figure 2: a) The outboard sidewall of the left front tire between 3:00 and 4:00 and b) higher magnification image of two notable features at approximately the 3:15 position: a round hole, approximately 5/8 inch in diameter and a triangular gouge, approximately 1 inch across.

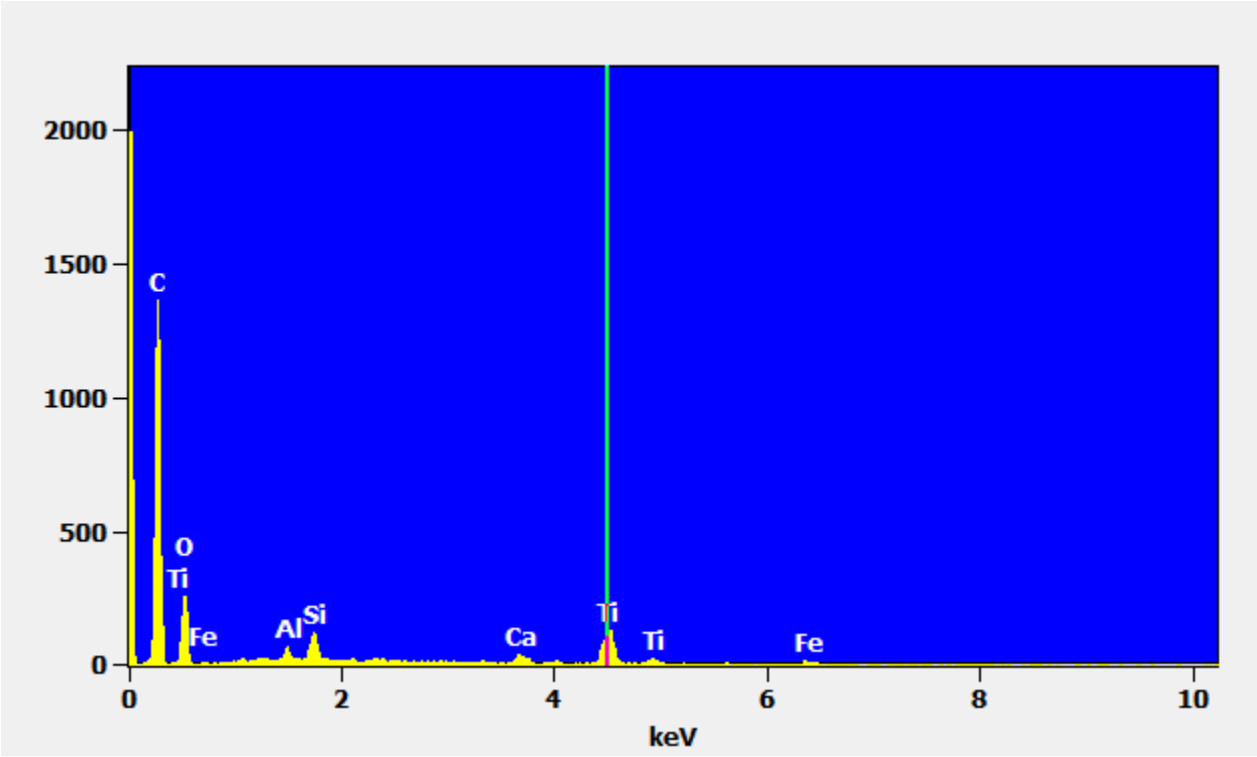

Figure 3: Energy dispersive spectroscopy spectrum from material lifted off of scuff marks on the sidewall of the tire.

Figure 4: End view of the guardrail end treatment.

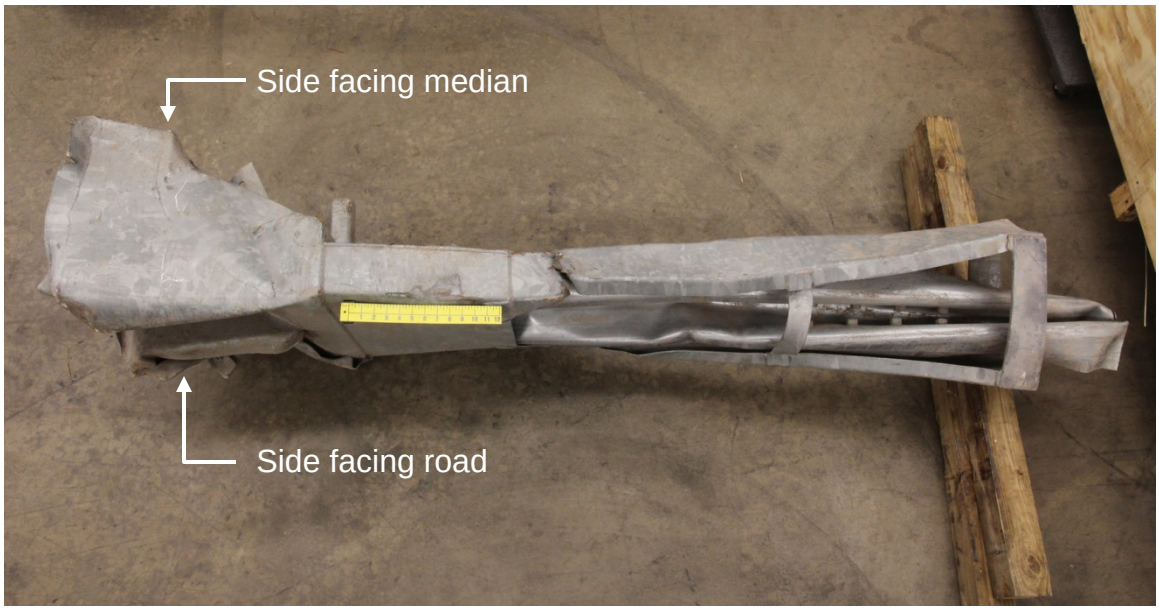

Figure 5: Top down view of the guardrail end treatment.

a)

b)

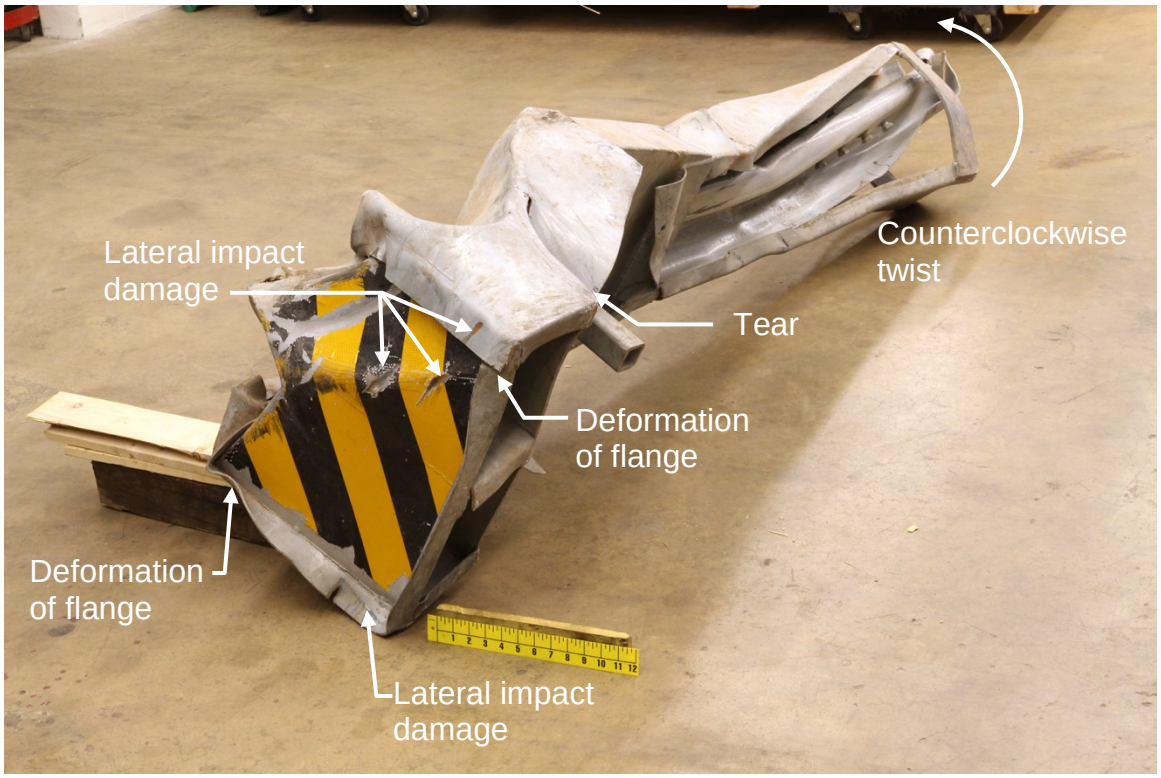

Figure 6: a) Image of the guardrail end treatment taken the day before the accident after it was struck by a motor vehicle and moved off of the shoulder of the road and b) image of the end treatment in the lab oriented and photographed at a similar angle as the image in part a).

APPENDIX A: PHOTOS OF OUTBOARD SIDEWALL


12
1
OK
DOT BB3T PKH 4813
WARNING:
SERIOUS INJURY MAY RESULT FROM
148/145M 120 PSI


1
2
WARNING:
SERIOUS INJURY MAY RESULT FROM
11R22.5
TUBELESS
148/145M 120 PSI
REGROOVABLE
PKH 4813


11R22.5
TUBELESS
REGROOVABLE
RADIAL
Ultra Mileage & Safety


RADIAL
Ultra Mileage & Safety


AH12
Hankook
MADE IN CHINA


H12
Hankook
MADE IN CHINA
STANDARD RIM:


STANDARDS FOR USE IN NORTH
16 P.R. LOAD RANGE
MAX. LOAD SINGLE
MAX. LOAD DUAL
TREAD SIDEWA
STANDARD RIM: 8.25
BRAND TIRE HERE
MADE IN CHINA


STANDARDS FOR USE IN NORTH AMERICA AND AUSTRALIA
16 P.R. LOAD RANGE
MAX. LOAD SINGLE 3000 kg (6610 LBS) AT 830 kPa (120 PSI) COLD
MAX. LOAD DUAL 2725 kg (6005 LBS) AT 830 kPa (120 PSI) COLD
TREAD SIDEWA
5 PLIES 1 PLY
STEEL
BRAND TIRE HERE
STANDARD RIM: 8.25


STEEL
PSD35000
INCH


PSD35000
KOREAN
INCH


10
11
KOREAN STANDARD


11
12
KOOK
KOREAN STANDARD
DOT BB3T PKH 4813

APPENDIX B: PHOTOS OF TREAD


12
1


1
2


2
3


3
4


4
5


5
6


6
7


7
8


8
9


9
10


10
11


11
12

APPENDIX C: PHOTOS OF INBOARD SIDEWALL


22.5
TUBELESS
REGROOVABLE
RADIAL
UMS
Ultra Mileage & Safety


WARNING:
11R22.5
TUBELESS
REGROOVABLE
Ultra Mileage & Safety


WARNING
SERIOUS INJURY MAY RESULT FROM
11R22
148/145M 120 PSI
TUBELESS
REGROOVAB


OOK
STANDARD


5
4
KOREAN STANDARD


6
5
KOREAN STANDARD


7
6
8900942096


8
7
STANDARDS FOR USE IN NORTH AMERICA AND AUSTRALIA
STEEL
16 P.R.
LOAD RANGE
MAX. LOAD SINGLE
MAX. LOAD DUAL
BRAND TIRE HERE
8900942096
8.25


STANDARDS FOR USE IN NORTH AMERICA AND AUSTRALIA
16 P.R. LOAD RANGE
H
TREAD
SIDEWALL
STEEL
BRAND TIRE HERE
STANDARD RIM: 8.25
INCH


12
MADE IN CHINA
STANDARD RIM: 8.25
INCH


H 1 2
HANKOOK
MADE IN CHINA
C319
CHONGQING
INCH


A H
RADIAL
C319
CHONGQING
HANKOOK
INCH