NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing

Norfolk Southern Railway general merchandise freight train 32N derailment with subsequent hazardous material release and fires, in East Palestine, Ohio, on February 3, 2023

GROUP | H

EXHIBIT

54

Agency / Organization

University Transportation Center for Railway Safety
The University of Texas Rio Grande Valley

Title

PowerPoint presentation related to Constantine Tarawneh's testimony

NTSB Investigative Hearing
East Palestine, OH
June 22-23, 2023

Prof. Constantine Tarawneh, Louis A Beecherl, Jr. Endowed Professor

Sr. Associate Dean of Research and Graduate Programs, CECS

Director, University Transportation Center for Railway Safety (UTCRS)

University of Texas Rio Grande Valley (UTRGV)

Biography

➢ 20 years of experience conducting railroad research with emphasis on advanced bearing and wheel condition monitoring techniques

➢ Developed several onboard sensors for health monitoring of railroad bearings and wheels. These sensors have been licensed

➢ Over $35 million in funding with emphasis on rail-related research

➢ Founding director for two multi-million federally funded centers

➢ Published 77 journal and conference paper publications with emphasis on railway safety and infrastructure condition monitoring

➢ Chaired 50 theses and dissertations

➢ Member of the TRB Railroad Operating Technologies Committee (AR030)

➢ Member of the Council of University Transportation Centers (CUTC) Executive Committee

➢ One of the four Directors of the Research and Education Division (RED) within the American Road and Transportation Builders Association (ARTBA).

INTRODUCTION AND BACKGROUND

Tapered-Roller Bearings
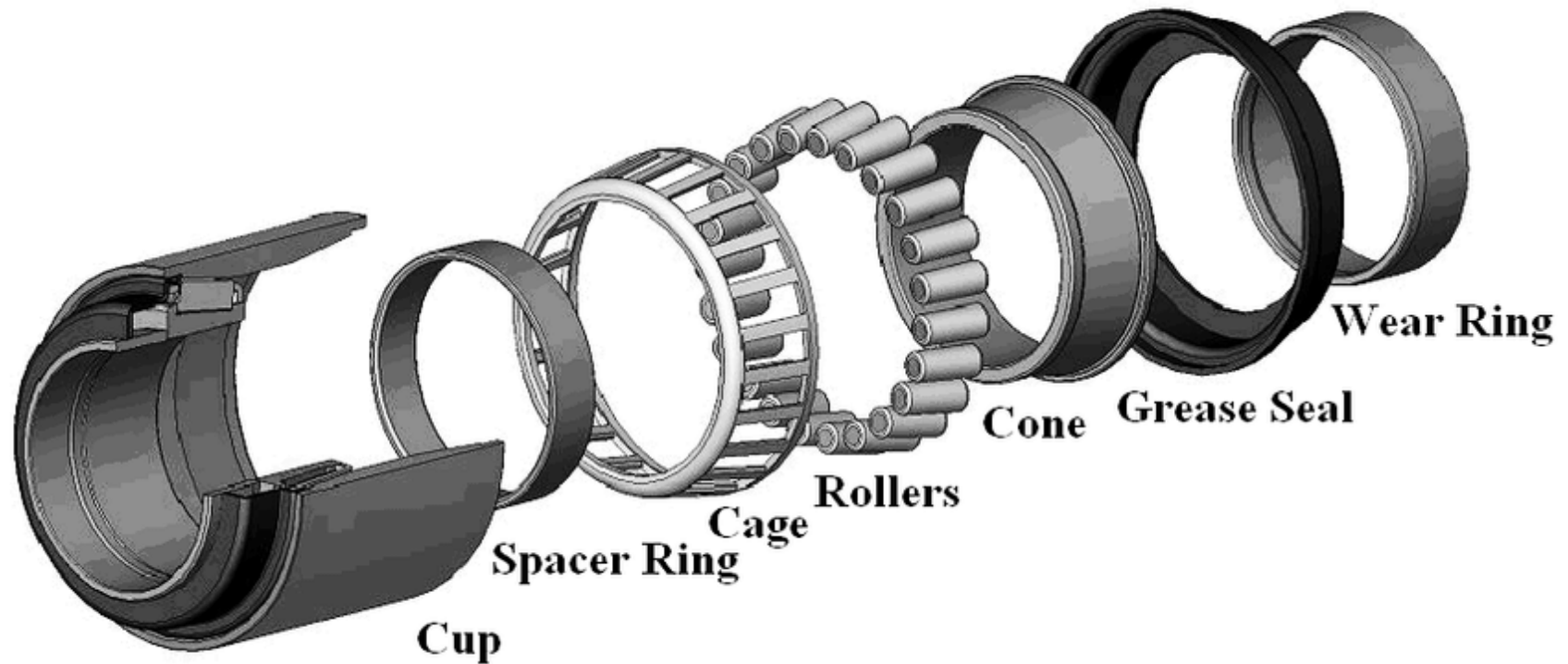
Types of Bearing Failures

Local Defects
- Pits
- Cracks
- Spalls

Distributed Defects
- Water-etch
- Waviness of raceways
- Asperities on multiple bearing components

Geometric Defects
- Out-of-tolerance components
- Geometric inconsistencies of bearing components

Cone spall example

Water-etch example

Burnt-off bearing

Wayside Technologies

- Health monitoring systems for freight railcar rolling stock

  - Hot Box Detectors (HBDs)

  - Acoustic Bearing Detectors (ABDs)

  - Wheel Impact Load Detectors (WILDs)

Hot-Box Detectors (HBDs)

- Hot-Box Detectors (HBDs) use infrared sensors to measure the temperature radiated from bearings, wheels, axles, and brakes
- Over 6,000 in use in North America [1]
- Poor HBD performance can lead to false setouts or derailments.

[2]
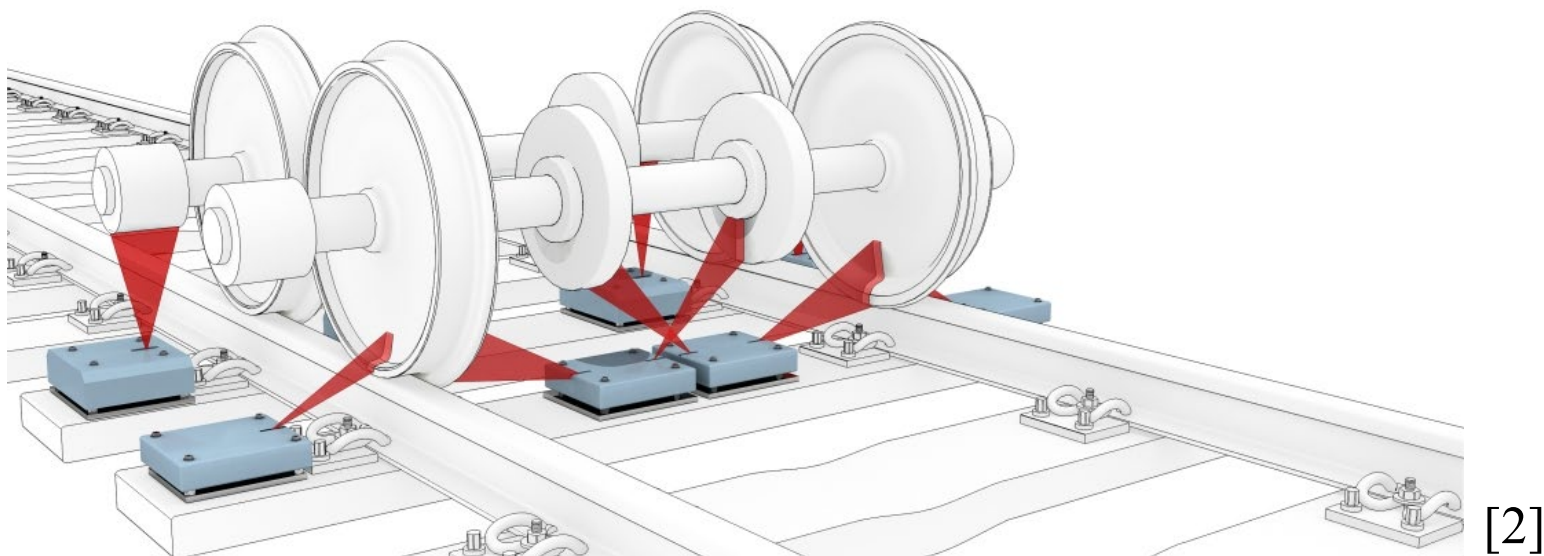
Acoustic Bearing Detectors (ABDs)

- Trackside Acoustic Detection Systems (TADS™) utilize wayside microphones

- Less than 30 systems in North America [3]

- Detect high-risk defects that span about 90% of a bearing's raceways [4]

[3]

[4]
006142

Wheel Impact Load Detectors (WILDs)

- Track-mounted strain gauges used to measure the wheel to rail contact force
- WILDs have been correlated to a decrease in wheel and/or weight related derailments dropping from 13.5 to 5.2 per year.

[5]

# LABORATORY TESTING FACILITIES

# Four-Bearing Test Rigs (4BTs)

4BT

O4BT

Single Bearing Dynamic Tester (SBT)

- Capable of testing AAR Class E, F, G and K bearings

- Can mimic rail service speed and load conditions including wheel and rail impacts and curving

- Equipped with accelerometers, thermocouples and bayonets to monitor the condition of the test bearing

- Samples at 5120 Hz for 4 seconds every 10 mins with the use of LabView and NI 9205 DAQ
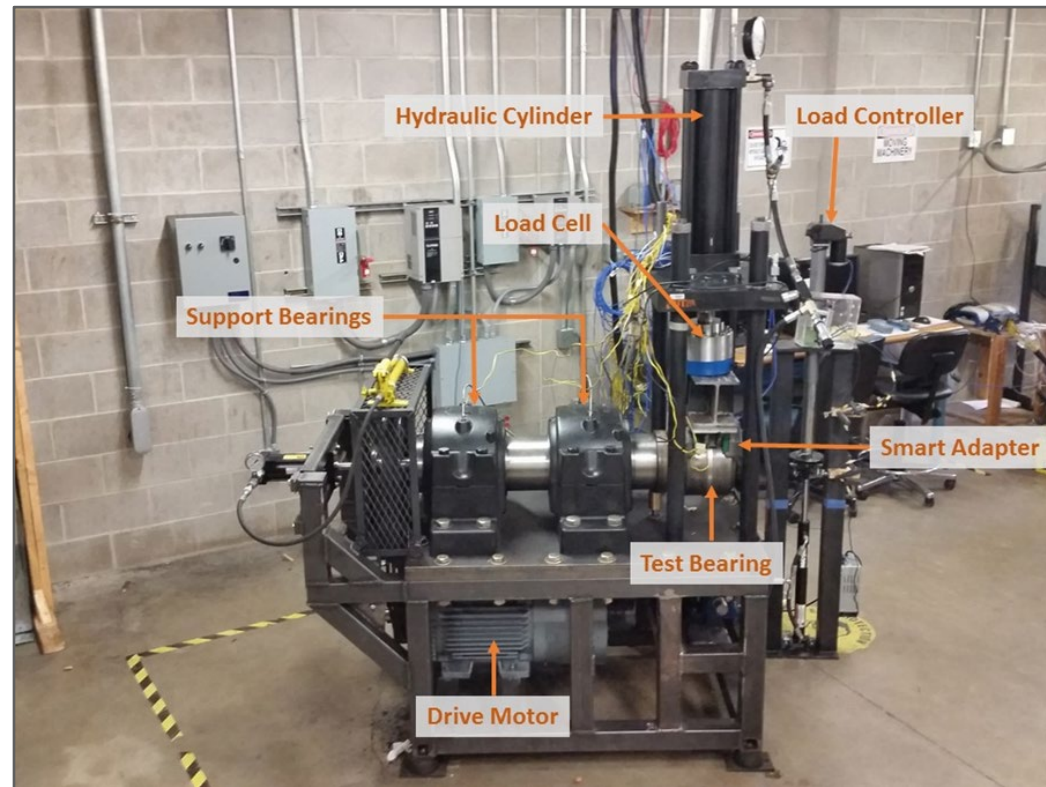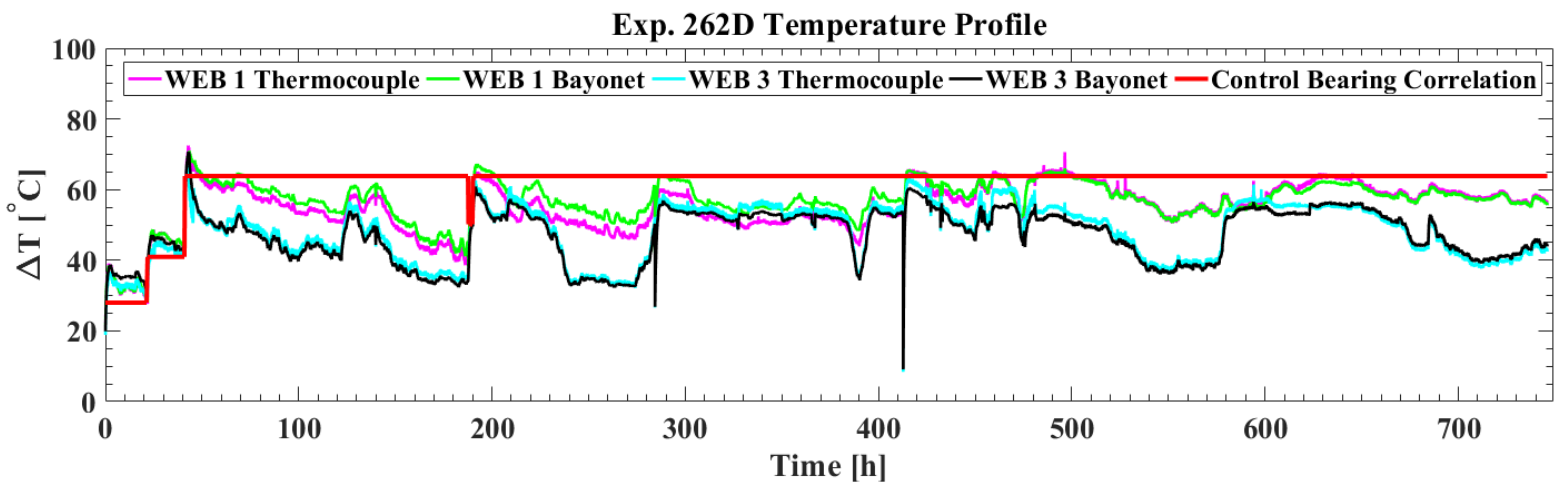
TEMPERATURE VS VIBRATION
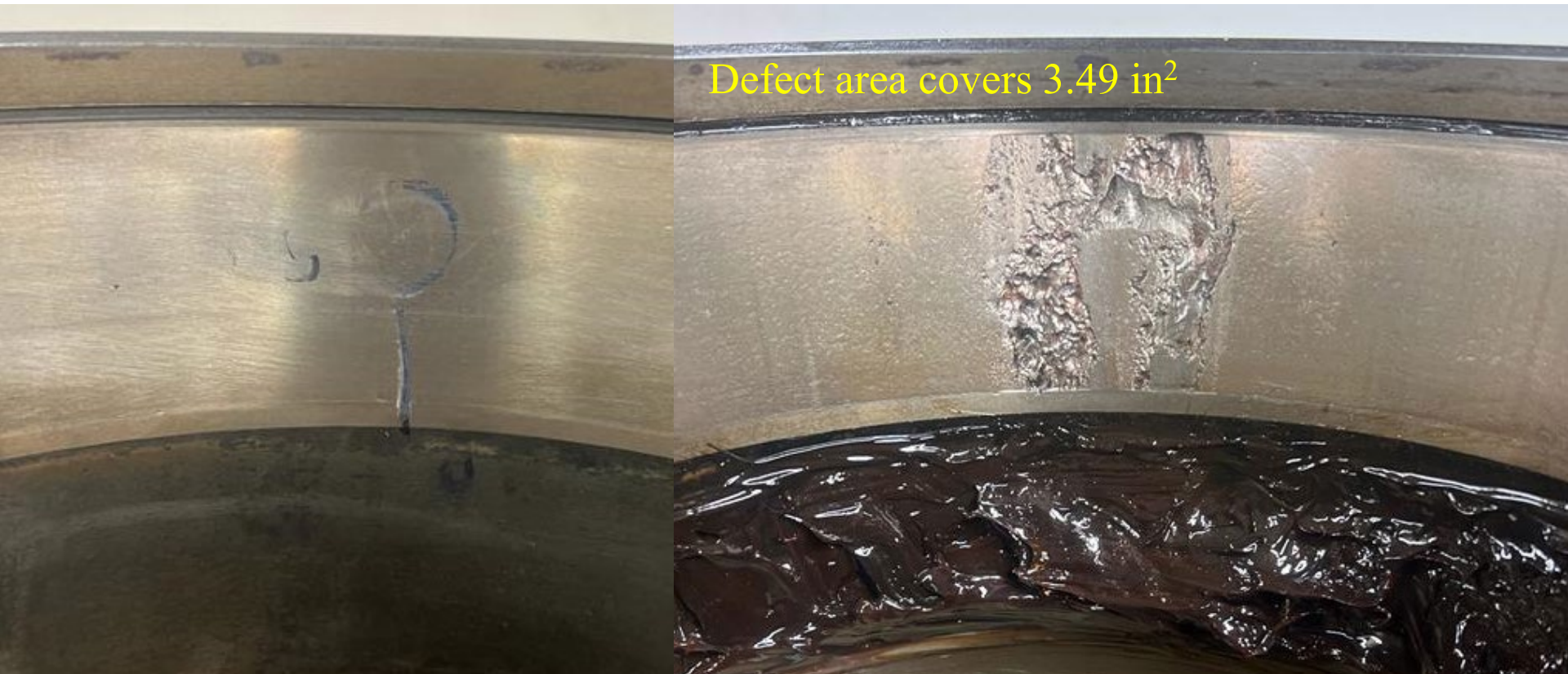
Temperature vs Vibration

WEB 3 Bearing Defect

Defect area covers 3.49 in^2
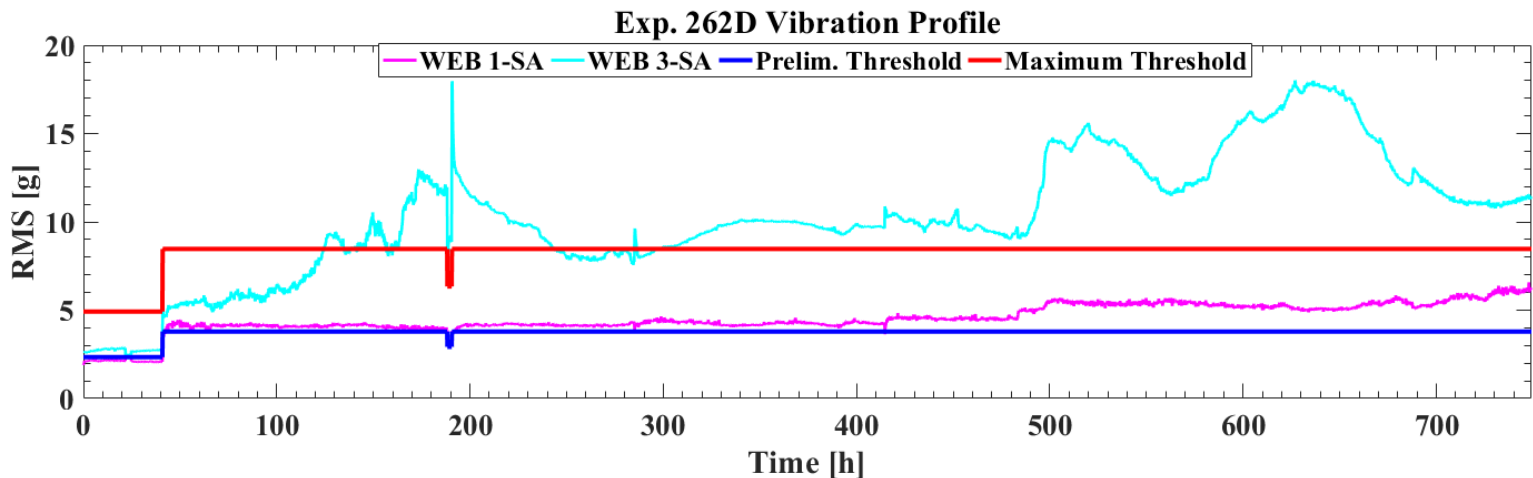
Bearing ran for 50,000 miles after defect developed

References

[1] Predikto. N.p.: Predikto, n.d. Predicting Hot Box Detector Failures. Predikto, 2015. Web.

[2] Ose, Mixanikos. "Heat Detectors-box and Brake Disc (Hot Box & Hot Wheel Detection System)." N.p., 16 July 2015. Web. 17 Jan. 2017.

[3] Transportation Technology Center, Inc. "TADS® Trackside Acoustic Detection System." https://aar.com/pdfs/TADSupdate_20160615.pdf

[4] Anderson, G., "Acoustic Detection of Distressed Freight Car Roller Bearings," Proceedings of the ASME/IEEE Joint Rail Conference & Internal Combustion Engine Spring Technical Conference, Pueblo, CO, USA, March 13-16, 2007.

[5] Stewart, M. F., Flynn, E., Marquis, B., Sharma & Associates. Department of Transportation. Federal Railroad Administration. An Implementation Guide for Wayside Detector Systems. Washington: GPO, 2019. Web. 4 Oct. 2020.