Mechanical Defect Reports Rules and Values

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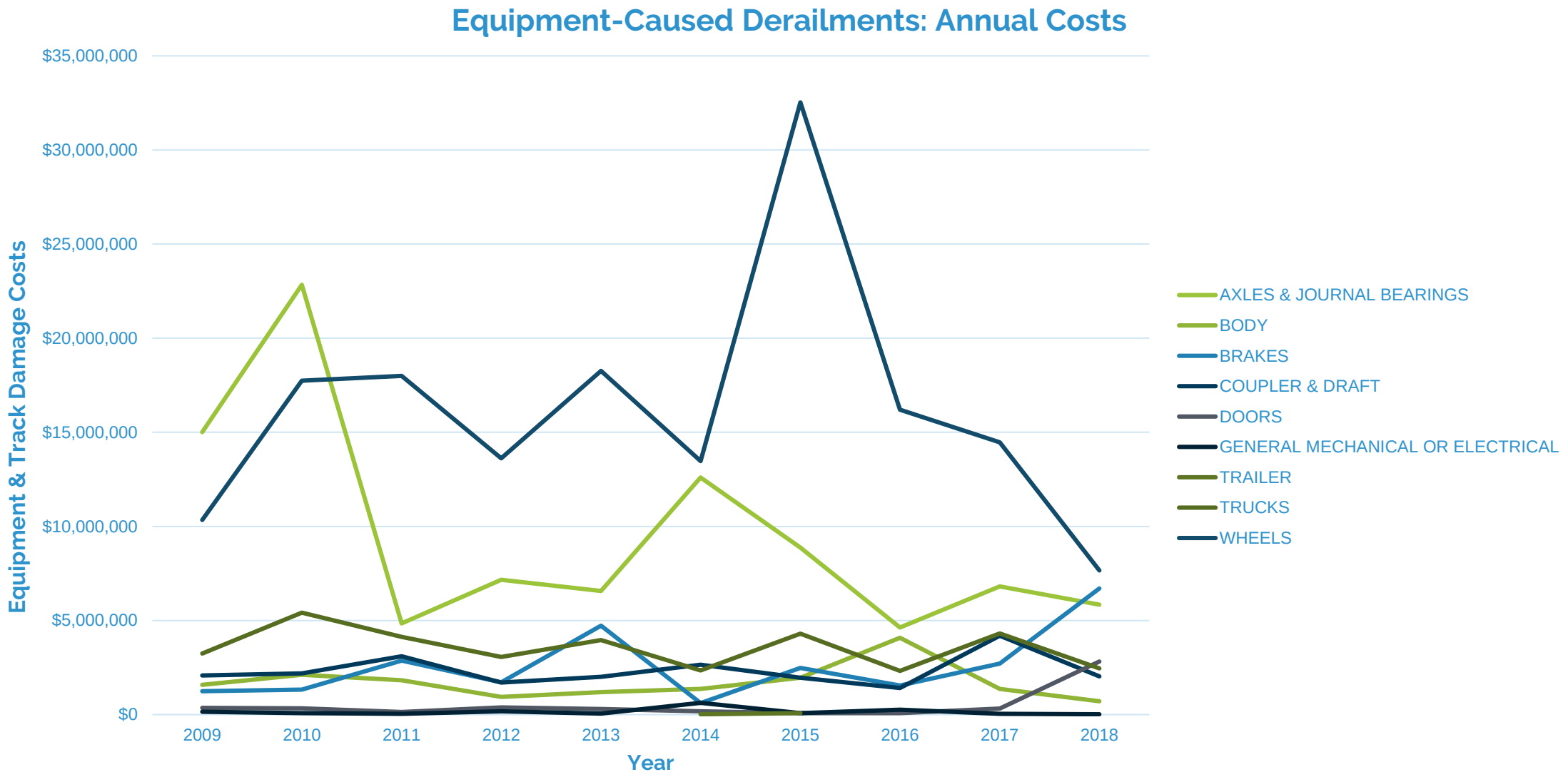
What are Mechanical Defect (MD) Reports?

- Mechanical Defects found on Wheels, Axles, Journal Roller Bearings, Truck Side Frames and Bolsters, and Couplers
- MD-11 – Journal Roller Bearings (Rule 36, overheated or acoustic)
  - Reported electronically
    - https://www.railinc.com/md11/
- MD-12 – Axles (Rule 43, broken or cracked)
  - Reported by paper, email, or fax
- MD-115 – Wheels (Rule 41, flange/rim/plate cracked or broken, thermal crack, loose, split rim)
  - Reported electronically
    - https://www.railinc.com/md115/
- MD-500 – Truck Side Frame and Bolster (Rule 47 Cracked or Broken)
  - Reported electronically
    - http://md500.aar.com/
- MD-502 – Couplers
  - Reported electronically (Rules 16-18, Broken, others optional)
    - https://www.railinc.com/md502/

FRA Safety Data



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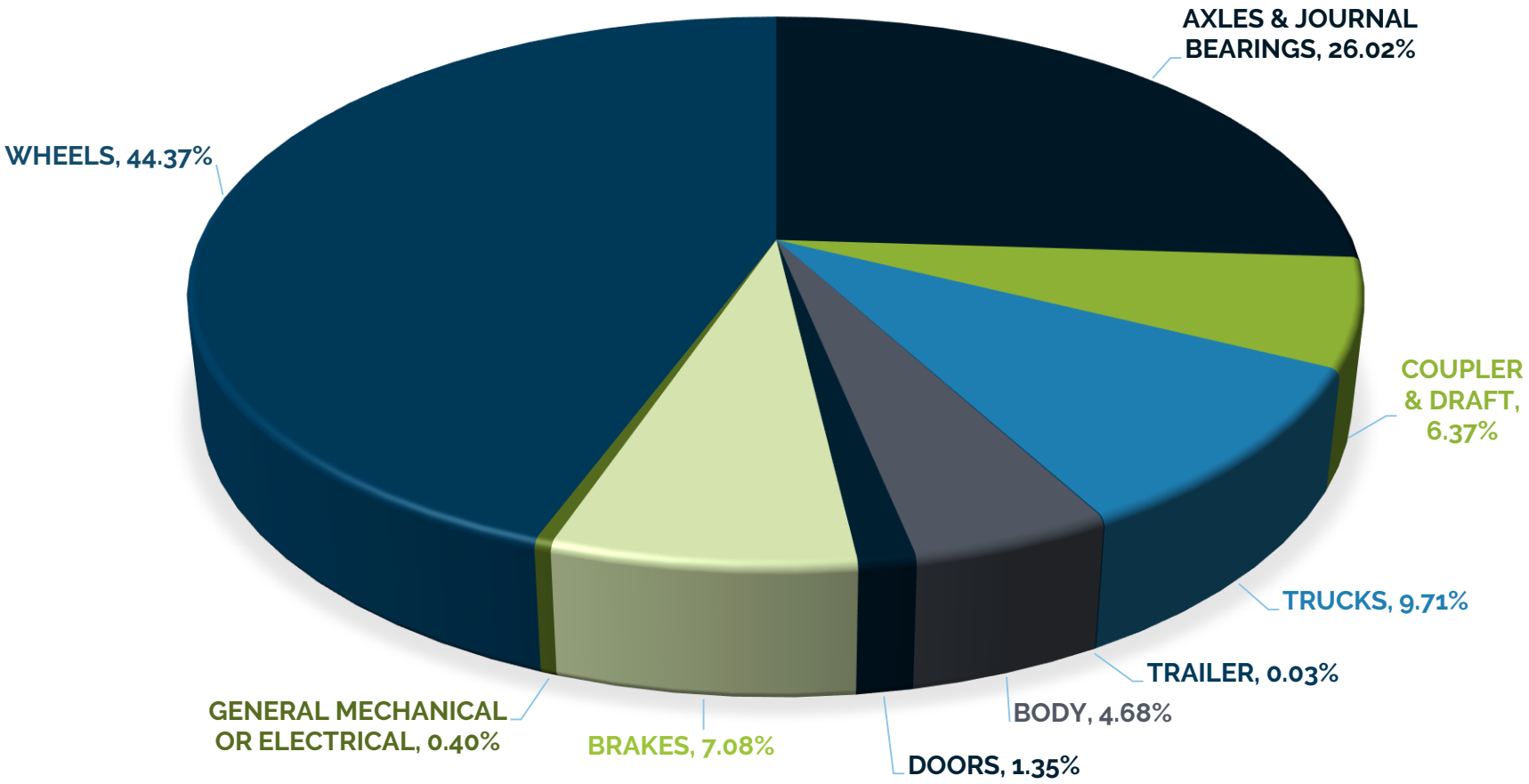
- FRA Derailment Database: 2009 - 2018. Annual cost estimates include track and equipment damage only

FRA Safety Data

EQUIPMENT CAUSED DERAILMENT PROPORTIONS:
COSTS BY EQUIPMENT TYPE 2009-2018



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- FRA Derailment Database: 2009 - 2018. Annual cost estimates include track and equipment damage only

Journal Roller Bearing Removals – MD-11

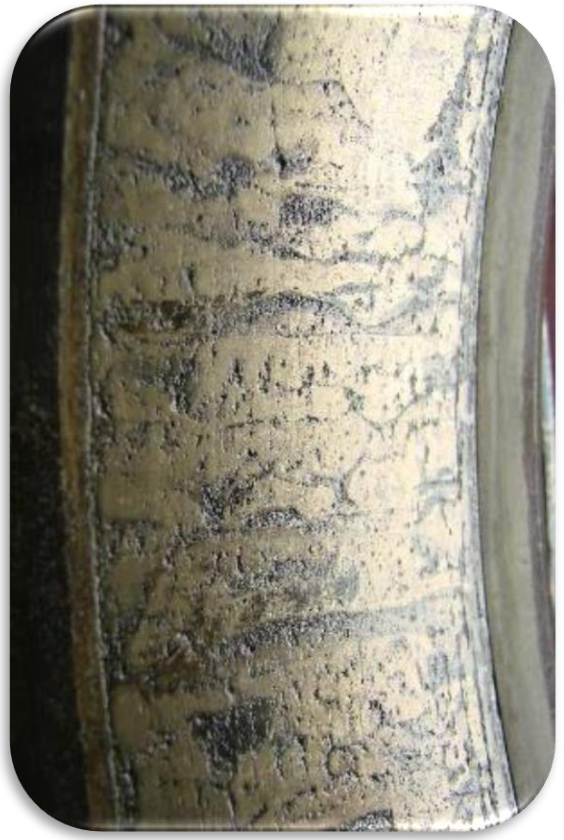
Why Made Code	Description
50	Roller bearing heated
51	Roller bearing temperature performance – Warm bearing trending
52	Roller bearing temperature performance – Warm bearing trending
91	Acoustic Bearing Detector Level 1, non-verified
95	Roller bearing fused due to overheating

MD-11 - Rule

- AAR Field Manual Rule 36.E.5
  - When a roller bearing axle is removed from the car due to a suspected/confirmed overheated roller bearing or acoustic bearing alert (WM50, WM51, WM52, WM95, or WM91),
    - an MD-11 report must be initiated at www.railinc.com/md11 or approved alternate method within 15 days of wheel set removal;
    - the roller bearing cup must be marked along the circumference with a 2-inch-wide white or yellow vinyl tape to identify the bearing for future teardown;
    - do not cover the bearing cup serial number;
    - the roller bearing cup must be marked with the car initial and number, bearing fail side, axle position, date of removal, Why Made Code, and unique identifier (MDID) provided by the MD-11 system. This should be completed using a paint pen or other suitable marking method on the tape.

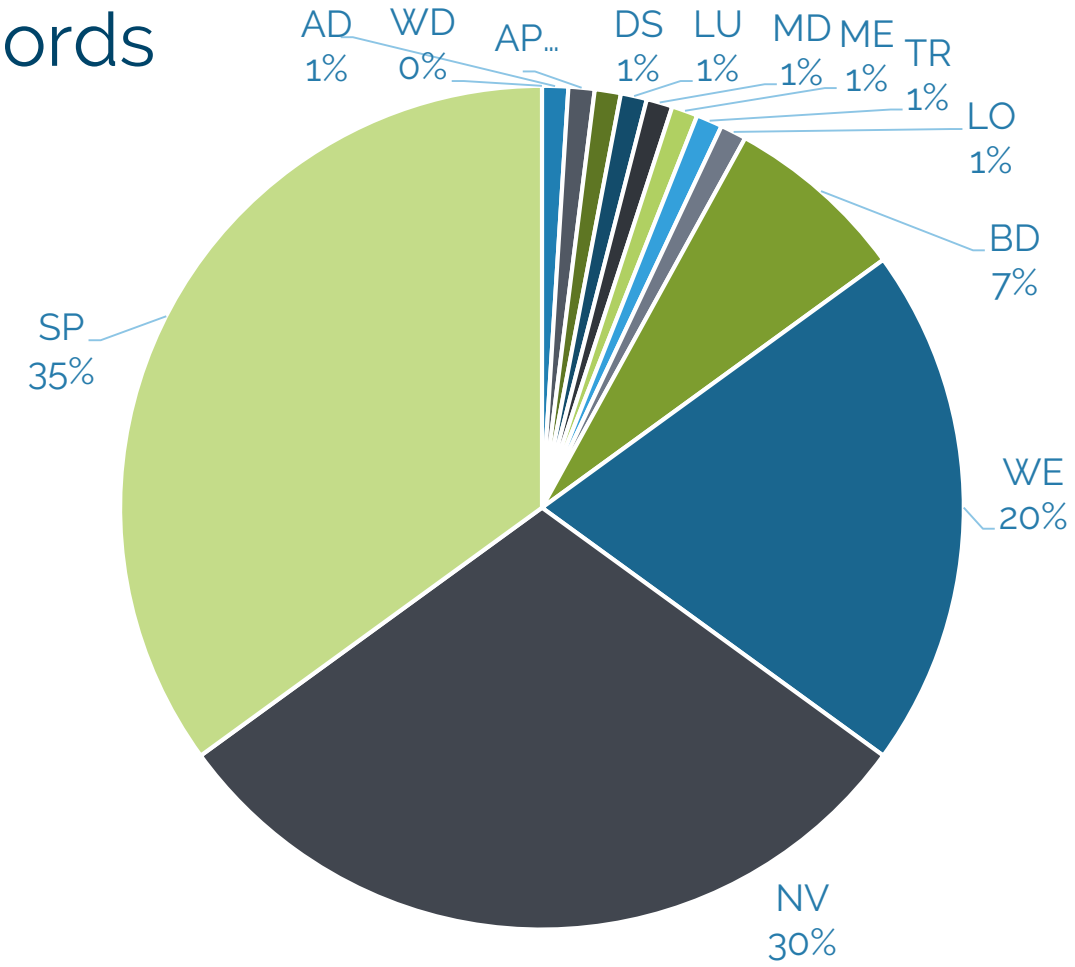
MD-11

- WABL Committee reviews twice a year
- Examining defect type, manufacturer, manufacture date, verified failures, detector type, seal type, and average years to failure
- All reports submitted via the Railinc website
  - Railroads use integrated Webservice



Bearing Removals

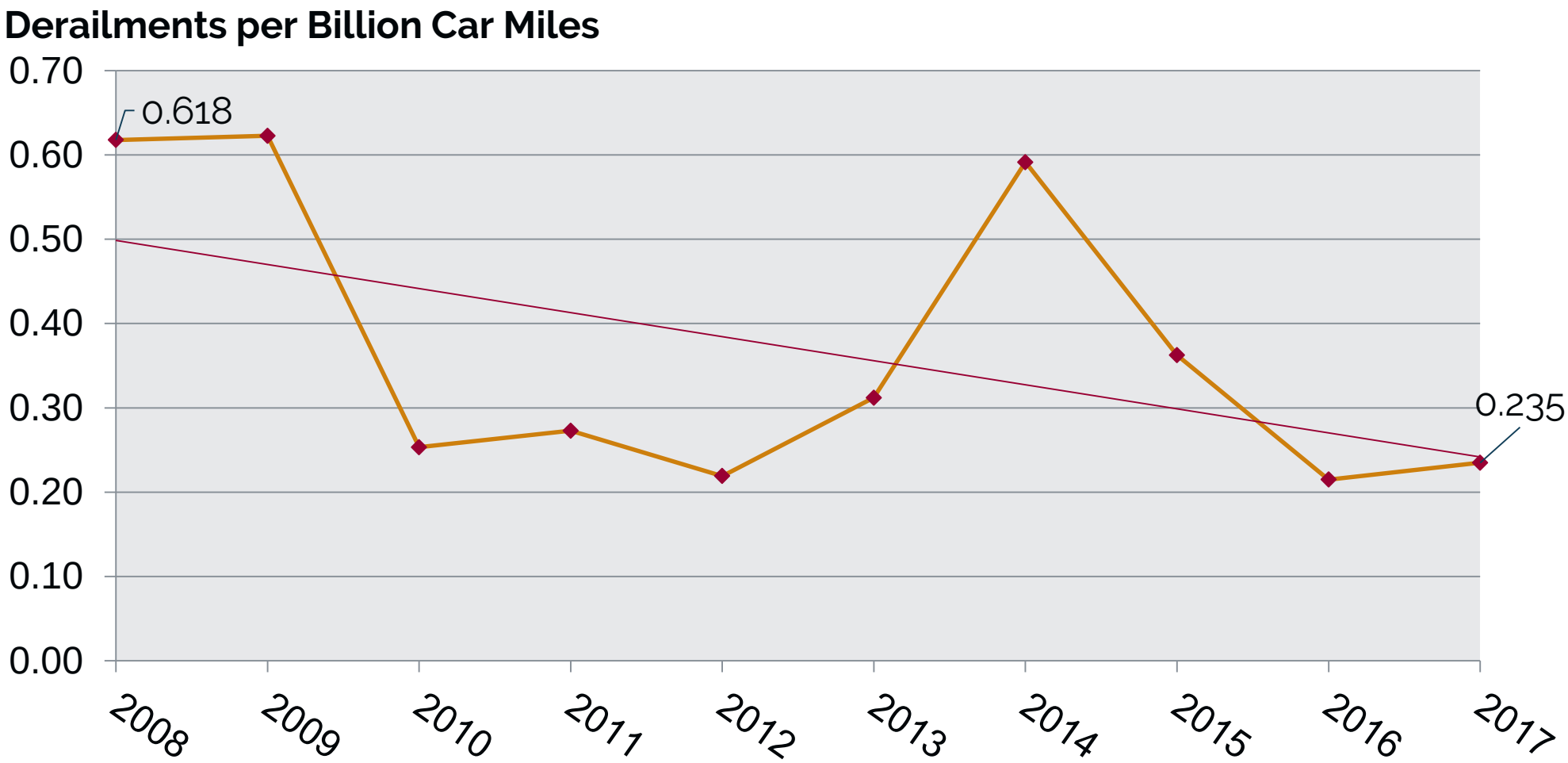
- 5 years of bearing teardown data
- ~28,500 records



Failure Progression Mode (FPM)	
AD	Adapter – Displaced, Worn, Wrong Size or Broken
AP	Application Defects
BD	Bearing Destroyed, Undetermined
DS	Displaced Seal
LO	Loose Bearing
LU	Lubrication
MD	Manufacturer/Remanufacturer/ Reconditioner Defect
ME	Mechanical
NV	Non Verified Setout
SP	Fatigue Spalling
TR	Truck Related
WD	Wheel Tread Defect
WE	Water Etch

Note: Simulated data

Bearing – FRA Reported Train Derailment Rates
U.S. Class I Railroads on Main Track (2008 – 2017)



Source: TTCI Analysis of FRA Train Accident Database, February 2019.
Note: Filtered by JOINTCD=1, ACCTRK=1 (main track), and TYPE=1 (derailments)
Bearing: E53C and E55C

Axle Removals – MD-12

Why Made Code	Description
54	Axle broken or visually cracked

MD-12 - Rule

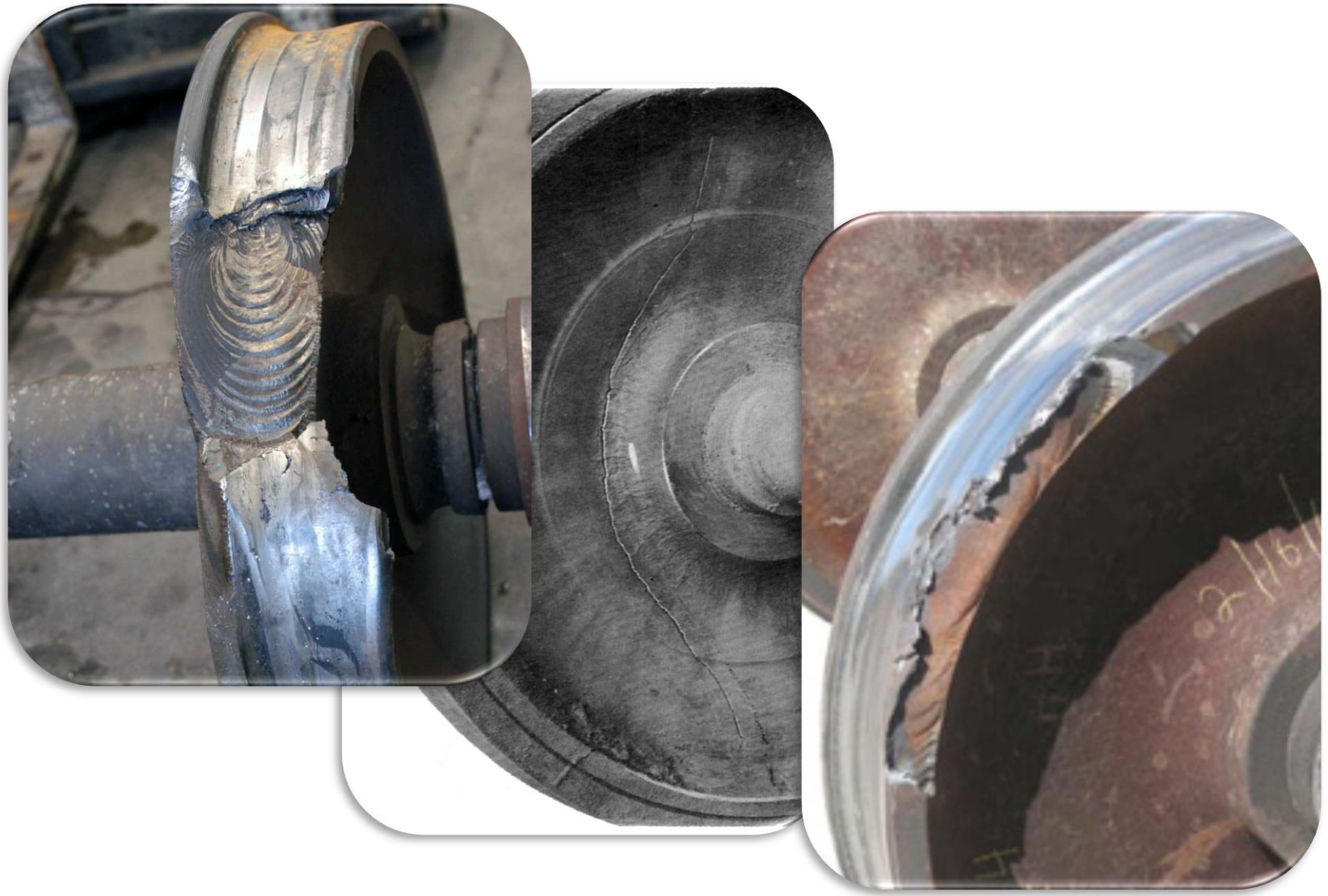
- AAR Field Manual Rule 43.E.5
  - An MD-12, AAR Failed Axle Report, must be prepared and submitted via facsimile or overnight mail within 15 days of axle removal for each axle removed for Why Made Code 54. Facsimiles must be submitted to TTCI at 719-585-1895.

MD-12

- WABL Committee reviews all axle failures
- Examining manufacturer, manufacturer date, axle heat, wheel shop, mounting date, and repairs
- 2 – 27 failures reported per year
  - Varies each year
- Railinc to automate in 2020

Wheel Removals – MD-115

Why Made Code	Description
66	Flange cracked or broken
68	Rim cracked or broken
69	Thermal crack extending into plate
71	Rim shattered
83	Wheel with cracked or broken plate
85	Wheel loose
1D	Vertical split rim

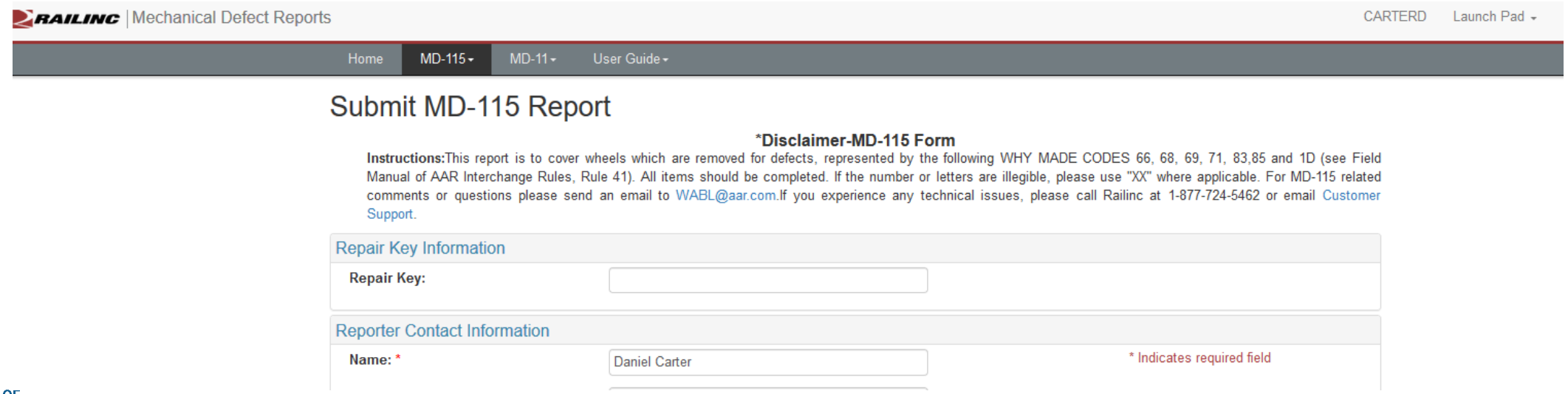


MD-115 - Rule

- AAR Field Manual Rule 41.E.10
  - An AAR Form MD-115 report must be submitted within 15 days of wheel removal for each wheel removed for Why Made Codes: 66, 68, 69, 71, 83, 85, and 1D. Wheels must be retained for 45 days. The report must contain an attachment of a digital photograph of the failed wheel fracture surface. All AAR Form MD-115 reports must be submitted via the Railinc website (https://www.railinc.com/md115/) or approved alternate method.

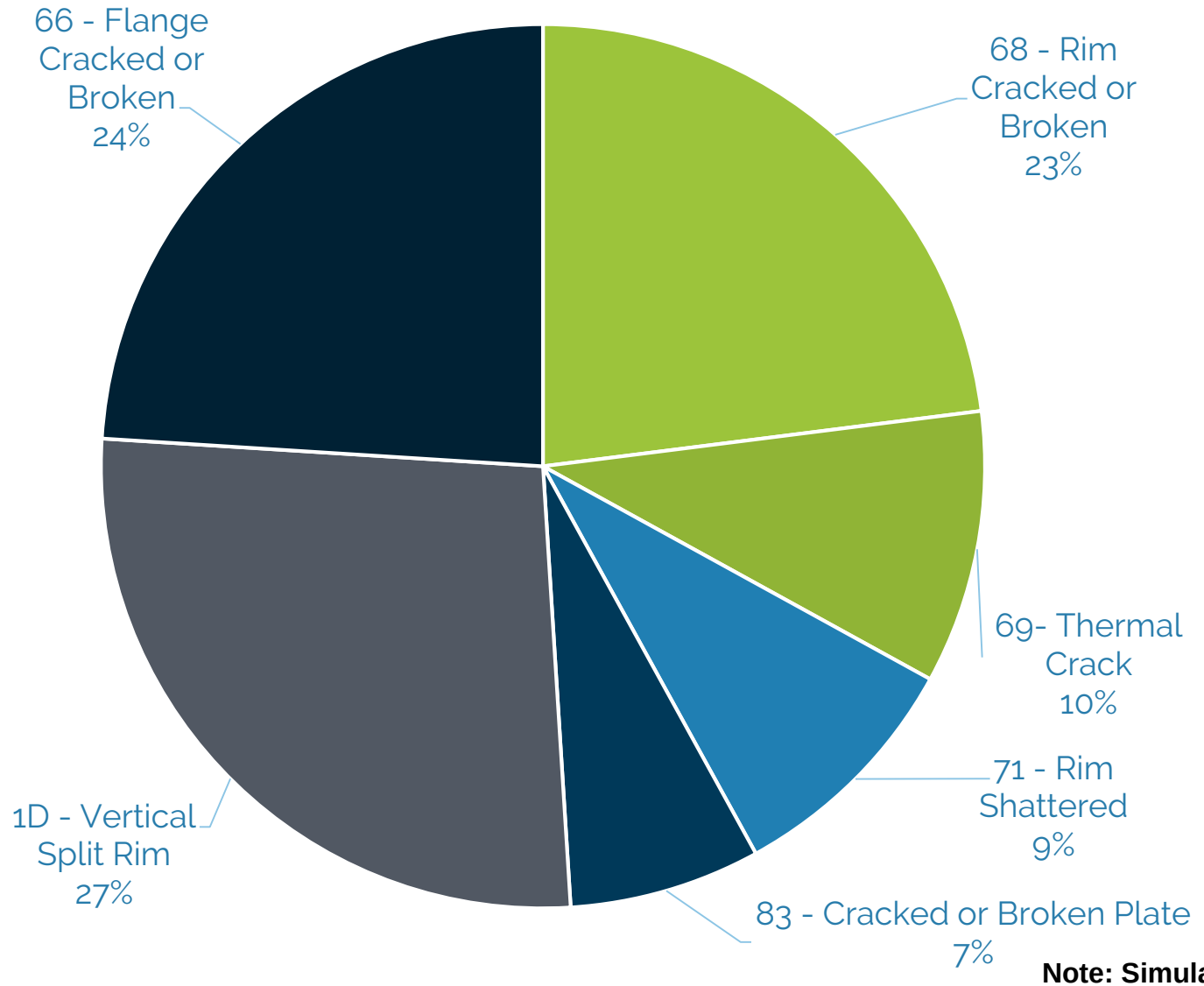
MD-115

- WABL Committee reviews twice a year
- Examining defect type, manufacturer, manufacture date, and failure rate
- All reports submitted via the Railinc website
  - Railroads use integrated Webservice



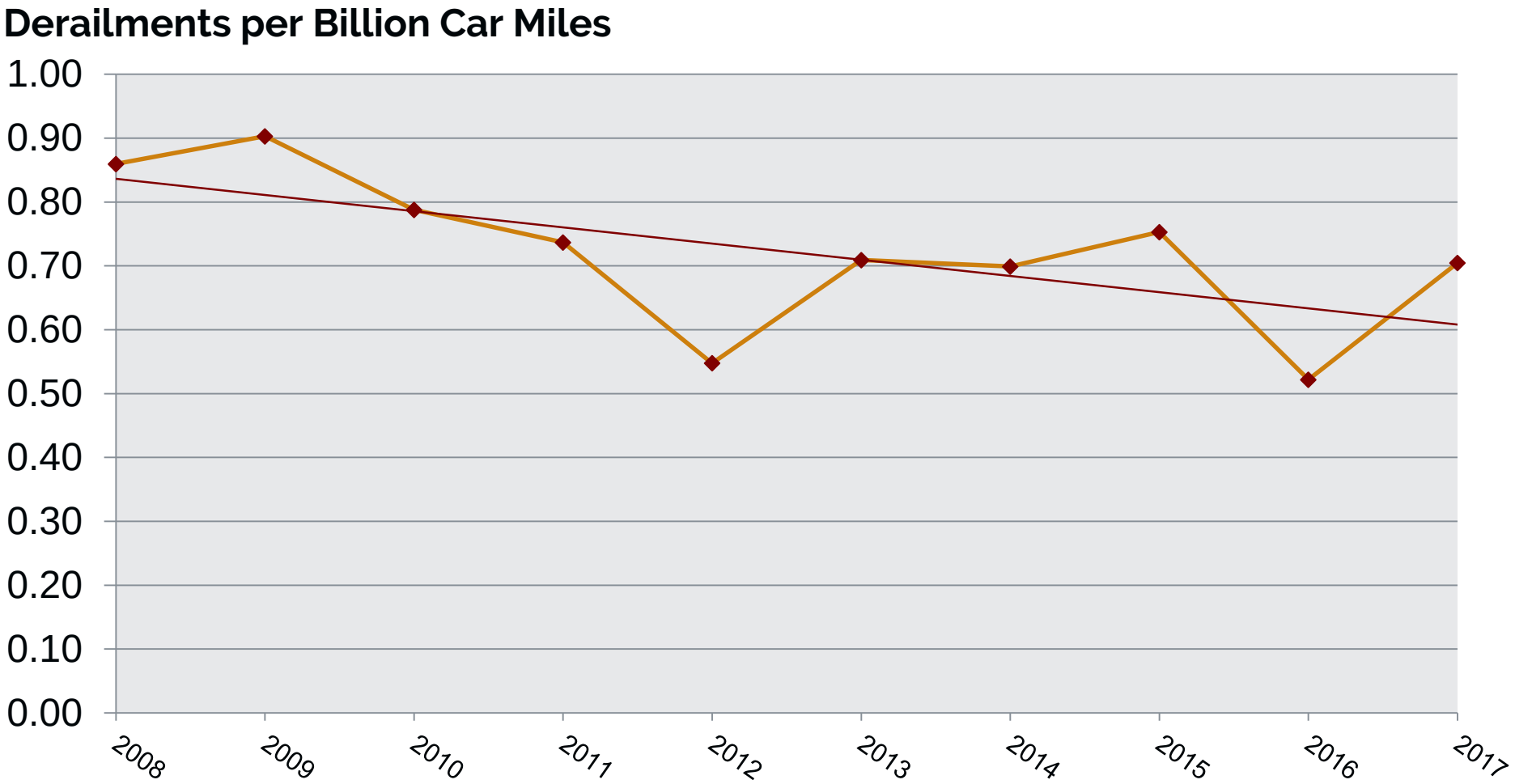
Wheel Removals

- MD-115 and CRB removal data
- Analysis includes 3 years of data
  - ~1,600 records



Note: Simulated data

Wheel – FRA Reported Train Derailment Rates
U.S. Class I Railroads on Main Track (2008 – 2017)



Source: TTCI Analysis of FRA Train Accident Database, February 2019.
Note: Filtered by JOINTCD=1, ACCTRK=1 (main track), and TYPE=1 (derailments)
Wheel: E60C-E69C, and E6AC

Truck Removals – MD-500

Why Made Code	Description
02	Broken*
41	Cracked*

*Report need not be submitted for a crack or break existing only in the bolster bowl rim and not extending below the top horizontal surface of the adjacent bolster body

MD-500 - Rule

- AAR Field Manual Rule 47.E.10
  - An AAR Form MD-500 Report must be submitted via the AAR website (http://md500.aar.com), or approved alternative method, within 15 days of bolster removal for each bolster removed for Why Made Codes 02 and 41. The report must contain an attachment of a digital photograph of the reported bolster fracture.
- AAR Field Manual Rule 48.E.7
  - An AAR Form MD-500 Report must be submitted via the AAR website (http://md500.aar.com), or approved alternative method, within 15 days of side frame removal for each side frame removed for Why Made Codes 02 and 41. The report must contain an attachment of a digital photograph of the reported side frame fracture.

MD-500

- Coupling System and Truck Castings Committee reviews
- Examining manufacturer, manufacture date, serial number, classification marks, and repairs
- Currently hosted by TTCI, to be migrated to Railinc in 2020

Coupler Failures – MD-502

Why Made Code	Description
02	Broken
1J	Broken Pin Protector
41	Cracked
79	Cracked behind horn
82	Cracked front face
86	Cracked key slot (E-type only)
87	Cracked pin protector
88	Cracked behind pulling lug

MD-502 – New Rule Added on January 1, 2020

- AAR Field Manual Rule 16.E.10
  - An AAR Form MD-502 report must be submitted within 15 days of coupler removal for each coupler removed for Why Made Code 02—Broken. The report must contain digital photographs of the failed coupler, including fracture surfaces, markings, and other images as indicated on the form. All AAR Form MD-502 reports must be submitted via the Railinc Web site (https://www.railinc.com/md502/) or an approved alternate method. Couplers removed for Why Made Codes 1J, 41, 79, 82, 86, 87, and 88 may also be reported using MD-502, although this is not mandatory.

MD-502

- CSTC Committee will review failures
- Evaluating failure modes and trends related to new and used couplers
- Expected 15,000 reported failures annually
- Railinc developed in 2019
- Reporting mandatory as of January 1, 2020.

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Thank you!