

How tomorrow moves [CSX]

Rail Integrity Management

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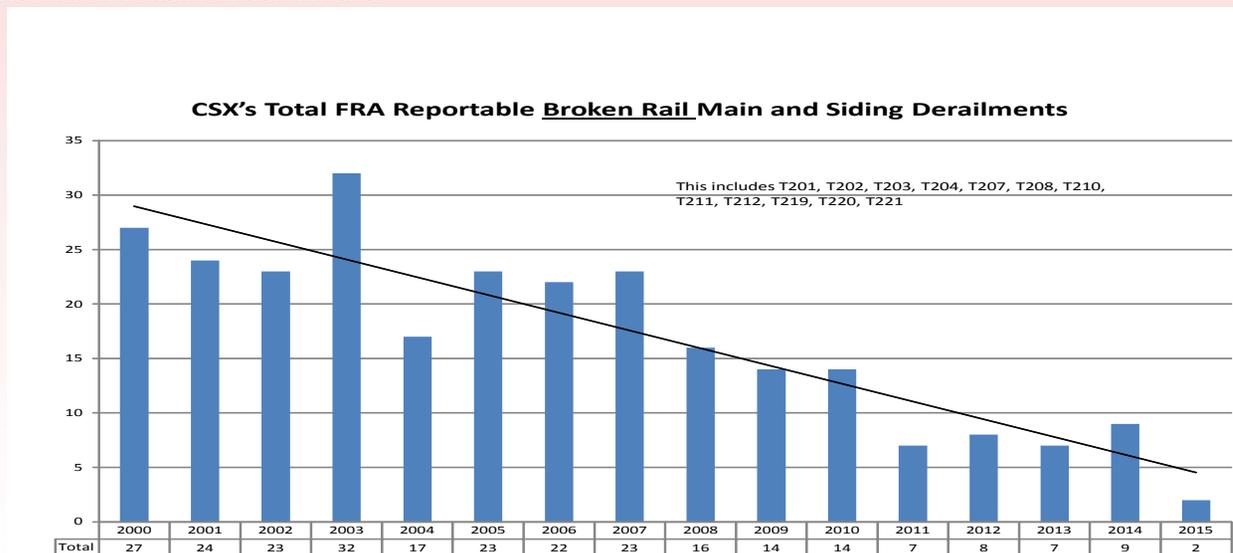
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WRI 2016

Railroad performance

- Long Term Trend
 - Reduced broken rail derailments



Risk Evaluation FRA 213

- FRA regulation and CSX evaluates segments of track based on Service Failures per mile per year.
- FRA regulations were published in 2014.
 - .10 RSF per year per mile of track for class 4, or class 5
 - .09 RSF per year per mile of track with passenger or Hazmat for class 3, class 4, and class 5.
 - .08 RSF per year per mile of track with Hazmat and passenger for class 3, class 4, and class 5.

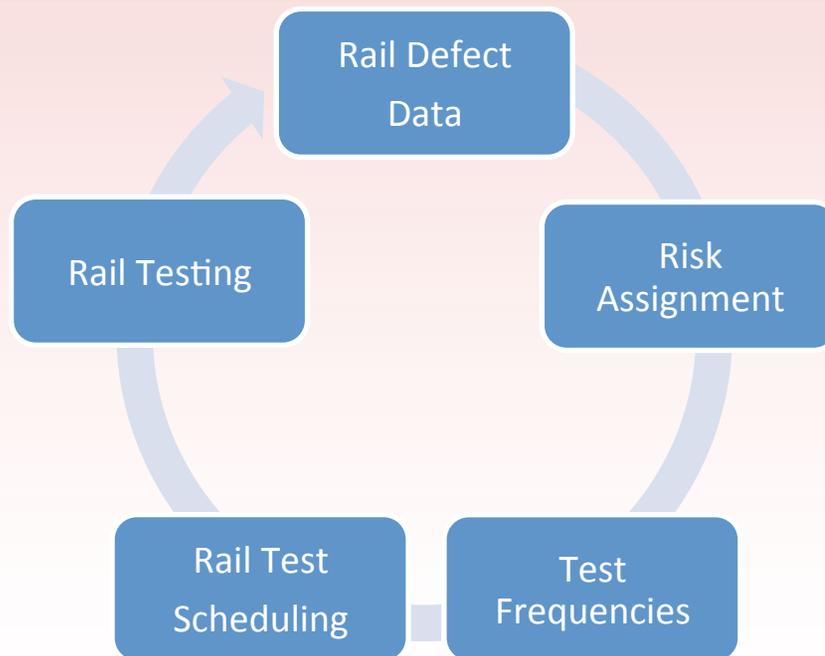


Corrective Actions

- Adjust Rail Test Frequency
- Rail Grinding
- Capital Planning – Rail Replacement
- Lubrication / Friction Modifiers
- Temporary Slow Order and Remediation
- Develop and explore new technologies and advancements in Service Failure Prevention



Rail Test Integration and Modeling



Inputs into the model,

- Detected Defect Data
- Service Failure Defect Data
- Previous Frequencies
- Track information – SGL, 1, 2,..
- HazMat Routes
- Tonnage
- Passenger Routes
- Speed

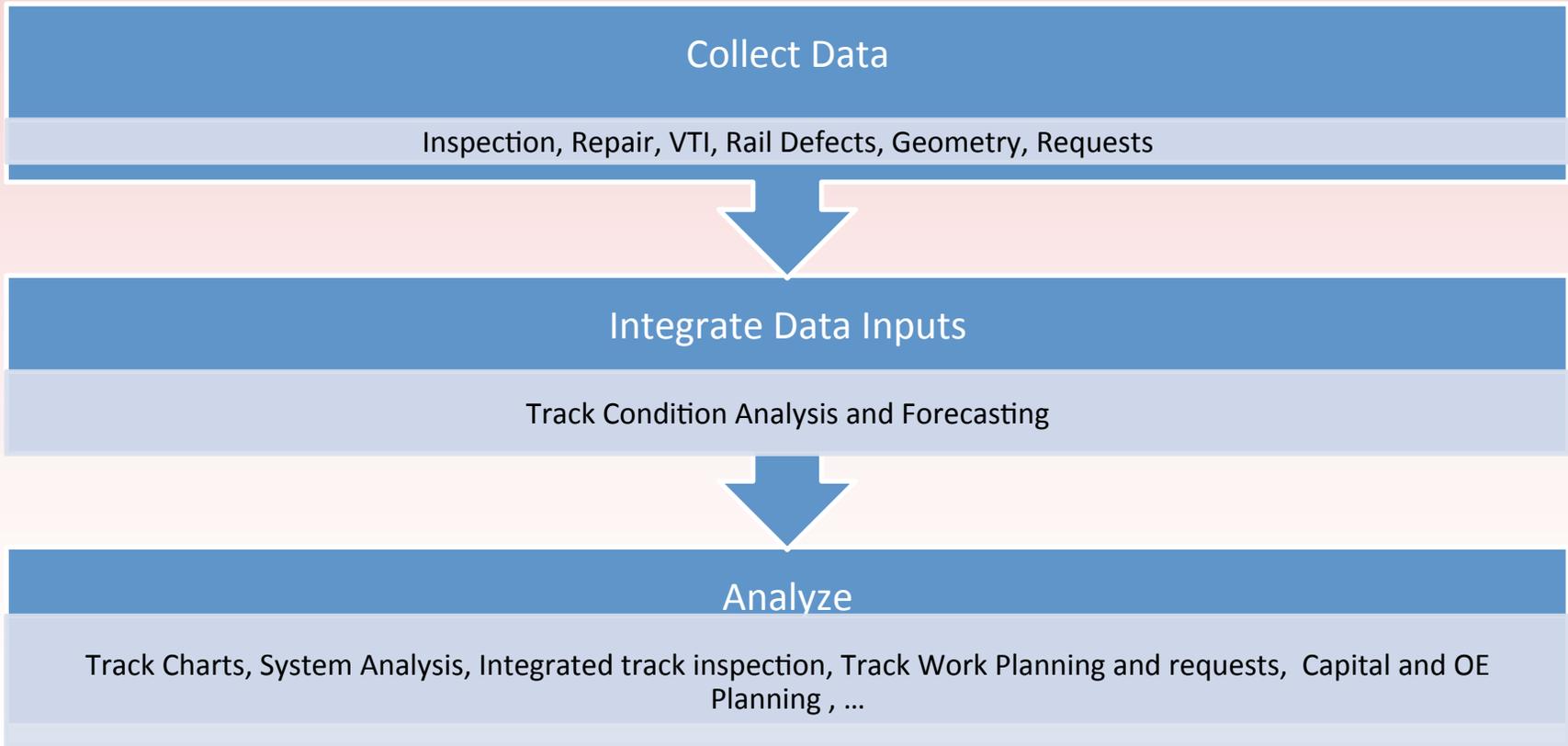
- Signal information



Rail Replacement

- Extending and maximizing life is accomplished by many factors and not just one. CSX uses a holistic approach.
- Taking all the inputs and putting your resources where you need it based on many factors.
 - Defect history
 - Age of rail
 - Wear and predictive wear
 - Risk assignment
 - Curvature and Grade





Rail Grinding

- Maintenance or Corrective Grinds
- Rail is the most expensive component of the track
- Grinding has evolved to help control wear on rail and wheel by managing WR Contact.
- Frequencies are based on many variables
 - Including type of track
 - Tonnage
 - curvature
 - Profile



Lubrication/ Friction Modifiers

– Gage Face

- Lubrication in curves has proven to be an effective technique to reduce rail and wheel wear
- Extends wear life
- Reduces curving forces
- Reduces Wheel Flanging noises



Lubrication/ Friction Modifiers

- Top Of Rail Friction Modifiers
 - CSX has been using TOR now for over 5 years
 - Wheel tread to distribute the friction modifier
 - Reduces wheel flanging noise and wheel squeal
 - Positive friction during wheel slippage
 - Reduces L/V Forces which reduces rail rollover and gage widening
 - Reduces Rail corrugation



What is new and coming to help manage rail integrity

- Eddy Current
- Phased Array
- Run on Run Real Time Analysis of Test Data
- Continuous Non- Stop Ultrasonic Testing
- Advancements in Machine Vision for RCF
- Thermal Imaging
- Laser based ultrasonic
- Big Data Integration
- Base Rail Testing
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*** All will be a piece of the puzzle for lowering risk

