



Transportation Technology Center, Inc., a subsidiary of the Association of American Railroads

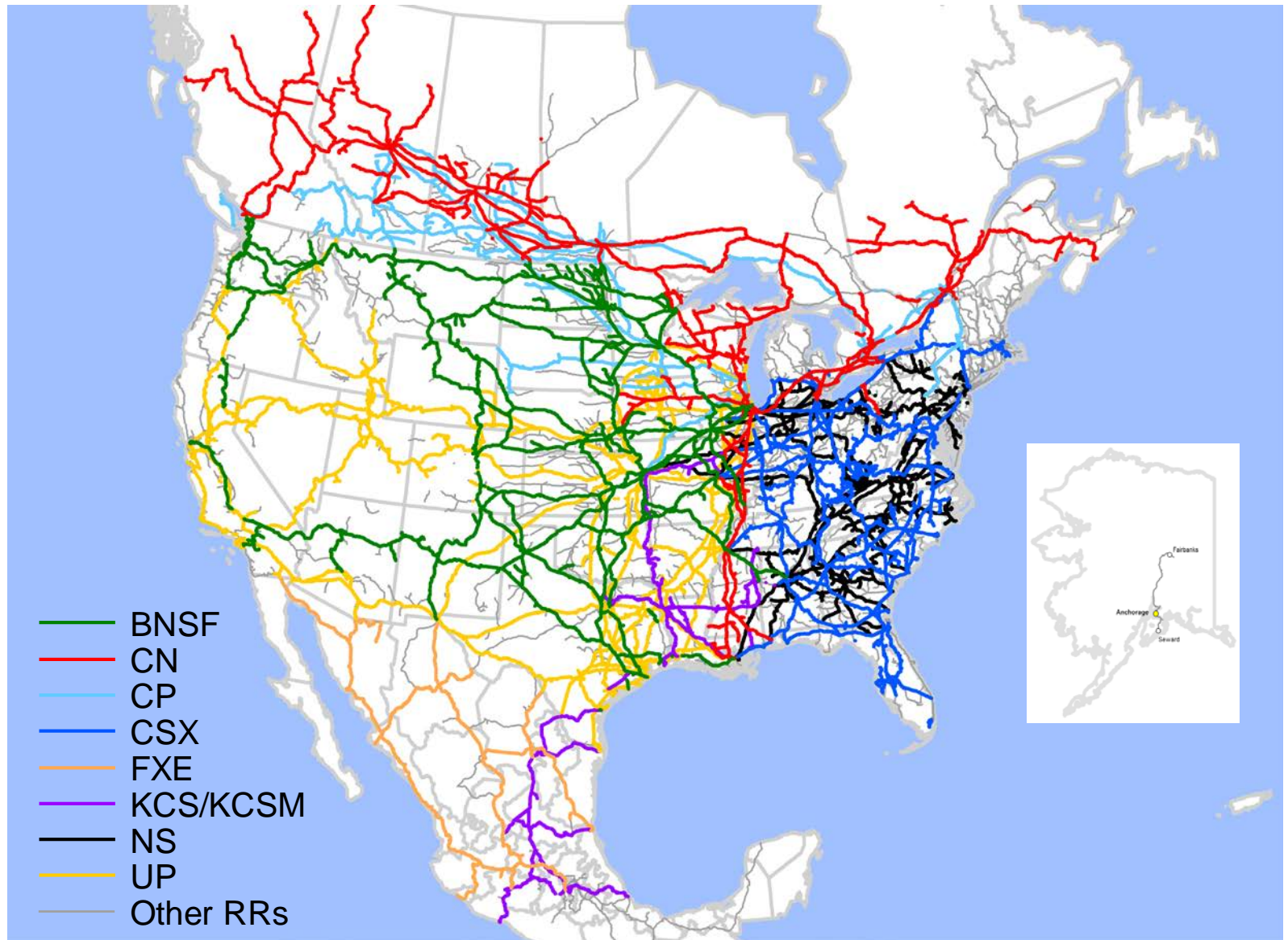


Rail Safety in North America

Lisa A. Stabler
President - TTCI

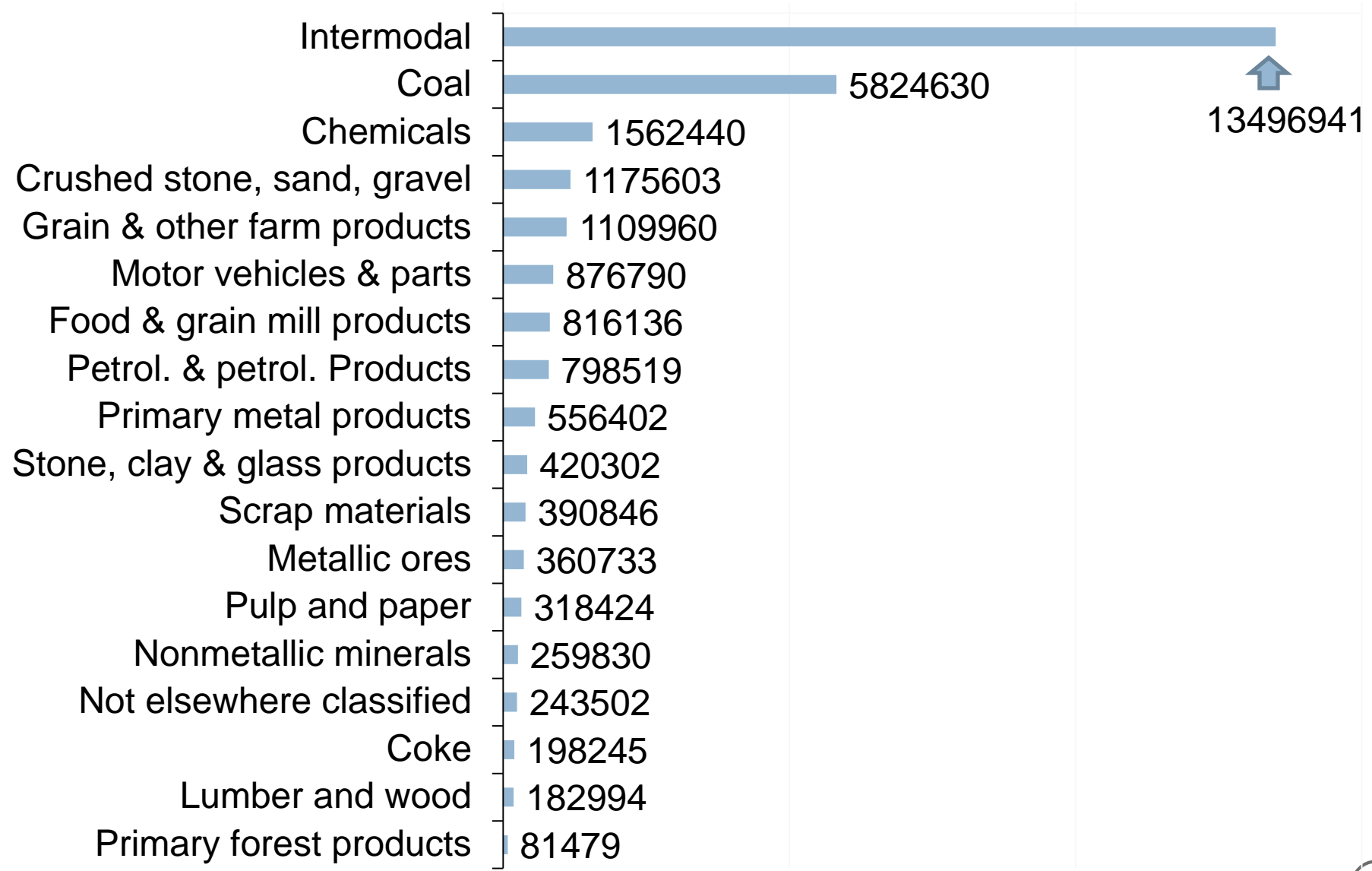


Freight Railroads in North America





Carrying the Things that America Depends On – Number of Carloads in 2014





Railroads' Scale Enables Efficiency Elsewhere in Economy

- ◆ **One railcar of coal = electricity for 60 homes for a year.**
- ◆ **One railcar of wheat = 258,000 loaves of bread.**
- ◆ **One railcar of corn = 37,000 chickens or 480,000 bags of Fritos.**
- ◆ **One railcar of fertilizer = 1,400 acres**



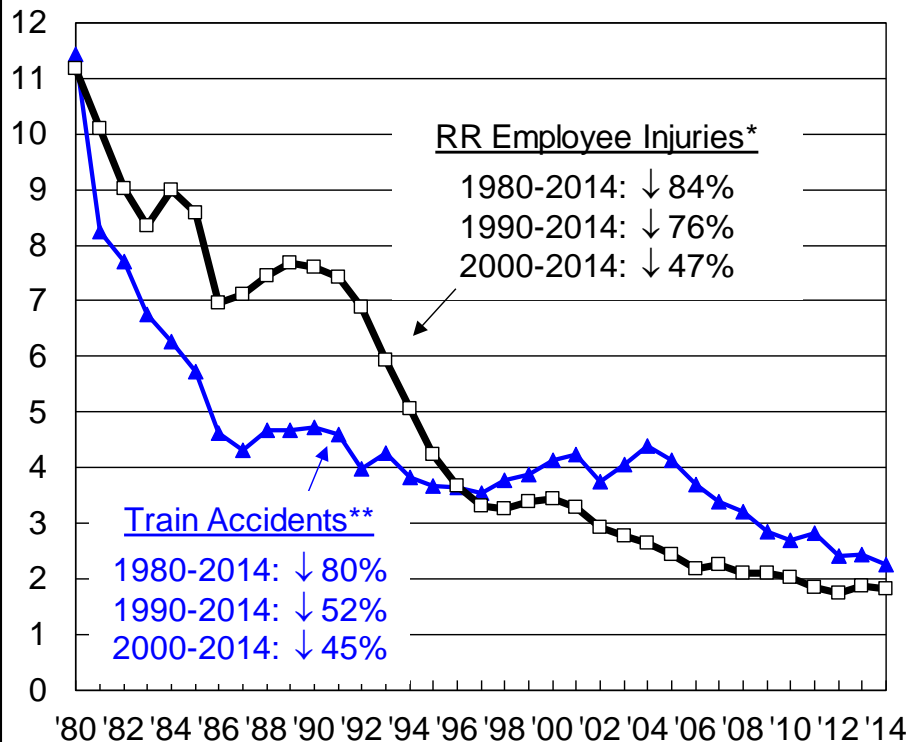


Why Freight Rail? Big Environmental Benefits

- ◆ **In 2014, RRs moved a ton of freight an average of 479 miles per gallon**
- ◆ **RRs are 4 times more fuel efficient than trucks**
 - Reduces greenhouse gases by 75%
- ◆ **One train = hundreds of trucks**
 - Cuts highway congestion
 - Reduces pressure to build new highways.

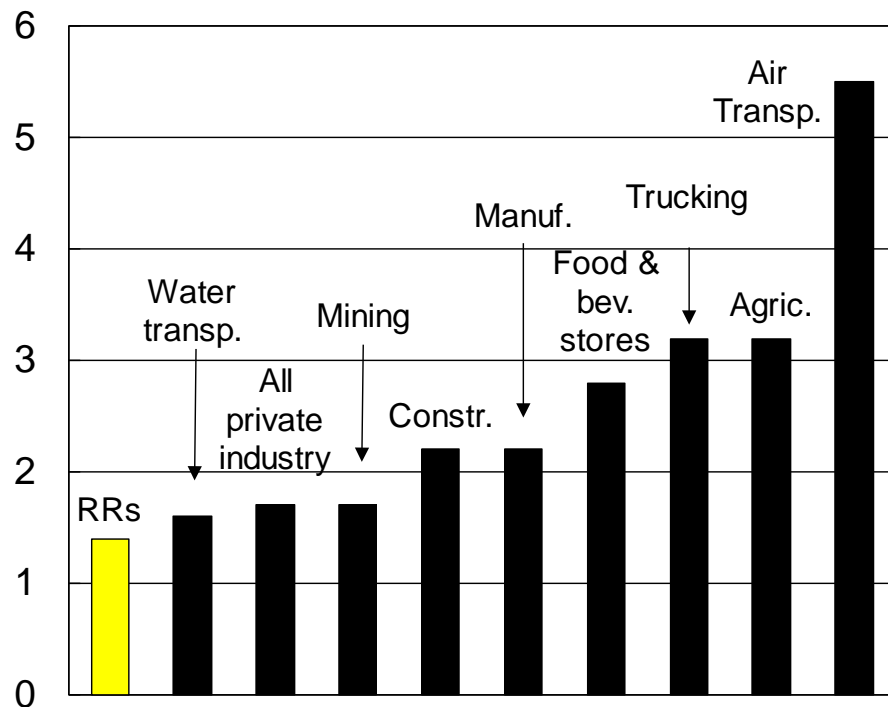


Rail Accident & Injury Rates Have Plunged



*Injuries and fatalities per 100 employee equivalents. **Train accidents per million train-miles. Source: FRA

RRs Are Safer Than Most Other Industries (injuries per 200,000 employee-hours)



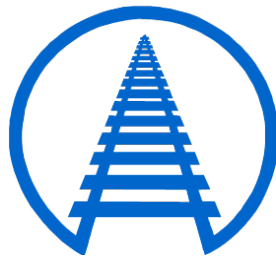
Data are 2013. Source: Bureau of Labor Statistics





The Association of American Railroads

- ◆ **Set industry standards**
- ◆ **Represent the railroad industry before Congress, regulatory agencies, etc.**
- ◆ **Collect and distribute statistical data**
- ◆ **Public affairs**
- ◆ **Research and evaluate new technologies**
- ◆ **Provide information technology services**



**ASSOCIATION OF
AMERICAN RAILROADS**





History of Transportation Technology Center (TTC)

- ◆ Formally dedicated as High Speed Ground Test Center-May 17, 1971
- ◆ Developed and operated by Federal Railroad Administration (FRA) and Urban Mass Transit Administration (UMTA), now Federal Transit Administration (FTA)
- ◆ AAR assumed care, custody, & control at TTC – October 1982
- ◆ AAR Research & Test Dept. consolidated at TTC - 1995-97
- ◆ TTCI formed January 1, 1998



TLRV

Tracked Levitated Rail Vehicle



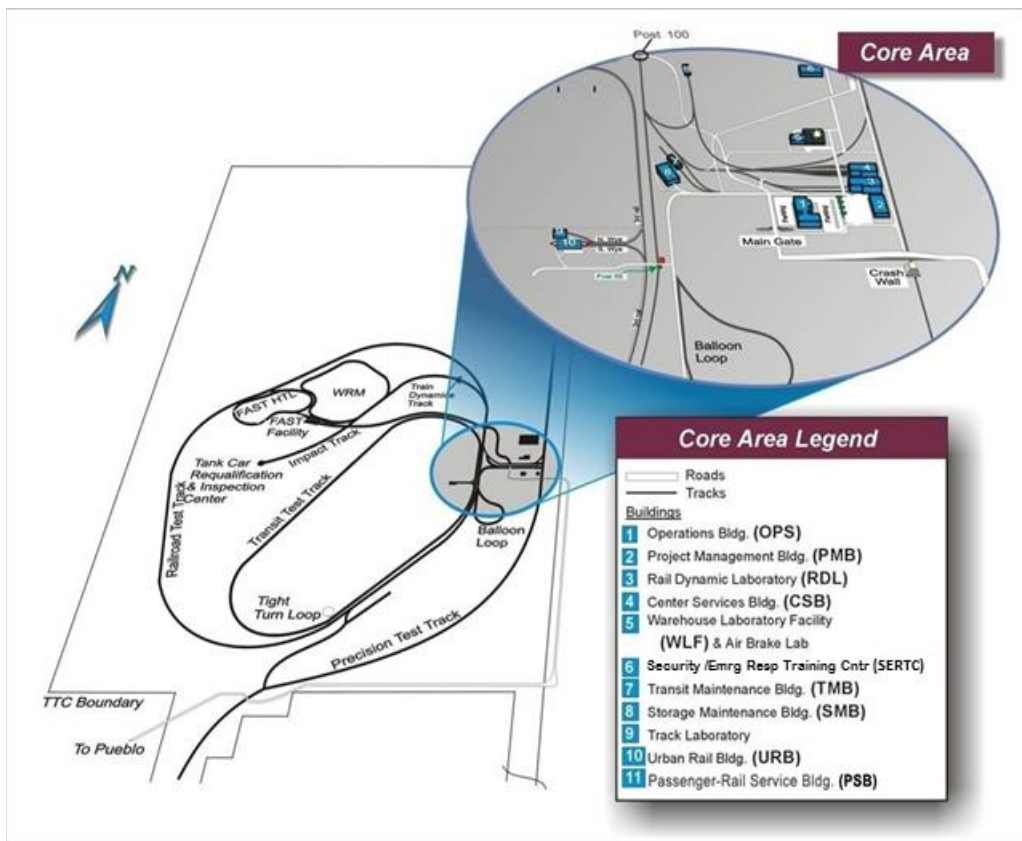
LIMR-V

Linear Induction Motor Rail Vehicle





TTCI – Transportation Technology Center, Inc.



- ◆ Wholly owned subsidiary of the Association of American Railroads
- ◆ Located in Pueblo, Colorado
- ◆ Operates the Transportation Technology Center on behalf of the Federal Railroad Administration
- ◆ Focus on research, development, testing and training for the rail industry
- ◆ 270 Employees
- ◆ 52 square mile facility with 48 miles of track
- ◆ Full-size laboratories capable of testing rail cars
- ◆ Brings \$38 annually to Southern Colorado

TTCI®
*Transportation
Technology Center, Inc.*



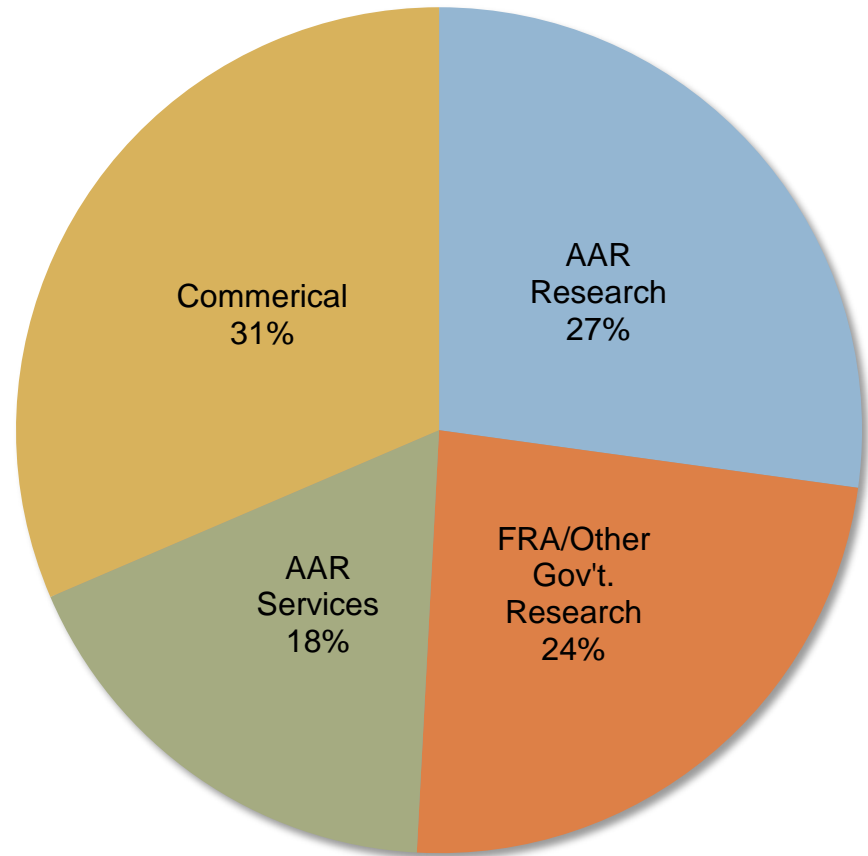


What Does TTCI Do?

◆ Basic Products and Services

- Research
- Consulting
- Testing
- System Engineering
- Inspections
- Training
- Technical Support

2014 Revenue





Engineered Facilities for Dynamic Testing

High Tonnage Loop (HTL)

- 2.7-mile loop, three 5° curves, one 6° curve
- Main use – HAL studies
- Test bed for various premium track components
- 25 MGT/month in controlled environment

Wheel/Rail Mechanism Track (WRM)

- 7.5°, 10°, and 12° curving performance tests
- Dynamic curving tests
- Lubrication studies

Transit Test Track (TTT)

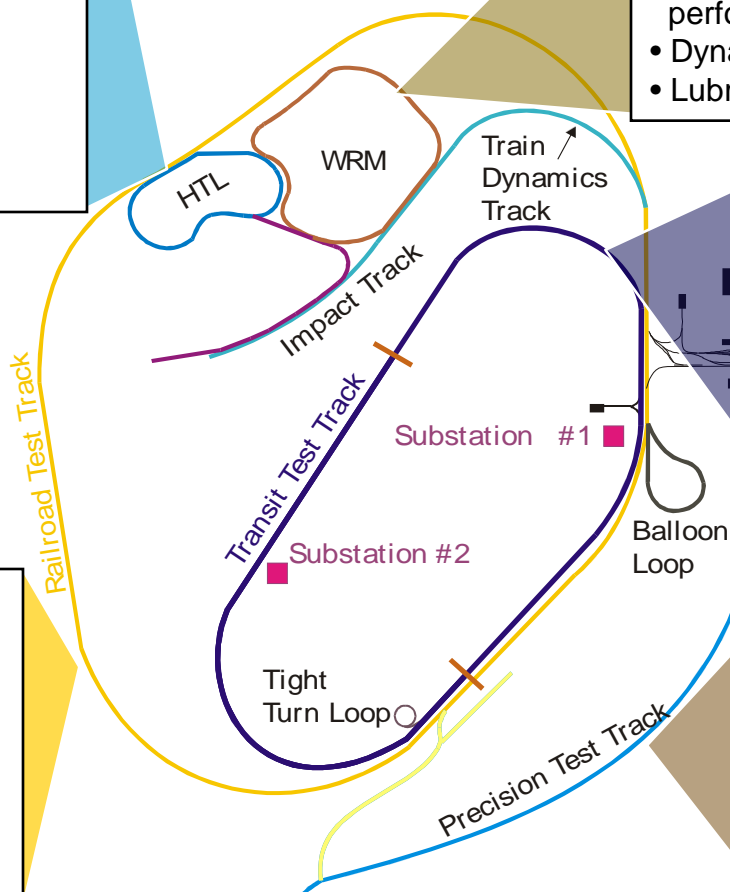
- 9.1-mile loop
- 80 mph max speed
- DC electrified third rail
 - Up to 1150 volts
 - Up to 12,000 amps

Railroad Test Track (RTT)

- 13.5-mile loop
- 1°-15' curve and four 50' curves
- Maximum speed 165 mph
- 12.5-, 25-, and 50-kV overhead catenary

Precision Test Track (PTT)

- Multi-use track for railcar testing
- Pitch and bounce
 - Twist and roll
 - Yaw and sway
 - Car impact
 - Miscellaneous studies



Full-Scale Laboratory Testing



Vibration Test Unit



Simuloader



Impact Wall



Squeeze Fixture





Revenue Service-Like Test Facilities

- ◆ Revenue service like environment
- ◆ Controlled conditions
- ◆ Known defects left in track or rolling stock
- ◆ Current facilities
 - Precision Test Track
 - Bridge Test Bed
 - High Speed Adjustable Perturbation Slab
 - Rail Defect Test Facility
 - Positive Train Control
 - Open Inspection of Track Components





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Facility for Accelerated Service Testing

◆ Investigate performance of improved track components and maintenance procedures under accelerated HAL service environment

- New rail steels to increase rail wear & fatigue performance
- Higher strength crossties
- Advanced special trackwork designs
- Proof of concept and prototype evaluation of new technologies
 - ▲ Test bed for advanced inspection technologies
 - ▲ Integrated freight trucks, wheel steels

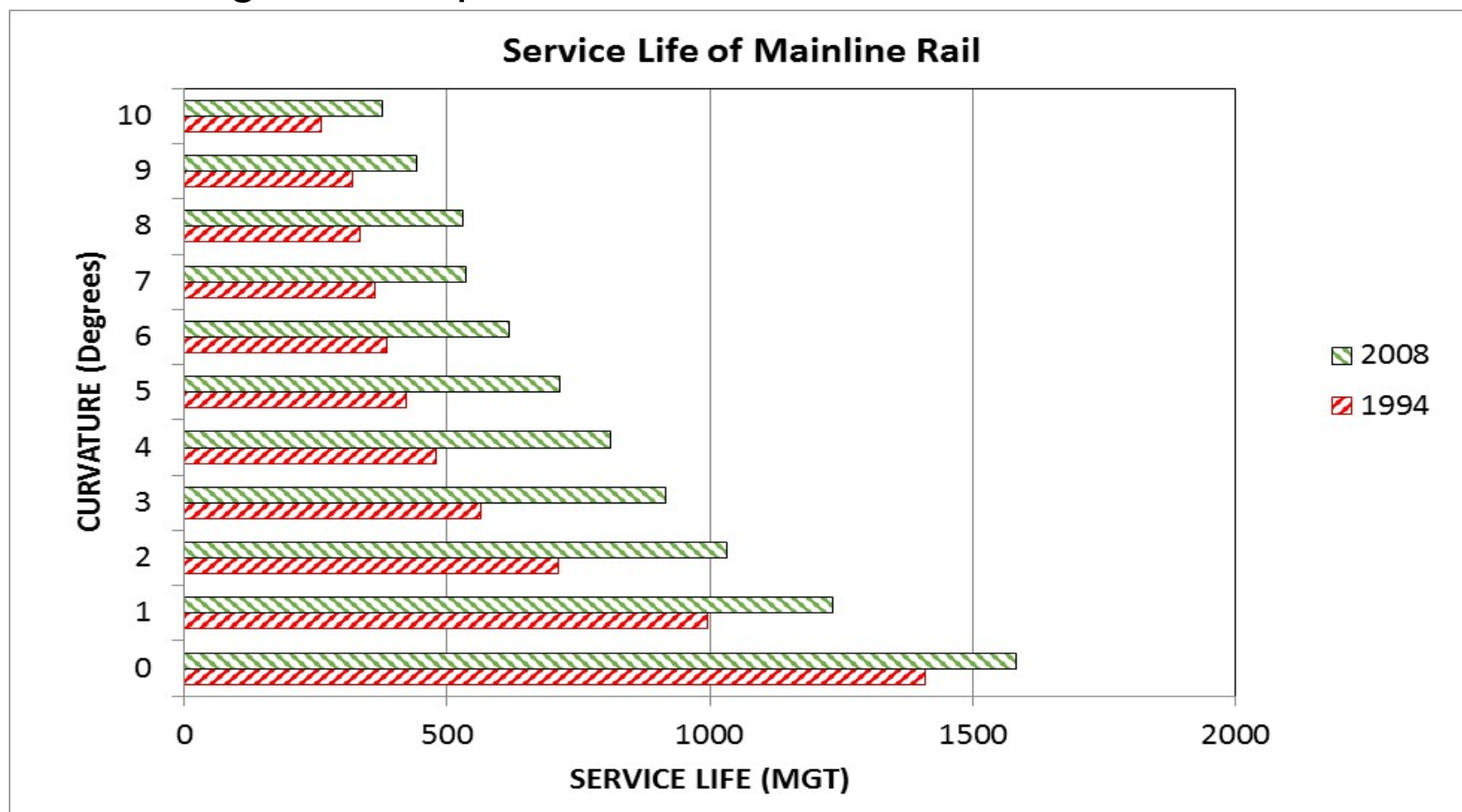


◆ TTCI's HAL Loop has carried 4 Billion Gross Ton Miles!



◆ Improved Rail Materials and Maintenance Methods

- Cleaner and harder rail steels
- Running surface profile and friction control



◆ Service Life Evaluation

- Spans under test at FAST have over 100 years of service

◆ Inspection Techniques / Fitness for Service Assessment

- Considers a broad spectrum of factors contributing to safe service life
- Onboard inspection systems

◆ Maintenance and Repair Techniques

- Reliability, durability and efficiency evaluated

◆ Advanced Designs and materials

- Cutting-edge composite structures

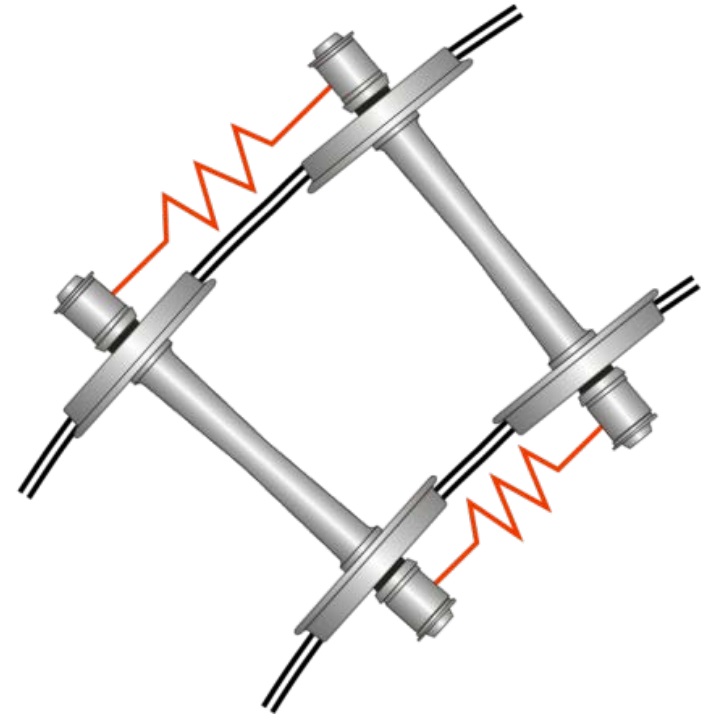
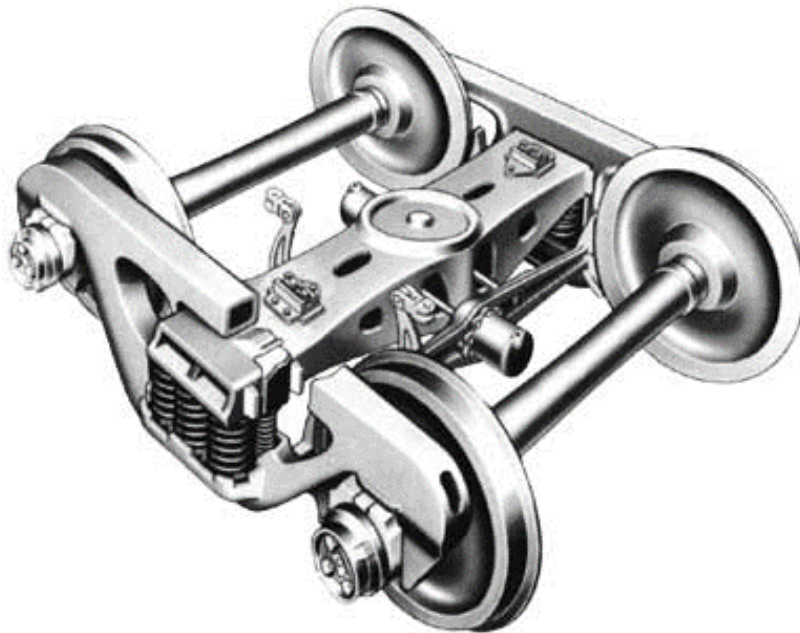




Improved Truck & Wheel Performance

◆ M-976 Trucks

- Adapter pads
- Allow more radial alignment of the wheelsets in a curve; this reduces steering forces at the wheel / rail interface
- Reduces wheel wear
 - ▲ Average 20 % increase in wheel life





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Passenger Car Crash Worthiness Improvements



Video on Passenger cars

Conventional Equipment

1/31/02



Crash Energy Management Equipment

3/23/06





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Tank Car Testing



FRA Full-Scale Tank Car Crash Testing

Validate.....Evaluate.....Simulate



TTCI Test Set Up



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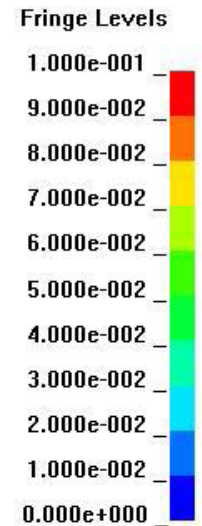
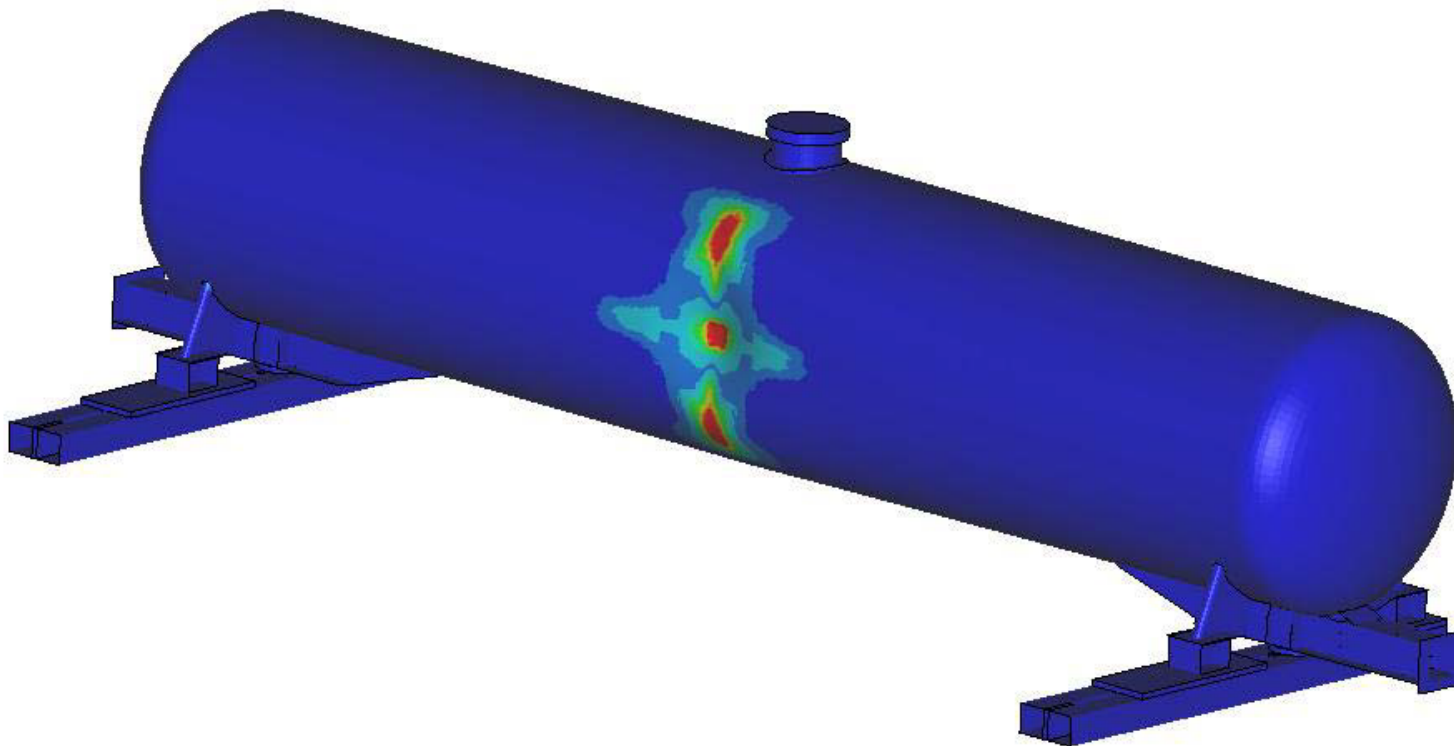


Testing at TTCI's Impact Wall



FEA Model of Test

Time = 0.52
Contours of Effective Plastic Strain
max ipt. value
min=-0.000212409, at elem# 143490
max=0.516112, at elem# 72229

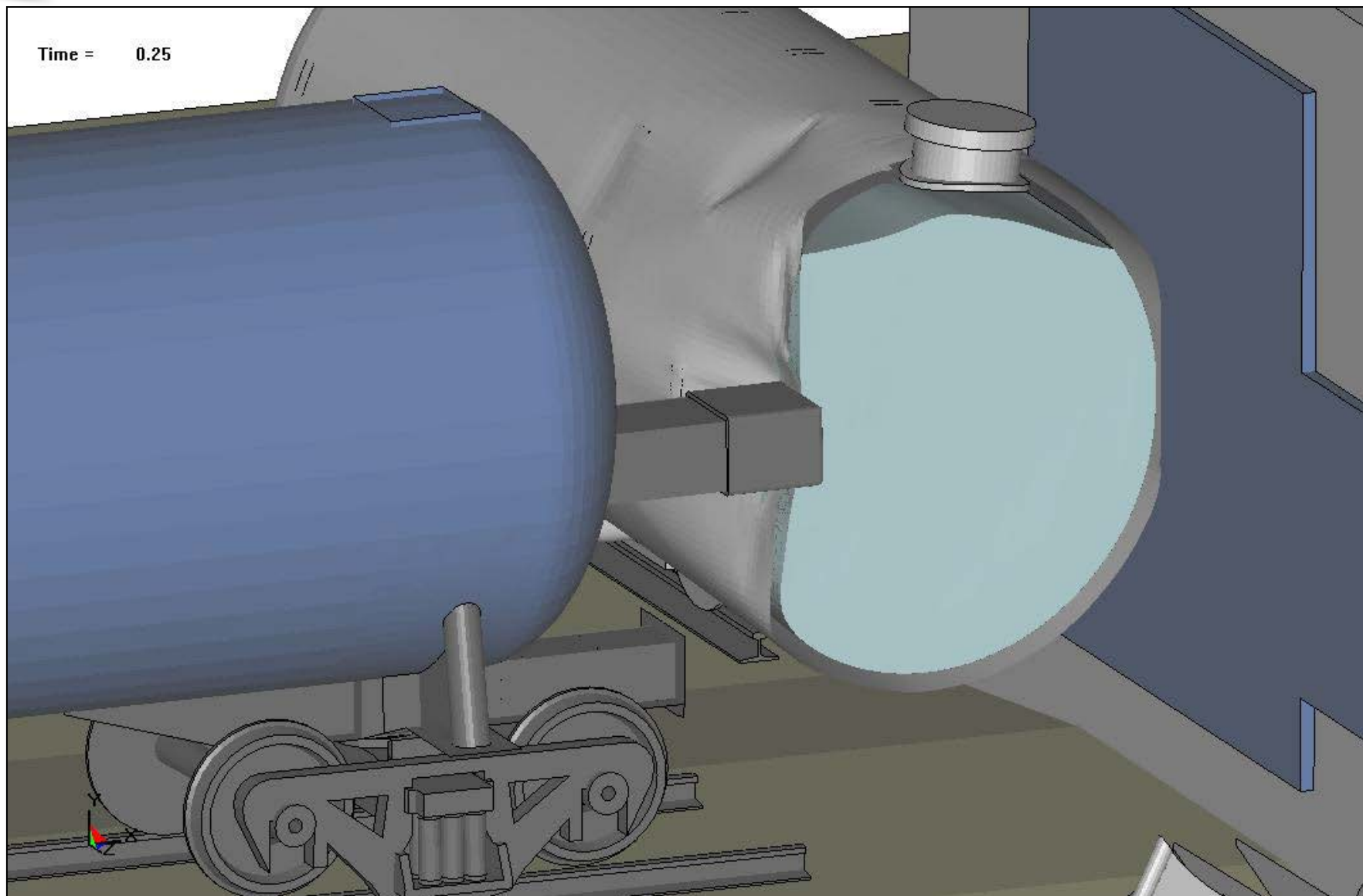


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Model Examines Multiple Scenarios



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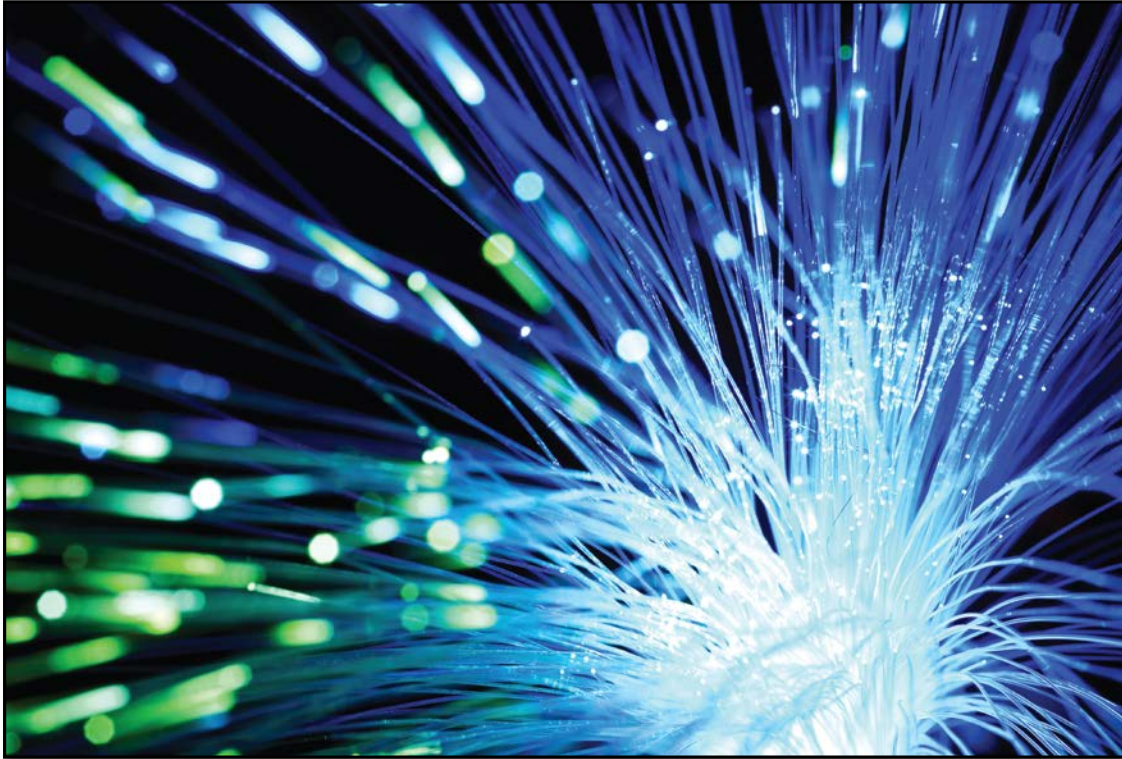
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Fiber Optic Distributed Acoustic Sensor



Fiber Optic Distributed Acoustic Sensor

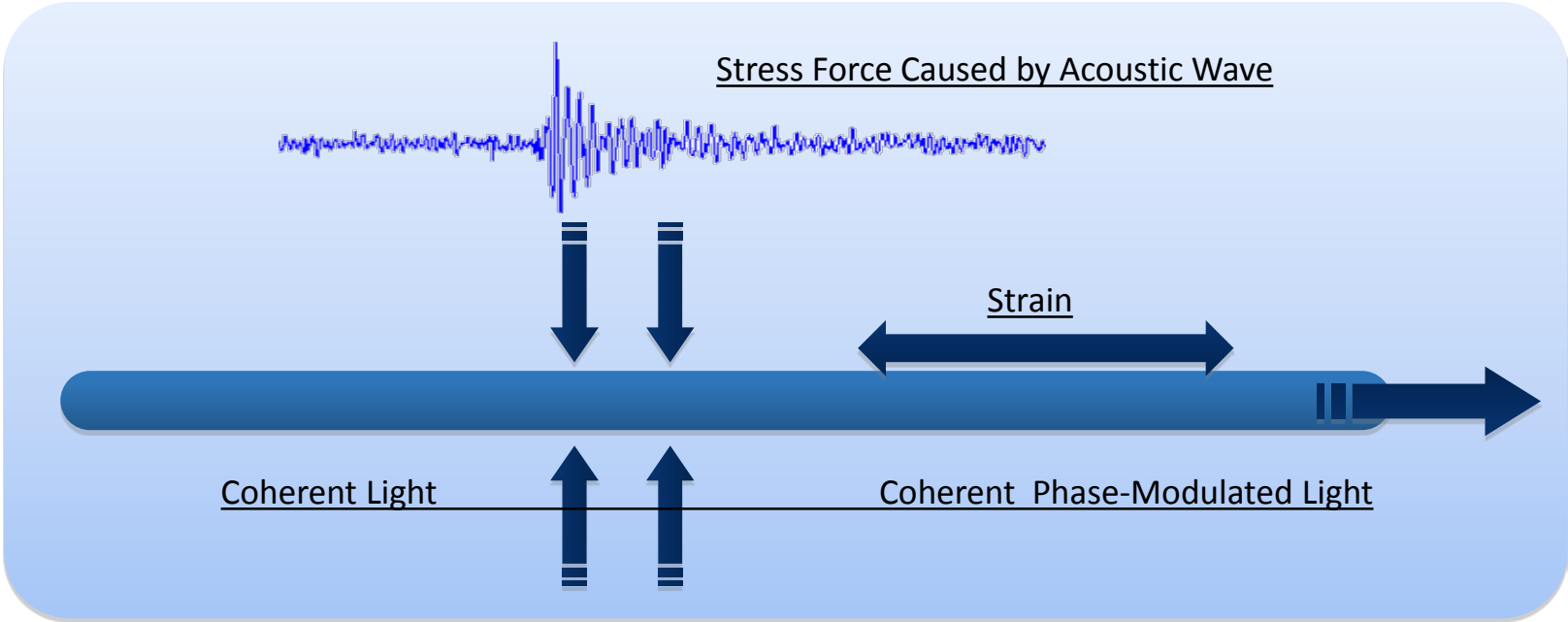


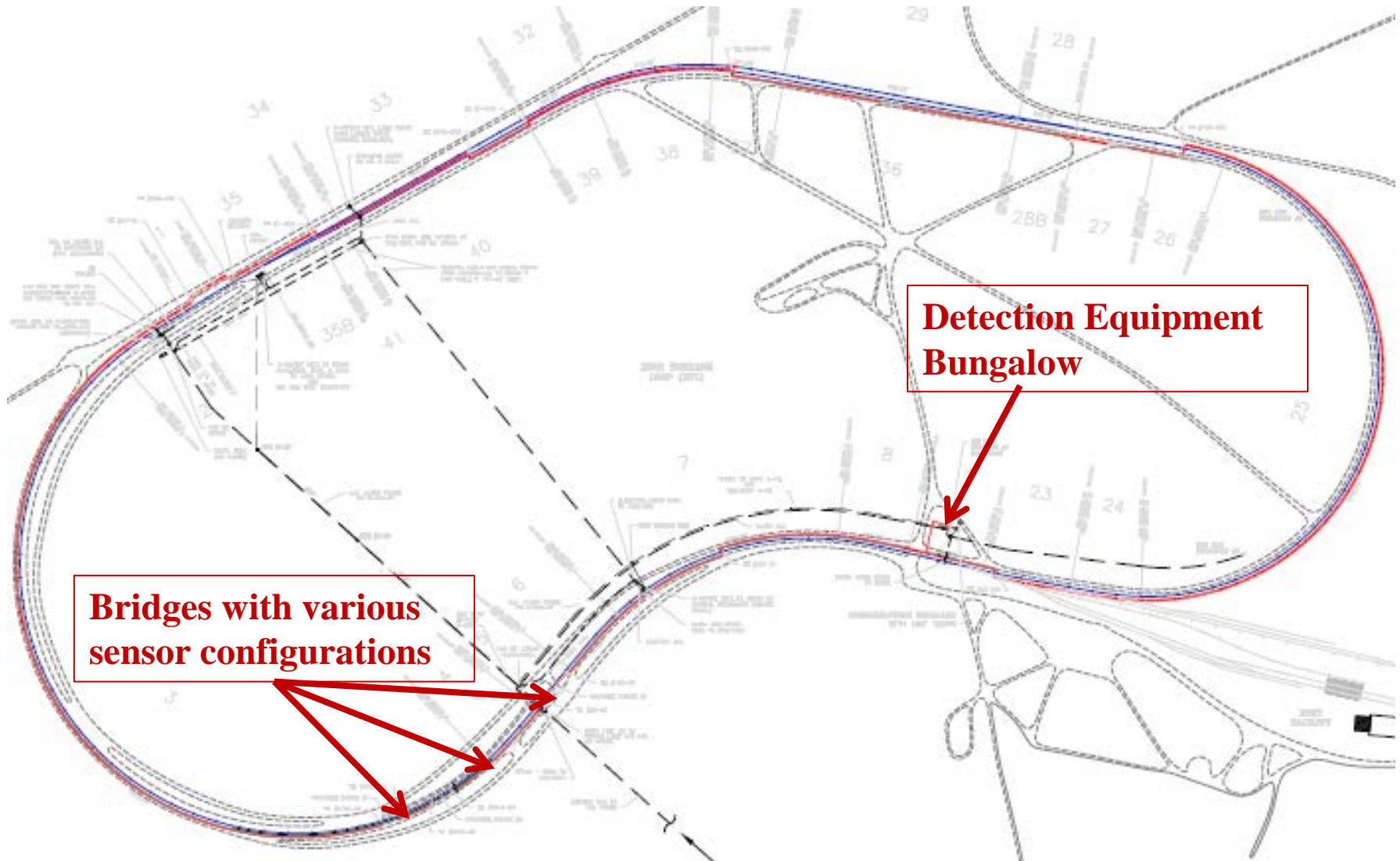
**Distributed
over a distance**





Fiber Optic Distributed Acoustic Sensor Overview





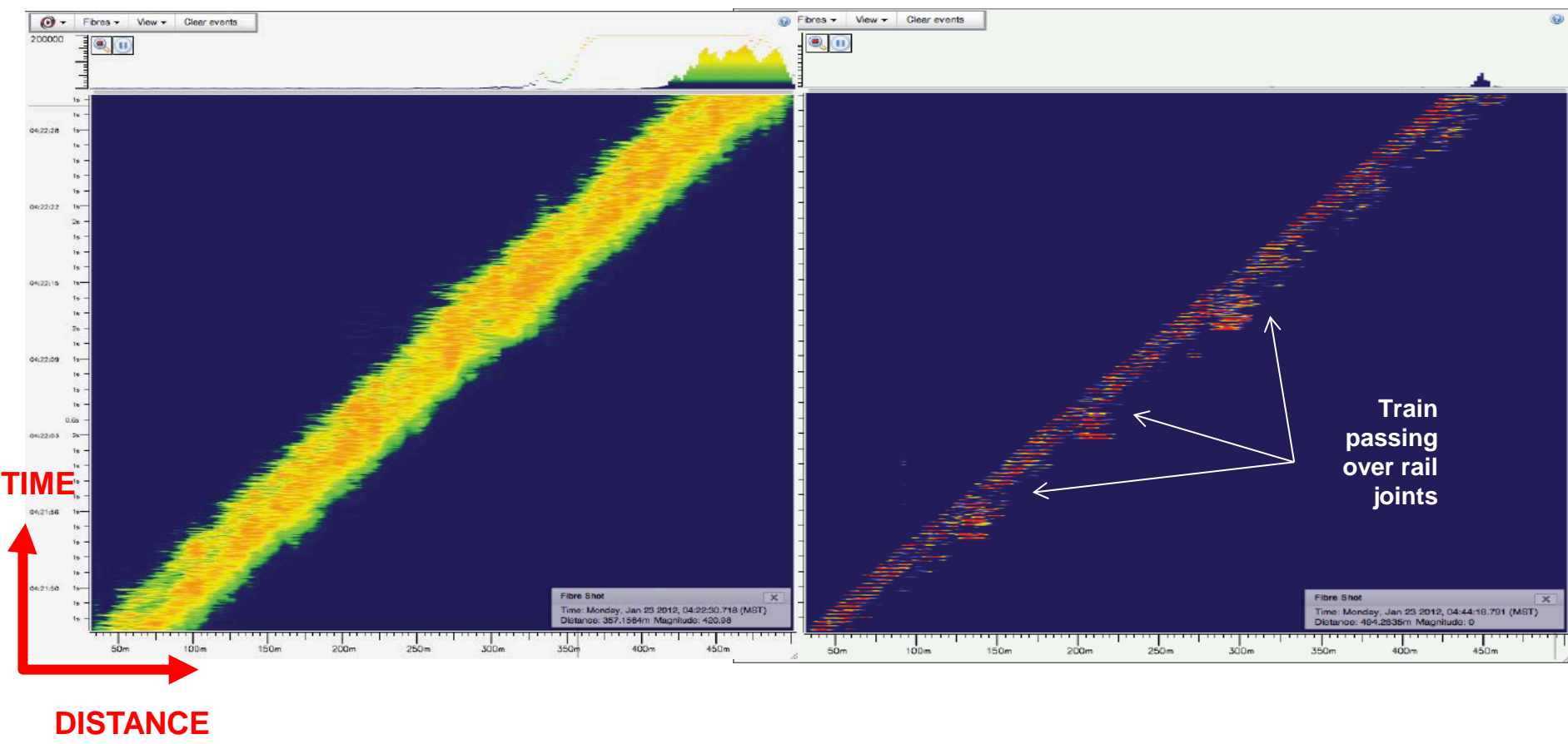


Fiber Optic DAS – Train Monitoring





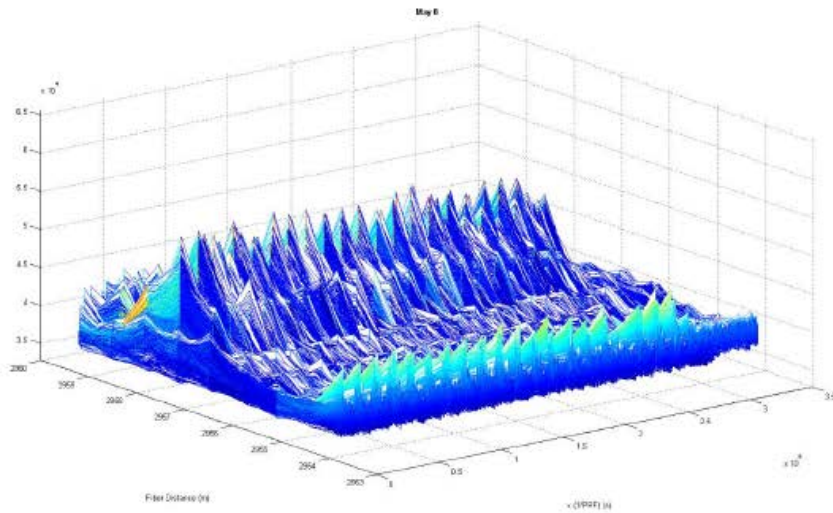
Fiber Optic DAS – Track Monitoring



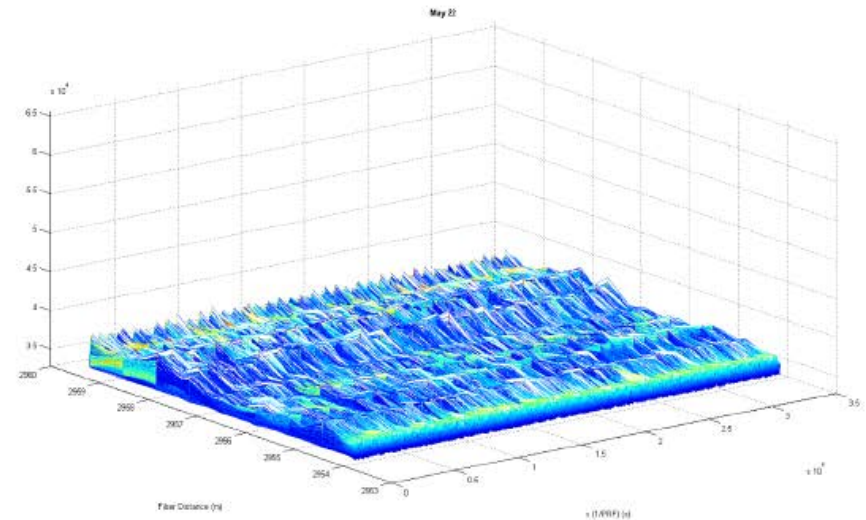


Example of Fiber Optic Signature from a Rail Break

Rail Break



Rail Break Repaired



◆ Possible Uses

- Train Location
- Train Velocity
- Train Length
- Rock/Snow Slides
- Bridge Integrity
- Intrusion
- High impact wheels





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Hazardous Materials Emergency Response Training



Training - Security and Emergency Response Training Center (SERTC)

- ◆ **In operation at TTC since 1985**
- ◆ **Hazmat response for Surface Transportation**
 - Focus on Rail and Highway
- ◆ **Approximately 55,000 students trained**
 - Railroad
 - Chemical and petroleum
 - Local, State and Tribal First Responders
- ◆ **“Graduate level” program**
- ◆ **Emphasis on preparedness and response**
- ◆ **See www.sertc.org for more information**



◆ **Classes use a “4-Phase Approach” that include at least 50% hands-on work**

- Theory, best practice, classroom lecture
- Cut-away training aids and hands-on work
- Techniques yard – field transfers and containment
- Response exercises using full-scale staged incidents



SERTC Facility at TTCI

- ◆ **Mixed freight derailment**
 - 43 cars and one locomotive
- ◆ **Highway equipment**
 - Diesel, gas, propane, anhydrous ammonia, mixed hazmat freight
- ◆ **Numerous rail and highway valves, fittings and cutaways in Highbay**
- ◆ **“Domehenge” uses pressurized air, water and smoke to simulate leaks**



Historic SERTC Course Offerings

- ◆ Tank Car
- ◆ Highway
- ◆ Intermodal
- ◆ Hazmat/WMD Technician
- ◆ Tactical Hazmat Operations
- ◆ Leadership and Management



New Offering - Crude by Rail Training

◆ 19 Car Derailment

- 3D fire, impingement and pool fires

◆ Boil over Car

- Demonstrates characteristics of crude

◆ Teaches appropriate decision making for crude oil fires







Ways to Sign Up for On-Site Training



◆ **Classes sponsored by DHS/FEMA**

- Register your interest at www.sertc.org
- Need approval from State Authorizing Agent
 - ▲ SAA will provide an authorization number
 - ▲ You will be allowed to register with an authorization number

◆ **Classes sponsored by Railroads**

- Register your interest at www.sertc.org
- Contact your Railroad Hazardous Materials Officer for more information on sponsorship

◆ **Open enrollment classes**

- Sign up at www.sertc.org





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