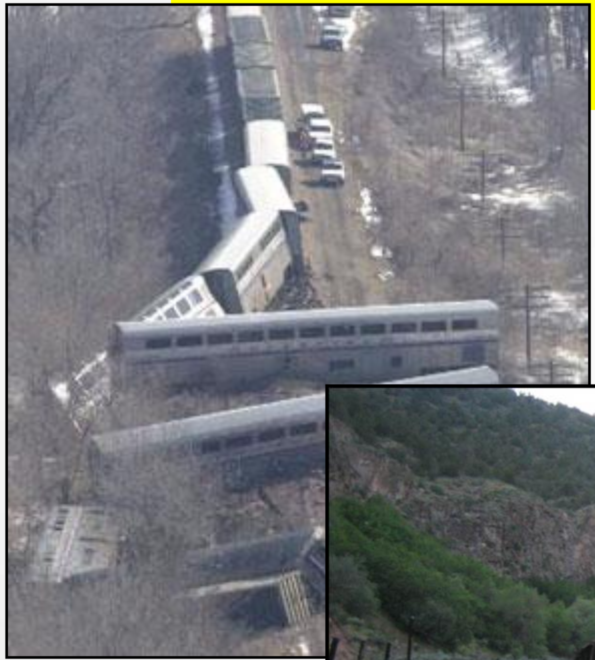
Essential Strategies for Derailment Elimination in Today's PSR Environment



Presented by: Gary Wolf

Wolf Railway Consulting
2838 Washington Street
Avondale Estates, Georgia 30002
404-600-2300
www.wolfrailway.com

WOLF
Railway Consulting

Disclaimer

The views and opinions presented here are mine alone and do not reflect the views of the University of Illinois, Major League Baseball, or hardly anyone else for that matter. In fact, some may find these views iconoclastic, too critical, or offensive, but sometimes tough love is required to effect long lasting change and improvement. These views are presented in hope of moving the needle downward on derailments in the coming years. If your feathers are easily ruffled, you may want to tune out or watch The Masters.

WOLF Railway Consulting

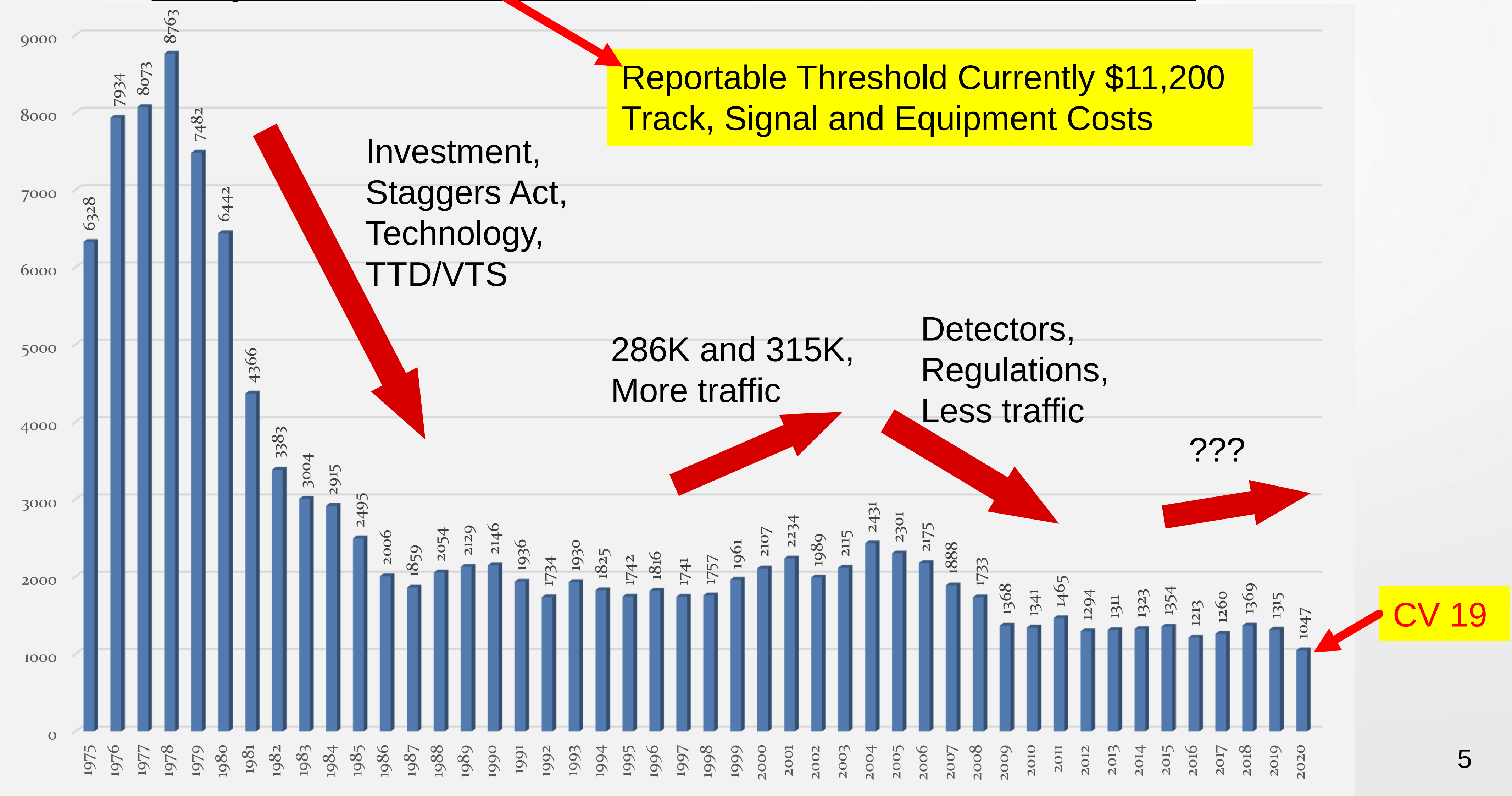
Presentation Outline

- Where are we on derailment numbers/rates?
- Impact of changes in the PSR operating environment and potential effects on derailment rates
- The role of the Railroads, FRA, and Investigative Agencies (NTSB, TSB)
- Suggested strategic changes required to move the needle
- 12 specific tactical strategies to reduce derailments

Where Are We?

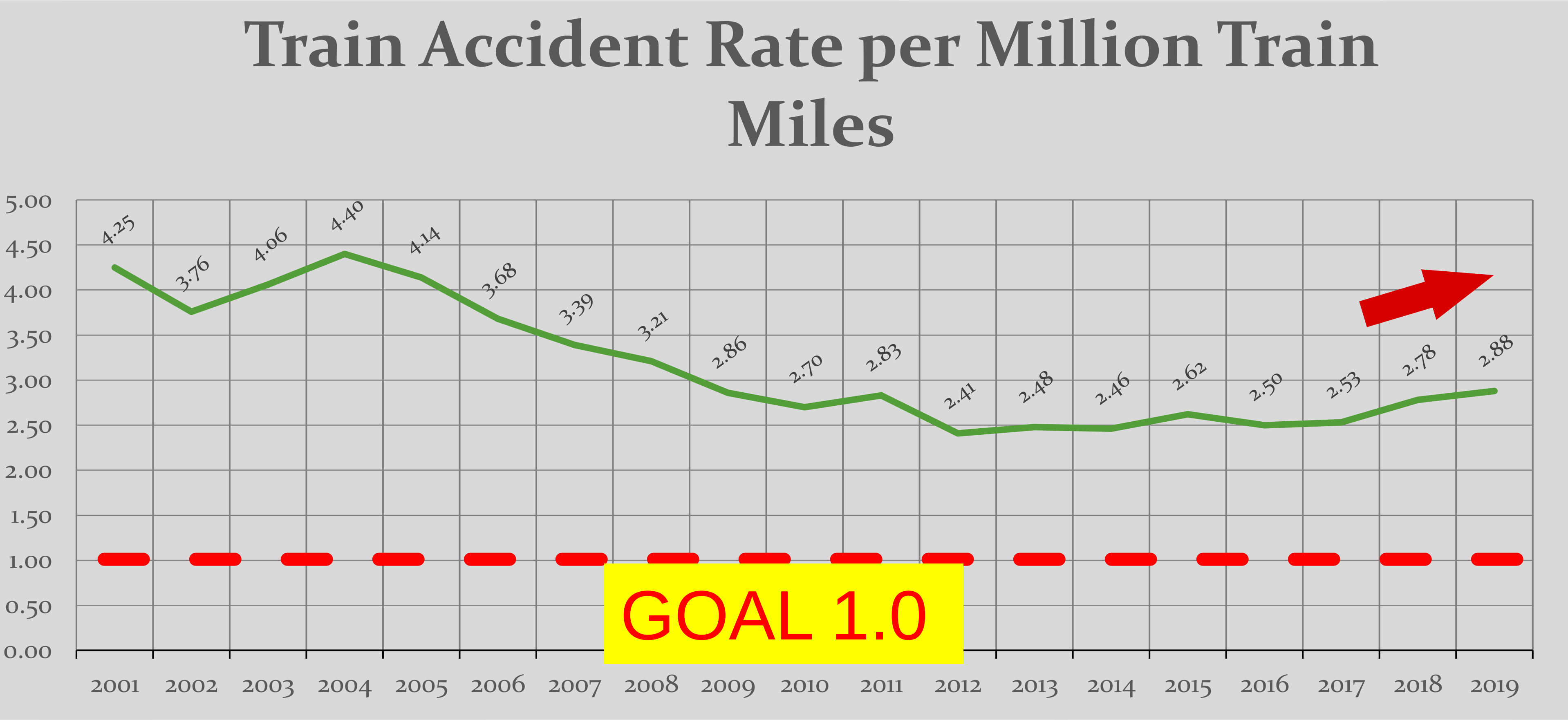
WOLF
Railway Consulting

U.S.A. Total Number of FRA Reportable Derailments 1984-2020



WOLF Railway Consulting

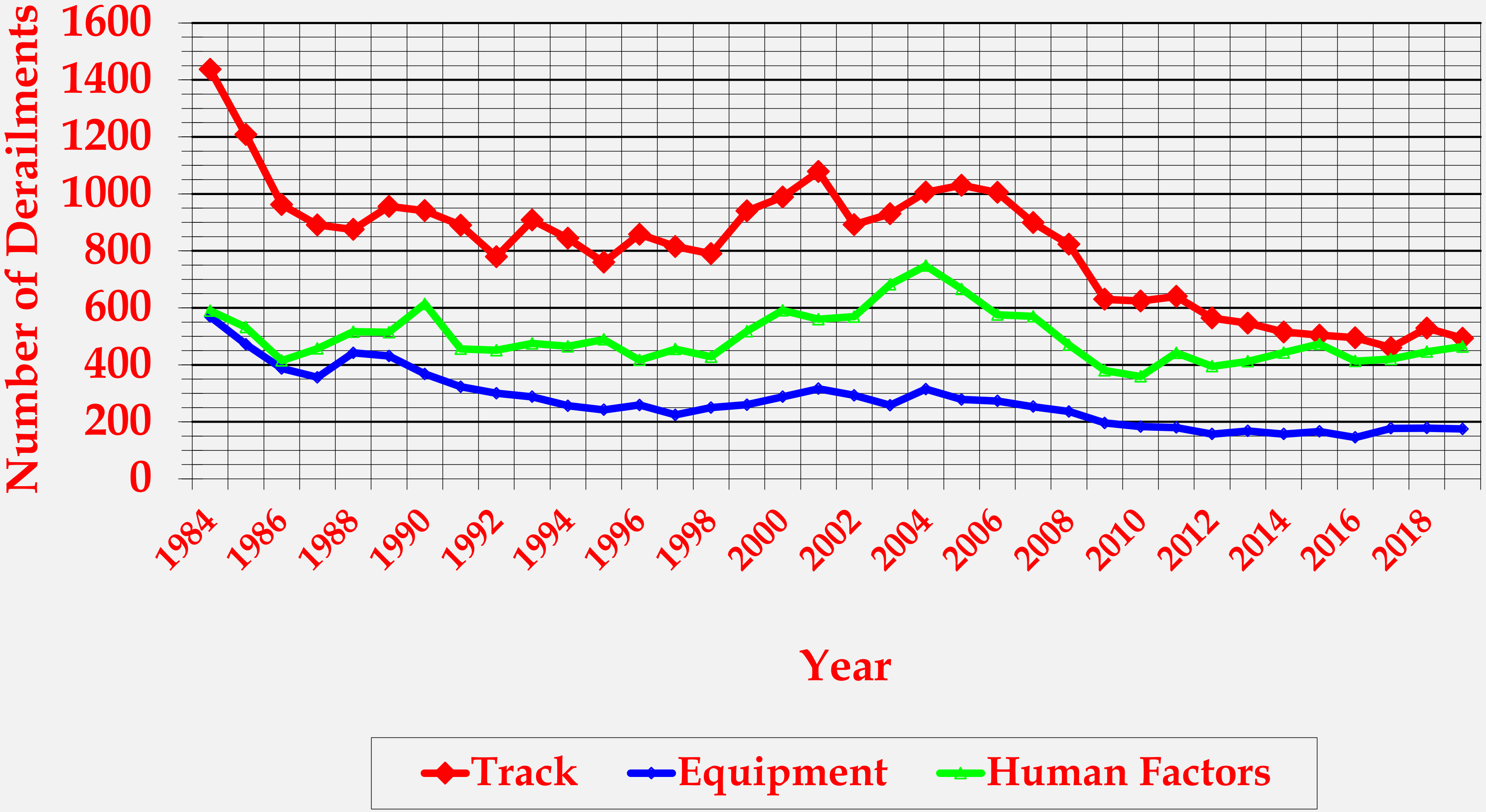
Source FRA Accident Database



Source FRA Accident Database

WOLF Railway Consulting

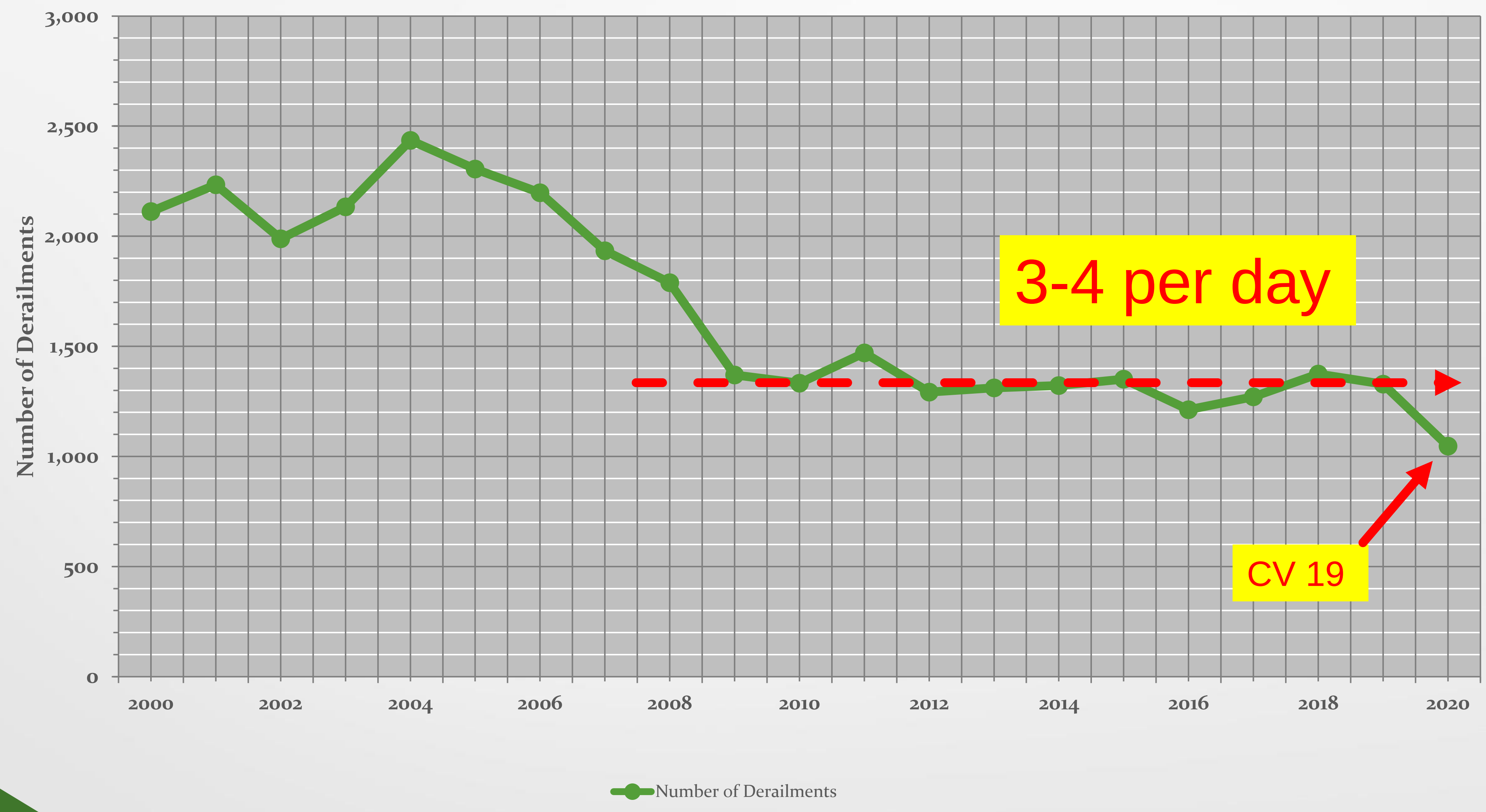
1984-2019 FRA Reportable Derailments by Cause



WOLF Railway Consulting

Source FRA Accident Database

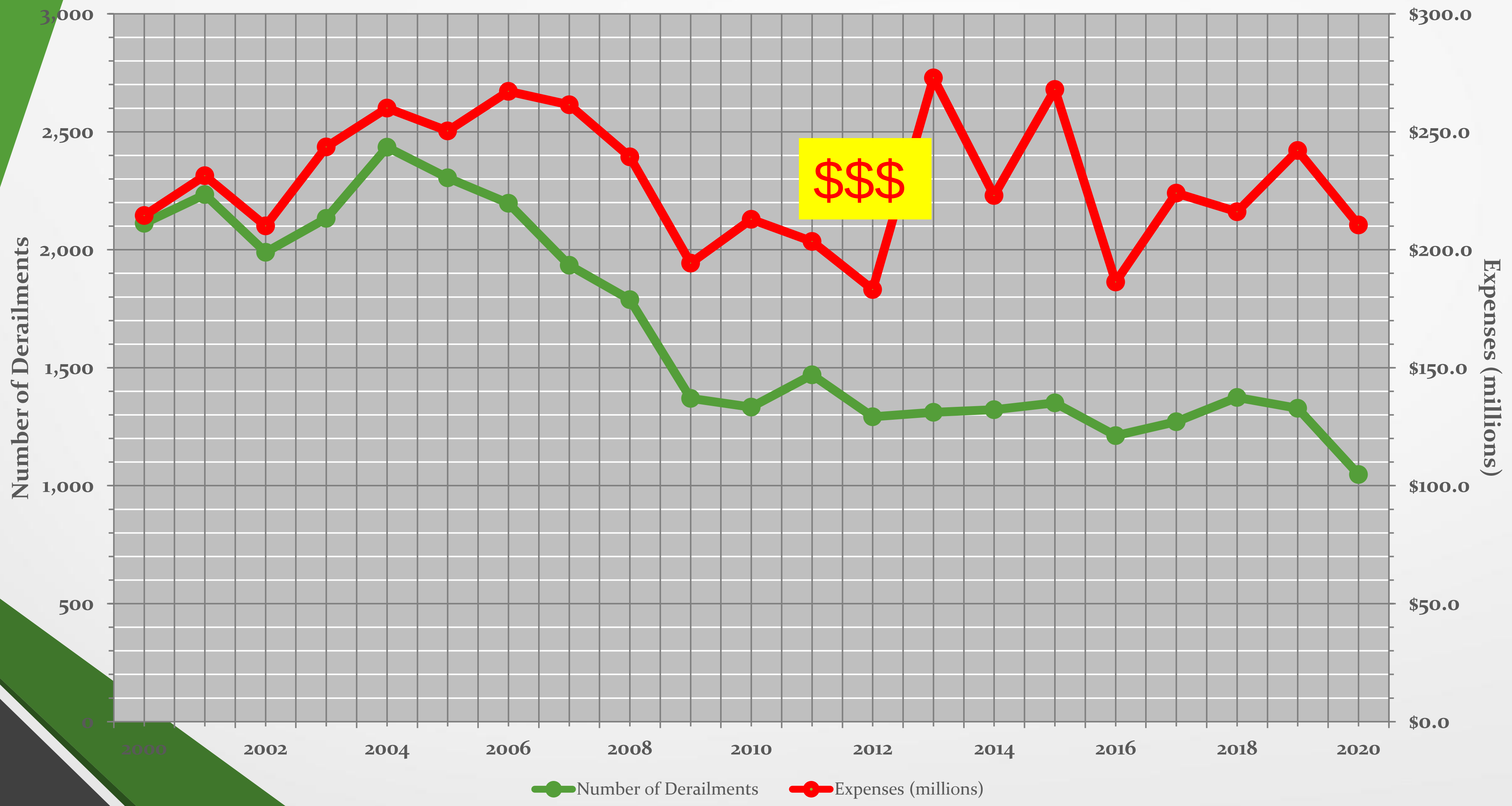
Annual Total Derailments (2000-2020)



Source FRA Accident Database

WOLF Railway Consulting

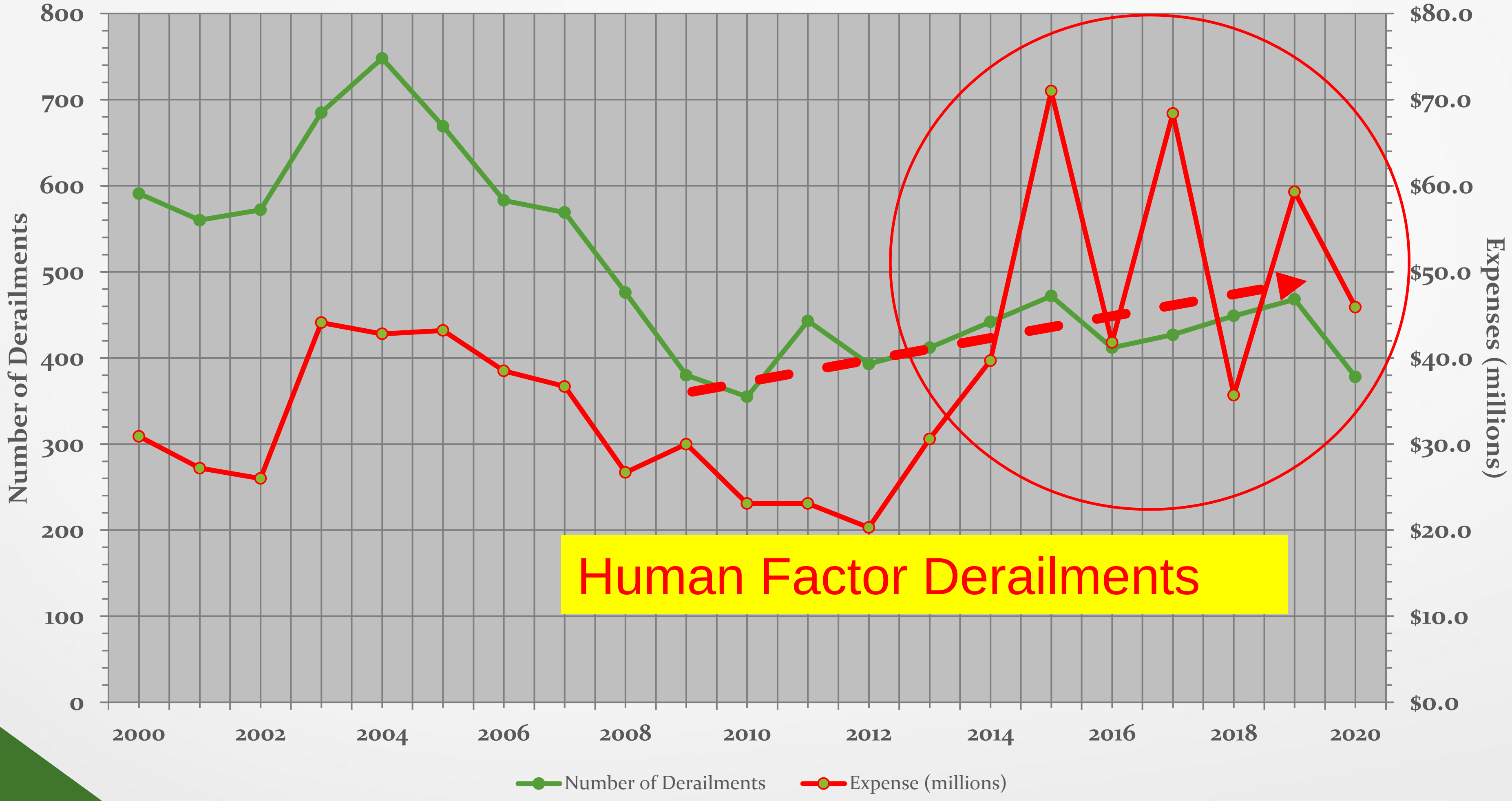
Annual Total Derailments and Expenses (2000-2020)



Source FRA Accident Database

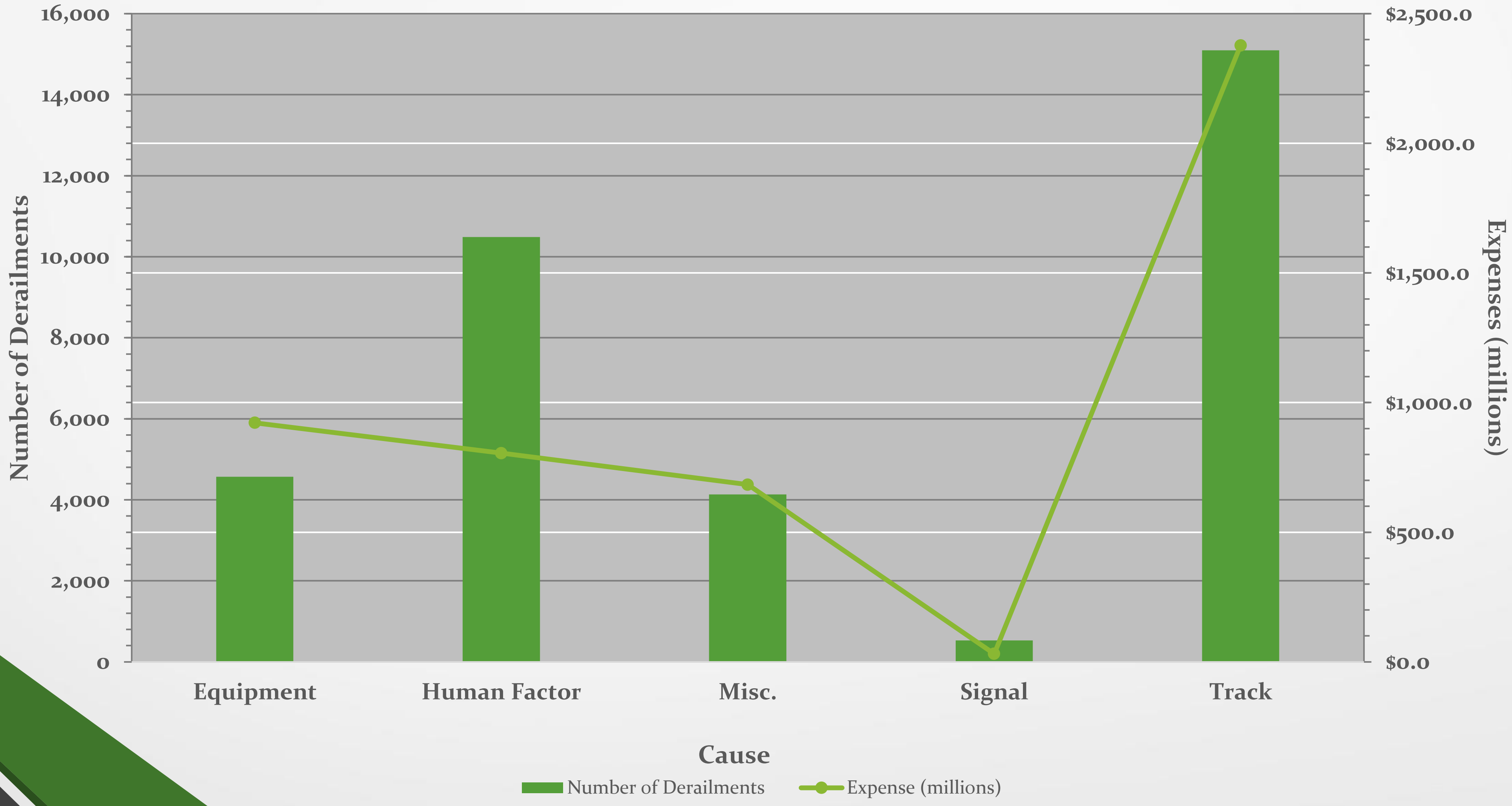
WOLF
Railway Consulting

Annual Human Factor Derailments and Expenses



Source FRA Accident Database

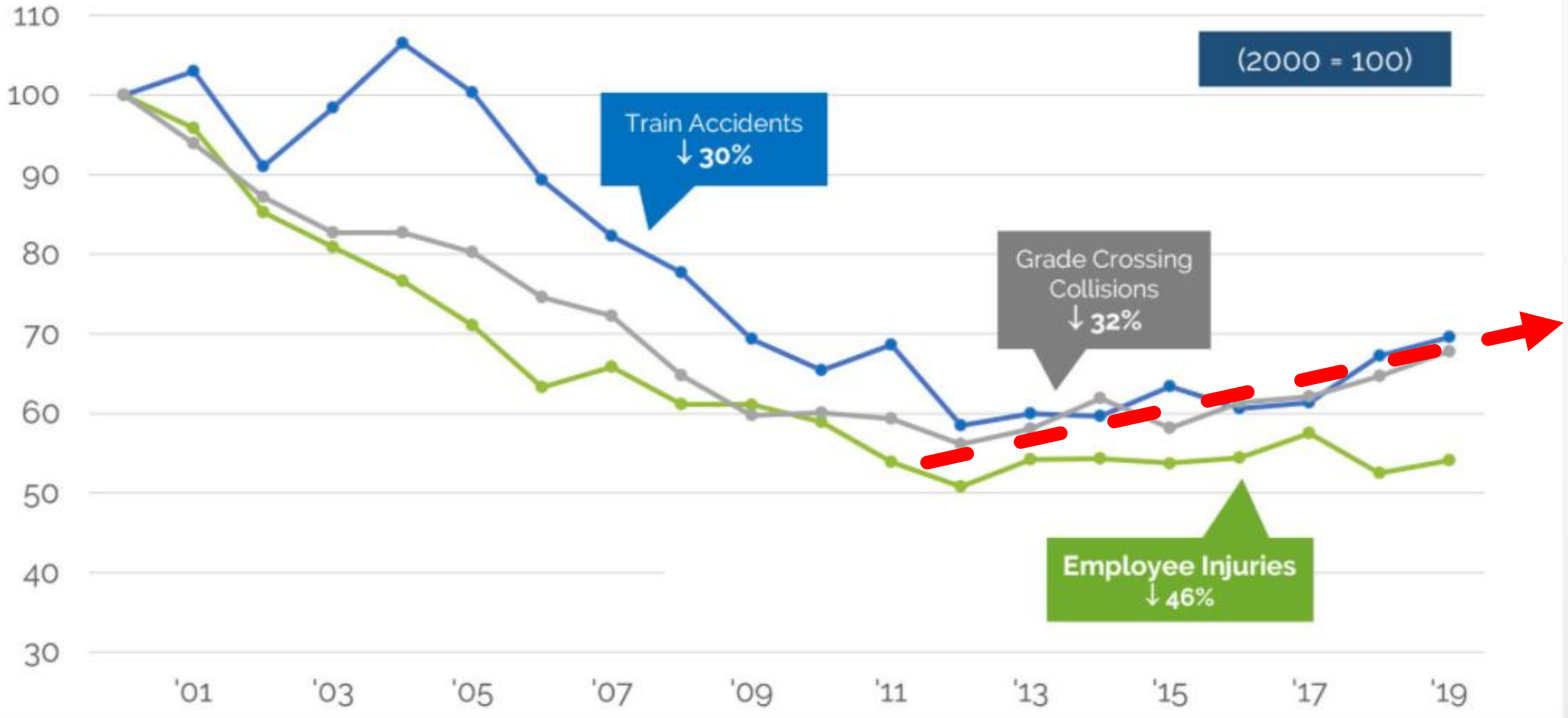
Total Derailments and Expenses by Cause (2000-2020)



WOLF
Railway Consulting

Recent Years Have Been Among the Safest Ever

ASSOCIATION OF AMERICAN RAILROADS



Thanks to robust investments to modernize their networks, the widespread adoption of advanced safety-enhancing technologies, and more rigorous employee training, the past ten years have been the safest in history for U.S. railroads. Railroads are proud of their safety record, but they also know the safety challenge never ends. They will continue working hard to reach the ultimate goal of zero accidents.

% = change in rate from 2000-2019. *Source: FRA*

WOLF Railway Consulting

Track and Equipment Costs Do Not Typically Include:

- Rerailing/clean up
- Lading damage and claims(trailer/containers are lading)
- Environmental clean up/damage
- Opportunity cost of track out of service; loss of network reliability
  - ✓ Car hire
  - ✓ Crew costs
  - ✓ Locomotive costs
  - ✓ Train delay penalties ($$)
- Litigation costs
- Injuries/fatalities
- Evacuations
- Public relations costs
- Access costs to get to derailment site
- Damage to adjacent land owners

WOLF Railway Consulting

Since 2000, The U.S. Railroads Have Spent ~$5.0 Billion on Derailments (T&E).

Factoring in all other Ancillary Costs, the Actual Total may be Closer to ~$10.0 Billion!

WOLF Railway Consulting

Inconvenient Truths

Derailment costs can vary widely based on speed, commodity, and location.

Lac Megantic derailment estimated to cost ~$3 Billion.

We probably would have never heard of Lac Megantic if the train was carrying frac sand.

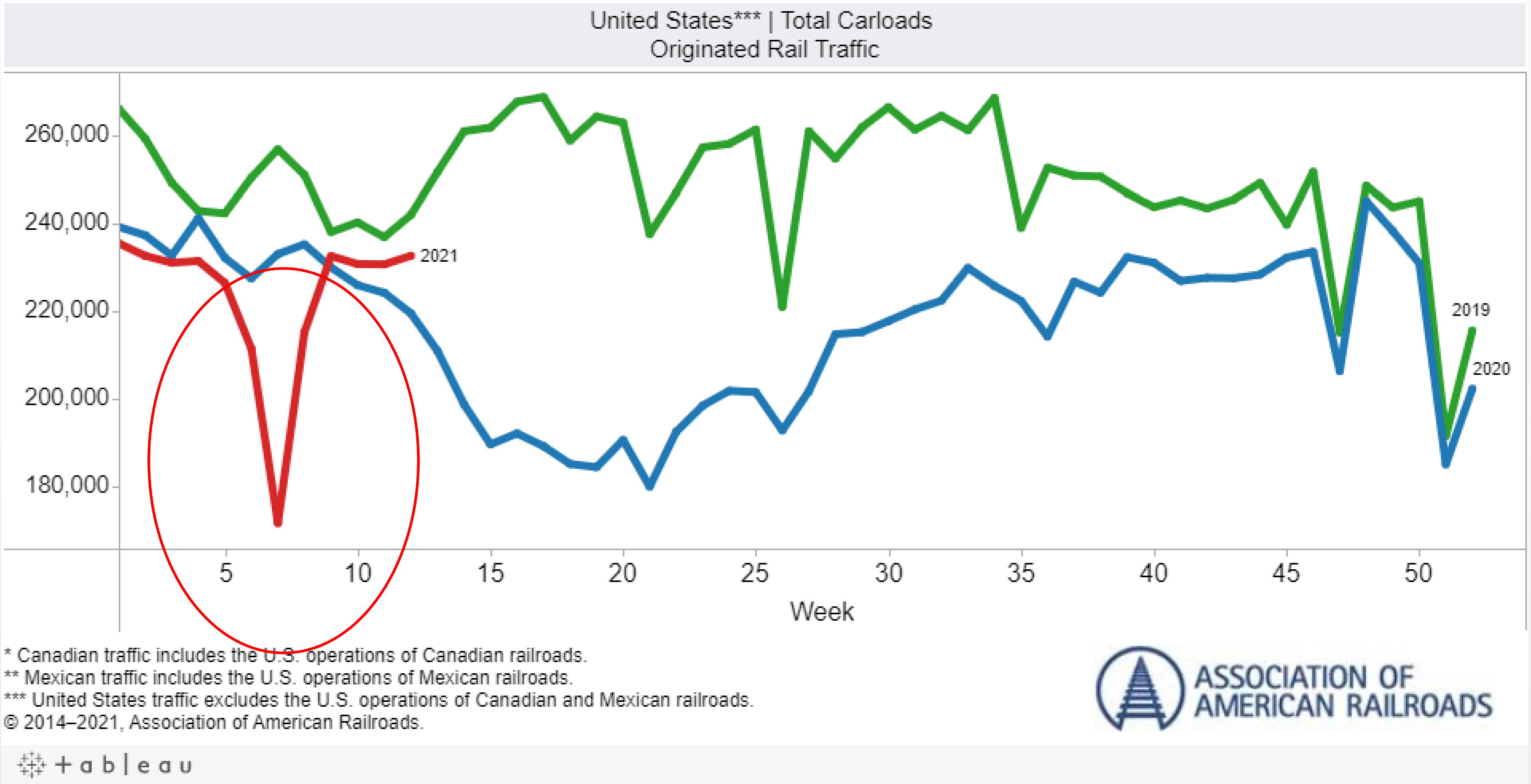
The PSR Environment and Potential Effects on Derailments

(BTW – We are not here to discuss the merits of PSR)

PSR, PTC, CV19 and WTF (Where's the Freight???)

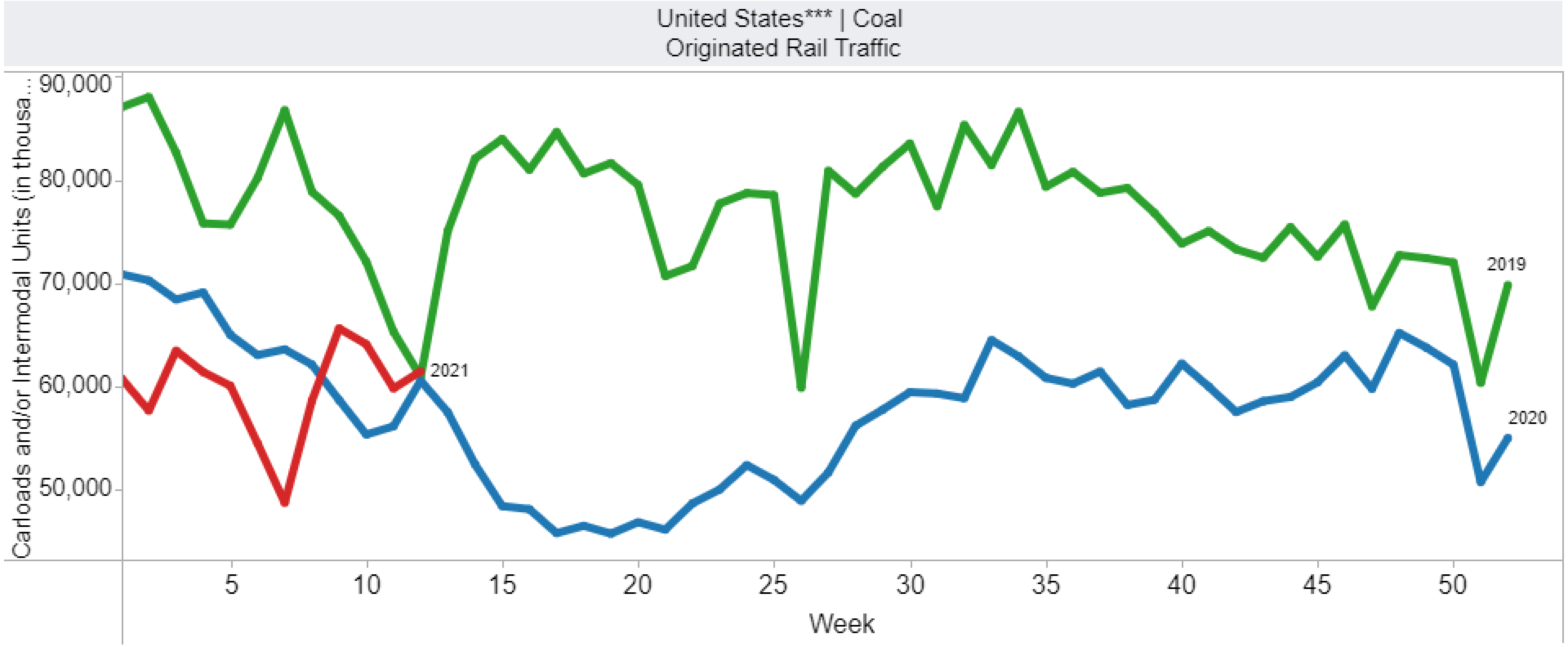
WOLF
Railway Consulting

Carload Freight



WOLF Railway Consulting

Coal Traffic



* Canadian traffic includes the U.S. operations of Canadian railroads.
** Mexican traffic includes the U.S. operations of Mexican railroads.
*** United States traffic excludes the U.S. operations of Canadian and Mexican railroads.

ASSOCIATION OF AMERICAN RAILROADS

tableau

WOLF Railway Consulting

If car loadings drop, and revenue slides, will we have the funds available for maintenance and investment?

Tenets of PSR

- Less touches per car – less switching, more destination blocking
- Focus on car performance; less on train performance
- Car/train velocity important; less terminal dwell
- Less Unit trains
- Optimizing network, not just single divisions/terminals
- Longer full tonnage trains; filling out tonnage enroute
- Running on Schedules; more predictability
- Less fire fighting; knowing what to expect
- More flat switching; less humping
- Drive decision making to local level; less bureaucracy

WOLF
Railway Consulting

PSR Summary

- Will see a change in train lengths(+/-) and speeds (+/-)
- Will see a change in traffic (Coal↓; Intermodal↑)
- Do more with Less…
  - ✓ Fewer locomotives
  - ✓ Fewer crews
  - ✓ Less staff
  - ✓ Fewer cars
  - ✓ Less yards
  - ✓ Less track (where not needed)

Higher utilization of assets means accelerated degradation of those assets, both physical and human.

WOLF Railway Consulting

Potential impacts of PSR on Derailments

- Curve elevation issues
  - ✓ Higher car velocity may increase speeds on certain curves; insufficient elevation
  - ✓ Longer trains may operate slower on certain portions of the track; excessive elevation
  - ✓ Effect on rail grinding and RCF
- Higher speeds
  - ✓ More truck hunting; effect on equipment and track
  - ✓ Change from slow coal/oil/ore trains to fast intermodal trains
- Possible changes in train blocking
  - ✓ More slack action; effect on equipment and track
  - ✓ Higher steady state coupler forces with longer trains
- Longer trains = more heat into the rail
  - ✓ Implications for track buckling
  - ✓ Effect on gage face and TOR lubrication retention rates

Potential impacts of PSR on Derailments Con't

- Longer trains = more locomotive horsepower
  - ✓Effect on rail anchoring; ballast sections
  - ✓Larger drawbar forces = larger lateral forces in curves
- Longer trains; more air brake problems (especially cold weather)
  - ✓Sticking brakes; flat wheels; wheel impacts on rail
- Longer/Faster trains = potentially bigger derailments
- Less track time available for maintenance; penalties for impacting schedules; might need more slow orders
- More turns per car/loco; faster degradation of equipment (inspection intervals?)
- Increased switching volumes in flat yards; More degradation of flat yard tracks
- Changing traffic patterns/crew districts; lack of route familiarization
- Fewer crews; human fatigue?
- Less management to handle exceptions; less bench strength
- Greater emphasis on derailment track clearing; less time for investigation

PSR and derailments…the bottom line (or, WTBD)

Operating precision and reliability cannot coexist with derailments, disruptions, slow orders, signal malfunctions, and human failure.

To operate a precision network we must eliminate disruptions/outages

WOLF Railway Consulting

A New PSR goal

An OR of 60% is great, but…
how about a new goal of:

1.0 Derailments/Million Train Miles

Can we get there??

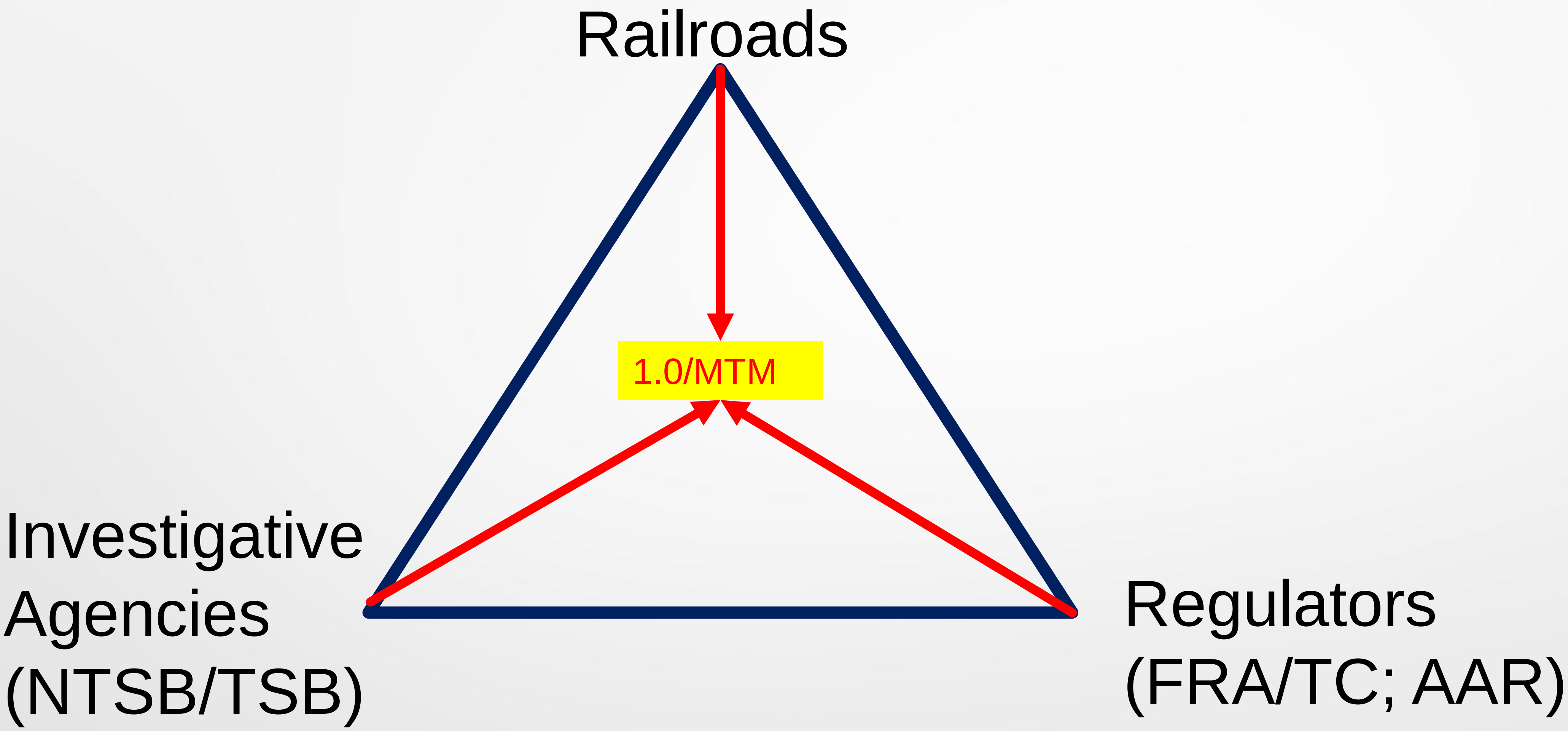
WOLF Railway Consulting

What is needed?

And who are the stakeholders?

WOLF
Railway Consulting

The Derailment Reduction/Prevention Trinity



To the Railroads:

- Assign corporate ownership to derailment prevention
  - ✓ Somebody must own it; it can’t be everyone's job or it falls through the cracks
- Better training in derailment cause finding
  - ✓ Many changes in the workforce; many new faces
- Better use of “Big Data” from the operating network to spot trends and conditions
- Continue application of automated detector systems
  - ✓ Drones, on-track, wayside, on-board, autonomous, IOT
- Provide adequate time and resources for derailment investigation
- Insure corrective actions are working; no unintended consequences
- Greater emphasis on understanding/eliminating human factor derailments
- Revise rules and instructions for greater clarity; less ambiguity

WOLF
Railway Consulting

To the Regulators:

- Ensure regulations are keeping pace with technology and infrastructure improvements
- Re-write, update, reconsider, simplify some of the sections in 49CFR
- Consider revamping all the derailment cause codes; need less ambiguity and more specificity. Reduce the number of miscellaneous codes. Minimize use of “cause not found”.
- Special emphasis on revising Human Factor Cause codes; move from accident description to the “Why”
  - “Switch run through” is not a cause, it is a description of what happened.
- Follow-up on railroad causes to ensure there is supporting data for the stated cause and ensure accurate causes enter the accident database

WOLF
Railway Consulting

Ensure regulations are keeping pace with technology and infrastructure improvements

WOLF Railway Consulting

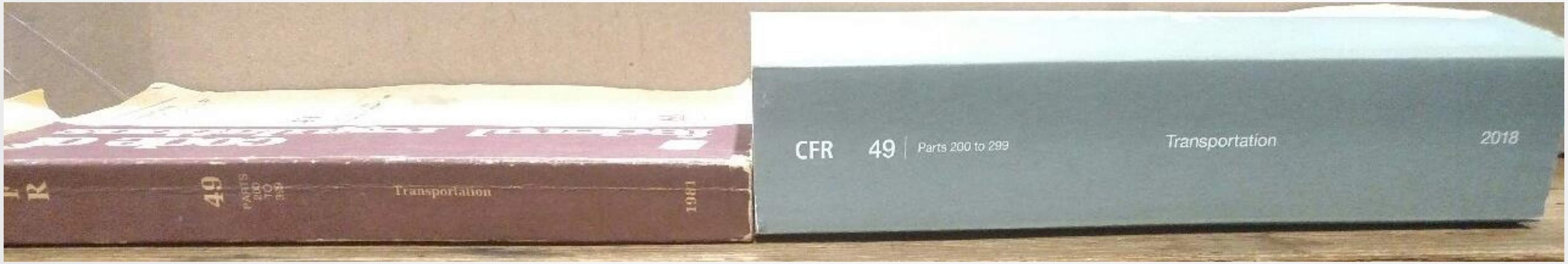
Regulations often Lag Usage/Implementation

Concrete Crossties 1980's	Regs ~ 2005
Constant Contact Side Bearings 1970's	No fed regs yet; AAR regs ~ 2006 (rule 62)
CWR 1950's/1960's	Regs ~ 1999
Event recorders 1970's	Regs ~ 1992
Plastic Centerbowl Liners	AAR regs ~ 2012

Re-write, update, reconsider, simplify some of the sections in 49CFR

213 Track Safety Standards Compliance Manual

213 Track Safety Standards



CFR 49 1981 ~ 500 pages

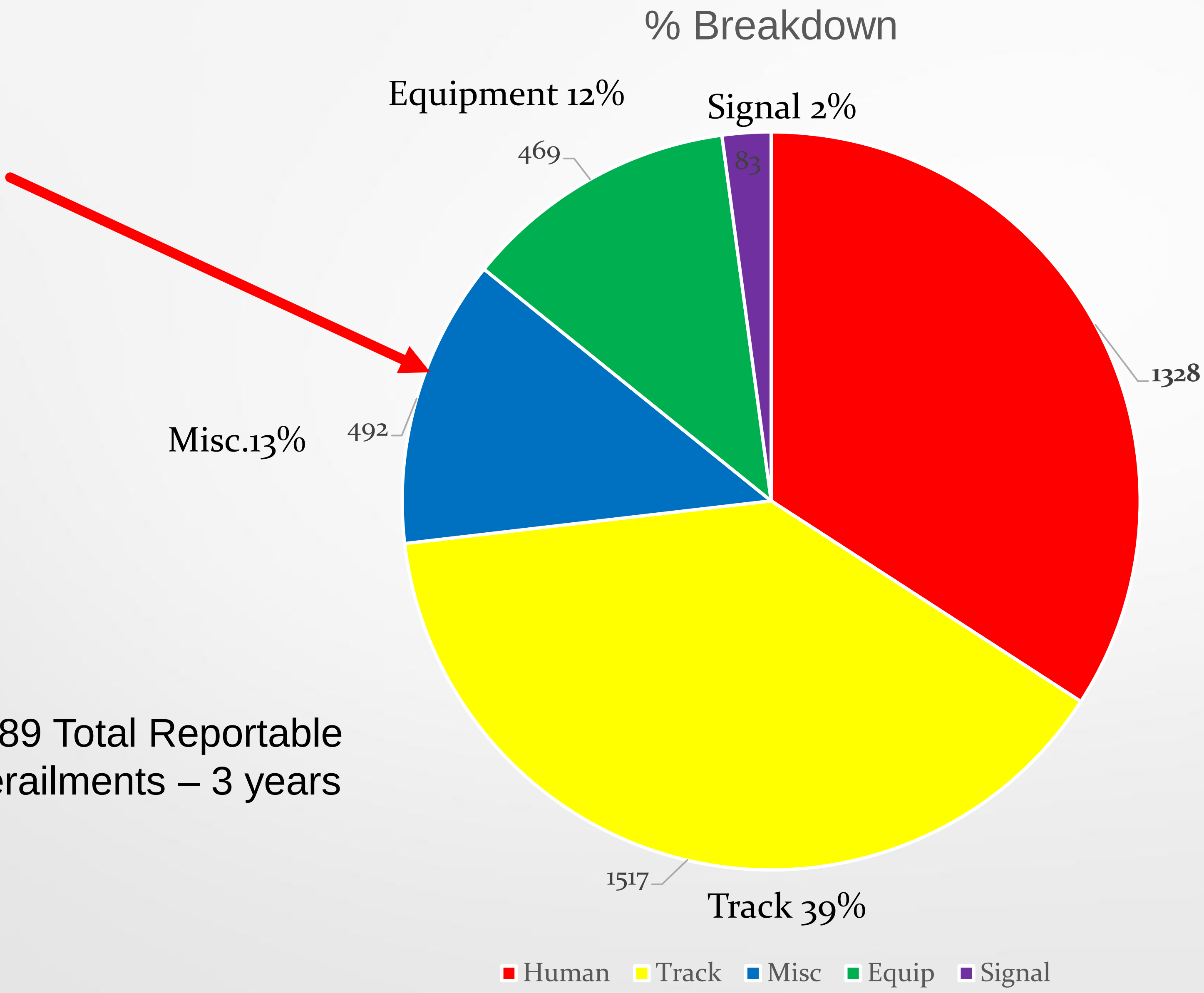
CFR 49 2018 ~ 1200 pages

Consider revamping all the derailment cause codes; need less ambiguity and more specificity. Cause Codes need to lead to corrective actions and focused research.

Reduce the number of miscellaneous codes. Minimize use of “cause not found”.

WOLF Railway Consulting

2014-2016 Derailment Cause Breakdown
U.S FRA Statistics



3889 Total Reportable Derailments – 3 years

Source FRA Accident Database

A small sample of Equipment Cause codes

Truck bolster stiff (failure to slew)	E4BC
Truck bolster stiff, improper swiveling	E46C
Truck hunting	E4TC

What is the difference in swivel vs. slew?

Multiple failures to cause stiff truck; stiff truck is result of poor maintenance such as:

- -tight side bearings
- -insufficient bowl rim clearance
- -excessive bowl wear
- -broken CB liner
- -improper centerplate repair

Truck hunting is a condition, not a failure. Multiple reasons for hunting

- - hollow worn wheels
- - insufficient CCSB restraint
- - defective/broken CCSB elements
- - poor friction damping restraint; wedge rise
- - speed restriction violation of restricted cars

WOLF Railway Consulting

A small sample of Track Cause codes

Track alignment irregular (buckled/sunkink)	T109
Track alignment irregular (other than buckled/sunkink)	T108

Track buckle is a condition, not a cause. There are multiple causes of track buckle/sunkink:

- poor anchoring pattern
- worn out anchors
- poor ballast section
- poor ballast quality
- poor control of neutral temperature
- improper rail laying temperature
- geometry irregularities
- fouled ballast
- failure to observe/set slow orders

WOLF Railway Consulting

Special emphasis on revising Human Factor Cause codes; move from accident description to the “Why”

WOLF
Railway Consulting

General Switching Rules

Causes	Code	Causes	Code
Car(s) shoved out and left out of clear	H301	Manual intervention of classification yard automatic control system modes by operator	H316
Cars left foul	H302	Moving cars while loading ramp/hose/chute/cables/bridge plate, etc., not in proper position	H311
Derail, failure to apply or remove	H303	Other general switching rules (Provide detailed description in narrative)	H399
Failure to couple	H310	Passed couplers (other than automated classification yard)	H312
Failure to stretch cars before shoving	H309	Portable derail, improperly applied	H315
Hazardous materials regulations, failure to comply	H304	Retarder yard skate improperly applied	H314
Humping or cutting off in motion equipment susceptible to damage, or to cause damage to	H317		
Humping or cutting off in motion equipment susceptible to damage, or to cause damage to other equipment	H317	Shoving movement, absence of man on or at leading end of movement	H306
Instruction to train/yard crew improper	H305	Shoving movement, man on or at leading end of movement, failure to control	H307
		Skate, failure to remove or place	H308
Kicking or dropping cars, inadequate precautions	H318		

These describe what happened but don't provide any information as to why the human failure occurred

WOLF
Railway Consulting

Follow-up on railroad causes to ensure there is supporting data for the stated cause and ensure accurate causes enter the accident database

....................Track information....................
Yard   Damage $13,784   Milepost 18   FRA Class 1   Total Casualties: 0 Deaths and 0 Injured

....Signalization....   ....Cause(s)....
Nonsignaled
Investigation complete, cause could not be determined
....Supplemental Codes....
Restricted Speed or Equivalent
Special Instructions

ROUSTABOUT CREW REPORTED DERAILING WHILE MAKING A DRILL MOVE FROM THE SWITCHING LEAD TO NO. 6 TRACK IN [redacted] Y
ARD. THE B END (3L, 3R, 4L,4R) OF THE WEST CAR 7419 DERAILED. WHILE NO DEFINITIVE CAUSE WAS POSITIVELY IDENTIFIED FOR TH
IS DERAILMENT, IT FALLS WITHIN THE CATEGORY OF ?LOW SPEED WHEEL CLIMB?. THERE ARE A NUMBER OF FACTORS THAT CAN CONTRIBUT
E TO THIS, INCLUDING TRACK GEOMETRY, TRACK CONDITION, TRUCK CONDITION, WHEEL CONDITION, RAIL AND FLANGE COEFFICIENT OF F
RICTION, TRAIN HANDLING, ETC. ALTHOUGH WITHIN FRA TRACK STANDARDS, THE CLASS OF TRACK FOR THE AREA IS MAINTAINED TO CLAS
S 1 CRITERIA. CONSEQUENTLY, WITH THE LOWER STANDARD OF TRACK, GREATER TOLERANCES TO ISSUES THAT MAY CONTRIBUTE TO SLOW S
PEED DERAILMENTS ARE DEEMED ACCEPTABLE. NO ONE FACTOR IS IN GENERAL ENOUGH TO CAUSE THE WHEEL CLIMB. IN MANY INSTANCES,
ALL THE PERTINENT MEASUREMENTS ARE WELL WITHIN APPLICABLE FRA SAFETY STANDARDS AND OFTEN WITHIN [redacted] MAINTENANCE REQUIRE
MENTS AS WELL.

```
.....................Track information.....................
Yard        Damage     $500    Milepost         FRA Class 1       Total Casualties:  0 Deaths and 0  Injured

....Method(s) of operation   ....Cause(s)....
Other than main track rules
Switch out of adjustment because of insufficient rail anchoring



EMPLOYEE FAILED TO PROPERLY LATCH DOWN THE SWITCH HANDLE.  AS THE TRAIN WAS PASSING, THE POINTS BEGAN TO FLOAT DERAILING
IT.  1 CARS DERAILED.  NO HAZARDOUS MATERIALS WERE RELEASED.
```

How does a human failure description morph into a track cause of insufficient rail anchoring????

....................Track information.....................
Main Damage $15,000 Milepost 10.9 FRA Class 1 Total Casualties: 0 Deaths and 0 Injured

....Signalization.... ....Cause(s)....
Nonsignaled
Speed, other
....Supplemental Codes....

WN-15 WAS HEADED NORTH BOUND ON WN LINE AT [redacted] COMING DOWN HILL WITH NO AIR THE TRAIN STARTED TO SLOW. THE ENGINEER TOOK POWER AND FELT A BUMP. THE TRAIN WAS BROUGHT TO A STOP. THE 10, 11, 12 CARS HAD DERAILED. ALL CARS WERE UPRIGHT. D WC 794900 WAS LISTING TO THE WEST. ALL CARS WERE STILL ON THEIR TRACKS. THERE IS TRACK DAMAGE.

Speed??? How did speed cause the derailment? What was speed? What was speed limit? Why did overspeed occur?

WOLF Railway Consulting

> $250,000 in cost

```
.....................Track information.....................
Yard       Damage  $57,270   Milepost 0.15    FRA Class 1       Total Casualties:  0 Deaths and 0  Injured

....Signalization....         ....Cause(s)....
Nonsignaled
Improper train make-up
....Supplemental Codes....
Restricted Speed or Equivalent



YCB32R-10 TOOK 16 CARS OUT OF THE BOWL AND DOUBLED OVER TO TRACK 486, WHICH HAD 59 CARS IN TRACK.  REMOTE JOB TIED INTO
TRACK 486 AND STRETCHED THE CUT OF NOW 75 CARS AHEAD ABOUT 15 CARS, SO THE EMPLOYEE COULD RIDE THE REAR OF THE CUT DOWN
FOR AN AIR SPOT.  WHEN THE JOB BEGAN TO SHOVE BACK, APPROXIMATELY 5 CAR LENGTHS INTO THE SHOVE, 6 EMPTY REEFER CARS DERA
ILED ACCORDION STYLE.  AFTER INVESTIGATION, CAUSE DETERMINED TO BE TRAIN MAKUP, WITH LOADS ON TRACK 486 AND NO AIR ON TH
E JOB (NORMAL OPERATING PROCEDURE ON TRIM JOB), THE WEIGHT FORCED A WHEEL TO POP OFF THE RAIL BEFORE THE JOB BEGAN SHOVI
NG.


=====Accident    23 ========================================================================
```

Wheel popped off track while sitting still? Hmmm?
No mention of car condition, track condition, how the train make-up was improper.

WOLF Railway Consulting

```
.....................Track information.....................
Yard       Damage  $17,572   Milepost 5.65    FRA Class 1       Total Casualties:  0 Deaths and 0  Injured

....Signalization....        ....Cause(s)....
Nonsignaled
Other truck component defects, (CAR)
....Supplemental Codes....
Restricted Speed or Equivalent
```

YOA21-17 WAS PULLING OUT OF TRACK 810. FOREMAN AND SWITCHMAN WERE ON THE GROUND GIVING CAR COUNTS, WHEN THE SW1 NOTICED AN AUTORACK WOBBLING AND THEN GAVE THE COMMAND TO STOP WHEN HE NOTICED THE 7TH AUTORACK FROM THE REAR ON THE GROUND.

Other Truck component defects??? What failed and why?

WOLF
Railway Consulting

Cost exceeded $100,000

......................Track information......................
Yard Damage $980 Milepost B278.0 FRA Class 1 Total Casualties: 0 Deaths and 0 Injured

....Signalization.... ....Cause(s)....
Nonsignaled
Object or equipment on or fouling track, other
....Supplemental Codes....
Restricted Speed or Equivalent

RUN IN OF COUPLER MOVEMENT CAUSED OLD YOKE MOUNTED TRAINLINE TROLLEY TO BREAK, RESULTING IN THE NEW COUPLER MOUNTED TRAIN LINE TROLLEY TO BREAK (100% NEW). NEW COUPLER MOUNTED TRAINLINE TROLLEY WAS DRAGGING WHILE L68L320 MOVED WEST. AS L68L320 MADE SSHOVE MOVEMENT EAST, TRAINLINE TROLLEY BECAME WEDGED INTO HEEL BLOCK OF CROSSOVER SWITCH RESULTING IN ADMX 28327 A-END TRUCK, WHEEL #3 TO DERAIL DURING SHOVE MOVEMENT, DERAILING THE SUBSEQUENT CARS ALL WHEELS ON ADMX 28724, ADMX 25462, ADMX 25799, AND LOCOMOTIVE [redacted] THE R1,2,3 AND L1,2,3

This was not an object fouling track cause (Misc. Cause Code), this was a mechanical failure of equipment. Or possibly improper train handling.

No Information provided on why the run-in occurred, magnitude of the run-in, or why the trolley broke.

WOLF Railway Consulting

To the Investigators (NTSB/TSB):

- Provide final reports in a timely manner; less than one year. If corrective actions required they must be given in a timely manner while attention is still focused on the accident.
- Cooperate with railroads at accident site; work as a team; eliminate us vs. them attitude. Share information and access to artifacts.
- Quit listing human failure as a cause, and explain why and how human failure occurred. Loss of situational awareness is not a cause. Utilize current research on human performance and attention awareness (Atticus Consulting, DEKRA, others) used in other safety sensitive industries.
- Minimize political inferences in the investigations; stick to nuts and bolts.
- Develop corrective actions/recommendations for primary and contributory causes.

WOLF
Railway Consulting

Provide final reports in a timely manner; less than one year. If corrective actions required they must be given in a timely manner while attention is still focused on the accident.

NTSB Accident Reporting in the 1970's

Report Number	NTSB Title	Accident Date	Report Date	City	State
RAR-72-01	Penn Central Transportation Co. Freight Train Derailment, Passenger Train Collision with Hazardous Material Car	10/8/1970	12/22/1971	Sound View	CT
RHR-71-01	Illinois Central Railroad Company, Train No. 1, Collision with Gasoline Tank Truck at South Second Street Grade Crossing	1/24/1970	7/8/1971	Loda	IL
RAR-71-03	Illinois Central Railroad Company and Indiana Harbor Belt Railroad Company Collision Between Yard Trains	9/8/1970	7/8/1971	Riverdale	IL
RAR-71-02	Chicago, Burlington, and Quincy R.R. Co., Train 64 and Train 824, Derailment and Collision with Tank Car Explosion	2/18/1969	2/24/1971	Crete	NE
RAR-71-01	Richmond, Fredericksburg and Potomac Railroad Company, Train No. 10/76	1/27/1970	2/3/1971	Franconia	VA
RAR-70-03	Penn Central Company, Collision of Trains N-48 and N-49	8/20/1969	10/14/1970	Darien	CT
RAR-70-02	Illinois Central Railroad Company, Derailment	9/11/1969	8/19/1970	Glendora	MS
RAR-70-01	Penn Central Company, Train Second 115 (Silver Star), Derailment	6/28/1969	6/10/1970	Glenn Dale	MD
RAR-69-01	Southern Railway Company, Train 154, Derailment with Fire and Explosion	1/25/1969	10/6/1969	Laurel	MS
RAR-68-03	Pennsylvania Railroad, Train PR-11A, Extra 2210 West and Train SW-6, Extra 2217 East, Derailment and Collision	1/1/1968	12/18/1968	Dunreith	IN

14 mo.
18 mo.
10 mo.
24 mo.
13 mo.
14 mo.
11 mo.
12 mo.
9 mo.
11 mo.

13 mo. Average

More Recent NTSB Accident Reporting

Report Number	NTSB Title	Accident Date	Report Date	City	State	Country	NTIS Number	
RAB-19-02	BNSF Railway Head-On Collision	6/28/2016	6/11/2019	Panhandle	TX			36 mo.
RAR-19-01	Amtrak Passenger Train 501 Derailment	12/18/2017	5/21/2019	DuPont	WA	USA	PB2019-100807	17 mo.
RAB-19-01	CSX Transportation Employee Fatalities at Ivy City Washington, DC	6/27/2017	3/25/2019	Washington	DC	USA		17 mo.
RAR-18-02	Derailment and Hazardous Materials Release of Union Pacific Railroad Unit Ethanol Train, Graettinger, Iowa, March 10, 2017	3/10/2017	10/30/2018	Graettinger	IA	USA	PB2019-100084	19 mo.
RAB-19-05	Derailment of Metro-North Railroad Commuter Train Rye, New York	5/18/2017	10/8/2019	Rye	NY	USA		29 mo.
RAB-19-04	Metropolitan Atlanta Rapid Transit Authority Train 401 Strikes On-Track Equipment	6/3/2018	8/6/2019	Sandy Springs	GA	USA		14 mo.
RAR-19-02	Amtrak Passenger Train Head-on Collision With Stationary CSX Freight Train	2/4/2018	7/23/2019	Cayce	SC	USA	PB2019-101308	17 mo.
RAB-19-03	New York City Transit Train Strikes Two Flagmen	11/3/2016	6/21/2019	Brooklyn	NY	USA		31 mo.
RAB1804	Railroad Accident Brief: Southwestern Railroad Collision Roswell, New Mexico	4/28/2015	4/19/2018	Roswell	NM	USA		36 mo.
RAB-18-03	Railroad Switching Services Employee Fatality	4/3/2015	3/1/2018	Pine Bluff	AR			35 mo.

25 mo. Average

WOLF Railway Consulting

The Grand Daddy…took over 5 years

RAB-12-03	Derailment of CSX Transportation Freight Train Q502-15 With Hazardous Materials Release	1/16/2007	3/30/2012	Shepherdsville KY

62 months !!

WOLF Railway Consulting

Nearly 4 years and NO Cause found

CSX Freight Train Derailment and Subsequent Fire in the Howard Street Tunnel

Probable Cause

The National Transportation Safety Board, after an exhaustive investigative effort, could not identify convincing evidence to explain the derailment of CSX freight train L-412-16 in the Baltimore, Maryland, Howard Street Tunnel on July 18, 2001.

No preaccident equipment defects or rail defects were found. Computer simulations were used to evaluate locomotive event recorder data, train profile data, track profile data, and preaccident track geometry data. These simulations indicated that neither train operations nor changes in track conditions alone likely resulted in a derailment. Available physical evidence and computer simulations also showed that the most likely derailment scenario involved an obstruction between a wheel and the rail, in combination with changes in track geometry. However, postaccident fire, flooding, and necessary emergency response activities, including removing burning freight cars from the tunnel, significantly disturbed the accident site; and, no obstruction was identified that could be convincingly connected to wheel climb and evidence was insufficient to determine changes in track geometry.

Accident Location: Baltimore , MD
Accident Date: 7/18/2001
Accident ID: DCA01MR004

Date Adopted: 12/16/2004
NTSB Number: RAB-04-08
NTIS Number:
Docket Link: DCA01MR004

41 months

WOLF Railway Consulting

Canada TSB Investigation Length

Completed	R20W0031	2020-02-18	**Main-track train derailment** Canadian National Railway Company Train X35041-18 Mile 108.25, Fort Frances Subdivision Emo, Ontario	2020-07-28	5 months
Completed	R20V0005	2020-01-07	**Main track train derailment** Canadian National Railway Company Freight train U79351-06 Mile 69.97, Bulkley Subdivision near Kitwanga, British Columbia	2020-11-04	10 months
Completed	R19W0329	2019-12-31	**Main-track derailment** VIA Rail Canada Inc. Passenger Train 692 Mile 22, CN Gladstone Subdivision Katrime, Manitoba	2020-08-13	8 months
Completed	R19D0117	2019-11-16	**Main-track train derailment** Central Maine & Quebec Railway Freight train 630 Mile 103.73, Sherbrooke Subdivision Bolton-Ouest, Quebec	2020-06-29	7 months
Completed	R19C0111	2019-10-11	**Main-track derailment** Canadian Pacific Railway Train 369-406 Mile 85.0, Taber Subdivision near Barnwell, Alberta	2020-04-02	6 months
Completed	R19E0150	2019-09-29	**Main-track train derailment** Canadian National Railway Company Freight train G86341-28 Mile 80.45, Vegreville Subdivision Chipman, Alberta	2021-03-31	6 months

Kudos to the TSB!

7 Month Average

WOLF Railway Consulting

Quit listing human failure as a cause and explain why and how human failure occurred. Loss of situational awareness is not a cause. Utilize current research on human performance and attention awareness (Atticus Consulting, DEKRA, Others) used in other safety sensitive industries.

WOLF Railway Consulting

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was a buildup of ice and snow that derailed a boxcar on which an employee was riding, crushing the employee between the boxcar and an adjacent building. Contributing to the accident was the decision to ride the boxcar when conditions were not determined to be safe.

Why did he ride the car on the side between the building? Why not on outside?

- distractions
- job pressure; lack of job briefing
- were job steps interrupted
- lack of rule knowledge
- rule test history; rule violation
- were close clearance signs present
- why wasn't ice/snow cleared

How to prevent recurrence?

WOLF Railway Consulting

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was that the conductor slipped, tripped, or fell during his attempt to board locomotive [redacted] as it passed at 12.5 mph, which is three times the maximum authorized speed to board moving equipment.

Why did he attempt to board the train?

- distractions
- job pressure
- were job steps interrupted
- lack of rule knowledge; rule violation
- rule test history

Falling is a result of actions, not a cause.
Did he trip/fall due to objects on track?
How to prevent recurrence?

WOLF Railway Consulting

Probable Cause

The National Transportation Safety Board determines that the probable cause of the [redacted] remote control operator being struck and killed on May 10, 2009, [redacted] was the operator's loss of situational awareness when he stepped between moving equipment while attempting to couple the equipment, in violation of [redacted] Safety Rule TS-15.

Why did he loose "situational awareness"?

- distractions
- job pressure
- were job steps interrupted
- content of job briefing
- lack of rule knowledge; rule violation
- rule test history

How much separation between the cars?

How to prevent recurrence?

WOLF Railway Consulting

What has our derailment experience taught us?

- We have learned that current methods of condition assessment, i.e., individual measurements of track geometry, rail, and vehicles at discrete increments, may not be sufficient to prevent all derailments.
- Current practice of periodic human track and vehicle inspections is not finding conditions that can lead to derailment. Compliance with standards is not always enough.
- Why?
  - Humans may not be capable of correlating all the conditions they observe and making connections as to possible outcomes
  - Human inspection is variable - based on skill, experience, and physical/mental condition.
  - The interval between geometry/vehicle measurements may be too long to catch rapidly developing conditions (PSR).
  - Track inspections may not be taking into account variability of vehicle conditions, wheel profiles, operating speeds and drawbar forces.
- Current management methods, training, rules, rules testing, and job briefings are not providing continuous reductions of human factor derailments

WOLF
Railway Consulting

Strategic changes needed for rail industry

- Move away from maintenance based on pass/fail regulations. Change from reactive to proactive.
- Performance based derailment risk assessment based on actual geometry measurements, taking into account the types of vehicles that may operate over that track (including defects), magnitude of drawbar forces, and the speeds they may operate.
- Autonomous and automated track geometry and rail profile measurements performed frequently at time intervals commensurate with traffic conditions on line.
- An automated method to measure rail neutral temperature
- Updated track regulations based on actual performance vs. measured conditions. This should include combination conditions in the track instead of just discrete measurements.
- Regulatory incentives to move in this direction by relaxation of mandated labor intensive and safety sensitive weekly/monthly/mileage inspections.
- Develop $$ incentives for deployment of more premium trucks
- Further deployment of continuous ultrasonic rail testing
- Automated inspection of turnout geometry, wear, and condition
- Increased emphasis and understanding of why human failure occurs

WOLF
Railway Consulting

Can we do this?

- YES!!!
- Most of the technology exists today to make this happen.
- What is needed:
  - A cultural shift at the railroad and regulatory level.
  - A realization that new and different data may be needed in our measurements
  - Better data mining to connect the dots in the mounds of data we are collecting
  - Collaboration within the vehicle, track and operating departments; <u>It is a system</u>!
- We need to change finders into fixers.
- Need a business model to show cost effectiveness
  - Economic modeling taking into account the cost of failure and loss of precision/reliability on the network

WOLF
Railway Consulting

How to start?

- Start small, one division or territory
- Get buy in from stakeholders
    - ✓ Labor
    - ✓ Regulatory
    - ✓ All affected departments
- Determine criteria for evaluation; Define Success.
- Make Business case $$$$

WOLF Railway Consulting

12 Tactical Strategies to bring derailments under 1.0/MTM

WOLF Railway Consulting

12 Tactical Strategies

1. Develop a corporate Focus
2. Develop a network of integrated and automated inspection/detection systems
3. Leverage Big Data
4. Insure Correct Curve Elevations
5. Manage Wheel/Rail Interface
6. Develop an effective rail lubrication program

WOLF
Railway Consulting

12 Tactical Strategies con't

7. Eliminate Rail Cant
8. Eliminate tight side bearings and excessive friction wedge rise from your cars/wagons
9. Manage CWR and Rail Neutral Temperature
10. Develop train make up rules and strategies
11. Perform Root Cause Analysis on Human failures; Change descriptions into causes.
12. Increased focus on drainage/water management

WOLF Railway Consulting

Part 2. of this presentation will include a complete and more thorough discussion of the 12 tactical strategies. TBC.

(<u>If</u> U. of I. invites me back for a second time)

WOLF
Railway Consulting

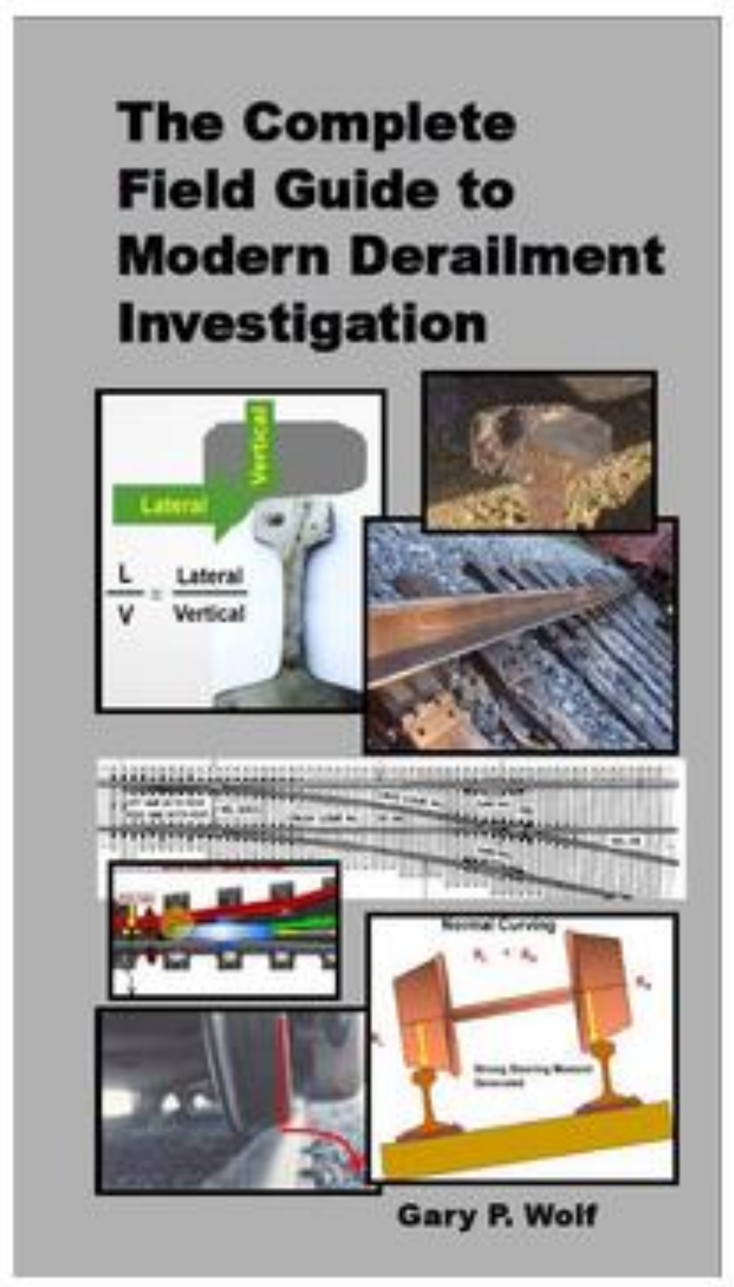
And now the commercial….

435 page handbook, ~ 1000 photos/diagrams, full color on coated paper, with steel spiral binding for laying flat. Pocket sized (a Carhartt pocket) for use on site.

Covers freight, passenger, transit, locomotive equipment. Large chapter on human failure investigation. Complete discussion of track and vehicle inspection. Every type of derailment, symptoms and causes is thoroughly explained.

Also includes the 12-step Derailment Dozen™ investigation process.

Available at www.wolfrailway.com. $75.00 plus S&H.



WOLF Railway Consulting

The End

Thank You for your attention.

gary@wolfrailway.com