

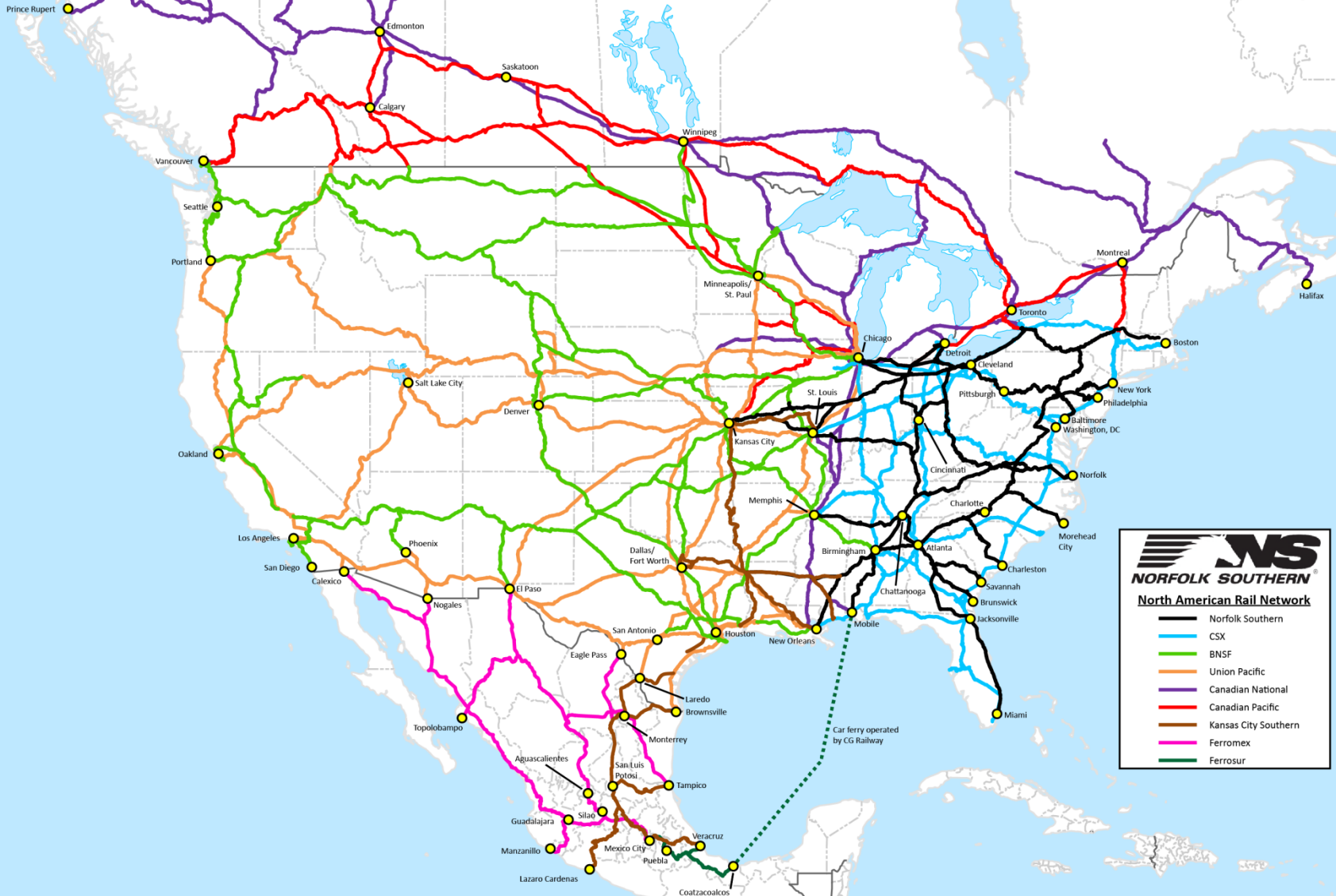
Select Issues and Update on the Railroad Industry

Transportation Research Board
June 2019

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Vice President – Strategic Planning
Norfolk Southern

- Industry Structure
- Precision Scheduled Railroading (PSR)
- PTC
- Automation

North American rail network



Industry Structure – Non-Light-Rail

Class I US Railroads

BNSF
UP
CSX
NS
KCS – US Ops
CN – US Ops
CP – US Ops



Govt Supported Commuter Lines

Metro North
NJ Transit
Metra
Caltrain
Septa
MBTA
Etc.

US Short Lines

G&W
Watco
Wheeling & Lake Erie
Pan Am Railways
Iowa Interstate
Etc

Private Passenger

Brightline

Govt Supported Passenger

Amtrak

Freight Railroads: Class I and Short Lines

YEAR	Class 1 Railroads			Short Line Railroads		
	Count of RRs	Employee Count	Operated Track Miles	Count of RRs	Employee Count	Operated Track Miles
1980	35	458,332	297,789	383	38,600	20,427
1990	14	216,424	224,314	497	26,763	39,770
2000	8	168,360	199,065	545	19,688	42,750
2010	7	151,854	196,996	560	17,931	43,003
2016	7	152,702	198,442	603	17,800	47,500

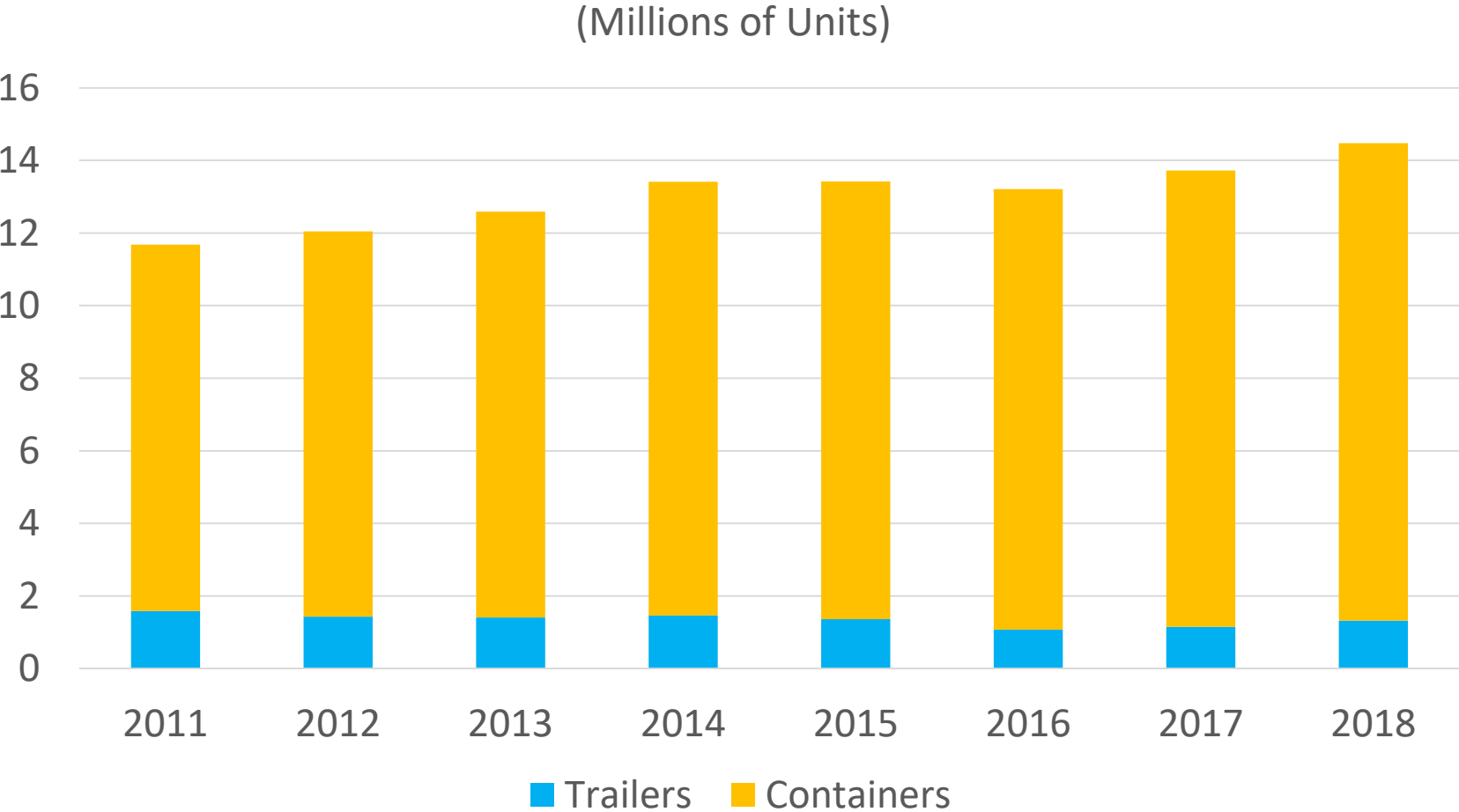
US Class I Revenues:
\$80 billion*

US Short Line Rev:
\$7 to \$9 billion*

* *Estimates*

US Intermodal Set Another Record in 2018

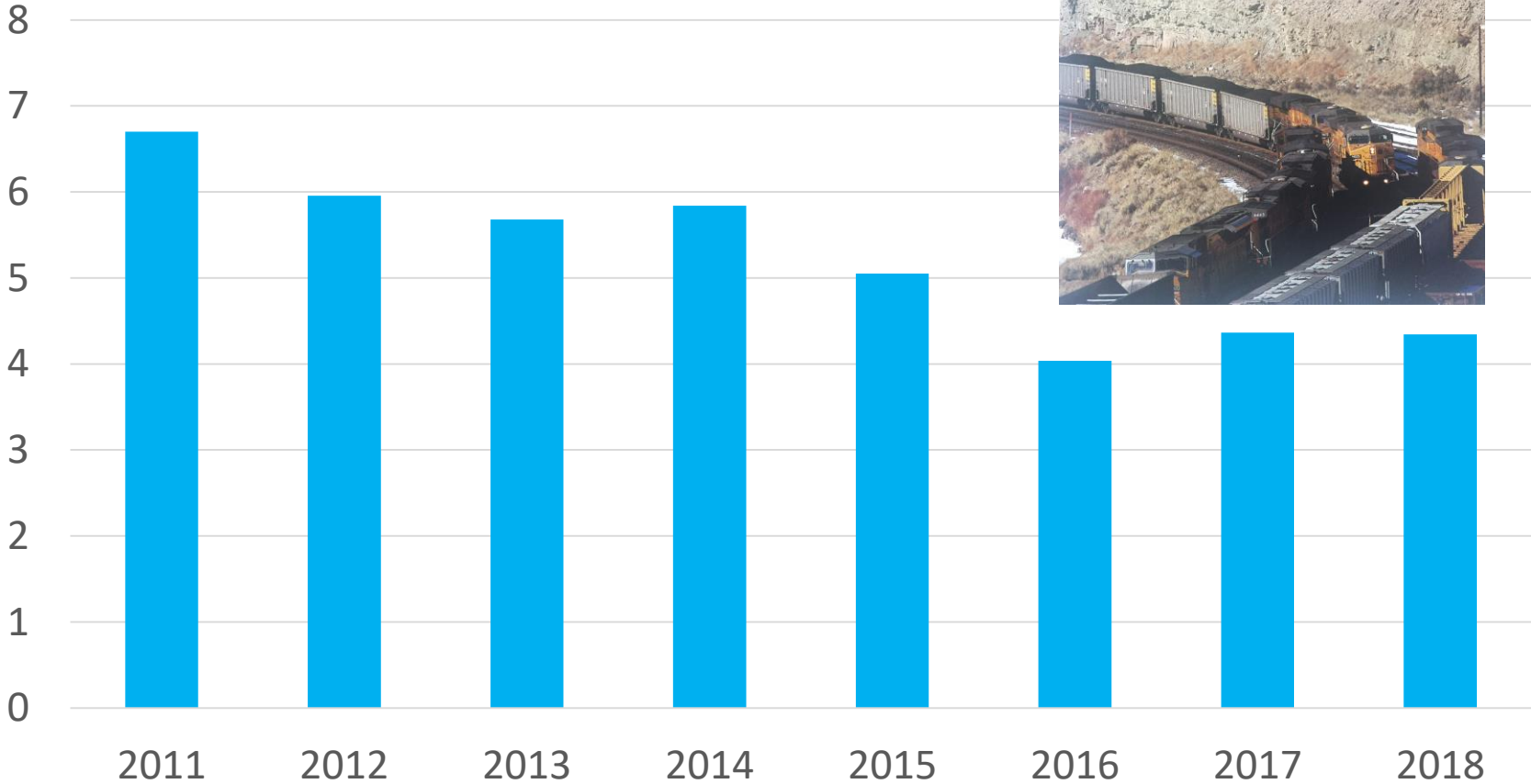
Intermodal down approximately 3% in 2019



Meanwhile Coal Continues Its Decline

Coal volume down approximately 4.5% in 2019

(Millions of Carloads)



What is PSR – Precision Scheduled Railroading?

Core Principles

- Serve the Customer
- Control Expenses
- Manage Assets
- Operate Safely
- Develop and Empower People



Class I PSR Status

Railroad	Status
CN	Complete
CP	Complete
CSX	Complete
NS	Underway
UP	Underway
KCS	Underway
BNSF	TBD

Class 1 Annual Revenue & OR

Industry is driving to operating margins of 40%

YEAR	BNSF		UP		CSXT		NS		CN		CP	
	Annual Revenue (Millions)	Operating Ratio	Annual Revenue (Millions)	Operating Ratio	Annual Revenue (Millions)	Operating Ratio	Annual Revenue (Millions)	Operating Ratio	Annual Revenue (Millions)	Operating Ratio	Annual Revenue (Millions)	Operating Ratio
2000	\$9,200	0.77	\$10,539	0.83	\$6,462	0.95	\$6,159	0.90	\$5,428	0.70	\$3,655	0.77
2001	\$9,201	0.81	\$11,973	0.83	\$6,454	0.93	\$6,170	0.84	\$5,652	0.70	\$3,699	0.77
2002	\$8,963	0.82	\$12,491	0.81	\$6,003	0.86	\$6,270	0.82	\$6,110	0.76	\$3,666	0.77
2003	\$9,380	0.83	\$11,551	0.82	\$6,182	0.91	\$6,468	0.84	\$5,884	0.70	\$3,661	0.80
2004	\$10,857	0.85	\$12,215	0.89	\$6,694	0.87	\$7,312	0.77	\$6,548	0.67	\$3,903	0.80
2005	\$12,846	0.78	\$13,578	0.87	\$7,256	0.82	\$8,527	0.75	\$7,240	0.64	\$4,392	0.77
2006	\$14,811	0.77	\$15,578	0.81	\$8,154	0.77	\$9,407	0.73	\$7,716	0.61	\$4,583	0.75
2007	\$15,909	0.79	\$16,283	0.79	\$8,674	0.77	\$9,432	0.73	\$7,897	0.64	\$4,708	0.75
2008	\$18,132	0.79	\$17,970	0.77	\$9,789	0.75	\$10,661	0.71	\$8,482	0.66	\$4,932	0.79
2009	\$14,124	0.78	\$14,143	0.76	\$7,837	0.73	\$7,969	0.75	\$7,367	0.67	\$4,303	0.79
2010	\$16,689	0.75	\$16,965	0.71	\$9,939	0.72	\$9,516	0.72	\$8,297	0.64	\$4,982	0.78
2011	\$19,323	0.74	\$19,557	0.71	\$11,676	0.74	\$11,172	0.71	\$9,028	0.63	\$5,177	0.81
2012	\$20,604	0.72	\$20,926	0.68	\$11,689	0.75	\$11,040	0.72	\$9,920	0.63	\$5,695	0.83
2013	\$21,774	0.70	\$21,963	0.66	\$11,950	0.76	\$11,245	0.71	\$10,575	0.63	\$6,133	0.77
2014	\$23,036	0.70	\$23,988	0.64	\$12,590	0.76	\$11,624	0.69	\$12,134	0.62	\$6,620	0.65
2015	\$21,766	0.65	\$21,813	0.63	\$11,733	0.76	\$10,511	0.73	\$12,611	0.58	\$6,712	0.60
2016	\$19,278	0.66	\$19,941	0.64	\$11,069	0.69	\$9,888	0.69	\$12,037	0.56	\$6,232	0.59
2017	\$21,387	0.66	\$21,240	0.62	\$11,408	0.68	\$10,551	0.66	\$13,041	0.57	\$6,554	0.57
2018	\$23,855	0.67	\$22,832	0.63	\$12,250	0.60	\$11,458	0.65	\$14,321	0.62	\$7,316	0.61

*Canadian revenues are in loonies

Sources: AAR & public financial statements

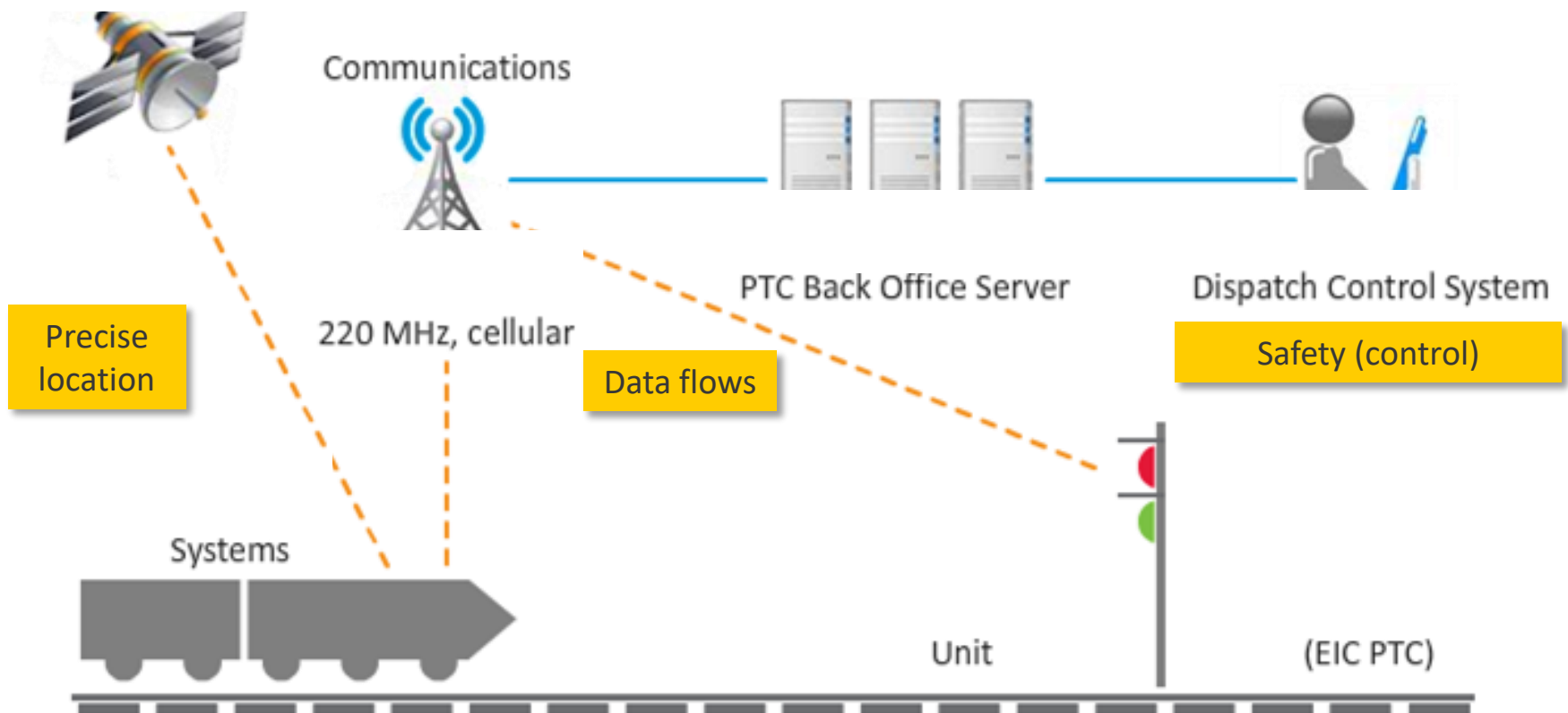
History of Positive Train Control

- 2007 – Rail Safety Improvement Act (RSIA) Introduced to Congress
- 2008 Chatsworth, CA Metrolink crash results in 25 fatalities and hundreds of injuries
- RSIA signed in to law in December of 2008
- Through extensions, technology must be in place by December 31, 2020
- Mandated the use of fail safe train stopping technology on rail lines with certain characteristics
- Will cost the industry in excess of \$30 billion

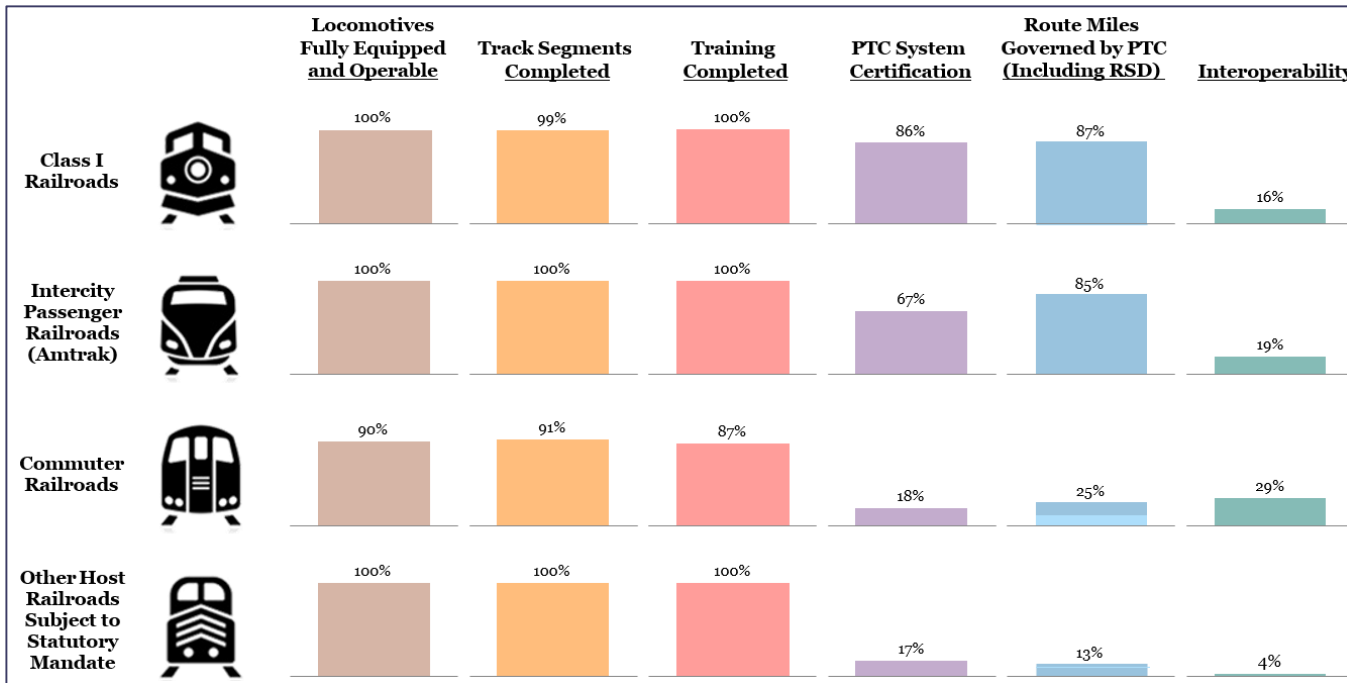


PTC leverages GPS, detailed track data, onboard sensors and significant communications infrastructure

PTC overrides a locomotive engineer's actions if she/he fails to stop a train.



Industry PTC Installation Status – Q1 2019



Locomotives Fully Equipped and Operable
Percentage of locomotives that are equipped with PTC system hardware and software and are operational

Track Segments Completed
Percentage of track segments that are equipped with PTC

Training Completed
Percentage of employees that received the training required under FRA's PTC regulations and the railroad's program

PTC System Certification
Percentage of host railroads that have received conditional PTC System Certification, based on conditional approval of a PTC Safety Plan

Route Miles Governed by PTC
Percentage of required route miles where host railroads' operations are governed by PTC (either in revenue service demonstration (RSD) or in operation)

Interoperability
Percentage of required tenant railroads that have achieved interoperability with the host railroad's PTC system

What's Next for PTC?

- Development of *Train Optimizer* and *Leader* will allow trains to start and operate autonomously
- *PTC* provides a safety overlay to stop trains
- *PTC* helps set the stage for autonomous train operations





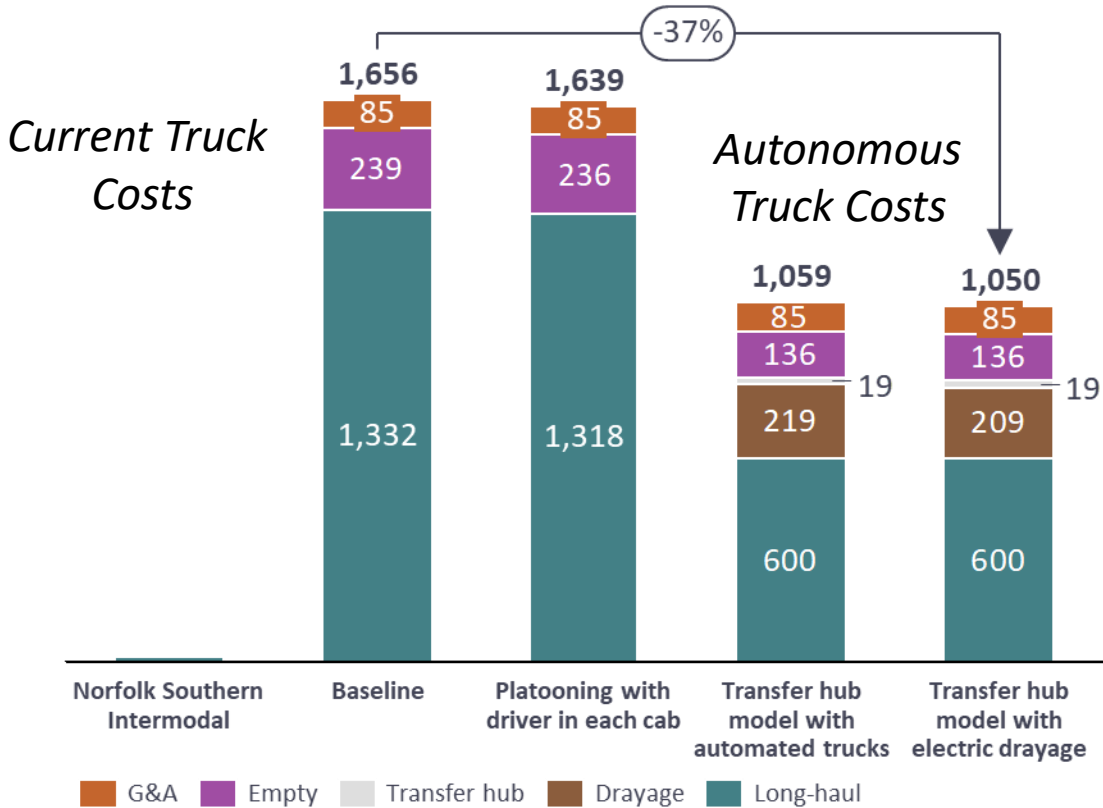
“Tesla trucks will be economic suicide for the railroad industry”

Highway Automation Has the Potential of Changing the Competitive Playing Field

Truck costs could decline by 25%-40%

Proprietary:
Illustrative Lane –
Midwest to Northeast

Operating cost [USD/load]



Productivity Through PSR, Automation and Next-gen Railcar Technology Collectively Provide a Path to Maintaining Competitive Position

- Train Operations
- Asset inspections
- Switching Automation
- Dispatching Automation
- Track Maintenance
- Terminal Automation

