U.S. Department of Transportation

Federal Motor Carrier Safety Administration

Enforcement Data Trends

2020 Transportation Research Board 99th Annual Meeting
Federal Motor Carrier Safety Administration
Analysis, Research, and Technology Forum
January 14, 2020

ELD Implementation Timeline

Leading up to Dec. 18, 2017

- On Dec. 18, 2017, FMCSA was ready

Dec. 18, 2017- April 1, 2018

- Motor carriers and drivers had time to acclimate to ELDs

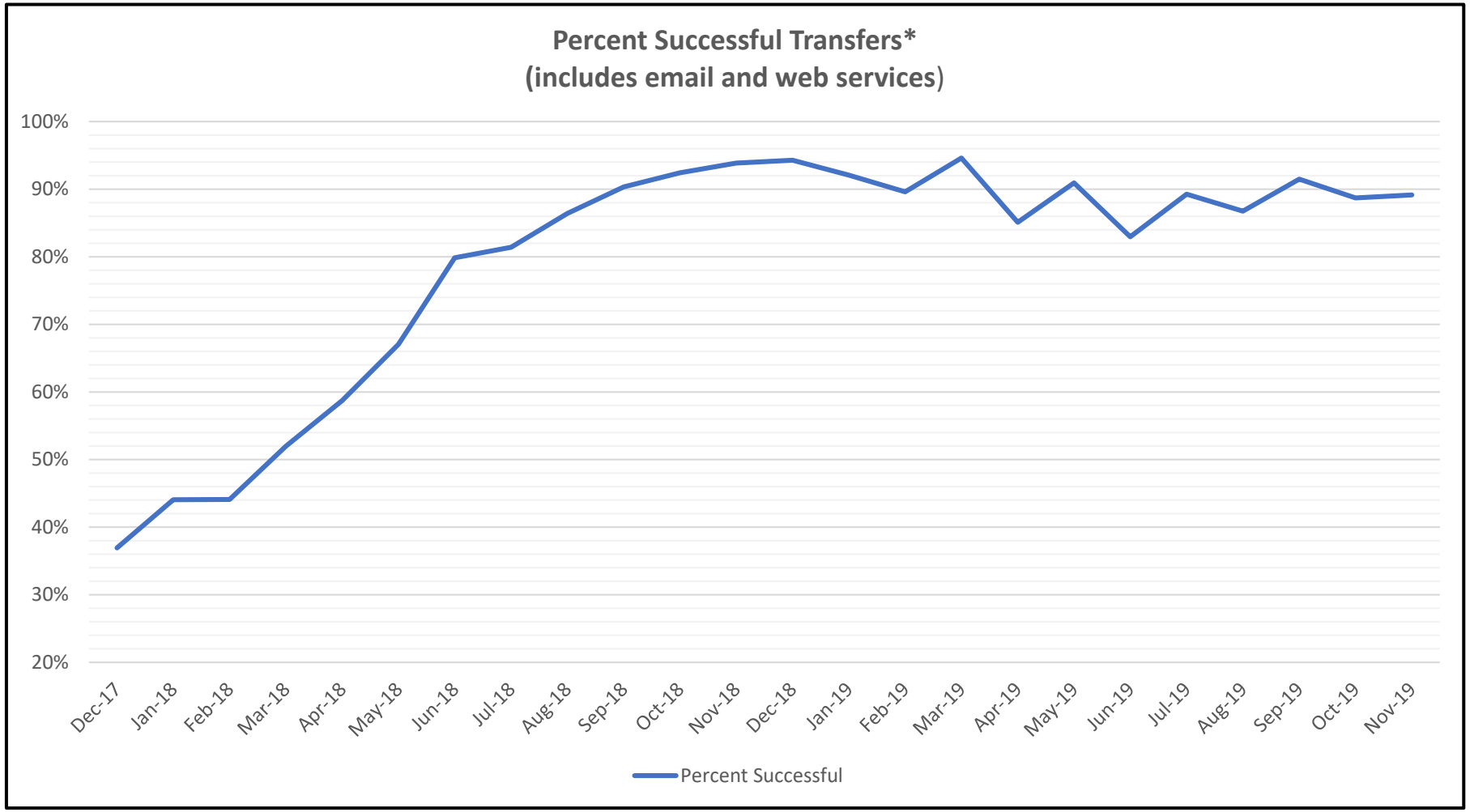
April 1, 2018 and onward

- CVSA OOS Criteria went into effect; less than 1% of inspected drivers placed OOS due to lack of ELD usage

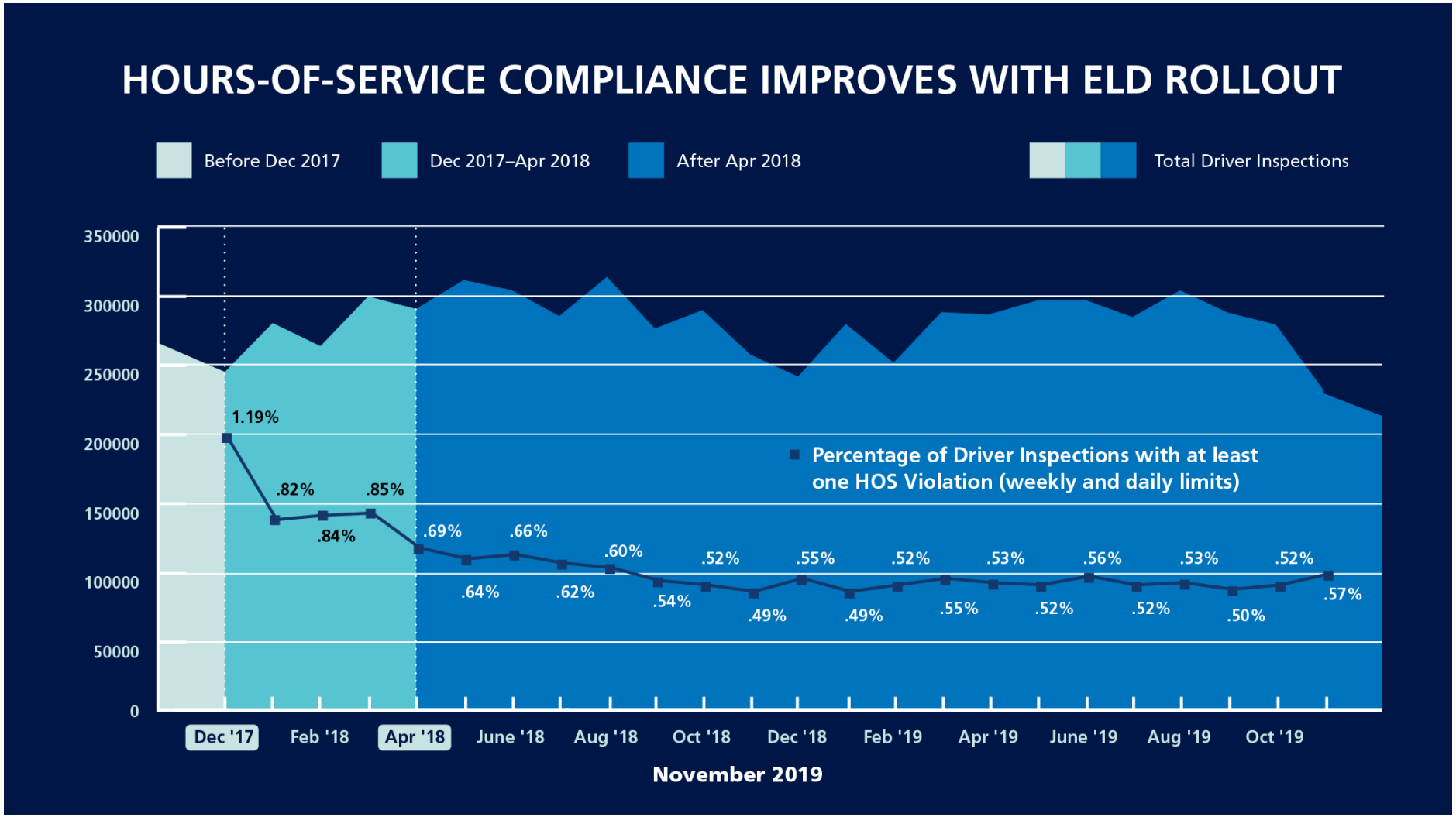
Dec. 16, 2019 and onward

- Full compliance with the ELD rule began

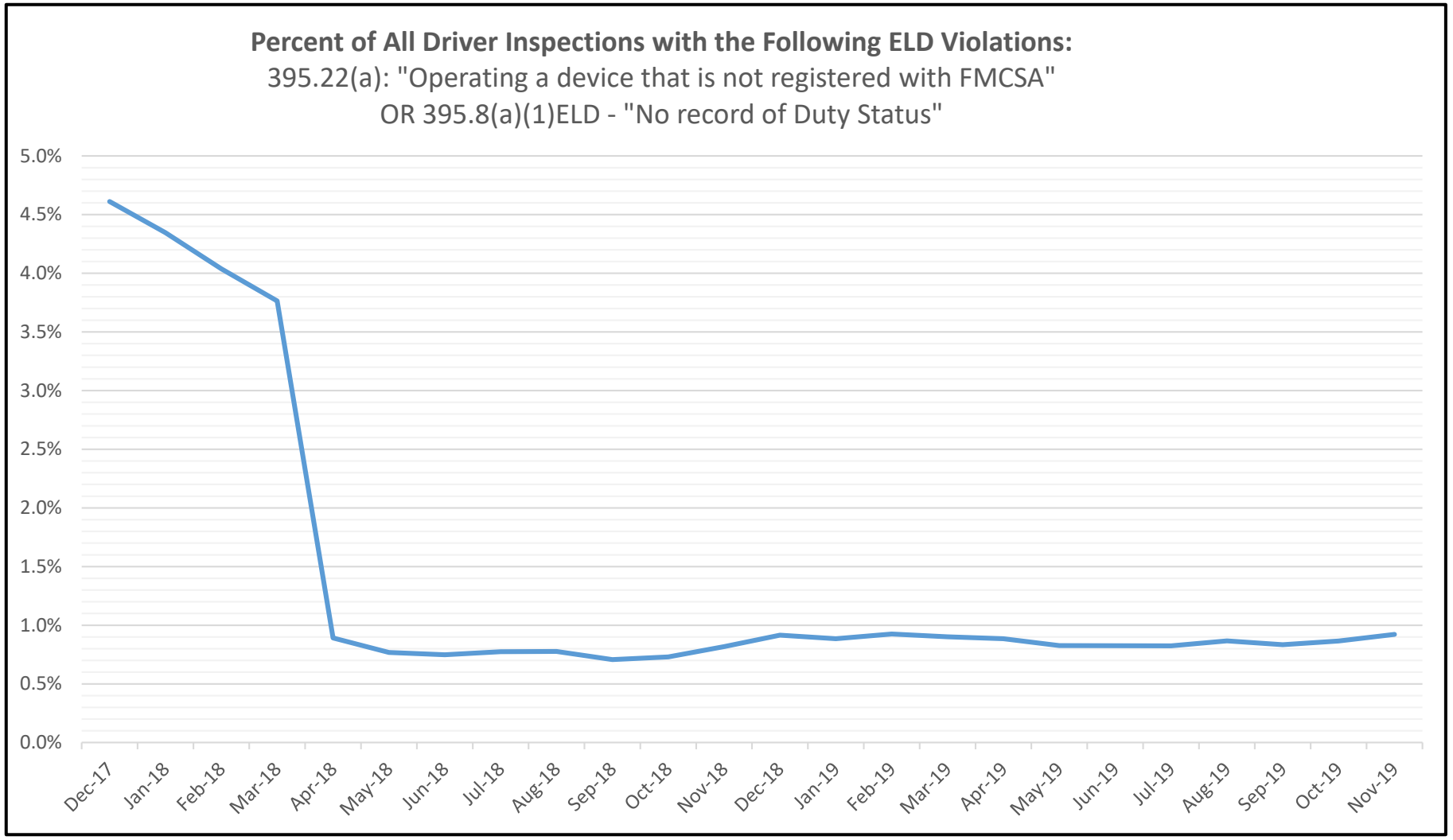
Successful Data Transfers via Web Services



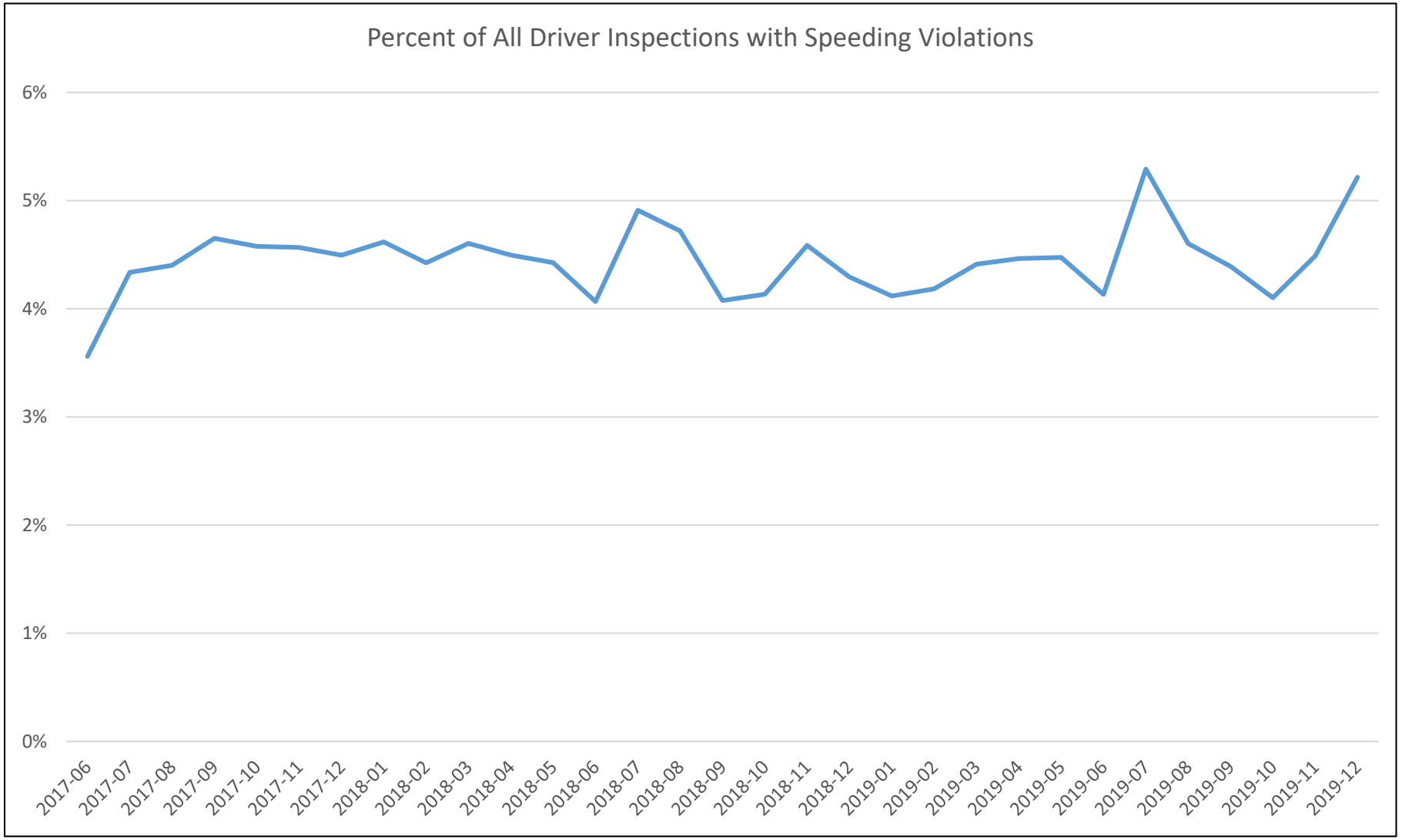
Hours of Service Violation Trends



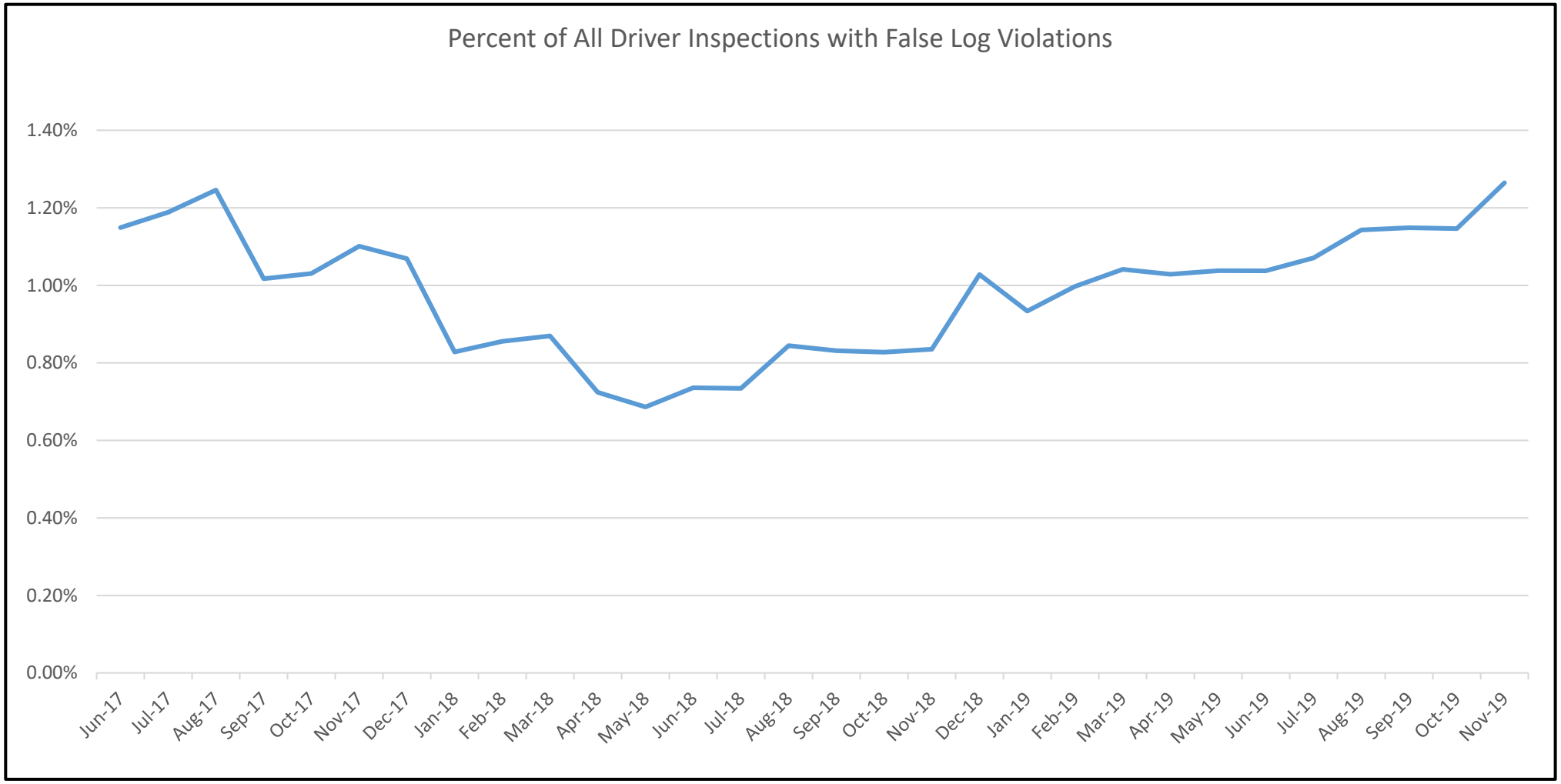
ELD Violations at the Roadside



Speeding Violations



False Log Violations



SMS HOS Statistics Pre- and Post- ELD Implementation

	Post-ELD*	Pre-ELD**	% Change
Prioritized Carriers In HOS Compliance BASIC	21,215	25,025	-15%
# of Inspections w/ HOS violations	397,629	516,055	-23%
# of Carriers w/ Percentiles in HOS BASIC	35,051	44,428	-21%
# of Driver Inspections	4,889,012	4,804,194	2%
Percent of Driver Inspections w/ HOS violation	8%	11%	-24%

HOS BASIC Measure at the Prioritization Threshold (65th percentile) by Safety Event Group (SEG)

	Post-ELD*	Pre-ELD**	% Change
SEG 1 (3-10 Driver Inspections)	2.03	2.29	-12%
SEG 2 (11-20 Driver Inspections)	1.11	1.46	-24%
SEG 3 (21-100 Driver Inspections)	0.73	1.16	-37%
SEG 4 (101-500 Driver Inspections)	0.38	0.79	-51%
SEG 5 (501+ Driver Inspections)	0.15	0.23	-36%

Top 10 Mostly Cited HOS Violations Pre-ELD (Nov 2015 to Nov 2017)

Rank	Cite	Violation Description	# of Violations Pre-ELD*	# of Violations Post-ELD**	% Change
1	3958	Record of Duty Status violation (general/form and manner)	341,774	146,659	-57%
2	3958F1 & F01	Drivers record of duty status not current	147,507	60,240	-59%
3	3953A3II	Driving beyond 8 hour limit since the end of the last off duty or sleeper period of at least 30 minutes	111,761	36,009	-68%
4	3958E	False report of drivers record of duty status	81,457	73,103	-10%
5	3953A2PROP	Driving beyond 14 hour duty period (Property carrying vehicle)	69,791	29,645	-58%
6	3958A	No drivers record of duty status when one is required	59,674	37,427	-37%
7	3958K2	Driver failing to retain previous 7 days records of duty status	50,614	25,402	-50%
8	3953A3PROP	Driving beyond 11 hour driving limit in a 14 hour period. (Property Carrying Vehicle)	39,762	20,072	-50%
9	3953A2PROPN	Driving beyond 14 hour duty period (Property carrying vehicle) - Nominal Violation	11,015	6,846	-38%
10	3953B2	Driving after 70 hours on duty in a 8 day period. (Property carrying vehicle)	7,241	1,990	-73%
		All Others HOS-Related Violations	52,648	374,375	611%
		Total	973,244	811,768	-17%

New Widely-Cited HOS Violations Post-ELD Implementation

Cite	Violation Description	# of Violations Post-ELD*
3958AELD	ELD - No record of duty status (ELD Required)	44,538
39522A	Operating with a device that is not registered with FMCSA	41,750
39522H4	Driver failed to maintain supply of blank driver's records of duty status graph-grids	34,182
39522H2	Driver failing to maintain ELD instruction sheet	29,961
39522G	Portable ELD not mounted in a fixed position and visible to driver	25,727
39522H1	Driver failing to maintain ELD user's manual	25,045
3958ANONELD	No record of duty status when one is required (ELD Not Required)	21,342
39522H3	Driver failed to maintain instruction sheet for ELD malfunction reporting requirements	15,412
39524C2III	Driver failed to manually add shipping document number	14,915
39530B1	Driver failed to certify the accuracy of the information gathered by the ELD	11,513
39524C2II	Driver failed to manually add the trailer number	8,073

Comparing SMS and IRT

Feature	Use in SMS	Use in IRT
Absolute Measure	• BASIC measures	• Not applicable • All measures are relative
Relative Measure	• BASIC percentiles	• Safety measure (theta) • Can be scaled/converted as needed (e.g., percentile)
Safety Event Group	• Groups carriers with similar number of inspections, violations, and crashes	• Not inherent to IRT • Can be incorporated with theta

Comparing SMS and IRT

Feature	Use in SMS	Use in IRT
Data Sufficiency Standard	• Carriers with less than X inspections with BASIC violations are not assessed	• Confidence interval can provide data-driven standard

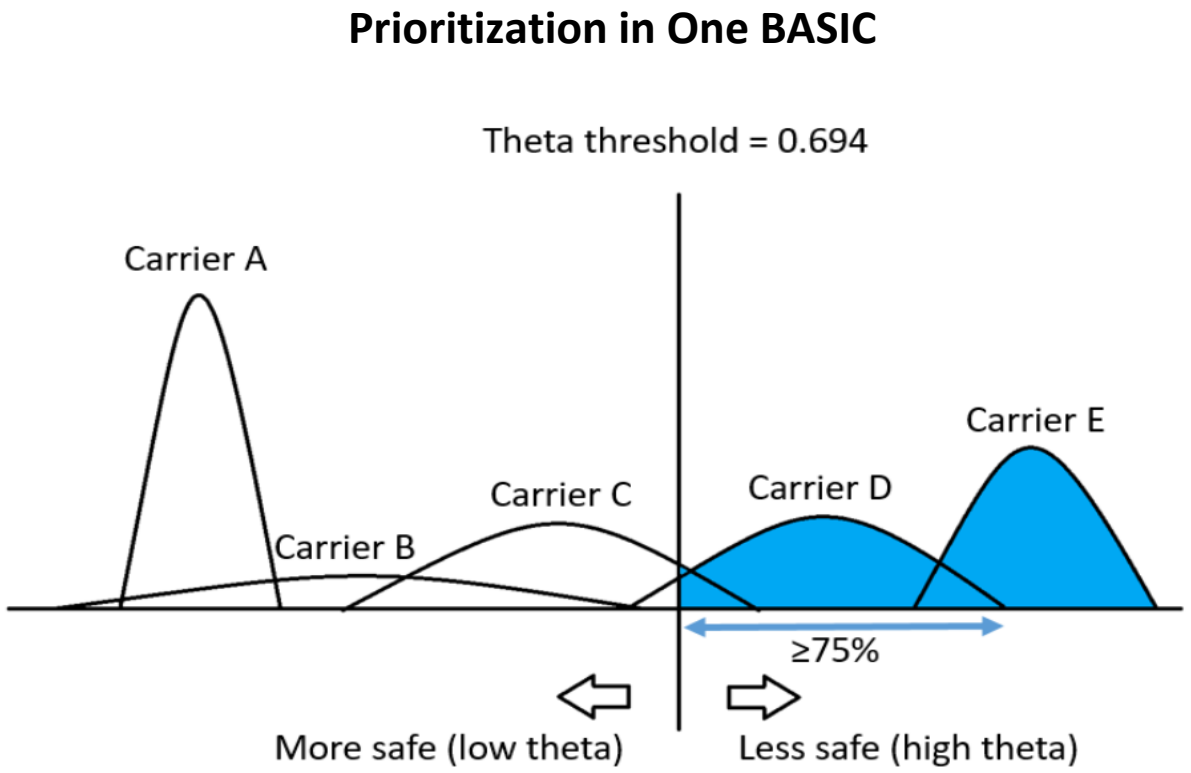
Severity Weighting	• Assigned to BASIC violations based on crash risk/OOS conditions
	• Based on enforcement expert opinion/crash occurrence analysis
	• Set weights/not responsive to new data
		• Statistically assigned value based on:
		  • How easy it is to get that violation
		  • How well that violation distinguishes between safe/unsafe carriers
		• Responsive to new data

Comparing SMS and IRT

Feature	Use in SMS	Use in IRT
Time Weighting	• Recent events have greater impact on carrier safety measure • Events older than 24 months are not used in assessment	• Not inherent to IRT • Can be incorporated
Reproducible Results	• Results and methodology available to public • Can be calculated without software • Carrier can use their own data to calculate their measure	• Results can be available to public • Software/training needed to run model code • Carrier needs entire data set to calculate their measure

IRT Overview

- IRT estimates every carrier's safety score (theta) for each BASIC many times, and uses those estimates to generate a mean theta and distribution.
- Carriers need to have their theta distribution above 75% to be prioritized.
  - This means that at least 75% of the time those carriers have thetas that are over the theta cutoff.
- We adjusted the theta cutoff until the same number of carriers were prioritized as in the SMS comparison group.



Carrier D and Carrier E are prioritized

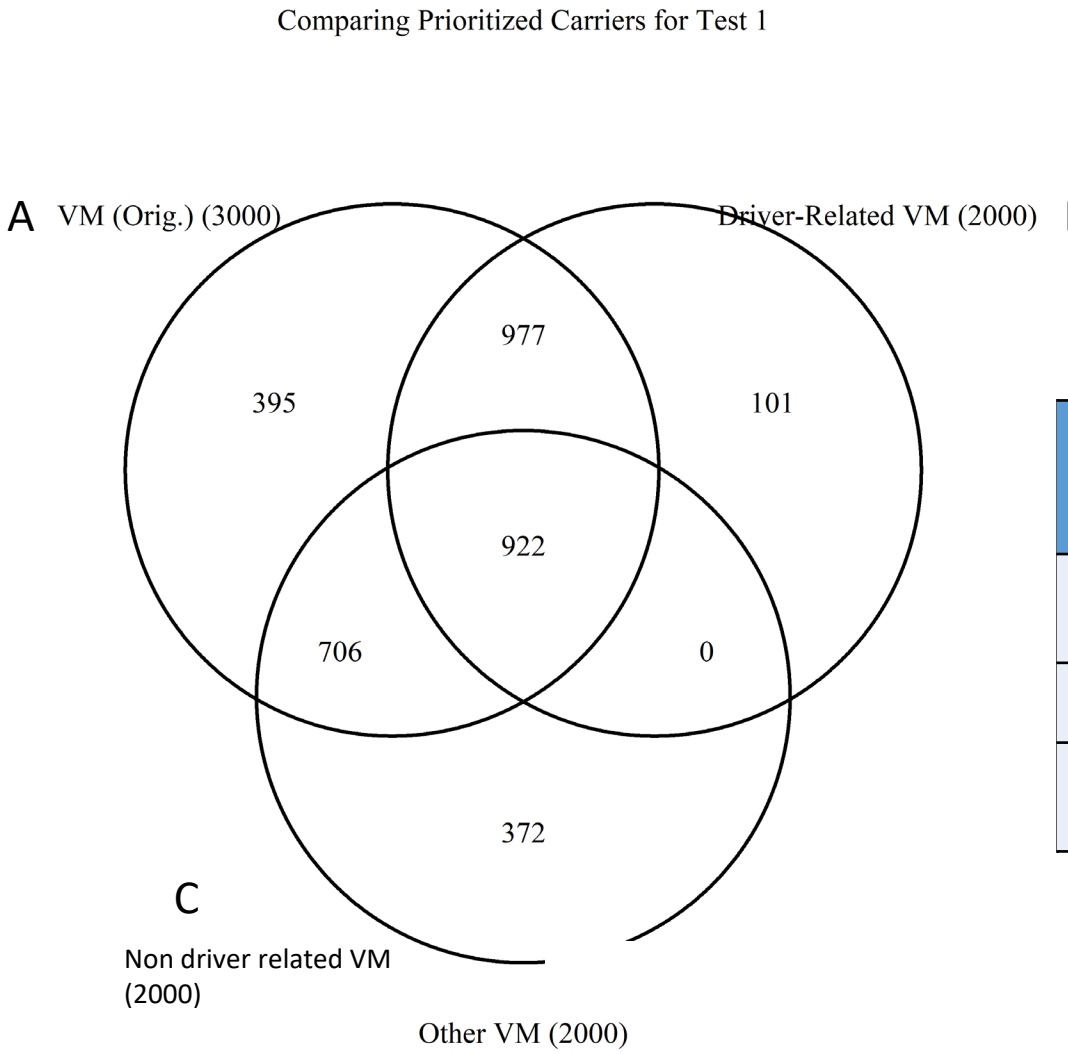
Example: Vehicle Maintenance

- Divide vehicle maintenance BASIC into driver-related and non-driver-related violations.
- Both vehicle maintenance BASICs performed well as an IRT model.
- There was no issue in model convergence.
- Confidence intervals are slightly wider when splitting the data for the models but are on par or better than the other existing BASICs.
- Currently performing predictive checks to confirm model fit.

External Model Evaluation Results

- Trained model on violation data from September 2015 – September 2017.
- Prioritized 2,000 – 3,000 carriers with the worst theta scores and smallest confidence intervals for each BASIC.
- Looked at their safety indicators during September 2017 – 2018 period.
- All IRT models performed well in selecting carriers with high violation rates in the test dataset (Sept. 2018)
- Looked at which carriers would potentially be added and removed when splitting original VM basic into two groups
  - The prioritized non-driver related VM carriers had a 12% increase in crash rate over prioritized driver related VM carriers.

Test 1: External Model Evaluation Results



Group	Number of Carriers	Crash Rate	Crashes	Power Units
(A) Original VM	3,000	6.04	4,548	75,261
(B) Dr VM	2,000	5.90	2,855	48,417
(C) Non-Dr VM	2,000	6.61	3,064	46,383

*Initial results for a sample of 20,000 carriers

Vehicle Maintenance Evaluation Results

- Results so far indicate splitting Vehicle Maintenance into two categories may add benefit to FMCSA's goal of improving safety.
- Two smaller VM models perform well as IRT models as there is sufficient violation data to estimate carrier safety score and violation characteristics.
- There is added benefit of being able to measure two facets of vehicle maintenance which were defined under a previous multidisciplinary study (IEP).
- Non-driver related VM violations may be more highly correlated with crash risk.
- Having two VM models allows FMCSA to optimize their prioritization list and emphasize one group over the other depending on crash risk.
- Decreased model runtime by 25%