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Benchmarking Motor Carriers

data, data everywhere

Steve Bryan, Vigillo

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Challenges to Benchmarking

1. Disparate enforcement
2. Crash accountability
3. Safety event groups (peer groups)

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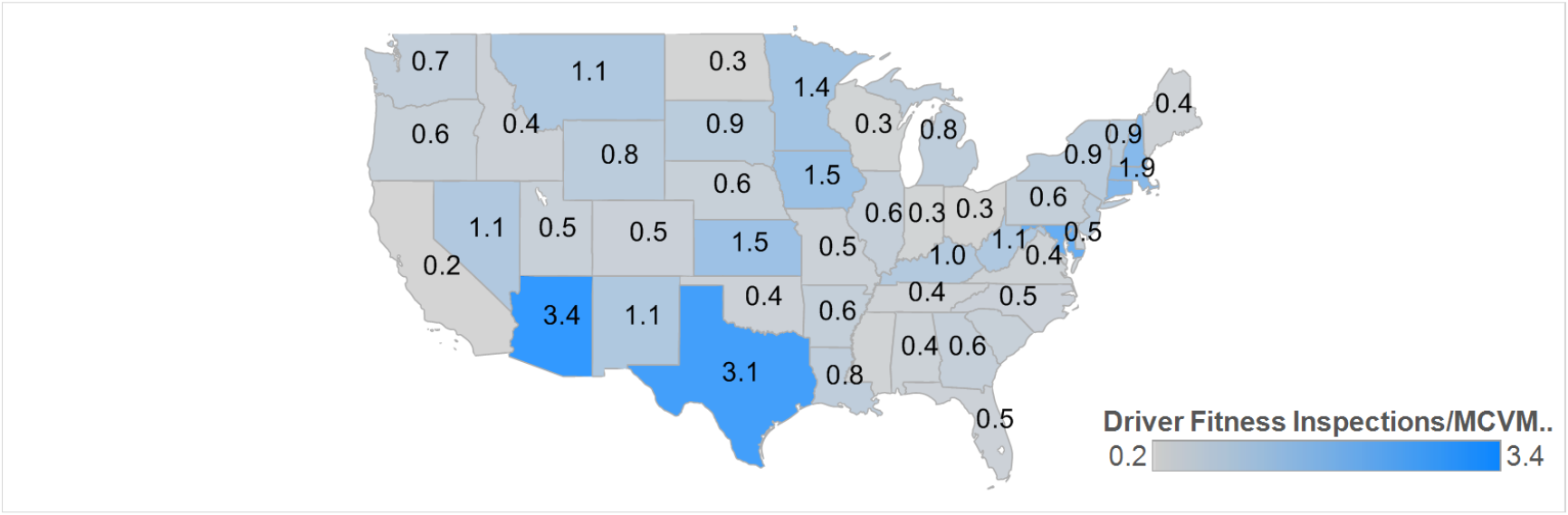
RETURN

Driver Fitness Inspections per Million Commercial Vehicle Miles Traveled



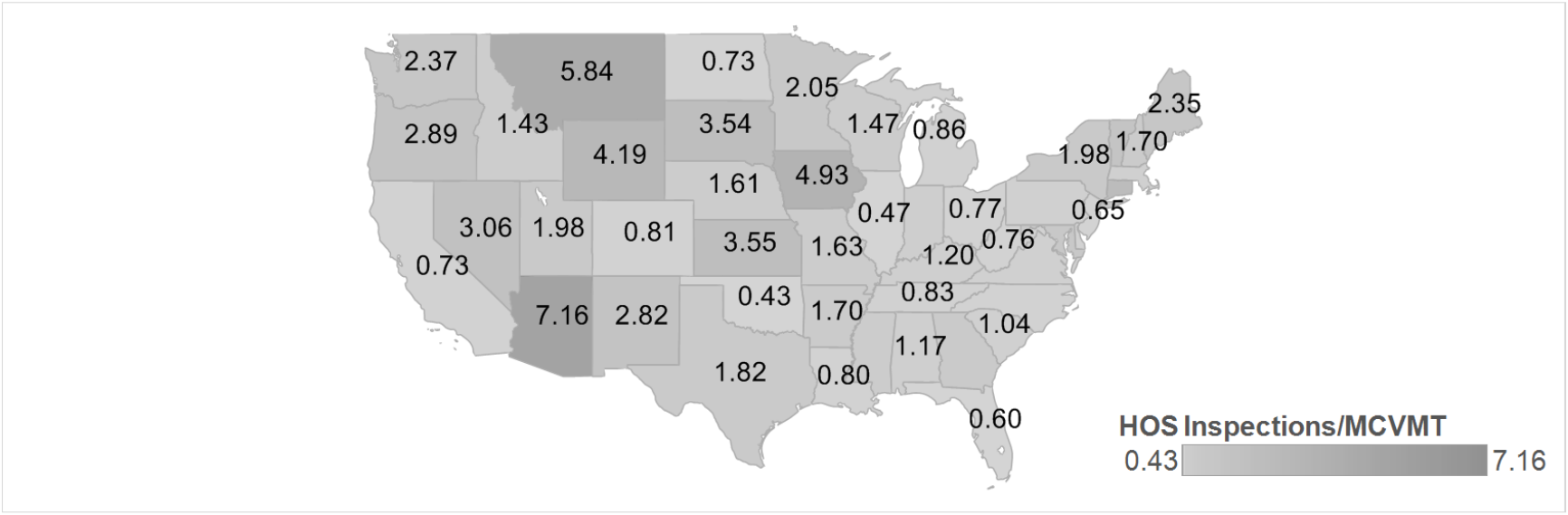
Driver Fitness CSA Points/MCVMT

AZ 12.89	MD 5.10	NH 3.77	NY 3.01	NV 2.27	NJ 2.07	VT 2.02	CO 1.88	WA 1.79	IL 1.74
	CT 4.65	KS 3.47	OR 2.69	SD 2.21	MI 1.68	ID 1.39	NC 1.33	UT 1.29	MO 1.28	DE 1.26
TX 12.38	IA 4.45	MT 3.25	MN 2.67	WV 2.20	ME 1.56	GA 1.14	CA	AL 0.98	WI 0.93
	NM 3.80	MA 3.11	LA 2.65	NE 2.10	AR 1.54	PA 1.08	FL	MS 0.85	IN 0.82
			WY 2.63	KY 2.08	SC 1.52	OK 1.08	TN	ND	OH
							VA		

Based on 2011 FHWA data. District of Columbia and Rhode Island have very low Commercial Vehicle Miles and were removed from this view.

RETURN

HOS Inspections/MCVMT

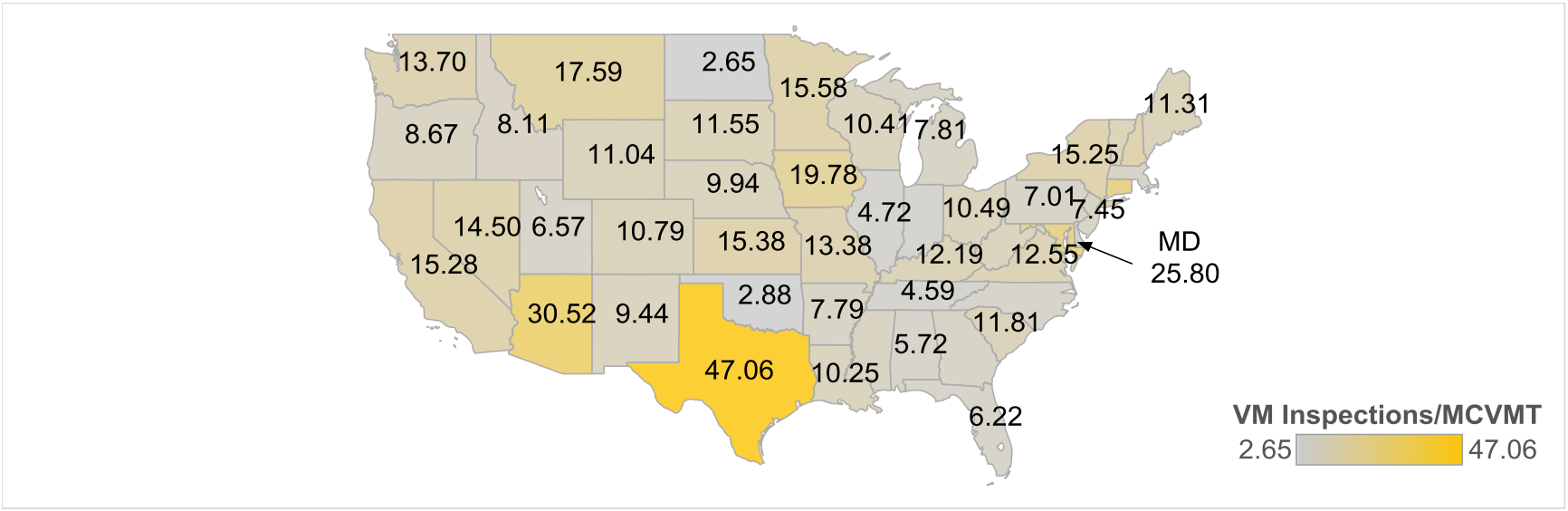


HOS CSA Points/MCVMT

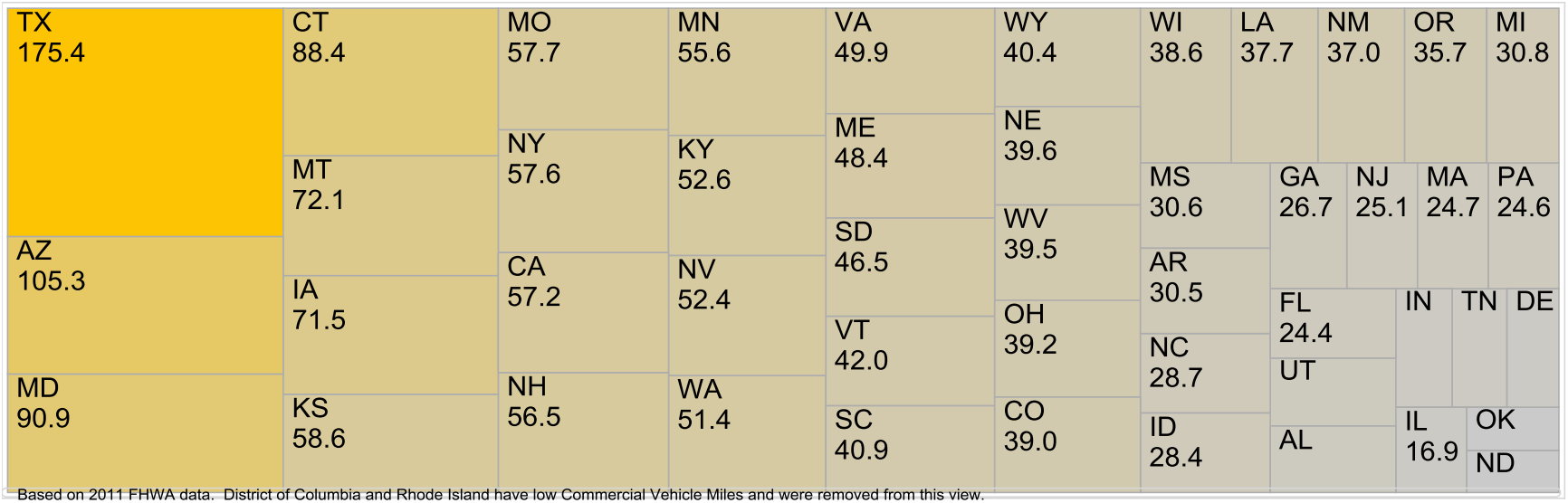
MT 26.45	WY 17.84	KS 15.50	MD 10.65	MN 8.51	AR 7.26	ID 5.88	KY 5.57	WI 5.51	AL 4.90
AZ 24.79	SD 17.35	CT 15.31	VT 10.41	UT 8.14	NH 7.02	IN 4.62	LA 4.11	SC 4.01	PA 4.00
IA 19.87	OR 16.38	NV 11.74	WA 9.60	MO 7.40	GA 6.91	MA 4.59	CA	NC 3.32	ND 3.22
		ME 10.81	NM 9.45	MS 7.38	NY 6.89	MI 4.36	WV	FL 2.71	NJ 2.40
				NE 7.27	TX 6.14	TN 4.18	OH	IL	OK
						DE	CO		

Based on 2011 FHWA data. District of Columbia and Rhode Island have low Commercial Vehicle Miles and were removed from this view.

Vehicle Maintenance Inspections/MCVMT



Vehicle Maintenance CSA Points/MCVMT



Based on 2011 FHWA data. District of Columbia and Rhode Island have low Commercial Vehicle Miles and were removed from this view.

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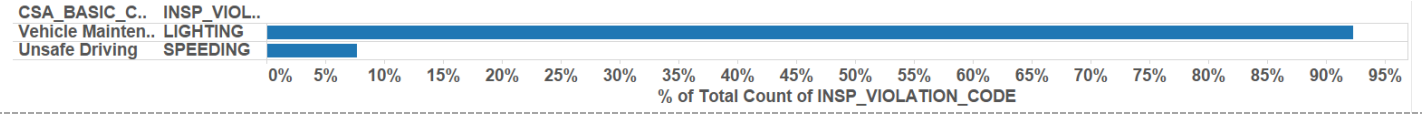
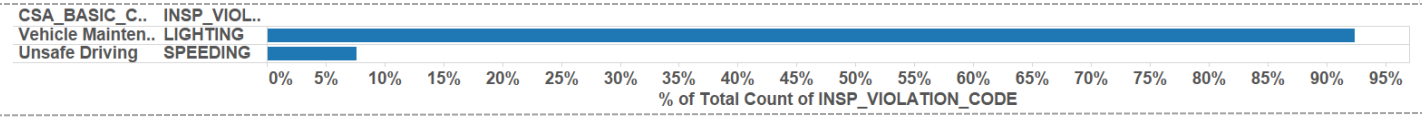
Regional Enforcement Disparity
Example – Traffic Enforcement vs. Roadside

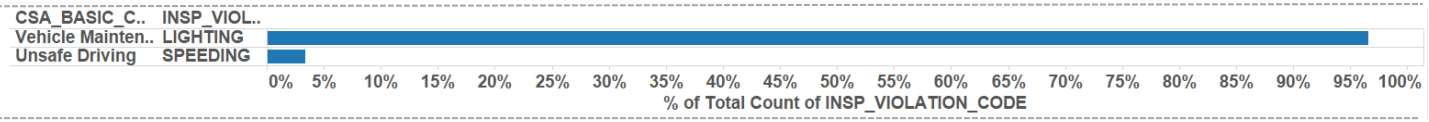
Light:Speed™ Ratio – **11.97 (US)**



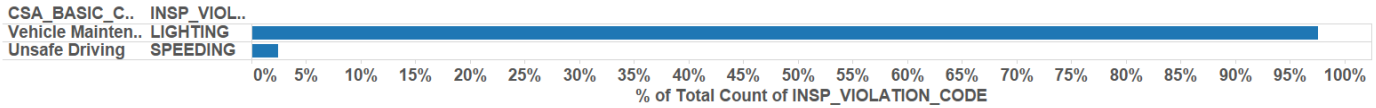
Light:Speed™ Ratio – **12.17 (South Carolina)**



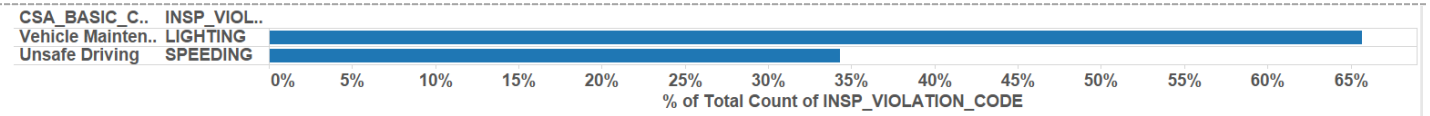
Light:Speed™ Ratio – **28.36 (Florida)**



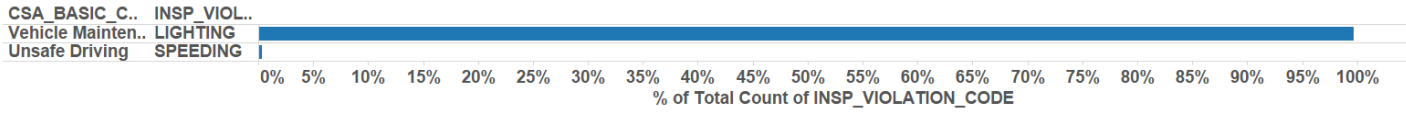
Light:Speed™ Ratio – **40.40 (Louisiana)**



Light:Speed™ Ratio – **1.91 (Indiana)**



Light:Speed™ Ratio – **321.02 (Texas)**



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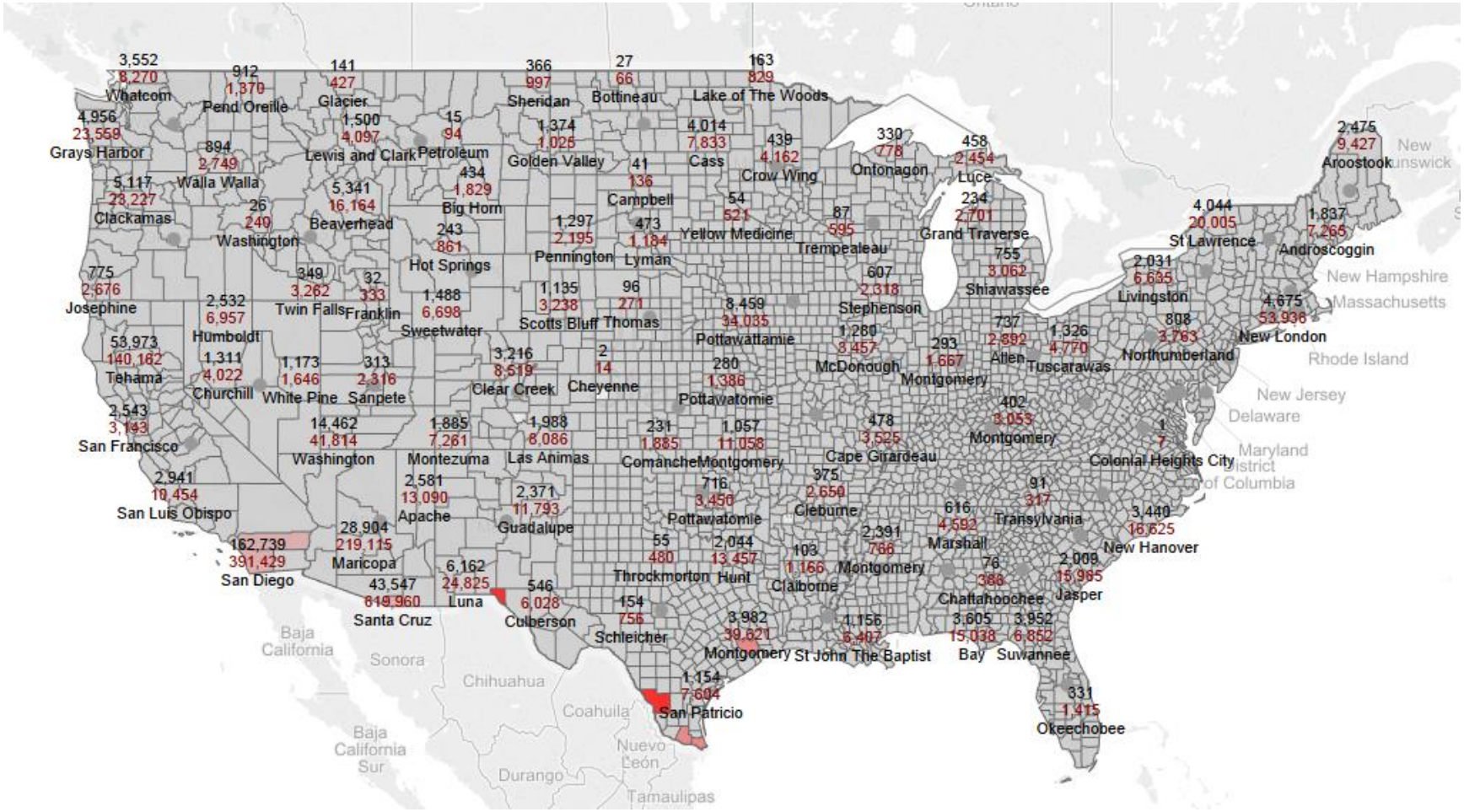

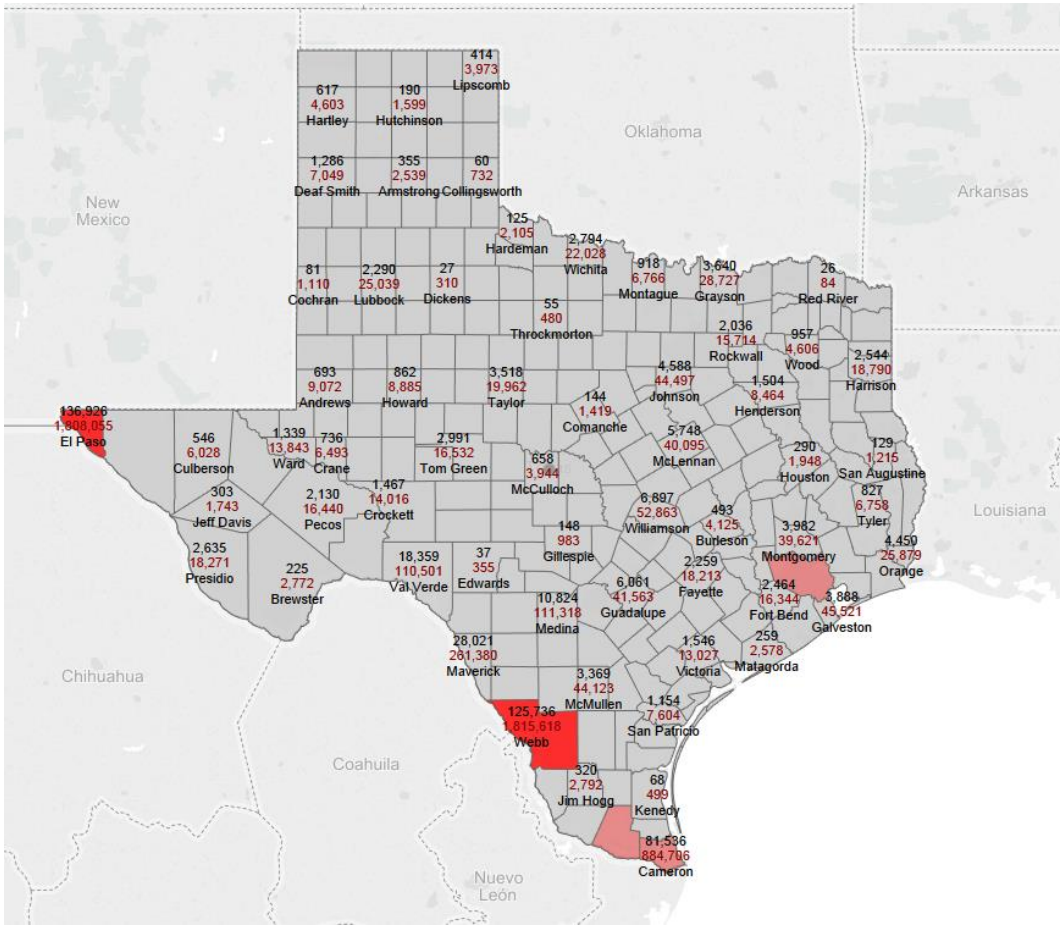
Oklahoma
New Mexico
Arkansas
Louisiana
Chihuahua
Coahuila
Nuevo León
414
3,973
Lipscomb
617
4,603
Hartley
190
1,599
Hutchinson
1,286
7,049
Deaf Smith
355
2,539
Armstrong
60
732
Collingsworth
125
2,105
Hardeman
2,794
22,028
Wichita
81
1,110
Cochran
2,290
25,039
Lubbock
27
310
Dickens
55
480
Throckmorton
918
6,766
Montague
3,640
28,727
Grayson
26
84
Red River
2,036
15,714
Rockwall
957
4,606
Wood
2,544
18,790
Harrison
693
9,072
Andrews
862
8,885
Howard
3,518
19,962
Taylor
4,588
44,497
Johnson
1,504
8,464
Henderson
144
1,419
Comanche
136,926
1,808,055
El Paso
546
6,028
Culberson
1,339
13,843
Ward
736
6,493
Crane
2,991
16,532
Tom Green
658
3,944
McCulloch
5,748
40,095
McLennan
290
1,948
Houston
129
1,215
San Augustine
303
1,743
Jeff Davis
2,130
16,440
Pecos
1,467
14,016
Crockett
6,897
52,863
Williamson
493
4,125
Burleson
827
6,758
Tyler
2,635
18,271
Presidio
225
2,772
Brewster
18,359
110,501
Val Verde
37
355
Edwards
148
983
Gillespie
3,982
39,621
Montgomery
4,450
25,879
Orange
2,259
18,213
Fayette
2,464
16,344
Fort Bend
3,888
45,521
Galveston
6,061
41,563
Guadalupe
10,824
111,318
Medina
28,021
261,380
Maverick
1,546
13,027
Victoria
259
2,578
Matagorda
3,369
44,123
McMullen
1,154
7,604
San Patricio
125,736
1,815,618
Webb
320
2,792
Jim Hogg
68
499
Kenedy
81,536
884,706
Cameron

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Crash Accountability

Analysis by Steve Bryan
s.bryan@vigillo.com

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DOT Reportable

A flattened trailer lays along the frontage road of Interstate 20 after a tornado reportedly tore through the southeastern portion of Dallas County on Tuesday near Lancaster, Texas. The National Weather Service confirmed at least two separate "large and extremely dangerous" tornadoes in the Dallas-Fort Worth area. Several other developing twisters were reported as a band of violent storms moved north through the metropolitan area. Officials had no immediate information about injuries. Photo: AP / SL

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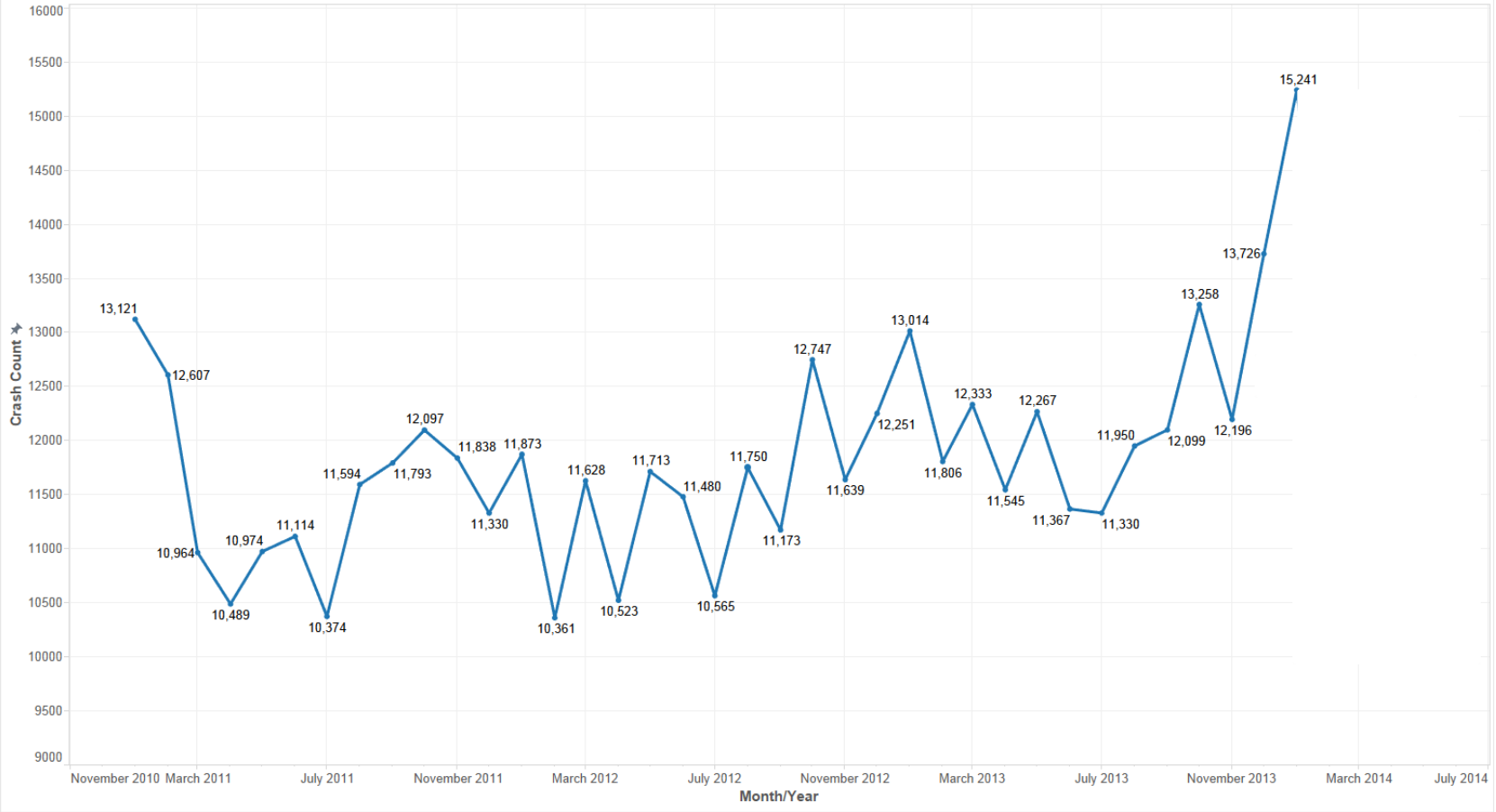
DOT Reportable



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Safety Event Group Analysis

Analysis by Steve Bryan
s.bryan@vigillo.com

SafetyEventGroup	
Drugs 1	4,733
Drugs 2	334
Drugs 3	51
Drugs 4	50
Fitness 1	84,900
Fitness 2	37,705
Fitness 3	33,391
Fitness 4	5,876
Fitness 5	898
HOS 1	162,519
HOS 2	37,705
HOS 3	33,391
HOS 4	5,876
HOS 5	898
Unsafe 1 Combo	15,858
Unsafe 1 Straight	6,603
Unsafe 2 Combo	3,892
Unsafe 2 Straight	2,888
Unsafe 3 Combo	1,303
Unsafe 3 Straight	1,104
Unsafe 4 Combo	326
Unsafe 4 Straight	280
Unsafe 5 Combo	128
Unsafe 5 Straight	71
VM 1	70,130
VM 2	28,408
VM 3	23,236
VM 4	3,510
VM 5	468
Grand Total	242,199

The following slides are the result of my first look at the make-up of the 29 safety vent groups based on the Public CSA BASICs

242,199 carriers across 29 safety event groups

15 safety event groups are not represented (private) because FMCSA does not make them available in the SMS preview.

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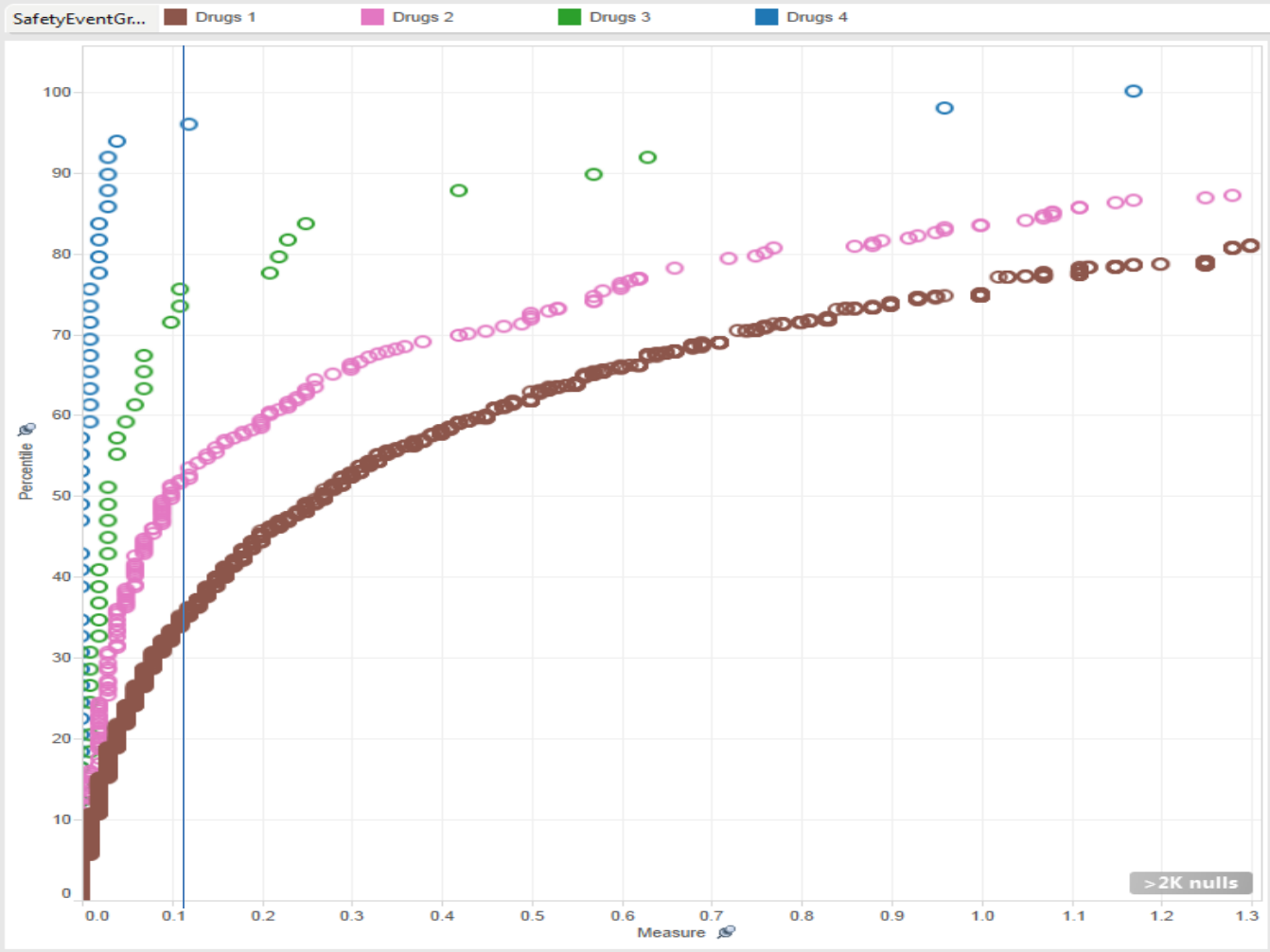
Drug & Alc.



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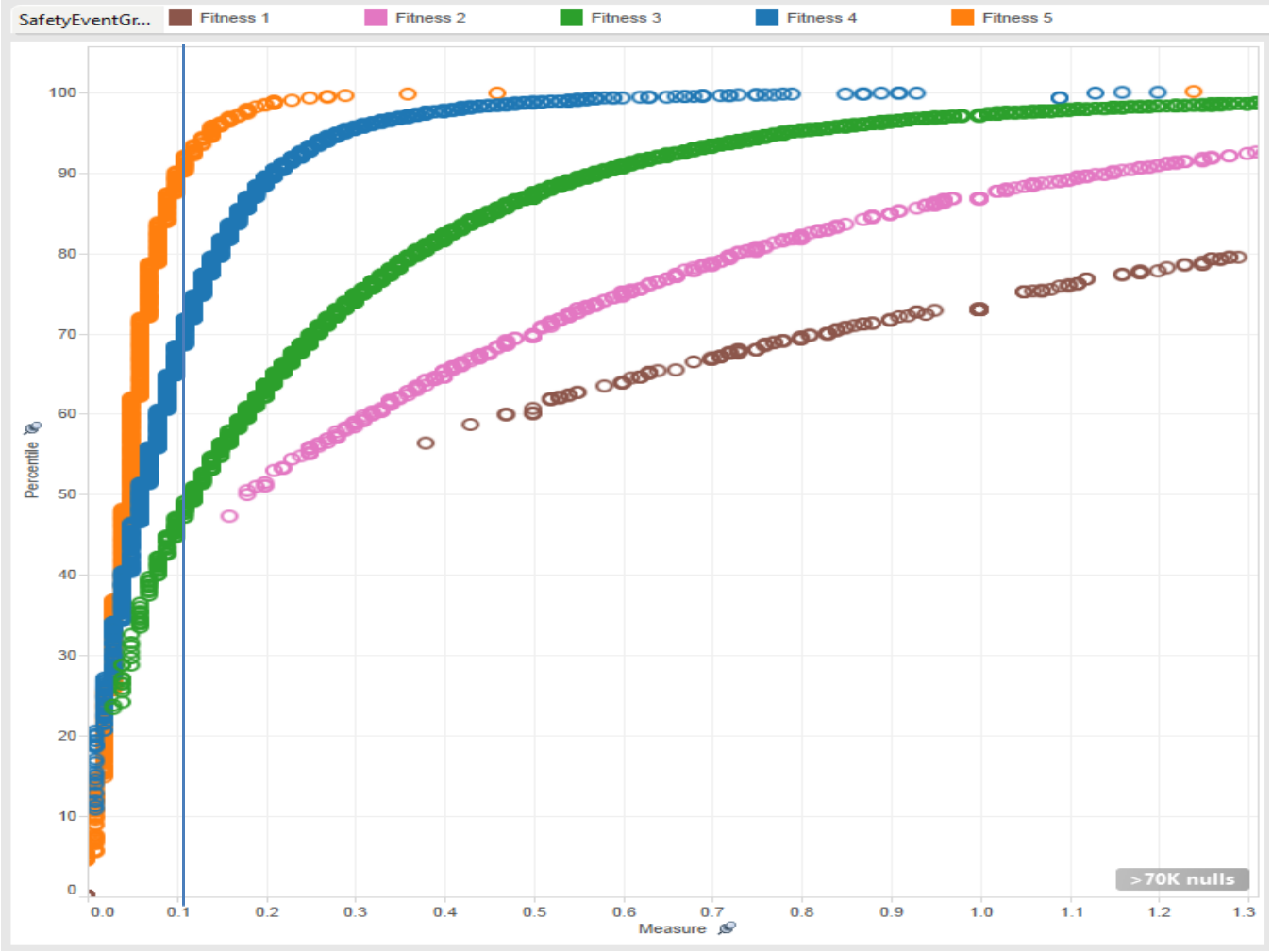
Driver Fitness



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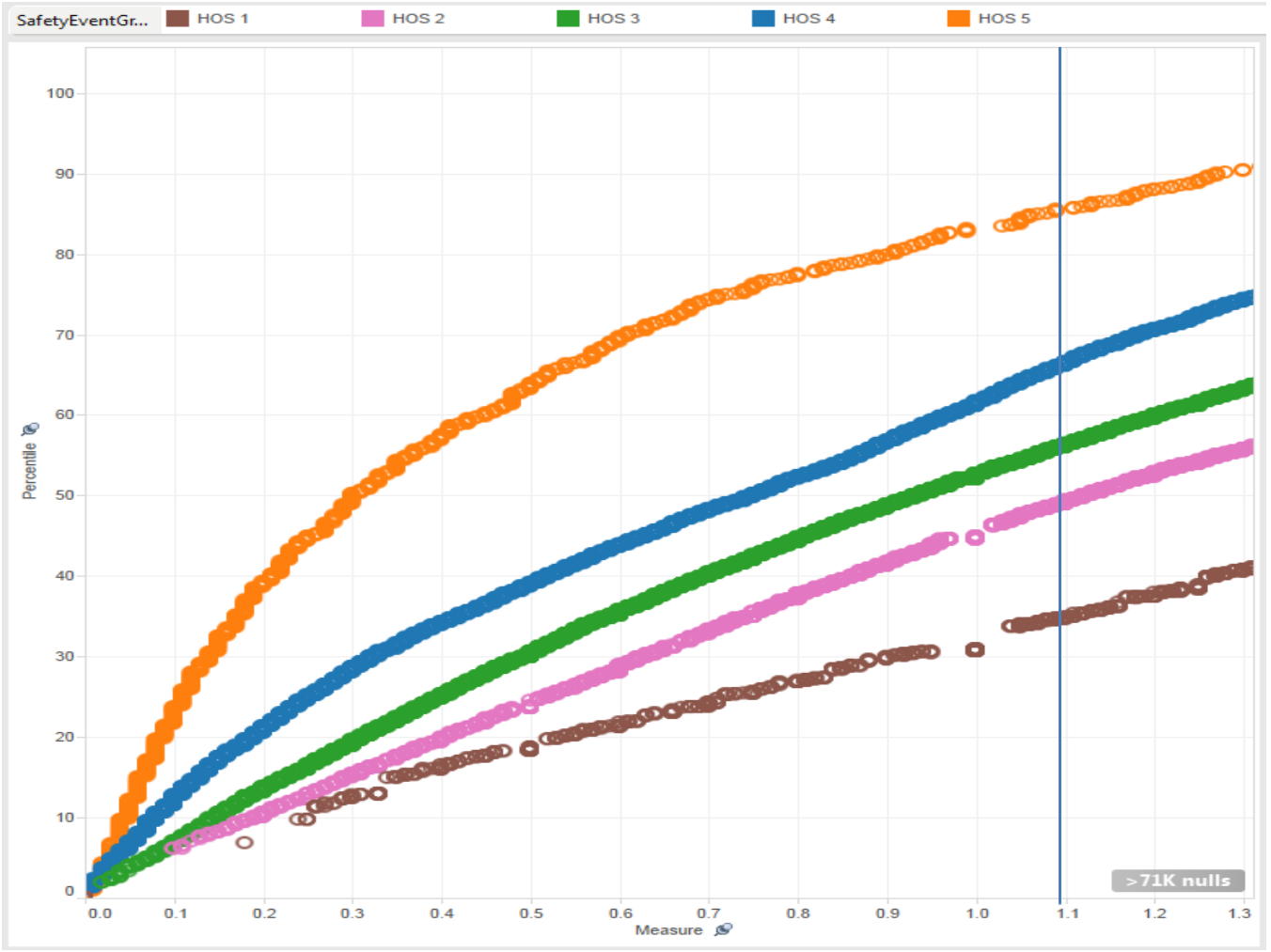
HOS Compliance



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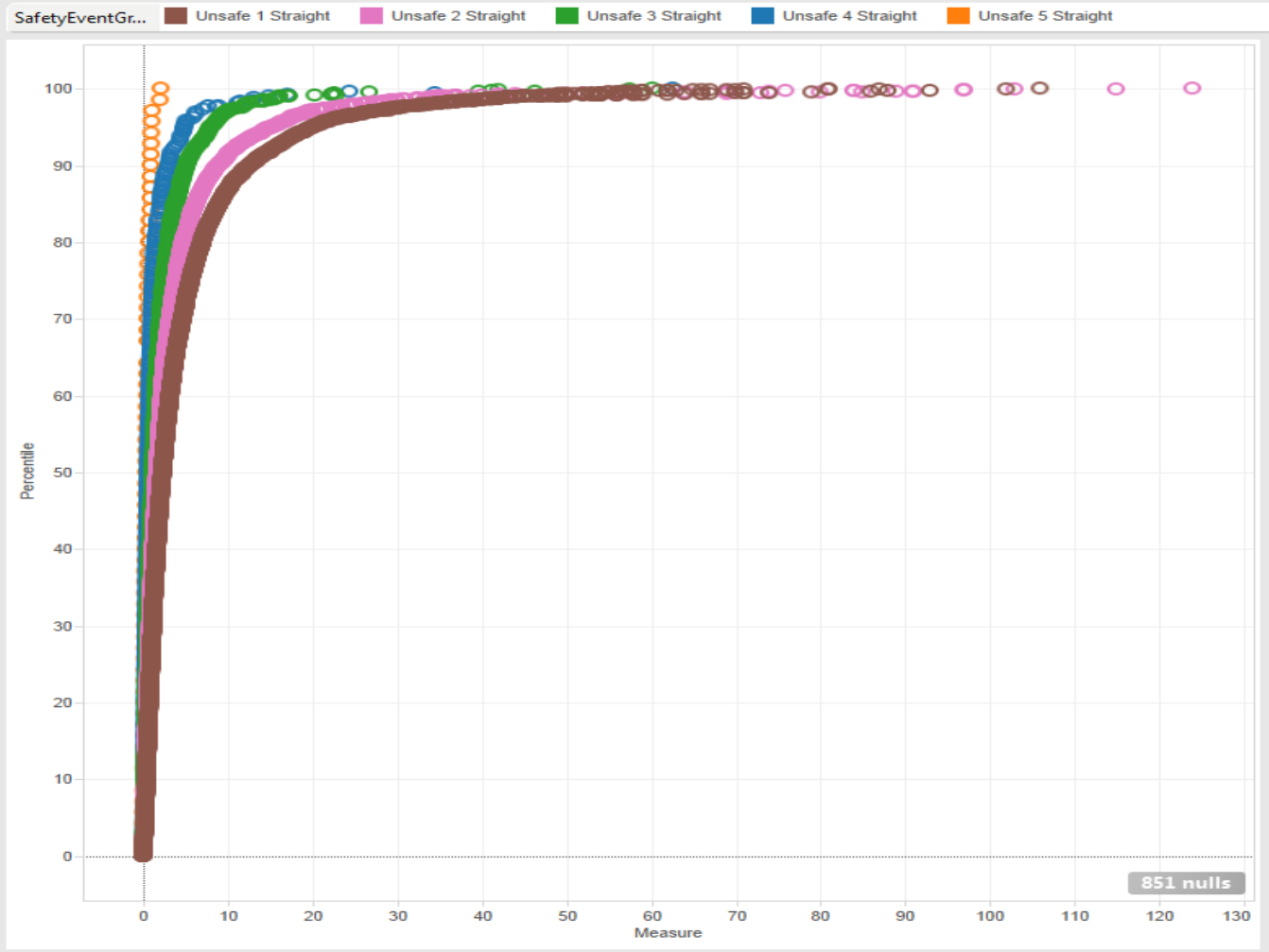
Unsafe - Straight



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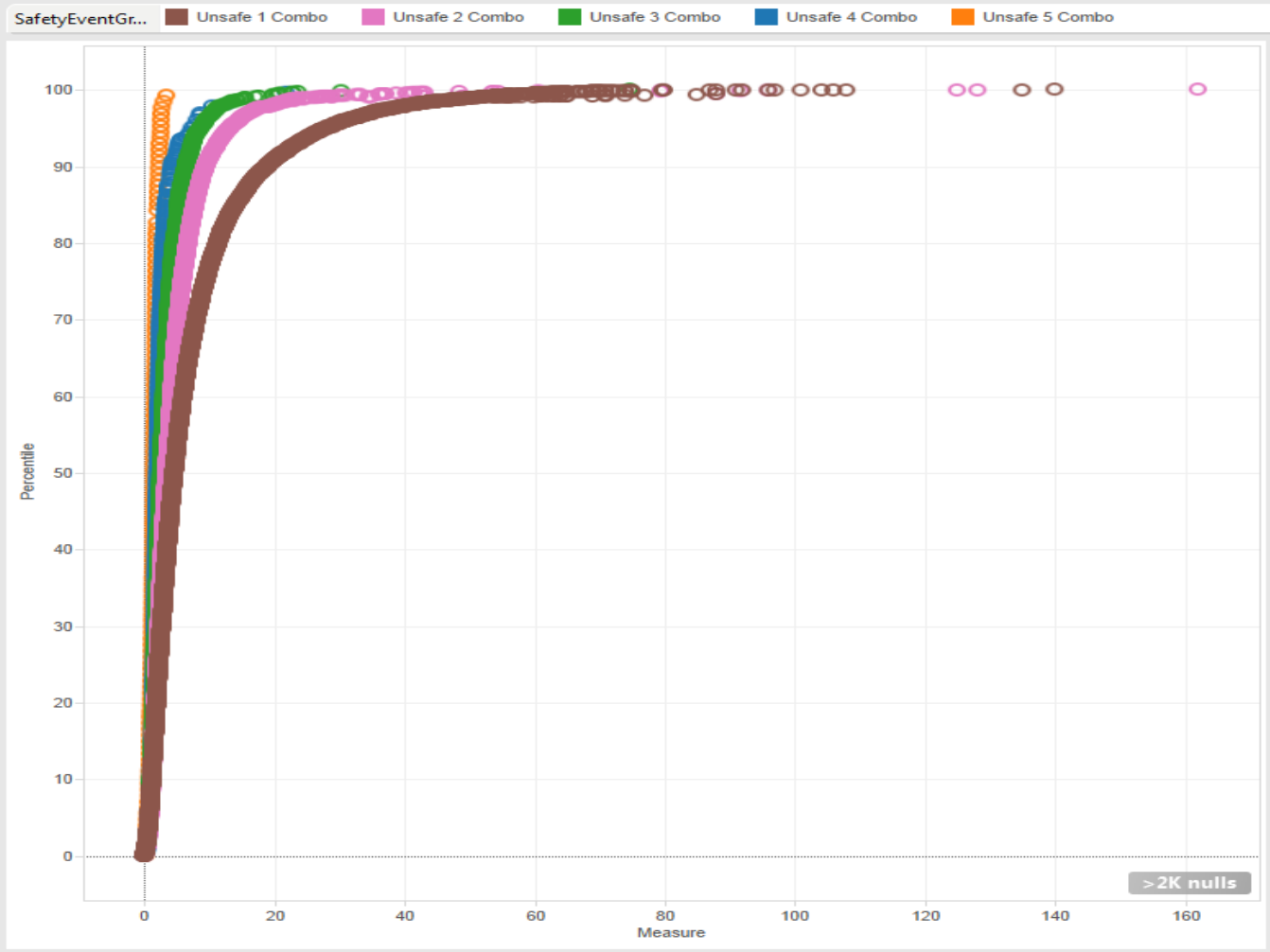
Unsafe - Combo



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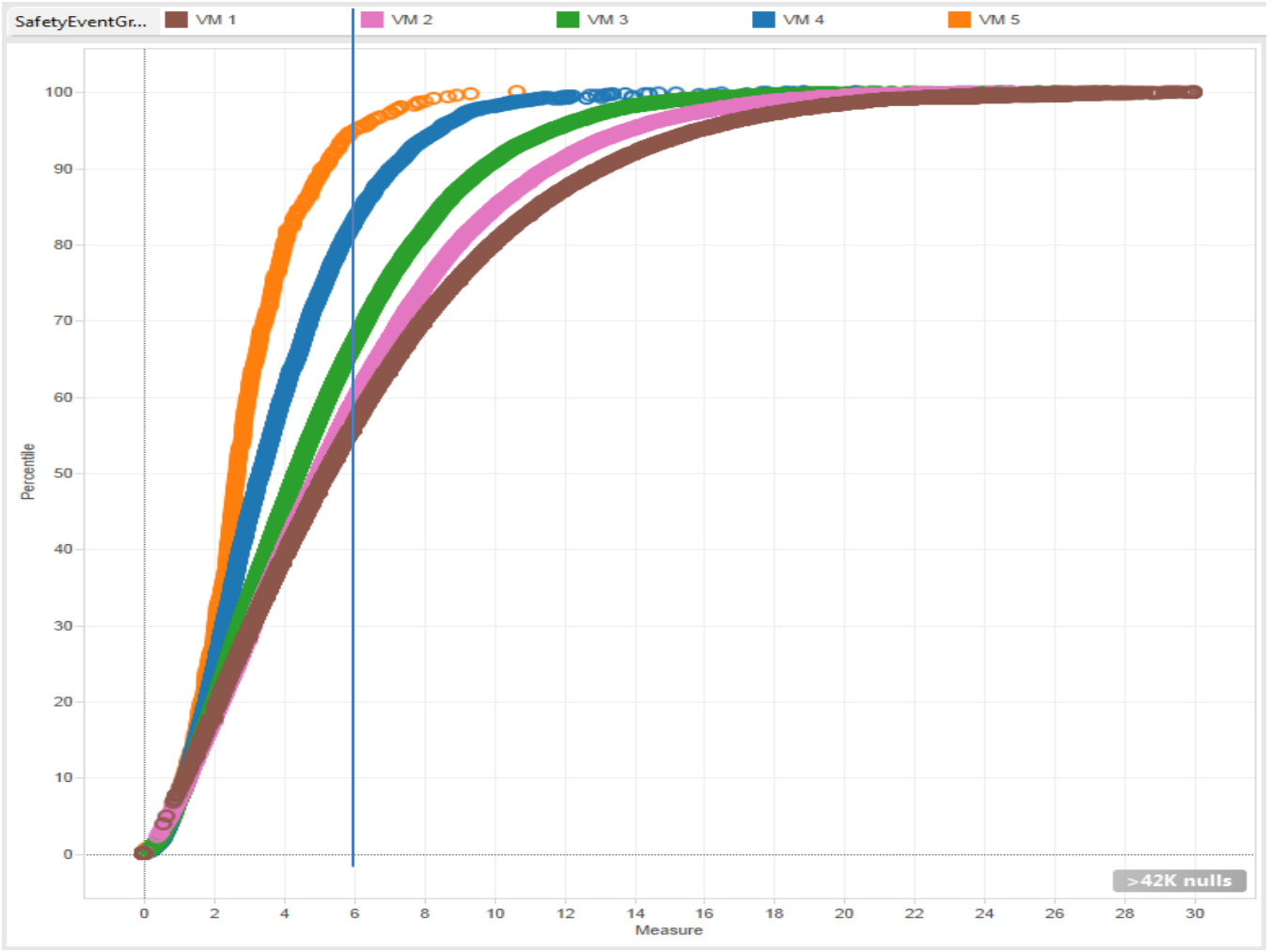
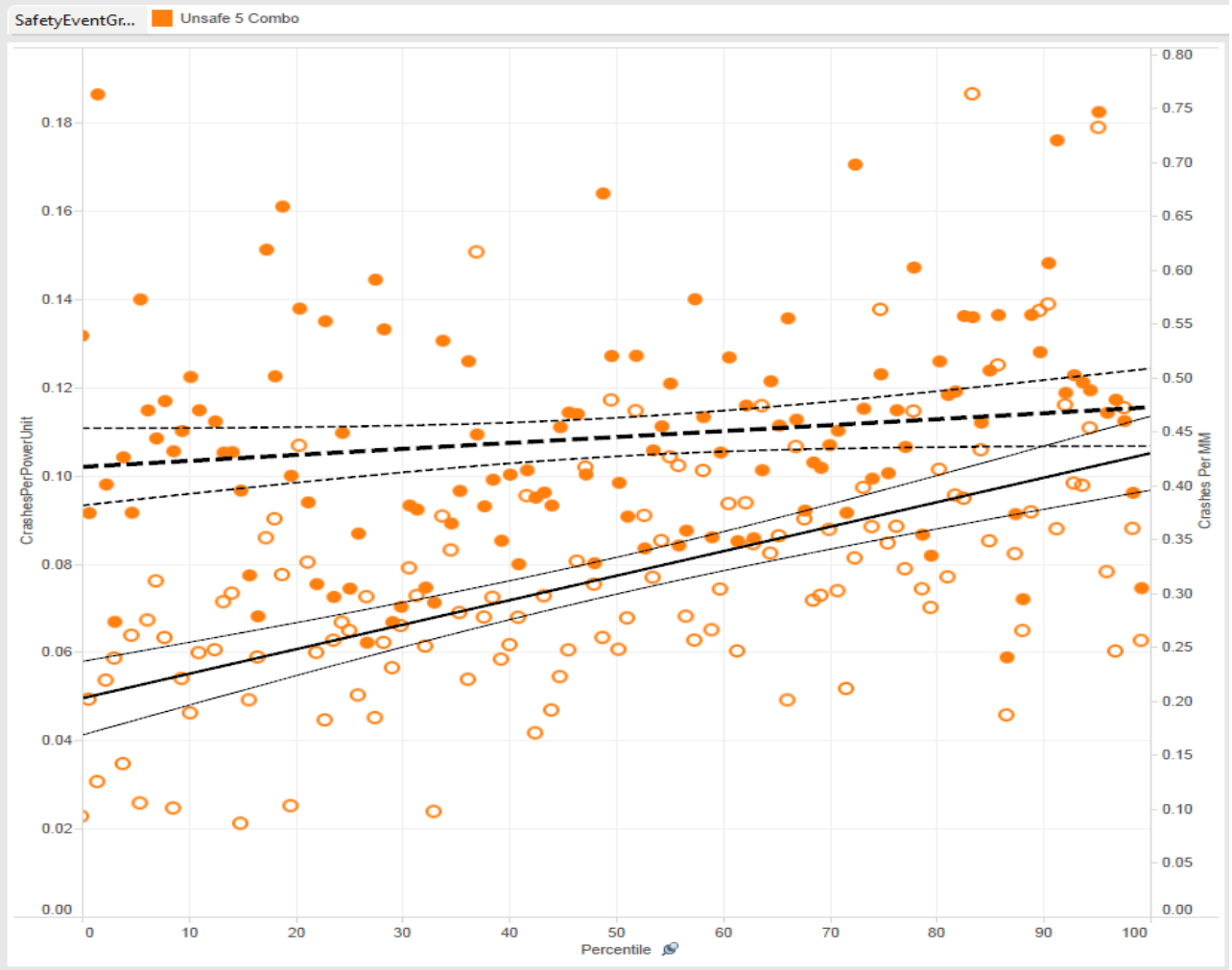
Maintenance



Linear Trend Model



Crashes/MM
Crashes/PU

Two extreme outliers, one from each data set, removed due to outrageously erroneous data

Linear

Trend Lines Model

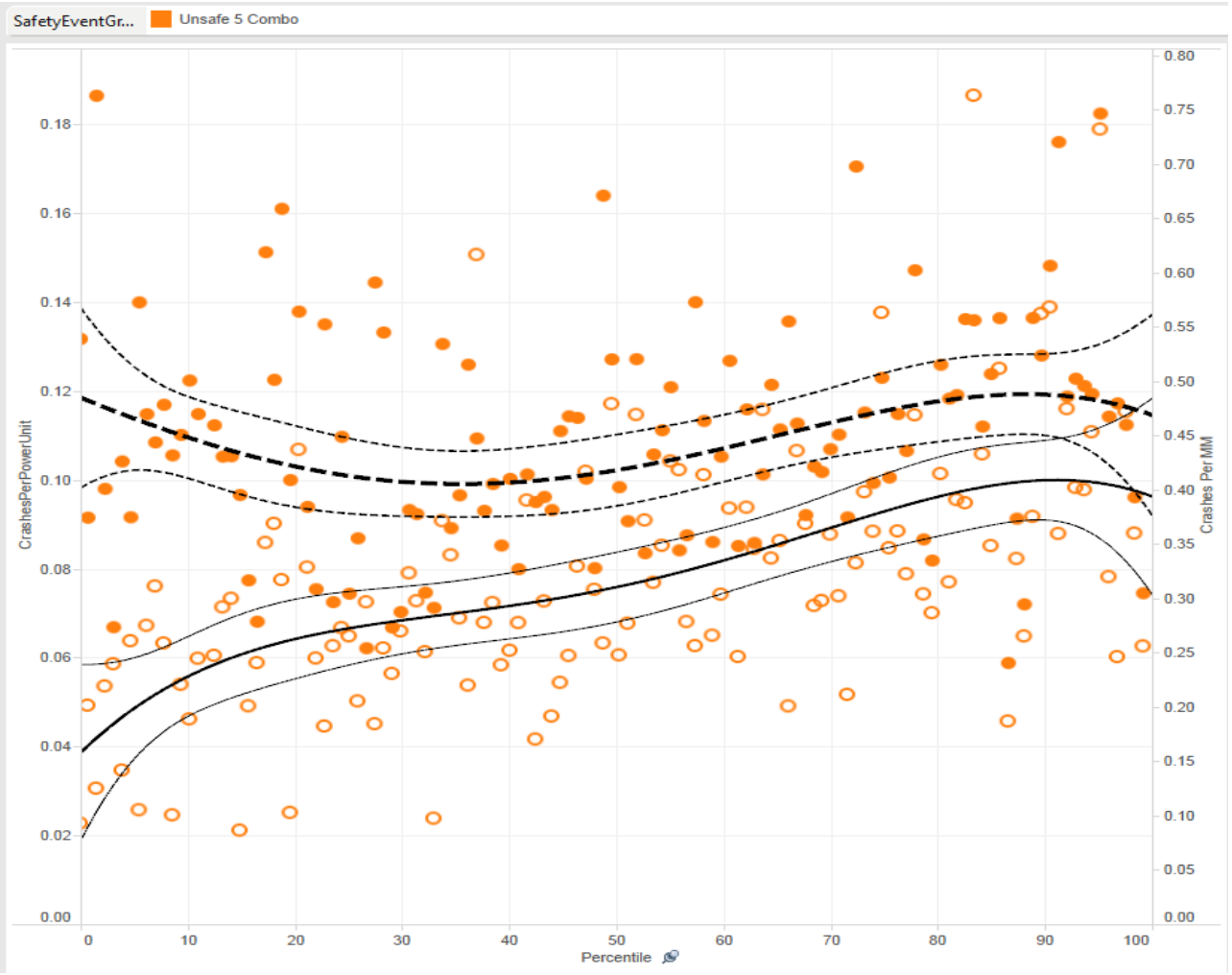
A linear trend model is computed for sum of Measure given sum of CrashesPerPowerUnit. The model may be significant at p <= 0.05.

Model formula:	(CrashesPerPowerUnit + intercept)
Number of modeled observations:	126
Number of filtered observations:	0
Model degrees of freedom:	2
Residual degrees of freedom (DF):	124
SSE (sum squared error):	32.8564
MSE (mean squared error):	0.264971
R-Squared:	0.233661
Standard error:	0.514754
p-value (significance):	< 0.0001

Individual trend lines:

Panes		Line		Coefficients				
Row	Column	p-value	DF	Term	Value	StdErr	t-value	p-value
Measure	CrashesPerPowerUnit	< 0.0001	124	CrashesPerPowerUnit	10.0626	1.63651	6.14884	< 0.0001
				intercept	0.836104	0.134246	6.22817	< 0.0001

4th Degree Polynomial Trend Model



Crashes/MM
Crashes/PU

Two extreme outliers, one from each data set, removed due to outrageously erroneous data

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4th Degree Polynomial

Trend Lines Model

A polynomial trend model of degree 4 is computed for sum of Measure given sum of CrashesPerPowerUnit. The model may be significant at p <= 0.05.

Model formula:	(CrashesPerPowerUnit^4 + CrashesPerPowerUnit^3 + CrashesPerPowerUnit^2 + CrashesPerPowerUnit + intercept)
Number of modeled observations:	126
Number of filtered observations:	0
Model degrees of freedom:	5
Residual degrees of freedom (DF):	121
SSE (sum squared error):	30.4215
MSE (mean squared error):	0.251417
R-Squared:	0.290454
Standard error:	0.501415
p-value (significance):	< 0.0001

Individual trend lines:

Panes		Line		Coefficients				
Row	Column	p-value	DF	Term	Value	StdErr	t-value	p-value
Measure	CrashesPerPowerUnit	< 0.0001	121	CrashesPerPowerUnit^4	14333.4	19123.2	0.74953	0.454993
				CrashesPerPowerUnit^3	-5860.55	7296.14	-0.803239	0.423411
				CrashesPerPowerUnit^2	717.088	952.21	0.753077	0.452866
				CrashesPerPowerUnit	-17.3787	49.9286	-0.34807	0.728392
				intercept	0.952918	0.882845	1.07937	0.282569

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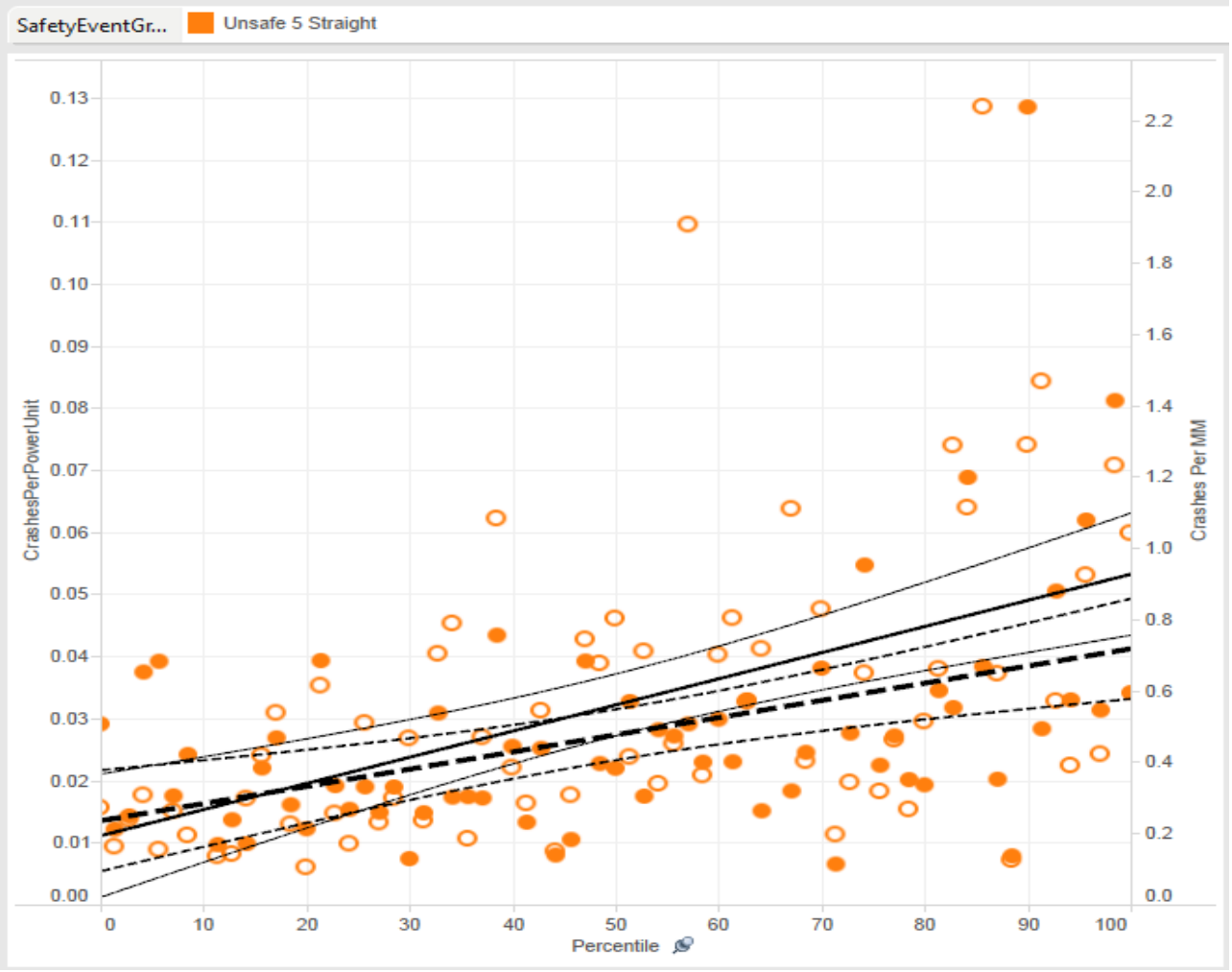
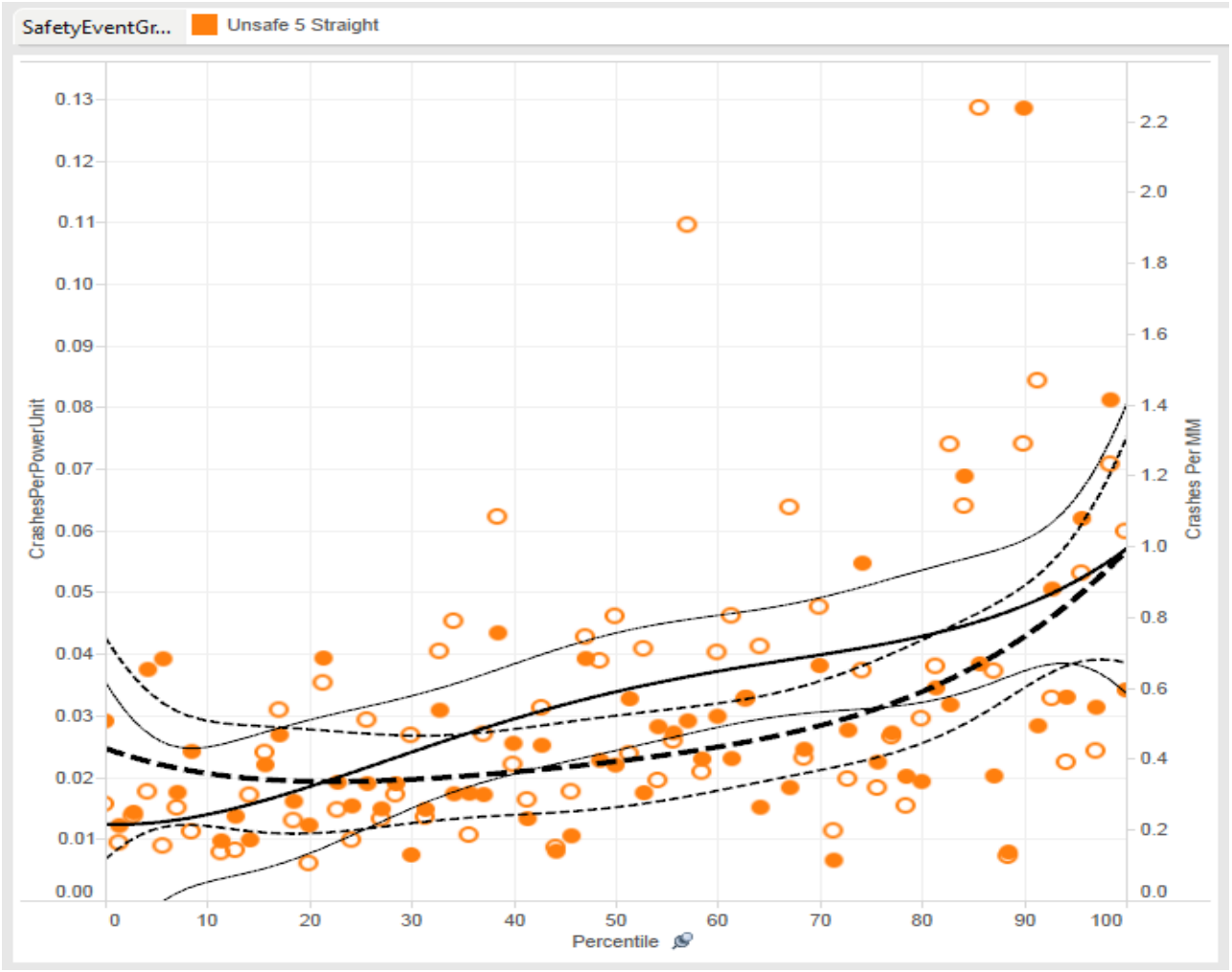
Linear



Crashes/MM
Crashes/PU

Poly 4



Crashes/MM
Crashes/PU

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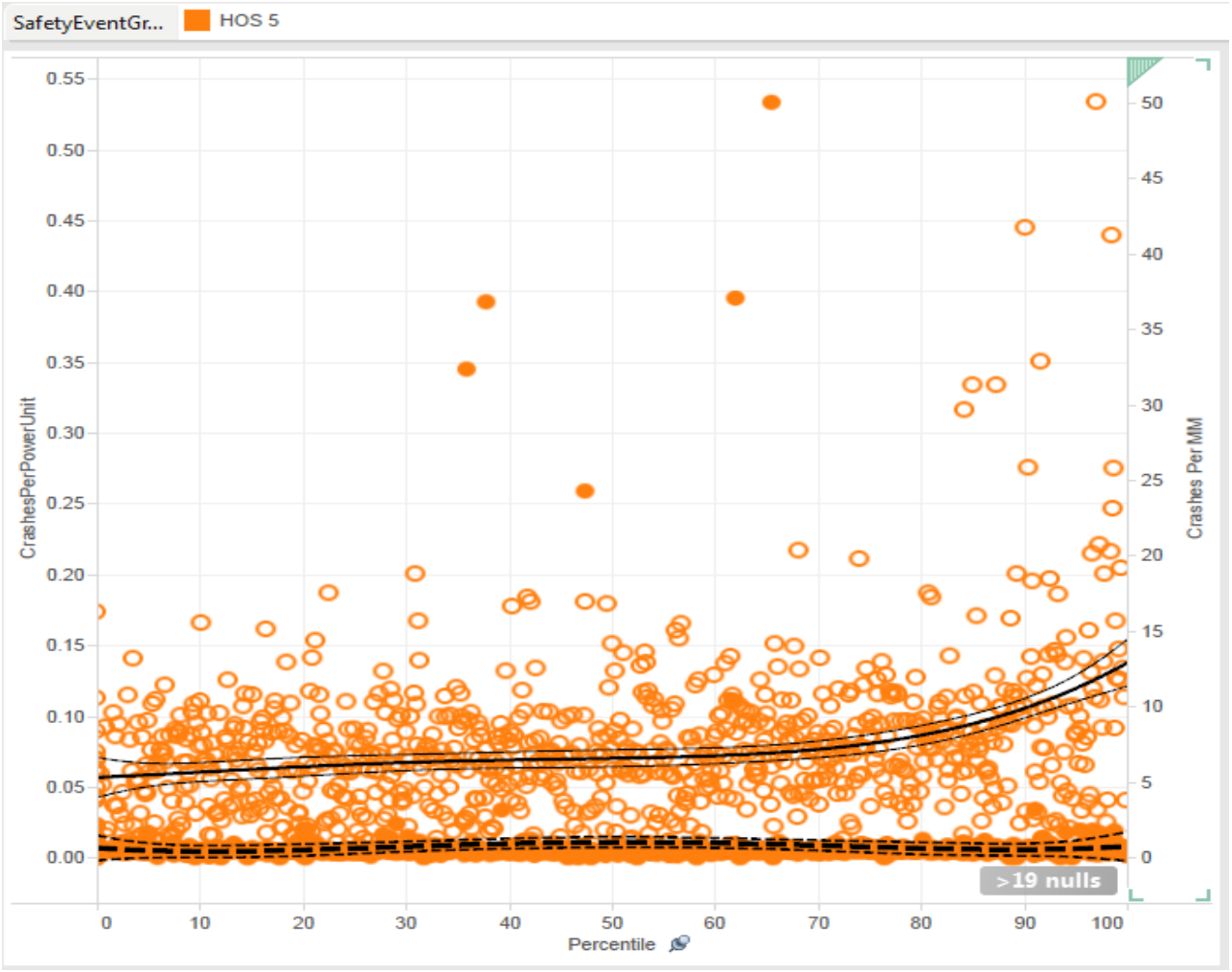
Poly 4



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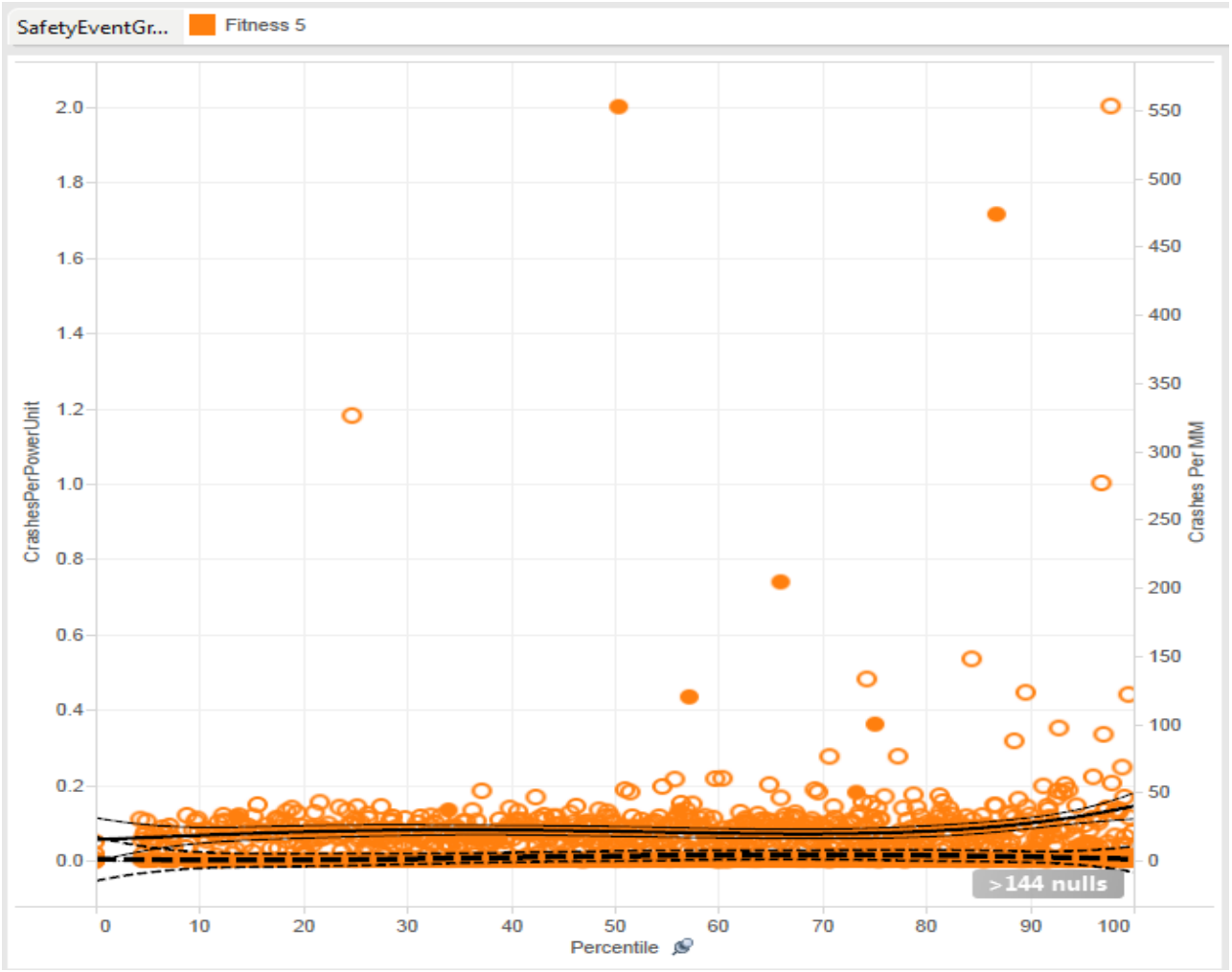
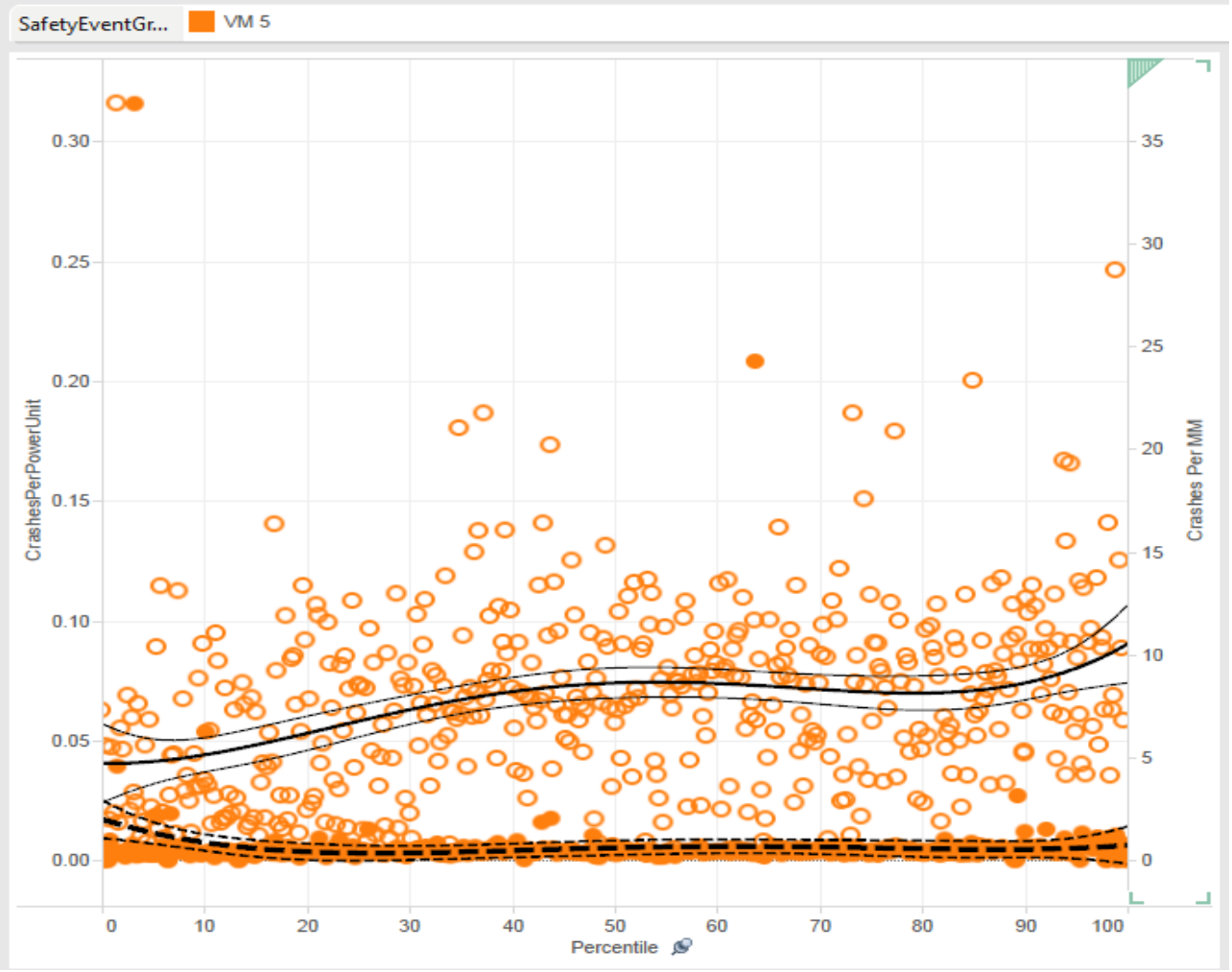
Poly 4



Poly 4



Crashes/MM
Crashes/PU

…

1. Measure to percentile relationship is consistently skewed across all BASICs
2. Using power units as the basis for crash rate makes little sense
3. A linear trend model is not appropriate on the surface, nor is it borne out as useful when applied
4. A 4^{th} order polynomial regression trend model fits the data better, but still does not result in meaningful predictive value (low R2)
5. Crashes/MM is a better measure of activity and presumably controllable behavior
6. When regression analysis is applied to Percentiles:Crashes/MM, there is still no meaningful predictive value (R2 never gets beyond approx .3)

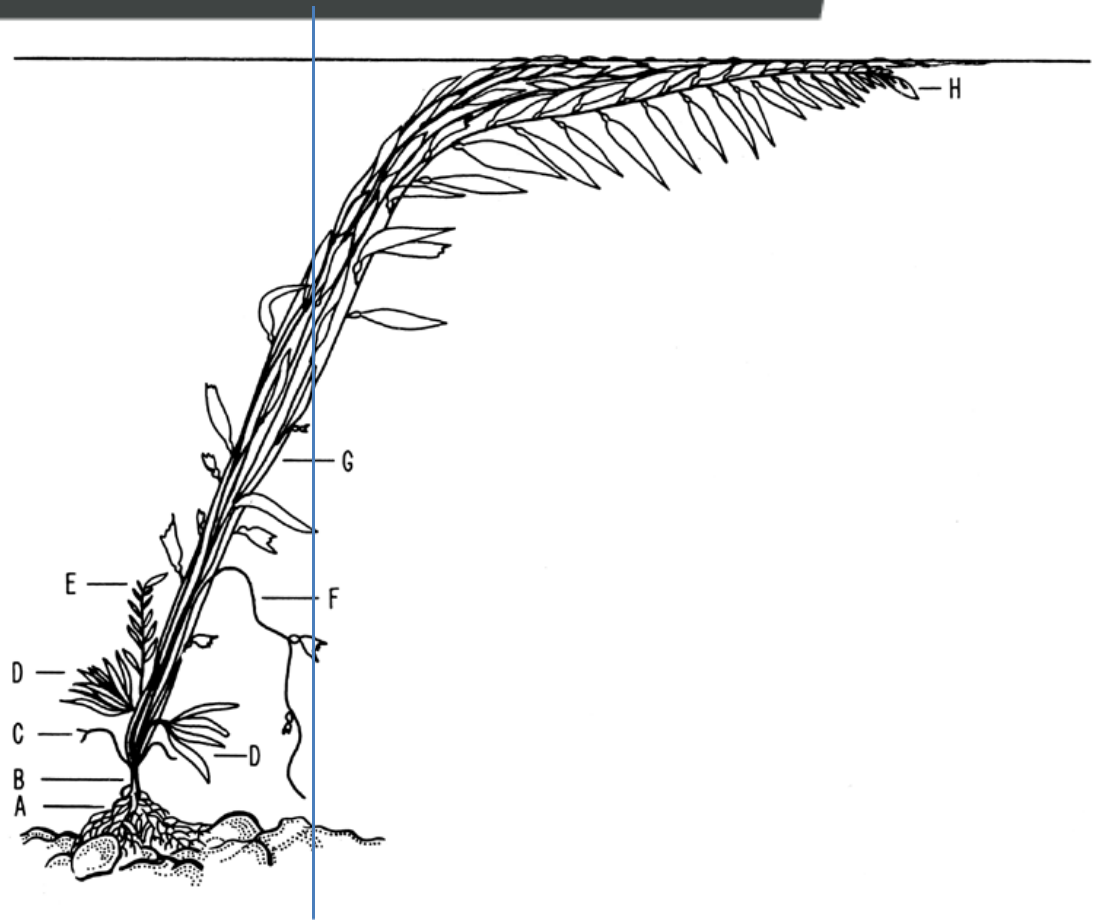


FIGURE 1. Diagram of a mature plant of the giant kelp, *Macrocystis pyrifera*, one to two years old, standing in 20 to 30 feet of water. A, holdfast; B, primary stipe; C, stub of an old frond; D, sporophyll clusters; E, juvenile frond; F, senile frond; G, stipe bundle; H, apical blade of mature frond, giving rise to additional blades.

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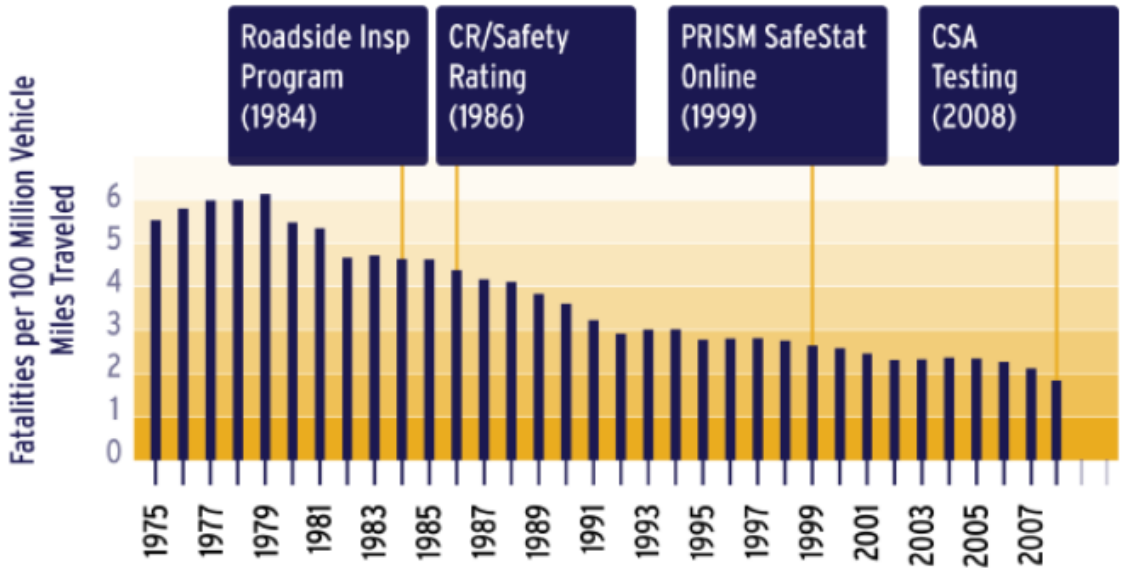
Fatalities per 100 Million Vehicle Miles Traveled (1975 - Present)



Fatalities per 100 Million Vehicle Miles Traveled has decreased since the implementation of the Roadside Inspection Program in 1984, the CR/Safety Rating Program in 1986, and the PRISM SafeStat Program in 1999 until 2008.

The new CSA Program is the next generation FMCSA safety program aimed to maximize federal and state enforcement agencies efforts to reduce the commercial vehicle related fatality rate. The FMCSA has taken a new approach to how the agency evaluates the safety of motor carriers and drivers.

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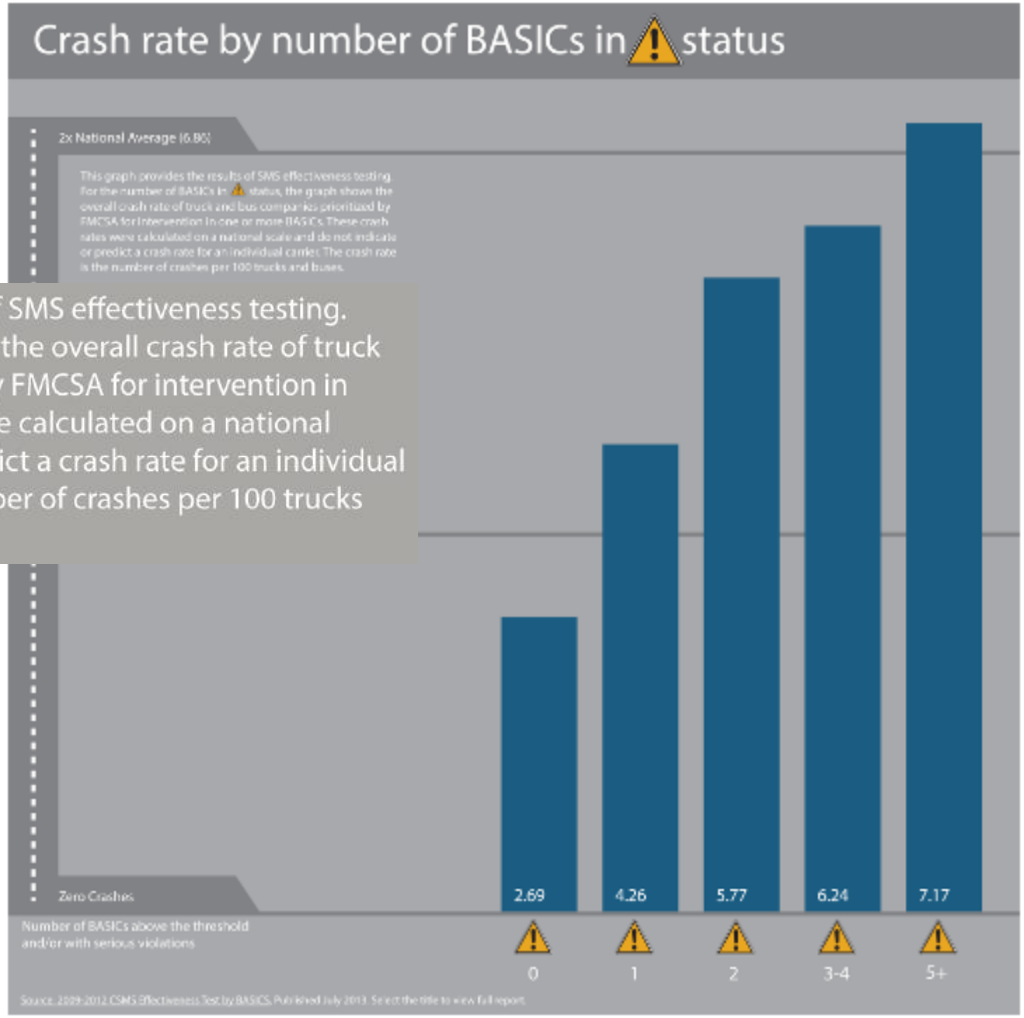
This graph provides the results of SMS effectiveness testing. For each BASIC, the graph shows the overall crash rate of truck and bus companies prioritized by FMCSA for intervention in that BASIC. These crash rates were calculated on a national scale and do not indicate or predict a crash rate for an individual carrier. The crash rate is the number of crashes per 100 trucks and buses.



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Questions?