



Association between Commercial Vehicle Driver At-Fault Crashes and Proximity to Rest Areas and Truck Stops

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Background

- 10% to 20% of all truck and bus crashes involve drivers who are fatigued (National Academies of Sciences, Engineering, and Medicine, 2016)
- Ongoing concern at national level about availability of adequate commercial vehicle rest areas and truck stops for commercial vehicle drivers to rest
 - Jason's Law Truck Parking Survey, August 2015
 - Kentucky ranked in bottom half of states for number of commercial vehicle truck parking spaces per 100,000 of daily combination vehicle miles traveled



Study Objectives

- 1) Characterize and compare sleepiness/fatigue-related vs. all other human factor-related commercial vehicle driver at-fault crashes
- 2) Map geographical locations of available rest areas and truck stops on the federal authorized national network for trucks
- 3) Examine association between at-fault commercial vehicle driver crashes involving fatigue and/or sleepiness and distances to nearest rest areas/truck stops
- 4) Map rest area/truck stop geographical locations relative to commercial vehicle driver at-fault crashes involving sleepiness/fatigue vs. those involving all other human factors



Methods

Retrospective population-based case-control study to evaluate if at-fault commercial motor vehicle driver crashes were more likely to involve sleepiness/fatigue vs. other human factors on roadways with low concentrations of rest areas and truck stops

Cases- At-fault commercial vehicle drivers where sleepiness and/or fatigue were listed as factor(s) in the crash reports

Controls- At-fault commercial vehicle drivers where other possible human factors were listed in the crash reports



ArcGIS

- Rest areas identified through Kentucky Transportation Cabinet rest area directory listing
- Truck stops identified using ArcGIS Business Analyst 2015 that matched truck stop descriptions within 25 miles of Kentucky's borders

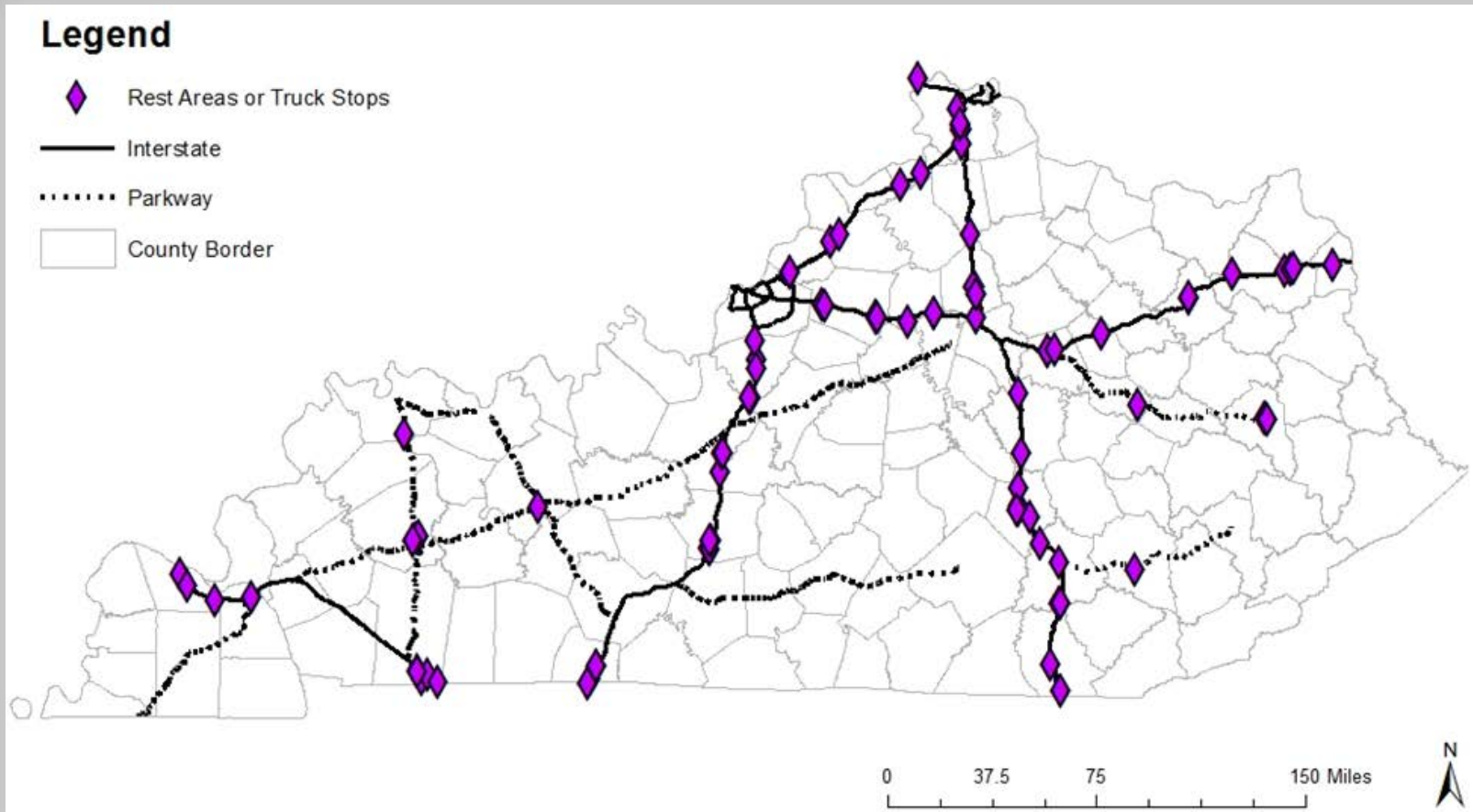


Chi-square and Stepwise Logistic Regression

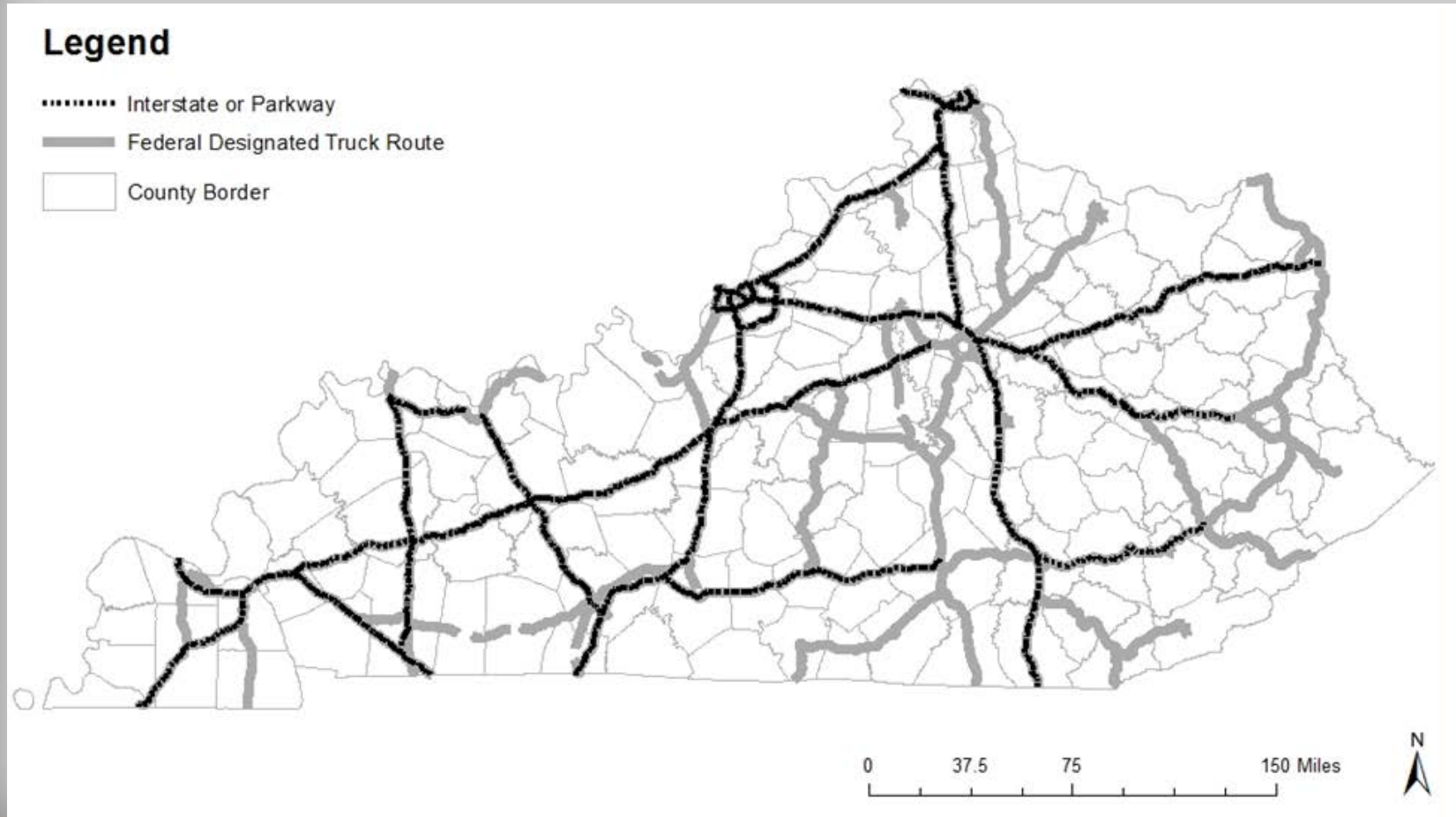
Possible Confounders

1. Total number of roadway lanes (1-2 vs. 2+)
2. Time of day of crash (7am < collision time < 6pm)
indicating daylight and nighttime hours
3. Roadway character (straight vs. curved)
4. Commercial vehicle driver age (21-24, 25-54, and 55+)
5. Roadway condition (dry vs. wet)
6. Roadway type (interstate vs. parkway)

Location of Truck Stops and Rest Areas in Kentucky, 2016



Roadways With at Least One Rest Area or Truck Stop Within the Federal Authorized National Network for Trucks in Kentucky, 2016



Demographic and Crash Characteristics of Commercial Vehicle Driver At-Fault Crashes in Kentucky, 2005-2014

Characteristic	Cases (n= 284)	Controls (n=7,254)	Chi-Square
Commercial Vehicle Driver Age Category			p=0.0805
21-24 years of age	8 (3%)	240 (3%)	
25-54 years of age	222 (78%)	5232 (72%)	
55+ years of age	54 (19%)	1782 (25%)	
Time of Day of Crash			p<0.0001
Daytime (7am-6:69pm)	76 (27%)	5026 (69%)	
Nighttime (7pm- 6:59am)	208 (73%)	2228 (31%)	
Commercial Vehicle Unit Type			p=0.8218
Truck and trailer	51 (18%)	1245 (17%)	
Truck-single unit	28 (10%)	796 (11%)	
Truck tractor and semi-trailer	198 (70%)	5077 (70%)	
Truck-other combination	7 (2%)	136 (2%)	
Distance (in miles) to Rest Area/Truck Stop			p<0.0001
<20 miles	241 (85%)	6800 (94%)	
20- 39.9 miles	39 (14%)	435 (6%)	
40+ miles	4 (1%)	19 (<1%)	

Demographic and Crash Characteristics of Commercial Vehicle Driver At-Fault Crashes in Kentucky, 2005-2014

Characteristic	Cases (n= 284)	Controls (n=7,254)	Chi-Square
Manner of Collision			p<0.0001
Angle	4 (1%)	219 (3%)	
Rear End/Rear to Rear	35 (12%)	2195 (30%)	
Sideswipe-Opposite Direction/ Sideswipe-Same Direction	20 (7%)	3015 (42%)	
Single Vehicle	223 (79%)	1645 (23%)	
Other	2 (1%)	179 (2%)	
Commercial Vehicle Driver Injury Severity			p<0.0001
Fatal injury	7 (2%)	55 (1%)	
Incapacitating injury	17 (6%)	103 (1%)	
Non-incapacitating injury	49 (17%)	295 (4%)	
Possible injury	41 (14%)	228 (3%)	
None	170 (60%)	6566 (91%)	
Commercial Vehicle Driver Restraint Use			p<0.0001
No	18 (6%)	139 (2%)	
Yes	266 (94%)	7115 (98%)	

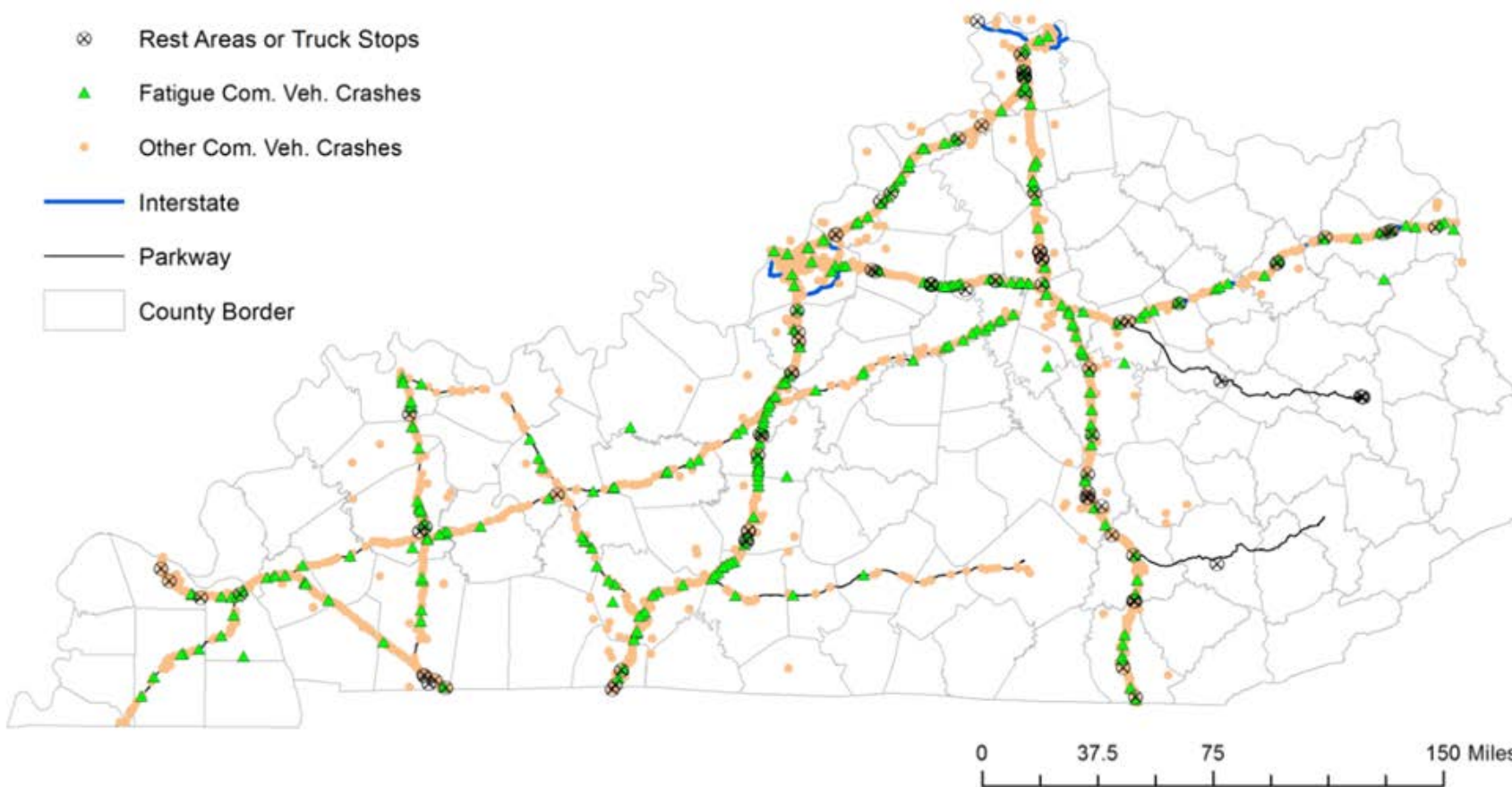
Roadway Characteristics of Commercial Vehicle Driver At-Fault Crashes in Kentucky, 2005-2014

Characteristic	Cases (n= 284)	Controls (n=7,254)	Chi-Square
Roadway Character			p=0.8678
Straight roadway	222 (78%)	5640 (76%)	
Curved roadway	62 (22%)	1614 (22%)	
Roadway Condition			p=0.0026
Dry roadway	239 (84%)	5547 (76%)	
Wet roadway	45 (16%)	1707 (24%)	
Number of Roadway Lanes			p=0.4518
1-2 lanes	49 (17%)	1381 (19%)	
>2 lanes	235 (83%)	5873 (81%)	
Roadway Type			p<0.0001
Interstate highway	203 (71%)	6595 (91%)	
Parkway	81 (29%)	659 (9%)	

Location of Commercial Vehicle Driver At-Fault Crashes Relative to Proximity to Rest Areas/ Truck Stops in Kentucky, 2005-2014

Legend

- ⊗ Rest Areas or Truck Stops
- ▲ Fatigue Com. Veh. Crashes
- Other Com. Veh. Crashes
- Interstate
- Parkway
- County Border



Odds Ratios for Commercial Vehicle Driver At-Fault Crashes Involving Sleepiness/Fatigue in Kentucky, 2005-2014

Commercial Vehicle Crash Characteristic	Odds Ratio	95% CI (p<0.05)
Nighttime vs. Daytime Hour of Commercial Vehicle Crash	6.340	4.845-8.297
Rest Area/Truck Stop Distance of 20-39.9 Miles vs. <20 Miles to Commercial Vehicle Crash Site	2.321	1.615-3.335
Rest Area/Truck Stop Distance of 40+ Miles vs. <20 Miles to Commercial Vehicle Crash Site	6.788	2.112-21.812
Dry vs. Wet Roadway at Time of Commercial Vehicle Crash	1.915	1.379-2.658

Odds Ratios for Commercial Vehicle Driver At-Fault Crashes Involving Sleepiness/Fatigue in Kentucky, 2005-2014

Commercial Vehicle Crash Characteristic	Odds Ratio	95% CI (p<0.05)
Nighttime vs. Daytime Hour of Commercial Vehicle Crash	6.524	4.965-8.572
Dry vs. Wet Roadway at Time of Commercial Vehicle Crash	1.921	1.378-2.678
Interstate-24 vs. Interstate-75	2.574	1.449-4.574
Interstate-64 vs. Interstate-75	2.519	1.678-3.781
Interstate-65 vs. Interstate-75	1.299	0.882-1.912
Interstate-71 vs. Interstate-75	1.549	0.950-2.526
Audubon Parkway vs. Interstate-75	15.256	3.135-74.238
Bluegrass Parkway vs. Interstate-75	5.940	3.086-11.435
Cumberland Parkway vs. Interstate-75	3.384	0.976-11.731
Pennyrile Parkway vs. Interstate-75	7.260	4.278-12.320
Purchase Parkway vs. Interstate-75	4.536	2.024-10.165
Western Kentucky Parkway vs. Interstate-75	3.931	2.207-7.001
William H. Natcher Parkway vs. Interstate-75	6.578	3.216-13.454

Odds Ratios for Commercial Vehicle Driver At-Fault Crashes Involving Sleepiness/Fatigue in Kentucky, 2005-2014

Commercial Vehicle Crash Characteristic	Odds Ratio	95% CI (p<0.05)
Nighttime vs. Daytime Hour of Commercial Vehicle Crash	6.199	4.733-8.119
Parkway vs. Interstate	3.747	2.834-4.954
Dry vs. Wet Roadway at Time of Commercial Vehicle Crash	1.909	1.373-2.655



Conclusions

- Regression analysis coupled with ArcGIS mapping provided opportunity to statistically determine and visualize association between rest area/truck stop distances and commercial vehicle driver at-fault crashes involving sleepiness/fatigue
- Results can be used by state and local highway transportation officials to inform and increase truck parking availability, especially on parkways
- Implementation and evaluation of commercial vehicle employer fatigue-prevention policies and interventions may help reduce fatigue and sleepiness in commercial vehicle drivers