Shortage of Commercial Vehicle Parking Influence on Interstate Ramp Crashes in Tennessee

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Background

- Commercial Vehicle (CMV) Parking Deficiency
  - 1996- 28,400 needed parking spaces need in US
  - Demand is expected to continue to increase by 3% annually through 2020
  - Jason's Law study found the Southeast US as the most challenging regions for CMV parking
  - 1999 TN Study- 40% of weekday night parking occurred on ramps and shoulders

Background

Federal Motor Carrier Safety Administration (FMCSA)

- No empty spaces at nearby facility (94%)
- No nearby parking facility (83%)
- Nearby parking spaces time limits (50%)
- Nearby spaces were blocked by other vehicles (50%)
- Convenience of ramp/shoulder for alighting (33%)
- Less likely to be interrupted by strangers (33%)
- Difficult to drive in congested parking lots (18%)
- Ramps/shoulders have better lighting (4%)

F M C S A

Federal Motor Carrier Safety Administration

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Collection of Parking Data

Recorded truck parking from Tuesday-Friday during 12 AM to 5 AM at:

- Truck facilities
- Interchange ramp shoulders

Measured:

- Occupied parking spaces
- Unoccupied parking spaces
- Vehicles outside of spaces
- Total capacity

TN Parking Volumes

Highway Corridor	Approx. Length (miles)	Public Parking Facilities		Private Parking Facilities		Parked at Interchanges		Annual Average Daily Traffic (AADT)	
		Designated Spaces	Total Parked	Designated Spaces	Total Parked	Parked on off-ramps	Parked on on-ramps	Avg.	% Trucks
I-24 from KY to Chattanooga	185	90	91	594	686	32	43	80,662	24
I-26 from KY to NC	31	53	26	0	4	0	0	32,063	11
I-40 from AR to NC	455	150	152	3,125	2,864	35	75	61,102	29
I-65 from KY to AL	122	15	15	395	412	7	22	83,333	20
I-75 from GA to I-40/75 Junction	85	40	46	345	371	22	29	60,846	26
I-75 from Knoxville to KY	58	N/A	N/A	245	253	3	14	50,435	24
I-81 from Dandridge to VA	76	134	105	509	403	7	26	30,541	34
Total	1,012	482	435	5213	4993	106	209		

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Collection of Parking Characteristics

- Horizontal alignment
- Material of the ramp's shoulder
- Width of the ramp's shoulder
- Presence of no parking signs
- Number of lane(s) on the ramp
- Width of lane(s)
- Length of ramp
- Proximity to truck facilities
- Presence of lighting

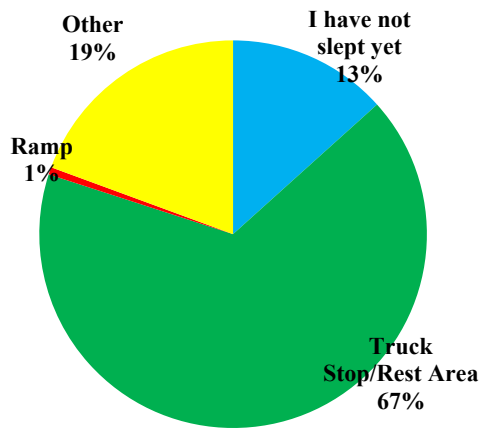# Public and Private Parking Facilities
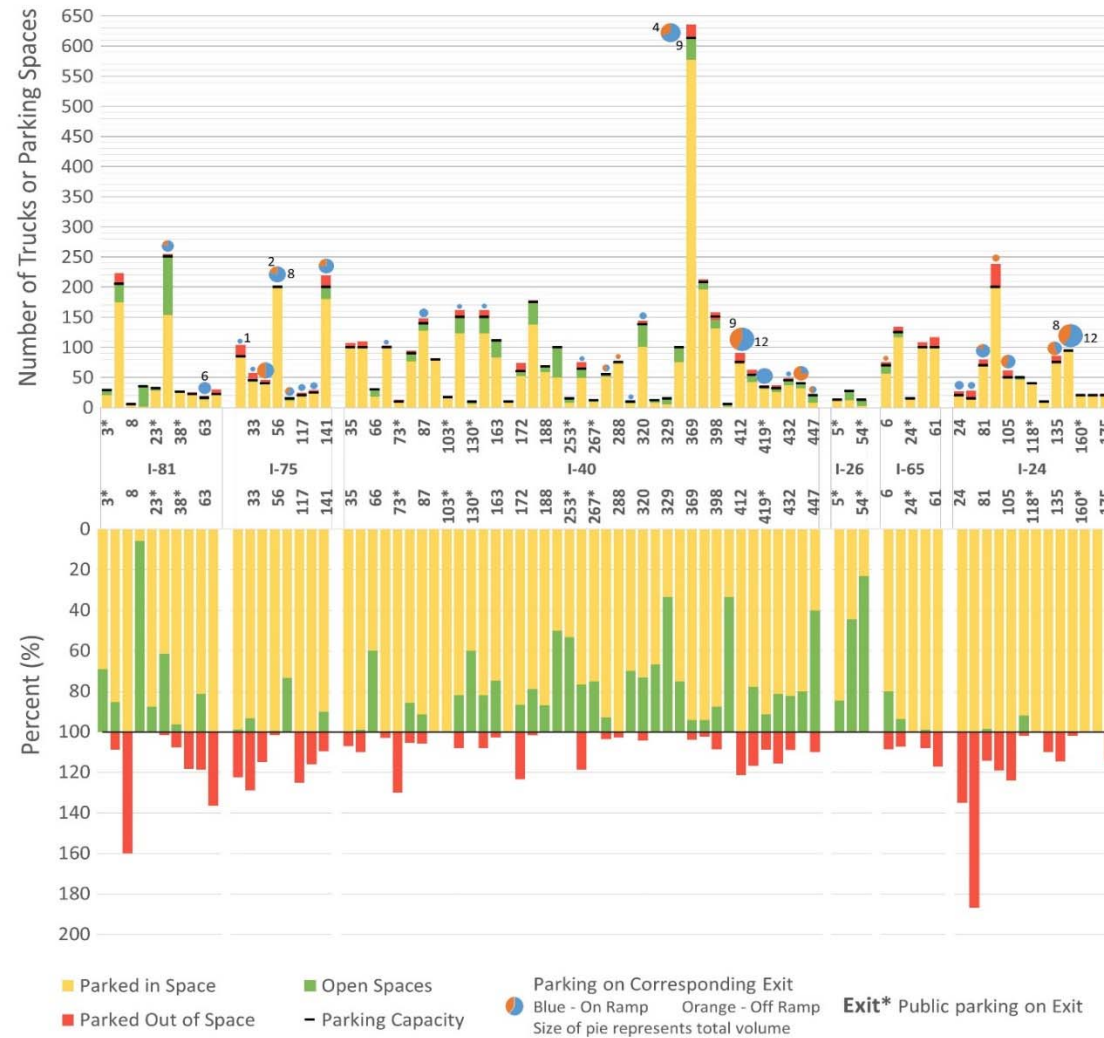
Results of Pearson Correlation

Number of Parked Trucks on Ramps	Pearson Correlation	Significance (2-tailed)
Geometric Shape (diamond)	0.080	0.019
Shoulder Material (mixed)	0.044	0.200
Shoulder Width	0.192	0.000
No Parking Signage	0.112	0.001
Number of Lane(s) Exiting/Entering Interstate	-0.041	0.234
Width of Lane(s) Exiting/Entering Interstate	-0.026	0.456
Number of Lane(s) Exiting/Entering Intersection	-0.086	0.012
Width of Lane(s) Exiting/Entering Intersection	-0.093	0.006
Length of Ramp	0.068	0.048
Proximity	0.016	0.636
Lighting (absence)	-0.303	0.380

Sample size: 854

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CMV Parking Behavior

On this trip, I parked and slept last at

- Other 19%
- I have not slept yet 13%
- Ramp 1%
- Truck Stop/Rest Area 67%

I am planning to park next at

- Other 26%
- Ramp 1%
- Truck Stop/Rest Area 73%
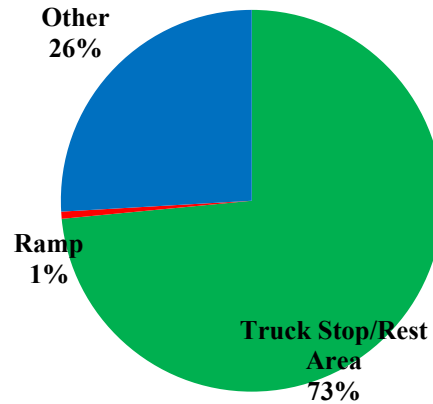
If parking facility is full, I will park

- On ramp 17%
- Off ramp 12%
- Loading terminal 14%
- Keep driving 57%
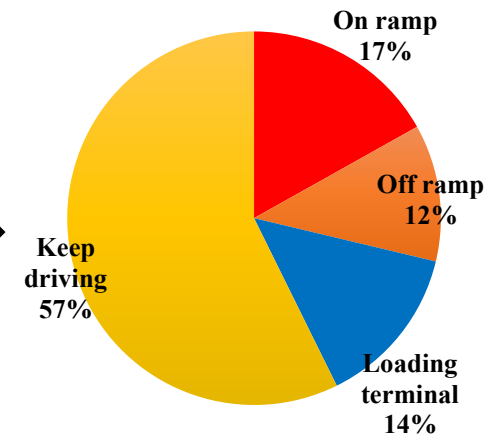
Background

Safety Implications

- Limits the acceleration rate of parked drivers on entrance ramp
  - Speed will lower than that of traffic on mainline
- Shoulders are not protected from errant vehicles
- Example: Jackson, TN in 1999

Descriptive Statistics

Variable	Description	Min.	Max.	Mean	SD
Geometric Shape	Shape of the freeways ramps Where: 0 = Curved (any type), 1 = Straight (diamond)	0.00	1.00	0.86	0.35
Utilization Rate	Volume to capacity in percentage of facility/facilities on exit	0.00	400.00	22.91	47.02
Ramp Type	Type of freeway ramp Where: 0 = Exit, 1 = Entrance	0.00	1.00	0.50	0.50
Number Parked	Number of truck(s) parked on ramp	0.00	11.00	0.28	1.03
Crash Frequency	Number of crashes involving trucks along freeway ramp	0.00	5.00	0.15	0.45
No Parking Sign	Presence of no parking sign along ramp shoulders Where: 0 = Absence, 1 = Presence	0.00	1.00	0.13	0.34
Shoulder width	Width of shoulder in feet	0.00	40.00	12.54	4.76
Shoulder pavement type	Pavement type of ramp shoulder Where: 0 = Asphalt, 1 = Concrete, 3 = Gravel, 4 = Mixed	0.00	3.00	1.64	1.46
Interstate Width	Width of ramp near the interstate (feet)	11.00	36.00	15.55	2.87
Interstate Lanes	Number of lane(s) near the interstate	1.00	2.00	1.06	0.23
Intersection Width	Width of ramp near the intersection (feet)	10.00	51.00	19.13	6.71
Interstate Lanes	Number of lane(s) near the intersection	1.00	4.00	1.32	0.66
Ramp Length	Length of freeway ramp in feet	106.00	6072.00	1282.84	609.78
Lights	Presence of luminaries Where: 0 = Absence, 1 = Presence	0.00	1.00	0.53	0.50
Proximity	Proximity to the nearest parking facility (miles)	0.09	149.36	28.87	25.38
Area	Freeway ramp area Where: 0 = Rural, 1= Urban	0.00	1.00	0.55	0.50
Average AADT	Average AADT of freeways mainline from 2006-2016	8362.73	178687.64	61541.86	39296.76

Crashes by Injury Type

		Fatal (n = 6)	Injury-Incapacitating (n = 11)	Injury-Non Incapacitating (n = 18)	Injury-Possible (n = 18)	Property Damage (n = 118)	Property Damage Under $400 (n = 8)	Total (n = 179)
Type	Entrance	4 (67%)	3 (27%)	8 (44%)	10 (56%)	56 (47%)	5 (63%)	86 (48%)
	Exit	2 (33%)	8 (73%)	10 (56%)	8 (44%)	62 (53%)	3 (38%)	93 (52%)
Manner	Side-swipe	1 (17%)	1 (9%)	1 (6%)	5 (28%)	48 (41%)	6 (75%)	62 (35%)
	Angle	1 (17%)	3 (27%)	3 (17%)	1 (6%)	10 (8%)	1 (13%)	19 (11%)
	Front to rear	2 (33%)	5 (45%)	10 (56%)	6 (33%)	40 (34%)	0 (0%)	63 (35%)
	Other	2 (33%)	2 (18%)	4 (22%)	6 (33%)	20 (17%)	1 (13%)	35 (20%)
Weather	Clear	3 (50%)	8 (73%)	13 (72%)	13 (72%)	82 (69%)	7 (88%)	126 (70%)
	Rain	1 (17%)	2 (18%)	1 (6%)	4 (22%)	17 (14%)	1 (13%)	26 (15%)
	Cloudy	2 (33%)	0 (0%)	4 (22%)	1 (6%)	12 (10%)	0 (0%)	19 (11%)
	Other	0 (0%)	1 (9%)	0 (0%)	0 (0%)	7 (6%)	0 (0%)	8 (4%)
First Harmful Event	Vehicle-In-Transport	0 (0%)	5 (45%)	4 (22%)	5 (28%)	58 (49%)	5 (63%)	77 (43%)
	Parked Motor Vehicle	5 (83%)	4 (36%)	10 (56%)	8 (44%)	52 (44%)	2 (25%)	81 (45%)
	Other	1 (17%)	2 (18%)	4 (22%)	5 (28%)	8 (7%)	1 (13%)	21 (12%)
Time of the Day	0 – 5	4 (67%)	5 (45%)	7 (39%)	6 (33%)	38 (32%)	2 (25%)	62 (35%)
	5:01 – 10	0 (0%)	1 (9%)	7 (39%)	5 (28%)	30 (25%)	2 (25%)	45 (25%)
	10:01 – 14	0 (0%)	3 (27%)	0 (0%)	3 (17%)	8 (7%)	1 (13%)	15 (8%)
	14:01 – 19	0 (0%)	1 (9%)	4 (22%)	3 (17%)	25 (21%)	2 (25%)	35 (20%)
	19:01–23:59	2 (33%)	1 (9%)	0 (0%)	1 (6%)	17 (14%)	1 (13%)	22 (12%)

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Correlation of Ramp Attributes and Crash Frequency

Truck Crash Frequency	Pearson's Correlation	Significance (2-tailed)
Geometric (diamond)	0.099	0.001
Facility Utilization Rate on Exit	0.148	0.000
Ramp Type (on-ramp)	-0.008	0.788
Number of CMVs Parked	0.186	0.000
No Parking Signage (presence)	0.127	0.000
Shoulder Width (feet)	0.128	0.000
Shoulder Material	0.021	0.456
Width near Interstate (feet)	0.030	0.295
Lane(s) near Interstate	0.016	0.576
Width near Intersection (feet)	-0.022	0.440
Lane(s) near Intersection	-0.021	0.472
Ramp length (feet)	-0.60	0.035
Lighting (presence)	-0.052	0.068
Proximity to nearest Facility (miles)	-0.062	0.030
Area (urban)	-0.137	0.000
Average AADT (2006-2016)	-0.080	0.005

Conclusions

- Shortage of parking in TN
  - 95% average capacity
  - 24, 65, and 75
- Significant correlations developed
  - CMV parking and ramp attributes
  - Crash frequency and ramp attributes
- Build more facilities
- Accurate and reliable ITS technologies
- Citing illegal parked CMV

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Questions?

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