

INTRODUCTION

- Public agencies struggle to provide adequate parking for commercial vehicles (CMV) due to static revenue and increasing truck traffic resulting in ramp parking.
- CMV drivers are faced with two arduous options: surpass federal hours-of-service (HOS) regulations to find legal parking or park illegally along the interstate on- and off-ramps.
- Interstate ramps are the location of more crashes per mile than any other segment, yet CMV drivers park here for off-duty rest.
- This study examines the influence of CMV parking deficiency on crash frequency on ramps.

METHODOLOGY

- Utilization rates of private and public facilities were recorded during peak hours (12 am to 5 am) of off-duty rest during the weekday (Tuesday morning to Friday morning)
 - Occupied parking spaces
 - Unoccupied parking spaces
 - Vehicles parked outside of designated parking spaces
- Characteristics of 1,221 urban and rural ramps in Tennessee were recorded through Google Earth, Inc. and Tennessee Department of Transportation's (TDOT) Enhanced Tennessee Roadway Information Management System (E-TRIMS) (<https://e-trims.tdot.tn.gov>)
 - 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

179 CMV crashes along interstate ramps were obtained through Tennessee Interrelated Traffic Analysis (TITAN) database (<https://titan.safety.tn.gov>) from January 1, 2006 to September 31, 2016

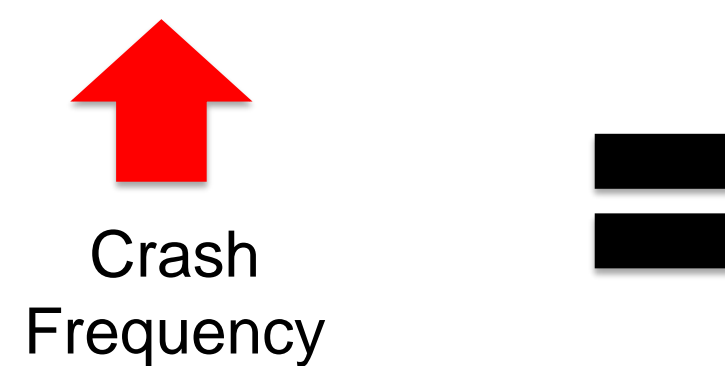


RESULTS

Descriptive Statistics

Variable	Description	Min.	Max.	Mean	SD
Crash Frequency	Number of crashes involving trucks along freeway ramp	0.00	5.00	0.15	0.45
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
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, 2 = Gravel, 3 = 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
Intersection 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

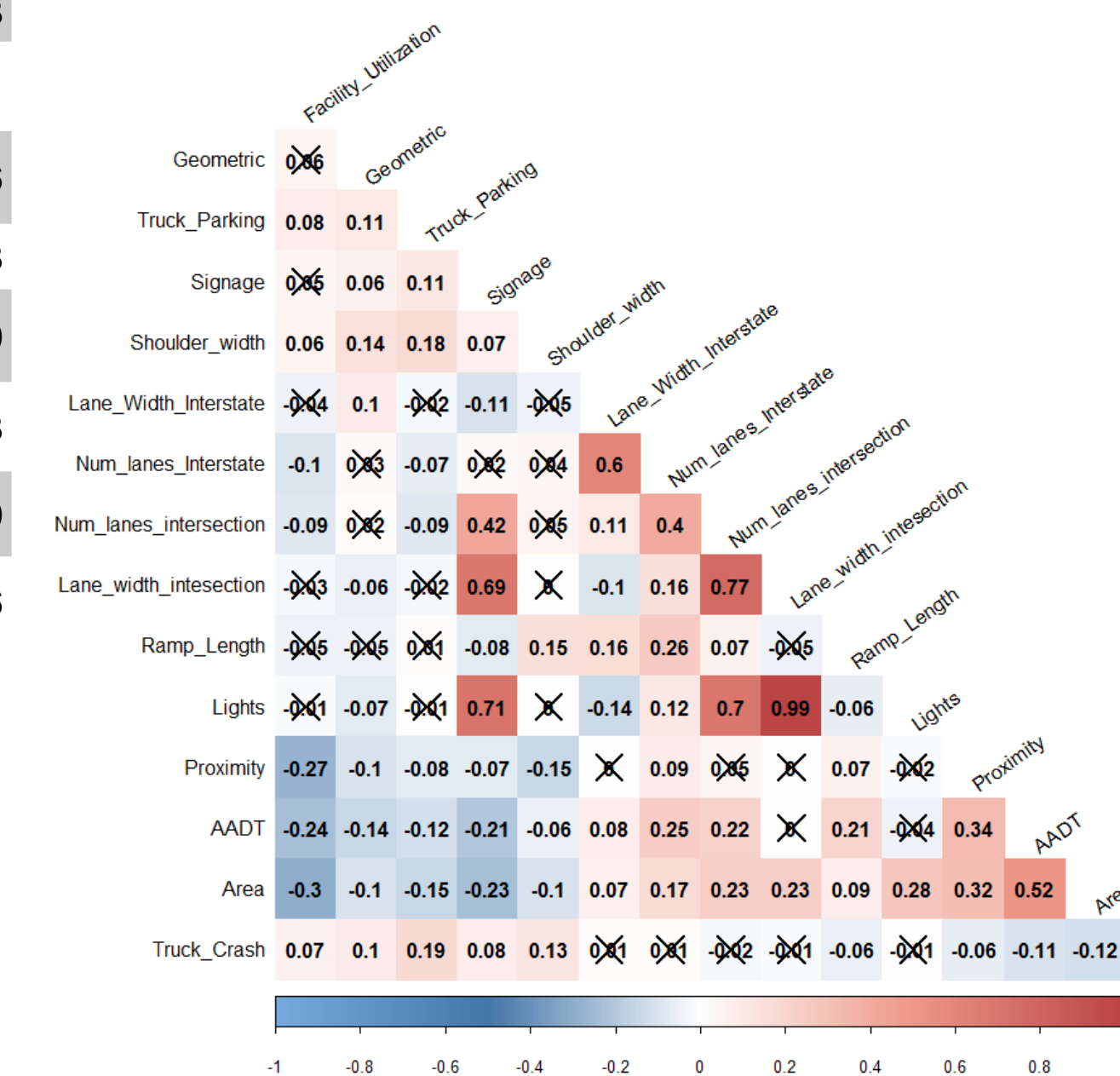
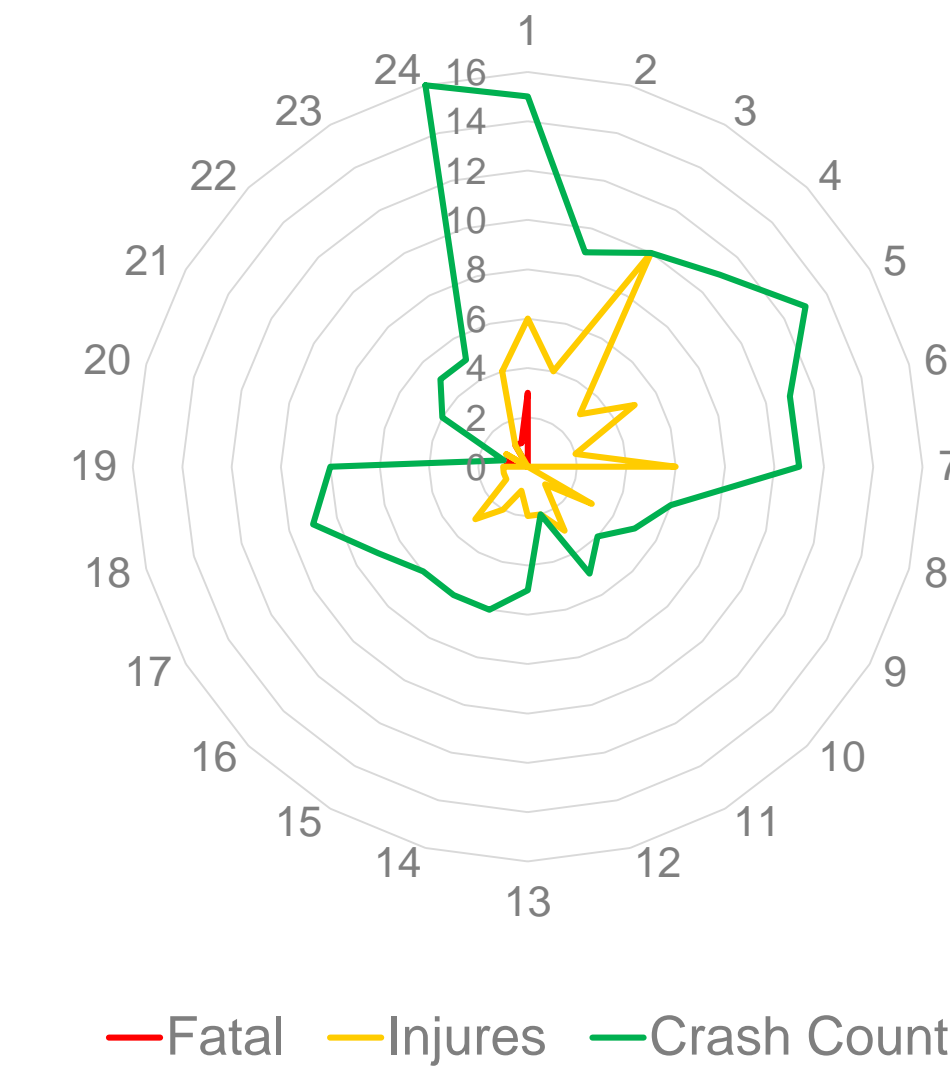
Comparison between ramps with crashes and without crashes



- Higher utilization rate
- Higher number of trucks parked
- Larger shoulder width
- Presence of lighting
- Presence of no parking signs
- Located in rural areas
- Lower AADT

Crashes by Injury Type

	Fatal (n = 6)	Injury-Incap (n = 11)	Injury-Non Incap (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%)	86 (48%)
	Exit	2 (33%)	8 (73%)	10 (56%)	8 (44%)	62 (53%)	93 (52%)
Manner	Side-swipe	1 (17%)	1 (9%)	1 (6%)	5 (28%)	48 (41%)	62 (35%)
	Angle	1 (17%)	3 (27%)	3 (17%)	1 (6%)	10 (8%)	19 (11%)
	Front to rear	2 (33%)	5 (45%)	10 (56%)	6 (33%)	40 (34%)	63 (35%)
	Other	2 (33%)	2 (18%)	4 (22%)	6 (33%)	20 (17%)	35 (20%)
	Vehicle-In-Transport	0 (0%)	5 (45%)	4 (22%)	5 (28%)	58 (49%)	5 (63%)
First Harmful Event	Parked Motor Vehicle	5 (83%)	4 (36%)	10 (56%)	8 (44%)	52 (44%)	81 (45%)
	Other	1 (17%)	2 (18%)	4 (22%)	5 (28%)	8 (7%)	21 (12%)



- Geometric shape
- Facility utilization on exit
- Number of CMVs parked on ramp
- Presence of no parking signage
- Shoulder width
- Ramp length
- Presence of lighting
- Area of ramp
- Average AADT (2006-2016)

Significant CMV Crash Frequency Attributes

CONCLUSION

- More fatal crashes occurred on entrance ramps, but more severe injury crashes occurred on exit.
- Significant correlations were developed between ramp attributes and crash frequency.
- Rather than prohibit ramp parking without exception, and necessarily not enforcing all ramp parking, this research could be used to target the most unsafe parking facilities based on geometry and other characteristics.
- Enhanced engineering, and enforcement at the most dangerous facilities could discourage parking there, while relatively safer facilities (i.e., long ramps, limited curvature) could be developed in such a way that diminishes the rates of severe crashes.

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