Leveraging Probe Data to Model Speeding on Limited Access Highway Segments during the COVID-19 Pandemic

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Introduction

- During the COVID-19 pandemic, the frequency of severe crashes increased, presumably due to increased speeding
- Vehicle speed and speeding have strong influences over the likelihood of a severe or fatal crash outcome
- This study explored the impact of COVID-19, traffic density, and temporal variables on vehicle speeding in Maine and Connecticut
- Emerging probe data sources were used to capture network level speed and flow, and estimate density.
- This analysis provides a better understanding of how factors influenced speeding during the COVID-19 Pandemic

Traffic Data Collection

- Speed and traffic flow information were obtained from Streetlight Insight®
- Data derived from location based services (LBS) information retrieved from cellphones and compounded by device ID
- Data points collected hourly for every DOT defined roadway segment on urban controlled access roadways
- Crash data were obtained from Maine DOT and Conn DOT

Methodology

- A mixed effect binomial regression model is used to model speeding by 10, 15, and 20 mph over the speed limit for datasets from Maine, Connecticut.
- A total of 6 models were fitted with the variables listed to the left

Variables Considered in Models

Variables	Classes
Traffic Density	LOS A (0 < K ≤ 11)
	LOS B (11 < K ≤18)
	LOS C (18 < K ≤ 26)
	LOS D (26 < K ≤ 35)
	LOS E (35 < K ≤45) (=0)
Time of the Day	Off Peak (=0)
	Morning Peak Period
	Evening Peak Period
COVID-19 Phases	Before Stay-at-Home (=0)
	Stay-at-Home
	Post Stay-at-Home
Speed Limit	Speed Limit ≤55 (=0)
	Speed Limit = 60 mph
	Speed Limit = 65 mph
	Speed Limit = 70 mph
Presence of Curve	No Curve (=0)
	Curve Presence
Shoulder Width	Wide Shoulder (=0)
	Narrow Shoulder
State	Maine
	Connecticut (=0)
Time of the Week	Weekday (=0)
	Weekend

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Modeling Results for Maine

Category	Variables	+10 Mph Odds Ratio	+15 Mph Odds Ratio	+20 Mph Odds Ratio
Intercept	Constant	-	-	-
Traffic Density (or LOS)	LOS A (0 < K ≤ 11)	1.99	2.09	1.93
	LOS B (11 < K ≤ 18)	1.89	1.93	1.71
	LOS C (18 < K ≤ 26)	1.60	1.59	1.41
	LOS D (26 < K ≤ 35)	1.29	1.26	1.15
Time Variables	Morning Peak Period	1.18	1.17	1.12
	Evening Peak Period	1.19	1.18	1.14
	Weekend	1.43	1.44	1.40
Pandemic phases	Stay-at-Home	1.03	1.20	1.45
	Post Stay-at-Home	1.29	1.25	1.06
Pandemic Phases and Time of the day	Morning Peak × Stay-at-Home	1.04	1.07	1.11
	Evening Peak × Stay-at-Home	1.12	1.13	1.14
	Morning Peak × Post Stay-at-Home	1.01	1.03	1.03
	Evening Peak × Post Stay-at-Home	1.05	1.08	1.13
Segment Features	Curve Presence	0.73	0.77	0.82
	Shoulder Width < 6ft.	-	-	-
	Speed Limit = 60	0.27	0.26	0.30
	Speed Limit = 65	0.56	0.40	0.33
	Speed Limit = 70	0.16	0.13	0.11

Modeling Results for Connecticut

Category	Variables	+10 Mph Odds Ratio	+15 Mph Odds Ratio	+20 Mph Odds Ratio
Intercept	Constant	-	-	-
Traffic Density (or LOS)	LOS A (0 < K ≤ 11)	1.76	1.88	2.18
	LOS B (11 < K ≤ 18)	1.72	1.75	1.91
	LOS C (18 < K ≤ 26)	1.48	1.48	1.56
	LOS D (26 < K ≤ 35)	1.23	1.23	1.27
Time Variables	Morning Peak Period	1.23	1.30	1.32
	Evening Peak Period	1.05	1.08	1.10
	Weekend	1.47	1.41	1.36
Pandemic phases	Stay-at-Home	1.27	1.39	1.52
	Post Stay-at-Home	1.26	1.23	1.14
Pandemic Phases and Time of the day	Morning Peak × Stay-at-Home	1.00	0.98	0.99
	Evening Peak × Stay-at-Home	1.22	1.23	1.22
	Morning Peak × Post Stay-at-Home	1.01	1.00	1.00
	Evening Peak × Post Stay-at-Home	1.07	1.05	1.04
Segment Features	Curve Presence	0.94	-	-
	Shoulder Width < 6 ft.	0.85	0.84	0.83
	Speed Limit = 65	0.24	0.18	0.13

Key Results

- During evening peak hours, the odds of speeding speeding 10,15, and 20mph or more increased by 54%, 71% and 85% in Connecticut and by 15%, 36%, and 65% in Maine during the COVID-19 stay at home orders
- The odds of speeding in Maine were increased by an overall lower rate during COVID-19 than the odds of speeding in Connecticut
- As roadway density increases the odds of speeding decrease, especially for speeding by larger amounts.

Conclusion

- During the COVID-19 pandemic the odds of speeding were increased, and they have not fallen back to the levels they were pre-pandemic
- Density results show that when DOT's direct their funding to improving roadway capacity, they are not necessarily improving safety. There is a trade off, as too low of densities can increase speeding