



Crash Risk and Access Spacing on Two-Lane and Multi-Lane Highways



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INTRODUCTION

Effective access management is essential to mitigating traffic crash risks. Most of the crashes occurring near access points are a result of conflicts between multiple vehicles. This motivates the development of guidelines for access spacing. To this end, this study evaluated the relationship between crash risk and access point spacing on two-lane and multi-lane highways across the state of Iowa.

DATA COLLECTION

- As part of the study, data were obtained for 1,247 miles of multi-lane highways and 5,795 miles of two-lane highways.
- Several geometric and cross sectional characteristics were taken from Geographical Information Management System (GIMS).
- Crash data were acquired for a 5-year period from 2012 through 2016.
- Only non-animal crashes were considered for the study.

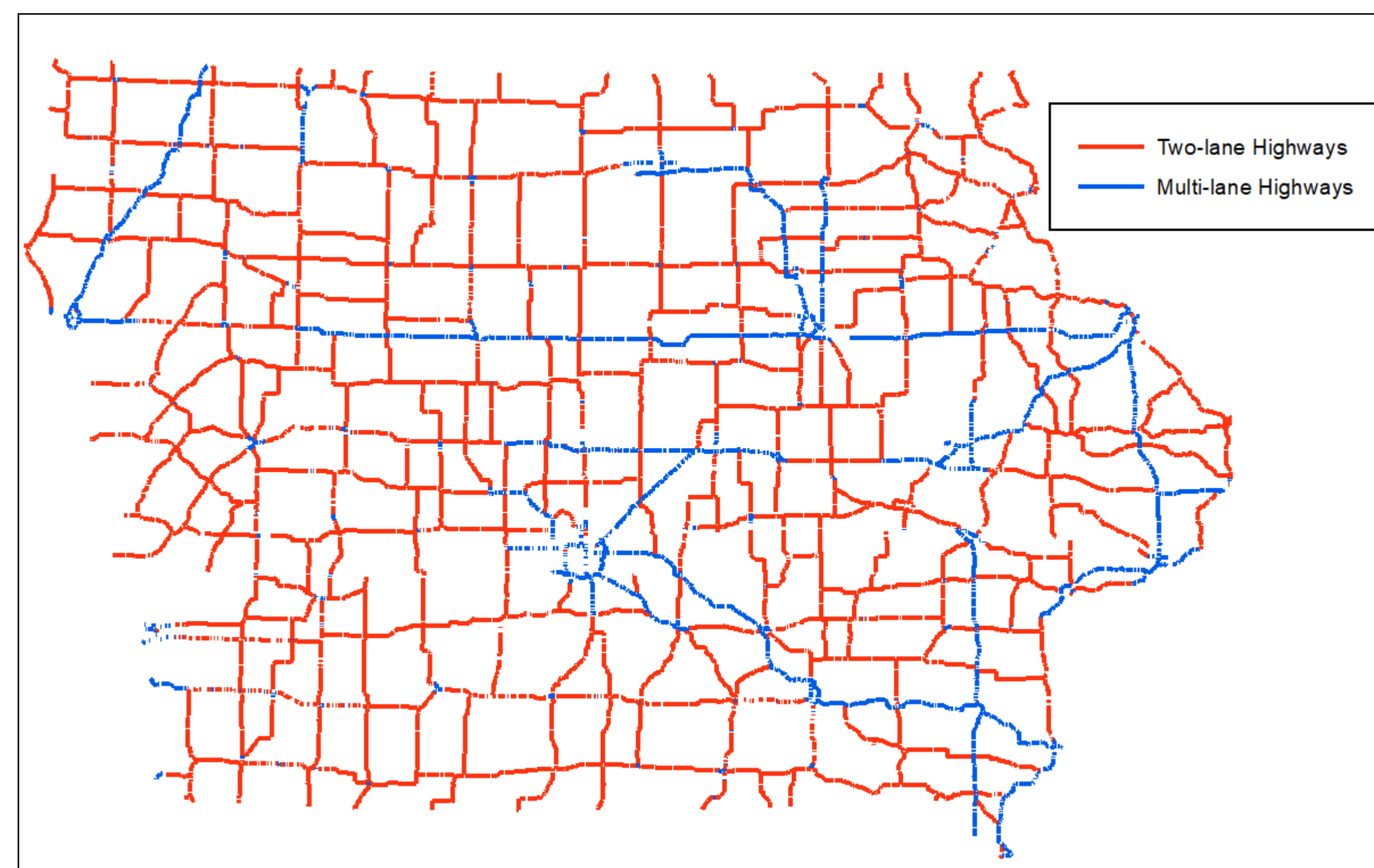


Figure 1: Two-lane and multi-lane highways across the state of Iowa

STATISTICAL METHODOLOGY

- Negative binomial model was used to access how crashes varied with access spacing.

$$\lambda_i = e^{\beta_0} \times AADT^{\beta_1} \times L \times e^{(\beta_2 X_2 + \dots + \beta_n X_n)}$$

λ_i = expected number of crashes on i^{th} road segment
 β_0 = regression coefficient for the constant
 β_1 = regression coefficient for AADT
 L = roadway segment length in miles
 $\beta_2 \dots \beta_n$ = regression coefficients for other variables
 $X_2 \dots X_n$ = segment specific variables

RESULTS AND DISCUSSION

Table 1: Crash prediction model for multi-lane highways

Parameter	Estimate	Std. Error	t-stat	P-value	Marginal Effects (%)
Intercept	-11.912	0.330	-36.150	<0.001	-99.99
Natural log of annual average daily traffic	1.395	0.036	38.570	<0.001	303.50
Access spacing > 1320 ft. (base)	-	-	-	-	-
Access spacing 1000-1320 ft.	0.361	0.169	2.140	0.033	43.48
Access spacing 600-1000 ft.	0.559	0.114	4.900	<0.001	74.89
Access spacing 300-600 ft.	0.686	0.121	5.680	<0.001	98.58
Access spacing 150-300 ft.	1.142	0.120	9.540	<0.001	213.30
Access spacing ≤ 150 ft.	1.471	0.089	16.600	<0.001	335.36
Divided	-1.053	0.076	-13.790	<0.001	-65.11

Table 2: Crash prediction model for two-lane highways

Parameter	Estimate	Std. Error	t-stat	P-value	Marginal Effects (%)
Intercept	-9.432	0.182	-51.880	<0.001	-99.99
Natural log of annual average daily traffic	1.039	0.023	44.710	<0.001	182.64
Access spacing > 2640 ft. (base)	-	-	-	-	-
Access spacing 1320-2640 ft.	0.159	0.043	3.700	<0.001	17.23
Access spacing 1000-1320 ft.	0.376	0.074	5.060	<0.001	45.64
Access spacing 600-1000 ft.	0.691	0.064	10.750	<0.001	99.57
Access spacing 300-600 ft.	0.709	0.083	8.540	<0.001	103.20
Access spacing 150-300 ft.	1.015	0.082	12.440	<0.001	175.94
Access spacing ≤ 150 ft.	1.505	0.050	30.120	<0.001	350.42

- Results from Tables 1 and 2 show that as access point spacing increases, rate of crashes tends to decrease.
- For example, for multi-lane highways, it is expected that a segment with access spacing less than or equal to 150 ft will experience 335 percent more crashes on average than those with the same characteristics on a segment with access spacing greater than 1,320 ft.
- For multi-lane highways, it is expected that divided multi-lane highways will have 65 percent less number of crashes as compared to undivided multi-lane highways.
- Both two-lane and multi-lane highway models have the same trends except that the two-lane highways are expected to have lower number of crashes per mile as compared to multi-lane highways.

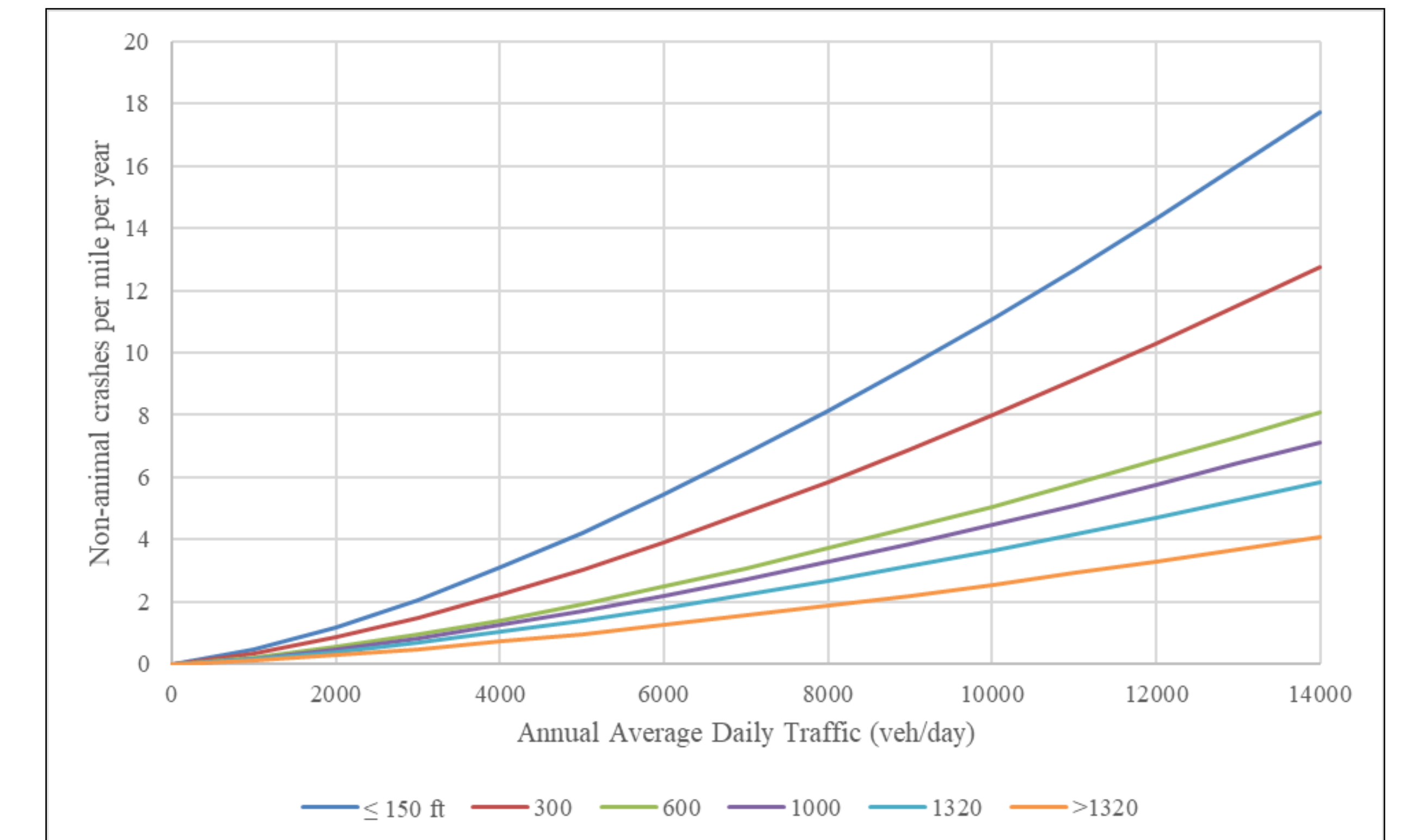


Figure 2: Annual crash rate with respect to access spacing and annual average daily traffic for multi-lane highways

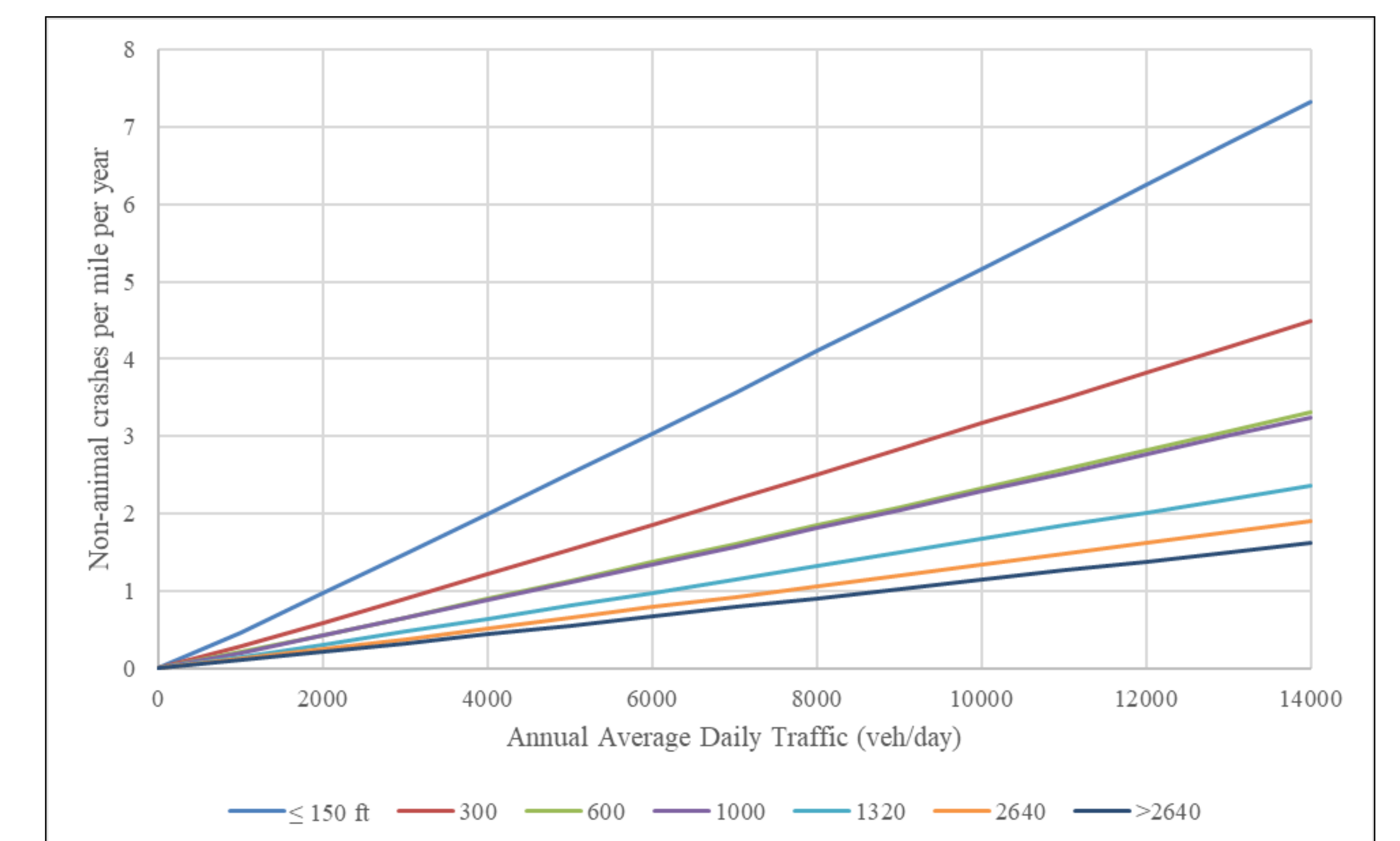


Figure 3: Annual crash rate with respect to access spacing and annual average daily traffic for two-lane highways

CONCLUSION

- Based on the models provided within the analysis, it is seen that the access point spacing has a significant effect on crash rate.
- Crash rates were found to be more sensitive to access spacing on multi-lane highways as compared to two-lane highways.
- In addition to spacing, access volumes were a primary determinant of crash risk, as was the median type for multi-lane highways.