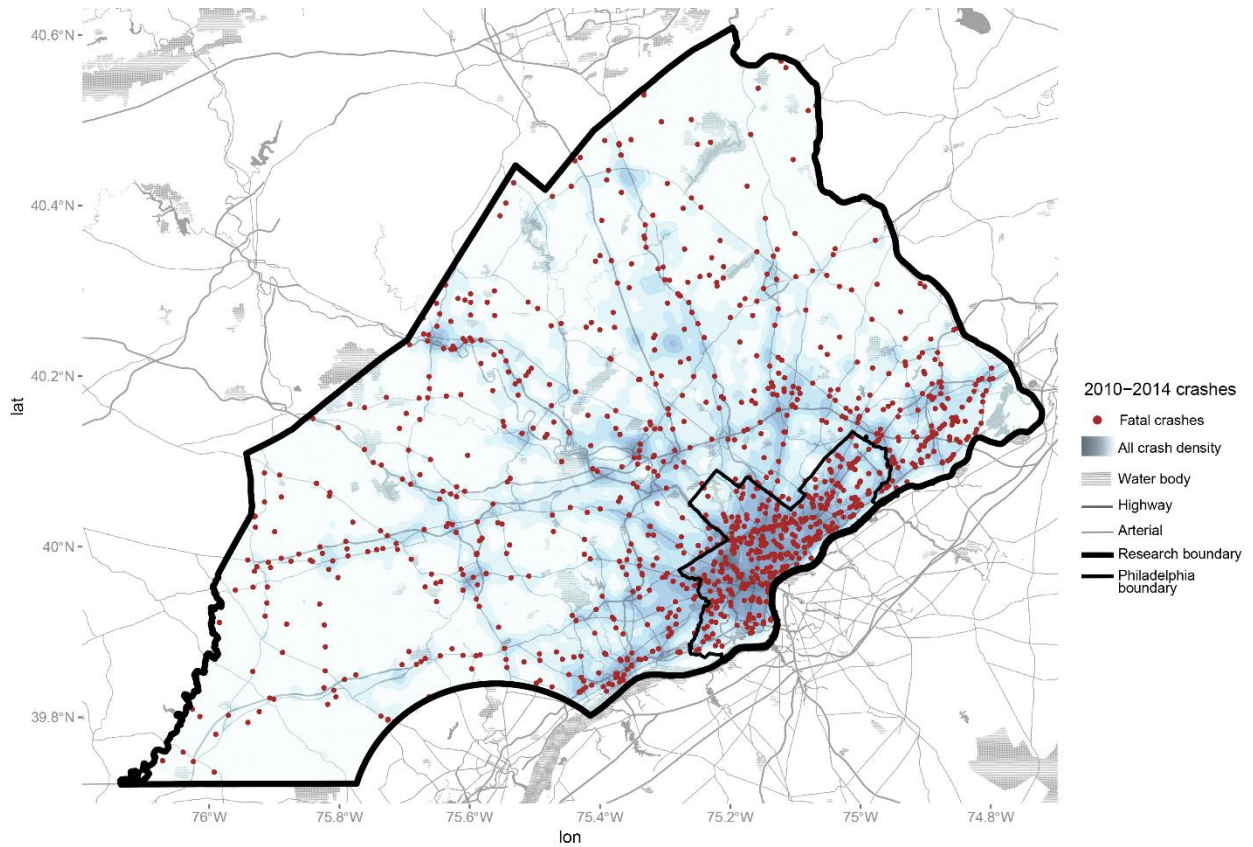
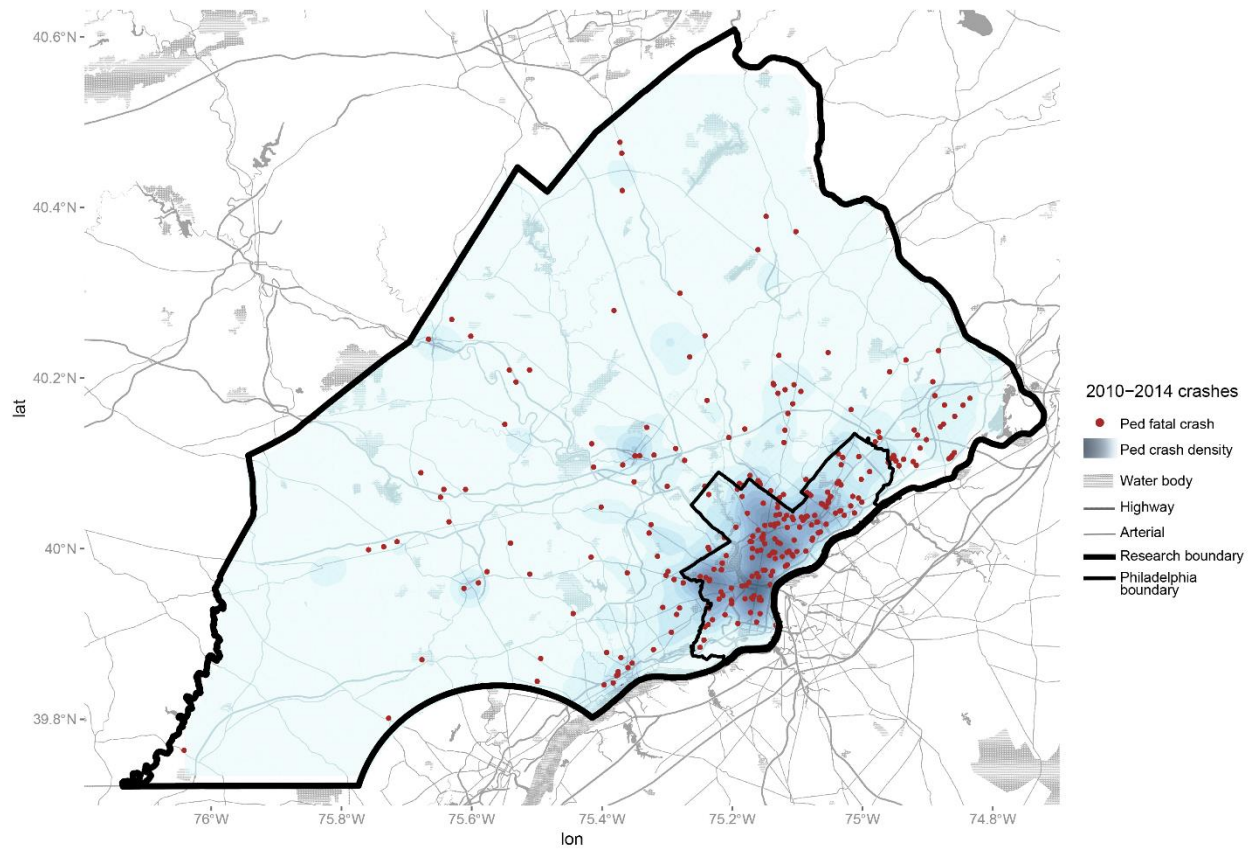


Appendix A

Appendix A.1 Density of total crashes and fatal crashes in Philadelphia and suburban Pennsylvania counties from 2010 to 2014.



Appendix A.2 Density of pedestrian crashes and pedestrian fatalities in Philadelphia and suburban Pennsylvania counties from 2010 to 2014.



Appendix B

Appendix B.1 Random intercept multilevel negative binomial models of total crashes by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log)</i> <i>in Philadelphia</i>	-0.15*** (0.02)	-0.20*** (0.02)	-0.07*** (0.02)	-0.10*** (0.02)	-0.09*** (0.02)	-0.10*** (0.02)
<i>Population density (log)</i> <i>in suburbs</i>	0.01 (0.02)	-0.04 (0.02)	0.08*** (0.02)	-0.004 (0.02)	-0.03 (0.02)	-0.06** (0.02)
<i>Proportion of black</i> <i>residents (log)</i>		0.06** (0.02)	0.07*** (0.02)	0.07*** (0.02)	0.06*** (0.02)	0.07*** (0.02)
<i>Proportion of families in</i> <i>poverty (log)</i>		0.09*** (0.03)	0.08*** (0.02)	0.08*** (0.02)	0.07** (0.02)	0.08*** (0.02)
<i>Proportion of residents</i> <i>over 64 (log)</i>		0.02 (0.04)	-0.08* (0.03)	-0.08** (0.03)	-0.09** (0.03)	-0.08** (0.03)
<i>Jobs per acre (log)</i>						0.06** (0.02)
<i>Land use diversity</i>					0.06*** (0.02)	0.03 (0.02)
<i>Public school enrollments</i> <i>(log)</i>					-0.005 (0.004)	-0.002 (0.004)
<i>Street link-to-node ratio</i>					-0.29*** (0.07)	-0.27*** (0.07)
<i>Pedestrian exposure (log)</i>				0.17*** (0.02)	0.16*** (0.02)	0.11*** (0.02)
Average annual daily traffic (log)				0.35*** (0.003)	0.35*** (0.003)	0.35*** (0.003)
Speed limit (reference category: 25 mph and low frequency)						
None available			0.11*** (0.02)	0.04 (0.02)	0.04 (0.02)	0.04 (0.02)
35 mph			1.26*** (0.01)	0.97*** (0.01)	0.97*** (0.01)	0.96*** (0.01)
45 mph			1.61*** (0.06)	1.14*** (0.06)	1.14*** (0.06)	1.14*** (0.06)
55 & 65 mph			1.69*** (0.03)	1.09*** (0.03)	1.09*** (0.03)	1.08*** (0.03)
Roadway segment length (in feet)			1.05*** (0.01)	1.03*** (0.01)	1.03*** (0.01)	1.03*** (0.01)
Length (in feet) of limited access highways (log)			0.13*** (0.01)	0.15*** (0.01)	0.15*** (0.01)	0.15*** (0.01)
Length (in feet) of secondary highways (log)			0.17*** (0.01)	0.15*** (0.01)	0.15*** (0.01)	0.15*** (0.01)
Length (in feet) of major arterials (log)			0.04*** (0.004)	0.04*** (0.003)	0.04*** (0.003)	0.04*** (0.003)
Length (in feet) of secondary highways: one way (log)			-0.06*** (0.01)	-0.02 (0.01)	-0.02 (0.01)	-0.02 (0.01)
Length (in feet) of major arterials: one way (log)			0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.04*** (0.01)
AADT missing dummy			-2.43*** (0.03)	0.01 (0.04)	0.01 (0.04)	0.01 (0.04)
Intersection dummy			7.02***	6.74***	6.74***	6.75***

			(0.05)	(0.05)	0.05)	(0.05)
Philadelphia intercept	0.80***	0.68***	0.72***	0.45***	0.37***	0.35***
	(0.07)	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)
Constant	-0.64***	-0.86***	-8.07***	-11.33***	-10.64***	-10.37***
	(0.03)	(0.12)	(0.12)	(0.17)	(0.22)	(0.23)
AIC	445,859	445,826	395,946	384,143	384,123	384,114
BIC	445,921	445,920	396,165	384,383	384,393	384,395

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in *italic* are measured on Census tract level as opposed to segment/intersection level

Appendix B.2 Random intercept multilevel negative binomial models of serious injuries by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log) in Philadelphia</i>	-0.17*** (0.03)	-0.26*** (0.03)	-0.15 (0.11)	-0.11*** (0.03)	-0.11*** (0.03)	-0.10*** (0.03)
<i>Population density (log) in suburbs</i>	-0.13*** (0.03)	-0.22*** (0.03)	-0.09 (0.09)	-0.10** (0.03)	-0.10** (0.04)	-0.08* (0.04)
<i>Proportion of black residents (log)</i>		0.07* (0.03)	0.12 (0.09)	0.09** (0.03)	0.09** (0.03)	0.08** (0.03)
<i>Proportion of families in poverty (log)</i>		0.23*** (0.04)	0.22 (0.13)	0.21*** (0.04)	0.20*** (0.04)	0.19*** (0.04)
<i>Proportion of residents over 64 (log)</i>		-0.05 (0.06)	-0.13 (0.19)	-0.18*** (0.05)	-0.18*** (0.05)	-0.19*** (0.05)
<i>Jobs per acre (log)</i>						-0.05 (0.04)
<i>Land use diversity</i>					0.03 (0.03)	0.05 (0.03)
<i>Public school enrollments (log)</i>					0.0005 (0.01)	-0.002 (0.01)
<i>Street link-to-node ratio</i>					-0.03 (0.13)	-0.05 (0.13)
<i>Pedestrian exposure (log)</i>				0.06 (0.03)	0.05 (0.04)	0.08 (0.05)
Average annual daily traffic (log)				0.32*** (0.01)	0.32*** (0.01)	0.32*** (0.01)
Speed limit (reference category: 25 mph and low frequency)						
None available			-0.28 (0.30)	0.08 (0.10)	0.08 (0.10)	0.08 (0.10)
35 mph			1.07*** (0.23)	0.77*** (0.05)	0.76*** (0.05)	0.77*** (0.05)
45 mph			1.99 (1.06)	1.06*** (0.18)	1.06*** (0.18)	1.05*** (0.18)
55 & 65 mph			1.68** (0.52)	0.89*** (0.09)	0.89*** (0.09)	0.89*** (0.09)
Roadway segment length (in feet)			1.02*** (0.11)	1.09*** (0.03)	1.09*** (0.03)	1.09*** (0.03)
Length (in feet) of limited access highways (log)			0.10 (0.12)	0.05** (0.02)	0.05** (0.02)	0.05** (0.02)
Length (in feet) of secondary highways (log)			0.20* (0.09)	0.09*** (0.02)	0.09*** (0.02)	0.09*** (0.02)
Length (in feet) of major			0.07	0.03**	0.03**	0.03**

arterials (log)			(0.06)	(0.01)	(0.01)	(0.01)
Length (in feet) of secondary highways: one way (log)			0.04 (0.21)	0.0002 (0.03)	0.0002 (0.03)	0.0002 (0.03)
Length (in feet) of major arterials: one way (log)			0.03 (0.16)	0.02 (0.02)	0.02 (0.02)	0.02 (0.02)
AADT missing dummy			-2.50*** (0.35)	-0.21 (0.21)	-0.21 (0.21)	-0.20 (0.21)
Intersection dummy			6.59*** (0.66)	7.01*** (0.21)	7.01*** (0.21)	7.00*** (0.21)
Philadelphia intercept	0.90*** (0.10)	0.67*** (0.10)	0.70 (0.39)	0.55*** (0.11)	0.56*** (0.12)	0.58*** (0.12)
Constant	-4.32*** (0.04)	-4.55*** (0.18)	-11.49*** (0.90)	-14.26*** (0.37)	-14.09*** (0.44)	-14.30*** (0.47)
AIC	36,600	36,535	46,628	32,048	32,053	32,053
BIC	36,662	36,629	46,847	32,288	32,324	32,334

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in *italic* are measured on Census tract level as opposed to segment/intersection level

Appendix B.3 Random intercept multilevel negative binomial models of total fatalities by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log) in Philadelphia</i>	-0.26*** (0.03)	-0.36*** (0.04)	-0.18*** (0.04)	-0.16*** (0.04)	-0.13*** (0.04)	-0.13*** (0.04)
<i>Population density (log) in suburbs</i>	-0.15*** (0.04)	-0.23*** (0.04)	-0.03 (0.05)	-0.02 (0.05)	-0.03 (0.05)	0.01 (0.06)
<i>Proportion of black residents (log)</i>		0.09 (0.05)	0.09* (0.04)	0.10* (0.04)	0.08. (0.04)	0.07 (0.04)
<i>Proportion of families in poverty (log)</i>		0.20** (0.06)	0.20*** (0.06)	0.20*** (0.06)	0.14* (0.06)	0.12* (0.06)
<i>Proportion of residents over 64 (log)</i>		0.13 (0.09)	0.02 (0.08)	-0.01 (0.08)	-0.02 (0.08)	-0.03 (0.08)
<i>Jobs per acre (log)</i>						-0.08 (0.05)
<i>Land use diversity</i>					0.17*** (0.04)	0.21*** (0.05)
<i>Public school enrollments (log)</i>					0.005 (0.01)	0.002 (0.01)
<i>Street link-to-node ratio</i>					-0.30 (0.20)	-0.34 (0.20)
<i>Pedestrian exposure (log)</i>				-0.03 (0.05)	-0.10 (0.05)	-0.03 (0.07)
Average annual daily traffic (log)				0.31*** (0.02)	0.31*** (0.02)	0.31*** (0.02)
Speed limit (reference category: 25 mph and low frequency)						
None available			0.59*** (0.14)	0.45** (0.14)	0.44** (0.14)	0.44** (0.14)
35 mph			0.95*** (0.09)	0.70*** (0.09)	0.69*** (0.09)	0.70*** (0.09)
45 mph			1.85*** (0.24)	1.49*** (0.24)	1.50*** (0.24)	1.49*** (0.24)

55 & 65 mph			1.46*** (0.15)	0.88*** (0.15)	0.85*** (0.15)	0.86*** (0.15)
Roadway segment length (in feet)			1.13*** (0.05)	1.11*** (0.05)	1.12*** (0.05)	1.11*** (0.05)
Length (in feet) of limited access highways (log)			0.07** (0.03)	0.04 (0.03)	0.04 (0.03)	0.04 (0.03)
Length (in feet) of secondary highways (log)			0.14*** (0.02)	0.11*** (0.02)	0.11*** (0.02)	0.11*** (0.02)
Length (in feet) of major arterials (log)			0.07*** (0.02)	0.06** (0.02)	0.06** (0.02)	0.06** (0.02)
Length (in feet) of secondary highways: one way (log)			0.06 (0.04)	0.06 (0.03)	0.06 (0.03)	0.06 (0.03)
Length (in feet) of major arterials: one way (log)			0.05 (0.04)	0.02 (0.04)	0.02 (0.04)	0.02 (0.04)
AADT missing dummy			-2.19*** (0.30)	-0.01 (0.32)	-0.04 (0.32)	-0.03 (0.32)
Intersection dummy			7.26*** (0.34)	6.95*** (0.34)	6.97*** (0.34)	6.94*** (0.34)
Philadelphia intercept	1.18*** (0.13)	1.03*** (0.14)	1.15*** (0.13)	1.09*** (0.15)	1.11*** (0.16)	1.15*** (0.16)
Constant	-5.49*** (0.06)	-6.22*** (0.27)	-13.84*** (0.44)	-15.42*** (0.57)	-14.27*** (0.67)	-14.62*** (0.71)
AIC	14,640	14,619	13,141	12,840	12,829	12,829
BIC	14,702	14,713	13,360	13,080	13,100	13,110

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in *italic* are measured on Census tract level as opposed to segment/intersection level

Appendix B.4 Random intercept multilevel negative binomial models of pedestrian involved crashes by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log) in Philadelphia</i>	0.06 (0.05)	-0.01 (0.03)	0.07** (0.02)	0.003 (0.02)	-0.02 (0.09)	-0.02 (0.02)
<i>Population density (log) in suburbs</i>	0.76*** (0.05)	0.62*** (0.04)	0.70*** (0.03)	0.58*** (0.03)	0.45*** (0.10)	0.47*** (0.04)
<i>Proportion of black residents (log)</i>		0.12*** (0.03)	0.12*** (0.02)	0.13*** (0.02)	0.16* (0.07)	0.13*** (0.02)
<i>Proportion of families in poverty (log)</i>		0.20*** (0.04)	0.22*** (0.03)	0.21*** (0.03)	0.19 (0.10)	0.22*** (0.03)
<i>Proportion of residents over 64 (log)</i>		-0.21*** (0.05)	-0.24*** (0.05)	-0.21*** (0.04)	-0.25 (0.16)	-0.19*** (0.04)
<i>Jobs per acre (log)</i>						0.11*** (0.03)
<i>Land use diversity</i>					0.13 (0.07)	0.04 (0.03)
<i>Public school enrollments (log)</i>					-0.02 (0.02)	-0.01 (0.01)
<i>Street link-to-node ratio</i>					-0.45 (0.36)	-0.67*** (0.11)
<i>Pedestrian exposure (log)</i>				0.33*** (0.03)	0.32*** (0.09)	0.24*** (0.04)
Average annual daily traffic (log)				0.26*** (0.01)	0.28*** (0.05)	0.26*** (0.01)

Speed limit (reference category: 25 mph and low frequency)

None available			0.06 (0.06)	0.01 (0.06)	-0.34 (0.23)	0.01 (0.06)
35 mph			0.89*** (0.03)	0.70*** (0.03)	0.82*** (0.18)	0.69*** (0.03)
45 mph			1.36*** (0.15)	1.04*** (0.15)	1.12 (0.84)	1.06*** (0.15)
55 & 65 mph			1.03*** (0.08)	0.50*** (0.08)	0.55 (0.42)	0.49*** (0.08)
Roadway segment length (in feet)			0.85*** (0.02)	0.87*** (0.02)	0.91*** (0.08)	0.87*** (0.02)
Length (in feet) of limited access highways (log)			-0.06** (0.02)	-0.12*** (0.02)	-0.05 (0.09)	-0.12*** (0.02)
Length (in feet) of secondary highways (log)			0.16*** (0.01)	0.13*** (0.01)	0.13 (0.07)	0.13*** (0.01)
Length (in feet) of major arterials (log)			0.09*** (0.01)	0.07*** (0.01)	0.06 (0.04)	0.07*** (0.01)
Length (in feet) of secondary highways: one way (log)			-0.05* (0.02)	-0.03 (0.02)	0.02 (0.16)	-0.03 (0.02)
Length (in feet) of major arterials: one way (log)			0.01 (0.02)	-0.01 (0.02)	-0.01 (0.12)	-0.01 (0.02)
AADT missing dummy			-1.68*** (0.13)	0.10 (0.14)	0.01 (0.40)	0.11 (0.14)
Intersection dummy			6.07*** (0.14)	5.97*** (0.14)	5.83*** (0.50)	5.98*** (0.14)
Philadelphia intercept	3.15*** (0.17)	2.67*** (0.11)	2.73*** (0.10)	2.24*** (0.10)	2.18*** (0.34)	1.99*** (0.10)
Constant	-5.27*** (0.07)	-5.14*** (0.17)	-11.19*** (0.22)	-15.23*** (0.30)	-14.32*** (1.20)	-13.38*** (0.36)
AIC	99,091	73,857	67,104	65,804	111,996	65,740
BIC	99,154	73,950	67,322	66,044	112,267	66,021

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in *italic* are measured on Census tract level as opposed to segment/intersection level

Appendix B.5 Random intercept multilevel negative binomial models of serious pedestrian injuries by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log) in Philadelphia</i>	0.03 (0.05)	-0.07 (0.05)	0.05 (0.06)	0.02 (0.06)	0.02 (0.06)	0.02 (0.06)
<i>Population density (log) in suburbs</i>	0.62*** (0.07)	0.48*** (0.08)	0.59*** (0.08)	0.50*** (0.08)	0.46*** (0.09)	0.46*** (0.09)
<i>Proportion of black residents (log)</i>		0.06 (0.05)	0.06 (0.05)	0.06 (0.05)	0.05 (0.05)	0.05 (0.05)
<i>Proportion of families in poverty (log)</i>		0.26*** (0.08)	0.27*** (0.07)	0.28*** (0.08)	0.25** (0.08)	0.24** (0.08)
<i>Proportion of residents over 64 (log)</i>		-0.02 (0.11)	-0.04 (0.11)	-0.03 (0.11)	-0.02 (0.11)	-0.02 (0.11)
<i>Jobs per acre (log)</i>						-0.02 (0.07)
<i>Land use diversity</i>					0.13*	0.13*

				(0.06)	(0.06)
<i>Public school enrollments</i>				-0.01	-0.02
<i>(log)</i>				(0.01)	(0.01)
<i>Street link-to-node ratio</i>				-0.73**	-0.74**
				(0.27)	(0.27)
<i>Pedestrian exposure (log)</i>		0.25***		0.24***	0.25**
		(0.07)		(0.07)	(0.09)
Average annual daily traffic (log)		0.31***		0.31***	0.31***
		(0.03)		(0.03)	(0.03)
Speed limit (reference category: 25 mph and low frequency)					
None available		-0.01	-0.08	-0.09	-0.09
		(0.22)	(0.22)	(0.22)	(0.22)
35 mph		0.94***	0.74***	0.73***	0.73***
		(0.10)	(0.10)	(0.10)	(0.10)
45 mph		0.68	0.30	0.30	0.30
		(0.60)	(0.60)	(0.60)	(0.60)
55 & 65 mph		1.53***	0.88***	0.87***	0.87***
		(0.21)	(0.21)	(0.21)	(0.21)
Roadway segment length (in feet)		0.81***	0.83***	0.83***	0.83***
		(0.07)	(0.07)	(0.07)	(0.07)
Length (in feet) of limited access highways (log)		-0.05	-0.11*	-0.11*	-0.11*
		(0.05)	(0.05)	(0.05)	(0.05)
Length (in feet) of secondary highways (log)		0.14***	0.09**	0.09**	0.09**
		(0.03)	(0.03)	(0.03)	(0.03)
Length (in feet) of major arterials (log)		0.09***	0.06*	0.06*	0.06*
		(0.03)	(0.03)	(0.03)	(0.03)
Length (in feet) of secondary highways: one way (log)		0.03	0.05	0.04	0.04
		(0.05)	(0.05)	(0.05)	(0.05)
Length (in feet) of major arterials: one way (log)		0.03	0.02	0.01	0.02
		(0.05)	(0.05)	(0.05)	(0.05)
AADT missing dummy		-2.03***	0.08	0.09	0.09
		(0.51)	(0.54)	(0.54)	(0.54)
Intersection dummy		5.37***	5.24***	5.25***	5.24***
		(0.45)	(0.45)	(0.45)	(0.45)
Philadelphia intercept	2.17***	1.87***	1.91***	1.46***	1.29***
	(0.21)	(0.22)	(0.23)	(0.25)	(0.26)
Constant	-7.39***	-7.68***	-13.37***	-17.13***	-15.65***
	(0.13)	(0.37)	(0.61)	(0.81)	(0.93)
AIC	8,573	8,553	8,021	7,853	7,848
BIC	8,636	8,647	8,239	8,093	8,119

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in italic are measured on Census tract level as opposed to segment/intersection level

Appendix B.6 Random intercept multilevel negative binomial models of pedestrian fatalities by segment/intersection in the Philadelphia region

	Control levels					
	None	Demographics	Roadway	Exposure	Land use	Full
	Estimate (standard error)					
<i>Population density (log) in Philadelphia</i>	-0.16*** (0.05)	-0.27*** (0.06)	-0.14* (0.06)	-0.13* (0.06)	-0.10 (0.06)	-0.11 (0.06)
<i>Population density (log) in suburbs</i>	0.32** (0.10)	0.20* (0.10)	0.33** (0.11)	0.32** (0.12)	0.32** (0.12)	0.26* (0.13)

<i>Proportion of black residents (log)</i>	0.11 (0.08)	0.10 (0.08)	0.11 (0.08)	0.10 (0.08)	0.12 (0.08)
<i>Proportion of families in poverty (log)</i>	0.22 (0.11)	0.24* (0.11)	0.23* (0.11)	0.14 (0.11)	0.17 (0.11)
<i>Proportion of residents over 64 (log)</i>	0.10 (0.14)	0.03 (0.14)	0.004 (0.14)	0.01 (0.14)	0.01 (0.14)
<i>Jobs per acre (log)</i>					0.13 (0.10)
<i>Land use diversity</i>				0.22** (0.08)	0.16 (0.09)
<i>Public school enrollments (log)</i>				0.01 (0.02)	0.02 (0.02)
<i>Street link-to-node ratio</i>				-0.52 (0.37)	-0.44 (0.37)
<i>Pedestrian exposure (log)</i>			0.07 (0.09)	-0.004 (0.10)	-0.11 (0.12)
Average annual daily traffic (log)			0.31*** (0.04)	0.31*** (0.04)	0.31*** (0.04)
Speed limit (reference category: 25 mph and low frequency)					
None available		0.56* (0.26)	0.46 (0.26)	0.45 (0.26)	0.44 (0.26)
35 mph		0.88*** (0.15)	0.67*** (0.16)	0.65*** (0.16)	0.65*** (0.16)
45 mph		0.95 (0.63)	0.68 (0.63)	0.70 (0.63)	0.71 (0.63)
55 & 65 mph		1.20*** (0.30)	0.71* (0.30)	0.67* (0.30)	0.66* (0.30)
Roadway segment length (in feet)		0.76*** (0.10)	0.78*** (0.10)	0.78*** (0.10)	0.79*** (0.10)
Length (in feet) of limited access highways (log)		0.09 (0.06)	0.02 (0.06)	0.02 (0.06)	0.02 (0.06)
Length (in feet) of secondary highways (log)		0.25*** (0.04)	0.21*** (0.04)	0.21*** (0.04)	0.21*** (0.04)
Length (in feet) of major arterials (log)		0.14*** (0.04)	0.11** (0.04)	0.11** (0.04)	0.11** (0.04)
Length (in feet) of secondary highways: one way (log)		0.04 (0.06)	0.04 (0.06)	0.04 (0.06)	0.04 (0.06)
Length (in feet) of major arterials: one way (log)		0.10 (0.06)	0.07 (0.07)	0.06 (0.07)	0.06 (0.07)
AADT missing dummy		-1.77** (0.59)	0.40 (0.65)	0.38 (0.65)	0.37 (0.65)
Intersection dummy		5.22*** (0.63)	5.09*** (0.63)	5.11*** (0.63)	5.15*** (0.63)
Philadelphia intercept	2.22*** (0.23)	1.98*** (0.25)	1.98*** (0.26)	1.81*** (0.30)	1.76*** (0.32)
Constant	-7.75*** (0.17)	-8.39*** (0.48)	-13.87*** (0.83)	-16.35*** (1.10)	-14.85*** (1.27)
AIC	4,330	4,324	4,048	3,974	3,971
BIC	4,392	4,418	4,267	4,214	4,252

Significance levels: < 0.001 ***, < 0.01 **, < 0.05 *

Variables in italic are measured on Census tract level as opposed to segment/intersection level