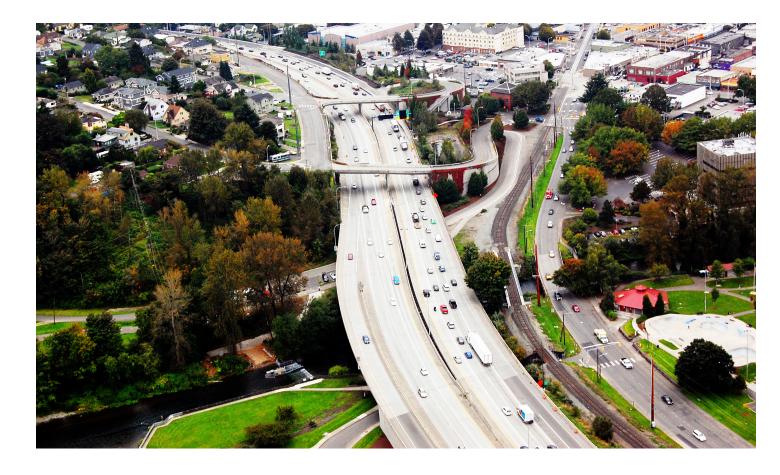
An Implementation Framework for Random Parameter Models for Crash Frequency Prediction and Safety Investment Prioritization on the Washington State DOT Highway Network

WA-RD 886.1

Jeremy Blum Shuaiqi Huang Puttipan Seraneeprakarn Narayan Venkataraman Venky Shankar June 2018





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Research Report

Agreement GCA6865 WA-RD 886.1

An Implementation Framework for Random Parameter Models for Crash Frequency Prediction and Safety Investment Prioritization on the Washington State DOT Highway Network

by

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> Washington State Department of Transportation Technical Monitor: John Milton

> > Prepared for

The State of Washington Department of Transportation Roger Millar, Secretary 30 June 2018

TECHNICAL REPORT DOCUMENTATION PAGE

I. Report No. 2. Government Accession No. 3. Recipient's Catalog No. WA:RD 886.1 5. Report Date 30 June 2018	IECHNIC	CAL REPORT DOCU	MENTATION PAGE	
4. Title and Subtitle 5. Report Date An Implementation Framework for Random Parameter Models for Crash Frequency 30. June 2018 Prediction and Safety Investment Prioritization on the Washington State DOT 30. June 2018 F. Author(s) 6. Performing Organization Code Jeremy Blum, PhD, Shuaiqi Huang, PhD Student, Puttipan Seraneeprakarn, PhD 8. Performing Organization Report No. Stremy Blum, PhD, Shuaiqi Huang, PhD Student, Puttipan Seraneeprakarn, PhD 8. Performing Organization Report No. Stremy Blum, PhD, Shuaiqi Huang, PhD Student, Puttipan Seraneeprakarn, PhD 8. Performing Organization Report No. Stremy Blum, PhD, Shuaiqi Huang, PhD Student, Puttipan Seraneeprakarn, PhD 10. Work Unit No. Stremy Blum, PhD, Shuaiqi Huang, PhD Student, Puttipan Seraneeprakarn, PhD 10. Work Unit No. Stremy Blum, PhD, Shuaiqi Huang, PhO Student, Puttipan Seraneeprakarn, PhD 11. Contract or Grant No. Agreement GCA6862 11. Tontract or Grant No. Agreement GCA6862 11. Sponsoring Agency Name and Address Research Office 13. Type of Report and Period Covered Washington State Department of Transportation 14. Sponsoring Agency Code 11. Supplementary Notes 15. Supplementary Notes 11. Study was conducted in cooperation with the U.S. Department of Transportation (Federal Highway Administration <th></th> <th>2. Government Accession</th> <th>No. 3. Recipient's Catalog No.</th> <th></th>		2. Government Accession	No. 3. Recipient's Catalog No.	
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17. Key Words	18. Distribution Stat	tement		
Random parameter models, crash frequency, safety	Enter any other agency mandated distribution statements.			
highway network, geometric attributes	Remove NTIS statement if it does not apply.			
19. Security Classif. (of this report)	ssif. (of this page)	21. No. of Pages	22. Price	
Unclassified.	Unclassified.		141	

Form DOT F 1700.7 (8-72)

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AN IMPLEMENTATION FRAMEWORK FOR RANDOM PARAMETER MODELS FOR CRASH FREQUENCY PREDICTION AND SAFETY INVESTMENT PRIORITIZATION ON THE WASHINGTON STATE DEPARTMENT OF TRANSPORTATION HIGHWAY NETWORK

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June 29, 2018

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1. Introduction

The Washington State Department of Transportation (WSDOT) highway network is comprised of multiple functional classes, ranging from two-lane rural, to two-lane urban, interstate, and other classes. This study is focused on developing a framework for implementing random parameter models of annual crash frequency for these roadway classes. The implementation framework includes statistical models developed for the two-year period 2014-2015 at the 1-mile scale, and a web-based interface that embeds the 1-mile models in a user-friendly manner. The objective of the web-based interface is to provide to decision makers a facility to evaluate the impact of changes in geometric attributes on predicted crash counts for any segment on the WSDOT highway network. To the authors' knowledge, a systematic framework that includes "what-if" scenario capability using random parameter models is not established in the literature. Table 1.1 shows the descriptive statistics for the 1-mile segment network for the entire state.

	Functional Class					
			Non-two-lane and Non-	Non-two-lane and Non-		
Route	Two-lane Rural	Two-lane Urban	Interstate Rural	Interstate Urban	Interstate	
2	230	7	57	28	0	
3	38	3	0	19	0	
4	55	0	1	6	0	
5	0	0	0	0	277	
6	51	0	0	0	0	
7	40	4	0	14	0	
8	0	0	21	0	0	
9	52	26	0	11	0	
10	16	0	0	0	0	
11	19	1	0	0	0	
12	261	0	42	21	0	
14	161	4	0	15	0	
16	0	0	3	24	0	
17	124	2	2	7	0	
18	6	0	4	18	0	
19	13	0	0	0	0	
20	363	17	5	10	0	
21	179	0	0	0	0	
22	32	3	1	0	0	
23	66	0	0	0	0	
24	72	5	0	2	0	
25	121	0	0	0	0	
26	133	1	0	0	0	
27	80	2	1	5	0	
28	112	17	0	6	0	
31	27	0	0	0	0	
41	0	0	1	0	0	
82	0	0	0	0	132	
90	0	0	0	0	297	
92	0	7	0	1	0	

Table 1.1 Summary descriptive statistics of 1-mile fixed-length segments for all functional classes

	Functional Class							
			Non-two-lane	Non-two-lane				
Douto	True lane Drugel	True lana Unhan	and Non-	and Non-	Tradorando do			
Route 96	Two-lane Rural	Two-lane Urban 3	Interstate Rural 0	Interstate Urban 3	<u>Interstate</u> 0			
90 97	228	0	17	4	0			
97	0	0	0	4	0			
100	5	0	0	0	0			
100	315	7	30	13	0			
101	16	0	0	0	0			
103	23	2	2	4	0			
104	45	1	0	2	0			
105	20	0	0	0	0			
100	8	0	0	0	0			
107	<u> </u>	0	1	0	0			
108	36	4	0	0	0			
1109	30	0	0	0	0			
110	61	0	0	0	0			
112	10	0	0	0	0			
115	2	0	0	0	0			
115	6	0	0	0	0			
117	0	0	0	0	0			
117	9	0	0	0	0			
121	7	0	0	0	0			
121	8	0	0	0	0			
122	16	0	0	0	0			
123	42	2	1	0	0			
124	16	3	2	3	0			
125	27	0	0	0	0			
127	0	0	0	0	0			
129	36	4	0	1	0			
131	2	0	0	0	0			
131	26	0	0	0	0			
142	35	0	0	0	0			
150	11	0	0	0	0			
153	31	0	0	0	0			
155	78	0	0	0	0			
160	4	3	0	0	0			
161	16	0	0	14	0			
162	0	16	0	1	0			
163	0	0	0	3	0			
164	7	6	0	1	0			
165	16	3	0	0	0			
166	0	3	0	2	0			
167	0	0	0	28	0			

 Table 1.1 (Continued) Summary descriptive statistics of 1-mile fixed-length segments for all functional classes

	Functional Class						
			Non-two-lane	Non-two-lane			
Route	Two-lane Rural	Two-lane Urban	and Non- Interstate Rural	and Non- Interstate Urban	Interstate		
169	7	1 wo-lane Orban 8	2	7	0		
109	3	0	1	0	0		
170	0	1	0	2	0		
172	35	0	0	0	0		
172	12	0	0	0	0		
173	40	0	1	0	0		
181	0	0	0	6	0		
182	0	0	0	0	15		
102	2	0	0	0	0		
193	14	0	0	0	0		
195	75	0	14	3	0		
195	1	0	1	0	0		
202	15	9	1	5	0		
202	21	2	1	0	0		
203	0	1	0	1	0		
205	0	0	0	0	11		
205	13	2	0	0	0		
207	4	0	0	0	0		
211	15	0	0	0	0		
213	1	0	0	0	0		
215	6	0	0	0	0		
221	26	0	0	0	0		
223	4	0	0	0	0		
224	6	0	0	3	0		
225	11	0	0	0	0		
231	72	0	0	0	0		
240	22	5	0	12	0		
241	23	2	0	0	0		
243	28	0	0	0	0		
260	38	0	0	0	0		
261	56	0	0	0	0		
262	20	0	0	0	0		
263	9	0	0	0	0		
270	2	0	3	5	0		
271	8	0	0	0	0		
272	19	0	0	0	0		
274	2	0	0	0	0		
278	3	0	0	0	0		
281	9	0	1	0	0		
282	4	1	0	0	0		
283	14	0	1	0	0		

Table 1.1 (Continued) Summary descriptive statistics of 1-mile fixed-length segments for all functional classes

	Functional Class							
			Non-two-lane	Non-two-lane				
Route	Two-lane Rural	Two-lane Urban	and Non- Interstate Rural	and Non- Interstate Urban	Interstate			
285	0	0	0	5	0			
290	0	5	1	12	0			
290	15	3	0	5	0			
292	6	0	0	0	0			
300	3	0	0	0	0			
302	10	4	0	3	0			
303	0	0	0	9	0			
304	0	0	0	3	0			
305	3	8	0	1	0			
307	3	1	1	0	0			
308	0	2	0	1	0			
310	0	0	0	2	0			
395	94	1	76	16	0			
397	1	14	0	6	0			
401	11	0	1	0	0			
405	0	0	0	0	30			
409	3	0	1	0	0			
410	89	10	0	8	0			
411	7	6	0	0	0			
432	3	2	0	4	0			
433	0	0	0	1	0			
500	0	11	0	11	0			
501	3	8	2	1	0			
502	1	3	2	0	0			
503	44	3	0	6	0			
504	52	0	0	0	0			
505	19	0	0	0	0			
506	10	0	1	0	0			
507	38	3	0	2	0			
508	31	1	1	0	0			
509	0	12	0	15	0			
510	6	4	1	2	0			
512	0	0	0	12	0			
513	0	0	0	3	0			
515	0	0	0	7	0			
516	0	3	0	13	0			
518	0	0	0	3	0			
519	0	0	0	1	0			
520	0	0	0	13	0			
522	0	3	0	21	0			
523	0	0	0	1	0			

 Table 1.1 (Continued) Summary descriptive statistics of 1-mile fixed-length segments for all functional classes

	Functional Class					
Route	Two-lane Rural	Two-lane Urban	Non-two-lane and Non- Interstate Rural	Non-two-lane and Non- Interstate Urban	Interstate	
524	0	7	0	8	0	
525	19	2	2	7	0	
526	0	0	0	4	0	
527	0	0	0	9	0	
528	0	0	0	3	0	
529	0	0	0	7	0	
530	48	1	0	0	0	
531	5	3	1	0	0	
532	9	0	1	0	0	
534	4	0	1	0	0	
536	2	2	0	1	0	
538	0	0	0	3	0	
539	3	1	7	4	0	
542	52	3	1	1	0	
543	1	0	0	0	0	
544	9	0	0	0	0	
546	8	0	0	0	0	
547	10	0	0	0	0	
548	8	5	1	0	0	
599	0	0	0	1	0	
702	8	0	1	0	0	
704	0	0	0	1	0	
705	0	0	0	0	1	
706	14	0	0	0	0	
730	6	0	0	0	0	
821	23	1	1	0	0	
823	0	1	0	4	0	
900	0	5	2	7	0	
902	12	0	0	0	0	
903	10	0	0	0	0	
904	13	1	1	2	0	
906	3	0	0	0	0	
970	10	0	0	0	0	
971	10	0	0	0	0	
Total	4,806	362	323	607	763	
Total length (miles)	4,808.16	361.18	321.66	611.1	763.83	

 Table 1.1 (Continued) Summary descriptive statistics of 1-mile fixed-length segments for all functional classes

As seen in Table 1.1, the total number of segments for each functional class is defined by 1-mile segment counts. The 1-mile segment counts are typically contiguous segments. A 1-mile segmentation scale was used to ensure project-level consistency with decisions arising from a random parameter statistical model. In the literature, a variety of segmentations have been analyzed – from homogeneous segments (which can be as small as 0.01 miles) to segmentation that includes homogeneous segments with respect to curvature,

to segmentation that is fixed-length in nature (for example, 1 mile). The 1-mile segmentation provides the facility to analyze the impact of corridor-level safety investments. This is done due to the fact that heterogeneity in the corridors is addressed at a higher scale than the typical homogeneous segment scale. Second, the 1-mile scale also enables compatibility with network screening methods that are widely used in the application of the highway safety manual (HSM).

As observed in Table 1.1, the two-lane rural network used in our implementation framework totals 4,806 miles consisting of 4,806 segments. Another 362 segments constitute the two-lane urban network, while 763 segments constitute the interstate network. The remaining functional classes are defined collectively as non-two-lane-non-interstate urban and non-two-lane-non-interstate rural, respectively. These two classes collectively are comprised of 930 segments. In total, the network coverage totals 6,861 segments covering 6,865.93 miles. This reflects a 95.2 percentage usage of the available network. About 4.8 percent of the network was not used because of incomplete roadway information. Therefore, the used portion of the network includes complete geometric information on shoulder width, number of lanes, curvature, volume, pavement type, median treatment, and median type. The total mileage used in the modeling in this study reflects the fact that the last segment is not exactly 1 mile long.

The 1-mile segmentation also requires a different approach to the measurement of roadway geometrics. Since geometrics can vary over 1 mile, we use weighted averages of the geometric variables. In addition, we also assembled variables measuring the frequency of geometric variables occurring over 1 mile (such as count of vertical curves or horizontal curves).

To evaluate scale-specific effects with respect to heterogeneity, we also estimate random parameter models at the 0.5-mile and 0.25-mile segment scales. Descriptive statistics of the 0.5-mile segment network are shown in Table A.1 (in Appendix A). As shown in Table A.1, the number of segments is not exactly double the number used in the 1-mile network. This is because small discontinuities in functional classification result in loss of segment coverage as the scale is shortened. For the 1-mile segmentation models, we assumed a 90% functional class threshold to define if a segment belonged to a particular functional class.

Table A.2 shows the 0.25-mile segmentation network broken down by functional classes. The number of segments is roughly four times that used for the 1-mile segmentation network. This allows for a larger sample size for statistical model development on the one hand; on the other hand, it also poses limitations in usability of the model for project-level decisions.

2. Data description and assembly

Table 2.1 shows the variable types and associated data elements that were available after segmentation of the raw state highway network data into fixed-length segments. Seven major variable types were identified and assembled through multiple data elements for each type. The seven variable types were ADT, horizontal curvature, vertical curvature, travel lane, roadway, travel shoulder, and median. As is shown in the table, a variety of data elements were constructed for the seven variable types. The construction of this detailed set of data elements provided the basis for comprehensive random parameter model specification. This ensured that the correct random parameters were identified, by limiting potential omitted variable effects.

Table 2.2 shows the summary of variable categories developed and used in the random parameter model estimations. The variable categories are common to the various functional classes and scales (1-mile, 0.5-mile and 0.25-mile). The majority of the variable types and data elements were continuous in nature. The one exception was the "urban-rural indicator," which was a binary variable.

The random parameter models were developed for the following outcomes: total crashes, property damage only, possible injury, evident injury, severe injury, and fatal injury. These outcomes were modeled for three scales, at the 1-mile, 0.5-mile, and 0.25-mile fixed-length segmentations.

Variable Type		Data	a Elements	
	Weighted Average	Weighted Average	Natural Logarithm of	
ADT	of ADT	of ADT/10000	Weighted Average	
Horizontal curve information	Count of horizontal curves	Count of horizontal curves for specific radius range, central angle or design speed range	Proportion of horizontal curves for specific radius range, central angle or design speed range	Natural logarithm of proportion of horizontal curves for specific radius range, central angle or design speed range
Vertical curve information	Count of vertical curves	Count of vertical curves for specific K-value range or design speed range	Proportion of vertical curves for specific K- value range or design speed range, or ranges of absolute begin and ending grades	Natural logarithm of proportion of vertical curves for specific K- value range or design speed range, or ranges of absolute begin and ending grades
Travel lane information	Proportion of number of lanes in cross section			
Roadway information	Weighted average of width	Proportion of ranges of weighted average of width		
Travel shoulder information	Weighted average of width	Proportion of ranges of weighted average of width	Proportion of shoulder surface type	
Median information	Proportion of ranges of weighted average of width	Proportion of median surface type		

Table 2.1 Variable types and data elements assembled for fixed-length segmentation models

Table 2.2. Continuous data elements for the seven variable types

Variable Category	Continuous					
	Original Value	Natural Logarithm of Original Value	Count	Proportion	Natural Logarithm of Proportion	
ADT	\checkmark	\checkmark				
Horizontal curve information			\checkmark	~	\checkmark	
Vertical curve information			\checkmark	✓	\checkmark	
Travel lane information				✓		
Roadway information				✓		
Travel shoulder information				✓		
Median information				✓		

Table 2.3 shows the summary of crashes by the various functional classes. As shown in the table, crash summaries are broken down by years 2014 and 2015. The distribution of severity across the two years remains stable, with property-damage-only crashes resulting in around 65% to 70% of all crashes. The severity distribution across functional classes varies. Interstate crashes are comprised of 70% PDOs. On the other end of the severity spectrum, fatal crashes comprise 1.2% of all two-lane crashes, while interstate crashes consist of 0.3% fatal crashes.

Descriptive statistics for key variables used in the estimation of random parameters models are provided in Appendix B in Tables B.1 through B.3.

			Severity of Crash				
Function Class	Year	Property Damage Only	Possible Injury	Evident Injury	Serious Injury	Fatality	
Two-lane	2014	4,195	1,230	784	185	85	
rural	2015	4,473	1,267	829	175	86	
Two-lane	2014	2,544	959	294	61	16	
urban	2015	2,831	1,009	337	67	17	
Non-interstate	2014	864	235	111	30	10	
and non-two- lane rural	2015	889	256	130	26	15	
Non-interstate	2014	10,326	3,663	889	164	44	
and non-two- lane urban	2015	11,285	4,018	1,008	195	47	
	2014	9,839	2,992	728	110	34	
Interstate	2015	10,973	3,193	776	118	50	

Table 2.3 Descriptive statistic of crash counts

3. Random parameter modeling results

The random parameters models for the various severity outcomes across the functional classes resulted in the identification of random parameters as shown in the tables that follow. For example, Tables 3.1 through 3.6 show the random parameter occurrence by variable type for functional classes named two-lane rural (TLR), two-lane urban (TLU), non-interstate, non-two-lane rural (NINTR), non-interstate, non-two-lane rural (NINTU), and Interstate (INT). The interstate model appears to have the greatest number of random parameters, while the NINTR consists of the least number of random parameters. This pattern appears to be consistent across the severity outcomes. In the NINTR case, the higher severity models do not consist of random parameters (in particular, serious and fatal injury models). Travel shoulder variable types have the greatest number of random parameters, followed by vertical curvature variable types and travel lane and roadway variable types. This suggests that unobserved heterogeneity may be most prevalent in travel shoulder data elements, followed by vertical curvature data elements. This pattern appears to repeat across segmentation scales, namely the 0.5-mile and 0.25-mile scales. The tables for 0.5-mile and 0.25-mile segmentations are shown in Appendix C, in tables C.1 through C.12. Further in Appendix C, model estimation results are shown for all segmentations, for six severity outcomes. These tables are numbered C.13 through C.30.

_	0				
Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	1	0	0
Dummy variable	0	0	0	0	1
Horizontal curve information	2	0	0	1	1
Vertical curve information	3	0	0	2	4
Travel lane information	2	1	1	1	1
Roadway information	0	2	0	2	2
Travel shoulder information	3	3	1	0	5
Median information	0	0	0	1	1

Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	3	0	0	1	1
Vertical curve information	3	0	1	2	4
Travel lane information	0	1	0	1	1
Roadway information	0	2	0	0	2
Travel shoulder information	3	1	1	2	5
Median information	0	0	0	0	1

Table 3.2 Random parameter occurrence of property-damage-only crash models for 1-mile segments

Table 3.3 Random parameter occurrence of possible injury crash models for 1-mile segments

Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	2	0	0	0	3
Vertical curve information	3	1	1	2	1
Travel lane information	0	1	0	0	1
Roadway information	1	2	1	2	3
Travel shoulder information	1	0	1	2	3
Median information	0	0	0	2	1

Table 3.4 Random parameter occurrence of evident injury crash models for 1-mile segments

Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	0	0
Vertical curve information	1	0	0	0	1
Travel lane information	1	0	1	0	0
Roadway information	0	1	1	2	1
Travel shoulder information	0	1	0	0	3
Median information	0	0	0	0	1

Table 3.5 Random parameter occurrence of serious injury crash models for 1-mile segments

Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	0
Horizontal curve information	0	0	0	0	1
Vertical curve information	2	0	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	2	2
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

Function Class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	0
Horizontal curve information	0	0	0	0	1
Vertical curve information	1	1	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	0	0
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

Table 3.6 Random parameter occurrence of fatal crash models for 1-mile segments

4. Implementation framework for random parameter models

The design of the implementation framework for the random parameter models started with the definition of a set of goals and the identification of potential challenges for the framework. With these goals and challenges in mind, different implementation approaches were evaluated. Ultimately, a design for a webbased application was selected. This model was chosen for its flexibility in the presentation of the model results; scalability in incorporating both a large number of models in its initial version and the ability to accommodate yearly models in the future; and its ability to leverage existing data presentation tools.

4.1 Goals and Challenges

The primary goal of the framework was to create a system that would allow for new ways of presenting the analysis from the random parameter models. The framework should allow for the presentation of estimated and actual crash frequencies and severities. It should allow for the exploration of problematic segments by crash type and investigate model predictions of the effect of infrastructure changes on crash severity and frequency. Moreover, the framework should expose the large amount of information captured in the random parameter models in ways that can inform the transportation planning process. In capturing segment-specific heterogeneity in parameter estimates, these models hold a great amount of information about roadway segments; however, given the number of segments in the study, the richness of analysis in these models is not readily presented. Rather than fixed parameter values and summaries of central tendencies and dispersion for random parameters, the goal of this framework is to explore ways of presenting these values to be used by practitioners.

In addition to meeting the challenges in creating new ways to visualize the models, the creation of the framework faced a significant scalability challenge. Models were created for each of five functional classes and six injury severities. These thirty models cover 6,861 segments, with 99 fixed and random parameters. The values include nearly 70,000 random parameter values, as well as attribute values for each segment.

While the initial framework presents the 2014/2015 combined model, the design needed to be flexible enough to be able to include yearly models in addition. Ultimately, the inclusion of a decade or more worth of models would lead to the need to store millions of values and efficiently be able to retrieve and manipulate them.

4.2 Alternative Designs for Implementation

The first design that was explored was a spreadsheet-based system that presented the models using Excel. Although there was concern with the scalability of this approach, the design would have the advantage of

providing a familiar interface for practitioners. A prototype was developed that included only the two-lane, rural functional class. This is the largest functional class, in terms of the number of segments, so that it presented a good test for the scalability of this approach. The prototype that was developed supported concerns about the scalability of this approach. A number of the required operations were extremely slow, and given the limitations of the Excel programming language were difficult to optimize. The performance may have been acceptable if separate spreadsheets were developed for each functional class. However, this would limit the ability to analyze the entirety of many routes, since a number of routes in the Washington State road network span multiple functional classes.

Due to the scalability concerns with the Excel-based approach, a design for a web-application was selected. The web application design included static files, without the need to run any server side scripting. The static files include base html files, style sheets, data files, and a number of JavaScript files.

4.3 Requirements for Views for Web-Based System

The system was designed to provide three distinct views into the random parameter models. The views provide different levels of granularity for the exploration of the models.

At the highest level, the models can be explored at the route level. The user should be able to select a route, and then view both expected and actual crashes on segments on the route. The view should allow for the display of these crashes as a heat map on an aerial view of the route, and as a histogram plotting crashes for each segment by the adjusted route milepost (ARM).

At the next level of granularity, a driver view should allow for the exploration of a portion of a route using driver views provided on the Washington State Department of Transportation website. In addition to presenting actual crashes and estimated crashes from the models, this view should allow practitioners to explore segments, either by simulating driving on the segment or manually jumping through images.

The segment-level view will provide the ability to explore the models at the segment level. This view will present the attributes and parameters that are used by the models for each type of crash severity for a given segment. In addition, this view will allow users to explore the effect of attribute changes on model predictions for each segment.

4.4 File Structure

The web application consists of entirely static content. This content includes html files, style sheets, clientside JavaScript files, and JSON-encoded data files.

The application is accessed via an index.html file. This file contains all of the resources for the dashboard. The other html file is an about file, presenting a user guide for the system, and contact information in the case of problems.

The index.html file loads style sheets and client-side JavaScript files. The style sheets customize the display of the HTML elements. The client-side JavaScript provides the dynamic behavior of the dashboard and include the following files:

- /js/main.js: This file loads the various JSON-encoded data files and allows for navigation between views in the dashboard.
- /js/Plotting/route_select.js: This file contains the code used to respond to changes in selection of routes and starting and ending ARMs on a route.

- /js/Plotting/map.js: This file contains the code used to create a crash heat map on the Google map object.
- /js/Plotting/crashPlot.js: This file contains the code used to generate the histograms of crashes versus ARM in the Route View.
- /js/Plotting/driver.js: This file contains the code that provides the dynamic functionality in the Driver View
- /js/Plotting/segment.js: This file manages the dynamic display of items in the Segment View

The JSON-encoded data files capture all of the data that back the dashboard. This includes attributes for each segment, including both model attributes and latitude and longitude information, the parameter values used in the models, and historical crash counts. The data are structured to enable fast access based on routes and segments.

4.5 External Resources

The web-based application provides the ability to leverage existing libraries and resources. The external resources used by the application are freely available, with the exception of the Google Maps resources. However, the pricing for Google Maps provides a large quota of free usage, which should be more than adequate for internal use of the tool by the Washington State DOT, at no cost. The specific external resources include:

JQuery (<u>https://jquery.com/</u>) is a JavaScript library that simplifies a number of tasks, including providing multi-browser support. This library is free to use under the MIT license, allowing for commercial use, as long as the copyright header is left intact.

Bootstrap (<u>https://getbootstrap.com/docs/</u>) provides cascading style sheets that simplify support for multiple screen sizes and browsers. It is also available under the MIT license.

The dashboard uses the Material Dashboard React template provided by <u>www.creative-tim.com</u>. Like the previous two resources, this template is available under the MIT license.

Plotly (<u>https://plot.ly/</u>) is an open source tool for creating plots and maps. The plots that are used in the system are all available under the free tier.

Google Maps is available via a paid subscription from Google. The original system called for the use of Plotly's map capability. However, the performance of the map was poor, so the system ultimately uses Google Maps instead. The Google Maps API subscription provides a free tier with \$200 worth of free usage every month, which Google asserts is enough for most users. For this system, the free usage includes 100,000 static maps per month, or about 3,300 per day. After exceeding the free usage limits, billing is at \$0.50 USD per 1,000 additional requests, up to 100,000 per 24 hours. The system designers believe that this free allowance should be adequate for internal Washington State DOT usage. Currently the API key that provides access to the system is tied to the Penn State network. When the system is moved to be hosted on the Washington State website, a new API key will need to be set in the index.html file.

The final external resource is provided from the Washington State DOT system. The images for the Driver View are dynamically retrieved, as needed from the Washington State DOT State Route Web tool.

5. Demonstration of implementation framework

A demonstration of the implementation framework is presented in the form of a dashboard system. It can be accessed by using an up-to-date web browser, e.g. Chrome v. 54 or newer. The system is accessed via the url <u>https://turing.cs.hbg.psu.edu/wsdot</u>. The web page is currently password protected. Please send an email to <u>jjb24@psu.edu</u> to obtain the login credentials.

5.1 Route View

When the web page is first opened, the screen in figure 5.1 appears. From the initial screen, the user can select a route, change to a different view, or select the About/Help page.

	Washington State Department of Transportation Dashboard		
Route View	Salect Route		
Driver's View			
Segment Analysis	Route Map Crashes by Segment		
About/Help			

Figure 5.1: Initial dashboard screen

If the user selects a route in the initial page, a crash map and histogram are displayed on the Route View page, as shown in Figure 5.2. The map presents a heat map of crashes on the route, with the colors set dynamically for the roadway portion that is selected. Green represents segments with no crashes, while red is used for segments with the maximum number of crashes in the selected roadway portion.

Using the boxes at the top of the screen, the user can adjust the beginning and ending ARM for the route being displayed. The ARM location choices presented in the dropdowns correspond to the segments used in the random parameter models.



Washington State Department of Transportation Dashboard

Figure 5.2: The Route View after a route has been selected

In addition to displaying a heat map, the map includes additional functionality. As shown in Figure 5.3, hovering the mouse pointer over a segment will cause an informational window to pop up with the position and crash statistics for a segment.

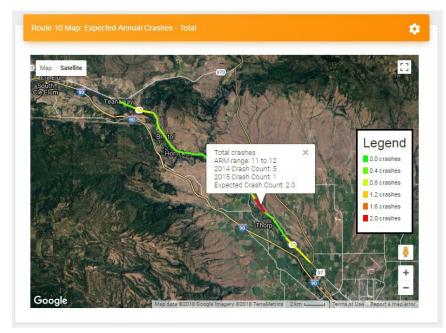


Figure 5.3: Map functionality in Route View

In addition, the map contains the typical functionality in Google Maps. Users can switch between Map and Satellite views via buttons at the top left; toggle the display of labels by hovering the mouse over these buttons; pan by clicking and dragging the map; zoom in and out using the plus and minus icons at the bottom right of the map; drag the person icon to a portion of the roadway to see a street level view; and click on the icon at the top right to see the map in full screen mode.

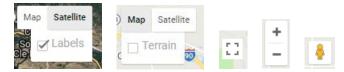


Figure 5.4: Maps API-provided functionality. From left to right, these include satellite imagery with or without map labels; a map display with or without terrain; full screen mode; zoom controls; and street-level view

The histogram also provides a set of additional functionality. As shown in Figure 5.5, hovering over the graph will show the plotted values in the graph, and the beginning ARM for a segment. Moreover, the user can click and drag to zoom in on a portion of the graph. Finally, hovering the mouse over the graph causes a set of icons to appear at the top right, which allows the user to access additional Plotly functionality.



Figure 5.5: Additional functionality for the histogram

The buttons at the top of the histogram provide the following capabilities:

- Download the plot as an image file. Clicking on this icon will cause an image of the graph to be downloaded in Portable Network Graphic (png) format.
- This icon will open the graph in the Chart Editor on Plotly's website. The editor allows you to change the plot layout, edit the underlying data, and export the resulting chart.
- When this icon will be selected, mouse interactions with the chart will cause the display to zoom.

- When this icon will be selected, mouse interactions with the chart will cause the display to pan left and right, or up and down.
- E Clicking this icon causes the display to zoom in.
- Clicking this icon causes the display to zoom out.
- Clicking this icon restores the display to auto-scale, removing any effects of previous zoom and pan operations.
- Clicking this icon restores the axes, which also removes any effects of previous zoom and pan operations.
- The functionality provide by this icon is not used in the current system.
- When this icon is selected and multiple data series are plotted, hovering over the chart will show values from the closest data series, rather than all of them.
 - When this icon is selected and multiple data series are plotted, hovering over the chart will show values from all of the data series, rather than just the one closest to the mouse pointer.

By default, the map in the Route View will display the predicted annual crashes from the Random Parameter Models, and the graph will display these predictions and the actual annual crashes from the years 2014 and 2015. The expected crashes are generated at the segment level based on the functional class for each segment. Thus, if a roadway contains segments from multiple functional classes (e.g., Route 2), the predictions displayed will use multiple models, choosing the model appropriate for each segment's functional class.

Clicking on the gear icons at the top of the map and the chart will display a pop-up menu that allows the user to select different values to be plotted. As shown in Figure 5.6, the menu will allow the user to select either expected or annual crashes to be displayed in the map. In addition, the user can choose to display total crashes or select crashes by injury outcome. Clicking on either the gear or the *OK* button will apply the changes to the map. For the histogram, the user can select multiple data series to be plotted at one time, in addition to being able to specify the crash type.

Select Attribute O Expected annual crashes	Select Attributes Expected annual crashes Annual crashes (2014/2015) Annual crashes (2014)
Actual annual crashes (2014/2015) Select Crash Type Total OK	Annual crashes (2015) Select Crash Type Total Total
al Crashes - Total 🔹	\$

Figure 5.6: Pop-up menus for the map (left) and histogram (right) in the Route View

5.2 Driver's View

To select the Driver's View, the user should click on the corresponding icon to the left of the screen. If a route has already been selected in another view, the top of the view will appear as Figure 5.7, with an additional box at the top of the screen that controls which direction of travel is displayed, either the view from the direction of increasing mileposts or that of decreasing mileposts. If the user selects the Driver's View without first selecting a route, a route can be chosen at the top of this screen to enable this functionality.

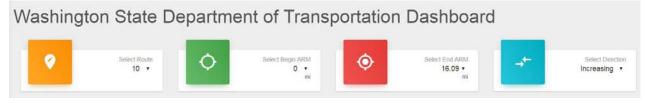


Figure 5.7: In the Driver's View, in addition to selecting a route and the beginning/ending ARMs, users may specify the direction of travel in the view

Once a route has been selected, the user can scroll through the segment, viewing the roadway from the driver's point of view, as well as expected and actual crash rates on each segment, as shown in Figure 5.8. The image on the left is the view from the front of the vehicle, and the image on the right is a view of the roadway to the right of the vehicle. The images that are displayed are dynamically served by the Washington State DOT State Route Web tool.



Figure 5.8: The Driver's View in the dashboard

The controls at the bottom of the screen provide the following functionality:

- Go back to the start of the segment. If the user is already at the start of a segment and the previous segment is a portion of the range selected at the top of the screen, this button will go to the start of the previous segment. The previous segment is defined in terms of the direction of travel. Thus if displaying views in the decreasing direction, selecting this button will increase the current ARM.
- Go back 1/100th of a mile in the direction of travel, if the location is within the selected range.
 - Play (or pause) the views as a slideshow. The playback speed slider controls how quickly images are changed in the slideshow.
- Go forward 1/100th of a mile in the direction of travel, if the location is within the selected range.
 - Go forward to the start of the next segment in the direction of travel. If the next segment is outside of the selected range at the top of the screen, this button will go to the end of the current segment.

5.3 Segment Analysis View

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The Segment Analysis View provides the ability to investigate information captured in the models at the segment level. To begin using this view, one must select a segment within the selected range for a route, which is done in the right-most box at the top of the screen (Figure 5.9).

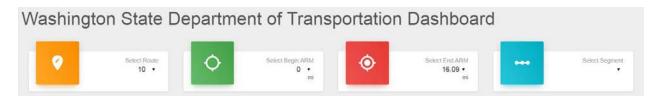


Figure 5.9: The controls for the Segment Analysis View in the dashboard

Once a segment has been selected, the four panes allow for investigation of the segment attributes and parameters. The pane at the top left provides the same map view as in the Route View, with the same functionality described previously.

The pane at the top right provides the ability to investigate the effect of changes in a segment's attribute on model predictions of the expected number of crashes. Initially this box is blank, waiting for the user to select an attribute. As shown in Figure 5.9, once an attribute is selected, the user can view the parameters associated with that attribute in models for different crash types. For example, in Figure 5.10, the user has selected attribute *Count of horizontal curves with an angle of deflection less than or equal to 500 degrees*. The system shows the current value for this attribute (2) and the parameters associated with this attribute in different models.

Count of h Current ∨al	bute (grayed out attribu oriz. curves with angle lue: 2		-	Ŧ
Select New	/ Value: 2			
Calculate	expected values after of	change		
Crash Severity	Parameter Value in Model for this Attribute	Annual Crashes (2014/2015)	Current Expected Annual Crashes	Expected Annual Crashes After Change
Total	0.077	2	0.967	
Property Damage Only	0.106	1	0.481	
Probable Injury	0.177	0.5	0.213	
Evident Injury	N/A	0.5	0.122	
Severe Injury	N/A	0	0.009	
Fatal Injury	N/A	0	0.013	

Figure 5.10: The Alter Segment box in the Segment Analysis View after an attribute has been selected

This parameter appears in the Total crash model, Property Damage Only model and the Probable Injury model. The positive values displayed for the parameters indicate that increases in this attribute value would be expected to increase the likelihood of the corresponding crash types. The "N/A" values for the parameter values in the other models indicate that this attribute was not included in those models. The table also displays the average annual crash rate for 2014 and 2015 and the expected annual crashes given the current parameter model.

Select Attribute (grayed out attributes represent categories): Count of horiz. curves with angle of deflection \leq 500 deg

Current Value: 2

Select New Value: 1

Calculate expected values after change

Crash Severity	Parameter Value in Model for this Attribute	Annual Crashes (2014/2015)	Current Expected Annual Crashes	Expected Annual Crashes After Change
Total	0.077	2	0.967	0.895 (-7.42%)
Property Damage Only	0.106	1	0.481	0.433 (-10.02%)
Probable Injury	0.177	0.5	0.213	0.178 (-16.18%)
Evident Injury	N/A	0.5	0.122	
Severe Injury	N/A	0	0.009	
Fatal Injury	N/A	0	0.013	

Figure 5.11: The Alter Segment box in the Segment Analysis View showing the effect of a new attribute value on the predicted annual crash rate

Changing the value in the Select New Value textbox (Figure 5.11), followed by a click on the button, allows the user to investigate changes in an attribute value on the model outputs. For example, in Figure 5.12, the number of horizontal curves with a deflection of 500 degrees or less was reduced to 1. This reduction caused the models to predict 7.42% fewer total crashes, 10.02% fewer property-damage-only crashes, and 16.18% fewer probable injury crashes.

The box at the bottom right of the Segment Analysis View provides measures of central tendency and dispersion for attributes used in models for the current functional class. The attributes are grouped based on their types (e.g., attributes-related horizontal curves, roadway, median, and so on). The measures are calculated across all segments in the current functional class. Since the segment from ARM 1 to 2 in Route 10 is a two-lane, rural road, the display, shown in Figure 5.12, has statistics for this functional class. For the first attribute, as an example, the value of 2 for this segment would put this segment in the top quartile for this attribute.

Attribute Statistics: Two-Lane Rural

Attribute	Minimum	1st Quartile	Median	Mean	3rd Quartile	Maximum	Standard Deviation		
	Horizontal Curve								
Count of horiz. curves with angle of deflection ≤ 500 deg	0.00	0.00	0.00	0.19	0.00	5.00	0.52		
Count of horiz. curves	0.00	1.00	2.00	2.54	4.00	20.00	2.50		
Log proportion of horiz. curves with design speed ≤ 25 mph	-4.61	-1.51	-0.80	-0.92	0.00	0.00	0.94		
Log proportion of horiz. curves with 30 ≤ design speed ≤ 35 mph		0.00	0.00	-0.41	0.00	0.00	0.89		
Log proportion of horiz. curves with 40 ≤ design speed ≤ 45		0.00	0.00	-0.17	0.00	0.00	0.58		

Figure 5.12: Summary statistics for the functional class of the chosen segment in the Segment Analysis View

The box at the bottom right of the Segment Analysis View, presents model parameters for all attributes in models for the current segment's functional class. Figure 5.13, for example, shows details on the parameters associated with the horizontal curve attribute. The Total and Probable Injury models included a fixed parameter for this attribute.

Model Parameters: Two-Lane Rural

	Fixed Parameter	Ra	Random Parameter		
Parameter	Crash Severity	Value	Value	Mean Across Segments	Standard Deviation Across Segments
	Total	0.586			
	Property Damage Only		0.630	0.198	0.434
Constant	Probable Injury		0.943	0.562	0.446
Constant	Evident Injury		-2.205	-2.498	0.213
	Severe Injury		-2.892	-2.883	0.097
	Fatal Injury	-3.746			
	Horizo	ntal Curve			
	Total	0.077			
Count of horiz. curves with angle of deflection ≤ 500 deg	Property Damage Only		0.106	0.073	0.010
deg	Probable Injury	0.177			

Figure 5.13: Parameter values for the functional class of the chosen segment in the Segment Analysis View

The property-damage-only model, on the other hand, included a random parameter for this attribute. The mean values for this parameter across all segments was 0.073, with a standard deviation of 0.010. However, for this segment, the model led to a significantly higher parameter estimate of 0.106 for this parameter in the current segment. This is an example of the ability to investigate this segment-specific heterogeneity in the random parameter models, one of the key goals of this system.

6. Conclusions and recommendations

This study had two major components – the first, involving the development and testing of random parameter models at 1-mile, 0.5-mile and 0.25-mile scales to test the implementability of predictive models. The second component involves the development of a web-based implementation framework for the predictive models. The fixed-length approach at multiple scales showed that fully specified random

parameter models are estimable at multiple scales, and that the models showed significant consistencies in the identification of random parameters across functional classes. Table 6.1 presents a summary of total crash models for the 1-mile scale, 0.5-mile scale, and 0.25-mile scale.

1-mile Scale Model Summary					
	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	9612	724	646	1214	3052
Number of Parameters	41	20	17	26	45
Number of Significant Random Parameters Excluding Constant (Significant Standard Deviations)	10	6	3	7	15
Restricted Negative Binomial Log- Likelihood (Fixed Parameters at Convergence)	-14377.22	-2352.39	-1497.42	-4883.06	-4777.90
Log-Likelihood	-13824.79	-2158.54	-1434.59	-4406.63	-4486.97
AIC	27731.58	4357.08	2903.18	8865.26	9063.94
BIC	28025.58	4448.78	2979.18	8997.90	9335.00
LL Ratio	1104.86	387.70	125.66	952.86	581.85
Adjusted Pseudo R-squared	0.112	0.117	0.085	0.134	0.234
0.5-mile Scale Model Summary					
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	41	20	17	26	45
Number of Significant Random Parameters Excluding Constant (Significant Standard Deviations)	10	6	1	6	13
Restricted Negative Binomial Log- Likelihood (Fixed Parameters at	-20446.40	2408.00	2212.02	9711 55	7662.24
Convergence) Log-Likelihood	-20446.40	-3408.96	-2213.93	-8711.55 -7889.09	-7663.34
		-3172.77	-2120.57		-7352.23
AIC BIC	39694.17 40016.78	6385.55	4275.14 4361.70	15830.18	14794.46
Chi-Square	1280.63	6489.97 472.38	186.71	15981.69 1644.92	15065.55 622.22
Adjusted Pseudo R-squared	0.095	0.084	0.094	0.131	0.235
0.25-mile Scale Model Summary	0.095	0.084	0.094	0.151	0.235
Number of Observations (2014-2015)	38730	2844	2326	4918	6110
Number of Observations (2014-2013)	41	2044	17	26	45
Number of Significant Random Parameters Excluding Constant (Significant Standard Deviations)	8	6	1	7	10
Restricted Negative Binomial Log- Likelihood (Fixed Parameters at Convergence)	-27653.42	-5394.15	-3140.65	- 14074.55	-12360.07
Log-Likelihood	-26879.79	-5045.05	-2994.24	- 12753.29	-11859.00
AIC	53841.58	10130.09	6022.48	25558.58	23807.99
BIC	54192.72	10249.15	6120.27	25727.60	24110.29
LL Ratio	1547.26	698.20	292.81	2642.52	1002.15
Adjusted Pseudo R-squared	0.086	0.082	0.089	0.131	0.226

 Table 6.1 Summary of fixed-length random parameter models for total crash frequency

As Table 6.1 shows, when the same specifications were tested across multiple scales, the pattern of heterogeneity is maintained across functional classes. Random parameters were not consistently significant across scales, due to changes in heterogeneity scale. However, across scales, the interstate models contained the greatest number of random parameters, while the two-lane rural models (TWLR) contained the second highest number of random parameters. The least number of random parameters was found to be in the non-interstate, non-two-lane urban models. The consistency of this patterns is found across severity outcomes as well. The model summaries for all severity outcomes are presented in Appendix C. Establishing random parameter consistency will ensure that any implementation framework will yield consistent predictive results at multiple scales.

We tested model consistencies across 1-mile, 0.5-mile, and 0.25-mile scales. These are discrete scales and do not represent a continuum for model testing. Therefore, two issues are worth considering in further testing for implementation frameworks. The first relates to spot improvement level scales, where the scales can be smaller than 0.25 miles in length. The second issue relates to temporal consistencies. The models tested in this study are based on a two-year period 2014-2015. Model testing across longer time periods will potentially involve time-variant heterogeneities, due to changes in the economy, enforcement effects, and vehicle model effects.

6.1 Functionality of web-based implementation framework

A dashboard was created to present the results of the random parameter models. The dashboard presents both actual crash and expected crash rates, at the segment level, for different crash types. Moreover, by presenting different views along with the roadway crash rates, including maps, histograms, and driver-level views, the dashboard can allow for investigation of areas with high crash rates. Finally, a Segment Analysis View enables the investigation of changes in parameter values, particularly for these segments. By showing random parameter values for a segment, this view provides a way to investigate the segment-specific heterogeneity captured in the random parameter models.

The following recommendations are made with respect to the implementation framework for the random parameter models:

- The demonstration system provides the opportunity to engage with Washington State practitioners on ways to explore ways that this type of system can be enhanced to maximize its utility. We recommend soliciting input on the system as it currently stands, and ways it could be enhanced, with a goal of allowing practitioners to leverage the rich information in safety models when planning infrastructure improvements.
- The current random parameter models, and limits on available data, limit the number of attributes that are included in each model. Other modelling approaches, for example ensemble models, would allow the incorporation of a larger set of attributes. The resulting models hold the potential of enabling more robust investigations of attribute changes on expected crash rates.
- The current implementation system includes models based on 2014/2015 combined crash data. The system, however, has been designed for scalability needed to be able to incorporate yearly models. The inclusion of these models, in the future, would enable investigation into changes in model parameters and crash rates over time.
- Real-time monitoring of crashes could be incorporated into the system. This capability would enable the system to present notifications to practitioners whenever current crash rates exceed predicted values by some threshold. These alerts of unusually high crash rates would then allow practitioners to identify potential problems to allow them to be addressed in a timely fashion.

Appendix A

	Functional Class								
	Non-two-lane Non-two-lane								
Douto	Two long Dunal	Two long Unhon	and Non-	and Non-	T				
Route 2	Two-lane Rural	462	Interstate Rural	Interstate Urban 112	Interstate 57				
3	3	462 76	5	0	39				
4	4		0						
5	5	110 0	0	1 0	13 0				
		103	0	0	0				
6	6 7								
7 8	8	79 0	10 0	0	27 0				
<u>8</u> 9	9	105	58	41	19				
9 10	10	32		0	0				
			0						
11	11	37	5	0	0				
12	12	525	0	82	42				
14 16	14	<u>322</u> 0	7 0	0 7	<u>31</u> 47				
16	16			9					
17	17	244 13	4 0	9	<u>13</u> 35				
18 19	18	25	0	9	<u> </u>				
	20	727		7	27				
20			29						
21	21	358	0	0	0				
22	22	65	6	1	0				
23	23	132	0	0	0				
24	24	144	10	0	3				
25	25	242	0	0	0				
26	26	264	3	0	0				
27	27	162	5	0	13				
28	28	222	32	3	13				
31	31	53	0	0	0				
41	41	1	0	0	0				
82	82	0	0	0	0				
90	90	0	0	0	0				
92	92	0	15	0	1				
96	96	0	6	0	7				
97	97	458	1	30	11				
99	99	0	0	0	98				
100	100	9	0	0	0				
101	101	628	14	63	26				
103	103	33	0	0	0				
104	104	48	3	1	11				
105	105	89	6	0	2				
106	106	40	0	0	0				
107	107	16	0	0	0				
108	108	24	0	0	0				
109	109	73	6	0	1				
110	110	7	0	0	0				

 Table A.1 Summary descriptive statistics of 0.5 mile fixed-length segments for all functional classes

	Functional Class								
			Non-two-lane						
D 4 .	True lane Druel	True lane Unhan	and Non-	and Non-	T				
Route 112	Two-lane Rural	Two-lane Urban 0	Interstate Rural 0	Interstate Urban 0	Interstate 0				
112	123	0	0	0	0				
115	4	0	0	0	0				
115	12	0	0	0	0				
117	0	2	0	1	0				
119	19	0	0	0	0				
121	13	2	0	0	0				
122	15	0	0	0	0				
123	32	0	1	0	0				
124	85	4	0	0	0				
125	32	4	4	7	0				
127	54	0	0	0	0				
128	0	1	0	0	0				
129	72	12	0	1	0				
131	4	0	0	0	0				
141	52	0	0	0	0				
142	70	0	0	0	0				
150	20	0	1	0	0				
153	62	0	0	0	0				
155	157	0	0	0	0				
160	9	6	0	0	0				
161	32	3	0	29	0				
162	0	35	0	0	0				
163	0	1	0	6	0				
164	14	10	0	5	0				
165	32	8	0	0	0				
166	0	8	0	2	0				
167	0	0	0	57	0				
169	17	17	1	15	0				
170	7	0	0	0	0				
171	0	1	0	6	0				
172	70	0	0	0	0				
173	23	0	0	0	0				
174	81	0	0	0	0				
181	0	0	0	12	0				
182	0	0	0	0	30				
193	4	0	0	0	0				
194	28	0 0	0 31	0 9	0 0				
195	147 5	0	0	0	0				
197									
202 203	33 42	17 4	1	10	0				
203	0	3	0	2	0				

Table A.1 (Continued) Summary descriptive statistics of 0.5 mile fixed-length segments for all functional classes

	Functional Class								
	Non-two-lane Non-two-lane								
Route			and Non-	and Non-	.				
	Two-lane Rural	Two-lane Urban 0	Interstate Rural 0	Interstate Urban 0	Interstate 21				
205	0	0	0	0	21				
206	27	3	0	1	0				
207	9	0	0	0	0				
211	30	0	0	0	0				
213	1	0	0	0	0				
215	12	0	0	0	0				
221	52	0	0	0	0				
223	7	0	0	0	0				
224	11	4	0	5	0				
225	23	0	0	0	0				
231	144	0	0	0	0				
240	44	13	0	23	0				
241	46	4	0	0	0				
243	56	0	0	0	0				
260	76	0	0	0	0				
261	112	0	0	0	0				
262	40	0	0	0	0				
263	18	0	0	0	0				
270	2	2	8	8	0				
271	17	0	0	0	0				
272	37	0	0	0	0				
274	4	0	0	0	0				
278	6	0	0	0	0				
281	19	0	1	0	0				
282	9	1	0	0	0				
283	29	0	0	0	0				
285	0	0	0	10	0				
290	1	9	0	25	0				
291	31	5	0	11	0				
292	12	0	0	0	0				
300	7	0	0	0	0				
302	19	12	0	2	0				
303	0	0	0	18	0				
304	0	0	0	6	0				
305	6	19	0	2	0				
307	9	1	0	0	0				
308	0	6	0	1	0				
310	0	0	0	4	0				
395	184	0	154	34	0				
397	1	33	0	10	0				
401	24	0	0	0	0				
405	0	0	0	0	60				
409	8	0	0	0	0				

Table A.1 (Continued) Summary descriptive statistics of 0.5 mile fixed-length segments for all functional classes

	Functional Class								
	Non-two-lane Non-two-lane								
Route	Two-lane Rural	Two-lane Urban	and Non- Interstate Rural	and Non- Interstate Urban	Interstate				
		17	0	18	0				
410	179	11	0	1	0				
411	15	11	0	1	0				
432	6 0	3	0	11 0	0				
433 500	0	2	0	23	0				
500	10	13	1	4	0				
502	5	13	1	5	0				
502	88	3	1	14	0				
503	103	0	0	0	0				
505	39	0	0	0	0				
505	23	0	0	0	0				
507	78	4	0	5	0				
508	63	2	0	0	0				
509	0	29	0	29	0				
510	13	7	2	4	0				
510	0	0	0	24	0				
512	0	0	0	7	0				
515	0	0	0	15	0				
516	0	10	0	23	0				
518	0	0	0	7	0				
519	0	0	0	2	0				
520	0	0	0	25	0				
522	0	5	0	44	0				
523	0	0	0	3	0				
524	0	15	0	14	0				
525	40	3	3	15	0				
526	0	0	0	9	0				
527	0	0	0	18	0				
528	0	0	0	6	0				
529	0	0	0	15	0				
530	97	4	0	0	0				
531	11	6	0	3	0				
532	18	0	2	0	0				
534	10	0	0	0	0				
536	3	6	1	0	0				
538	0	2	0	5	0				
539	5	3	15	7	0				
542	105	3	2	4	0				
543	0	0	2	0	0				
544	18	0	0	0	0				
546	16	0	0	0	0				
547	19	0	0	0	0				
548	17	11	0	0	0				

Table A.1 (Continued) Summary descriptive statistics of 0.5 mile fixed-length segments for all functional classes

	Functional Class								
Route	Two-lane Rural	Two-lane Urban	Non-two-lane and Non- Interstate Rural	Non-two-lane and Non- Interstate Urban	Interstate				
599	0	0	0	3	0				
702	18	0	0	0	0				
704	0	0	0	1	0				
705	0	0	0	0	3				
706	27	0	0	0	0				
730	12	0	0	0	0				
821	49	1	0	0	0				
823	0	3	0	7	0				
900	4	7	0	19	0				
902	25	0	0	0	0				
903	20	0	0	0	0				
904	27	2	0	5	0				
906	4	0	1	0	0				
970	20	0	0	0	0				
971	21	0	0	0	0				
Total	9,658	684	601	1,254	1,527				
Total length (mile)	4,829.9	342.98	299.92	629.3	763.83				

Table A.1 (Continued) Summary descriptive statistics of 0.5 mile fixed-length segments for all functional classes

	Functional Class								
	Non-two-lane Non-two-lane and Non- and Non-								
Route	Two-lane Rural Two-lane Urban			Interstate Urban	Interstate				
2	933	31	213	114	0				
3	152	11	0	76	0				
4	221	0	1	27	0				
5	0	0	0	0	1106				
6	205	0	0	0	0				
7	157	21	0	55	0				
8	0	0	83	0	0				
9	211	117	1	37	0				
10	64	0	0	0	0				
11	72	12	1	0	0				
12	1055	1	158	84	0				
14	645	16	0	60	0				
16	0	0	15	93	0				
17	488	8	18	26	0				
18	26	0	17	70	0				
19	50	0	0	0	0				
20	1457	60	14	50	0				
21	717	0	0	0	0				
22	130	11	2	0	0				
23	264	0	0	0	0				
24	290	20	0	5	0				
25	485	0	0	0	0				
26	528	6	0	0	0				
27	324	12	0	23	0				
28	448	65	6	22	0				
31	107	0	0	0	0				
41	1	0	0	0	0				
82	0	0	0	0	530				
90	0	0	0	0	1190				
92	0	31	0	1	0				
96 97	0 920	13 3	0 57	14 22	0 0				
<u>97</u> 99	0	0	0	196	0				
100	18	0	0	0	0				
100	1258	31	125	48	0				
101	66	0	0	0	0				
103	95	7	3	21	0				
104	178	11	0	5	0				
105	80	0	0	0	0				
100	31	0	0	0	0				
107	48	0	0	0	0				
100	147	13	0	1	0				
110	13	0	0	0	0				

Table A.2 Summary descriptive statistics of 0.25 mile fixed-length segments for all functional classes

	Functional Class								
Route	Non-two-laneNon-two-laneTwo-laneand Non-and Non-and Non-								
	Two-lane Rural	Two-lane Urban			Interstate				
112	245	0	0	Interstate Urban 0	0				
112	38	0	0	0	0				
115	9	0	0	0	0				
116	24	0	0	0	0				
117	0	4	0	1	0				
119	37	0	0	0	0				
121	25	5	0	0	0				
122	31	0	0	0	0				
123	64	0	1	0	0				
124	171	7	0	0	0				
125	65	8	8	14	0				
127	107	0	0	0	0				
128	0	2	0	0	0				
129	143	25	0	2	0				
131	8	0	0	0	0				
141	104	0	0	0	0				
142	141	0	0	0	0				
150	43	0	1	0	0				
153	123	0	0	0	0				
155	313	0	0	0	0				
160	19	11	0	0	0				
161	63	9	0	57	0				
162	0	69	0	0	0				
163	0	2	0	11	0				
164	28	21	0	9	0				
165	64	17	0	0	0				
166	0	16	0	4	0				
167	0	0	0	114	0				
169	36	34	0	31	0				
170	14	0	0	0	0				
171	0	3	0	12	0				
172	140	0	0	0	0				
173	46	0	0	0	0				
174	162	0	0	0	0				
181	0	0	0	24	0				
182	0	0	0	0	60				
193	8	0	0	0	0				
194	56	0	0	0	0				
195	296	0	59	18	0				
197	10	0	0	0	0				
202	67	34	2	19	0				
203 204	86 0	<u>9</u> 7	0	1 2	0				

Table A.2 (Continued) Summary descriptive statistics of 0.25 mile fixed-length segments for all functional classes

	Functional Class								
	Non-two-lane Non-two-lane								
Route			and Non-	and Non-					
	Two-lane Rural	Two-lane Urban	Interstate Rural 0	Interstate Urban 0	Interstate 42				
205	0	0	0	0	42				
206	53	7	0	1	0				
207	17	0	0	0	0				
211	61	0	0	0	0				
213	1	0	0	0	0				
215	25	0	0	0	0				
221	104	0	0	0	0				
223	15	0	0	0	0				
224	21	9	0	10	0				
225	45	0	0	0	0				
231	288	0	0	0	0				
240	88	27	0	45	0				
241	93	7	0	0	0				
243	113	0	0	0	0				
260	152	0	0	0	0				
261	224	0	0	0	0				
262	80	0	0	0	0				
263	36	0	0	0	0				
270	3	5	16	15	0				
271	33	0	0	0	0				
272	76	0	0	0	0				
274	8	0	0	0	0				
278	11	0	0	0	0				
281	40	0	0	1	0				
282	18	2	0	0	0				
283	58	0	0	0	0				
285	0	0	0	20	0				
290	3	17	0	51	0				
291	62	10	0	21	0				
292	24	0	0	0	0				
300	13	0	0	0	0				
302	38	25	0	4	0				
303	0	0	0	37	0				
304	0	0	0	12	0				
305	11	40	0	2	0				
307	20	1	0	0	0				
308	0	13	0	1	0				
310	0	0	0	7	0				
395	370	0	307	69	0				
397	1	68	0	20	0				
401	48	0	0	0	0				
405	0	0	0	0	121				
409	15	0	0	0	0				

Table A.2 (Continued) Summary descriptive statistics of 0.25 mile fixed-length segments for all functional classes

	Functional Class								
Route	Two-lane Rural	Two-lane Urban	Non-two-lane and Non- Interstate Rural	Non-two-lane and Non- Interstate Urban	Interstate				
410	358	35	0	35	0				
411	29	23	0	1	0				
432	12	6	0	23	0				
433	0	3	0	0	0				
500	0	45	0	44	0				
501	21	25	1	8	0				
502	11	2	1	10	0				
503	178	5	1	28	0				
504	207	0	0	0	0				
505	77	0	0	0	0				
506	46	0	0	0	0				
507	156	10	0	8	0				
508	128	3	0	0	0				
509	0	58	0	60	0				
510	27	15	3	7	0				
512	0	0	0	48	0				
513	0	0	0	13	0				
515	0	0	0	31	0				
516	0	20	0	46	0				
518	0	0	0	14	0				
519	0	0	0	3	0				
520	0	0	0	51	0				
522	0	12	0	85	0				
523	0	0	0	6	0				
524	0	34	0	24	0				
525	81	8	6	27	0				
526	0	0	0	18	0				
527	0	0	0	37	0				
528	0	0	0	13	0				
529	0	0	0	31	0				
530	194	7	0	0	0				
531	22	12	0	5	0				
532	36	0	4	0	0				
534	20	0	0	0	0				
536	6	13	1	1	0				
538	0	4	0	10	0				
539	11	5	29	15	0				
542	213	6	3	7	0				
543	0	0	4	0	0				
544	36	0	0	0	0				
546	31	0	0	0	0				
547	38	0	0	0	0				
548	32	23	0	0	0				

Table A.2 (Continued) Summary descriptive statistics of 0.25 mile fixed-length segments for all functional classes

		Functional Class								
Route	Two-lane Rural	Two-lane Urban	Non-two-lane and Non- Interstate Rural	Non-two-lane and Non- Interstate Urban	Interstate					
599	0	0	0	7	0					
702	37	0	0	0	0					
704	0	0	0	2	0					
705	0	0	0	0	6					
706	55	0	0	0	0					
730	24	0	0	0	0					
821	98	2	0	0	0					
823	0	10	0	11	0					
900	8	15	0	38	0					
902	49	0	0	0	0					
903	40	0	0	0	0					
904	54	7	0	7	0					
906	10	0	1	0	0					
970	41	0	0	0	0					
971	41	0	0	0	0					
Total	19,365	1,422	1,163	2,459	3,055					
Total length (mile)	4839.78	356.58	290.04	615.7	763.83					

 Table A.2 (Continued) Summary descriptive statistics of 0.25 mile fixed-length segments for all functional classes

Appendix B

		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description	KUK	1111			
Variable	Description		wiean	(standard de 1.012		4.677
AADT	AADT (ADTK10=AADT/10000)			(1.601)	view	(5.212)
				8.256	View	(3.212)
LNADT	Natural log of AADT			(1.593)		
	Location indicator (if segment is located in			(0.070)		0.389
URBAN	urban area, 1, otherwise, 0)					(0.488)
	Horizontal curv	ve informat	ion			
	Count of horizontal curves within the fixed-	2.539	2.058			1.435
NHC	length segment	(2.496)	(2.093)			(1.118)
	Count of horizontal curves with angle of					
	deflection (Δ) <= 5 (degrees) within the	0.189			0.287	
NHCA5DW	fixed-length segment	(0.519)			(0.660)	
	Count of horizontal curves with 1000 <=					
	radius < 1500 (feet) within the fixed-length					0.048
NHCR1015	segment					(0.269)
	Count of horizontal curves with 500 <=					
	radius < 700 (feet) within the fixed-length	0.223	0.196			
NHCR57	segment	(0.684)	(0.539)			
	Count of horizontal curves with 700 \leq	0.000				
NUCD 710	radius < 1000 (feet) within the fixed-length	0.390				
NHCR710	segment	(0.838)				
	Count of horizontal curves with design speed of 30 mph or 35 mph within the	0.270				
NHSP3035		0.279 (0.659)				
NH3F 3033	fixed-length segment Count of horizontal curves with design	(0.039)				
	speed of 40 mph or 45 mph within the	0.138				
NHSP4045	fixed-length segment	(0.504)				
	Count of horizontal curves with design	(0.504)				
	speed of 60 mph or 65 mph within the					0.113
NHSP6065	fixed-length segment					(0.438)
	Count of horizontal curves with design					()
	speed more than 70 (mph) within the fixed-					0.216
NHSP70UP	length segment					(0.524)
	Proportion of horizontal curves with 2000					
	<= radius < 3000 (feet) within the fixed-					0.053
PHCR2030	length segment					(0.121)
	Natural log of proportion of horizontal					
	curves with radius less than 100 (feet)	-0.029				
LHCR1DW	within the fixed-length segment	(0.321)				
	Natural log of proportion of horizontal	0.452		0.704		
	curves with $5000 \le \text{radius}$ (feet) within the	-0.453		-0.726		
LHCR50UP	fixed-length segment	(0.922)		(1.001)		
	Natural log of proportion of horizontal	0.020	1.000		0 701	
I USD25DW	curves with design speed <=25 (mph)	-0.920 (0.936)	-1.002 (1.058)		-0.781	
LHSP25DW	within the fixed-length segment Natural log of proportion of horizontal	(0.930)	(1.038)		(1.041)	
	curves with design speeds of 30 mph or 35	-0.408		-0.324	-0.345	
LHSP3035	mph within the fixed-length segment	(0.894)		(0.783)	(0.841)	
21101 2022	Natural log of proportion of horizontal	(0.0/4)		(0.705)	(0.071)	
	curves with design speed ranged from 40 to	-0.167				
LHSP4045	45 (mph) within the fixed-length segment	(0.580)				
	Natural log of proportion of horizontal	(2.2.00)				
	curves with design speed ranged from 50 to	-0.167	-0.178			
LHSP5055	55 (mph) within the fixed-length segment	(0.604)	(0.662)			

Table B.1 Descriptive statistics of significant variables for 1 mile fixed-length segment models

		TL	TL	NINT	NINT	DIT	
Variable	Description	RUR	URB	RUR	URB	INT	
Variable	Description Vertical curve	Mean (standard deviation)					
	Count of vertical curves with 2 <= absolute	morman					
	back slope < 4 within the fixed-length	0.762			0.880		
NVBSL24	segment	(1.079)			(1.068)		
NVDSL24	Count of vertical curves with 6 <= absolute	(1.077)			(1.000)		
	back slope < 8 within the fixed-length	0.118					
NVBSL68	segment	(0.450)					
TTEBELOO	Count of vertical curves within the fixed-	3.341	3.532				
NVC	length segment	(2.606)	(3.035)				
	Count of vertical curves with 100 < K value	1.013	1.105		1.060	0.317	
NVK1020	<=200 within the fixed-length segment	(1.350)	(1.417)		(1.427)	(0.762)	
	Count of vertical curves with 200 < K value	0.544	(1111)		0.661	0.392	
NVK2030	<=300 within the fixed-length segment	(0.828)			(0.907)	(0.717)	
	Count of vertical curves with 20 < K value	0.167			, ,		
NVK250	<=50 within the fixed-length segment	(0.712)					
	Count of vertical curves with 300 < K value	`_´				0.292	
NVK3040	<=400 within the fixed-length segment					(0.566)	
	Count of vertical curves with 400 < K value	0.777	0.721				
NVK40UP	within the fixed-length segment	(1.106)	(1.170)				
	Count of vertical curves with design speed						
	ranged from 60 to 65 (mph) within the	0.370					
NVSP6065	fixed-length segment	(0.645)					
	Natural log of proportion of vertical curves						
	with absolute ahead slope < 2 within the	-1.905		-1.837			
LVASL02	fixed-length segment	(1.267)		(1.059)			
	Natural log of proportion of vertical curves						
	with $2 \le absolute$ ahead slope < 4 within				-1.512		
LVASL24	the fixed-length segment				(1.583)		
	Natural log of proportion of vertical curves	0.044					
I MAGI 4C	with $4 \le absolute ahead slope < 6$ within	-0.841			-0.735		
LVASL46	the fixed-length segment	(1.374)			(1.342)		
	Natural log of proportion of vertical curves	1 200		1.020	1 410		
LVBSL24	with $2 \le absolute back slope < 4$ within the fixed length comment	-1.288 (1.500)		-1.030 (1.329)	-1.419 (1.468)		
LVDSL24	the fixed-length segment Natural log of proportion of vertical curves	(1.500)		(1.329)	(1.408)		
	with $6 \le absolute back slope < 8 within$	-0.271					
LVBSL68	the fixed-length segment ~ 3 within	(0.910)					
LIBBLOO	Natural log of proportion of vertical curves	(0.710)					
	with $100 < K$ value ≤ 200 within the fixed-	-1.076			-1.125		
LVK1020	length segment	(1.218)			(1.224)		
	Natural log of proportion of vertical curves	· /			, , ,		
	with $200 < K$ value ≤ 300 within the fixed-	-0.904	-0.914	-0.766	-1.004		
LVK2030	length segment	(1.252)	(1.360)	(1.169)	(1.286)		
	Natural log of proportion of vertical curves						
	with $400 < K$ value within the fixed-length	-0.893					
LVK40UP	segment	(1.168)					
	Natural log of proportion of vertical curves						
	with 50 < K value <=100 within the fixed-	-0.631		-0.256			
LVK510	length segment	(1.145)		(0.808)			
	Natural log of proportion of vertical curves						
	with design speed of 30 mph or 35 mph	-0.331	-0.486				
LVSP3035	within the fixed-length segment	(0.895)	(1.108)				

Table B.1 (Continued) Descriptive statistics of significant variables for 1 mile fixed-length segment model

mouci						
		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description	KUK		n (standard de	_	1111
variable	Description Natural log of proportion of vertical curves		Ivieal	i (stanuaru ue	viation)	
	with design speed ranged from 60 to 65	-0.684				
LVSP6065	(mph) within the fixed-length segment	(1.154)				
2.51.0000	Natural log of proportion of vertical curves	(1110-1)				
	with design speed more than 70 (mph)	-1.470				
LVSP70UP	within the fixed-length segment	(1.172)				
	Proportion of vertical curves with absolute	, ,				
	back slope < 2 within the fixed-length					0.119
PVBSL02	segment					(0.107)
	Proportion of vertical curves with $2 \ll 2$					
	absolute back slope < 4 within the fixed-					0.049
PVBSL24	length segment					(0.080)
	Proportion of vertical curves with $50 < K$					
	value <=100 within the fixed-length					0.001
PVK510	segment					(0.011)
	Travel lane in	nformation	1			
	Proportion of 1-lane cross section in	0.000				
I NEDECI	decreasing milepost direction, as	0.998				
LNSDEC1	continuous variable	(0.039)	0.020	0.905	0.004	
LNSFDECA	Roadway surface type is asphalt in	0.401	0.920	0.895	0.904	
LINSFDECA	decreasing milepost direction	(0.476)	(0.226)	(0.280)	(0.237)	
LNSFDECB	Roadway surface type is bituminous in	0.588 (0.479)				
LINSFDECD	decreasing milepost direction Roadway surface type is portland cement	0.009		0.035	0.065	0.452
LNSFDECP	concrete in decreasing milepost direction	(0.009)		(0.153)	(0.186)	(0.432)
LINGFDECF	Roadway surface type is asphalt in	0.401		0.691	(0.180)	(0.462)
LNSFINCA	increasing milepost direction	(0.401)		(0.447)		
LINDITINCA	Roadway surface type is bituminous in	(0.470)		(0.447)		0.013
LNSFINCB	increasing milepost direction					(0.113)
LIGINCD	Roadway surface type is portland cement	0.009		0.242		(0.115)
LNSFINCP	concrete in increasing milepost direction	(0.068)		(0.416)		
	Roadway in	· · · · ·		(0.110)		
	Roadway weighted average width in					
	decreasing milepost direction, as	11.579	14.179	21.315	24.472	30.362
RWDDEC	continuous variable	(1.368)	(5.084)	(5.005)	(6.302)	(8.428)
	Proportion of roadway width is in the 0.01	/			, , ,	/
	to 12.0 foot range in decreasing milepost	0.970		0.218	0.082	
RDEC012	direction, as continuous variable	(0.126)		(0.381)	(0.233)	
	Proportion of roadway width in the 12.01 to					
	24 foot range in decreasing milepost	0.026		0.744	0.584	0.596
RDEC1224	direction, as continuous variable	(0.115)		(0.392)	(0.374)	(0.476)
	Proportion of roadway width in the 24.01 to					
	36.0 foot range in decreasing milepost				0.264	0.284
RDEC2436	direction, as continuous variable				(0.311)	(0.422)
	Proportion of roadway width is in the 36.01					
	to 48.0 foot range in decreasing milepost					0.095
RDEC3648	direction, as continuous variable					(0.252)
	Proportion of roadway width is in the 0.01	0.073	0	0.100	0.070	
DDIG012	to 12.0 foot range in increasing milepost	0.972	0.754	0.182	0.079	
RINC012	direction, as continuous variable	(0.123)	(0.354)	(0.351)	(0.232)	
	Proportion of roadway width is in the 12.01	0.025	0.10.1	0.540	0.010	
DINICIA	to 24.0 foot range in increasing milepost	0.025	0.194	0.769	0.616	
RINC1224	direction, as continuous variable	(0.111)	(0.296)	(0.375)	(0.361)	

Table B.1 (Continued) Descriptive statistics of significant variables for 1 mile fixed-length segment model

		TL	TL	NINT	NINT	DIE
Variable	Description	RUR	URB	RUR (standard de	URB	INT
v al lable	Travel shoulde	r informat		(stanuaru u	eviation)	
	Proportion of travel shoulder width in the					
	2.01 to 4.0 foot range on the left side in					
	increasing milepost direction, as continuous	0.333				
SDWL24	variable	(0.439)				
	Proportion of travel shoulder width is in the					
	2.01 to 4.0 foot range on the left-center side					
	in increasing milepost direction, as					0.532
SDWLC24	continuous variable					(0.481)
	Proportion of travel shoulder width is in the					
	4.01 to 6.0 foot range on the left-center side in increasing milepost direction, as					0.159
SDWLC46	in increasing milepost direction, as continuous variable					(0.345)
SD WEE+0	Proportion of travel shoulder width in the					(0.545)
	8.01 to 10.0 foot range on the left-center					
	side in increasing milepost direction, as	0.078				
SDWLC810	continuous variable	(0.260)				
	Proportion of travel shoulder width is in the					
	0.01 to 2.0 foot range on the right side in					
65.U.B.0.6	increasing milepost direction, as continuous	0.213	0.068			
SDWR02	variable	(0.390)	(0.224)			
	Proportion of travel shoulder width is wider				0.011	
SDWR10P	than 10 ft. on the right side in increasing				0.011	
SDWRI0P	milepost direction, as continuous variableProportion of travel shoulder width is in the				(0.072)	
	2.01 to 4.0 foot range on the right side in					
	increasing milepost direction, as continuous	0.336	0.219		0.029	
SDWR24	variable	(0.439)	(0.351)		(0.129)	
	Proportion of travel shoulder width is in the				, , , ,	
	4.01 to 6.0 foot range on the right side in					
	increasing milepost direction, as continuous		0.139		0.055	
SDWR46	variable		(0.293)		(0.187)	
	Proportion of travel shoulder width is in the					
	6.01 to 8.0 foot range on the right side in		0.000		0.164	
SDWR68	increasing milepost direction, as continuous variable		0.292 (0.393)		0.164 (0.308)	
SDWK00	Proportion of travel shoulder width is in the		(0.393)		(0.308)	
	8.01 to 10.0 foot range on the right side in					
	increasing milepost direction, as continuous		0.092		0.334	0.908
SDWR810	variable		(0.248)		(0.430)	(0.227)
	Weighted average travel shoulder width on				, í	, , , , , , , , , , , , , , , , , , ,
	the right-center side in increasing milepost					3.846
SDWRC	direction, as continuous variable					(2.370)
	Proportion of travel shoulder width is in the					
	2.01 to 4.0 foot range on the right-center			0.545	0.152	
SDWRC24	side in increasing milepost direction, as continuous variable			0.545	0.153	
5D W KC24	Proportion of travel shoulder width is in the			(0.479)	(0.332)	
	4.01 to 6.0 foot range on the right-center					
	side in increasing milepost direction, as					0.149
SDWRC46	continuous variable					(0.337)
	Proportion of travel shoulder width is in the					. ,
	6.01 to 8.0 foot range on the right-center					
	side in increasing milepost direction, as					0.031
SDWRC68	continuous variable					(0.158)

Table B.1 (Continued) Descriptive statistics of significant variables for 1 mile fixed-length segment model

		TL	TL	NINT	NINT				
		RUR	URB	RUR	URB	INT			
Variable	Description Mean (standard deviation)								
	Travel shoulde	r informati	ion	T		1			
	Proportion of travel shoulder width is in the								
	8.01 to 10.0 foot range on the right-center								
	side in increasing milepost direction, as					0.065			
SDWRC810	continuous variable					(0.218)			
	Proportion of shoulder surface type is								
	bituminous on the left side in increasing	0.478							
SSFLB	milepost direction, as continuous variable	(0.486)							
	Proportion of curb shoulder surface type on								
	the left side in increasing milepost direction,	0.016	0.179	0.047	0.372				
SSFLC	as continuous variable	(0.081)	(0.323)	(0.164)	(0.434)				
	Proportion of shoulder surface type is								
	asphalt on the right side in increasing	0.444			0.582	0.912			
SSFRA	milepost direction, as continuous variable	(0.476)			(0.432)	(0.231)			
	Proportion of shoulder surface type is								
	bituminous on the right side in increasing	0.479							
SSFRB	milepost direction, as continuous variable	(0.486)							
	Proportion of curb shoulder surface type on								
	the right side in increasing milepost	0.017	0.166	0.050	0.364				
SSFRC	direction, as continuous variable	(0.084)	(0.308)	(0.168)	(0.431)				
	Proportion of shoulder surface type is								
	gravel on the right side in increasing	0.047							
SSFRG	milepost direction, as continuous variable	(0.205)							
	There's no shoulder on the right side in								
	increasing milepost direction within this	0.008							
SSFRNA	segment	(0.067)							
	Median inf	ormation							
	Proportion of shoulder surface type is								
	asphalt on the left side in increasing			0.156	0.254				
MSFA	milepost direction, as continuous variable			(0.339)	(0.380)				
	Proportion of median width in 10.01 to 20.0			0.133	0.199	0.113			
MWD1020	foot range, as continuous variable			(0.322)	(0.349)	(0.294)			
	Proportion of median width is in the 30.01				0.069				
MWD3040	to 40.0 foot range, as continuous variable				(0.226)				
	Proportion of median width in 40.01 to 50.0				0.040				
MWD4050	foot range, as continuous variable				(0.174)				

Table B.1 (Continued) Descriptive statistics of significant variables for 1 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description			(standard de		·
Variable	Description		Witcan	(stanuar u u		5.736
				1.237		(53020.4
AADT	AADT (ADTK10=AADT/10000)			(0.710)		50)
				9.274		
LNADT	Natural log of AADT			(0.563)		
	Location indicator (if segment is located in					0.390
URBAN	urban arear, 1, otherwise, 0)					(0.488)
	Horizontal curv	ve informat	ion			
	Count of horizontal curves within the fixed-	1.388	1.186			0.862
NHC	length segment	(1.441)	(1.333)			(0.767)
	Count of horizontal curves with angle of					
	deflection (Δ) <= 5 (degrees) within the	0.098			0.165	
NHCA5DW	fixed-length segment	(0.350)			(0.462)	
	Count of horizontal curves with 1000 <=					
	radius < 1500 (feet) within the fixed-length					0.028
NHCR1015	segment					(0.195)
	Count of horizontal curves with 500 <=	0.116	0.120			
NUCD 57	radius < 700 (feet) within the fixed-length	0.116	0.129			
NHCR57	segment	(0.438)	(0.415)			
	Count of horizontal curves with 700 \leq	0.200				
NHCR710	radius < 1000 (feet) within the fixed-length segment	0.208 (0.546)				
NHCK/10	Count of horizontal curves with design	(0.340)			-	-
	speed of 30 mph or 35 mph within the	0.157				
NHSP3035	fixed-length segment	(0.441)				
11151 5055	Count of horizontal curves with design	(0.441)				
	speed of 40 mph or 45 mph within the	0.079				
NHSP4045	fixed-length segment	(0.331)				
10101	Count of horizontal curves with design	(0.551)				
	speed of 60 mph or 65 mph within the					0.066
NHSP6065	fixed-length segment					(0.288)
	Count of horizontal curves with design					
	speed more than 70 (mph) within the fixed-					0.132
NHSP70UP	length segment					(0.389)
	Proportion of horizontal curves with 2000					
	<= radius < 3000 (feet) within the fixed-					0.053
PHCR2030	length segment					(0.150)
	Natural log of proportion of horizontal					
	curves with radius less than 100 (feet)	-0.013				
LHCR1DW	within the fixed-length segment	(0.199)				
	Natural log of proportion of horizontal	0.000		0.070		
	curves with $5000 \le \text{radius}$ (feet) within the	-0.220		-0.379		
LHCR50UP	fixed-length segment	(0.624)		(0.712)		-
	Natural log of proportion of horizontal	0.002	-0.672		0 472	
LHSP25DW	curves with design speed <=25 (mph) within the fixed-length segment	-0.663 (0.829)	-0.672 (0.900)		-0.473 (0.823)	
LU2L77	Natural log of proportion of horizontal	(0.829)	(0.900)		(0.823)	
	curves with design speeds of 30 mph or 35	-0.203		-0.166	-0.169	
LHSP3035	mph within the fixed-length segment	(0.603)		(0.509)	(0.560)	
LIGI 5055	Natural log of proportion of horizontal	(0.003)		(0.507)	(0.500)	
	curves with design speed ranged from 40 to	-0.089				
LHSP4045	45 (mph) within the fixed-length segment	(0.401)				
21101 -013	Natural log of proportion of horizontal	(0.401)				
	curves with design speed ranged from 50 to	-0.082	-0.090			
LHSP5055	55 (mph) within the fixed-length segment	(0.397)	(0.417)			

Table B.2 Descriptive statistics of significant variables for 0.5 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description	KUK				
Variable	Description Vertical curve	informatio		(standard d	eviation)	
	Count of vertical curves with 2 <= absolute	mormatic)11 		1	
	back slope < 4 within the fixed-length	0.414			0.476	
NVBSL24	segment	(0.714)			(0.748)	
IT V DOL24	Count of vertical curves with 6 <= absolute	(0.714)			(0.740)	
	back slope < 8 within the fixed-length	0.064				
NVBSL68	segment	(0.290)				
TTEBELOO	Count of vertical curves within the fixed-	1.792	1.800			
NVC	length segment	(1.544)	(1.779)			
1110	Count of vertical curves with 100 < K value	0.540	0.532		0.578	0.169
NVK1020	<=200 within the fixed-length segment	(0.861)	(0.886)		(0.936)	(0.484)
11111020	Count of vertical curves with 200 < K value	0.294	(0.000)		0.364	0.227
NVK2030	<=300 within the fixed-length segment	(0.570)			(0.636)	(0.516)
11112000	Count of vertical curves with $20 < K$ value	0.086			(0.02.0)	(0.010)
NVK250	<=50 within the fixed-length segment	(0.431)				
	Count of vertical curves with 300 < K value	(01.027)				0.164
NVK3040	<=400 within the fixed-length segment					(0.414)
	Count of vertical curves with $400 < K$ value	0.428	0.371			
NVK40UP	within the fixed-length segment	(0.722)	(0.741)			
	Count of vertical curves with design speed	()				
	ranged from 60 to 65 (mph) within the	0.200				
NVSP6065	fixed-length segment	(0.456)				
	Natural log of proportion of vertical curves					
	with absolute ahead slope < 2 within the	-1.409		-1.434		
LVASL02	fixed-length segment	(1.266)		(1.107)		
	Natural log of proportion of vertical curves					
	with $2 \le absolute ahead slope < 4$ within				-0.873	
LVASL24	the fixed-length segment				(1.294)	
	Natural log of proportion of vertical curves					
	with $4 \le$ absolute ahead slope < 6 within	-0.454			-0.384	
LVASL46	the fixed-length segment	(1.000)			(0.946)	
	Natural log of proportion of vertical curves					
	with $2 \ll absolute back slope < 4$ within	-0.747		-0.588	-0.815	
LVBSL24	the fixed-length segment	(1.189)		(1.059)	(1.208)	
	Natural log of proportion of vertical curves					
	with $6 \leq absolute back slope < 8$ within	-0.137				
LVBSL68	the fixed-length segment	(0.603)				
	Natural log of proportion of vertical curves					
	with $100 < K$ value ≤ 200 within the fixed-	-0.641			-0.659	
LVK1020	length segment	(0.970)			(0.982)	
	Natural log of proportion of vertical curves					
	with $200 < K$ value ≤ 300 within the fixed-	-0.463	-0.481	-0.409	-0.557	
LVK2030	length segment	(0.903)	(1.000)	(0.847)	(0.992)	
	Natural log of proportion of vertical curves					
	with 400 < K value within the fixed-length	-0.521				
LVK40UP	segment	(0.904)				
	Natural log of proportion of vertical curves			0.555		
1.11/2/10	with $50 < K$ value ≤ 100 within the fixed-	-0.360		-0.099		
LVK510	length segment	(0.839)		(0.462)		
	Natural log of proportion of vertical curves	0	0.0			
L MODOOOT	with design speed of 30 mph or 35 mph	-0.175	-0.257			
LVSP3035	within the fixed-length segment	(0.611)	(0.743)			

Table B.2 (Continued) Descriptive statistics of significant variables for 0.5 mile fixed-length segment model

nouci		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description		Mean	(standard d	eviation)	
	Natural log of proportion of vertical curves			Ì		
	with design speed ranged from 60 to 65	-0.332				
LVSP6065	(mph) within the fixed-length segment	(0.794)				
	Natural log of proportion of vertical curves					
	with design speed more than 70 (mph)	-0.981				
LVSP70UP	within the fixed-length segment	(1.071)				
	Proportion of vertical curves with absolute					
DUDGL00	back slope < 2 within the fixed-length					0.125
PVBSL02	segment					(0.142)
	Proportion of vertical curves with $2 \le 1$					0.054
PVBSL24	absolute back slope < 4 within the fixed-					0.054
PVBSL24	length segment					(0.112)
	Proportion of vertical curves with 50 < K value <=100 within the fixed-length					0.001
PVK510	segment					(0.016)
1 / 10						(0.010)
	Travel lane in	nformation	1	1	1	
	Proportion of 1-lane cross section in decreasing milepost direction, as	1.000				
LNSDEC1	decreasing milepost direction, as continuous variable	(0.002)				
LINSDECT	Roadway surface type is asphalt in	0.402	0.924	0.918	0.905	
LNSFDECA	decreasing milepost direction	(0.402)	(0.238)	(0.251)	(0.248)	
LIGIDECA	Roadway surface type is bituminous in	0.587	(0.238)	(0.231)	(0.240)	
LNSFDECB	decreasing milepost direction	(0.484)				
LIGIDLED	Roadway surface type is portland cement	0.009		0.040	0.066	0.453
LNSFDECP	concrete in decreasing milepost direction	(0.072)		(0.171)	(0.201)	(0.487)
	Roadway surface type is asphalt in	0.402		0.702	(01201)	(01107)
LNSFINCA	increasing milepost direction	(0.481)		(0.445)		
	Roadway surface type is bituminous in					0.013
LNSFINCB	increasing milepost direction					(0.113)
	Roadway surface type is portland cement	0.009		0.261		
LNSFINCP	concrete in increasing milepost direction	(0.072)		(0.429)		
	Roadway in	formation				
	Roadway weighted average width in					
	decreasing milepost direction, as	11.524	12.497	22.780	25.087	30.376
RWDDEC	continuous variable	(1.192)	(2.410)	(4.235)	(6.252)	(8.569)
	Proportion of roadway width in the 0.01 to					
	12.0 foot range in decreasing milepost	0.974		0.107	0.044	
RDEC012	direction, as continuous variable	(0.125)		(0.280)	(0.160)	
	Proportion of roadway width in the 12.01 to					
	24.0 foot range in decreasing milepost	0.023		0.838	0.598	0.596
RDEC1224	direction, as continuous variable	(0.116)		(0.327)	(0.395)	(0.479)
	Proportion of roadway width in the 24.01 to					
DDEC2426	36.0 foot range in decreasing milepost				0.282	0.284
RDEC2436	direction, as continuous variable				(0.345)	(0.430)
	Proportion of roadway width is in the 36.01					0.005
RDEC3648	to 48.0 foot range in decreasing milepost					0.095 (0.262)
KDEC3040	direction, as continuous variable Proportion of roadway width in the 0.01 to					(0.202)
	12.0 foot range in increasing milepost	0.974	0.845	0.087	0.049	
RINC012	direction, as continuous variable	(0.974) (0.125)	(0.297)	(0.250)	(0.176)	
1010012		(0.123)	(0.277)	(0.230)	(0.170)	<u> </u>
	Proportion of roadway width in the 12 01 to					
	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost	0.023	0.147	0.845	0.631	

Table B.2 (Continued) Descriptive statistics of significant variables for 0.5 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description	KUK		(standard de		
variable	Travel shoulde	r informat		(stanuar a a		
	Proportion of travel shoulder width in the					
	2.01 to 4.0 foot range on the left side in					
	increasing milepost direction, as continuous	0.332				
SDWL24	variable	(0.451)				
	Proportion of travel shoulder width is in the					
	2.01 to 4.0 foot range on the left-center side					0.522
SDWLC24	in increasing milepost direction, as continuous variable					0.532 (0.487)
SDWLC24	Proportion of travel shoulder width is in the					(0.467)
	4.01 to 6.0 foot range on the left-center side					
	in increasing milepost direction, as					0.159
SDWLC46	continuous variable					(0.352)
	Proportion of travel shoulder width in the					. ,
	8.01 to 10.0 foot range on the left-center					
	side in increasing milepost direction, as	0.078				
SDWLC810	continuous variable	(0.264)				
	Proportion of travel shoulder width is in the					
	0.01 to 2.0 foot range on the right side in	0.012	0.072			
SDWR02	increasing milepost direction, as continuous variable	0.213 (0.398)	0.072 (0.241)			
5D W K02	Proportion of travel shoulder width is wider	(0.398)	(0.241)			
	than 10 ft. on the right side in increasing				0.012	
SDWR10P	milepost direction, as continuous variable				(0.082)	
	Proportion of travel shoulder width is in the				, , , , , , , , , , , , , , , , , , ,	
	2.01 to 4.0 foot range on the right side in					
	increasing milepost direction, as continuous	0.336	0.232		0.026	
SDWR24	variable	(0.452)	(0.382)		(0.125)	
	Proportion of travel shoulder width is in the					
	4.01 to 6.0 foot range on the right side in increasing milepost direction, as continuous		0.163		0.045	
SDWR46	variable		(0.334)		(0.177)	
50 11 140	Proportion of travel shoulder width is in the		(0.334)		(0.177)	
	6.01 to 8.0 foot range on the right side in					
	increasing milepost direction, as continuous		0.321		0.150	
SDWR68	variable		(0.430)		(0.316)	
	Proportion of travel shoulder width is in the					
	8.01 to 10.0 foot range on the right side in					
SPUID 04 0	increasing milepost direction, as continuous		0.076		0.337	0.908
SDWR810	variable		(0.240)		(0.443)	(0.244)
	Weighted average travel shoulder width on the right center side in increasing milement					3.846
SDWRC	the right-center side in increasing milepost direction, as continuous variable					(2.467)
5D WRC	Proportion of travel shoulder width is in the					(2.407)
	2.01 to 4.0 foot range on the right-center					
	side in increasing milepost direction, as			0.595	0.155	
SDWRC24	continuous variable			(0.476)	(0.343)	
	Proportion of travel shoulder width is in the					
	4.01 to 6.0 foot range on the right-center					
(DUDC)	side in increasing milepost direction, as					0.149
SDWRC46	continuous variable					(0.343)
	Proportion of travel shoulder width is in the					
	6.01 to 8.0 foot range on the right-center side in increasing milepost direction, as					0.031
	continuous variable			1	1	(0.164)

Table B.2 (Continued) Descriptive statistics of significant variables for 0.5 mile fixed-length segment model

		TL	TL	NINT	NINT	
		RUR	URB	RUR	URB	INT
Variable	Description			(standard de	eviation)	
	Travel shoulde	r informati	ion	-		
	Proportion of travel shoulder width is in the					
	8.01 to 10.0 foot range on the right-center					
	side in increasing milepost direction, as					0.065
SDWRC810	continuous variable					(0.230)
	Proportion of shoulder surface type is					
	bituminous on the left side in increasing	0.477				
SSFLB	milepost direction, as continuous variable	(0.491)				
	Proportion of curb shoulder surface type on					
	the left side in increasing milepost direction,	0.016	0.120	0.044	0.399	
SSFLC	as continuous variable	(0.092)	(0.286)	(0.176)	(0.455)	
	Proportion of shoulder surface type is					
	asphalt on the right side in increasing	0.445			0.564	0.912
SSFRA	milepost direction, as continuous variable	(0.483)			(0.451)	(0.242)
	Proportion of shoulder surface type is					
	bituminous on the right side in increasing	0.478				
SSFRB	milepost direction, as continuous variable	(0.491)				
	Proportion of curb shoulder surface type on					
	the right side in increasing milepost	0.017	0.112	0.048	0.388	
SSFRC	direction, as continuous variable	(0.096)	(0.274)	(0.184)	(0.452)	
	Proportion of shoulder surface type is					
	gravel on the right side in increasing	0.047				
SSFRG	milepost direction, as continuous variable	(0.207)				
	There's no shoulder on the right side in					
	increasing milepost direction within this	0.009				
SSFRNA	segment	(0.076)				
	Median surface	e informati	on			
	Proportion of shoulder surface type is					
	asphalt on the left side in increasing			0.165	0.253	
MSFA	milepost direction, as continuous variable			(0.353)	(0.397)	
	Proportion of median width in 10.01 to 20.0			0.146	0.202	0.113
MWD1020	foot range, as continuous variable			(0.336)	(0.368)	(0.305)
	Proportion of median width is in the 30.01				0.072	
MWD3040	to 40.0 foot range, as continuous variable				(0.243)	
	Proportion of median width in 40.01 to 50.0				0.039	
MWD4050	foot range, as continuous variable				(0.183)	

Table B.2 (Continued) Descriptive statistics of significant variables for 0.5 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT
Variable	Description		Mean	(standard de	eviation)	•
				1.247		5.740
AADT	AADT (ADTK10=AADT/10000)			(0.716)		(5.304)
				9.284		
LNADT	Natural log of AADT			(0.554)		
	Location indicator (if segment is located in					0.390
URBAN	urban arear, 1, otherwise, 0)					(0.488)
	Horizontal curv	ve informat	ion			
	Count of horizontal curves within the fixed-	0.811	0.684			0.567
NHC	length segment	(0.899)	(0.842)			(0.591)
	Count of horizontal curves with angle of					
	deflection (Δ) <= 5 (degrees) within the	0.053			0.090	
NHCA5DW	fixed-length segment	(0.247)			(0.322)	
	Count of horizontal curves with 1000 <=					0.010
NUCD1015	radius < 1500 (feet) within the fixed-length					0.018
NHCR1015	segment Count of horizontal curves with 500 <=					(0.146)
	radius < 700 (feet) within the fixed-length	0.063	0.071			
NHCR57	segment	(0.287)	(0.287)			
MICK57	Count of horizontal curves with 700 <=	(0.207)	(0.207)			
	radius < 1000 (feet) within the fixed-length	0.117				
NHCR710	segment	(0.371)				
	Count of horizontal curves with design	(111)				
	speed of 30 mph or 35 mph within the	0.095				
NHSP3035	fixed-length segment	(0.320)				
	Count of horizontal curves with design					
	speed of 40 mph or 45 mph within the	0.050				
NHSP4045	fixed-length segment	(0.242)				
	Count of horizontal curves with design					
NUCDAOAS	speed of 60 mph or 65 mph within the					0.042
NHSP6065	fixed-length segment					(0.215)
	Count of horizontal curves with design					0.088
NHSP70UP	speed more than 70 (mph) within the fixed- length segment					(0.299)
NIISI /001	Proportion of horizontal curves with 2000					(0.299)
	<pre><= radius < 3000 (feet) within the fixed-</pre>					0.053
PHCR2030	length segment					(0.178)
	Natural log of proportion of horizontal					
	curves with radius less than 100 (feet)	-0.006				
LHCR1DW	within the fixed-length segment	(0.117)				
	Natural log of proportion of horizontal					
	curves with 5000 <= radius (feet) within the	-0.101		-0.208		
LHCR50UP	fixed-length segment	(0.398)		(0.533)		
	Natural log of proportion of horizontal					
LUGDACT	curves with design speed <=25 (mph)	-0.428	-0.419		-0.255	
LHSP25DW	within the fixed-length segment	(0.682)	(0.726)		(0.577)	
	Natural log of proportion of horizontal	0.007		0.000	0.004	
1 11502025	curves with design speeds of 30 mph or 35	-0.096		-0.082	-0.084	
LHSP3035	mph within the fixed-length segmentNatural log of proportion of horizontal	(0.388)		(0.349)	(0.374)	
	curves with design speed ranged from 40 to	-0.047				
LHSP4045	45 (mph) within the fixed-length segment	(0.277)				
	Natural log of proportion of horizontal	(0.277)				
	curves with design speed ranged from 50 to	-0.040	-0.049			
LHSP5055	55 (mph) within the fixed-length segment	(0.258)	(0.306)			

Table B.3 Descriptive statistics of significant variables for 0.25 mile fixed-length segment model

			TL	NINT	NINT	
Variable	Description	RUR	URB	RUR (standard de	URB	INT
variable	Description Vertical curve	informatic		(standard de	eviation)	
	Count of vertical curves with 2 <= absolute	morman	/11			
	back slope < 4 within the fixed-length	0.237			0.284	
NVBSL24	segment	(0.500)			(0.540)	
ITT DOLL	Count of vertical curves with 6 <= absolute	(0.500)			(0.510)	
	back slope < 8 within the fixed-length	0.036				
NVBSL68	segment	(0.201)				
	Count of vertical curves within the fixed-	1.019	1.012			
NVC	length segment	(0.975)	(1.098)			
	Count of vertical curves with $100 < K$ value	0.303	0.303		0.324	0.100
NVK1020	<=200 within the fixed-length segment	(0.584)	(0.606)		(0.625)	(0.339)
	Count of vertical curves with 200 < K value	0.169	(01000)		0.208	0.135
NVK2030	<=300 within the fixed-length segment	(0.414)			(0.461)	(0.373)
	Count of vertical curves with 20 < K value	0.045			. ,	(/
NVK250	<=50 within the fixed-length segment	(0.271)				
	Count of vertical curves with 300 < K value					0.097
NVK3040	<=400 within the fixed-length segment					(0.314)
	Count of vertical curves with 400 < K value	0.256	0.215			
NVK40UP	within the fixed-length segment	(0.511)	(0.501)			
	Count of vertical curves with design speed					
	ranged from 60 to 65 (mph) within the	0.118				
NVSP6065	fixed-length segment	(0.341)				
	Natural log of proportion of vertical curves					
	with absolute ahead slope < 2 within the	-0.909		-0.895		
LVASL02	fixed-length segment	(1.117)		(1.014)		
	Natural log of proportion of vertical curves					
	with $2 \ll$ absolute ahead slope < 4 within				-0.447	
LVASL24	the fixed-length segment				(0.919)	
	Natural log of proportion of vertical curves					
	with $4 \le$ absolute ahead slope < 6 within	-0.242			-0.199	
LVASL46	the fixed-length segment	(0.709)			(0.641)	
	Natural log of proportion of vertical curves			0.001		
LUDGLO	with $2 \ll absolute back slope < 4$ within	-0.396		-0.331	-0.452	
LVBSL24	the fixed-length segment	(0.849)		(0.784)	(0.899)	
	Natural log of proportion of vertical curves	0.079				
LVBSL68	with $6 \le absolute back slope < 8$ within the fixed length comment	-0.068				
LVDSL00	the fixed-length segment Natural log of proportion of vertical curves	(0.391)				
	with $100 < \text{K}$ value ≤ 200 within the fixed-	-0.347			-0.359	
LVK1020	length segment	(0.710)			(0.729)	
L V K1020	Natural log of proportion of vertical curves	(0.710)			(0.727)	
	with $200 < K$ value ≤ 300 within the fixed-	-0.222	-0.204	-0.179	-0.261	
LVK2030	length segment	(0.605)	(0.614)	(0.539)	(0.647)	
L (112030	Natural log of proportion of vertical curves	(0.005)	(0.017)	(0.557)	(0.047)	
	with $400 < K$ value within the fixed-length	-0.278				
LVK40UP	segment	(0.645)				
	Natural log of proportion of vertical curves	(0.0.0)				
	with $50 < K$ value $<=100$ within the fixed-	-0.183		-0.051		
LVK510	length segment	(0.565)		(0.307)		
	Natural log of proportion of vertical curves	/		,		1
	with design speed of 30 mph or 35 mph	-0.086	-0.134			
LVSP3035	within the fixed-length segment	(0.394)	(0.511)			

Table B.3 (Continued) Descriptive statistics of significant variables for 0.25 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT	
Variable	Description	Mean (standard deviation)					
	Natural log of proportion of vertical curves						
	with design speed ranged from 60 to 65	-0.153					
LVSP6065	(mph) within the fixed-length segment	(0.510)					
	Natural log of proportion of vertical curves						
	with design speed more than 70 (mph)	-0.569					
LVSP70UP	within the fixed-length segment	(0.855)					
	Proportion of vertical curves with absolute						
DUDGLOG	back slope < 2 within the fixed-length					0.139	
PVBSL02	segment					(0.200)	
	Proportion of vertical curves with $2 \le 1$					0.000	
DVDCI 24	absolute back slope < 4 within the fixed-					0.060	
PVBSL24	length segment					(0.155)	
	Proportion of vertical curves with 50 < K value <=100 within the fixed-length					0.001	
PVK510	5					(0.019)	
I VK510	segment					(0.019)	
	Travel lane in	nformation		1			
	Proportion of 1-lane cross section in	1 000					
LNODECI	decreasing milepost direction, as	1.000					
LNSDEC1	continuous variable	(0.001)	0.025	0.010	0.004		
LNSFDECA	Roadway surface type is asphalt in decreasing milepost direction	0.403	0.925	0.918	0.904 (0.262)		
LINSFDECA	Roadway surface type is bituminous in	(0.484) 0.586	(0.245)	(0.256)	(0.202)		
LNSFDECB	decreasing milepost direction	(0.487)					
LINSTDECD	Roadway surface type is portland cement	0.009		0.041	0.067	0.452	
LNSFDECP	concrete in decreasing milepost direction	(0.076)		(0.178)	(0.217)	(0.491)	
LIGIDECI	Roadway surface type is asphalt in	0.403		0.693	(0.217)	(0.471)	
LNSFINCA	increasing milepost direction	(0.485)		(0.453)			
LIGINCI	Roadway surface type is bituminous in	(0.405)		(0.433)		0.013	
LNSFINCB	increasing milepost direction					(0.113)	
LIGINOD	Roadway surface type is portland cement	0.009		0.270		(01110)	
LNSFINCP	concrete in increasing milepost direction	(0.076)		(0.436)			
				(01.000)		l	
	Roadway in Roadway weighted average width in	Iormation		T			
	decreasing milepost direction, as	11.525	12.570	23.036	25.419	30.376	
RWDDEC	continuous variable	(1.302)	(2.716)	(4.079)	(6.528)	(8.681)	
RUDDLC	Proportion of roadway width is in the 0.01	(1.502)	(2.710)	(4.077)	(0.520)	(0.001)	
	to 12.0 foot range in decreasing milepost	0.974		0.086	0.026		
RDEC012	direction, as continuous variable	(0.135)		(0.263)	(0.129)		
	Proportion of roadway width is in the 12.01	()					
	to 24.0 foot range in decreasing milepost	0.023		0.862	0.605	0.596	
RDEC1224	direction, as continuous variable	(0.126)		(0.316)	(0.423)	(0.482)	
	Proportion of roadway width is in the 24.01						
	to 36.0 foot range in decreasing milepost				0.290	0.284	
RDEC2436	direction, as continuous variable				(0.381)	(0.436)	
	Proportion of roadway width is in the 36.01						
	to 48.0 foot range in decreasing milepost					0.095	
RDEC3648	direction, as continuous variable			ļ		(0.273)	
	Proportion of roadway width is in the 0.01						
DD120 (-	to 12.0 foot range in increasing milepost	0.975	0.835	0.065	0.032		
RINC012	direction, as continuous variable	(0.135)	(0.329)	(0.228)	(0.149)		
	Proportion of roadway width in the 12.01 to	0.000	0.1	0.070	0.625		
DINGIOS	24.0 foot range in increasing milepost	0.023	0.157	0.870	0.639		
RINC1224	direction, as continuous variable	(0.126)	(0.317)	(0.304)	(0.406)		

Table B.3 (Continued) Descriptive statistics of significant variables for 0.25 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT		
Variable	Description	Mean (standard deviation)						
	Travel shoulde	r informat	ion					
	Proportion of travel shoulder width in the							
	2.01 to 4.0 foot range on the left side in	0.000						
SDWL24	increasing milepost direction, as continuous variable	0.332						
SDWL24	Proportion of travel shoulder width is in the	(0.460)						
	2.01 to 4.0 foot range on the left-center side							
	in increasing milepost direction, as					0.532		
SDWLC24	continuous variable					(0.490)		
	Proportion of travel shoulder width is in the							
	4.01 to 6.0 foot range on the left-center side					0.150		
SDWI CAG	in increasing milepost direction, as continuous variable					0.159		
SDWLC46	Proportion of travel shoulder width in the					(0.356)		
	8.01 to 10.0 foot range on the left-center							
	side in increasing milepost direction, as	0.078						
SDWLC810	continuous variable	(0.266)						
	Proportion of travel shoulder width is in the							
	0.01 to 2.0 foot range on the right side in							
SDWD02	increasing milepost direction, as continuous variable	0.213	0.070					
SDWR02	Proportion of travel shoulder width is wider	(0.403)	(0.244)					
	than 10 ft. on the right side in increasing				0.012			
SDWR10P	milepost direction, as continuous variable				(0.093)			
	Proportion of travel shoulder width is in the							
	2.01 to 4.0 foot range on the right side in							
	increasing milepost direction, as continuous	0.336	0.227		0.021			
SDWR24	variable	(0.460)	(0.393)		(0.126)			
	Proportion of travel shoulder width is in the 4.01 to 6.0 foot range on the right side in							
	increasing milepost direction, as continuous		0.163		0.042			
SDWR46	variable		(0.347)		(0.185)			
	Proportion of travel shoulder width is in the							
	6.01 to 8.0 foot range on the right side in							
25 11 15 40	increasing milepost direction, as continuous		0.315		0.146			
SDWR68	variable		(0.440)		(0.329)			
	Proportion of travel shoulder width is in the 8.01 to 10.0 foot range on the right side in							
	increasing milepost direction, as continuous		0.079		0.344	0.908		
SDWR810	variable		(0.252)		(0.455)	(0.255)		
	Weighted average travel shoulder width on		, ,		, í			
	the right-center side in increasing milepost					3.845		
SDWRC	direction, as continuous variable					(2.537)		
	Proportion of travel shoulder width is in the							
	2.01 to 4.0 foot range on the right-center side in increasing milepost direction, as			0.616	0.159			
SDWRC24	continuous variable			(0.475)	(0.355)			
	Proportion of travel shoulder width is in the			((0.500)			
	4.01 to 6.0 foot range on the right-center							
	side in increasing milepost direction, as					0.149		
SDWRC46	continuous variable					(0.348)		
	Proportion of travel shoulder width is in the 6.01 to 8.0 foot many on the right contained							
	6.01 to 8.0 foot range on the right-center side in increasing milepost direction, as					0.031		
SDWRC68	continuous variable					(0.168)		

Table B.3 (Continued) Descriptive statistics of significant variables for 0.25 mile fixed-length segment model

		TL RUR	TL URB	NINT RUR	NINT URB	INT			
¥7 · 11		KUK	-		-	1111			
Variable	Description Mean (standard deviation)								
	Travel shoulder	r informati	ion	1					
	Proportion of travel shoulder width is in the								
	8.01 to 10.0 foot range on the right-center					0.065			
SDWRC810	side in increasing milepost direction, as continuous variable					0.065			
SDWKC810						(0.237)			
	Proportion of shoulder surface type is bituminous on the left side in increasing	0.476							
SSFLB	milepost direction, as continuous variable	(0.494)							
SSILD	Proportion of curb shoulder surface type on	(0.494)							
	the left side in increasing milepost direction,	0.016	0.133	0.036	0.402				
SSFLC	as continuous variable	(0.102)	(0.316)	(0.170)	(0.470)				
55120	Proportion of shoulder surface type is	(01102)	(01010)	(011/0)	(011/0)				
	asphalt on the right side in increasing	0.446			0.562	0.912			
SSFRA	milepost direction, as continuous variable	(0.488)			(0.467)	(0.252)			
	Proportion of shoulder surface type is	,							
	bituminous on the right side in increasing	0.477							
SSFRB	milepost direction, as continuous variable	(0.494)							
	Proportion of curb shoulder surface type on								
	the right side in increasing milepost	0.017	0.124	0.040	0.392				
SSFRC	direction, as continuous variable	(0.106)	(0.302)	(0.175)	(0.467)				
	Proportion of shoulder surface type is								
	gravel on the right side in increasing	0.047							
SSFRG	milepost direction, as continuous variable	(0.209)							
	There's no shoulder on the right side in	0.000							
CCEDNIA	increasing milepost direction within this	0.009							
SSFRNA	segment	(0.082)							
	Median surface	e informati	on	1					
	Proportion of shoulder surface type is			0.1.60	0.050				
	asphalt on the left side in increasing			0.168	0.258				
MSFA	milepost direction, as continuous variable			(0.362)	(0.414)	0.112			
MWD1020	Proportion of median width in 10.01 to 20.0			0.148	0.207	0.113			
MWD1020	foot range, as continuous variable			(0.345)	(0.385) 0.074	(0.311)			
MWD3040	Proportion of median width is in the 30.01 to 40.0 foot range, as continuous variable				(0.253)				
IVI VY D3040	Proportion of median width in 40.01 to 50.0				0.041				
MWD4050	foot range, as continuous variable				(0.191)				
111107030	1000 range, as continuous variable			1	(0.171)				

Table B.3 (Continued) Descriptive statistics of significant variables for 0.25 mile fixed-length segment model

Appendix C

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	1	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	2	0	0	1	1
Vertical curve information	3	0	0	1	3
Travel lane information	2	1	0	1	1
Roadway information	0	2	0	2	2
Travel shoulder information	3	3	0	0	4
Median information	0	0	0	1	1

Table C.1 Random parameter occurrence of total crash models for 0.5 mile segments

Table C.2 Random parameter occurrence of property damage only crash models for 0.5 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	3	0	0	1	0
Vertical curve information	2	0	1	2	1
Travel lane information	0	1	0	1	0
Roadway information	0	2	0	0	0
Travel shoulder information	3	1	0	2	1
Median information	0	0	0	0	0

Table C.3 Random parameter occurrence of possible injury crash models for 0.5 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	1	0	0	0	0
Vertical curve information	3	1	0	1	1
Travel lane information	0	1	0	0	1
Roadway information	1	1	1	2	3
Travel shoulder information	1	0	0	1	2
Median information	0	0	0	2	0

Table C.4 Random parameter occurrence of evident injury crash models for 0.5 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	0	0
Vertical curve information	1	0	0	0	1
Travel lane information	1	0	1	0	1
Roadway information	0	0	1	1	1
Travel shoulder information	0	1	0	0	2
Median information	0	0	0	0	0

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	0
Horizontal curve information	0	0	0	0	0
Vertical curve information	1	0	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	0	1
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

Table C.5 Random parameter occurrence of serious injury crash models for 0.5 mile segments

Table C.6 Random parameter occurrence of fatal crash models for 0.5 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	0	1
Vertical curve information	1	0	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	0	0
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	1	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	1	0
Vertical curve information	3	0	0	2	3
Travel lane information	2	1	0	1	1
Roadway information	0	2	0	2	2
Travel shoulder information	3	3	0	0	2
Median information	0	0	0	1	1

Table C.7 Random parameter occurrence of total crash models for 0.25 mile segments

Table C.8 Random parameter occurrence of property damage only crash models for 0.25 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	2	0	0	0	0
Vertical curve information	2	0	1	2	2
Travel lane information	0	1	0	0	1
Roadway information	0	2	0	0	2
Travel shoulder information	3	1	0	2	3
Median information	0	0	0	0	0

Table C.9 Random parameter occurrence of possible injury crash models for 0.25 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	1	0	0	0	0
Vertical curve information	2	1	0	0	1
Travel lane information	0	1	0	0	1
Roadway information	1	2	1	2	2
Travel shoulder information	1	0	1	2	1
Median information	0	0	0	2	0

Table C.10 Random parameter occurrence of evident injury crash models for 0.25 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	0	0
Vertical curve information	1	0	0	0	0
Travel lane information	1	0	1	0	1
Roadway information	0	0	1	2	1
Travel shoulder information	0	0	0	0	1
Median information	0	0	0	0	0

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	0
Horizontal curve information	0	0	0	0	0
Vertical curve information	2	0	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	1	1
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

Table C.11 Random parameter occurrence of serious injury crash models for 0.25 mile segments

Table C.12 Random parameter occurrence of fatal crash models for 0.25 mile segments

Function class	TLR	TLU	NINTR	NINTU	INT
ADT	0	0	0	0	0
Urban-rural indicator	0	0	0	0	1
Horizontal curve information	0	0	0	0	1
Vertical curve information	1	0	0	0	0
Travel lane information	0	0	0	0	0
Roadway information	0	0	0	0	0
Travel shoulder information	0	0	0	0	0
Median information	0	0	0	0	0

	Fixed Paran	neters		1	1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.586				
Constant		(5.58)				
	Count of horizontal curves within the fixed-length		-0.032			
NHC	segment		(-4.24)			
	Count of horizontal curves with angle of					
	deflection (Δ) <= 5 (degrees) within the fixed-	0.077				
NHCA5DW	length segment	(4.14)			(-11.52)	
	Count of horizontal curves with 1000 <= radius <					0.187
NHCR1015	1500 (feet) within the fixed-length segment					(6.93)
	Count of horizontal curves with 500 <= radius <	0.070	0.170			
NHCR57	700 (feet) within the fixed-length segment	(4.36)	(6.29)			
	Count of horizontal curves with design speed of					
	30 mph or 35 mph within the fixed-length	-0.101				
NHSP3035	segment	(-5.00)				
	Count of horizontal curves with design speed of	0.5.				
	40 mph or 45 mph within the fixed-length	-0.067				
NHSP4045	segment	(-2.54)				
	Count of horizontal curves with design speed of					
	60 mph or 65 mph within the fixed-length					0.115
NHSP6065	segment					(7.88)
	Count of horizontal curves with design speed					
	more than 70 (mph) within the fixed-length					-0.100
NHSP70UP	segment					(-5.85)
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					0.138
PHCR2030	segment					(8.05)
	Natural log of proportion of horizontal curves	0.140				
	with radius less than 100 (feet) within the fixed-	-0.140				
LHCR1DW	length segment	(-6.41)				
	Natural log of proportion of horizontal curves	0.040				
	with 5000 <= radius (feet) within the fixed-length	0.049				
LHCR50UP	segment	(3.63)			(-11.52) (-11.52) (-1.	
	Natural log of proportion of horizontal curves		0.066		0.005	
	with design speed <=25 (mph) within the fixed-		-0.066			
LHSP25DW	length segment		(-5.36)	-	(-13.26)	
	Natural log of proportion of horizontal curves	0.071		0.004		
111002025	with design speeds of 30 mph or 35 mph within	-0.071		-0.084		
LHSP3035	the fixed-length segment	(-4.51)		(-3.79)		
	Natural log of proportion of horizontal curves	-0.068				
111504045	with design speed ranged from 40 to 45 (mph)					
LHSP4045	within the fixed-length segment Natural log of proportion of horizontal curves	(-3.36)				
	with design speed ranged from 50 to 55 (mph)	0.042				
LHSP5055	with design speed ranged from 50 to 55 (mpn) within the fixed-length segment	-0.043 (-3.00)				
101 3033	Count of vertical curves with $100 < K$ value	0.039			0.006	
NVK1020	<=200 within the fixed-length segment	(3.77)				
INVIN1020	<=200 within the fixed-length segment Count of vertical curves with $200 < K$ value	0.056		+	(20.39)	
NVK2030		(4.26)				
N V K2050	<=300 within the fixed-length segment Count of vertical curves with 20 < K value <=50	0.115				
NVK250						
IN V K230	within the fixed-length segment	(6.65)				0.044
NUK2040	Count of vertical curves with $300 < K$ value					-0.944
NVK3040	<=400 within the fixed-length segment					(-5.61)
	Natural log of proportion of vertical curves with 2			0.072		
I VDCI 24	<= absolute back slope < 4 within the fixed-			-0.072		
LVBSL24	length segment		1	(-4.61)	1	

Table C.13 Total	crash models by	functional classes f	for 1 mile segments
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	Fixed Paran	neters	1	1	1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Natural log of proportion of vertical curves with	0.040				
1.11/1000	100 < K value <=200 within the fixed-length	-0.048				
LVK1020	segment	(-5.53)				
	Natural log of proportion of vertical curves with			0.072		
1.111/2020	200 < K value <=300 within the fixed-length			-0.073		
LVK2030	segment			(-4.33)		
	Natural log of proportion of vertical curves with	0.076				
1 1/1/2 10	50 < K value <=100 within the fixed-length	-0.076				
LVK510	segment	(-8.64)		1.250	0.005	
NGEDEOD	Roadway surface type is portland cement concrete			1.250	0.885	
LNSFDECP	in decreasing milepost direction			(7.53)	(12.19)	0.55
	Roadway surface type is bituminous in increasing					-0.664
LNSFINCB	milepost direction					(-2.84)
NORDICE	Roadway surface type is portland cement concrete	0.553		-0.885		
LNSFINCP	in increasing milepost direction	(4.76)		(-11.26)		
	Roadway weighted average width in decreasing					-0.015
RWDDEC	milepost direction, as continuous variable				-0.928 (-8.31) -0.883 (-14.93)	(-2.42
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in decreasing milepost direction, as					
RDEC012	continuous variable				(-8.31)	
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as			0.661		
RDEC1224	continuous variable			(5.37)	(-14.93)	
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					0.806
RDEC2436	continuous variable					(5.94)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as					
RINC012	continuous variable				(-8.31) -0.883	
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,			-0.463		
RINC1224	as continuous variable			(-3.64)		
	Proportion of travel shoulder width is in the 0.01					
	to 2.0 foot range on the right side in increasing	-0.591				
SDWR02	milepost direction, as continuous variable	(-17.79)				
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right side in increasing		0.737			
SDWR810	milepost direction, as continuous variable		(8.37)			
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.512
SDWRC810	variable					(6.34)
	Proportion of curb shoulder surface type on the	0.45-				
	left side in increasing milepost direction, as	0.435				
SSFLC	continuous variable	(2.54)				
	Proportion of shoulder surface type is asphalt on	o -				
	the right side in increasing milepost direction, as	0.575				
SSFRA	continuous variable	(10.89)				
	Proportion of curb shoulder surface type on the					
	right side in increasing milepost direction, as	1.401	1.095		0.712	
SSFRC	continuous variable	(8.15)	(11.33)		(37.57)	
	Proportion of median width in 10.01 to 20.0 foot			0.343		
MWD1020	range, as continuous variable			(5.46)		

Table C.13 (Continued) Total crash models by functional classes for 1 mile segments

	Fixed Paran	neters	1	1		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of median width is in the 30.01 to 40.0				-0.443	
MWD3040	foot range, as continuous variable				(-9.09)	
		0.041	0.013	0.055	0.010	0.017
ALPHA	Dispersion parameter	(5.57)	(3.02)	(5.40)	(5.76)	(7.05)
	Random Para	ameters				
			1.728	0.852	2.382	3.614
Constant			(12.97)	(4.77)	(47.76)	(9.63)
				-0.072		
LNADT	Natural log of AADT			(-4.62)		
	Location indicator (if segment is located in in			. ,		0.788
URBAN	urban area, 1, otherwise, 0)					(32.14)
	Count of horizontal curves within the fixed-length	-0.022				0.082
NHC	segment	(-4.17)				(8.10)
	Natural log of proportion of horizontal curves with					
	design speed $<=25$ (mph) within the fixed-length	-0.055				
LHSP25DW	segment	(-5.56)				
	Natural log of proportion of horizontal curves with					
	design speeds of 30 mph or 35 mph within the				-0.054	
LHSP3035	fixed-length segment				(-6.64)	
	Count of vertical curves within the fixed-length	-0.052				
NVC	segment	(-7.91)				
	Count of vertical curves with 200 < K value <= 300				0.106	0.233
NVK2030	within the fixed-length segment				(14.27)	(20.59)
	Natural log of proportion of vertical curves with 2					
	\leq absolute back slope \leq 4 within the fixed-length				-0.053	
LVBSL24	segment				(-10.85)	
	Natural log of proportion of vertical curves with 6					
	<= absolute back slope < 8 within the fixed-length	0.144				
LVBSL68	segment	(10.17)				
	Natural log of proportion of vertical curves with	0.020				
	design speed more than 70 (mph) within the fixed-	0.039				
LVSP70UP	length segment	(4.64)				1 1 1 6
DUDGLOO	Proportion of vertical curves with absolute back					-1.116
PVBSL02	slope < 2 within the fixed-length segment Proportion of vertical curves with 2 <= absolute					(-10.33)
PVBSL24	back slope < 4 within the fixed-length segment					-0.850 (-6.81)
I VDSL24	Proportion of vertical curves with $50 < K$ value					5.250
PVK510	<=100 within the fixed-length segment					(11.04)
1 VK510	Proportion of 1-lane cross section in decreasing	-1.114				(11.04)
LNSDEC1	milepost direction, as continuous variable	(-12.76)				
ERODECT	Roadway surface type is asphalt in decreasing	0.639	1.070	0.687	0.992	
LNSFDECA	milepost direction	(17.53)	(12.92)	(5.81)	(15.58)	
LIGIDLOII	Roadway surface type is portland cement concrete	(17100)	(12:)2)	(0.01)	(10.00)	0.299
LNSFDECP	in decreasing milepost direction					(13.62)
	Proportion of roadway width is in the 12.01 to					(1010-)
	24.0 foot range in decreasing milepost direction,					-1.842
RDEC1224	as continuous variable					(-7.80)
	Proportion of roadway width is in the 24.01 to		1	1		/
	36.0 foot range in decreasing milepost direction,				-0.501	
RDEC2436	as continuous variable				(-9.20)	
	Proportion of roadway width is in the 36.01 to		1			
	48.0 foot range in decreasing milepost direction,					-0.444
RDEC3648	as continuous variable		1			(-4.15)

Table C.13 (Continued) Total crash models by functional classes for 1 mile segments

	Random Para	ameters	1			
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		-1.607			
RINC012	continuous variable		(-19.36)			
	Proportion of roadway width in the 12.01 to 24.0					
	foot range in increasing milepost direction, as		-1.004			
RINC1224	continuous variable		(-14.33)		(-13.09)	
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the left-center side in increasing milepost direction, as continuous					0.155
SDWLC24	variable					(2.54)
SDWLC24	Proportion of travel shoulder width is in the 4.01					(2.34)
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.567
SDWLC46	variable					(-11.12)
	Proportion of travel shoulder width is in the 2.01					(1112
	to 4.0 foot range on the right side in increasing	-0.317	0.417			
SDWR24	milepost direction, as continuous variable	(-12.65)	(5.15)			
	Proportion of travel shoulder width is in the 4.01					
	to $\hat{6}.0$ foot range on the right side in increasing		0.507			
SDWR46	milepost direction, as continuous variable		(5.89)			
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right side in increasing		0.488			
SDWR68	milepost direction, as continuous variable		(6.21)			
	Proportion of travel shoulder width is in the 8.01					
251115 040	to 10.0 foot range on the right side in increasing					-0.580
SDWR810	milepost direction, as continuous variable					(-16.51
	Weighted average travel shoulder width on the					0.025
SDWRC	right-center side in increasing milepost direction, as continuous variable					-0.025
SDWKC	Proportion of travel shoulder width is in the 4.01					(-1.94)
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.526
SDWRC46	variable					(7.26)
5D THE IS	Proportion of travel shoulder width is in the 6.01					(7.20)
	to 8.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.592
SDWRC68	variable					(5.46)
	Proportion of shoulder surface type is bituminous					
	on the left side in increasing milepost direction, as	-0.733				
SSFLB	continuous variable	(-4.07)				
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as			1.012		
SSFLC	continuous variable			(9.78)		
	Proportion of shoulder surface type is bituminous	0.040				
CCEDD	on the right side in increasing milepost direction,	0.842				
SSFRB	as continuous variable	(4.57)			0.000	0.572
MWD1020	Proportion of median width in 10.01 to 20.0 foot				0.202 (9.56)	0.562 (17.33)
IVI VV D1020	range, as continuous variable				(9.30)	(17.55)
	Standard Deviation for the Random Par	ameters wit			0 (0.5-5
C			0.581	0.482	0.452	0.378
Constant			(43.03)	(23.25)	(63.10)	(43.94)
INADT	Natural log of A ADT			0.002		
LNADT	Natural log of AADT			(0.85)		

Standard Deviation for the Random Parameters with Normal Distribution								
	Functional ClassTWLRTWLUNINTRNINTUINT							
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)		
URBAN	Location indicator (if segment is located in urban area, 1, otherwise, 0)					0.466 (26.58)		
CIUDINI	Count of horizontal curves within the fixed-	0.030				0.031		
NHC	length segment	(10.92)				(3.38)		
LHSP25DW	Natural log of proportion of horizontal curves with design speed <=25 (mph) within the fixed- length segment	0.129 (19.23)						
LHSP3035	Natural log of proportion of horizontal curves with design speeds of 30 mph or 35 mph within the fixed-length segment				0.015 (2.14)			
NVC	Count of vertical curves within the fixed-length segment	0.029 (14.13)						
NVK2030	Count of vertical curves with 200 < K value <=300 within the fixed-length segment				0.073 (12.98)	0.135 (16.21)		
LVBSL24	Natural log of proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment				0.031 (9.97)			
	Natural log of proportion of vertical curves with $6 \le absolute back slope < 8$ within the fixed-	0.170						
LVBSL68	length segment Natural log of proportion of vertical curves with	(13.54)						
LVSP70UP	design speed more than 70 (mph) within the fixed-length segment	0.061 (12.70)						
PVBSL02	Proportion of vertical curves with absolute back slope < 2 within the fixed-length segment, as continuous variable					0.047 (1.78)		
PVBSL24	Proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment, as continuous variable					0.223 (2.68)		
PVK510	Proportion of vertical curves with 50 < K value <=100 within the fixed-length segment, as continuous variable					8.198 (11.54)		
LNSDEC1	Proportion of 1-lane cross section in decreasing milepost direction, as continuous variable	0.476 (50.72)						
LNSFDECA	Roadway surface type is asphalt in decreasing milepost direction	0.654 (57.28)	0.184 (13.79)	0.272 (12.84)	0.425 (56.07)			
LNSFDECP	Roadway surface type is portland cement concrete in decreasing milepost direction					0.126 (11.34)		
RDEC1224	Proportion of roadway width is in the 12.01 to 24.0 foot range in decreasing milepost direction, as continuous variable					0.170 (11.01)		
RDEC2436	Proportion of roadway width is in the 24.01 to 36.0 foot range in decreasing milepost direction, as continuous variable				0.591 (38.73)			
RDEC3648	Proportion of roadway width is in the 36.01 to 48.0 foot range in decreasing milepost direction, as continuous variable					0.130 (6.67)		
RINC012	Proportion of roadway width is in the 0.01 to 12.0 foot range in increasing milepost direction, as continuous variable		0.530 (28.63)					
RINC1224	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable		0.841 (24.34)		0.468 (43.01)			

Table C.13 (Continued) Total crash models by functional classes for 1 mile segments

Standard Deviation for the Random Parameters with Normal Distribution							
	Functional Class	TWLR Coeff.	TWLU Coeff.	NINTR Coeff.	NINTU Coeff.	INT Coeff.	
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
	Proportion of travel shoulder width is in the 2.01	(((******)	(******	(1.1.1.1)	
	to 4.0 foot range on the left-center side in						
	increasing milepost direction, as continuous					0.100	
SDWLC24	variable					(5.83)	
	Proportion of travel shoulder width is in the 4.01						
	to 6.0 foot range on the left-center side in						
	increasing milepost direction, as continuous					0.120	
SDWLC46	variable					(5.06)	
	Proportion of travel shoulder width is in the 2.01	0.044					
CDUDA	to 4.0 foot range on the right side in increasing	0.064	0.137				
SDWR24	milepost direction, as continuous variable	(3.50)	(3.77)				
	Proportion of travel shoulder width is in the 4.01		0.756				
SDWR46	to 6.0 foot range on the right side in increasing milepost direction, as continuous variable		0.756				
SD W K40	Proportion of travel shoulder width is in the 6.01		(15.45)				
	to 8.0 foot range on the right side in increasing		0.163				
SDWR68	milepost direction, as continuous variable		(5.28)				
SD WR00	Proportion of travel shoulder width is in the 8.01		(3.20)				
	to 10.0 foot range on the right side in increasing					0.021	
SDWR810	milepost direction, as continuous variable					(2.25)	
	Weighted average travel shoulder width on the						
	right-center side in increasing milepost					0.047	
SDWRC	direction, as continuous variable					(25.38)	
	Proportion of travel shoulder width is in the 4.01						
	to 6.0 foot range on the right-center side in						
	increasing milepost direction, as continuous					0.090	
SDWRC46	variable					(1.59)	
	Proportion of travel shoulder width is in the 6.01						
	to 8.0 foot range on the right-center side in					0.1.60	
CDWDCCO	increasing milepost direction, as continuous variable					0.160	
SDWRC68						(3.85)	
	Proportion of shoulder surface type is bituminous on the left side in increasing	0.364					
SSFLB	milepost direction, as continuous variable	(19.42)					
ODI LD	Proportion of curb shoulder surface type on the	(17.42)					
	left side in increasing milepost direction, as			1.048			
SSFLC	continuous variable			(10.69)			
	Proportion of shoulder surface type is			()			
	bituminous on the right side in increasing	0.503					
SSFRB	milepost direction, as continuous variable	(26.59)					
	Proportion of median width in 10.01 to 20.0 foot	. ,			0.252	0.466	
MWD1020	range, as continuous variable				(14.55)	(23.14)	

Table C.13 (Continued) Total crash models by functional classes for 1 mile segments

The parameter and standard error estimates of the actual overdispersion parameter $(1/\psi)$ is estimated using Taylor's series approximations, that give $EE(1/\psi\psi) \approx \oint_{EE(\psi\psi)} \frac{\sigma_{\psi\psi}^2}{E^2(\psi\psi)} \oint_{e} d \operatorname{Var}(1/\psi\psi) \approx \frac{\sigma_{\psi\psi}^2}{E^2(\psi\psi)}$.

Fixed Parameters							
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT	
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
				-0.065			
LNADT	Natural log of AADT			(-3.53)			
	Count of horizontal curves within the fixed-length		-0.031				
NHC	segment		(-3.30)		0.150		
	Count of horizontal curves with angle of deflection $(A) = 5$ (degree) within the fixed length correct				-0.150		
NHCA5DW	$(\Delta) \le 5$ (degrees) within the fixed-length segment Count of horizontal curves with 1000 <= radius <				(-10.47)	0.214	
NHCR1015	1500 (feet) within the fixed-length segment					0.214 (6.91)	
WIICK1015	Count of horizontal curves with 500 <= radius <	0.064	0.205		-	(0.91)	
NHCR57	700 (feet) within the fixed-length segment	(3.14)	(6.16)				
MICK57	Count of horizontal curves with design speed of 40	-0.094	(0.10)				
NHSP4045	mph or 45 mph within the fixed-length segment	(-2.81)					
1151 4045	Count of horizontal curves with design speed of 60	(-2.01)				0.072	
NHSP6065	mph or 65 mph within the fixed-length segment					(3.64)	
	Count of horizontal curves with design speed more					-0.064	
NHSP70UP	than 70 (mph) within the fixed-length segment					(-3.27)	
	Proportion of horizontal curves with 2000 <= radius					(= ! = !)	
	< 3000 (feet) within the fixed-length segment, as					0.356	
PHCR2030	continuous variable					(4.28)	
	Natural log of proportion of horizontal curves with						
	radius less than 100 (feet) within the fixed-length	-0.182					
LHCR1DW	segment	(-7.32)					
	Natural log of proportion of horizontal curves with						
	design speed <=25 (mph) within the fixed-length	-0.054	-0.099				
LHSP25DW	segment	(-4.56)	(-6.53)				
	Natural log of proportion of horizontal curves with						
	design speeds of 30 mph or 35 mph within the fixed-	-0.058		-0.114	-0.057		
LHSP3035	length segment	(-3.33)		(-4.50)	(-6.00)		
	Natural log of proportion of horizontal curves with						
	design speed ranged from 40 to 45 (mph) within the	-0.103					
LHSP4045	fixed-length segment	(-4.22)					
	Count of vertical curves within the fixed-length	-0.051					
NVC	segment	(-6.36)					
NUV 1020	Count of vertical curves with 100 < K value <=200	0.048					
NVK1020	within the fixed-length segment Count of vertical curves with 20 < K value <=50	(3.82)					
NVK250	within the fixed-length segment	(5.41)					
NVIX 250	Count of vertical curves with 300 < K value <=400	(3.41)				0.146	
NVK3040	within the fixed-length segment					(8.76)	
	Natural log of proportion of vertical curves with 2					(0.70)	
	<= absolute back slope < 4 within the fixed-length				-0.057		
LVBSL24	segment				(-9.99)		
	Natural log of proportion of vertical curves with 6						
	<= absolute back slope < 8 within the fixed-length	0.102					
LVBSL68	segment	(6.57)					
	Natural log of proportion of vertical curves with						
	100 < K value $<=200$ within the fixed-length	-0.063					
LVK1020	segment	(-5.87)					
	Natural log of proportion of vertical curves with						
	200 < K value <= 300 within the fixed-length			-0.080			
LVK2030	segment			(-4.10)			
	Proportion of 1-lane cross section in decreasing	-0.590					
LNSDEC1	milepost direction, as continuous variable	(-3.41)					

 Table C.14 Property damage only crash models by functional classes for 1 mile segments

	Fixed Paran	neters		T		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Roadway surface type is portland cement concrete	0.494	(*******	(******	0.298	(*******)
LNSFDECP	in decreasing milepost direction	(3.15)			(4.08)	
	Roadway surface type is asphalt in increasing	0.855			· · · · · ·	
LNSFINCA	milepost direction	(18.32)				
	Roadway surface type is bituminous in increasing					-0.975
LNSFINCB	milepost direction					(-3.44)
	Roadway surface type is portland cement concrete			-1.011		(211)
LNSFINCP	in increasing milepost direction			(-10.41)		
	Roadway weighted average width in decreasing			(-10.41)		-0.015
RWDDEC	milepost direction, as continuous variable					(-2.05)
KWDDEC						(-2.03)
	Proportion of roadway width is in the 0.01 to 12.0	0 (10				
	foot range in decreasing milepost direction, as	-0.642				
RDEC012	continuous variable	(-2.94)				
	Proportion of roadway width is in the 12.01 to 24.0					
	foot range in decreasing milepost direction, as	-0.531		0.507	-0.184	
RDEC1224	continuous variable	(-2.56)		(6.88)	(-4.96)	
	Proportion of roadway width is in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-0.847
RDEC2436	continuous variable					(-4.18)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as				-1.098	
RINC012	continuous variable				(-19.67)	
	Proportion of roadway width in the 12.01 to 24.0				(1)107)	
	foot range in increasing milepost direction, as				-0.636	
RINC1224	continuous variable				(-16.30)	
KINC1224					(-10.30)	
	Proportion of travel shoulder width is in the 0.01 to	0.664				
	2.0 foot range on the right side in increasing	-0.664				
SDWR02	milepost direction, as continuous variable	(-16.22)				
	Proportion of travel shoulder width is in the 2.01 to					
	4.0 foot range on the right side in increasing				-0.949	
SDWR24	milepost direction, as continuous variable				(-7.79)	
	Proportion of travel shoulder width is in the 4.01 to					
	6.0 foot range on the right side in increasing		0.223		-0.907	
SDWR46	milepost direction, as continuous variable		(3.12)		(-9.78)	
	Proportion of travel shoulder width is in the 6.01 to					
	8.0 foot range on the right side in increasing		0.231			
SDWR68	milepost direction, as continuous variable		(3.81)			
02 11100	Weighted average travel shoulder width on the		(0.01)			
	right-center side in increasing milepost direction, as					-0.025
SDWRC	continuous variable					(-2.47)
SDWRC	Proportion of travel shoulder width is in the 6.01 to					(-2.47)
						0 621
SDWDCCO	8.0 foot range on the right-center side in increasing					0.631
SDWRC68	milepost direction, as continuous variable					(5.12)
	Proportion of shoulder surface type is bituminous	1.6.12				
	on the left side in increasing milepost direction, as	-1.043				
SSFLB	continuous variable	(-4.74)				
	Proportion of shoulder surface type is asphalt on the					
	right side in increasing milepost direction, as	0.481			0.407	
SSFRA	continuous variable	(7.35)			(5.18)	
	Proportion of curb shoulder surface type on the	*				
	right side in increasing milepost direction, as		0.939		0.498	
SSFRC	continuous variable		(10.08)		(8.34)	
	Proportion of median width in 10.01 to 20.0 foot		(1000)	0.394	0.180	
	Proportion of median width in 10 01 to 20 0 1000					

 Table C.14 (Continued) Property damage only crash models by functional classes for 1 mile segments

	Fixed Paran	neters		-		r
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of median width is in the 30.01 to 40.0	, ,			-0.491	· · · · · ·
MWD3040	foot range, as continuous variable				(-8.30)	
		0.033	0.021	374.075	0.010	0.020
ALPHA	Dispersion parameter	(2.90)	(2.93)	(23724.26)	(4.99)	(6.56)
	Random Para	ameters				
		0.198	1.351	0.770	2.419	3.082
Constant		(0.91)	(8.81)	(4.72)	(31.22)	(6.74)
	Location indicator (if segment is located in urban					0.843
URBAN	area, 1, otherwise, 0)					(29.89)
	Count of horizontal curves within the fixed-length	-0.039				0.099
NHC	segment	(-5.75)				(8.61)
	Count of horizontal curves with angle of					
	deflection (Δ) <= 5 (degrees) within the fixed-	0.073				
NHCA5DW	length segment	(3.49)				
	Count of horizontal curves with design speed of	-0.112				
NHSP3035	30 mph or 35 mph within the fixed-length segment	(-4.20)				
	Natural log of proportion of horizontal curves with				0.070	
	design speed <=25 (mph) within the fixed-length				-0.058	
LHSP25DW	segment			-	(-7.71)	
NU/2/1020	Count of vertical curves with $100 < K$ value				0.090	
NVK1020	<=200 within the fixed-length segment	0.000			(16.01)	0.200
NU/K2020	Count of vertical curves with $200 < K$ value	0.066			0.111	0.206
NVK2030	<=300 within the fixed-length segment	(4.09)			(12.98)	(16.01)
	Natural log of proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length			-0.098		
LVBSL24	segment			(-5.27)		
L V DSL24	Natural log of proportion of vertical curves with			(-5.27)		
	$50 < \text{K}$ value ≤ 100 within the fixed-length	-0.082				
LVK510	segment	-0.082 (-7.67)				
LURSIO	Natural log of proportion of vertical curves with	(-7.07)				
	design speed more than 70 (mph) within the fixed-	0.062				
LVSP70UP	length segment	(5.98)				
	Proportion of vertical curves with absolute back	(0.5.0)				
	slope < 2 within the fixed-length segment, as					-1.040
PVBSL02	continuous variable					(-8.34)
	Proportion of vertical curves with 2 <= absolute					
	back slope < 4 within the fixed-length segment,					-1.033
PVBSL24	as continuous variable					(-7.38)
	Proportion of vertical curves with $50 < K$ value					
	<=100 within the fixed-length segment, as					3.788
PVK510	continuous variable					(6.56)
	Roadway surface type is asphalt in decreasing		1.266		0.324	
LNSFDECA	milepost direction		(11.32)		(5.82)	
	Roadway surface type is portland cement concrete					0.242
LNSFDECP	in decreasing milepost direction					(9.71)
	Proportion of roadway width in the 12.01 to 24					1 72 4
DDEC1224	foot range in decreasing milepost direction, as					-1.734
RDEC1224	continuous variable					(-6.03)
	Proportion of roadway width is in the 36.01 to					0.210
	48.0 foot range in decreasing milepost direction,					-0.318
RDEC3648	as continuous variable Proportion of readway width is in the 0.01 to 12.0					(-2.49)
	Proportion of roadway width is in the 0.01 to 12.0		1 652			
RINC012	foot range in increasing milepost direction, as continuous variable		-1.653 (-16.26)			
KINC012	continuous variable		(-10.20)			

	Random Para	ameters			1	1
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of roadway width is in the 12.01 to		1 1 2 2			
DINIC1224	24.0 foot range in increasing milepost direction, as		-1.120			
RINC1224	continuous variable		(-13.08)			
	Proportion of travel shoulder width is in the 2.01 to 4.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.313
SDWLC24	variable					(4.43)
	Proportion of travel shoulder width is in the 4.01					(1112)
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.441
SDWLC46	variable					(-7.46)
	Proportion of travel shoulder width is in the 2.01					
~~~~~	to 4.0 foot range on the right side in increasing	-0.396				
SDWR24	milepost direction, as continuous variable	(-12.59)				
	Proportion of travel shoulder width is in the 6.01				0.622	
SDWR68	to 8.0 foot range on the right side in increasing milepost direction, as continuous variable				-0.623 (-8.11)	
SD W K08	Proportion of travel shoulder width is in the 8.01				(-0.11)	
	to 10.0 foot range on the right side in increasing		0.468		-0.665	-0.661
SDWR810	milepost direction, as continuous variable		(5.56)		(-8.84)	(-16.53)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.515
SDWRC46	variable					(5.47)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.917
SDWRC810	variable					(5.89)
	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as	1.773		1.339		
SSFLC	continuous variable	(14.26)		(11.57)		
SSILC	Proportion of shoulder surface type is bituminous	(14.20)		(11.57)		
	on the right side in increasing milepost direction,	1.210				
SSFRB	as continuous variable	(5.35)				
	Proportion of median width in 10.01 to 20.0 foot					0.841
MWD1020	range, as continuous variable					(22.65)
	Standard Deviation for the Random Par	ameters wit	h Normal D	istribution		
		0.738	0.710	0.599	0.159	0.233
Constant		(62.72)	(41.06)	(24.24)	(20.16)	(23.40)
	Location indicator (if segment is located in urban			. ,	. ,	0.646
URBAN	area, 1, otherwise, 0)					(32.22)
	Count of horizontal curves within the fixed-	0.042				0.122
NHC	length segment	(12.44)				(11.85)
	Count of horizontal curves with angle of					
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-	0.140				
NHCA5DW	length segment           Count of horizontal curves with design speed of	(8.33)				
	30 mph or 35 mph within the fixed-length	0.131				
NHSP3035	segment	(7.98)				
11151 5055	Natural log of proportion of horizontal curves	(1.90)				
	with design speed $\leq 25$ (mph) within the fixed-				0.110	
LHSP25DW	length segment				(19.91)	
-	Count of vertical curves with 100 < K value				0.092	
NVK1020	<=200 within the fixed-length segment		1		(23.18)	

Table C.14 (Continued) Pi	roperty damage only c	crash models by functional (	classes for 1 mile segments
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Standard Deviation for the Random Parameters with Normal Distribution							
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT	
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
	Count of vertical curves with 200 < K value	0.041			0.116	0.029	
NVK2030	<=300 within the fixed-length segment	(3.69)			(17.67)	(3.14)	
	Natural log of proportion of vertical curves with						
LUDGLA	$2 \ll absolute back slope < 4$ within the fixed-			0.025			
LVBSL24	length segment			(1.83)			
	Natural log of proportion of vertical curves with	0.065					
LVK510	$50 < K$ value $\leq 100$ within the fixed-length	0.065					
LVKJIU	segment Natural log of proportion of vertical curves with	(8.44)					
	design speed more than 70 (mph) within the	0.078					
LVSP70UP	fixed-length segment	(13.02)					
21017001	Proportion of vertical curves with absolute back	(13.02)					
	slope $< 2$ within the fixed-length segment, as					0.470	
PVBSL02	continuous variable					(6.58)	
	Proportion of vertical curves with $2 \le absolute$		1			(0.00)	
	back slope $< 4$ within the fixed-length segment,					0.373	
PVBSL24	as continuous variable					(3.82)	
	Proportion of vertical curves with $50 < K$ value						
	<=100 within the fixed-length segment, as					5.759	
PVK510	continuous variable					(7.51)	
	Roadway surface type is asphalt in decreasing		0.247		0.676		
LNSFDECA	milepost direction		(14.86)		(71.12)		
	Roadway surface type is portland cement					0.156	
LNSFDECP	concrete in decreasing milepost direction					(11.46)	
	Proportion of roadway width in the 12.01 to 24						
DDECLOQA	foot range in decreasing milepost direction, as					0.402	
RDEC1224	continuous variable					(23.94)	
	Proportion of roadway width is in the 36.01 to 48.0 foot range in decreasing milepost direction,					0.050	
RDEC3648	as continuous variable					0.056 (2.42)	
KDEC3048	Proportion of roadway width is in the 0.01 to 12.0					(2.42)	
	foot range in increasing milepost direction, as		0.263				
RINC012	continuous variable		(11.67)				
Iditeoitz	Proportion of roadway width is in the 12.01 to		(11.07)				
	24.0 foot range in increasing milepost direction,		0.739				
RINC1224	as continuous variable		(17.88)				
	Proportion of travel shoulder width is in the 2.01		, , , , , , , , , , , , , , , , , , ,				
	to 4.0 foot range on the left-center side in						
	increasing milepost direction, as continuous					0.065	
SDWLC24	variable					(3.39)	
	Proportion of travel shoulder width is in the 4.01						
	to 6.0 foot range on the left-center side in						
	increasing milepost direction, as continuous					0.124	
SDWLC46	variable					(4.46)	
	Proportion of travel shoulder width is in the 2.01	0.272					
CDWD24	to 4.0 foot range on the right side in increasing	0.373					
SDWR24	milepost direction, as continuous variable	(16.59)					
	Proportion of travel shoulder width is in the 6.01				0.227		
SDWD69	to 8.0 foot range on the right side in increasing milepost direction as continuous variable				0.327		
SDWR68	milepost direction, as continuous variable Proportion of travel shoulder width is in the 8.01				(12.04)		
	to 10.0 foot range on the right side in increasing		0.707		0.565	0.104	

 Table C.14 (Continued) Property damage only crash models by functional classes for 1 mile segments

Standard Deviation for the Random Parameters with Normal Distribution							
	TWLR	TWLU	NINTR	NINTU	INT		
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	
	Proportion of travel shoulder width is in the 4.01						
SDWRC46	to 6.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.298 (10.56)	
	Proportion of travel shoulder width is in the 8.01						
SDWRC810	to 10.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.613 (20.74)	
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable	0.775 (10.82)		0.941 (8.96)			
SSFRB	Proportion of shoulder surface type is bituminous on the right side in increasing milepost direction, as continuous variable	0.300 (12.93)					
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable	. ,				0.541 (23.49)	

Table C.14 (Continued) Property damage only crash models by functional classes for 1 mile segments

#### Table C.14 (Continued) Property damage only crash models by functional classes for 1 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	9612	724	646	1214	3052
Number of Parameters	41	20	17	26	45
Number of Random Parameters	10	7	4	8	17
Restricted Log-Likelihood	-11446.38	-2056.21	-1302.59	-4433.46	-4364.98
Log-Likelihood	-11104.50	-1911.14	-1255.47	-4022.99	-4127.78
AIC	22288.99	3856.27	2536.95	8101.98	8343.55
BIC	22575.82	3934.21	2595.07	8244.82	8608.59
LL Ratio	683.77	290.15	94.24	820.94	474.40
Adjusted Pseudo R-squared	0.109	0.117	0.079	0.131	0.230
	RP NB	RP NB	RP NB	RP NB	RP NB

	Fixed Parameters								
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT			
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.			
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)			
	Count of horizontal curves with angle of	0.177			0.104				
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-	0.177			-0.104				
NHCA5DW	length segment	(5.11)			(-4.61)				
NUCD710	Count of horizontal curves with 700 <= radius <	-0.092							
NHCR710	1000 (feet) within the fixed-length segment Natural log of proportion of horizontal curves	(-3.38)							
	with $5000 \le$ radius (feet) within the fixed-length	0.085		-0.108					
LHCR50UP	segment	(3.42)		(-2.82)					
LIICKSOOI	Natural log of proportion of horizontal curves	(3.42)		(-2.02)					
	with design speeds of 30 mph or 35 mph within				-0.082				
LHSP3035	the fixed-length segment				(-5.57)				
Libittott	Natural log of proportion of horizontal curves				(3.37)				
	with design speed ranged from 50 to 55 (mph)		0.152						
LHSP5055	within the fixed-length segment		(3.31)						
	Count of vertical curves with 2 <= absolute back		/		0.141				
NVBSL24	slope $< 4$ within the fixed-length segment				(12.44)				
	Count of vertical curves with 300 < K value					0.126			
NVK3040	<=400 within the fixed-length segment					(5.05)			
	Count of vertical curves with 400 < K value	-0.086							
NVK40UP	within the fixed-length segment	(-3.79)							
	Natural log of proportion of vertical curves with								
	$6 \ll absolute back slope < 8$ within the fixed-	0.137							
LVBSL68	length segment	(5.01)							
	Natural log of proportion of vertical curves with								
	200 < K value <=300 within the fixed-length		-0.107						
LVK2030	segment		(-6.41)						
	Natural log of proportion of vertical curves with	0.036							
LVK40UP	400 < K value within the fixed-length segment	(1.68)							
	Proportion of vertical curves with absolute back					1 (90			
DUDGLOO	slope $< 2$ within the fixed-length segment, as					-1.689			
PVBSL02	continuous variable Roadway surface type is bituminous in	-1.214				(-8.12)			
LNSFDECB		-1.214 (-24.35)							
LINSTDLCD	decreasing milepost direction Proportion of roadway width in the 12.01 to 24	(-24.33)							
	foot range in decreasing milepost direction, as				-0.494				
RDEC1224	continuous variable				(-8.39)				
1000000	Proportion of roadway width is in the 36.01 to				( 0.57)				
	48.0 foot range in decreasing milepost direction,					-0.473			
RDEC3648	as continuous variable					(-2.88)			
	Proportion of roadway width is in the 12.01 to								
	24.0 foot range in increasing milepost direction,	-1.302							
RINC1224	as continuous variable	(-5.15)							
	Proportion of travel shoulder width in the 2.01 to								
	4.0 foot range on the left side in increasing	-0.299							
SDWL24	milepost direction, as continuous variable	(-5.41)							
	Proportion of travel shoulder width is in the 2.01								
	to 4.0 foot range on the left-center side in								
	increasing milepost direction, as continuous					-0.345			
SDWLC24	variable		ļ			(-2.08)			
	Proportion of travel shoulder width is in the 0.01								
(DUD))	to 2.0 foot range on the right side in increasing		-0.910						
SDWR02	milepost direction, as continuous variable		(-5.43)						

Table C.15 Possible injury	crash models by functiona	l classes for 1 mile segment

	Fixed Para	meters		1		1
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is wider than					
	10 ft. on the right side in increasing milepost				1.059	
SDWR10P	direction, as continuous variable				(6.27)	
	Proportion of travel shoulder width is in the 8.01					0.004
CDUDO10	to 10.0 foot range on the right side in increasing					-0.824
SDWR810	milepost direction, as continuous variable					(-14.11)
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right-center side in			0.751		
SDWDC24	increasing milepost direction, as continuous			-0.751		
SDWRC24	variable			(-6.29)		
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right-center side in					0.545
SDWDC(0	increasing milepost direction, as continuous					0.545
SDWRC68	variable					(6.45)
	Proportion of curb shoulder surface type on the	1.052				
SSFLC	left side in increasing milepost direction, as	1.052				
SSFLC	continuous variable	(7.20)				
	Proportion of shoulder surface type is asphalt on the right side in increasing milepost direction, as					0.412
SSFRA	continuous variable					(6.17)
SSFKA		-1.511				(0.17)
SSFRNA	There's no shoulder on the right side in increasing	-1.511 (-4.19)				
SSFKINA	milepost direction within this segment	(-4.19)			0.019	0.015
ALPHA	Dispersion parameter				0.018 (3.09)	0.015 (2.60)
ALITIA	Dispersion parameter				(3.09)	(2.00)
	Random Pa		-			
		0.562	1.294	-0.219	1.677	2.222
Constant		(2.69)	(7.39)	(-2.21)	(35.12)	(4.03)
	Location indicator (if segment is located in urban					0.828
URBAN	area, 1, otherwise, 0)					(15.96)
	Count of horizontal curves within the fixed-length					0.143
NHC	segment					(8.85)
	Count of horizontal curves with design speed of					0.165
NHSP6065	60 mph or 65 mph within the fixed-length segment					(5.64)
	Count of horizontal curves with design speed					
	more than 70 (mph) within the fixed-length					-0.091
NHSP70UP	segment					(-3.21)
	Natural log of proportion of horizontal curves with					
	design speed ranged from 40 to 45 (mph) within	-0.099				
LHSP4045	the fixed-length segment	(-3.36)				
	Natural log of proportion of horizontal curves with					
	design speed ranged from 50 to 55 (mph) within	-0.048				
LHSP5055	the fixed-length segment	(-1.59)				
	Count of vertical curves with 2 <= absolute back	-0.085				
NVBSL24	slope $< 4$ within the fixed-length segment	(-3.92)				
	Count of vertical curves with 200 < K value	0.067				0.212
NVK2030	<=300 within the fixed-length segment	(2.82)				(10.76)
	Count of vertical curves with 400 < K value		-0.072			
NVK40UP	within the fixed-length segment		(-3.53)			
	Natural log of proportion of vertical curves with					
	100 < K value <=200 within the fixed-length				-0.047	
LVK1020	segment				(-4.26)	
	Natural log of proportion of vertical curves with					
	200 < K value <=300 within the fixed-length				-0.049	
LVK2030	segment				(-5.11)	1

Table C.15 (Continued) Possible injury crash models by functional classes for 1 mile segment

	Random Par	rameters	1	1		1
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff.	Coeff. (t-stat)	Coeff. (t-stat)	Coeff.	Coeff.
Variable	Description           Natural log of proportion of vertical curves with	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	50 < K value $<=100$ within the fixed-length	-0.138		-0.146		
LVK510	segment	(-8.21)		(-2.44)		
	Roadway surface type is asphalt in decreasing		1.359			
LNSFDECA	milepost direction		(8.35)			
	Roadway surface type is portland cement concrete					0.462
LNSFDECP	in decreasing milepost direction					(10.92)
	Roadway weighted average width in decreasing					-0.025
RWDDEC	milepost direction, as continuous variable					(-2.73)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in decreasing milepost direction, as			-0.989	-1.339	
RDEC012	continuous variable			(-5.88)	(-15.48)	
	Proportion of roadway width in the 12.01 to 24					2.259
RDEC1224	foot range in decreasing milepost direction, as continuous variable					-2.258 (-6.38)
KDEC1224	Proportion of roadway width in the 24.01 to 36.0					(-0.38)
	foot range in decreasing milepost direction, as					-1.153
RDEC2436	continuous variable					(-4.48)
10102100	Proportion of roadway width is in the 0.01 to 12.0					( 1.10)
	foot range in increasing milepost direction, as	-1.682	-2.431			
RINC012	continuous variable	(-8.29)	(-30.27)			
	Proportion of roadway width is in the 12.01 to		, , , , , , , , , , , , , , , , , , ,			
	24.0 foot range in increasing milepost direction, as		-1.432		-0.304	
RINC1224	continuous variable		(-13.27)		(-5.10)	
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.592
SDWLC46	variable					(-6.13)
	Proportion of travel shoulder width is in the 0.01	0.010				
CDUDOO	to 2.0 foot range on the right side in increasing	-0.812				
SDWR02	milepost direction, as continuous variable	(-9.91)				
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right-center side in increasing milepost direction, as continuous				-1.190	
SDWRC24	variable				(-14.12)	
50 11 10 24	Proportion of travel shoulder width is in the 4.01				(14.12)	
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.206
SDWRC46	variable					(2.24)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.491
SDWRC810	variable					(7.63)
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as			0.860	0.540	
SSFLC	continuous variable			(4.08)	(13.41)	
	Proportion of shoulder surface type is asphalt on				0.000	
MODA	the left side in increasing milepost direction, as				-0.339	
MSFA	continuous variable				(-6.47)	0.505
MWD1020	Proportion of median width in 10.01 to 20.0 foot				0.271	0.582
MWD1020	range, as continuous variable				(5.78)	(10.92)

Table C.15 (Continued) Possible injury crash models by functional classes for 1 mile segment

Standard Deviation for the Random Parameters with Normal Distribution						
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.938	0.749	0.603	0.637	0.202
Constant		(44.45)	(29.63)	(12.94)	(46.03)	(13.57)
	Location indicator (if segment is located in urban					0.629
URBAN	area, 1, otherwise, 0)					(21.66)
NUC	Count of horizontal curves within the fixed-					0.128
NHC	length segment					(8.69)
	Count of horizontal curves with design speed of 60 mph or 65 mph within the fixed-length					0.053
NHSP6065	segment					(2.19)
11151 0005	Count of horizontal curves with design speed					(2.17)
	more than 70 (mph) within the fixed-length					0.215
NHSP70UP	segment					(2.41)
11101 /001	Natural log of proportion of horizontal curves					(2.41)
	with design speed ranged from 40 to 45 (mph)	0.035				
LHSP4045	within the fixed-length segment	(1.40)				
	Natural log of proportion of horizontal curves	(1110)				
	with design speed ranged from 50 to 55 (mph)	0.159				
LHSP5055	within the fixed-length segment	(6.86)				
	Count of vertical curves with $2 \le absolute back$	0.119				
NVBSL24	slope $< 4$ within the fixed-length segment	(8.07)				
	Count of vertical curves with 200 < K value	0.070				0.077
NVK2030	<=300 within the fixed-length segment	(3.77)				(5.72)
	Count of vertical curves with 400 < K value		0.051			
NVK40UP	within the fixed-length segment		(2.81)			
	Natural log of proportion of vertical curves with					
	100 < K value <=200 within the fixed-length				0.119	
LVK1020	segment				(16.52)	
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length				0.046	
LVK2030	segment				(6.44)	
	Natural log of proportion of vertical curves with	0.005		0.107		
1.1/1/ 510	50 < K value <=100 within the fixed-length	0.095		0.197		
LVK510	segment	(7.31)	0.000	(4.55)		
LNSFDECA	Roadway surface type is asphalt in decreasing		0.089			
LINSFDECA	milepost direction Roadway surface type is portland cement		(3.75)			0.034
LNSFDECP	concrete in decreasing milepost direction					(1.76)
LIGI DLCI	Roadway weighted average width in decreasing					0.004
RWDDEC	milepost direction, as continuous variable					(9.92)
Riibble	Proportion of roadway width is in the 0.01 to 12.0					().)2)
	foot range in decreasing milepost direction, as			0.632	0.561	
RDEC012	continuous variable			(5.80)	(7.55)	
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					0.494
RDEC1224	continuous variable					(15.84)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					0.293
RDEC2436	continuous variable					(11.11)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as	0.081	0.496			
RINC012	continuous variable	(3.76)	(14.27)			
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		0.682		0.337	
RINC1224	as continuous variable		(12.22)		(16.54)	

Table C.15 (Continued)	<b>Possible injury</b>	crash models by	v functional	classes for 1	l mile segment
			,		

	Standard Deviation for the Random Pa	rameters wi	ith Normal I	Distribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.408
SDWLC46	variable					(8.23)
	Proportion of travel shoulder width is in the 0.01					
	to 2.0 foot range on the right side in increasing	0.506				
SDWR02	milepost direction, as continuous variable	(7.54)				
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right-center side in					
	increasing milepost direction, as continuous				0.917	
SDWRC24	variable				(14.34)	
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.235
SDWRC46	variable					(4.88)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
65 W B 6040	increasing milepost direction, as continuous					0.555
SDWRC810	variable					(11.36)
	Proportion of curb shoulder surface type on the					
6 6 FT 6	left side in increasing milepost direction, as			1.281	0.059	
SSFLC	continuous variable			(6.93)	(3.33)	
	Proportion of shoulder surface type is asphalt on				0.4.40	
	the left side in increasing milepost direction, as				0.460	
MSFA	continuous variable				(14.79)	
	Proportion of median width in 10.01 to 20.0 foot				0.353	0.640
MWD1020	range, as continuous variable				(11.14)	(18.33)

Table C.15 (Continued)	<b>Possible injury</b>	crash models by functional	classes for 1 mile segment

#### Table C.15 (Continued) Possible injury crash models by functional classes for 1 mile segment

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	9612	724	646	1214	3052
Number of Parameters	41	20	17	26	45
Number of Random Parameters	10	7	4	8	17
Restricted Log-Likelihood	-5753.38	-1729.58	-770.11	-3293.72	-2766.81
Log-Likelihood	-5348.02	-1342.09	-704.63	-3041.92	-2638.74
AIC	10750.05	2710.18	1429.26	6131.85	5351.47
BIC	10943.66	2769.79	1473.97	6254.29	5574.34
LL Ratio	810.72	774.97	130.95	503.59	256.15
Adjusted Pseudo R-squared	0.196	0.401	0.177	0.125	0.245
	RP Poisson	RP Poisson	RP Poisson	RP NB	RP NB

	Fixed Para	meters	1	n		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
Constant				-1.350 (-2.22)		
	Count of horizontal curves with 1000 <= radius					0.268
NHCR1015	< 1500 (feet) within the fixed-length segment					(3.03)
	Count of horizontal curves with design speed of					0.157
NHSP6065	60 mph or 65 mph within the fixed-length segment					0.157 (3.08)
NHSF0005	Proportion of horizontal curves with 2000 <=					(3.08)
	radius $< 3000$ (feet) within the fixed-length					0.537
PHCR2030	segment, as continuous variable					(2.44)
	Count of vertical curves with $6 \le absolute back$	-0.410				
NVBSL68	slope $< 8$ within the fixed-length segment	(-4.89)				
	Count of vertical curves with 100 < K value		0.108		0.061	
NVK1020	<=200 within the fixed-length segment		(4.22)		(3.91)	
	Count of vertical curves with 200 < K value					0.130
NVK2030	<=300 within the fixed-length segment					(3.56)
	Natural log of proportion of vertical curves with				0.045	
LVASL24	2 <= absolute ahead slope < 4 within the fixed- length segment				-0.045 (-2.97)	
LVA5L24	Natural log of proportion of vertical curves with				(-2.97)	
	$4 \le absolute ahead slope < 6 within the fixed-$	-0.049			-0.062	
LVASL46	length segment	(-2.69)			(-3.65)	
	Natural log of proportion of vertical curves with	(				
	100 < K value <=200 within the fixed-length	-0.049				
LVK1020	segment	(-2.24)				
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length			-0.091		
LVK2030	segment			(-1.68)		
	Natural log of proportion of vertical curves with design speed ranged from 60 to 65 (mph) within	-0.107				
LVSP6065	the fixed-length segment	(-3.46)				
L V 51 0005	Roadway weighted average width in decreasing	0.029	0.039	0.039		-
RWDDEC	milepost direction, as continuous variable	(2.78)	(4.31)	(1.83)		
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-2.203
RDEC2436	continuous variable					(-4.72)
	Proportion of roadway width is in the 36.01 to					
DDEC2640	48.0 foot range in decreasing milepost direction,					-1.080
RDEC3648	as continuous variable Proportion of roadway width is in the 0.01 to					(-3.60)
	12.0 foot range in increasing milepost direction,				-0.786	
RINC012	as continuous variable				(-4.32)	
	Proportion of roadway width is in the 12.01 to				(	
	24.0 foot range in increasing milepost direction,			-1.136		
RINC1224	as continuous variable			(-4.45)		
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					0
	increasing milepost direction, as continuous					-0.563
SDWLC46	variable					(-3.41)
	Proportion of travel shoulder width is in the 8.01					0.409
SDWR810	to 10.0 foot range on the right side in increasing milepost direction, as continuous variable					-0.498 (-4.96)

 Table C.16 Evident injury crash models by functional classes for 1 mile segment

	Fixed Para	meters	T	1		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right-center side in					0 744
CDUDC(0	increasing milepost direction, as continuous					0.746
SDWRC68	variable					(2.59)
	Proportion of shoulder surface type is bituminous on the right side in increasing	0.476				
SSFRB		-0.476 (-4.80)				
SSEKD	milepost direction, as continuous variable Proportion of curb shoulder surface type on the	(-4.80)				
	right side in increasing milepost direction, as	0.563			0.808	
SSFRC	continuous variable	(2.84)			(13.05)	
SSIRC	Proportion of shoulder surface type is gravel on	(2.04)			(15.05)	
	the right side in increasing milepost direction, as	-0.411				
SSFRG	continuous variable	(-2.50)				
55110	Proportion of shoulder surface type is asphalt on	(2.50)	+	1		-
	the left side in increasing milepost direction, as			0.925		
MSFA	continuous variable			(2.88)		
	Proportion of median width in 10.01 to 20.0 foot			-0.997		
MWD1020	range, as continuous variable			(-2.81)		
	Proportion of median width in 40.01 to 50.0 foot				-0.659	
MWD4050	range, as continuous variable				(-2.79)	
				13552.276		0.866
ALPHA	Dispersion parameter			(90708.11)		(4.40)
	Random Par	amotora				
		-2.498	-1.122		-0.459	3.979
Constant		(-16.47)	(-8.90)		(-3.17)	(3.80)
Constant	Location indicator (if segment is located in urban	(1011)	( 0.5 0)		(0117)	0.408
URBAN	area, 1, otherwise, 0)					(4.96)
	Count of vertical curves with design speed					
	ranged from 60 to 65 (mph) within the fixed-	-0.231				
NVSP6065	length segment	(-3.64)				
	Proportion of vertical curves with 2 <= absolute	× /			-	
	back slope $< 4$ within the fixed-length segment,					-0.951
PVBSL24	as continuous variable					(-2.49)
	Roadway surface type is portland cement					0.247
LNSFDECP	concrete in decreasing milepost direction					(3.55)
	Roadway surface type is asphalt in increasing	0.470		0.425		
LNSFINCA	milepost direction	(5.07)		(2.20)		
	Roadway weighted average width in decreasing				0.018	-0.059
RWDDEC	milepost direction, as continuous variable				(4.53)	(-3.37)
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					-3.307
RDEC1224	continuous variable					(-5.02)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as			-0.813		
RINC012	continuous variable			(-1.99)		
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		-0.540		-0.433	
RINC1224	as continuous variable		(-3.13)		(-5.61)	
	Weighted average travel shoulder width on the					
	right-center side in increasing milepost direction,					-0.069
SDWRC	as continuous variable					(-2.12)

#### Table C.16 (Continued) Evident injury crash models by functional classes for 1 mile segment

	Random Par	ameters	1		1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					0.00
	increasing milepost direction, as continuous					0.695
SDWRC46	variable					(3.21)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in increasing milepost direction, as continuous					1.190
SDWRC810	variable					(3.93)
5D WRC010	Proportion of curb shoulder surface type on the					(3.75)
	right side in increasing milepost direction, as		0.605			
SSFRC	continuous variable		(3.13)			
	Proportion of median width in 10.01 to 20.0 foot		(0110)			0.556
MWD1020	range, as continuous variable					(5.71)
	Standard Deviation for the Random Pa	ramatars wi	th Normal D	Vistribution		
		0.646	0.630	131110411011	0.513	0.149
Constant		(26.16)	(15.25)		(21.23)	(5.54)
	Location indicator (if segment is located in urban	(_0.10)	(-0.20)		()	0.452
URBAN	area, 1, otherwise, 0)					(8.09)
	Count of vertical curves with design speed					
	ranged from 60 to 65 (mph) within the fixed-	0.205				
NVSP6065	length segment	(6.07)				
	Proportion of vertical curves with $2 \le absolute$					
	back slope $< 4$ within the fixed-length segment,					1.831
PVBSL24	as continuous variable					(6.67)
	Roadway surface type is portland cement					0.050
LNSFDECP	concrete in decreasing milepost direction					(1.43)
	Roadway surface type is asphalt in increasing	0.376		0.466		
LNSFINCA	milepost direction	(11.85)		(6.26)	0.000	0.004
DWDDEC	Roadway weighted average width in decreasing				0.009	0.001
RWDDEC	milepost direction, as continuous variable				(10.85)	(1.27)
	Proportion of roadway width in the 12.01 to 24					0.548
RDEC1224	foot range in decreasing milepost direction, as continuous variable					(10.17
KDEC1224	Proportion of roadway width is in the 0.01 to 12.0					(10.17
	foot range in increasing milepost direction, as			0.392		
RINC012	continuous variable			(2.22)		
	Proportion of roadway width is in the 12.01 to			()		
	24.0 foot range in increasing milepost direction,		0.576		0.224	
RINC1224	as continuous variable		(5.35)		(6.16)	
	Weighted average travel shoulder width on the					
	right-center side in increasing milepost direction,					0.019
SDWRC	as continuous variable					(3.31)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.297
SDWRC46	variable					(3.60)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					0.255
	increasing milepost direction, as continuous variable					0.356
CDWDC010	VALIANIA		1	1	1	(4.09)
SDWRC810						. ,
SDWRC810	Proportion of curb shoulder surface type on the right side in increasing milepost direction, as		0.631			

#### Table C.16 (Continued) Evident injury crash models by functional classes for 1 mile segment

	Standard Deviation for the Random Parameters with Normal Distribution						
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT	
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
	Proportion of median width in 10.01 to 20.0 foot					0.139	
MWD1020	range, as continuous variable					(2.40)	

#### Table C.16 (Continued) Evident injury crash models by functional classes for 1 mile segment

#### Table C.16 (Continued) Evident injury crash models by functional classes for 1 mile segment

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	9612	724	646	1214	3052
Number of Parameters	41	20	17	26	45
Number of Random Parameters	10	7	4	8	17
Restricted Log-Likelihood	-4450.29	-941.65	-496.04	-1985.71	-1732.54
Log-Likelihood	-4381.79	-878.70	-494.69	-1876.02	-1710.97
AIC	8791.58	1773.40	1011.39	3776.05	3483.93
BIC	8891.97	1810.08	1060.56	3837.27	3670.66
LL Ratio	136.99	125.91	2.69	219.38	43.15
Adjusted Pseudo R-squared	0.062	0.120	0.027	0.176	0.173
-	RP Poisson	RP Poisson	RP NB	RP Poisson	RP NB

	Fixed Para	neters	1	1	1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
Constant			-2.117 (-15.08)			-1.432 (-3.55)
NHC	Count of horizontal curves within the fixed-length segment					0.158 (2.45)
NHSP3035	Count of horizontal curves with design speed of 30 mph or 35 mph within the fixed-length segment	-0.302 (-2.32)				
LHCR50UP	Natural log of proportion of horizontal curves with 5000 <= radius (feet) within the fixed-length segment	0.224 (2.81)				
LHSP3035	Natural log of proportion of horizontal curves with design speeds of 30 mph or 35 mph within the fixed-length segment	-0.293 (-3.32)				
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment				0.124 (2.78)	
LVK2030	Natural log of proportion of vertical curves with 200 < K value <=300 within the fixed-length segment		-0.111 (-1.73)			
LNSFDECB	Roadway surface type is bituminous in decreasing milepost direction Proportion of roadway width in the 24.01 to 36.0	-1.070 (-8.99)				
RDEC2436	foot range in decreasing milepost direction, as continuous variable				0.359 (2.00)	
SDWR02	Proportion of travel shoulder width is in the 0.01 to 2.0 foot range on the right side in increasing milepost direction, as continuous variable	-0.314 (-1.93)				
SDWR810	Proportion of travel shoulder width is in the 8.01 to 10.0 foot range on the right side in increasing milepost direction, as continuous variable					-1.059 (-4.32)
SDWRC810	Proportion of travel shoulder width is in the 8.01 to 10.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.447 (1.98)
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable		1.082 (4.28)		0.613 (4.74)	
ALPHA	Dispersion parameter		2.265 (2.21)			1.200 (2.53)
	Random Para	ameters			•	
Constant		-2.883 (-30.20)			-1.627 (-10.64)	
PHCR2030	Proportion of horizontal curves with 2000 <= radius < 3000 (feet) within the fixed-length segment, as continuous variable					1.222 (2.31)
LVK40UP	Natural log of proportion of vertical curves with $400 < K$ value within the fixed-length segment	0.142 (2.80)				
LVK510	Natural log of proportion of vertical curves with $50 < K$ value <=100 within the fixed-length segment	-0.094 (-2.13)				
RDEC1224	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as continuous variable					-0.632 (-2.06)

Table C.17 Serious injury crash models by functional classes for 1 mile segment

	Fixed Parag	neters	_	-		
Functional Class     TWLR     TWLU     NINTR     NINTU     INT						
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-0.364
RDEC2436	continuous variable					(-1.95)

## Table C.17 (Continued) Serious injury crash models by functional classes for 1 mile segment

	Random Par	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
RINC1224	Proportion of roadway width is in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable				-0.472 (-2.89)	
	Standard Deviation for the Random Pa	rameters wit	h Normal D	istribution		
Constant		0.605 (11.48)			0.530 (10.15)	
PHCR2030	Proportion of horizontal curves with 2000 <= radius < 3000 (feet) within the fixed-length segment					0.903 (1.83)
LVK40UP	Natural log of proportion of vertical curves with $400 < K$ value within the fixed-length segment	0.207 (5.34)				
LVK510	Natural log of proportion of vertical curves with 50 < K value <=100 within the fixed-length segment	0.106 (3.17)				
RDEC1224	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as continuous variable					0.270 (2.25)
RDEC2436	Proportion of roadway width in the 24.01 to 36.0 foot range in decreasing milepost direction, as continuous variable					0.682 (5.43)
RINC1224	Proportion of roadway width is in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable				0.295 (3.52)	

#### Table C.17 (Continued) Serious injury crash models by functional classes for 1 mile segment

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	9612			1214	3052
Number of Parameters	41			26	45
Number of Random Parameters	10			8	17
Restricted Log-Likelihood	-1483.39			-813.65	-609.94
Log-Likelihood	-1479.97			-806.76	-608.85
AIC	2981.93			1627.52	1241.70
BIC	3060.81			1663.23	1313.98
LL Ratio	6.84			13.79	2.18
Adjusted Pseudo R-squared	0.045			0.047	0.097
	<b>RP</b> Poisson			<b>RP</b> Poisson	RP NB

	Fixed Paran	neters	0	T		I
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
Constant		-3.746 (-20.92)	-4.118 (-6.18)			-4.561 (-11.06)
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment	-0.233 (-1.88)				
INV DSL24	Sope $<4$ within the fixed-tength segment Count of vertical curves with $100 < K$ value $<=200$	(-1.00)	0.722			
NVK1020	within the fixed-length segment		(2.51)			
NVK2030	Count of vertical curves with 200 < K value <=300 within the fixed-length segment					-0.413 (-2.11)
	Count of vertical curves with $400 < K$ value within		0.817			( =)
NVK40UP	the fixed-length segment		(2.62)			
	Natural log of proportion of vertical curves with					
	absolute ahead slope $< 2$ within the fixed-length	-0.126				
LVASL02	segment	(-2.12)				
	Natural log of proportion of vertical curves with 2					
	<= absolute back slope < 4 within the fixed-length	-0.118				
LVBSL24	segment	(-1.71)				
	Natural log of proportion of vertical curves with					
	200 < K value <=300 within the fixed-length		-0.489			
LVK2030	segment		(-2.91)			
	Natural log of proportion of vertical curves with					
	design speed of 30 mph or 35 mph within the	-0.134	-0.498			
LVSP3035	fixed-length segment	(-1.75)	(-2.25)			
	Roadway surface type is bituminous in decreasing	-0.856				
LNSFDECB	milepost direction	(-4.97)				
	Roadway weighted average width in decreasing	(, . )				0.050
RWDDEC	milepost direction, as continuous variable					(3.98)
	Proportion of travel shoulder width is in the 6.01					(0.20)
	to 8.0 foot range on the right side in increasing		1.248			
SDWR68	milepost direction, as continuous variable		(2.24)			
5D WIRdo	Proportion of travel shoulder width is in the 8.01		(2:21)			
	to 10.0 foot range on the right side in increasing		2.005			
SDWR810	milepost direction, as continuous variable		(3.18)			
SDWR010	Proportion of curb shoulder surface type on the left		(3.10)			
	side in increasing milepost direction, as	3.987				
SSFLC	continuous variable	(3.05)				
SSILC	Proportion of curb shoulder surface type on the	(3.03)				
	right side in increasing milepost direction, as	-5.496				
SSFRC	continuous variable	(-2.33)				
SSIAC	continuous variable	(-2.33)				
	Random Para	meters				-
	Location indicator (if segment is located in urban					0.578
URBAN	arear, 1, otherwise, 0)					(2.28)
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					-4.088
PHCR2030	segment, as continuous variable					(-2.36)
	Count of vertical curves within the fixed-length		-0.710			
NVC	segment		(-2.76)			
	Natural log of proportion of vertical curves with					
	$200 < K$ value $\leq 300$ within the fixed-length	0.340				
LVK2030	segment	(3.88)				
			L N			•
	Standard Deviation for the Random Par	ameters wit	n Normal D	istribution		0.1.00
	Location indicator (if segment is located in urban					0.169
URBAN	arear, 1, otherwise, 0)				1	(0.69)

Standard Deviation for the Random Parameters with Normal Distribution								
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT		
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)		
, an labre	Proportion of horizontal curves with 2000 <=	(t stat)						
	radius < 3000 (feet) within the fixed-length					2.905		
PHCR2030	segment, as continuous variable					(2.30)		
	Count of vertical curves within the fixed-length		0.181					
NVC	segment		(3.75)					
	Natural log of proportion of vertical curves with							
	200 < K value <=300 within the fixed-length	0.341						
LVK2030	segment	(5.95)						

Table C.18 (Continued) Fatal crash models by functional classes for 1-mile segment

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	646	1214			3052
Number of Parameters	17	26			45
Number of Random Parameters	4	8			17
Restricted Log-Likelihood	-835.35	-123.41			-311.11
Log-Likelihood	-831.35	-120.04			-310.86
AIC	1682.70	258.07			635.73
BIC	1754.41	299.34			677.89
LL Ratio	8.01	6.74			0.50
Adjusted Pseudo R-squared	0.033	0.113			0.061
	<b>RP</b> Poisson	<b>RP</b> Poisson			<b>RP</b> Poisson

	Fixed Para Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
~		12.258				
Constant		(5.15)				0.4.40
AADT						0.140
AADT	AADT (ADTK10=AADT/10000)		0.000			(59.52)
NHC	Count of horizontal curves within the fixed-length		-0.088 (-6.84)			
NHC	segment Count of horizontal curves with angle of		(-0.84)			
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-	0.057			-0.086	
NHCA5DW	length segment $(\Delta) = 5$ (degrees) whilm the fixed-	(2.03)			(-5.40)	
	Count of horizontal curves with 1000 <= radius <	(2.05)			( 3.10)	0.305
NHCR1015	1500 (feet) within the fixed-length segment					(9.96)
	Count of horizontal curves with 500 <= radius <	0.088	0.355			())))
NHCR57	700 (feet) within the fixed-length segment	(3.80)	(9.94)			
	Count of horizontal curves with design speed of		. ,			
	30 mph or 35 mph within the fixed-length	-0.087				
NHSP3035	segment	(-2.85)				
	Count of horizontal curves with design speed of					
	40 mph or 45 mph within the fixed-length	-0.066				
NHSP4045	segment	(-1.59)				
	Count of horizontal curves with design speed of					
	60 mph or 65 mph within the fixed-length					0.117
NHSP6065	segment					(5.09)
	Count of horizontal curves with design speed					
	more than 70 (mph) within the fixed-length					-0.091
NHSP70UP	segment					(-4.42)
	Proportion of horizontal curves with 2000 <=					0.100
DUCD2020	radius < 3000 (feet) within the fixed-length					0.199
PHCR2030	segment, as continuous variable Natural log of proportion of horizontal curves					(3.96)
	with radius less than 100 (feet) within the fixed-	-0.221				
LHCR1DW	length segment	-0.221 (-6.54)				
LIICKIDW	Natural log of proportion of horizontal curves	(-0.54)				
	with 5000 <= radius (feet) within the fixed-length	0.040				
LHCR50UP	segment	(2.01)				
	Natural log of proportion of horizontal curves	(2:01)				
	with design speed $\leq 25$ (mph) within the fixed-		-0.152		-0.063	
LHSP25DW	length segment		(-9.12)		(-8.66)	
	Natural log of proportion of horizontal curves					
	with design speeds of 30 mph or 35 mph within	-0.066		-0.060		
LHSP3035	the fixed-length segment	(-2.69)		(-1.75)		
	Natural log of proportion of horizontal curves					
	with design speed ranged from 40 to 45 (mph)	-0.089				
LHSP4045	within the fixed-length segment	(-2.79)				
	Natural log of proportion of horizontal curves					
	with design speed ranged from 50 to 55 (mph)	-0.093				
LHSP5055	within the fixed-length segment	(-4.28)				
NU 1020	Count of vertical curves with $100 < K$ value	0.040			0.065	
NVK1020	<=200 within the fixed-length segment	(2.39)			(9.95)	
	Count of vertical curves with $200 < K$ value	0.085				
NVK2030	<=300 within the fixed-length segment	(4.72)				
NU/Wasa	Count of vertical curves with 20 < K value <=50	0.113				
NVK250	within the fixed-length segment	(4.66)				0.002
NU/K2040	Count of vertical curves with $300 < K$ value					0.093
NVK3040	<=400 within the fixed-length segment		1	1	1	(5.03)

Table C.19 Total crash models by functional classes for 0.5 mile segments

	Fixed Parameters								
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT			
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.			
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)			
	Natural log of proportion of vertical curves with								
	$2 \ll absolute back slope < 4$ within the fixed-			-0.050					
LVBSL24	length segment			(-2.66)					

	Fixed Para	meters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Natural log of proportion of vertical curves with					
	100 < K value <=200 within the fixed-length	-0.057				
LVK1020	segment	(-4.76)				
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length			-0.070		
LVK2030	segment			(-3.20)		
	Natural log of proportion of vertical curves with					
	$50 < K$ value $\leq 100$ within the fixed-length	-0.130				
LVK510	segment	(-11.71)				
	Roadway surface type is portland cement			0.908	0.815	
LNSFDECP	concrete in decreasing milepost direction			(4.66)	(13.25)	
	Roadway surface type is bituminous in increasing					-0.378
LNSFINCB	milepost direction					(-1.90)
	Roadway surface type is portland cement	0.449		-0.578		
LNSFINCP	concrete in increasing milepost direction	(4.18)		(-7.79)		
	Roadway weighted average width in decreasing					-0.025
RWDDEC	milepost direction, as continuous variable					(-5.84)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in decreasing milepost direction, as				-0.429	
RDEC012	continuous variable				(-4.82)	
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as			-0.036	-0.576	
RDEC1224	continuous variable			(-0.40)	(-12.97)	
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-0.770
RDEC2436	continuous variable					(-6.48)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as				-0.995	
RINC012	continuous variable				(-12.42)	
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,			-0.329		
RINC1224	as continuous variable			(-3.84)		
	Proportion of travel shoulder width is in the 0.01					
	to 2.0 foot range on the right side in increasing	-0.560				
SDWR02	milepost direction, as continuous variable	(-17.96)				
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right side in increasing		0.502			
SDWR810	milepost direction, as continuous variable		(6.05)			
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					o <del>-</del> · -
	increasing milepost direction, as continuous					0.747
SDWRC810	variable					(7.10)
	Proportion of curb shoulder surface type on the	1.6.1-				
GOTI C	left side in increasing milepost direction, as	1.045				
SSFLC	continuous variable	(8.86)				

	Fixed Parameters								
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT			
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.			
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)			
	Proportion of shoulder surface type is asphalt on								
	the right side in increasing milepost direction, as	0.483							
SSFRA	continuous variable	(9.47)							
	Proportion of curb shoulder surface type on the								
	right side in increasing milepost direction, as	0.613	0.648		0.771				
SSFRC	continuous variable	(4.92)	(6.66)		(46.07)				
	Proportion of median width in 10.01 to 20.0 foot			0.142					
MWD1020	range, as continuous variable			(2.23)					
	Proportion of median width is in the 30.01 to 40.0				-0.419				
MWD3040	foot range, as continuous variable				(-10.09)				

	Fixed Para	meters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.038	0.017	0.041	0.013	0.024
ALPHA	Dispersion parameter	(4.06)	(2.30)	(2.43)	(6.23)	(7.90)
	Random Par	ameters				
			3.823	-4.273	1.607	2.273
Constant			(14.86)	(-10.87)	(36.63)	(8.58)
				0.500		
LNADT	Natural log of AADT			(11.53)		
	Location indicator (if segment is located in in					0.377
URBAN	urban arear, 1, otherwise, 0)					(14.44)
	Count of horizontal curves within the fixed-length	-0.028				0.114
NHC	segment	(-3.17)				(9.41)
	Natural log of proportion of horizontal curves					
	with design speed <=25 (mph) within the fixed-	-0.038				
LHSP25DW	length segment	(-3.32)				
	Natural log of proportion of horizontal curves					
	with design speeds of 30 mph or 35 mph within				-0.052	
LHSP3035	the fixed-length segment				(-4.35)	
	Count of vertical curves within the fixed-length	-0.070				
NVC	segment	(-6.93)				
	Count of vertical curves with 200 < K value				0.108	0.191
NVK2030	<=300 within the fixed-length segment				(11.18)	(14.30)
	Natural log of proportion of vertical curves with 2					
	<= absolute back slope < 4 within the fixed-				-0.103	
LVBSL24	length segment				(-19.67)	
	Natural log of proportion of vertical curves with					
	$6 \ll absolute back slope < 8$ within the fixed-	0.251				
LVBSL68	length segment	(10.77)				
	Natural log of proportion of vertical curves with					
	design speed more than 70 (mph) within the fixed-	0.026				
LVSP70UP	length segment	(2.74)				
	Proportion of vertical curves with absolute back					
	slope $< 2$ within the fixed-length segment, as					-0.525
PVBSL02	continuous variable					(-7.13)
	Proportion of vertical curves with 2 <= absolute					
	back slope $< 4$ within the fixed-length segment,					-0.565
PVBSL24	as continuous variable					(-6.92)
	Proportion of vertical curves with $50 < K$ value					
DUIDETO	<=100 within the fixed-length segment, as					4.226
PVK510	continuous variable					(14.37)
	Proportion of 1-lane cross section in decreasing	-13.540				
LNSDEC1	milepost direction, as continuous variable	(-5.69)				

	Fixed Parar	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Roadway surface type is asphalt in decreasing	0.687	0.880	0.303	0.887	
LNSFDECA	milepost direction	(19.04)	(10.79)	(1.88)	(16.49)	
	Roadway surface type is portland cement concrete					0.267
LNSFDECP	in decreasing milepost direction					(13.93)
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					-1.094
RDEC1224	continuous variable					(-6.55)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as				-0.341	
RDEC2436	continuous variable				(-8.51)	
	Proportion of roadway width is in the 36.01 to					
	48.0 foot range in decreasing milepost direction,					-0.448
RDEC3648	as continuous variable					(-5.92)

	Random Par	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		-4.102			
RINC012	continuous variable		(-16.79)			
	Proportion of roadway width is in the 12.01 to		2.5.0		0.545	
DINIC1224	24.0 foot range in increasing milepost direction, as continuous variable		-3.762		-0.567	
RINC1224			(-15.05)		(-20.29)	
	Proportion of travel shoulder width is in the 2.01 to 4.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.053
SDWLC24	variable					(-1.11)
SD WEC24	Proportion of travel shoulder width is in the 4.01					(-1.11)
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.133
SDWLC46	variable					(-3.03)
	Proportion of travel shoulder width is in the 2.01					
	to $4.0$ foot range on the right side in increasing	-0.272	0.182			
SDWR24	milepost direction, as continuous variable	(-11.92)	(2.52)			
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right side in increasing		0.326			
SDWR46	milepost direction, as continuous variable		(4.32)			
	Proportion of travel shoulder width is in the 6.01					
65 W B 40	to 8.0 foot range on the right side in increasing		0.334			
SDWR68	milepost direction, as continuous variable		(4.80)			
	Proportion of travel shoulder width is in the 8.01					0.054
SDWR810	to 10.0 foot range on the right side in increasing					-0.256
SDWR810	milepost direction, as continuous variable Weighted average travel shoulder width on the					(-9.34)
	right-center side in increasing milepost direction,					-0.062
SDWRC	as continuous variable					-0.062 (-5.68)
SDWKC	Proportion of travel shoulder width is in the 4.01					(-5.00)
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.357
SDWRC46	variable					(5.43)
	Proportion of travel shoulder width is in the 6.01					0.504
SDWRC68	to 8.0 foot range on the right-center side in					(5.95)

	Random Par	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	increasing milepost direction, as continuous variable					
	Proportion of shoulder surface type is bituminous					
	on the left side in increasing milepost direction, as	-0.725				
SSFLB	continuous variable	(-4.06)				
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as			0.998		
SSFLC	continuous variable			(10.40)		
	Proportion of shoulder surface type is bituminous					
	on the right side in increasing milepost direction,	0.788				
SSFRB	as continuous variable	(4.32)				
	Proportion of median width in 10.01 to 20.0 foot				0.103	0.205
MWD1020	range, as continuous variable				(5.37)	(7.49)
	Standard Deviation for the Random Par	rameters wit	th Normal D	istribution		
			0.731	0.183	0.724	0.293
Constant			(48.00)	(8.50)	(101.72)	(37.71)
			1	0.074		* *
LNADT	Natural log of AADT			(32.94)		

	Standard Deviation for the Random Par	ameters wit	th Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
URBAN	Location indicator (if segment is located in in urban arear, 1, otherwise, 0)					0.429 (27.69)
NHC	Count of horizontal curves within the fixed-length segment	0.049 (10.60)				0.079 (6.04)
LHSP25DW	Natural log of proportion of horizontal curves with design speed <=25 (mph) within the fixed- length segment	0.029 (3.50)				
LHSP3035	Natural log of proportion of horizontal curves with design speeds of 30 mph or 35 mph within the fixed-length segment				0.123 (11.02)	
NVC	Count of vertical curves within the fixed-length segment	0.037 (10.14)				
NVK2030	Count of vertical curves with 200 < K value <=300 within the fixed-length segment				0.000 (0.03)	0.107 (10.08)
LVBSL24	Natural log of proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment				0.055 (14.00)	
LVBSL68	Natural log of proportion of vertical curves with $6 \le absolute back slope < 8$ within the fixed-length segment	0.270 (14.44)				
LVSP70UP	Natural log of proportion of vertical curves with design speed more than 70 (mph) within the fixed-length segment	0.084 (13.66)				
PVBSL02	Proportion of vertical curves with absolute back slope $< 2$ within the fixed-length segment, as continuous variable					0.084 (1.71)
PVBSL24	Proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment, as continuous variable					1.179 (19.17)

	Standard Deviation for the Random Par	rameters wit	th Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of vertical curves with $50 < K$ value					
	<=100 within the fixed-length segment, as					0.163
PVK510	continuous variable					(0.59)
	Proportion of 1-lane cross section in decreasing	0.728				
LNSDEC1	milepost direction, as continuous variable	(79.82)				
	Roadway surface type is asphalt in decreasing	0.509	0.474	0.034	0.460	
LNSFDECA	milepost direction	(45.37)	(31.80)	(1.51)	(65.17)	
	Roadway surface type is portland cement					0.162
LNSFDECP	concrete in decreasing milepost direction					(15.38)
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					0.287
RDEC1224	continuous variable					(19.93)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as				0.239	
RDEC2436	continuous variable				(19.59)	
	Proportion of roadway width is in the 36.01 to					
	48.0 foot range in decreasing milepost direction,					0.283
RDEC3648	as continuous variable					(16.82)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		0.262			
RINC012	continuous variable		(15.83)			
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		0.290		0.287	
RINC1224	as continuous variable		(7.83)		(29.15)	

	Standard Deviation for the Random Pa	rameters wit	th Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.235
SDWLC24	variable					(14.70)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.076
SDWLC46	variable					(3.46)
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right side in increasing	0.038	0.129			
SDWR24	milepost direction, as continuous variable	(2.23)	(3.73)			
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right side in increasing		0.260			
SDWR46	milepost direction, as continuous variable		(6.56)			
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right side in increasing		0.314			
SDWR68	milepost direction, as continuous variable		(11.11)			
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right side in increasing					0.091
SDWR810	milepost direction, as continuous variable					(10.37)
	Weighted average travel shoulder width on the					
	right-center side in increasing milepost direction,					0.038
SDWRC	as continuous variable		ļ			(23.66)
	Proportion of travel shoulder width is in the 4.01					0.035
SDWRC46	to 6.0 foot range on the right-center side in					(1.57)

	Standard Deviation for the Random Par	rameters wit	th Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	increasing milepost direction, as continuous					
	variable					
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.033
SDWRC68	variable					(0.97)
	Proportion of shoulder surface type is bituminous					
	on the left side in increasing milepost direction, as	0.459				
SSFLB	continuous variable	(25.06)				
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as			0.016		
SSFLC	continuous variable			(0.21)		
	Proportion of shoulder surface type is bituminous					
	on the right side in increasing milepost direction,	0.163				
SSFRB	as continuous variable	(8.95)				
	Proportion of median width in 10.01 to 20.0 foot				0.466	0.095
MWD1020	range, as continuous variable				(28.66)	(5.85)

	Fixed Parar					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
AADT	A ADT (ADTE 10-A ADT/10000)					0.137
AADI	AADT (ADTK10=AADT/10000)			0.599		(32.33)
LNADT	Natural log of AADT			(11.62)		
LIADI	Count of horizontal curves within the fixed-length		-0.100 (-	(11.02)		
NHC	segment		6.22)			
	Count of horizontal curves with angle of		,			
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-				-0.113	
NHCA5DW	length segment				(-5.99)	
	Count of horizontal curves with 1000 <= radius <					0.259
NHCR1015	1500 (feet) within the fixed-length segment					(4.88)
	Count of horizontal curves with 500 <= radius <	0.070	0.362			
NHCR57	700 (feet) within the fixed-length segment	(2.31)	(8.30)			
	Count of horizontal curves with design speed of					
NUICE 40.45	40 mph or 45 mph within the fixed-length	-0.091				
NHSP4045	segment	(-1.61)			-	
	Count of horizontal curves with design speed of					0.059
NHSP6065	60 mph or 65 mph within the fixed-length segment					(1.27)
11131 0005	Count of horizontal curves with design speed					(1.27)
	more than 70 (mph) within the fixed-length					-0.136
NHSP70UP	segment					(-3.50)
111517001	Proportion of horizontal curves with 2000 <=					( 0100)
	radius $< 3000$ (feet) within the fixed-length					0.114
PHCR2030	segment, as continuous variable					(1.26)
	Natural log of proportion of horizontal curves					
	with radius less than 100 (feet) within the fixed-	-0.247				
LHCR1DW	length segment	(-5.87)				
	Natural log of proportion of horizontal curves					
	with design speed <=25 (mph) within the fixed-	-0.046	-0.138			
LHSP25DW	length segment	(-3.25)	(-6.78)			
	Natural log of proportion of horizontal curves	-0.079		-0.066	-0.087	
LHSP3035	with design speeds of 30 mph or 35 mph within the fixed-length segment	(-2.80)		(-1.76)	(-6.35)	
21131 3033	Natural log of proportion of horizontal curves	(-2.00)		(-1.70)	(-0.33)	
	with design speed ranged from 40 to 45 (mph)	-0.104				
LHSP4045	within the fixed-length segment	(-2.51)				
	Count of vertical curves within the fixed-length	-0.065				-
NVC	segment	(-5.14)				
	Count of vertical curves with 100 < K value	0.023				
NVK1020	<=200 within the fixed-length segment	(1.06)				
	Count of vertical curves with 20 < K value <=50	0.108				
NVK250	within the fixed-length segment	(3.52)				
	Count of vertical curves with 300 < K value					0.080
NVK3040	<=400 within the fixed-length segment			ļ		(2.54)
	Natural log of proportion of vertical curves with 2				0.112	
LVDCL 24	<= absolute back slope < 4 within the fixed-				-0.112	
LVBSL24	length segment Natural log of proportion of vertical curves with				(-18.54)	
	Natural log of proportion of vertical curves with $6 \le absolute back slope < 8$ within the fixed-	0.141				
LVBSL68	length segment	(6.20)				
L I DOLUG	Natural log of proportion of vertical curves with	(0.20)				ļ
	100 < K value <=200 within the fixed-length	-0.073				
		0.075	1	1	1	

 Table C.20 Property damage only crash models by functional classes for 0.5 mile segments

	Fixed Parar	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length			-0.060		
LVK2030	segment			(-2.42)		

# Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mile segments

	Fixed Paran					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of 1-lane cross section in decreasing	-13.372				
LNSDEC1	milepost direction, as continuous variable	(-4.73)				
	Roadway surface type is portland cement concrete	0.443			0.501	
LNSFDECP	in decreasing milepost direction	(3.01)			(7.72)	
	Roadway surface type is asphalt in increasing	0.847				
LNSFINCA	milepost direction	(18.50)				
	Roadway surface type is bituminous in increasing	· · · · ·				-0.593
LNSFINCB	milepost direction					(-2.44)
	Roadway surface type is portland cement concrete			-0.710		
LNSFINCP	in increasing milepost direction			(-7.74)		
	Roadway weighted average width in decreasing			(		-0.036
RWDDEC	milepost direction, as continuous variable					(-4.96)
iti bbbb	Proportion of roadway width is in the 0.01 to 12.0					( 1.70)
	foot range in decreasing milepost direction, as	0.080				
RDEC012	continuous variable	(0.37)				
	Proportion of roadway width in the 12.01 to 24	(0.57)				
	foot range in decreasing milepost direction, as	0.075		-0.248	-0.187	
RDEC1224	continuous variable	(0.35)		(-2.86)	(-6.16)	
RDLC1224	Proportion of roadway width in the 24.01 to 36.0	(0.33)		(-2.00)	(-0.10)	
	foot range in decreasing milepost direction, as			-0.935		
RDEC2436	continuous variable					(-4.82)
RDEC2430	Proportion of roadway width is in the 0.01 to 12.0					(-4.02)
	foot range in increasing milepost direction, as				-1.070	
RINC012	continuous variable				(-16.47)	
KINC012	Proportion of roadway width is in the 12.01 to				(-10.47)	
	24.0 foot range in increasing milepost direction,				-0.597	
RINC1224	as continuous variable				(-18.93)	
KINC1224	Proportion of travel shoulder width is in the 0.01				(-18.93)	
	to 2.0 foot range on the right side in increasing	-0.642				
SDWR02	milepost direction, as continuous variable	(-16.15)				
SD WK02	Proportion of travel shoulder width is in the 2.01	(-10.15)			-	
					0.250	
SDWR24	to 4.0 foot range on the right side in increasing milepost direction, as continuous variable				-0.350 (-3.41)	
SD W K24					(-3.41)	
	Proportion of travel shoulder width is in the 4.01		0.144		-0.556	
SDWR46	to 6.0 foot range on the right side in increasing milepost direction, as continuous variable					
SD W K40			(2.23)		(-6.61)	
	Proportion of travel shoulder width is in the 6.01		0.224			
SDWR68	to 8.0 foot range on the right side in increasing		0.234			
SD W K08	milepost direction, as continuous variable		(4.26)			
	Weighted average travel shoulder width on the					0.012
CDWDC	right-center side in increasing milepost direction,					-0.013
SDWRC	as continuous variable					(-0.94)
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right-center side in					0.010
CDWD C/O	increasing milepost direction, as continuous					0.213
SDWRC68	variable					(1.72)

	Fixed Parameters						
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT	
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	
	Proportion of shoulder surface type is bituminous						
	on the left side in increasing milepost direction, as	-0.968					
SSFLB	continuous variable	(-4.54)					
	Proportion of shoulder surface type is asphalt on						
	the right side in increasing milepost direction, as	0.369			0.309		
SSFRA	continuous variable	(5.95)			(4.10)		

Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mil	e
segments	

	Fixed Paran	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of curb shoulder surface type on the					
	right side in increasing milepost direction, as		0.548		0.705	
SSFRC	continuous variable		(5.50)		(13.09)	
	Proportion of median width in 10.01 to 20.0 foot			0.174	0.107	
MWD1020	range, as continuous variable			(2.31)	(4.69)	
	Proportion of median width is in the 30.01 to 40.0				-0.438	
MWD3040	foot range, as continuous variable				(-8.61)	
		0.065	0.023	0.051	0.013	0.317
ALPHA	Dispersion parameter	(3.97)	(2.01)	(2.29)	(4.90)	(23.48)
	Random Para	ameters				
		11.600	3.756	-5.390	1.284	3.451
Constant		(4.11)	(12.50)	(-11.32)	(18.10)	(7.26)
	Location indicator (if segment is located in in	. /			. ,	0.448
URBAN	urban arear, 1, otherwise, 0)					(11.96)
	Count of horizontal curves within the fixed-	-0.047				0.131
NHC	length segment	(-4.16)				(6.60)
	Count of horizontal curves with angle of					
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-	-0.008				
NHCA5DW	length segment	(-0.24)				
	Count of horizontal curves with design speed of					
	30 mph or 35 mph within the fixed-length	-0.110				
NHSP3035	segment	(-2.74)				
	Natural log of proportion of horizontal curves	( )				
	with design speed <=25 (mph) within the fixed-				-0.054	
LHSP25DW	length segment				(-6.11)	
	Count of vertical curves with $100 < K$ value				0.095	
NVK1020	<=200 within the fixed-length segment				(12.30)	
	Count of vertical curves with 200 < K value	0.085			0.113	0.204
NVK2030	<=300 within the fixed-length segment	(3.73)			(10.02)	(9.09)
	Natural log of proportion of vertical curves with	(0110)			()	(,,,,,)
	$2 \le absolute back slope < 4$ within the fixed-			-0.083		
LVBSL24	length segment			(-3.77)		
	Natural log of proportion of vertical curves with			(2)		
	50 < K value <=100 within the fixed-length	-0.123				
LVK510	segment	(-8.57)				
	Natural log of proportion of vertical curves with	( 0.07)				
	design speed more than 70 (mph) within the	0.037				
LVSP70UP	fixed-length segment	(3.10)				
2101/001	Proportion of vertical curves with absolute back	(0.10)	<u> </u>			
	slope $< 2$ within the fixed-length segment, as					-0.555
PVBSL02	continuous variable					(-5.05)

	Fixed Parar	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
SSFRC	Proportion of curb shoulder surface type on the right side in increasing milepost direction, as continuous variable		0.548 (5.50)		0.705 (13.09)	
PVBSL24	Proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment, as continuous variable					-0.505 (-4.16)
PVK510	Proportion of vertical curves with 50 < K value <=100 within the fixed-length segment, as continuous variable					4.572 (4.61)
LNSFDECA	Roadway surface type is asphalt in decreasing milepost direction		0.996 (9.28)		0.536 (10.55)	
LNSFDECP	Roadway surface type is portland cement concrete in decreasing milepost direction					0.272 (9.19)
RDEC1224	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as continuous variable					-1.268 (-4.71)

Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mile segments

	Random Para	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
variable	Proportion of roadway width is in the 36.01 to	(l-stat)	(t-stat)	(l-stat)	(i-siai)	(l-stat)
	48.0 foot range in decreasing milepost direction,					-0.604
RDEC3648	as continuous variable					(-4.61)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		-4.453			
RINC012	continuous variable		(-15.54)			
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		-4.017			
RINC1224	as continuous variable		(-13.64)			
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the left-center side in					0.206
SDWLC24	increasing milepost direction, as continuous variable					-0.306 (-4.14)
SDWLC24	Proportion of travel shoulder width is in the 4.01					(-4.14)
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.246
SDWLC46	variable					(-3.51)
	Proportion of travel shoulder width is in the 2.01					()
	to 4.0 foot range on the right side in increasing	-0.373				
SDWR24	milepost direction, as continuous variable	(-12.47)				
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right side in increasing				-0.455	
SDWR68	milepost direction, as continuous variable				(-6.54)	
	Proportion of travel shoulder width is in the 8.01					
<b>GD U D</b> 04 0	to 10.0 foot range on the right side in increasing		0.353		-0.376	-0.231
SDWR810	milepost direction, as continuous variable		(4.05)		(-5.50)	(-4.62)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in increasing milepost direction, as continuous					0.168
SDWRC46	variable					(1.74)
SD WINCHU	Proportion of travel shoulder width is in the 8.01					(1./4)
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.374
SDWRC810	variable					(2.55)

	Random Para	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
RDEC3648	Proportion of roadway width is in the 36.01 to 48.0 foot range in decreasing milepost direction, as continuous variable					-0.604 (-4.61)
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable	1.586 (14.21)		0.994 (8.55)		
SSFRB	Proportion of shoulder surface type is bituminous on the right side in increasing milepost direction, as continuous variable	1.045 (4.77)				
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable					0.194 (3.69)
	Standard Deviation for the Random Par	ameters wit	h Normal D	istribution		
Constant		0.807 (69.37)	0.803 (42.28)	0.775 (31.64)	0.770 (93.21)	0.868 (5.07)
URBAN	Location indicator (if segment is located in in urban arear, 1, otherwise, 0)					0.057 (1.90)
NHC	Count of horizontal curves within the fixed-length segment	0.067 (11.32)				0.010 (0.37)
NHCA5DW	Count of horizontal curves with angle of deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-length segment	0.261 (9.20)				

Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mile	
segments	

	Standard Deviation for the Random Par	ameters wit	h Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Count of horizontal curves with design speed of					
	30 mph or 35 mph within the fixed-length	0.125				
NHSP3035	segment	0.125				
		(5.14)	-			
	Natural log of proportion of horizontal curves				0.127	
LUCDOCDU	with design speed <=25 (mph) within the fixed-				0.137	
LHSP25DW	length segment				(18.62)	
	Count of vertical curves with 100 < K value				0.158	
NVK1020	<=200 within the fixed-length segment				(25.35)	
	Count of vertical curves with 200 < K value	0.002			0.091	0.026
NVK2030	<=300 within the fixed-length segment	(0.10)			(9.78)	(1.21)
	Natural log of proportion of vertical curves with 2					
	<= absolute back slope < 4 within the fixed-			0.042		
LVBSL24	length segment			(2.29)		
	Natural log of proportion of vertical curves with					
	$50 < K$ value $\leq 100$ within the fixed-length	0.033				
LVK510	segment	(2.99)				
	Natural log of proportion of vertical curves with					
	design speed more than 70 (mph) within the fixed-	0.080				
LVSP70UP	length segment	(10.14)				
	Proportion of vertical curves with absolute back					
	slope $< 2$ within the fixed-length segment, as					0.041
PVBSL02	continuous variable					(0.52)
	Proportion of vertical curves with 2 <= absolute					
	back slope $< 4$ within the fixed-length segment,					0.339
PVBSL24	as continuous variable					(3.95)

	Standard Deviation for the Random Par					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Count of horizontal curves with design speed of					
	30 mph or 35 mph within the fixed-length	0.105				
NHSP3035	segment	0.125				
		(5.14)				
	Proportion of vertical curves with $50 < K$ value					
	<=100 within the fixed-length segment, as					1.196
PVK510	continuous variable					(0.82)
	Roadway surface type is asphalt in decreasing		0.266		0.262	
LNSFDECA	milepost direction		(15.10)		(33.00)	
	Roadway surface type is portland cement concrete					0.001
LNSFDECP	in decreasing milepost direction					(0.06)
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					0.008
RDEC1224	continuous variable					(0.41)
	Proportion of roadway width is in the 36.01 to					
	48.0 foot range in decreasing milepost direction,					0.030
RDEC3648	as continuous variable					(1.04)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		0.262			
RINC012	continuous variable		(12.67)			
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		0.307			
RINC1224	as continuous variable		(6.90)			
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.011
SDWLC24	variable					(0.56)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					0.013
SDWLC46	variable					(0.38)
	Proportion of travel shoulder width is in the 2.01					
	to $\hat{4.0}$ foot range on the right side in increasing	0.373				
SDWR24	milepost direction, as continuous variable	(17.03)	1			

 Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Par	ameters wit	h Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right side in increasing				0.305	
SDWR68	milepost direction, as continuous variable				(11.61)	
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right side in increasing		0.878		0.575	0.035
SDWR810	milepost direction, as continuous variable		(12.22)		(33.14)	(2.67)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.031
SDWRC46	variable					(0.82)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.048
SDWRC810	variable					(1.06)
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as	0.515		0.002		
SSFLC	continuous variable	(8.39)		(0.02)		

	Standard Deviation for the Random Parameters with Normal Distribution					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right side in increasing				0.305	
SDWR68	milepost direction, as continuous variable				(11.61)	
	Proportion of shoulder surface type is bituminous					
	on the right side in increasing milepost direction,	0.209				
SSFRB	as continuous variable	(9.07)				
	Proportion of median width in 10.01 to 20.0 foot					0.035
MWD1020	range, as continuous variable					(0.98)

# Table C.20 (Continued) Property damage only crash models by functional classes for 0.5 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	40	17	13	28	44
Number of Random Parameters	10	5	3	7	16
Restricted Log-Likelihood (Fixed Parameters at Convergence)	-15747.44	-2873.18	-1879.56	-7788.07	-6906.38
Log-Likelihood	-15414.65	-2706.74	-1805.60	-7102.81	-6886.11
AIC	30909.31	5447.47	3637.20	14261.63	13860.21
BIC	31224.06	5536.23	3703.39	14424.79	14125.28
LL Ratio	665.58	332.88	147.91	1370.51	40.55
Adjusted Pseudo R-squared	0.088	0.080	0.091	0.127	0.204
	RP NB	RP NB	RP NB	RP NB	RP NB

	Fixed Para	meters		-		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
						0.149
AADT	AADT (ADTK10=AADT/10000)					(32.08)
	Count of horizontal curves with angle of					
	deflection ( $\Delta$ ) <= 5 (degrees) within the fixed-	-0.081			-0.100	
NHCA5DW	length segment	(3.77)			(-3.22)	
	Count of horizontal curves with 700 <= radius <	-0.086				
NHCR710	1000 (feet) within the fixed-length segment	(-1.96)				
	Natural log of proportion of horizontal curves					
	with 5000 <= radius (feet) within the fixed-length	-1.217		-0.120		
LHCR50UP	segment	(2.88)		(-2.37)		
	Natural log of proportion of horizontal curves				0.046	
111002025	with design speeds of 30 mph or 35 mph within				-0.046	
LHSP3035	the fixed-length segment				(-2.05)	
	Natural log of proportion of horizontal curves		0.222			
LUCDEOEE	with design speed ranged from 50 to 55 (mph)		0.223			
LHSP5055	within the fixed-length segment Count of vertical curves with 2 <= absolute back		(2.56)		0.157	
NUDEL 24					0.157	
NVBSL24	slope < 4 within the fixed-length segment Count of vertical curves with 300 < K value				(10.57)	0.000
NVK3040						0.069
N V K3040	<=400 within the fixed-length segment Count of vertical curves with 400 < K value	0.641				(1.96)
NVK40UP	within the fixed-length segment					
NVK400F		(-2.26)				
	Natural log of proportion of vertical curves with $6 \ll$ absolute back slope $< 8$ within the fixed-	0.020				
LVBSL68	length segment	(4.43)				
LIDSLOO	Natural log of proportion of vertical curves with	(+.+3)				
	$200 < K$ value $\leq 300$ within the fixed-length		-0.123			
LVK2030	segment		(-5.04)			
2112050	Natural log of proportion of vertical curves with	0.202	( 5.01)			
LVK40UP	400 < K value within the fixed-length segment	(0.66)				
2.11.001	Proportion of vertical curves with absolute back	(0.00)				
	slope $< 2$ within the fixed-length segment, as					-0.460
PVBSL02	continuous variable					(-3.17)
	Roadway surface type is bituminous in	0.207				. ,
LNSFDECB	decreasing milepost direction	(-24.69)				
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as				-0.376	
RDEC1224	continuous variable				(-7.91)	
	Proportion of roadway width is in the 36.01 to					
	48.0 foot range in decreasing milepost direction,					-0.539
RDEC3648	as continuous variable					(-3.85)
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,	-0.213				
RINC1224	as continuous variable	(1.58)				
	Proportion of travel shoulder width in the 2.01 to					
	4.0 foot range on the left side in increasing	1.214				
SDWL24	milepost direction, as continuous variable	(-4.13)				
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.403
SDWLC24	variable					(-5.71)
	Proportion of travel shoulder width is in the 0.01					
	to 2.0 foot range on the right side in increasing		-0.737			
SDWR02	milepost direction, as continuous variable		(-4.77)			

Table C.21 Possible injury crash models by functional classes for 0.5 mile segments

	Fixed Parar	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is wider than					
65 H IS 1 65	10 ft. on the right side in increasing milepost				0.738	
SDWR10P	direction, as continuous variable				(5.10)	
	Proportion of travel shoulder width is in the 8.01					0.404
CDUD010	to 10.0 foot range on the right side in increasing					-0.401
SDWR810	milepost direction, as continuous variable					(-7.52)
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right-center side in			0.492		
SDWDC24	increasing milepost direction, as continuous			-0.482		
SDWRC24	variable Proportion of travel shoulder width is in the 6.01			(-4.27)		
	to 8.0 foot range on the right-center side in					0.197
SDWRC68	increasing milepost direction, as continuous variable					(2.44)
SDWKC08	Proportion of curb shoulder surface type on the		-	-		(2.44)
	left side in increasing milepost direction, as	-0.941				
SSFLC	continuous variable	-0.941 (8.38)				
SSILC	Proportion of shoulder surface type is asphalt on	(0.50)				
	the right side in increasing milepost direction, as					-0.011
SSFRA	continuous variable					(-0.18)
551 101	There's no shoulder on the right side in increasing	-2.388				(-0.10)
SSFRNA	milepost direction within this segment	(-2.97)				
SSIRI	intepost direction within this segment	(-2.97)			0.025	0.042
					(3.34)	(4.55)
ALPHA	Dispersion parameter				(5.51)	(1.55)
	Random Para	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.414	2.841	-1.282	0.869	1.076
Constant		(-5.95)	(5.85)	(-12.68)	(20.67)	(2.25)
	Location indicator (if segment is located in in					0.390
URBAN	urban arear, 1, otherwise, 0)					(6.75)
	Count of horizontal curves with design speed of					
	60 mph or 65 mph within the fixed-length					0.123
NHSP6065	segment					(2.89)
	Count of horizontal curves with design speed					0.400
NUCCESSION	more than 70 (mph) within the fixed-length					-0.109
NHSP70UP	segment					(-2.85)
	Natural log of proportion of horizontal curves	0.025				
111004045	with design speed ranged from 40 to 45 (mph)	-0.025				
LHSP4045	within the fixed-length segment	(-1.49)				
	Natural log of proportion of horizontal curves	-0.142				
	with design speed ranged from 50 to 55 (mph) within the fixed-length segment					
1 11505055	within the fixed-fengul segment	(-0.47)				
LHSP5055				1		1
	Count of vertical curves with 2 <= absolute back	0.070				
LHSP5055 NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment	(-1.35)				0.101
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segmentCount of vertical curves with 200 < K value	(-1.35) 1.035				0.181
	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment Count of vertical curves with 200 < K value <=300 within the fixed-length segment	(-1.35)	0.106			0.181 (7.10)
NVBSL24 NVK2030	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment Count of vertical curves with 200 < K value <=300 within the fixed-length segment Count of vertical curves with 400 < K value	(-1.35) 1.035	-0.196			
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segmentCount of vertical curves with 200 < K value <=300 within the fixed-length segment	(-1.35) 1.035	-0.196 (-4.18)			
NVBSL24 NVK2030	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segmentCount of vertical curves with 200 < K value <=300 within the fixed-length segment	(-1.35) 1.035			-0.115	
NVBSL24 NVK2030	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment Count of vertical curves with 200 < K value <=300 within the fixed-length segment Count of vertical curves with 400 < K value within the fixed-length segment	(-1.35) 1.035			-0.115 (-9.69)	

 Table C.21 (Continued) Possible injury crash models by functional classes for 0.5 mile segments

Random Parameters						
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
** • • •		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description           Natural log of proportion of vertical curves with	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	$200 < K$ value $\leq 300$ within the fixed-length				-0.043	
LVK2030	segment				(-3.71)	
	Natural log of proportion of vertical curves with					
	50 < K value <=100 within the fixed-length	-0.042		-0.228		
LVK510	segment	(-6.23)		(-2.63)		
LNSFDECA LNSFDECP	Roadway surface type is asphalt in decreasing		1.156			
	milepost direction		(7.01)			0.055
	Roadway surface type is portland cement					0.257
LINGFDECF	concrete in decreasing milepost direction Roadway weighted average width in decreasing					(6.30)
RWDDEC	milepost direction, as continuous variable					(-4.26)
	Proportion of roadway width is in the 0.01 to 12.0					(1.20)
	foot range in decreasing milepost direction, as			-0.569	-1.335	
RDEC012	continuous variable			(-2.85)	(-12.00)	
	Proportion of roadway width in the 12.01 to 24					
DDECISA	foot range in decreasing milepost direction, as					-1.368
RDEC1224	continuous variable					(-4.44)
	Proportion of roadway width in the 24.01 to 36.0 foot range in decreasing milepost direction, as					1.027
RDEC2436	continuous variable					-1.027 (-4.64)
KDEC2430	Proportion of roadway width is in the 0.01 to 12.0					(-4.04)
	foot range in increasing milepost direction, as	-0.855	-4.519			
RINC012	continuous variable	(1.04)	(-9.57)			
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		-3.664		-0.393	
RINC1224	as continuous variable		(-7.36)		(-8.36)	
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the left-center side in					-0.111
SDWLC46	increasing milepost direction, as continuous variable					(-1.28)
50 11 20 40	Proportion of travel shoulder width is in the 0.01					(1.20)
	to 2.0 foot range on the right side in increasing	-0.071				
SDWR02	milepost direction, as continuous variable	(-10.15)				
	Proportion of travel shoulder width is in the 2.01					
	to 4.0 foot range on the right-center side in					
SDWDC24	increasing milepost direction, as continuous				-1.025	
SDWRC24	variable				(-13.11)	
	Proportion of travel shoulder width is in the 4.01 to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					-0.009
SDWRC46	variable					(-0.11)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.147
SDWRC810	variable					(2.42)
	Proportion of curb shoulder surface type on the			1 522	0.642	
SSFLC	left side in increasing milepost direction, as continuous variable			1.533 (10.27)	0.642 (17.70)	
SSFLC	Proportion of shoulder surface type is asphalt on			(10.27)	(17.70)	
	the left side in increasing milepost direction, as				-0.308	
MSFA	continuous variable				(-6.42)	
	Proportion of median width in 10.01 to 20.0 foot				0.209	0.342
MWD1020	range, as continuous variable				(4.98)	(6.91)

Table C.21 (Continued) Possible injury crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Pa	rameters wit	h Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.090	0.851	0.912	0.793	0.276
Constant		(49.16)	(28.60)	(22.32)	(59.08)	(18.38)
	Location indicator (if segment is located in in					0.040
URBAN	urban arear, 1, otherwise, 0)					(1.42)
	Count of horizontal curves with design speed of 60 mph or 65 mph within the fixed-length					0.005
NHSP6065	segment					0.005 (0.14)
11151 0005	Count of horizontal curves with design speed					(0.14)
	more than 70 (mph) within the fixed-length					0.007
NHSP70UP	segment					(0.22)
	Natural log of proportion of horizontal curves					(**==)
	with design speed ranged from 40 to 45 (mph)	0.240				
LHSP4045	within the fixed-length segment	(0.31)				
	Natural log of proportion of horizontal curves					
	with design speed ranged from 50 to 55 (mph)	0.107				
LHSP5055	within the fixed-length segment	(5.87)				
	Count of vertical curves with 2 <= absolute back	0.119				
NVBSL24	slope $< 4$ within the fixed-length segment	(7.49)				
	Count of vertical curves with 200 < K value	0.119				0.200
NVK2030	<=300 within the fixed-length segment	(4.04)				(10.09)
	Count of vertical curves with 400 < K value		0.487			
NVK40UP	within the fixed-length segment		(11.47)			
	Natural log of proportion of vertical curves with				0.005	
I VIV 1020	100 < K value <=200 within the fixed-length				0.085	
LVK1020	segment				(9.58)	
	Natural log of proportion of vertical curves with $200 < K$ value <=300 within the fixed-length				0.016	
LVK2030	segment				(1.64)	
LINE000	Natural log of proportion of vertical curves with				(1.01)	
	$50 < \text{K}$ value $\leq 100$ within the fixed-length	0.171		0.002		
LVK510	segment	(5.70)		(0.03)		
	Roadway surface type is asphalt in decreasing	· /	0.262			
LNSFDECA	milepost direction		(9.39)			
	Roadway surface type is portland cement concrete					0.395
LNSFDECP	in decreasing milepost direction					(19.25)
	Roadway weighted average width in decreasing					0.003
RWDDEC	milepost direction, as continuous variable					(9.10)
	Proportion of roadway width is in the 0.01 to 12.0					
DDEG010	foot range in decreasing milepost direction, as			0.512	0.826	
RDEC012	continuous variable			(3.27)	(8.29)	
	Proportion of roadway width in the 12.01 to 24					0.294
RDEC1224	foot range in decreasing milepost direction, as					0.384
KDEC1224	continuous variable Proportion of roadway width in the 24.01 to 36.0					(12.02)
	foot range in decreasing milepost direction, as					0.371
RDEC2436	continuous variable					(14.47)
	Proportion of roadway width is in the 0.01 to 12.0					(1117)
	foot range in increasing milepost direction, as	0.669	0.212			
RINC012	continuous variable	(4.20)	(6.46)			
	Proportion of roadway width is in the 12.01 to	× -/				
	24.0 foot range in increasing milepost direction,		0.104		0.300	
RINC1224	as continuous variable		(1.52)		(15.79)	
	Proportion of travel shoulder width is in the 4.01					0.152
SDWLC46	to 6.0 foot range on the left-center side in		1			(3.22)

Table C.21 (Continued) Possible injury crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Parameters with Normal Distribution						
	TWLR	TWLU	NINTR	NINTU	INT		
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	
	increasing milepost direction, as continuous variable						

# Table C.21 (Continued) Possible injury crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Parameters with Normal Distribution					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of travel shoulder width is in the 0.01 to 2.0 foot range on the right side in increasing	0.014				
SDWR02	milepost direction, as continuous variable Proportion of travel shoulder width is in the 2.01 to 4.0 foot range on the right-center side in	(10.21)			1.052	
SDWRC24	increasing milepost direction, as continuous variable				1.053 (17.62)	
SDWRC46	Proportion of travel shoulder width is in the 4.01 to 6.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.002
SDWRC810	Proportion of travel shoulder width is in the 8.01 to 10.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.290 (6.47)
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable			0.101 (0.82)	0.002 (0.11)	
MSFA	Proportion of shoulder surface type is asphalt on the left side in increasing milepost direction, as continuous variable				0.634 (20.93)	
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable				0.175 (6.00)	0.016 (0.57)

# Table C.21 (Continued) Possible injury crash models by functional classes for 0.5 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	27	13	10	24	38
Number of Random Parameters	8	5	4	9	14
Restricted Log-Likelihood (Fixed Parameters at Convergence)	-7270.34	-2029.36	-1000.08	-5496.53	-4025.48
Log-Likelihood	-6874.92	-1764.57	-915.17	-5113.23	-3938.60
AIC	13803.84	3555.15	1850.33	10274.46	7953.20
BIC	14016.29	3623.02	1901.25	10414.32	8182.12
LL Ratio	790.84	529.57	169.84	766.60	173.76
Adjusted Pseudo R-squared	0.141	0.178	0.155	0.115	0.252
	RP Poisson	RP Poisson	RP Poisson	RP NB	RP NB

	Fixed Para Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		(1.11.1)	(* * * * * * * * *	-2.344	(1.1.1.1)	(1.1.1.1)
Constant				(-4.59)		
						0.090
AADT	AADT (ADTK10=AADT/10000)					(11.22)
	Count of horizontal curves with 1000 <= radius <					0.274
NHCR1015	1500 (feet) within the fixed-length segment					(2.80)
	Count of horizontal curves with design speed of					0.102
NUISDENES	60 mph or 65 mph within the fixed-length					0.192
NHSP6065	segment Proportion of horizontal curves with 2000 <=					(2.69)
	radius $< 3000$ (feet) within the fixed-length					0.301
PHCR2030	segment, as continuous variable					(1.70)
1110102050	Count of vertical curves with 6 <= absolute back	-0.400				(1.70)
NVBSL68	slope $< 8$ within the fixed-length segment	(-3.34)				
	Count of vertical curves with $100 < K$ value	( 2.0 .)	0.178		0.045	
NVK1020	<=200 within the fixed-length segment		(3.78)		(1.86)	
~	Count of vertical curves with 200 < K value					0.135
NVK2030	<=300 within the fixed-length segment					(2.82)
	Natural log of proportion of vertical curves with 2					
	<= absolute ahead slope < 4 within the fixed-				-0.056	
LVASL24	length segment				(-3.07)	
	Natural log of proportion of vertical curves with					
	$4 \ll absolute ahead slope < 6$ within the fixed-	-0.014			-0.080	
LVASL46	length segment	(-0.56)			(-3.24)	
	Natural log of proportion of vertical curves with					
1.1/1/1020	100 < K value <=200 within the fixed-length	-0.050				
LVK1020	segment	(-1.92)				
	Natural log of proportion of vertical curves with $200 < K$ value <=300 within the fixed-length			-0.187		
LVK2030	segment			(-3.01)		
L / R2050	Natural log of proportion of vertical curves with			( 5.01)		
	design speed ranged from 60 to 65 (mph) within	-0.097				
LVSP6065	the fixed-length segment	(-2.04)				
	Roadway weighted average width in decreasing	-0.043	0.025	0.043		
RWDDEC	milepost direction, as continuous variable	(-1.85)	(0.77)	(2.69)		
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-1.500
RDEC2436	continuous variable					(-5.94)
	Proportion of roadway width is in the 36.01 to					
	48.0 foot range in decreasing milepost direction,					-0.685
RDEC3648	as continuous variable					(-3.69)
	Proportion of roadway width is in the 0.01 to 12.0				0.649	
RINC012	foot range in increasing milepost direction, as				-0.648 (-3.19)	
KINCU12	continuous variable Proportion of roadway width is in the 12.01 to				(-3.19)	
	24.0 foot range in increasing milepost direction,			-0.829		
RINC1224	as continuous variable			(-3.56)		
	Proportion of travel shoulder width is in the 4.01			( 5.50)		
	to $6.0$ foot range on the left-center side in					
	increasing milepost direction, as continuous					-0.164
SDWLC46	variable					(-1.05)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right side in increasing					-0.295
SDWR810	milepost direction, as continuous variable					(-3.37)

Table C.22 Evident injury crash models by functional classes for 0.5 mile segments

	Fixed Para	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 6.01					
	to 8.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.801
SDWRC68	variable					(3.01)
	Proportion of shoulder surface type is bituminous					
	on the right side in increasing milepost direction,	-0.514				
SSFRB	as continuous variable	(-5.28)				
	Proportion of curb shoulder surface type on the	0.044				
	right side in increasing milepost direction, as	0.964			0.853	
SSFRC	continuous variable	(4.24)			(14.00)	
	Proportion of shoulder surface type is gravel on	0.444				
	the right side in increasing milepost direction, as	-0.466				
SSFRG	continuous variable	(-3.06)				
	Proportion of shoulder surface type is asphalt on			0.505		
	the left side in increasing milepost direction, as			0.595		
MSFA	continuous variable			(2.02)		
MWD1020	Proportion of median width in 10.01 to 20.0 foot			-0.814		
MWD1020	range, as continuous variable			(-2.59)	0.501	
NUVD 4050	Proportion of median width in 40.01 to 50.0 foot				-0.501	
MWD4050	range, as continuous variable				(-2.39)	0.000
ALPHA	Dispersion nonemotor				0.124	0.066
ALPHA	Dispersion parameter				(3.58)	(2.19)
	Random Par			1		
<b>G</b> ( ) (		-2.360	-1.718		-1.204	1.718
Constant		(-8.24)	(-4.49)		(-8.53)	(3.25)
	Location indicator (if segment is located in in					0.142
URBAN	urban arear, 1, otherwise, 0)					(1.54)
	Count of vertical curves with design speed	-0.229				
NUCDEOE5	ranged from 60 to 65 (mph) within the fixed-					
NVSP6065	length segment	(-2.44)				
	Proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment,					-0.725
PVBSL24	as continuous variable					(-2.66)
I VDSL24	Roadway surface type is portland cement					0.184
LNSFDECP	concrete in decreasing milepost direction					(2.67)
END DECI	Roadway surface type is asphalt in increasing	0.440		0.148		(2.07)
LNSFINCA	milepost direction	(4.90)		(0.76)		
LIGING	Roadway weighted average width in decreasing	(4.90)		(0.70)	0.021	-0.046
RWDDEC	milepost direction, as continuous variable				(5.34)	(-5.17)
RHDDLC	Proportion of roadway width in the 12.01 to 24				(5.51)	(3.17)
	foot range in decreasing milepost direction, as					-2.057
RDEC1224	continuous variable					(-6.12)
	Proportion of roadway width is in the 0.01 to 12.0					()
	foot range in increasing milepost direction, as			-0.579		
RINC012	continuous variable			(-1.53)		
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		-0.319		-0.454	
RINC1224	as continuous variable		(-1.00)		(-5.94)	
	Weighted average travel shoulder width on the					
	right-center side in increasing milepost direction,					-0.113
SDWRC	as continuous variable					(-4.00)

Table C.22 (Continued) Evident injury crash models by functional classes for 0.5 mile segments

	Random Par	ameters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.581
SDWRC46	variable					(3.05)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					1.277
SDWRC810	variable					(4.89)
	Proportion of curb shoulder surface type on the		0.100			
GGEDC	right side in increasing milepost direction, as		0.189			
SSFRC	continuous variable		(0.65)			0.005
1000	Proportion of median width in 10.01 to 20.0 foot					0.305
MWD1020	range, as continuous variable					(3.26)
	Standard Deviation for the Random Par			istribution	0.574	0.007
Constant		0.739	0.743		0.576	0.007
Constant		(29.44)	(16.19)		(23.28)	(0.25)
URBAN	Location indicator (if segment is located in in					0.199
UKDAN	urban arear, 1, otherwise, 0) Count of vertical curves with design speed					(3.63)
	ranged from 60 to 65 (mph) within the fixed-	0.302				
NVSP6065	length segment	(6.19)				
10005	Proportion of vertical curves with 2 <= absolute	(0.17)				
	back slope $< 4$ within the fixed-length segment,					0.745
PVBSL24	as continuous variable					(3.44)
1 1 2022	Roadway surface type is portland cement					0.356
LNSFDECP	concrete in decreasing milepost direction					(10.00)
	Roadway surface type is asphalt in increasing	0.422		0.826		
LNSFINCA	milepost direction	(13.20)		(10.83)		
	Roadway weighted average width in decreasing			, í		0.000
RWDDEC	milepost direction, as continuous variable					(0.06)
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					0.472
RDEC1224	continuous variable					(9.42)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as			0.437		
RINC012	continuous variable			(1.85)		
	Proportion of roadway width is in the 12.01 to					
	24.0 foot range in increasing milepost direction,		0.042		0.374	
RINC1224	as continuous variable		(0.29)		(10.05)	
	Weighted average travel shoulder width on the					0.000
(DUTC	right-center side in increasing milepost direction,					0.002
SDWRC	as continuous variable					(0.35)
	Proportion of travel shoulder width is in the 4.01					
	to 6.0 foot range on the right-center side in					0.071
CDWDC44	increasing milepost direction, as continuous					0.271
SDWRC46	variable			<u> </u>		(3.45)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					0 165
SDWRC810	increasing milepost direction, as continuous variable					0.165
SD WINCOID	variaute		1			(2.06)

Table C.22 (Continued) Evident injury crash models by functional classes for 0.5 mile segments

Standard Deviation for the Random Parameters with Normal Distribution							
Functional Class         TWLR         TWLU         NINTR         NINTU			NINTU	INT			
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.	
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)	
	Proportion of curb shoulder surface type on the						
	right side in increasing milepost direction, as		0.507				
SSFRC	continuous variable		(3.48)				
	Proportion of median width in 10.01 to 20.0 foot					0.002	
MWD1020	range, as continuous variable					(0.03)	

Table C.22 (Continued) Evident injury crash models by functional classes for 0.5 mile segments

# Table C.22 (Continued) Evident injury crash models by functional classes for 0.5 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	14	8	10	13	31
Number of Random Parameters	3	3	2	3	10
Restricted Log-Likelihood (Fixed Parameters at Convergence)	-5530.38	-1078.23	-630.82	-2930.18	-2403.33
Log-Likelihood	-5474.60	-1050.19	-617.32	-2894.85	-2392.88
AIC	10977.20	2116.38	1254.63	5815.70	4847.75
BIC	11087.36	2158.15	1305.55	5891.46	5034.50
LL Ratio	111.56	56.08	27.00	70.66	20.92
Adjusted Pseudo R-squared	0.044	0.028	0.052	0.071	0.159
	RP Poisson	RP Poisson	RP Poisson	RP NB	RP NB

		TWIT D	TRANE TI	NUNTRE	NUMBER	TATT
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat) 0.085
AADT	AADT (ADTK10=AADT/10000)					(4.99)
AADI	Count of horizontal curves within the fixed-length					0.012
NHC	segment					(0.13)
MIC	Count of horizontal curves with design speed of					(0.13)
	30 mph or 35 mph within the fixed-length	-0.305				
NHSP3035	segment	(-1.37)				
11151 5055	Natural log of proportion of horizontal curves	(-1.37)				
	with 5000 <= radius (feet) within the fixed-length	0.205				
LHCR50UP	segment	(1.93)				
Energoon	Natural log of proportion of horizontal curves	(1.)3)				
	with design speeds of 30 mph or 35 mph within	-0.239				
LHSP3035	the fixed-length segment	(-1.53)				
21151 5055	Count of vertical curves with 2 <= absolute back	(-1.55)			0.160	
NVBSL24	slope $< 4$ within the fixed-length segment				(2.58)	
11 1 DOL24	Roadway surface type is bituminous in decreasing	-1.072			(2.30)	
LNSFDECB	milepost direction	-1.072 (-9.18)				
LIGFDECD	Proportion of roadway width in the 24.01 to 36.0	(-9.10)				
	foot range in decreasing milepost direction, as				0.138	
RDEC2436	continuous variable					
KDEC2430	Proportion of travel shoulder width is in the 0.01				(0.84)	
		0.244				
CDWD02	to 2.0 foot range on the right side in increasing	-0.244				
SDWR02	milepost direction, as continuous variable	(-1.54)				
	Proportion of travel shoulder width is in the 8.01					0.000
00000010	to 10.0 foot range on the right side in increasing					-0.809
SDWR810	milepost direction, as continuous variable					(-3.68)
	Proportion of travel shoulder width is in the 8.01					
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.365
SDWRC810	variable					(1.56)
	Proportion of curb shoulder surface type on the					
	left side in increasing milepost direction, as				0.761	
SSFLC	continuous variable				(6.11)	
						0.598
ALPHA	Dispersion parameter					(2.07)
	Random Para	meters				
		-3.576 (-			-2.324 (-	
Constant		41.10)			14.90)	
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					1.222
PHCR2030	segment, as continuous variable					(3.16)
	Natural log of proportion of vertical curves with	0.238				
LVK40UP	400 < K value within the fixed-length segment	(3.13)				
	Natural log of proportion of vertical curves with	-				
	50 < K value $<=100$ within the fixed-length	-0.135 (-				
LVK510	segment	2.42)				
	Proportion of roadway width in the 12.01 to 24	,				
	foot range in decreasing milepost direction, as					-0.327
RDEC1224	continuous variable					(-1.07)
	Proportion of roadway width in the 24.01 to 36.0			1		(
	foot range in decreasing milepost direction, as					-0.393
RDEC2436	continuous variable					(-1.53)
	Proportion of roadway width is in the 12.01 to				1	(1.00)
				1	1	1
	24.0 foot range in increasing milepost direction,				-0.353	

Table C.23 Serious injury crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Parameters with Normal Distribution							
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT		
		0.551			0.567			
Constant		(10.46)			(11.23)			
	Proportion of horizontal curves with 2000 <=							
	radius < 3000 (feet) within the fixed-length					0.001		
PHCR2030	segment					(0.00)		
	Natural log of proportion of vertical curves with	0.397						
LVK40UP	400 < K value within the fixed-length segment	(7.50)						
	Natural log of proportion of vertical curves with 50	0.007						
LVK510	< K value <=100 within the fixed-length segment	(0.13)						
	Proportion of roadway width in the 12.01 to 24							
	foot range in decreasing milepost direction, as					0.002		
RDEC1224	continuous variable					(0.02)		
	Proportion of roadway width in the 24.01 to 36.0							
	foot range in decreasing milepost direction, as					0.871		
RDEC2436	continuous variable					(7.17)		
	Proportion of roadway width is in the 12.01 to 24.0							
	foot range in increasing milepost direction, as				0.021			
RINC1224	continuous variable				(0.27)			

Table C.23 (Continued) Serious injury crash models by functional classes for 0.5 mile segments

	Table C.23 (Continued)	Serious injury of	rash models by functi	onal classes for 0.5 m	ile segments
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	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	11			7	11
Number of Random Parameters	3			2	3
Restricted Log-Likelihood (Fixed Parameters at Convergence)	-1755.24			-1110.86	-758.10
Log-Likelihood	-1751.99			-1106.89	-754.97
AIC	3525.98			2227.78	1531.94
BIC	3612.53			2268.57	1598.21
LL Ratio	6.50			7.94	6.26
Adjusted Pseudo R-squared	0.034			0.038	0.094
	<b>RP</b> Poisson			<b>RP</b> Poisson	RP NB

	Fixed Param Functional Class	TWLR	TWLU	NINTR	NINTU	INT
	r unctional Class	Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
v al lable	Description	-4.320	-4.261	(l-stat)	(l-stat)	(1-5141)
Constant		(-30.31)	(-8.68)			
Constant			(-0.00)			
	Count of vertical curves with $2 \le absolute back$	-0.087				
NVBSL24	slope $< 4$ within the fixed-length segment	(-0.45)	0.10.1	-		
	Count of vertical curves with 100 < K value <=200		0.634			
NVK1020	within the fixed-length segment		(1.82)			
	Count of vertical curves with 200 < K value <= 300					-0.435
NVK2030	within the fixed-length segment					(-1.65)
	Count of vertical curves with 400 < K value within		0.491			
NVK40UP	the fixed-length segment		(1.31)			
	Natural log of proportion of vertical curves with					
	absolute ahead slope $< 2$ within the fixed-length	-0.126				
LVASL02	segment	(-2.09)				
	Natural log of proportion of vertical curves with 2			1		
	<= absolute back slope < 4 within the fixed-length	0.130				
LVBSL24	segment	(1.15)				
	Natural log of proportion of vertical curves with	(				
	200 < K value <=300 within the fixed-length		-0.207			
LVK2030	segment		(-0.93)			
L V K2050	Natural log of proportion of vertical curves with		(-0.73)			
	design speed of 30 mph or 35 mph within the fixed-	-0.159				
LVSP3035		(-1.39)				
L V SF 3033	length segment Roadway surface type is bituminous in decreasing	-0.843				
INCEDECD						
LNSFDECB	milepost direction	(-5.23)		-		0.011
DUDDEC	Roadway weighted average width in decreasing					0.044
RWDDEC	milepost direction, as continuous variable					(3.57)
	Proportion of travel shoulder width is in the 6.01 to					
	8.0 foot range on the right side in increasing		0.801			
SDWR68	milepost direction, as continuous variable		(1.67)			
	Proportion of travel shoulder width is in the 8.01 to					
	10.0 foot range on the right side in increasing		1.564			
SDWR810	milepost direction, as continuous variable		(2.59)			
	Proportion of curb shoulder surface type on the left					
	side in increasing milepost direction, as continuous	1.910				
SSFLC	variable	(0.47)				
	Proportion of curb shoulder surface type on the	· /				
	right side in increasing milepost direction, as	-2.715				
SSFRC	continuous variable	(-0.56)				
	Random Para		1	11		
	Location indicator (if segment is located in in	meters				-0.126
URBAN	urban arear, 1, otherwise, 0)					-0.120
UNDAIN	Proportion of horizontal curves with 2000 <=					(-0.40)
						2 2 4 7
DUCD2020	radius < 3000 (feet) within the fixed-length					-3.247
PHCR2030	segment, as continuous variable		0.400			(-2.07)
NUC	Count of vertical curves within the fixed-length		-0.400			
NVC	segment		(-1.38)	ļ		
	Natural log of proportion of vertical curves with					
	200 < K value <=300 within the fixed-length	0.560				
LVK2030	segment	(3.63)				
	Standard Deviation for the Random Par	ameters wit	th Normal I	Distribution		
	Location indicator (if segment is located in in					2.092
URBAN	urban arear, 1, otherwise, 0)					(5.95)

Table C.24 Fatal crash models by functional classes for 0.5 mile segments

	Standard Deviation for the Random Para	ameters wit	h Normal D	istribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					2.646
PHCR2030	segment, as continuous variable					(2.72)
	Count of vertical curves within the fixed-length		0.001			
NVC	segment		(0.01)			
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length	0.570				
LVK2030	segment	(6.66)				

Table C.24 (Continued) Fatal crash models by functional classes for 0.5 mile segments

# Table C.24 (Continued) Fatal crash models by functional classes for 0.5 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	19316	1368	1202	2508	3054
Number of Parameters	10	8			7
Number of Random Parameters	1	1			2
Restricted Log-Likelihood (Fixed Parameters at Convergence)	-963.76	-150.54			-373.61
Log-Likelihood	-961.80	-145.15			-371.15
AIC	1943.59	306.31			756.29
BIC	2022.28	348.08			798.46
LL Ratio	3.93	10.77			4.93
Adjusted Pseudo R-squared	0.023	0.041			0.046
	<b>RP</b> Poisson	RP Poisson			<b>RP</b> Poisson

	Fixed Paran	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
Constant		1.845 (0.46)				
AADT	AADT (ADTK10=AADT/10000)					0.141 (66.09)
	Count of horizontal curves within the fixed-length		-0.163			(00.07)
NHC	segment		(-7.92)			
	Count of horizontal curves with angle of deflection	0.076			-0.138	
NHCA5DW	$(\Delta) \le 5$ (degrees) within the fixed-length segment	(1.96)			(-6.25)	
	Count of horizontal curves with 1000 <= radius <					0.348
NHCR1015	1500 (feet) within the fixed-length segment					(9.73)
NUCD 77	Count of horizontal curves with 500 <= radius <	0.119	0.392			
NHCR57	700 (feet) within the fixed-length segment	(3.71)	(8.35)			
NHSP3035	Count of horizontal curves with design speed of 30	-0.098 (-2.23)				
11101 2022	mph or 35 mph within the fixed-length segment Count of horizontal curves with design speed of 40	-0.079				
NHSP4045	mph or 45 mph within the fixed-length segment	(-1.46)				
11151 -0-15	Count of horizontal curves with design speed of 60	(1.40)				0.147
NHSP6065	mph or 65 mph within the fixed-length segment					(4.96)
	Count of horizontal curves with design speed more					-0.090
NHSP70UP	than 70 (mph) within the fixed-length segment					(-3.61)
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					0.048
PHCR2030	segment, as continuous variable					(1.23)
	Natural log of proportion of horizontal curves with					
	radius less than 100 (feet) within the fixed-length	-0.304				
LHCR1DW	segment Natural log of proportion of horizontal curves with	(-5.74)				
	Solo $\leq$ radius (feet) within the fixed-length	0.057				
LHCR50UP	segment	(1.85)				
Literater	Natural log of proportion of horizontal curves with	(1.00)				
	design speed <=25 (mph) within the fixed-length		-0.154		-0.086	
LHSP25DW	segment		(-7.32)		(-8.68)	
	Natural log of proportion of horizontal curves with					
	design speeds of 30 mph or 35 mph within the	-0.062		-0.133		
LHSP3035	fixed-length segment	(-1.60)		(-2.65)		
	Natural log of proportion of horizontal curves with					
	design speed ranged from 40 to 45 (mph) within	-0.064				
LHSP4045	the fixed-length segment	(-1.43)				
	Natural log of proportion of horizontal curves with	0.070				
LHSP5055	design speed ranged from 50 to 55 (mph) within the fixed length segment	-0.079 (-2.53)				
1101 3033	the fixed-length segment Count of vertical curves with 100 < K value <=200	0.053			0.129	
NVK1020	within the fixed-length segment	(2.16)			(13.78)	
	Count of vertical curves with 200 < K value <= 300	0.114			(13.70)	
NVK2030	within the fixed-length segment	(4.93)				
	Count of vertical curves with 20 < K value <=50	0.139				
NVK250	within the fixed-length segment	(3.87)				
	Count of vertical curves with 300 < K value <=400					0.097
NVK3040	within the fixed-length segment					(4.31)
	Natural log of proportion of vertical curves with 2					
	<= absolute back slope < 4 within the fixed-length			-0.010		
LVBSL24	segment			(-0.39)		

Table C.25 Total crash models by functional classes for 0.25 mile segments

	Fixed Paran	neters		1		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Natural log of proportion of vertical curves with	(1.1.1.1)	(1.1.1.1)	(******)	(1.1.1.1)	(******)
	100 < K value <=200 within the fixed-length	-0.054				
LVK1020	segment	(-3.12)				
	Natural log of proportion of vertical curves with					
	200 < K value <= 300 within the fixed-length			-0.011		
LVK2030	segment			(-0.30)		
1 1/1/2 5 1 0	Natural log of proportion of vertical curves with 50	-0.121				
LVK510	<pre>&lt; K value &lt;=100 within the fixed-length segment</pre>	(-7.64)		0.050	0.762	
INCEDECD	Roadway surface type is portland cement concrete			0.959	0.763	
LNSFDECP	in decreasing milepost direction Roadway surface type is bituminous in increasing			(5.14)	(14.53)	-0.445
LNSFINCB	milepost direction					-0.443
LINSTINCE	Roadway surface type is portland cement concrete	0.335		-0.618		(-2.42)
LNSFINCP	in increasing milepost direction	(3.26)		(-8.76)		
	Roadway weighted average width in decreasing	(3.20)		( 0.70)		-0.024
RWDDEC	milepost direction, as continuous variable					(-7.09)
	Proportion of roadway width is in the 0.01 to 12.0					(
	foot range in decreasing milepost direction, as				-0.466	
RDEC012	continuous variable				(-5.99)	
	Proportion of roadway width in the 12.01 to 24 foot				Ì,	
	range in decreasing milepost direction, as			0.009	-0.573	
RDEC1224	continuous variable			(0.10)	(-16.65)	
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-0.692
RDEC2436	continuous variable					(-7.63)
	Proportion of roadway width is in the 0.01 to 12.0					
	foot range in increasing milepost direction, as				-0.726	
RINC012	continuous variable				(-10.45)	
	Proportion of roadway width is in the 12.01 to 24.0			0.250		
DINC1224	foot range in increasing milepost direction, as			-0.250		
RINC1224	continuous variable			(-3.10)		
	Proportion of travel shoulder width is in the 0.01 to 2.0 foot range on the right side in increasing	-0.530				
SDWR02	to 2.0 foot range on the right side in increasing milepost direction, as continuous variable	-0.330 (-17.76)				
5D W R02	Proportion of travel shoulder width is in the 8.01	(-17.70)				
	to 10.0 foot range on the right side in increasing		0.377			
SDWR810	milepost direction, as continuous variable		(4.90)			
	Proportion of travel shoulder width is in the 8.01		(11)0)			
	to 10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.811
SDWRC810	variable					(9.50)
	Proportion of curb shoulder surface type on the left					
	side in increasing milepost direction, as continuous	0.564				
SSFLC	variable	(5.51)				
	Proportion of shoulder surface type is asphalt on					
	the right side in increasing milepost direction, as	0.406				
SSFRA	continuous variable	(8.42)				
	Proportion of curb shoulder surface type on the	0.077	0.0		o <b>-</b>	
	right side in increasing milepost direction, as	0.983	0.370		0.779	
SSFRC	continuous variable	(8.95)	(4.45)	0.000	(51.38)	
	Proportion of median width in 10.01 to 20.0 foot			0.086		
MWD1020	range, as continuous variable			(1.43)	0.410	
	Proportion of median width is in the 30.01 to 40.0				-0.419	
MWD3040	foot range, as continuous variable				(-10.77)	

Table C.25 (Continued) Total crash models by functional classes for 0.25 mile segments

	Fixed Paran	neters		1	,	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
		0.027	0.021		0.013	0.030
ALPHA	Dispersion parameter	(2.41)	(2.14)		(5.21)	(8.43)
	Random Para	meters				
<b>G</b> ( ) (			2.019	-4.740	0.957	1.485
Constant			(11.62)	(-11.93)	(23.68)	(7.37)
LNADT	Natural log of AADT			0.459 (10.70)		
	Location indicator (if segment is located in in urban			(10.70)		0.381
URBAN	arear, 1, otherwise, 0)					(15.14)
	Count of horizontal curves within the fixed-length	0.018				
NHC	segment	(1.38)				
	Natural log of proportion of horizontal curves with					
	design speed <=25 (mph) within the fixed-length	-0.015				
LHSP25DW	segment	(-0.99)				
	Natural log of proportion of horizontal curves with				0.077	
111002025	design speeds of 30 mph or 35 mph within the				-0.066	
LHSP3035	fixed-length segment Count of vertical curves within the fixed-length	-0.075			(-3.95)	
NVC	segment	-0.075 (-5.09)				
ive	Count of vertical curves with 200 < K value <= 300	(-3.09)			0.110	0.222
NVK2030	within the fixed-length segment				(8.57)	(13.08)
11112030	Natural log of proportion of vertical curves with 2				(0.57)	(15.00)
	<= absolute back slope < 4 within the fixed-length				-0.069	
LVBSL24	segment				(-10.65)	
	Natural log of proportion of vertical curves with 6					
	<= absolute back slope < 8 within the fixed-length	0.322				
LVBSL68	segment	(9.36)				
	Natural log of proportion of vertical curves with					
	design speed more than 70 (mph) within the fixed-	0.023				
LVSP70UP	length segment           Proportion of vertical curves with absolute back	(2.00)				
	slope $< 2$ within the fixed-length segment, as					-0.344
PVBSL02	continuous variable					(-7.30)
I VB5E02	Proportion of vertical curves with $2 \le absolute$					(7.50)
	back slope $< 4$ within the fixed-length segment, as					-0.434
PVBSL24	continuous variable					(-8.06)
	Proportion of vertical curves with 50 < K value					
	<=100 within the fixed-length segment, as					3.001
PVK510	continuous variable					(13.71)
LNEDECI	Proportion of 1-lane cross section in decreasing	-3.938				
LNSDEC1	milepost direction, as continuous variable Roadway surface type is asphalt in decreasing	(-0.99) 0.772	1.084	0.274	0.775	
LNSFDECA	milepost direction	(22.00)	(13.78)	(1.74)	(17.01)	
LIGI DLCA	Roadway surface type is portland cement concrete	(22.00)	(13.70)	(1./4)	(17.01)	0.261
LNSFDECP	in decreasing milepost direction					(14.95)
	Proportion of roadway width in the 12.01 to 24 foot					(
	range in decreasing milepost direction, as					-0.933
RDEC1224	continuous variable					(-7.35)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as				-0.325	
RDEC2436	continuous variable				(-10.98)	
	Proportion of roadway width is in the 36.01 to 48.0					
	foot range in decreasing milepost direction, as					-0.393

	Random Para	meters			,	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
, unuble	Proportion of roadway width is in the 0.01 to 12.0	(t stat)	(1 5141)	(t stat)	(t stat)	(t stat)
	foot range in increasing milepost direction, as		-3.232			
RINC012	continuous variable		(-21.12)			
	Proportion of roadway width is in the 12.01 to 24.0					
	foot range in increasing milepost direction, as		-2.611		-0.526	
RINC1224	continuous variable		(-16.71)		(-22.28)	
	Proportion of travel shoulder width is in the 2.01 to					
	4.0 foot range on the left-center side in increasing					-0.094
SDWLC24	milepost direction, as continuous variable					(-2.36)
	Proportion of travel shoulder width is in the 4.01 to					0 120
CDWI CAC	6.0 foot range on the left-center side in increasing					-0.138
SDWLC46	milepost direction, as continuous variable Proportion of travel shoulder width is in the 2.01 to					(-3.46)
	4.0 foot range on the right side in increasing	-0.271	0.226			
SDWR24	milepost direction, as continuous variable	(-12.32)	(3.36)			
5D W K24	Proportion of travel shoulder width is in the 4.01 to	(-12.32)	(3.30)			
	6.0 foot range on the right side in increasing		0.273			
SDWR46	milepost direction, as continuous variable		(3.92)			
SD WIKIO	Proportion of travel shoulder width is in the 6.01 to		(3.72)			
	8.0 foot range on the right side in increasing		0.284			
SDWR68	milepost direction, as continuous variable		(4.38)			
	Proportion of travel shoulder width is in the 8.01 to					
	10.0 foot range on the right side in increasing					-0.287
SDWR810	milepost direction, as continuous variable					(-12.04)
	Weighted average travel shoulder width on the					
	right-center side in increasing milepost direction,					-0.075
SDWRC	as continuous variable					(-8.40)
	Proportion of travel shoulder width is in the 4.01 to					
	6.0 foot range on the right-center side in increasing					0.387
SDWRC46	milepost direction, as continuous variable					(6.92)
	Proportion of travel shoulder width in the 6.01 to					
	8.0 foot range on the right-center side in increasing					0.588
SDWRC68	milepost direction, as continuous variable					(8.26)
	Proportion of shoulder surface type is bituminous					
	on the left side in increasing milepost direction, as	-0.666				
SSFLB	continuous variable	(-4.09)				
	Proportion of curb shoulder surface type on the left			1.242		
SSFLC	side in increasing milepost direction, as continuous			1.242		
SSFLC	variable Proportion of shoulder surface type is bituminous			(13.26)		
	on the right side in increasing milepost direction, as	0.694				
SSFRB	continuous variable	(4.16)				
551 KD	Proportion of median width in 10.01 to 20.0 foot	(7.10)			0.080	0.189
MWD1020	range, as continuous variable				(4.64)	(8.08)
111121020				• . ••	(1.01)	(0.00)
	Standard Deviation for the Random Para	ameters wi		0.468	0.860	0.424
Constant			0.936 (61.37)	(21.83)	0.860 (126.71)	0.424 (57.58)
Constant			(01.37)	0.081	(120.71)	(37.30)
LNADT	Natural log of AADT			(35.34)		
	Location indicator (if segment is located in in urban			(33.34)		0.436
						(30.34)
URBAN	arear I otherwise (1)					
URBAN	arear, 1, otherwise, 0) Count of horizontal curves within the fixed-length	0.001				(30.34)

Table C.25 (Continued) Total crash models by functional classes for 0.25 mile segments

	Standard Deviation for the Random Par	ameters wit	th Normal D	Distribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Natural log of proportion of horizontal curves with		· ·			
	design speed <=25 (mph) within the fixed-length	0.012				
LHSP25DW	segment	(1.07)				
	Natural log of proportion of horizontal curves with					
111002025	design speeds of 30 mph or 35 mph within the				0.056	
LHSP3035	fixed-length segment	0.061			(3.53)	
NVC	Count of vertical curves within the fixed-length	(10.29)				
INVC	segment Count of vertical curves with 200 < K value <=300	(10.29)			0.065	0.134
NVK2030	within the fixed-length segment				(5.72)	(9.32)
111112030	Natural log of proportion of vertical curves with 2				(3.72)	().32)
	<= absolute back slope < 4 within the fixed-length				0.043	
LVBSL24	segment				(8.10)	
	Natural log of proportion of vertical curves with 6				, ,	
	<= absolute back slope < 8 within the fixed-length	0.341				
LVBSL68	segment	(12.34)				
	Natural log of proportion of vertical curves with					
	design speed more than 70 (mph) within the fixed-	0.042				
LVSP70UP	length segment	(5.06)				
	Proportion of vertical curves with absolute back					
	slope $< 2$ within the fixed-length segment, as					0.171
PVBSL02	continuous variable					(4.79)
	Proportion of vertical curves with $2 \le absolute$					0.60.6
	back slope $< 4$ within the fixed-length segment, as					0.626
PVBSL24	continuous variable					(14.33)
	Proportion of vertical curves with $50 < K$ value					0.045
PVK510	<=100 within the fixed-length segment, as continuous variable					0.045 (0.21)
F VKJ10	Proportion of 1-lane cross section in decreasing	0.910				(0.21)
LNSDEC1	milepost direction, as continuous variable	(102.49)				
LINDLCI	Roadway surface type is asphalt in decreasing	0.307	0.309	0.026	0.380	
LNSFDECA	milepost direction	(28.84)	(22.08)	(1.17)	(58.37)	
LI (DI DECIT	Roadway surface type is portland cement concrete	(20.04)	(22.00)	(1.17)	(30.37)	0.185
LNSFDECP	in decreasing milepost direction					(19.06)
	Proportion of roadway width in the 12.01 to 24 foot					
	range in decreasing milepost direction, as					0.380
RDEC1224	continuous variable					(27.70)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as				0.462	
RDEC2436	continuous variable				(41.85)	
	Proportion of roadway width in the 36.01 to 48.0					
	foot range in decreasing milepost direction, as					0.354
RDEC3648	continuous variable					(23.24)
	Proportion of roadway width in the 0.01 to 12.0 foot		0.212			
	range in increasing milepost direction, as		0.313			
RINC012	continuous variable		(19.32)			
	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as		0.201		0.414	
DINC1224	continuous variable		0.391		0.414	
RINC1224	Proportion of travel shoulder width in the 2.01 to		(12.26)		(44.40)	
	4.0 foot range on the left-center side in increasing					0.065
	+.0 root range on the ren-center side in increasing			1		0.005

 Table C.25 (Continued) Total crash models by functional classes for 0.25 mile segments

	Standard Deviation for the Random Par	ameters wi	th Normal E	Distribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the left-center side in increasing	(* 2000)	(******)	(*****)	(******)	0.004
SDWLC46	milepost direction, as continuous variable Proportion of travel shoulder width in the 2.01 to					(0.21)
SDWR24	4.0 foot range on the right side in increasing milepost direction, as continuous variable	0.236 (14.39)	0.065 (2.00)			
SDWR46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the right side in increasing milepost direction, as continuous variable		0.230 (6.27)			
SDWR68	Proportion of travel shoulder width in the 6.01 to 8.0 foot range on the right side in increasing milepost direction, as continuous variable		0.172 (6.40)			
SDWR810	Proportion of travel shoulder width in the 8.01 to 10.0 foot range on the right side in increasing milepost direction, as continuous variable					0.001 (0.12)
SDWRC	Weighted average travel shoulder width on the right-center side in increasing milepost direction, as continuous variable					0.041 (26.46)
SDWRC46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.005 (0.24)
SDWRC68	Proportion of travel shoulder width in the 6.01 to 8.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.012 (0.38)
SSFLB	Proportion of shoulder surface type is bituminous on the left side in increasing milepost direction, as continuous variable	0.339 (19.21)				
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable			0.025 (0.36)		
SSFRB	Proportion of shoulder surface type is bituminous on the right side in increasing milepost direction, as continuous variable	0.220 (12.34)				
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable				0.112 (7.74)	0.157 (10.74)

Table C.25 (Continued) Total crash models by functional classes for 0.25 mile segments

Functional Class           Description           T (ADTK10=AADT/10000)           al log of AADT           of horizontal curves within the fixed-length segment           of horizontal curves with angle of deflection           5 (degrees) within the fixed-length segment           of horizontal curves with 1000 <= radius <           (feet) within the fixed-length segment           of horizontal curves with 500 <= radius <           eet) within the fixed-length segment           of horizontal curves with design speed of 40           r 45 mph within the fixed-length segment           of horizontal curves with design speed of 60           r 65 mph within the fixed-length segment           of horizontal curves with design speed more           of mph within the fixed-length segment           of horizontal curves with design speed more           of mph within the fixed-length segment           of horizontal curves with design speed more           of mph within the fixed-length segment           of horizontal curves with 2000 <=           < 3000 (feet) within the fixed-length           of horizontal curves with 2000 <= <t< th=""><th>TWLR Coeff. (t-stat) 0.105 (2.52) -0.127 (-1.73)</th><th>TWLU           Coeff.           (t-stat)           -0.185           (-7.07)           0.427           (7.23)</th><th>NINTR Coeff. (t-stat) 0.577 (11.12)</th><th>NINTU Coeff. (t-stat) -0.141 (-5.34)</th><th>INT Coeff. (t-stat) 0.140 (56.94) 0.332 (8.21)</th></t<>	TWLR Coeff. (t-stat) 0.105 (2.52) -0.127 (-1.73)	TWLU           Coeff.           (t-stat)           -0.185           (-7.07)           0.427           (7.23)	NINTR Coeff. (t-stat) 0.577 (11.12)	NINTU Coeff. (t-stat) -0.141 (-5.34)	INT Coeff. (t-stat) 0.140 (56.94) 0.332 (8.21)
Description           T (ADTK10=AADT/10000)           al log of AADT           of horizontal curves within the fixed-length ent           of horizontal curves with angle of deflection           = 5 (degrees) within the fixed-length segment           of horizontal curves with 1000 <= radius < (feet) within the fixed-length segment           of horizontal curves with 500 <= radius < (set) within the fixed-length segment           of horizontal curves with design speed of 40 or 45 mph within the fixed-length segment           of horizontal curves with design speed of 60 or 65 mph within the fixed-length segment           of horizontal curves with design speed more 0 (mph) within the fixed-length segment           of horizontal curves with design speed more 0 (mph) within the fixed-length segment	(t-stat) 0.105 (2.52) -0.127	(t-stat) -0.185 (-7.07) 0.427	Coeff. (t-stat)	Coeff. (t-stat)	(t-stat) 0.140 (56.94) 0.332
al log of AADT of horizontal curves within the fixed-length nt of horizontal curves with angle of deflection = 5 (degrees) within the fixed-length segment of horizontal curves with 1000 <= radius < (feet) within the fixed-length segment of horizontal curves with 500 <= radius < eet) within the fixed-length segment of horizontal curves with design speed of 40 or 45 mph within the fixed-length segment of horizontal curves with design speed of 60 or 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable	(2.52) -0.127	(-7.07)			0.332
of horizontal curves within the fixed-length int of horizontal curves with angle of deflection = 5 (degrees) within the fixed-length segment of horizontal curves with 1000 <= radius < (feet) within the fixed-length segment of horizontal curves with 500 <= radius < eet) within the fixed-length segment of horizontal curves with design speed of 40 r 45 mph within the fixed-length segment of horizontal curves with design speed of 60 r 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable	(2.52) -0.127	(-7.07)			
ent of horizontal curves with angle of deflection 5 (degrees) within the fixed-length segment of horizontal curves with 1000 <= radius < feet) within the fixed-length segment of horizontal curves with 500 <= radius < eet) within the fixed-length segment of horizontal curves with design speed of 40 r 45 mph within the fixed-length segment of horizontal curves with design speed of 60 r 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable	(2.52) -0.127	(-7.07)			
<ul> <li>5 (degrees) within the fixed-length segment of horizontal curves with 1000 &lt;= radius &lt;</li> <li>(feet) within the fixed-length segment of horizontal curves with 500 &lt;= radius &lt;</li> <li>(eet) within the fixed-length segment of horizontal curves with design speed of 40 or 45 mph within the fixed-length segment of horizontal curves with design speed of 60 or 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 &lt;=</li> <li>&lt; 3000 (feet) within the fixed-length ent, as continuous variable</li> </ul>	(2.52) -0.127				
(feet) within the fixed-length segment of horizontal curves with 500 <= radius < eet) within the fixed-length segment of horizontal curves with design speed of 40 or 45 mph within the fixed-length segment of horizontal curves with design speed of 60 or 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable	(2.52) -0.127				
eet) within the fixed-length segment of horizontal curves with design speed of 40 r 45 mph within the fixed-length segment of horizontal curves with design speed of 60 r 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable	(2.52) -0.127				
r 45 mph within the fixed-length segment of horizontal curves with design speed of 60 r 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable					
r 65 mph within the fixed-length segment of horizontal curves with design speed more 0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable					
0 (mph) within the fixed-length segment rtion of horizontal curves with 2000 <= < 3000 (feet) within the fixed-length ent, as continuous variable					0.122 (3.58)
< 3000 (feet) within the fixed-length ent, as continuous variable					-0.105 (-3.67)
					-0.024 (-0.53)
al log of proportion of horizontal curves with less than 100 (feet) within the fixed-length ent	-0.332 (-5.09)				
al log of proportion of horizontal curves with a speed <=25 (mph) within the fixed-length ent	-0.015 (-0.83)	-0.181 (-6.84)			
al log of proportion of horizontal curves with a speeds of 30 mph or 35 mph within the length segment	-0.034 (-0.75)		0.012 (0.21)	-0.087 (-4.46)	
al log of proportion of horizontal curves with a speed ranged from 40 to 45 (mph) within the length segment	-0.073 (-1.27)			(	
of vertical curves within the fixed-length	-0.087 (-4.55)				
of vertical curves with 100 < K value <=200 the fixed-length segment	0.043 (1.34)				
of vertical curves with 20 < K value <=50 the fixed-length segment	0.167 (3.65)				
the fixed-length segment					0.113 (4.35)
solute back slope < 4 within the fixed-length ent				-0.090 (-11.76)	
solute back slope < 8 within the fixed-length ant	0.202 (5.76)				
al log of proportion of vertical curves with K value <=200 within the fixed-length ent	-0.073				
	(		0.051		
	the fixed-length segment of vertical curves with 20 < K value <=50 the fixed-length segment of vertical curves with 300 < K value <=400 the fixed-length segment al log of proportion of vertical curves with 2 solute back slope < 4 within the fixed-length nt al log of proportion of vertical curves with 6 solute back slope < 8 within the fixed-length nt al log of proportion of vertical curves with K value <=200 within the fixed-length nt al log of proportion of vertical curves with K value <=300 within the fixed-length	the fixed-length segment $(1.34)$ of vertical curves with $20 < K$ value <=50	the fixed-length segment $(1.34)$ of vertical curves with 20 < K value <=50	the fixed-length segment $(1.34)$ of vertical curves with $20 < K$ value <=50	the fixed-length segment $(1.34)$ of vertical curves with 20 < K value <=50

	Fixed Paran	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
LNSDEC1	Proportion of 1-lane cross section in decreasing milepost direction, as continuous variable	-4.257 (-0.82)				
LNSFDECP	Roadway surface type is portland cement concrete in decreasing milepost direction	0.380 (2.86)			0.409 (7.00)	
LNSFINCA	Roadway surface type is asphalt in increasing milepost direction	0.887 (19.76)				
LNSFINCB	Roadway surface type is bituminous in increasing milepost direction					-0.651 (-2.86)
LNSFINCP	Roadway surface type is portland cement concrete in increasing milepost direction			-0.734 (-8.31)		
RWDDEC	Roadway weighted average width in decreasing milepost direction, as continuous variable					-0.024 (-5.97)
RDEC012	Proportion of roadway width in the 0.01 to 12.0 foot range in decreasing milepost direction, as continuous variable	-0.353 (-2.20)				
RDEC1224	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as continuous variable	-0.246 (-1.61)		-0.163 (-1.76)	-0.214 (-8.15)	
RDEC2436	Proportion of roadway width in the 24.01 to 36.0 foot range in decreasing milepost direction, as continuous variable Proportion of roadway width in the 0.01 to 12.0					-0.654 (-6.09)
RINC012	foot range in increasing milepost direction, as continuous variable				-0.803 (-12.02)	
RINC1224	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable				-0.582 (-21.40)	
SDWR02	Proportion of travel shoulder width in the 0.01 to 2.0 foot range on the right side in increasing milepost direction, as continuous variable	-0.616 (-15.96)				
SDWR24	Proportion of travel shoulder width in the 2.01 to 4.0 foot range on the right side in increasing milepost direction, as continuous variable				-0.313 (-3.16)	
SDWR46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the right side in increasing milepost direction, as continuous variable		0.141 (2.33)		-0.453 (-5.89)	
SDWR68	Proportion of travel shoulder width in the 6.01 to 8.0 foot range on the right side in increasing milepost direction, as continuous variable		0.156 (3.01)			
SDWRC	Weighted average travel shoulder width on the right-center side in increasing milepost direction, as continuous variable					-0.003 (-0.40)
SDWRC68	Proportion of travel shoulder width in the 6.01 to 8.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.089 (1.33)
SSFLB	Proportion of shoulder surface type is bituminous on the left side in increasing milepost direction, as continuous variable	-0.827 (-4.31)				
SSFRA	Proportion of shoulder surface type is asphalt on the right side in increasing milepost direction, as continuous variable	0.282 (4.87)			0.100 (1.50)	

Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

	Fixed Paran	neters		•		
	Functional Class	TWLR Coeff.	TWLU Coeff.	NINTR Coeff.	NINTU Coeff.	INT Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of curb shoulder surface type on the		, í		· · · · · · · · · · · · · · · · · · ·	· · · · ·
	right side in increasing milepost direction, as		0.238		0.619	
SSFRC	continuous variable		(2.84)		(12.99)	
	Proportion of median width in 10.01 to 20.0 foot			0.117	0.089	
MWD1020	range, as continuous variable			(1.61)	(4.16)	
	Proportion of median width in the 30.01 to 40.0				-0.380	
MWD3040	foot range, as continuous variable				(-8.04)	
			0.034	0.072	0.014	0.033
ALPHA	Dispersion parameter		(2.21)	(2.46)	(4.17)	(7.32)
	Random Para	meters	-			
_		2.171	1.863	-6.010	0.760	1.077
Constant		(0.42)	(8.95)	(-12.29)	(11.74)	(4.51)
	Location indicator (if segment is located in in urban					0.454
URBAN	arear, 1, otherwise, 0)	0.017				(15.58)
	Count of horizontal curves within the fixed-length	-0.015				
NHC	segment	(-0.92)		ļ		
	Count of horizontal curves with angle of deflection	0.066				
NHCA5DW	$(\Delta) \le 5$ (degrees) within the fixed-length segment	(1.47)				
NUICE2025	Count of horizontal curves with design speed of 30	-0.076				
NHSP3035	mph or 35 mph within the fixed-length segment	(-1.38)				
	Natural log of proportion of horizontal curves with				-0.097	
LHSP25DW	design speed <=25 (mph) within the fixed-length segment				(-8.38)	
LHSF25DW	Count of vertical curves with 100 < K value <=200				0.118	
NVK1020	within the fixed-length segment				(10.41)	
107 K1020	Count of vertical curves with 200 < K value <= 300	0.120			0.132	0.235
NVK2030	within the fixed-length segment	(4.02)			(8.84)	(12.24)
11112000	Natural log of proportion of vertical curves with 2	(1.02)			(0.01)	(12.21)
	<= absolute back slope < 4 within the fixed-length			-0.045		
LVBSL24	segment			(-1.43)		
	Natural log of proportion of vertical curves with 50	-0.127				
LVK510	< K value $<=100$ within the fixed-length segment	(-6.21)				
	Natural log of proportion of vertical curves with					
	design speed more than 70 (mph) within the fixed-	0.028				
LVSP70UP	length segment	(1.93)				
	Proportion of vertical curves with absolute back					
	slope $< 2$ within the fixed-length segment, as					-0.308
PVBSL02	continuous variable					(-5.68)
	Proportion of vertical curves with $2 \le absolute$					_ · · ·
	back slope $< 4$ within the fixed-length segment, as					-0.425
PVBSL24	continuous variable					(-6.80)
	Proportion of vertical curves with $50 < K$ value					2 10 4
DVV510	<=100 within the fixed-length segment, as					3.194
PVK510	continuous variable		1.099		0.421	(13.06)
	Roadway surface type is asphalt in decreasing milenest direction				0.431	
LNSFDECA	milepost direction Roadway surface type is portland cement concrete		(10.58)		(9.20)	0.246
	Roadway surface type is portland cement concrete in decreasing milepost direction					0.246 (12.35)
INSEDECD	In accreasing ninebost unection		1	1		(12.33)
LNSFDECP						
LNSFDECP	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as					-0.918

Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

	Random Para	meters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of roadway width in the 36.01 to 48.0					
	foot range in decreasing milepost direction, as					-0.446
RDEC3648	continuous variable					(-6.53)
	Proportion of roadway width in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		-3.423			
RINC012	continuous variable		(-18.57)			
	Proportion of roadway width in the 12.01 to 24.0		0.504			
DINC1224	foot range in increasing milepost direction, as		-2.724			
RINC1224	continuous variable Proportion of travel shoulder width in the 2.01 to		(-14.42)			
	4.0 foot range on the left-center side in increasing					-0.318
SDWLC24	milepost direction, as continuous variable					(-7.51)
5D WEC24	Proportion of travel shoulder width in the 4.01 to					(-7.51)
	6.0 foot range on the left-center side in increasing					-0.229
SDWLC46	milepost direction, as continuous variable					(-5.04)
	Proportion of travel shoulder width in the 2.01 to				1	( 2.2.7)
	4.0 foot range on the right side in increasing	-0.351				
SDWR24	milepost direction, as continuous variable	(-12.37)				
	Proportion of travel shoulder width in the 6.01 to					
	8.0 foot range on the right side in increasing				-0.382	
SDWR68	milepost direction, as continuous variable				(-6.05)	
	Proportion of travel shoulder width in the 8.01 to					
	10.0 foot range on the right side in increasing		0.199		-0.233	-0.309
SDWR810	milepost direction, as continuous variable		(2.40)		(-3.82)	(-11.39)
	Proportion of travel shoulder width in the 4.01 to					0.000
CDUDCAC	6.0 foot range on the right-center side in increasing					0.090
SDWRC46	milepost direction, as continuous variable					(1.60)
	Proportion of travel shoulder width in the 8.01 to					
	10.0 foot range on the right-center side in increasing milepost direction, as continuous					0.144
SDWRC810	variable					(1.84)
SD WRC010	Proportion of curb shoulder surface type on the left					(1.04)
	side in increasing milepost direction, as continuous	1.300		1.270		
SSFLC	variable	(13.69)		(10.84)		
	Proportion of shoulder surface type is bituminous	(		(10101)		
	on the right side in increasing milepost direction,	0.817				
SSFRB	as continuous variable	(4.12)				
	Proportion of median width in 10.01 to 20.0 foot					0.204
MWD1020	range, as continuous variable					(7.66)
	Standard Deviation for the Random Par	ameters wi	th Normal T	Distribution		
		0.918	0.940	0.940	0.970	0.539
Constant		(80.41)	(49.02)	(37.28)	(119.29)	(62.65)
	Location indicator (if segment is located in in	. ,	. ,	· · /	. ,	0.239
URBAN	urban arear, 1, otherwise, 0)					(14.86)
	Count of horizontal curves within the fixed-length	0.002				
NHC	segment	(0.22)				
	Count of horizontal curves with angle of deflection	0.109				
NHCA5DW	$(\Delta) \le 5$ (degrees) within the fixed-length segment	(2.79)				
	Count of horizontal curves with design speed of 30	0.083				
NHSP3035	mph or 35 mph within the fixed-length segment	(2.51)				
	Natural log of proportion of horizontal curves with					
1.11000-00-0	design speed <=25 (mph) within the fixed-length				0.011	
LHSP25DW	segment				(1.06)	

Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

	Standard Deviation for the Random Para	ameters wit	lii Normai L			
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
NVK1020	Count of vertical curves with 100 < K value <=200 within the fixed-length segment				0.161 (17.48)	
	Count of vertical curves with 200 < K value <= 300	0.033			0.027	0.030
NVK2030	within the fixed-length segment	(1.40)			(2.05)	(1.82)
	Natural log of proportion of vertical curves with 2					
	<= absolute back slope < 4 within the fixed-length			0.056		
LVBSL24	segment			(2.00)		
	Natural log of proportion of vertical curves with 50	0.094				
LVK510	< K value <=100 within the fixed-length segment	(5.63)				
	Natural log of proportion of vertical curves with	0.050				
	design speed more than 70 (mph) within the fixed-	0.058				
LVSP70UP	length segment	(5.46)				
	Proportion of vertical curves with absolute back					0.051
PVBSL02	slope $< 2$ within the fixed-length segment, as continuous variable					0.051
PVDSL02	Proportion of vertical curves with $2 \le absolute$					(1.26)
	back slope $< 4$ within the fixed-length segment, as					0.418
PVBSL24	continuous variable					(8.24)
TVD5E24	Proportion of vertical curves with 50 < K value					(0.24)
	<=100 within the fixed-length segment, as					0.116
PVK510	continuous variable					(0.50)
	Roadway surface type is asphalt in decreasing		0.051		0.003	(010 0)
LNSFDECA	milepost direction		(2.96)		(0.37)	
	Roadway surface type is portland cement concrete					0.107
LNSFDECP	in decreasing milepost direction					(9.61)
	Proportion of roadway width in the 12.01 to 24 foot					
	range in decreasing milepost direction, as					0.378
RDEC1224	continuous variable					(23.81
	Proportion of roadway width in the 36.01 to 48.0					
	foot range in decreasing milepost direction, as					0.415
RDEC3648	continuous variable					(23.71
	Proportion of roadway width in the 0.01 to 12.0					
	foot range in increasing milepost direction, as		0.426			
RINC012	continuous variable		(20.57)			
	Proportion of roadway width in the 12.01 to 24.0		0.107			
RINC1224	foot range in increasing milepost direction, as		0.197			
KINC1224	continuous variable Proportion of travel shoulder width in the 2.01 to		(5.04)			
	4.0 foot range on the left-center side in increasing					0.083
SDWLC24	milepost direction, as continuous variable					(4.66)
50 11 LC24	Proportion of travel shoulder width in the 4.01 to					(4.00)
	6.0 foot range on the left-center side in increasing					0.006
SDWLC46	milepost direction, as continuous variable					(0.23)
	Proportion of travel shoulder width in the 2.01 to					(0.23)
	4.0 foot range on the right side in increasing	0.355				
SDWR24	milepost direction, as continuous variable	(16.75)				
	Proportion of travel shoulder width in the 6.01 to	(				
	8.0 foot range on the right side in increasing				0.249	
SDWR68	milepost direction, as continuous variable				(9.77)	
	Proportion of travel shoulder width in the 8.01 to					
	10.0 foot range on the right side in increasing		0.779		0.382	0.054
SDWR810	milepost direction, as continuous variable		(11.52)		(23.10)	(5.68)

Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

	Standard Deviation for the Random Par-	ameters wit	th Normal D	Distribution		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
SDWRC46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.036 (1.51)
SDWRC810	Proportion of travel shoulder width in the 8.01 to 10.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.391 (15.68)
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable	0.596 (11.38)		0.017 (0.19)		
SSFRB	Proportion of shoulder surface type is bituminous on the right side in increasing milepost direction, as continuous variable	0.292 (12.86)				
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable					0.002 (0.11)

Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

# Table C.26 (Continued) Property damage only crash models by functional classes for 0.25 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	38730	2844	2326	4918	6110
Number of Parameters	40	17	13	28	44
Number of Random Parameters	10	5	3	7	16
Restricted Log-Likelihood (Fixed Parameter at Convergence)	-20709.83	-4389.69	-2579.65	-12358.49	-10927.59
Log-Likelihood	-20334.58	-4159.33	-2473.12	-11302.89	-10515.58
AIC	40749.17	8352.66	4972.23	22661.77	21119.15
BIC	41091.74	8453.86	5047.01	22843.79	21414.73
LL Ratio	750.49	460.72	213.07	2111.20	824.02
Adjusted Pseudo R-squared	0.079	0.075	0.083	0.124	0.222
	RP NB	RP NB	RP NB	RP NB	RP NB

	Fixed Paran	neters		1		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
AADT	AADT (ADTK10=AADT/10000)					0.151 (36.01)
NHCA5DW	Count of horizontal curves with angle of deflection $(\Delta) \le 5$ (degrees) within the fixed-length segment	0.242 (3.08)			-0.176 (-4.00)	
NHCR710	Count of horizontal curves with 700 <= radius < 1000 (feet) within the fixed-length segment	0.006 (0.10)				
LHCR50UP	Natural log of proportion of horizontal curves with 5000 <= radius (feet) within the fixed-length segment	0.129 (2.14)		-0.115 (- 1.57)		
LHSP3035	Natural log of proportion of horizontal curves with design speeds of 30 mph or 35 mph within the fixed-length segment				-0.062 (-1.96)	
LHSP5055	Natural log of proportion of horizontal curves with design speed ranged from 50 to 55 (mph) within the fixed-length segment		0.228 (1.82)			
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment				0.101 (4.84)	
NVK3040	Count of vertical curves with 300 < K value <=400 within the fixed-length segment Count of vertical curves with 400 < K value within	-0.175				0.074 (1.71)
NVK40UP	the fixed-length segment Natural log of proportion of vertical curves with 6	(-3.01)				
LVBSL68	<= absolute back slope < 8 within the fixed-length segment	0.201 (3.01)				
LVK2030	Natural log of proportion of vertical curves with 200 < K value <=300 within the fixed-length segment		-0.110 (-2.64)			
LVK40UP	Natural log of proportion of vertical curves with $400 < K$ value within the fixed-length segment	0.008 (0.16)				
PVBSL02	Proportion of vertical curves with absolute back slope $< 2$ within the fixed-length segment, as continuous variable	-1.234				-0.269 (-2.98)
LNSFDECB	Roadway surface type is bituminous in decreasing milepost direction Proportion of roadway width in the 12.01 to 24 foot	-1.234 (-25.25)				
RDEC1224	range in decreasing milepost direction, as continuous variable				-0.356 (-8.44)	
RDEC3648	Proportion of roadway width in the 36.01 to 48.0 foot range in decreasing milepost direction, as continuous variable					-0.356 (-3.26)
RINC1224	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable	0.273 (0.91)				
SDWL24	Proportion of travel shoulder width in the 2.01 to 4.0 foot range on the left side in increasing milepost direction, as continuous variable	-0.205 (-4.13)				
SDWLC24	Proportion of travel shoulder width in the 2.01 to 4.0 foot range on the left-center side in increasing milepost direction, as continuous variable					-0.401 (-6.45)
SDWR02	Proportion of travel shoulder width in the 0.01 to 2.0 foot range on the right side in increasing milepost direction, as continuous variable		-0.620 (-4.08)			

 Table C.27 Possible injury crash models by functional classes for 0.25 mile segments

	Fixed Paran	neters		-		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of travel shoulder width is wider than		, <u>,</u>			
	10 ft. on the right side in increasing milepost				0.667	
SDWR10P	direction, as continuous variable				(5.26)	
	Proportion of travel shoulder width in the 8.01 to					
	10.0 foot range on the right side in increasing					-0.419
SDWR810	milepost direction, as continuous variable					(-9.07)
	Proportion of travel shoulder width is in the 2.01 to			0.504		
	4.0 foot range on the right-center side in increasing			-0.524		
SDWRC24	milepost direction, as continuous variable			(-4.72)		
	Proportion of travel shoulder width in the 6.01 to					0.162
	8.0 foot range on the right-center side in increasing					0.162
SDWRC68	milepost direction, as continuous variable					(2.19)
	Proportion of curb shoulder surface type on the left	1 202				
SSFLC	side in increasing milepost direction, as continuous	1.203 (9.33)				
DOFLU	variable Proportion of shoulder surface type is asphalt on	(9.33)				
	the right side in increasing milepost direction, as					-0.095
SSFRA	continuous variable					(-1.88)
SSIKA	There's no shoulder on the right side in increasing	-0.941				(-1.66)
SSFRNA	milepost direction within this segment	-0.941 (-3.17)				
SSI'KIYA	innepost direction within this segment	(-3.17)			0.029	0.044
ALPHA	Dispersion parameter				(3.23)	(4.02)
					(3.23)	(4.02)
	Random Para					
<b>a</b> , ,		-2.788	0.915	-2.053	0.148	-0.203
Constant		(-9.38)	(2.80)	(-20.27)	(3.86)	(-0.55)
	Location indicator (if segment is located in in					0.418
URBAN	urban arear, 1, otherwise, 0)					(7.52)
NHSP6065	Count of horizontal curves with design speed of 60					0.231
INHSF0003	mph or 65 mph within the fixed-length segmentCount of horizontal curves with design speed more					(4.05)
NHSP70UP	than 70 (mph) within the fixed-length segment					(-2.16)
NHSP/UUP	Natural log of proportion of horizontal curves with					(-2.10)
	design speed ranged from 40 to 45 (mph) within	-0.013				
LHSP4045	the fixed-length segment	-0.013 (-0.19)				
LIISI 4045	Natural log of proportion of horizontal curves with	(-0.19)				
	design speed ranged from 50 to 55 (mph) within	-0.032				
LHSP5055	the fixed-length segment	(-0.41)				
21151 5055	Count of vertical curves with 2 <= absolute back	-0.043				
NVBSL24	slope $< 4$ within the fixed-length segment	(-0.97)				
	Count of vertical curves with 200 < K value <=300	0.044				0.176
NVK2030	within the fixed-length segment	(0.91)				(5.41)
	Count of vertical curves with 400 < K value within	(0.91)	-0.150			(3.11)
NVK40UP	the fixed-length segment		(-2.45)			
	Natural log of proportion of vertical curves with		( =: :0)			
	100 < K value <=200 within the fixed-length				-0.135	
LVK1020	segment				(-8.95)	
. – •	Natural log of proportion of vertical curves with				( 2.70)	
	$200 < K$ value $\leq 300$ within the fixed-length				-0.073	
LVK2030	segment				(-4.27)	
	Natural log of proportion of vertical curves with 50	-0.049		-0.173	(, )	
LVK510	< K value <= 100 within the fixed-length segment	(-1.33)		(-1.49)	I I I	
LVK510	< K value <=100 within the fixed-length segment Roadway surface type is asphalt in decreasing	(-1.33)	0.956	(-1.49)		

	Random Para	meters	1	1		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
LNSFDECP	Roadway surface type is portland cement concrete in decreasing milepost direction					0.251 (6.79)
RWDDEC	Roadway weighted average width in decreasing milepost direction, as continuous variable					-0.024 (-3.91)
RDEC012	Proportion of roadway width in the 0.01 to 12.0 foot range in decreasing milepost direction, as continuous variable			-0.905 (-3.46)	-0.807 (-6.63)	· · · ·
RDEC1224	Proportion of roadway width in the 12.01 to 24 foot range in decreasing milepost direction, as continuous variable					-0.898 (-3.76)
RDEC2436	Proportion of roadway width in the 24.01 to 36.0 foot range in decreasing milepost direction, as continuous variable					-0.738 (-4.31)
RINC012	Proportion of roadway width in the 0.01 to 12.0 foot range in increasing milepost direction, as continuous variable	0.021 (0.07)	-3.161 (-10.58)			
RINC1224	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable		-2.429 (-7.61)		-0.403 (-9.64)	
SDWLC46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the left-center side in increasing milepost direction, as continuous variable					-0.061 (-0.77)
SDWR02	Proportion of travel shoulder width in the 0.01 to 2.0 foot range on the right side in increasing milepost direction, as continuous variable	-0.747 (-9.54)				
SDWRC24	Proportion of travel shoulder width is in the 2.01 to 4.0 foot range on the right-center side in increasing milepost direction, as continuous variable				-0.947 (-13.29)	
SDWRC46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the right-center side in increasing milepost direction, as continuous variable					-0.052 (-0.69)
SDWRC810	Proportion of travel shoulder width in the 8.01 to 10.0 foot range on the right-center side in increasing milepost direction, as continuous variable					0.102 (1.87)
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable			1.454 (9.39)	0.648 (19.43)	
MSFA	Proportion of shoulder surface type is asphalt on the left side in increasing milepost direction, as continuous variable				-0.353 (-7.78)	
MWD1020	Proportion of median width in 10.01 to 20.0 foot range, as continuous variable				0.192 (4.85)	0.352 (8.17)
	Standard Deviation for the Random Par	ameters wit		Distribution		
Constant		1.054 (50.78)	0.708 (25.19)	1.063 (23.17)	0.938 (69.87)	0.522 (35.74)
URBAN	Location indicator (if segment is located in in urban arear, 1, otherwise, 0)					0.073 (2.76)
NHSP6065	Count of horizontal curves with design speed of 60 mph or 65 mph within the fixed-length segment					0.005 (0.09)
NHSP70UP	Count of horizontal curves with design speed more than 70 (mph) within the fixed-length segment					0.009 (0.23)

Table C.27 (Continued)	Possible injury cra	ash models by function	al classes for 0.25 mile segments
		······································	

	Standard Deviation for the Random Para					
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description           Natural log of proportion of horizontal curves with	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	design speed ranged from 40 to 45 (mph) within	0.006				
LHSP4045	the fixed-length segment	(0.09)				
LIISI 4045	Natural log of proportion of horizontal curves with	(0.07)				
	design speed ranged from 50 to 55 (mph) within	0.385				
LHSP5055	the fixed-length segment	(6.77)				
	Count of vertical curves with $2 \le absolute back$	0.343				
NVBSL24	slope $< 4$ within the fixed-length segment	(9.91)				
	Count of vertical curves with 200 < K value <= 300	0.028				0.207
NVK2030	within the fixed-length segment	(0.65)				(7.55)
	Count of vertical curves with 400 < K value within		0.349			
NVK40UP	the fixed-length segment		(6.50)			
	Natural log of proportion of vertical curves with					
	100 < K value <=200 within the fixed-length				0.005	
LVK1020	segment				(0.37)	
	Natural log of proportion of vertical curves with					
	200 < K value <=300 within the fixed-length				0.019	
LVK2030	segment			0.001	(1.23)	
1102510	Natural log of proportion of vertical curves with 50	0.287		0.036		
LVK510	< K value <=100 within the fixed-length segment	(9.74)	0.001	(0.33)		
	Roadway surface type is asphalt in decreasing		0.691 (24.10)			
LNSFDECA	milepost direction Roadway surface type is portland cement concrete		(24.10)			0.227
LNSFDECP	in decreasing milepost direction					0.327 (17.55)
LINSTIDLET	Roadway weighted average width in decreasing					0.000
RWDDEC	milepost direction, as continuous variable					(1.05)
KNDDLC	Proportion of roadway width in the 0.01 to 12.0					(1.05)
	foot range in decreasing milepost direction, as			1.024	0.505	
RDEC012	continuous variable			(5.35)	(4.34)	
	Proportion of roadway width in the 12.01 to 24 foot			(0.00)	(112-1)	
	range in decreasing milepost direction, as					0.209
RDEC1224	continuous variable					(6.86)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					0.300
RDEC2436	continuous variable					(12.49)
	Proportion of roadway width in the 0.01 to 12.0					
	foot range in increasing milepost direction, as	0.469	0.334			
RINC012	continuous variable	(22.48)	(10.33)			
	Proportion of roadway width in the 12.01 to 24.0		0.502		0.074	
DINC1224	foot range in increasing milepost direction, as		0.503		0.056	
RINC1224	continuous variable Proportion of travel shoulder width in the 4.01 to		(8.19)		(3.05)	
	6.0 foot range on the left-center side in increasing					0.063
SDWLC46	milepost direction, as continuous variable					(1.40)
22 11 LC-10	Proportion of travel shoulder width in the 0.01 to					(1.40)
	2.0 foot range on the right side in increasing	0.484				
SDWR02	milepost direction, as continuous variable	(7.50)				
	Proportion of travel shoulder width is in the 2.01 to	(				
	4.0 foot range on the right-center side in increasing				0.796	
SDWRC24	milepost direction, as continuous variable				(14.32)	
	Proportion of travel shoulder width in the 4.01 to					
	6.0 foot range on the right-center side in increasing					0.021
SDWRC46	milepost direction, as continuous variable					(0.49)

Table C.27 (Continued) Possible injury crash models by functional classes for 0.25 mile segments

Standard Deviation for the Random Parameters with Normal Distribution											
Functional Class			TWLU	NINTR	NINTU	INT					
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.					
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)					
	Proportion of travel shoulder width in the 8.01 to										
	10.0 foot range on the right-center side in										
	increasing milepost direction, as continuous					0.353					
SDWRC810	variable					(8.61)					
	Proportion of curb shoulder surface type on the left										
	side in increasing milepost direction, as continuous			0.287	0.041						
SSFLC	variable			(2.24)	(2.71)						
	Proportion of shoulder surface type is asphalt on										
	the left side in increasing milepost direction, as				0.717						
MSFA	continuous variable				(24.23)						
	Proportion of median width in 10.01 to 20.0 foot				0.291	0.020					
MWD1020	range, as continuous variable				(10.41)	(0.78)					

Table C.27 (Continued) Possible injury crash models by functional classes for 0.25 mile segments

# Table C.27 (Continued) Possible injury crash models by functional classes for 0.25 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	38730	2844	2326	4918	6110
Number of Parameters	27	13	10	24	38
Number of Random Parameters	8	5	4	9	14
Restricted Log-Likelihood (Fixed Parameter at Convergence)	-8871.68	-2839.35	-1240.81	-8162.42	-5910.24
Log-Likelihood	-8512.91	-2565.84	-1136.99	-7656.46	-5779.56
AIC	17079.82	5157.69	2293.97	15360.91	11635.12
BIC	17311.06	5235.08	2351.49	15516.93	11890.39
LL Ratio	717.54	547.00	207.65	1011.93	261.36
Adjusted Pseudo R-squared	0.112	0.132	0.131	0.108	0.250
	RP Poisson	RP Poisson	RP Poisson	RP NB	RP NB

	Fixed Paran	neters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
Constant				-2.777 (-5.16)		
AADT	AADT (ADTK10=AADT/10000)					0.092 (12.48)
NHCR1015	Count of horizontal curves with 1000 <= radius < 1500 (feet) within the fixed-length segment					0.337 (2.95)
NHSP6065	Count of horizontal curves with design speed of 60 mph or 65 mph within the fixed-length segment					0.266 (2.82)
PHCR2030	Proportion of horizontal curves with 2000 <= radius < 3000 (feet) within the fixed-length segment					0.228 (1.82)
NVBSL68	Count of vertical curves with 6 <= absolute back slope < 8 within the fixed-length segment	-0.339 (-2.14)				
NVK1020	Count of vertical curves with 100 < K value <=200 within the fixed-length segment		0.199 (2.94)		0.087 (2.60)	
NVK2030	Count of vertical curves with 200 < K value <=300 within the fixed-length segment Natural log of proportion of vertical curves with 2					0.078 (1.22)
LVASL24	<= absolute ahead slope < 4 within the fixed- length segment				-0.022 (-0.92)	
LVASL46	Natural log of proportion of vertical curves with 4 <= absolute ahead slope < 6 within the fixed- length segment	-0.027 (-0.76)			-0.069 (-2.05)	
LVK1020	Natural log of proportion of vertical curves with 100 < K value <=200 within the fixed-length segment	-0.055 (-1.58)				
LVK2030	Natural log of proportion of vertical curves with 200 < K value <=300 within the fixed-length segment			-0.063 (-0.57)		
LVSP6065	Natural log of proportion of vertical curves with design speed ranged from 60 to 65 (mph) within the fixed-length segment	0.004 (0.04) -0.033	0.013	0.032		
RWDDEC	Roadway weighted average width in decreasing milepost direction, as continuous variable Proportion of roadway width in the 24.01 to 36.0	-0.033 (-1.49)	(0.50)	0.032 (1.90)		
RDEC2436	foot range in decreasing milepost direction, as continuous variable					-1.008 (-3.43)
RDEC3648	Proportion of roadway width in the 36.01 to 48.0 foot range in decreasing milepost direction, as continuous variable					-0.306 (-1.58)
RINC012	Proportion of roadway width in the 0.01 to 12.0 foot range in increasing milepost direction, as continuous variable				-0.631 (-2.79)	
RINC1224	Proportion of roadway width in the 12.01 to 24.0 foot range in increasing milepost direction, as continuous variable			-0.770 (-2.81)		
SDWLC46	Proportion of travel shoulder width in the 4.01 to 6.0 foot range on the left-center side in increasing milepost direction, as continuous variable					-0.180 (-1.28)
SDWR810	Proportion of travel shoulder width in the 8.01 to 10.0 foot range on the right side in increasing milepost direction, as continuous variable					-0.381 (-4.77)

Table C.28 Evident injury crash models by functional classes for 0.25 mile segments
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	Fixed Paran	neters	1			
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of travel shoulder width in the 6.01 to					
	8.0 foot range on the right-center side in increasing					0.554
SDWRC68	milepost direction, as continuous variable					(2.64)
	Proportion of shoulder surface type is bituminous					
	on the right side in increasing milepost direction,	-0.463				
SSFRB	as continuous variable	(-4.72)				
	Proportion of curb shoulder surface type on the					
aard a	right side in increasing milepost direction, as	0.791			0.836	
SSFRC	continuous variable	(3.49)			(15.38)	
	Proportion of shoulder surface type is gravel on the	0.420				
a a f f f a	right side in increasing milepost direction, as	-0.430				
SSFRG	continuous variable	(-2.88)				
	Proportion of shoulder surface type is asphalt on			o 10 <b>-</b>		
	the left side in increasing milepost direction, as			0.497		
MSFA	continuous variable			(1.79)		
	Proportion of median width in 10.01 to 20.0 foot			-0.749		
MWD1020	range, as continuous variable			(-2.46)	0.506	
1050	Proportion of median width in 40.01 to 50.0 foot				-0.526	
MWD4050	range, as continuous variable			0.447	(-2.71)	0.000
				0.447		0.090
ALPHA	Dispersion parameter			(2.25)		(2.02)
	Random Para	meters				
		-3.319	-2.399		-1.731	0.156
Constant		(-12.05)	(-7.94)		(-14.18)	(0.25)
	Location indicator (if segment is located in in					0.102
URBAN	urban arear, 1, otherwise, 0)					(1.13)
	Count of vertical curves with design speed ranged					
	from 60 to 65 (mph) within the fixed-length	-0.137				
NVSP6065	segment	(-1.01)				
	Proportion of vertical curves with 2 <= absolute					
	back slope < 4 within the fixed-length segment, as					-0.328
PVBSL24	continuous variable					(-1.77)
	Roadway surface type is portland cement concrete					0.148
LNSFDECP	in decreasing milepost direction					(2.29)
	Roadway surface type is asphalt in increasing	0.538		0.140		
LNSFINCA	milepost direction	(5.95)		(0.74)		
	Roadway weighted average width in decreasing				0.014	-0.035
RWDDEC	milepost direction, as continuous variable				(4.01)	(-3.22)
	Proportion of roadway width in the 12.01 to 24 foot					
	range in decreasing milepost direction, as					-1.438
RDEC1224	continuous variable					(-3.54)
	Proportion of roadway width in the 0.01 to 12.0			1.1.00		
	foot range in increasing milepost direction, as			-1.168		
RINC012	continuous variable			(-2.31)		
	Proportion of roadway width in the 12.01 to 24.0		0.000		0.497	
	foot range in increasing milepost direction, as		-0.238		-0.486	
RINC1224	continuous variable		(-0.89)		(-7.34)	
	Weighted average travel shoulder width on the					0.001
CDWDC	right-center side in increasing milepost direction,					-0.081
SDWRC	as continuous variable					(-3.83)
	Proportion of travel shoulder width in the 4.01 to					0 477
COUDCH	6.0 foot range on the right-center side in increasing					0.457
SDWRC46	milepost direction, as continuous variable					(2.89)

Table C.28 (Continued) Evident injury crash models by functional classes for 0.25 mile segmen	Table C.28 (Continu	ied) Evident injurv	crash models by functiona	l classes for 0.25 mile segments
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	Random Para	meters		1	1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
, an able	Proportion of travel shoulder width in the 8.01 to	(t stat)	(t stat)	(t stat)	(t stut)	(t stat)
	10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.901
SDWRC810	variable					(4.56)
	Proportion of curb shoulder surface type on the					
	right side in increasing milepost direction, as		0.264			
SSFRC	continuous variable		(1.06)			
	Proportion of median width in 10.01 to 20.0 foot					0.324
MWD1020	range, as continuous variable					(3.84)
	Standard Deviation for the Random Par	ameters wit	h Normal I	Distribution		
		0.893	0.938		0.557	0.018
Constant		(35.41)	(20.00)		(24.57)	(0.68)
	Location indicator (if segment is located in in					0.588
URBAN	urban arear, 1, otherwise, 0)					(10.56)
	Count of vertical curves with design speed ranged					
	from 60 to 65 (mph) within the fixed-length	0.428				
NVSP6065	segment	(6.30)				
	Proportion of vertical curves with $2 \le absolute$					
	back slope $< 4$ within the fixed-length segment, as					0.007
PVBSL24	continuous variable					(0.04)
	Roadway surface type is portland cement concrete					0.391
LNSFDECP	in decreasing milepost direction					(11.03)
	Roadway surface type is asphalt in increasing	0.250		0.898		
LNSFINCA	milepost direction	(7.92)		(12.04)		
	Roadway weighted average width in decreasing				0.017	0.000
RWDDEC	milepost direction, as continuous variable				(22.51)	(0.22)
	Proportion of roadway width in the 12.01 to 24 foot					
	range in decreasing milepost direction, as					0.320
RDEC1224	continuous variable					(6.61)
	Proportion of roadway width in the 0.01 to 12.0					
	foot range in increasing milepost direction, as			1.363		
RINC012	continuous variable			(4.42)		
	Proportion of roadway width in the 12.01 to 24.0			. ,		
	foot range in increasing milepost direction, as		0.008		0.419	
RINC1224	continuous variable		(0.06)		(11.94)	
	Weighted average travel shoulder width on the				, , ,	
	right-center side in increasing milepost direction,					0.046
SDWRC	as continuous variable					(8.24)
	Proportion of travel shoulder width in the 4.01 to					. /
	6.0 foot range on the right-center side in increasing					0.091
SDWRC46	milepost direction, as continuous variable					(1.21)
	Proportion of travel shoulder width in the 8.01 to					. /
	10.0 foot range on the right-center side in					
	increasing milepost direction, as continuous					0.091
SDWRC810	variable					(1.17)
	Proportion of curb shoulder surface type on the					
	right side in increasing milepost direction, as		0.070			
SSFRC	continuous variable		(0.54)			
	Proportion of median width in 10.01 to 20.0 foot		× - /			0.002
MWD1020	range, as continuous variable					(0.04)

# Table C.28 (Continued) Evident injury crash models by functional classes for 0.25 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	38730	2844	2326	4918	6110
Number of Parameters	14	8	11	12	30
Number of Random Parameters	3	3	2	3	10
Restricted Log-Likelihood (Fixed Parameter at Convergence)	-6645.07	-1427.11	-752.99	-4086.41	-3250.59
Log-Likelihood	-6595.57	-1388.13	-746.71	-3920.08	-3222.31
AIC	13219.15	2792.26	1515.42	7864.16	6504.62
BIC	13339.05	2839.88	1578.69	7942.17	6706.15
LL Ratio	98.99	77.96	12.56	332.66	56.56
Adjusted Pseudo R-squared	0.035	0.028	0.022	0.110	0.178
	RP Poisson	RP Poisson	RP NB	RP Poisson	RP Poisson

Table C.28 (Continued) Evident injury crash models by functional classes for 0.25 mile segments

	Fixed Paran	neters		•		
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
						0.090
AADT	AADT (ADTK10=AADT/10000)	0.001				(5.82)
NHSP3035	Count of horizontal curves with design speed of 30 mph or 35 mph within the fixed-length segment	-0.296 (-1.00)				
NHSF 5055	Natural log of proportion of horizontal curves with	(-1.00)				
	$5000 \ll$ radius (feet) within the fixed-length	0.146				
LHCR50UP	segment	(0.89)				
	Natural log of proportion of horizontal curves with					
1.11000005	design speeds of 30 mph or 35 mph within the	-0.228				
LHSP3035	fixed-length segment Count of vertical curves with 2 <= absolute back	(-0.92)			0.127	
NVBSL24	slope $< 4$ within the fixed-length segment				0.127 (1.45)	
IT V DSL24	Roadway surface type is bituminous in decreasing	-1.094			(1.43)	
LNSFDECB	milepost direction	(-9.34)				
	Proportion of roadway width in the 24.01 to 36.0	. ,				
	foot range in decreasing milepost direction, as				-0.091	
RDEC2436	continuous variable				(-0.60)	
	Proportion of travel shoulder width in the 0.01 to 2.0 foot range on the right side in increasing	-0.213				
SDWR02	milepost direction, as continuous variable	(-1.38)				
SD WR02	Proportion of travel shoulder width in the 8.01 to	(1.50)				
	10.0 foot range on the right side in increasing					-0.700
SDWR810	milepost direction, as continuous variable					(-3.54)
	Proportion of travel shoulder width in the 8.01 to					
	10.0 foot range on the right-center side in increasing milepost direction, as continuous					0.350
SDWRC810	variable					(1.54)
SD WRC010	Proportion of curb shoulder surface type on the left					(1.54)
	side in increasing milepost direction, as continuous				0.782	
SSFLC	variable				(6.43)	
					0.593	
ALPHA	Dispersion parameter				(2.57)	
	Random Para	meters		1	1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
Constant		-4.309 (-52.40)			-2.840 (-18.18)	
Constant	Proportion of horizontal curves with 2000 <=	( 52.40)			(10.10)	
	radius $< 3000$ (feet) within the fixed-length					0.713
PHCR2030	segment, as continuous variable					(2.27)
	Natural log of proportion of vertical curves with	0.481				
LVK40UP	400 < K value within the fixed-length segment	(3.77)				
LVK510	Natural log of proportion of vertical curves with 50 < K value <=100 within the fixed-length segment	0.077 (0.73)				
271310	Proportion of roadway width in the 12.01 to 24 foot	(0.75)		1		
	range in decreasing milepost direction, as					-0.265
RDEC1224	continuous variable					(-0.96)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					-0.334
RDEC2436	continuous variable					(-1.42)

Table C.29 Serious	iniurv	crash models b	v functional	classes for 0.2	5 mile segments
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	Random Para	meters				
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
	Proportion of roadway width in the 12.01 to 24.0	· ·				
	foot range in increasing milepost direction, as				-0.587	
RINC1224	continuous variable				(-3.81)	
	Standard Deviation for the Random Par	ameters wit	th Normal E	Distribution		
		0.676			0.595	
Constant		(12.91)			(11.47)	
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					0.002
PHCR2030	segment, as continuous variable					(0.01)
	Natural log of proportion of vertical curves with	0.601				
LVK40UP	400 < K value within the fixed-length segment	(7.83)				
	Natural log of proportion of vertical curves with 50	0.342				
LVK510	< K value <= 100 within the fixed-length segment	(4.43)				
	Proportion of roadway width in the 12.01 to 24					
	foot range in decreasing milepost direction, as					0.001
RDEC1224	continuous variable					(0.01)
	Proportion of roadway width in the 24.01 to 36.0					
	foot range in decreasing milepost direction, as					0.843
RDEC2436	continuous variable					(7.55)
	Proportion of roadway width in the 12.01 to 24.0					
	foot range in increasing milepost direction, as				0.461	
RINC1224	continuous variable				(5.95)	

# Table C.29 (Continued) Serious injury crash models by functional classes for 0.25 mile segments

# Table C.29 (Continued) Serious injury crash models by functional classes for 0.25 mile segments

	TWLR	TWLU	NINTR	NINTU	INT	
Number of Observations (2014-2015)	38730			4918	6110	
Number of Parameters	11			8	11	
Number of Random Parameters	3			2	3	
Restricted Log-Likelihood (Fixed Parameter at Convergence)	-2013.39			-1349.27	-911.88	
Log-Likelihood	-2008.37			-1347.16	-910.57	
AIC	4038.75			2710.32	1843.15	
BIC	4132.96			2762.33	1917.04	
LL Ratio	10.03			4.22	2.62	
Adjusted Pseudo R-squared	0.029			0.030	0.076	
	RP Poisson			RP NB	RP Poisson	

	Fixed Paran	neters			1	
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
Variable	Description	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)	Coeff. (t-stat)
Constant		-5.022 (-42.15)	-5.212 (-12.02)			
NVBSL24	Count of vertical curves with 2 <= absolute back slope < 4 within the fixed-length segment	-0.221 (-0.61)				
NVK1020	Count of vertical curves with 100 < K value <=200	( 0.01)	0.636			
	Count of vertical curves with 200 < K value <= 300		(1.82)			-0.273
NVK2030	within the fixed-length segment Count of vertical curves with 400 < K value within		0.507			(-0.87)
NVK40UP	the fixed-length segment Natural log of proportion of vertical curves with		(1.19)			
LVASL02	absolute ahead slope $< 2$ within the fixed-length segment	-0.041 (-0.58)				
LVBSL24	Natural log of proportion of vertical curves with 2 <= absolute back slope < 4 within the fixed-length	0.080				
	segmentNatural log of proportion of vertical curves with200 < K value <=300 within the fixed-length	(0.37)	-0.276			
LVK2030	segment Natural log of proportion of vertical curves with	0.205	(-1.01)			
LVSP3035	design speed of 30 mph or 35 mph within the fixed- length segment	-0.395 (-2.64) -0.834				
LNSFDECB	Roadway surface type is bituminous in decreasing milepost direction	-0.834 (-5.17)				0.027
RWDDEC	Roadway weighted average width in decreasing milepost direction, as continuous variable					0.037 (2.97)
SDWR68	Proportion of travel shoulder width in the 6.01 to 8.0 foot range on the right side in increasing milepost direction, as continuous variable		0.847 (1.89)			
SDWR810	Proportion of travel shoulder width in the 8.01 to 10.0 foot range on the right side in increasing milepost direction, as continuous variable		1.503 (2.57)			
SSFLC	Proportion of curb shoulder surface type on the left side in increasing milepost direction, as continuous variable	0.514 (0.11)				
SSFRC	Proportion of curb shoulder surface type on the right side in increasing milepost direction, as continuous variable	-1.576 (-0.34)				
	Random Para	meters	1	1		
URBAN	Location indicator (if segment is located in in urban arear, 1, otherwise, 0)					-0.030 (-0.10)
PHCR2030	Proportion of horizontal curves with 2000 <= radius < 3000 (feet) within the fixed-length segment, as continuous variable					-2.497 (-1.74)
NVC	Count of vertical curves within the fixed-length segment		-0.186 (-0.56)			
LVK2030	Natural log of proportion of vertical curves with 200 < K value <=300 within the fixed-length segment	0.393 (2.04)				
	Standard Deviation for the Random Par	ameters wit	th Normal E	Distribution		
URBAN	Location indicator (if segment is located in in urban arear, 1, otherwise, 0)					1.914 (5.75)

Table C.30 Fatal crash models by functional classes for 0.25 mile segments.

Standard Deviation for the Random Parameters with Normal Distribution						
	Functional Class	TWLR	TWLU	NINTR	NINTU	INT
		Coeff.	Coeff.	Coeff.	Coeff.	Coeff.
Variable	Description	(t-stat)	(t-stat)	(t-stat)	(t-stat)	(t-stat)
	Proportion of horizontal curves with 2000 <=					
	radius < 3000 (feet) within the fixed-length					2.117
PHCR2030	segment, as continuous variable					(2.78)
	Count of vertical curves within the fixed-length		0.001			
NVC	segment		(0.01)			
	Natural log of proportion of vertical curves with					
	200 < K value <=300 within the fixed-length	0.682				
LVK2030	segment	(6.64)				

Table C.30 (Continued) Fatal crash models by functional classes for 0.25 mile segments

# Table C.30 (Continued) Fatal crash models by functional classes for 0.25 mile segments

	TWLR	TWLU	NINTR	NINTU	INT
Number of Observations (2014-2015)	38730	2844			6110
Number of Parameters	10	8			7
Number of Random Parameters	1	1			2
Restricted Log-Likelihood (Fixed Parameter at Convergence)	-1084.72	-178.01			-434.03
Log-Likelihood	-1082.39	-173.13			-431.63
AIC	2184.78	362.26			877.26
BIC	2270.43	409.89			924.29
LL Ratio	4.66	9.75			4.80
Adjusted Pseudo R-squared	0.020	0.036			0.033
	RP Poisson	RP Poisson			RP Poisson

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